# Systematic analysis of the evolution and conservation of genetic interactions using *C. elegans* as a model system

This dissertation is submitted in accordance with the requirements of the University of Cambridge for the degree of Doctor of Philosophy

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To my parents, with love

#### Preface

This thesis describes my work undertaken in the laboratory of Andrew G. Fraser at the Wellcome Trust Sanger Institute while member of Clare Hall, University of Cambridge. It is submitted in fulfilment of the requirements for the degree of Doctor of Philosophy. This dissertation is the result of my own work and includes nothing, which is the outcome of work done in collaboration except where specifically indicated in the text. The work described here has not been submitted for any degree, diploma, or other qualification. This thesis does not exceed 300, single-sided pages of double spaced text, not including the bibliography and appendices.

> Julia Tischler Cambridge, September 2007

#### Abstract

Systematic analyses of loss-of-function phenotypes have been carried out for the majority of genes in *S. cerevisiae*, *C. elegans*, and *D. melanogaster*. While these studies greatly expand our knowledge of individual gene functions, they do not address redundancy in genetic networks nor do they attempt to identify genetic interactions. Developing tools for the systematic mapping of genetic interactions is thus a crucial step for exploring gene networks.

I established protocols for simultaneously targeting multiple genes by RNA interference (RNAi) in *C. elegans* using bacterial feeding ('combinatorial RNAi'). This approach allows me to examine interactions between any pair of genes and to detect the great majority of previously known synthetic lethal (SL) and post-embryonic synthetic genetic interactions. I used this technique to provide the first large-scale analysis in any organism of the redundant functions of gene duplicates. Focusing on genes that have been duplicated in the genome of *C. elegans* since divergence from either *S. cerevisiae* or *D. melanogaster*, I identified 16 out of 143 of duplicated gene pairs amenable to analysis by combinatorial RNAi to be at least partially functionally redundant. Intriguingly, the majority of these redundant gene pairs were duplicated before the split of *C. elegans* and *C. briggsae* 80-110 million years ago. My findings support population genetics models, which suggest that redundancy is not just a transient side effect of recent gene duplication but is instead a phenomenon that can be maintained over substantial periods of evolutionary time.

While I have identified functional redundancy between gene duplicates, most redundancy in genetic networks tends to be more complex. The majority of synthetic lethal interactions that were uncovered in *S. cerevisiae* occur between genes unrelated at the sequence level. To date, there is still much debate about how such 'higher-order' functional redundancy might arise, whether it is a selectable trait, and whether such redundancy can be conserved throughout evolution. Thus, to shed light on the evolution of genetic interactions, I investigated the conservation of gene networks between *S. cerevisiae* and *C. elegans*. Using an RNAi-based approach, I set out to explore whether

individual synthetic lethal interactions uncovered in *S. cerevisiae* are retained in *C. elegans.* I found synthetic lethal interactions to be poorly conserved between yeast and worm — despite the very high degree of conservation of individual gene functions — demonstrating a substantial evolutionary plasticity of complex gene networks. My results suggest that SL interactions are unlikely to be explained by simple models of genetic redundancy and led me to propose a novel model for the interpretation of SL interactions. In this view ('induced essentiality'), SL interactions represent a special form of conditional essentiality.

#### **Publications**

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Lehner, B., Calixto, A., Crombie, C., <u>Tischler, J.</u>, Fortunato, A., Chalfie, M., Fraser, A.
G. (2006). Loss of LIN-35, the *Caenorhabditis elegans* ortholog of the tumor suppressor p105Rb, results in enhanced RNA interference. *Genome Biol*, 7, R4.

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**Chapter 1** 

Introduction

**Chapter 1** 

Introduction

While biological research in the second half of the 20th century embraced 'molecule-centered' approaches to defining the properties of individual components of living systems, this reductionist view has changed with the availability of whole genome sequences for numerous model organisms. By employing integrated computationalexperimental approaches, it had become a reachable goal to unravel the molecular functions of each individual gene. These advances led to the appreciation that for a better understanding of living systems, one needs to take a step beyond studying gene functions one at a time. Researchers realized that properties of systems — e.g. organisms, gene networks, protein complexes — are more than merely the sum of their parts. This view led to defining a new area of research, 'Systems Biology' (Ideker et al., 2001; Kitano, 2002a; Kitano, 2002b; Pennisi, 2003). The central aim of Systems Biology is to gain insights into the 'emergent' properties of systems, features that cannot be attributed to any of their individual components. In order to get an understanding of such emergent properties, one needs firstly to identify all of a system's individual components, secondly to unravel the function(s) of each individual component and, finally, to decipher how these individual components interact to result in system-level dynamics (reviewed in Strange, 2006).

#### **1.1. Outline of introduction**

In this introduction, I will discuss the major steps that have been taken in the postgenomics era to address the fundamental biological question: 'How does an organism's genotype relate to its phenotype?' Since I used *C. elegans* as model organism for my studies, I will start by introducing 'the worm' and its versatility as model system. I will then describe the various genomics approaches that have been taken to generate genomescale views of gene function in *C. elegans*, *D. melanogaster*, and *S. cerevisiae*. Moreover, I will discuss the insights gained from large-scale studies of gene functions in worm, fly, and yeast and consequently the hypotheses that have been brought forward. I will conclude by introducing the rationale, aim, and significance of my study.

#### 1.2. Caenorhabditis elegans as a model system

The nematode *Caenorhabditis elegans* — also referred to as 'the worm' — has been extensively used as an experimental organism for genetics, development and neurobiology in the 1970s (Brenner, 1974). Numerous unique attributes make *C. elegans* a powerful model system (reviewed in Jorgensen and Mango, 2002; Strange, 2006): Worms have a short life–cycle, with a three-day generation time at room temperature. Animals pass through four larval stages (L1-L4), before they reach adulthood and become fertile. Worms are small in size (~1 mm), produce ~ 300 progeny per animal and can be grown easily and inexpensively in the laboratory on agar plates or in liquid cultures. *C. elegans* feed on bacteria, but can enter a specific developmental programme — called the 'dauer stage' — under limiting food conditions, in which they can survive for months. Furthermore, worms can be kept as frozen stocks.

*C. elegans* reproduces through self-fertilization in hermaphrodites or by mating with males. Hermaphrodites carry two X chromosomes, whereas males are of X0 karyotype, which arises through occasional meiotic non-disjunction. Self-fertilization allows worms to be propagated clonally and greatly facilitates the isolation of mutants through genetic screens, while males are used for inter-crossing mutant strains.

*C. elegans* is a highly differentiated animal but of simple anatomy — hermaphrodites comprise of 959 somatic cells only. Nonetheless, worms share many tissues with more complex animals, such as the nervous system, muscles, a reproductive and gastro-intestinal tract and an epidermis. Heroic efforts have been made to trace the fate of every somatic cell in *C. elegans*, starting from the first division (Sulston and Horvitz, 1977; Sulston *et al.*, 1983). This observation culminated in a documentation of the complete cell lineage of the worm, which was found to be relatively invariant. This study was followed by a comprehensive description of the structure of the nervous system, which resulted in a wiring diagram of all 302 *C. elegans* neurons (White *et al.*, 1986).

#### 1.3. Uncovering gene functions in C. elegans

#### **1.3.1.** Forward genetic screens

Traditionally, ethyl methane sulphonate- (EMS-) or N-ethyl-N-nitrosourea-(ENU-) induced mutagenesis followed by genetic screening has been used to identify genes that function in a biological process or pathway of interest (reviewed in Jorgensen and Mango, 2002). Typically, about one null mutation in any single gene is recovered in ~ 2,000 genomes through such forward genetic approaches. By using mutagenesis screens, Sydney Brenner identified 619 mutants with visible phenotypes (Brenner, 1974). These were instrumental in establishing *C. elegans* as a key model organism, and many similar screens have been performed since then.

#### 1.3.2. Reverse genetic approaches

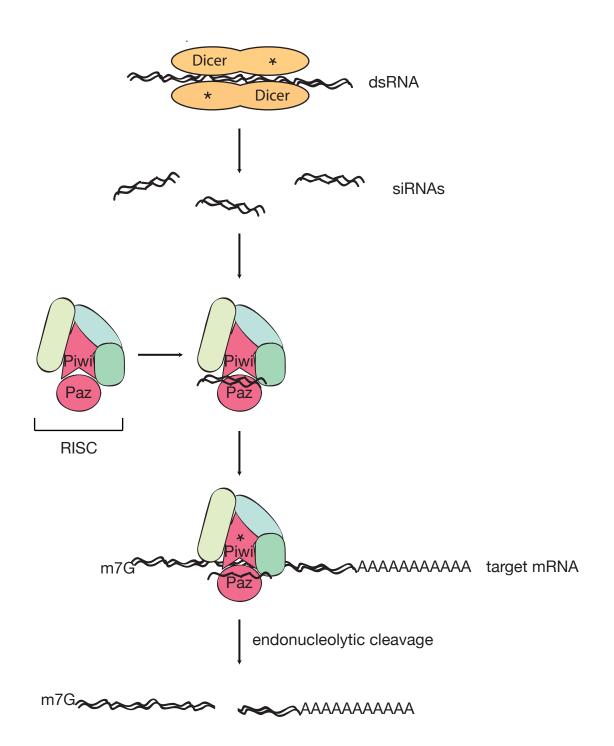
As an alternative to forward genetic analysis, injection of anti-sense RNAs homologous to any gene of interest has been used as a means to reduce gene expression from endogenous loci to study loss-of-function phenotypes (Fire et al., 1991; Guo and Kemphues, 1995). Surprisingly, Guo and Kemphues found that both anti-sense and sense RNAs were equally efficient for suppressing gene expression (Guo and Kemphues, 1995). This result led Andrew Fire and Craig Mello to their breakthrough. They discovered that introduction of double-stranded RNAs (dsRNAs) into C. elegans was substantially more effective in reducing gene expression than introducing single-stranded RNAs (Fire et al., 1998). This potent RNA-mediated interference effect, however, was not observed when dsRNAs homologous to promoters or intronic sequences were used (Fire *et al.*, 1998). These observations, together with the finding that injection of dsRNA resulted in reduced or undetectable levels of corresponding mRNAs, suggested a posttranscriptional gene silencing mechanism. Studies in plant systems further supported this notion (de Carvalho et al., 1992; Jones et al., 2001; Ruiz et al., 1998). Finally, biochemical approaches verified that the observed interference effect resulted from dsRNA-induced degradation of the endogeneous mRNA (Hammond et al., 2000; Kennerdell and Carthew, 1998; Tuschl et al., 1999). This mechanism was termed RNA interference (RNAi).

#### 1.3.2.1. RNA interference phenomena

Strikingly, injection of dsRNA into the germline or extracellular body cavity of *C. elegans* was found to result in an interference effect in a broad region of the animal, demonstrating that dsRNA has the remarkable capacity to cross cell boundaries ('spreading'; Timmons and Fire, 1998). This observation led to the significant discovery that feeding worms on *Escherichia coli* engineered to express dsRNA could also confer specific interference effects; just as worms normally feed on bacteria, dsRNA-expressing bacteria are ingested, dsRNA absorbed through the gut and distributed to somatic tissues and the germ line ('RNAi by feeding'; Timmons and Fire, 1998). Subsequently, it was shown that soaking worms in a solution of dsRNA ('RNAi by soaking') could also induce specific interference with gene expression (Tabara *et al.*, 1998). Finally, it was found that introduction of dsRNA into hermaphrodite worms can also produce a specific and robust interference effect in the progeny (Tabara *et al.*, 1998). Thus, dsRNA-induced gene silencing can be used to study the loss-of-function phenotype of any gene of known sequence. However, RNAi by bacterial feeding or soaking is less effective than direct injection of dsRNA (Tabara *et al.*, 1998).

#### 1.3.2.2. Mechanism of double-stranded RNA-induced gene silencing

Genetic studies in *C. elegans* and plants together with biochemical approaches using *Drosophila* embryonic extracts or S2 cells have provided fundamental insights into the mechanisms underlying dsRNA-induced gene silencing (reviewed in Hannon, 2002; Joshua-Tor, 2006; Matzke and Birchler, 2005; Zamore and Haley, 2005). In the current model (Figure 1.1.), Dicer, an evolutionarily conserved member of the family of RNase III ribonucleases, recognizes and cleaves dsRNAs into ~ 22-nucleotide fragments, with two-nucleotide 3' overhangs and 5' phosphorylated termini. The protein structure of RNase III enzymes led to the suggestion that the ~22-nucleotide RNAs are generated by association of two Dicer homo-dimers in antiparallel orientation. In this view, one of the two catalytic domains in each homo-dimer is inactive, with the two active catalytic domains being spaced by ~ 22 nucleotides. This configuration results in cleavage of dsRNAs into small interfering RNAs (siRNAs) of ~ 22-nucleotide length. siRNAs are



#### Figure 1.1. Mechanism of RNA interference

Two Dicer homo-dimers associate in anti-parallel orientation to cleave double-stranded RNA (dsRNA). Only one catalytic centre in each Dicer homo-dimer is active (\*). Active catalytic domains are spaced by ~ 22 nucleotides (nt), resulting in cleavage products - small interfering RNAs (siRNAs) - of ~ 22 nt length. siRNAs are incorporated into the RNA-induced silencing complex (RISC), a ribonuclease-containing protein complex, which is activated (\*) through unwinding of siRNAs. Watson-Crick base-pairing with siRNAs identifies homologous target mRNAs. The Piwi domain of the ribonuclease Slicer (shown in red, comprising of two RNA-binding domains, Piwi and Paz) mediates cleavage of target mRNA.

subsequently incorporated into a ribonuclease-containing protein complex, termed 'RNAinduced silencing complex' (RISC), targeting complementary mRNAs for degradation. Base complementarity with siRNAs identifies target mRNAs, which are subsequently endonucleolytically cleaved by Slicer, the catalytic core of the effector complex RISC. Slicer is a member of the Argonaute protein family, containing two RNA binding domains, the Piwi and PAZ domain. The Piwi domain, which is structurally homologous to ribonuclease H, comprises the endonuclease for cleavage of target mRNAs. *In vitro*, the inactive RISC precursor complex becomes activated upon addition of ATP. Remarkably, a correlation between RISC activation and unwinding of siRNAs was identified.

Intriguingly, in *C. elegans* and plants, RNAi can spread throughout the organism, whereas silencing in *Drosophila* and mammals appears to be cell-autonomous. The requirement of RNA-directed RNA polymerases (RdRPs) for dsRNA-induced gene silencing in *C. elegans* and plants led to the suggestion that siRNAs prime the synthesis for additional dsRNAs by RdRPs, thereby amplifying the silencing signal. While in plants, spreading of dsRNAs can occur by movement through plasmodesmata, in *C. elegans*, a transmembrane protein encoded by *sid-1* is suggested to mediate spreading of the silencing signal. Interestingly, orthologues of SID-1 are also encoded in mammalian genomes, whereas they were not identified in *Drosophila*. However, systemic gene silencing has thus far not been demonstrated in mammals.

#### 1.4. The C. elegans genome

Being the first multicellular organism for which a complete genome sequence was available, *C. elegans* set a milestone in genomics in 1998 (The *C. elegans* Sequencing Consortium, 1998). To begin the annotation and analysis of the 97–megabase worm genome, GENEFINDER, an algorithm for the identification of putative coding regions, was used (The *C. elegans* Sequencing Consortium, 1998). By comparing computational gene predictions to experimental genome annotations based on extensive collections of expressed sequence tags (ESTs), over 90% of computationally predicted genes were found to overlap with experimentally verified introns. Additional manual annotation was

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used to further refine computational gene structure predictions. With more genomic information becoming available and the development of better genome annotation tools, the analysis and annotation of the *C. elegans* genome is expected to further improve in the future.

The *C. elegans* genome is predicted to encode ~ 19,000 protein-coding genes, with an average density of 1 gene per 5kb, distributed on five autosomes and the X chromosome.

#### 1.5. WormBase

A comprehensive web-accessible database for information on *C. elegans* and related nematodes has been generated for the *C. elegans* research community (www.wormbase.org). This repository is based on the *C. elegans* genome database architecture ('AceDB') that was originally generated for the storage of sequence information (The *C. elegans* Sequencing Consortium, 1998). WormBase is a very navigable database, providing extensive information on the sequence and structure on the genomes of *C. elegans* and its related nematode *C. briggsae*. WormBase also stores information on mutant strains and alleles — these are publicly available from two stock centres, the *C. elegans* Genetics Center, USA (http:// www.cbs.umn.edu/CGC/) and the National Bioresources Project, Japan (http:// shigen.lab.nig.ac.jp/c.elegans/index.jsp). Results from RNAi experiments, gene expression patterns, functional annotations, comparative data, such as orthologues and syntenic regions between species (reviewed in Strange, 2006) are also deposited in WormBase.

#### 1.6. RNA interference in *C. elegans* by bacterial feeding

While the penetrance of the interference effects obtained through delivering dsRNAs by bacterial feeding or soaking are not as strong as those obtained by direct injection of dsRNAs (Tabara *et al.*, 1998; Timmons and Fire, 1998), RNAi by feeding has nonetheless numerous advantages for large-scale applications of RNAi. Firstly, RNAi by feeding is reasonably cost-effective, because it circumvents the need for expensive *in* 

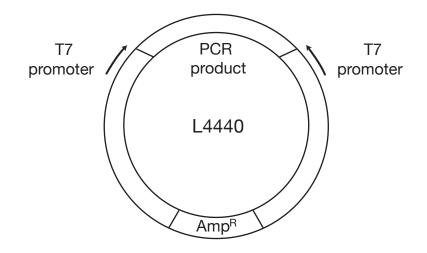
*vitro* synthesis of dsRNA that is necessary when using RNAi by injection or soaking. Secondly, bacterial strains expressing dsRNA can be kept as a reusable resource and thus can be distributed indefinitely. Finally, RNAi by bacterial feeding is less labour-intensive than injection, thereby allowing RNAi experiments to be scaled up to a reasonably high throughput.

This powerful technique led Julie Ahringer's lab to generate a whole-genome RNAi feeding library (also referred to as the 'Ahringer RNAi library'; Fraser *et al.*, 2000; Kamath and Ahringer, 2003; Kamath *et al.*, 2003). In this resource, gene-specific DNA fragments of roughly 1000 – 1500 bp were inserted between inverted repeats of the bacteriophage T7 promoter into a bacterial plasmid vector (L4440; Figure 1.2.). These plasmids were transformed into an RNaseIII-deficient *E. coli* strain (HT115(DE3), also referred to as 'bacterial feeding strain'), which was engineered to express T7 RNA polymerase under an isopropyl- $\beta$ -D-thiogalactopyranoside- (IPTG-) inducible promoter. Thus, expression of dsRNA could be induced upon addition of IPTG (Timmons *et al.*, 2001; Timmons and Fire, 1998). RNaseIII-deficiency was found to improve the efficacy of RNAi by bacterial feeding, presumably because it results in increased stability of dsRNA that is produced in bacteria (Timmons *et al.*, 2001).

Using this approach, DNA fragments corresponding to ~86% of the predicted *C*. *elegans* genes were cloned, resulting in a collection of 16,757 dsRNA-expressing bacterial strains (Fraser *et al.*, 2000; Kamath *et al.*, 2003), each targeting one predicted gene. With the generation of this potent resource, RNAi by feeding has become a powerful reverse genetic tool for studying *C. elegans* gene functions on a large scale.

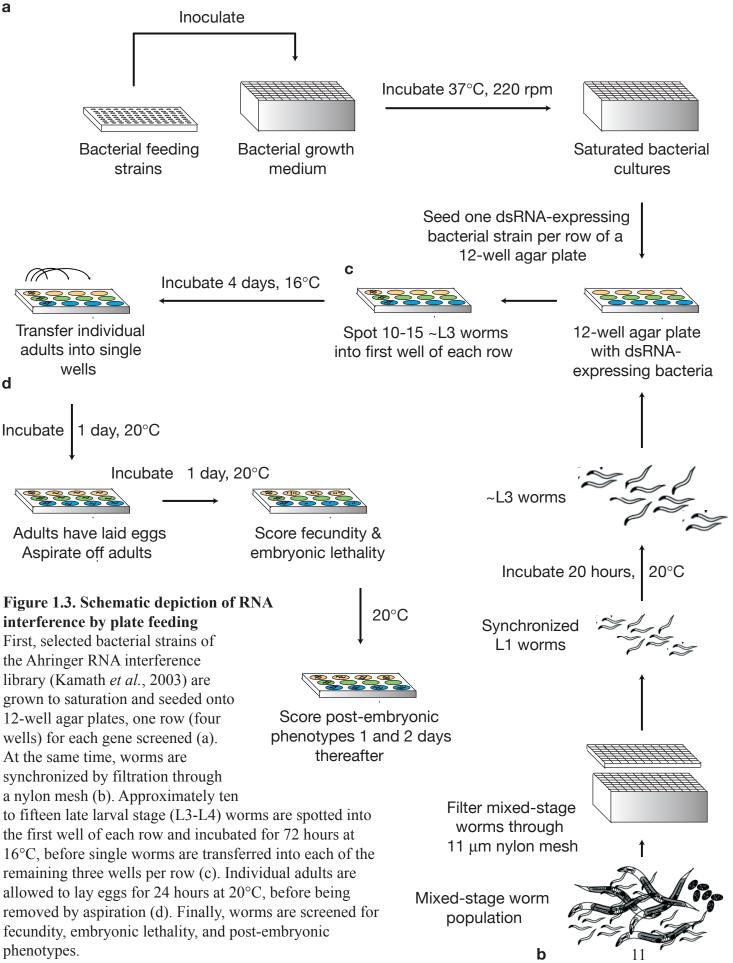
#### 1.6.1. Experimental setup for RNA interference by bacterial feeding

The experimental procedure for RNAi by bacterial feeding, optimized by Kamath and Ahringer (2003), involves three major steps (Figure 1.3.). Firstly, selected bacterial strains of the *C. elegans* whole-genome library are grown to saturation and seeded onto IPTG-containing 12-well assay plates ('plate feeding'). Secondly, late larval-stage worms are placed onto pre-seeded assay plates and are clonally propagated after an appropriate



#### Figure 1.2. L4440 RNA interference feeding vector

A PCR product homologous to a target gene of interest is cloned between inverted T7 promoter sites. Induction of T7 RNA polymerase expression in the bacterial host genome (HT115(DE3)) results in transcription of anti-parallel single-stranded RNAs (ssRNAs). These ssRNAs anneal and form double-stranded RNAs, which trigger RNA interference.



incubation time. Finally, individual adults and their progeny are screened for viability, fecundity, and post-embryonic growth and development. Using this methodology, phenotypes were assigned to 16,757 predicted *C. elegans* genes in wild-type worms (Fraser *et al.*, 2000; Kamath *et al.*, 2003).

#### 1.6.2. Genome-wide RNA interference by bacterial feeding

When using the Ahringer library to target 16,757 predicted *C. elegans* genes in wild-type hermaphrodites, mutant phenotypes were detected for ~10% of targeted genes. While ~7% of genes were found to be essential for viability, knockdown of ~ 3% of genes generated worms with slowed post-embryonic growth or defects in post-embryonic development (Kamath *et al.*, 2003). By assessing the ability to correctly identify the known loss-of-function phenotypes of previously studied loci, the effectiveness of RNAi by bacterial feeding was determined to be, on average, ~64%. The detection rate was higher for loci with non-viable phenotypes (~78%) than for loci with post-embryonic phenotypes (~42%).

Notably, the results obtained by genome-wide RNAi by bacterial feeding correlated well with other previously reported large-scale studies, in which RNAi by injection and soaking, respectively, was used (Gonczy *et al.*, 2000; Maeda *et al.*, 2001). Thus, results obtained by RNAi are highly reproducible regardless of the method used. Most importantly, the false-positive rate of RNAi by bacterial feeding is below 1%, as assessed by targeting 225 genes that were known not to affect viability when deleted. RNAi against one gene only caused a mutant phenotype.

This initial screen was subsequently repeated in a genetic mutant deficient for the putative RNA-directed RNA polymerase RRF-3, which was found to be hypersensitive to RNAi in a forward genetic screen (Simmer *et al.*, 2002). Using the *rrf-3* background, mutant phenotypes could be assigned to an additional 400 genes, thereby increasing the percentage of *C. elegans* genes with a detectable RNAi phenotype to approximately 12% (Simmer *et al.*, 2003).

# **1.7.** Using RNA interference in cell-based approaches for uncovering gene functions in *D. melanogaster* on a large scale

The completion of the Drosophila genome sequence (Adams et al., 2000) together with the finding that addition of long dsRNAs to Drosophila cells was a potent method to reduce the expression of specific target genes (Clemens et al., 2000; Hammond et al., 2000) led to the assembly of a collection of dsRNAs targeting most of the roughly 13,600 predicted genes in the genome of D. melanogaster (Boutros et al., 2004). When using this resource to target over 90% of predicted fly genes in cell-based assays, approximately 3% of genes were found to be indispensable for growth and viability in D. melanogaster (Boutros et al., 2004). Recently, further progress has been made to refine the analysis of loss-of-function phenotypes generated by RNAi in cellbased approaches (Bjorklund et al., 2006). Flow cytrometry has been used to study the role of ~70% of *D. melanogaster* genes in cell cycle progression. That way, numerous genes governing cell size, cytokinesis, apoptosis, and cell cycle progression were identified and ordered into known pathways. RNAi reagents have now also become available for genome-scale screens in mammalian cells (reviewed in Moffat and Sabatini, 2006). Thus, cell-based approaches similar to the ones taken for systematically deciphering gene function in D. melanogaster will help unravel gene functions on a genome-wide scale in mammals.

#### **1.8.** Uncovering gene functions in *S. cerevisiae* on a genome-wide scale

For the systematic unraveling of gene functions in the yeast *S. cerevisiae*, precise start-stop codon deletions were generated for each of the ~ 6,000 predicted genes (Giaever *et al.*, 2002; Winzeler *et al.*, 1999). These were constructed by targeted disruption of each predicted open reading frame (ORF) through homologous recombination (Baudin *et al.*, 1993; Lorenz *et al.*, 1995; Wach *et al.*, 1994). Targeting constructs for each gene were generated through polymerase chain reaction (PCR) amplification of a selectable marker gene, by using primers with a short sequence of homology to the predicted start and stop codons of each gene. In addition, unique 20-bp sequences ('barcode' sequences) — referred to as 'up' and 'down' tags (Hensel *et al.*, *et* 

1995; Shoemaker *et al.*, 1996) — flanking the marker gene and universal PCR priming sites just outside the barcodes were included in the targeting cassette. This design allows individual gene deletions to be identified in pools of mutant strains through PCR amplification using primers homologous to the universal sequence and subsequent hybridization of PCR products to a barcode microarray.

Mutant strains are maintained as a collection of heterozygous diploid strains, each of which is carrying a deletion in one copy of a specific gene, whereas the other copy is maintained as wild-type. The accomplishment of precisely deleting every single predicted ORF in the genome of *S. cerevisiae* paved the way for providing a genome-scale view of gene functions in yeast. When analyzing haploid meiotic progeny after induced sporulation, it was found that almost 5,000 of the predicted ~6,000 yeast genes can be eliminated entirely without any apparent deleterious consequences (Giaever *et al.*, 2002).

#### **1.9. Identification of orthologous genes**

To be able to transfer functional information between organisms, computational algorithms have been developed that enable the identification of orthologous genes in different species. Traditionally, phylogenetic trees have been constructed for the detection of orthologues (Yuan *et al.*, 1998). However, orthologue assignment by phylogenetic methods is difficult to automate and requires immense computing power. Thus, phylogenetic tree-based approaches are not suitable for assigning orthologues on a genome-wide scale.

The automatic clustering based on two-way best matches provides an alternative method (Chervitz *et al.*, 1998; Mushegian *et al.*, 1998; Rubin *et al.*, 2000; Wheelan *et al.*, 1999). Orthologue assignment, however, can be complicated through the existence of genes in multiple copies ('co-orthologues' or 'paralogues'). While it might be desired to identify paralogues that arose after divergence of one species from another, it had initially not been possible to separate paralogues that predated species split from paralogues that arose after by using conventional clustering approaches based on two-way best pairwise matches.

To overcome this obstacle, an algorithm for the identification of orthologues and paralogues that arose after divergence of one species from another (so-called 'inparalogues', to distinguish them from 'out-paralogues', paralogues that arose before species split) was devised (Remm *et al.*, 2001). This method (INPARANOID) is based on two-way best pairwise matches for detecting orthologues, with an algorithm added to identify in-paralogues between any two genomes. First, pairwise similarity scores are calculated using BLAST, with the bi-directional best hits being assigned the main orthologue pair. Adjustable cut-off values are applied to separate significant similarity scores from erroneous matches and thus to avoid inclusion of false positives. INPARANOID is based on the assumption that genes within one species that are more similar in sequence to the main orthologue than to any sequence from the other species represent in-paralogues (Figure 1.4.). Consequently, INPARANOID assigns confidence values (on a scale of 0% to 100%) as a measure of sequence similarity of a given in-paralogue to the main orthologue pair (which is assigned 100%).

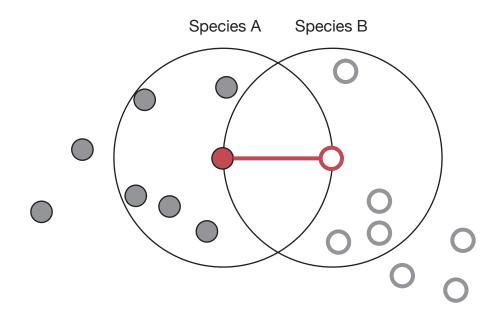
By comparing orthologue assignments generated by INPARANOID with manual tree-based orthologue detection approaches, INPARANOID was demonstrated to generate data sets with a high degree of confidence.

Thus, while orthologues and in-paralogues have previously been detected through the construction of phylogenetic trees, a rather slow approach that is difficult to automate, alternative methods, based on two-way best pairwise matches, could not separate inparalogues from out-paralogues. The INPARANOID algorithm, however, provides a powerful method for assigning orthologues and in-paralogues between any two species. Notably, INPARANOID is conservative and rather underpredicts orthologues and paralogues by excluding insignificant hits, though I recognize that this may exclude some true in-paralogues.

#### 1.10. Gene dispensability and its potential underlying causes

The availability of whole genome-sequences for numerous model organisms together with the development of technological platforms has paved the way for the systematic investigation of gene functions on genome-wide scales (Bjorklund *et al.*,

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#### Figure 1.4. Graphical model for orthologue assignment using INPARANOID

Reciprocal best pair-wise matches of genes in two species (here species A and B) are assigned the main orthologue pair (shown as red filled and open circles, respectively). Additional orthologues within each species (co-orthologues) that are more similar in sequence to the main orthologue than to any other gene in the other species are assigned 'in-paralogues' (shown as grey filled and open circles within species A and B, respectively), whereas all other orthologues are assigned 'out-paralogues' (drawn outside the black circles). In-paralogues are considered co-orthologues that arose after divergence of one species from another, whereas out-paralogues represent co-orthologues that predate the species split. Re-drawn based on figure from Remm *et al.*, 2001.

2006; Boutros *et al.*, 2004; Giaever *et al.*, 2002; Kamath *et al.*, 2003). One striking insight gained from these systematic studies was the discovery that the great majority of genes encoded in eukaryotic genomes are dispensable for viability under laboratory conditions. Several theories have been put forward to explain this 'lack-of-phenotype' phenomenon; I will discuss these below.

Although intense theoretical work has been done on this subject, the causes of gene dispensability have remained controversial (reviewed in Wagner, 2005). One hypothesis suggests that apparently dispensable genes might be essential for survival only under specific environmental conditions that have not yet been probed in the laboratory. In this view, gene dispensability might reflect the system's ability to adjust to changing environments ('environmental adaptation'; Papp *et al.*, 2004).

Conversely, another theory postulates functional redundancy as genetic mechanism underlying gene dispensability (Wagner, 2000a; reviewed in Hartman *et al.*, 2001; Wagner, 2005). This view suggests the existence of 'back-up' mechanisms or compensatory pathways, such that loss of one gene has little effect because redundant or alternative pathways can counteract this loss ('mutational robustness').

Both theories suggest that the genetic networks that underlie viability are not constant, but can adjust their mode of operation under different external or internal conditions (reviewed in Kitano, 2004; Wagner, 2005). The two models for gene dispensability, however, might not be mutually exclusive. It has been increasingly noted that mutational robustness might have arisen as a 'by-product' of environmental adaptation (reviewed in Kitano, 2004; Wagner, 2005). I will discuss both theories in more detail below.

#### 1.10.1. Environmental adaptation

While it has long been appreciated that seemingly dispensable genes can have important biological functions under specific environmental conditions, this notion has recently been investigated systematically through the computational modeling of metabolic networks in yeast (Papp *et al.*, 2004). When calculating the metabolic flux

under various nutrient conditions, roughly half of the apparently non-essential genes were predicted to be active under specific growth conditions. Recent experimental support for this computational approach came from large-scale phenotypic analyses, in which yeast deletion mutants were monitored for fitness defects under numerous environmental conditions. These studies led to the suggestion that at least 20% of the approximately 5,000 seemingly dispensable genes in *S. cerevisiae* might have essential functions under specific environmental conditions (Chang *et al.*, 2002; Davis-Kaplan *et al.*, 2004; Dudley *et al.*, 2005; Enyenihi and Saunders, 2003; Kuepfer *et al.*, 2005; Martinez *et al.*, 2004; Smith *et al.*, 2006). Most conditional essential genes were found to be indispensable under a limited number of growth conditions only, further demonstrating their environment-specific essentiality.

It had further been hypothesized that if seemingly dispensable genes were to have essential functions under specific environmental conditions, these genes might not be conserved in species that never encountered these conditions (Papp *et al.*, 2004). In agreement with this theory, enzymes that were predicted to be active under restricted nutrient conditions only by *in silico* modeling of the metabolic flux in yeast were found to have a limited phylogenetic distribution as compared to unconditionally active enzymes (Papp *et al.*, 2004). This computational study was supported by direct experimental evidence from studies on condition-specific genes in *E. coli* (Glasner *et al.*, 2003; discussed in Papp *et al.*, 2004). Furthermore, while the fraction of dispensable genes in yeast is approximated to be above 60%, the proportion of non-essential genes in the parasite *Mycoplasma genitalium* is estimated to be below 25%, suggesting a low number of condition-specific genes, which is consistent with the parasite's narrow host specificity (discussed in Papp *et al.*, 2004).

#### 1.10.2. Functional redundancy and mutational robustness

One obvious source of genetic redundancy is through gene duplication. Duplicated genes that retain at least partially overlapping functions can confer robustness to mutation in the other copy (Force *et al.*, 1999; Lynch and Force, 2000). Gene duplicates can arise through homologous recombination and DNA repair processes, the action of retrotransposons, or may be relics from whole-genome duplication events. Following a duplication event, both genes are initially performing the same function. However, for proper functions to be maintained, genes need to be under selective pressure. This notion led to the suggestion of various models for the evolutionary fate of duplicated genes.

The classical model for the evolution of gene duplicates predicts that the ancestral gene might be selected to maintain its original function, while its duplicate copy is free to diverge (Ohno, 1970). In this view, the most common fate of the duplicate copy was suggested to be extinction by the accumulation of deleterious mutations ('non-functionalization'; Kimura and King, 1979). Under this model, however, the duplicate copy, while it is not protected against mutations, might acquire new functions through rare beneficial mutations. This scenario has long been considered as the only mechanism for the preservation of gene duplicates and is regarded an important driving force for evolutionary innovation ('neo-functionalization'; Ohno, 1970).

The rationale that the probability for a gene to acquire a degenerative mutation might be higher than the likelihood to acquire a beneficial mutation (Lynch and Walsh, 1998), however, led to the proposal of an alternative model for the evolutionary fate of gene duplicates (Force et al., 1999). This model ('duplication-degenerationcomplementation', thereafter also referred to as 'sub-functionalization') suggests degenerative mutations as the central mechanism underlying duplicate gene preservation: Immediately after a duplication event, both copies might experience a period of relaxed selection, in which they might acquire deleterious mutations that impair different ancestral sub-functions. Such partially compromising mutations might result in a duplicate gene pair with complementary functions that can perform the original gene function in combination only. This sub-functionalization model is supported by findings from genome-wide studies, which reveal that, following a duplication event, both copies appear to be under selective pressure, with stronger purifying selection acting on older than on more recent gene duplicates (Kondrashov et al., 2002; reviewed in Wagner, 2002). In addition, available experimental evidence suggests that sub-functionalization through complementary mutations frequently results in the partitioning of tissue-specific expression (Lynch and Force, 2000).

Various theoretical models have been proposed to explain how genes with redundant functions can be evolutionarily stable (Nowak *et al.*, 1997). One model predicts the maintenance of redundancy under the assumption that two genes perform their functions with equal efficiencies and under the same mutation rates. In this model, even if mutation rates differ marginally, thus rendering redundancy evolutionary unstable, it would still require a substantial amount of time until the overlap in function were eliminated, provided mutation rates are low. Conversely, two alternative theories suggest scenarios in which functional redundancy can be maintained indefinitely. While one model predicts the evolutionarily stability of redundancy based on the assumption that two genes perform the same function with different efficacies, with the more efficient gene experiencing higher mutation rates, the other theory relates pleiotropy to redundancy; two genes are maintained by selection because of their individual functions, while they are redundant with respect to another function.

Indirect experimental evidence for the redundant functions of duplicated genes comes from the systematic analysis of loss-of-function phenotypes of single genes: In both yeast and worms, it was found that inactivation of a duplicated gene is less likely to result in a non-viable phenotype than inactivation of a single-copy gene (Conant and Wagner, 2004; Gu *et al.*, 2003; Kamath and Ahringer, 2003). However, there are strong biases in the types of genes that are duplicated in genomes, which complicates the interpretation of these results (Castillo-Davis and Hartl, 2002) and at the time this study began, no attempt had been made to examine the extent of redundancy between duplicated genes *in vivo* directly and systematically.

The first systematic investigation into the mechanistic basis underlying gene dispensability was provided by an *in silico* analysis of the metabolic flux in *S. cerevisiae* (Papp *et al.*, 2004). Notably, while metabolic networks do not contain any redundant biochemical reactions — that is any metabolite is produced by one enzyme only —, approximately half of a system's unique enzymatic reactions can be perturbed without negatively affecting metabolic output (discussed in Wagner, 2005). Computational modeling of yeast metabolic fluxes was used to predict the effects of single-gene deletions under different environmental conditions and the concomitant changes in metabolic flux distribution (Papp *et al.*, 2004). Results from this *in silico* analysis

suggested that compensation for loss of individual gene function by a duplicate copy could account for roughly one quarter of dispensable genes in the yeast metabolic network. In addition, non-essentiality of fewer than 20% of metabolic genes could be explained by a re-routing of the metabolic flux through alternative, unaffected pathways. Remarkably, enzymes with unrelated activities can confer mutational robustness of metabolic networks by co-operation and flux re-organization.

Similar observations were made in developmental biology (reviewed in Wagner, 2005). Regulatory networks, such as the segment polarity network in *D. melanogaster*, do not comprise genes with equivalent functions. These networks, however, can maintain their functions despite perturbations (von Dassow *et al.*, 2000). Thus, genes that do not resemble one another at the sequence level and do not have related molecular roles can nonetheless compensate for loss of one another. This 'higher-order' functional redundancy is often referred to as 'distributed robustness', to distinguish it from genuine functional redundancy of gene duplicates ('redundancy of parts'; reviewed in Wagner, 2005).

# **1.10.2.1.** Systematic experimental approaches for uncovering genetic interactions and functional genetic redundancy

While available evidence supports both conditional essentiality and functional redundancy as potential origins of gene dispensability, direct systematic experimental approaches are needed in order to examine the relative contribution of either source to the high proportion of seemingly non-essential genes. For the scope of this study, I will focus on experimental approaches that have been used to investigate genomes for functional genetic redundancy.

Traditionally, suppressor or enhancement genetics have been used to unravel functional relationships between genes (reviewed in Guarente, 1993; Hartman *et al.*, 2001). Genetic interactions were uncovered by screening with mutant alleles of known genes with defined phenotypes for mutations in other genes that can modulate this phenotype. That way, new genes with functions in the same or related molecular process were uncovered. Suppression, in which mutation in one gene alleviates the effects of

mutation in another gene, can unravel genes with roles in parallel biochemical or genetic pathways, if the second-site mutation increases pathway function ('bypass suppression'). Suppressor screens can also unravel genes functioning in the same pathway and have been instrumental in uncovering regulatory hierarchies. 'Synthetic enhancement', in which mutation in one gene worsens the effects of mutation in another gene, may occur between genes acting in the same biochemical pathways, or in distinct, but functionally redundant pathways. Synthetic lethality represents the most severe form of synthetic enhancement. This phenomenon was first observed by fly geneticists early last century who uncovered mutations in specific pairwise combinations of genes that resulted in lethality, whereas animals carrying mutations in each individual gene were viable (Dobzhansky, 1946; Sturtevant, 1956).

The identification of genetic interactions has provided major insights into key regulatory processes and pathway organization (Avery and Wasserman, 1992; Guarente, 1993; Hartman *et al.*, 2001; Lu and Horvitz, 1998; Thomas, 1993). However, before the availability of complete genome sequences and the feasibility of reverse genetic approaches, genetic interactions have been uncovered on a rather small scale to assist functional biological studies.

Considered a promising approach to uncover functional redundancy on a large scale, high-throughput technological platforms have been developed for the systematic mapping of synthetic lethal (SL) interactions in the yeast *S. cerevisiae*. I will discuss these in more detail below.

# **1.10.2.1.1.** Identifying synthetic lethal interactions in the yeast *S. cerevisiae* on a large scale

Synthetic lethal (SL) interactions represent the most severe form of synthetic enhancement and thus are considerably straightforward to map. Therefore, thus far, most systematic studies focused on synthetic lethality as a framework for identifying non-additive genetic interactions.

Synthetic genetic array (SGA) analysis was the first methodology that had been developed for the genome-scale mapping of synthetic sick or synthetic lethal (SL) interactions in the genome of *S. cerevisiae* (Tong *et al.*, 2001). Using an automated approach, haploid strains carrying defined mutations are intercrossed and, following sporulation, fitness of double mutant meiotic progeny is assessed and compared to fitness of each single mutant. Therefore, a haploid strain of one mating type ( $\alpha$ ), carrying a mutation in a query gene of interest, is crossed into an array of haploid mutant strains of opposite mating type (a). Mutations in both strains are linked to different antibiotic resistance markers, allowing for selection of double mutant meiotic progeny. Importantly, to prevent mating of meiotic progeny — this would give rise to false-negative results — the query mutant strain is engineered to carry a selectable marker under a mating type a-specific promoter (*MFA1pr-HIS3*), permitting growth of meiotic progeny of one mating type (a) only. This approach has been pioneered by Amy Tong in Charlie Boone's lab and has since then been used extensively to systematically map SL interactions in *S. cerevisiae* (Tong *et al.*, 2004).

SGA analysis has further been extended to screen for genetic interactions between yeast essential genes (Davierwala et al., 2005). Therefore, conditional expression alleles and temperature-sensitive (ts) conditional alleles of essential genes have been created. For the generation of conditional expression alleles, the endogenous promoter is replaced by a tetracycline (tet) – repressible promoter that can be shut off by the addition of doxycycline, a tetracycline analog (Mnaimneh et al., 2004). Ts conditional alleles can be readily created by linking a heat-inducible destabilizing protein ('degron', Arg-DHFR(ts)) to the N-terminus of an essential gene, which results in protein degradation (Dohmen and Varshavsky, 2005). Using these approaches, extensive collections of tetpromoter mutants and degron alleles have been generated (Kanemaki et al., 2003; Mnaimneh *et al.*, 2004). Furthermore, for the systematic construction of hypomorphic alleles, 3' untranslated regions of essential genes are replaced with selectable markers, which results in lower transcript levels through mRNA destabilization ('decreased abundance by mRNA perturbation, DAmP'; Schuldiner et al., 2005). Recently, SGA technology has been coupled with quantitative approaches to allow genetic interactions to be identified more accurately (Schuldiner et al., 2005).

Diploid synthetic lethal analysis by microarray (dSLAM) provides an alternative method to SGA analysis for uncovering SL interactions in the yeast *S. cerevisiae* (Pan *et al.*, 2004). In this approach, a deletion construct for a query gene of interest is transformed into a pool of barcode-tagged heterozygous deletion stains, which are carrying a selectable marker under a mating type-specific promoter (see SGA analysis). Following induced sporulation, DNA from pooled mutants is amplified by polymerase chain reaction (PCR) using a pair of primers binding common sequences outside the barcode tags (as discussed in 'Uncovering gene functions in *S. cerevisiae* on a genomewide scale'). The abundance of each double mutant in the pool is determined by hybridization of PCR fragments to a barcode miniarray. This approach has been used to uncover SL interactions between genes with functions in the maintenance of DNA integrity (Pan *et al.*, 2006).

While the accuracy of identifying SL interactions by using SGA versus dSLAM approaches has not been assessed systematically, overlaps in data sets are found. Each method, however, also identifies SL interactions not uncovered by one or other approach. Beyond the differences in methodological approach, SGA technology uses haploid deletion strains, whereas dSLAM technology uses the yeast gene deletion collection in heterozygous diploid format. Notably, strains maintained as haploid deletion mutants might be subject to considerable selection pressure, which might lead to the accumulation of compensatory mutations. Results were found to differ when using homozygous haploid and diploid deletion mutants (Pan *et al.*, 2004). In contrast, maintaining mutant strains as heterozygous diploids reduces selection pressures through the existence of a wild-type copy for each deletion allele. Thus — with the exception of ~ 3% haplo-insufficient genes — the great majority of heterozygous yeast deletion mutants show normal growth on rich medium (Deutschbauer *et al.*, 2005).

## **1.10.2.1.2.** Defining non-additive, 'synthetic' genetic interactions by a multiplicative model

For the unambiguous identification of non-additive, 'synthetic' genetic interactions, phenotypes are quantified and subject to statistical analysis. A

'multiplicative model' best describes the contributions of independent genetic loci to a phenotype; that is, the quantitative effects of mutations in individual genes should combine multiplicatively (Phillips et al., 2000; Puniyani et al., 2004). For additive genetic interactions, a double mutant's phenotype is expected to be the product of phenotypes for both individual genes. Divergence of the double mutant phenotype from the expected multiplicative values related to phenotypes for both individual genes is suggestive of a non-additive, synthetic genetic interaction. The multiplicative model also represents an application of Fisher's definition of 'epistacy', in which he describes epistasis as a phenomenon where the double mutant shows an unpredicted phenotype that is deviating from the expected product of phenotypes for both individual genes (Fisher, 1918). Deviations can have either negative or positive values, representing aggravating (fitness of the double mutant is lower than expected, with synthetic lethality as the most dramatic form) and alleviating (fitness of the double mutant is higher than anticipated) synthetic genetic effects. While aggravating interactions often occur between genes acting in distinct, but compensatory pathways ('between-pathway' interactions), alleviating interactions often reflect genes functioning in the same biochemical pathway ('within-pathway' interactions; Segre et al., 2005; St Onge et al., 2007). Notably, databases that store genetic interaction data for model organisms do often not discriminate between additive and non-additive (i.e. aggravating or alleviating) genetic interactions.

### 1.10.2.1.3. Inferring functional relationships from genetic interaction screens

When systematically mapping genetic interactions in the yeast *S. cerevisiae*, using synthetic genetic array (SGA) or diploid synthetic lethal analysis by microarray (dSLAM) technology, synthetic lethal (SL) interactions were found to be enriched between functionally related genes (Davierwala *et al.*, 2005; Pan *et al.*, 2006; Tong *et al.*, 2001; Tong *et al.*, 2004). Notably, the interaction density of genetic networks was found to exceed that of physical interactions (Tong *et al.*, 2004). Genetic interactions appear to be largely non-overlapping with physical interactions and tend not to occur between components of the same linear biochemical pathway, with the exception of essential

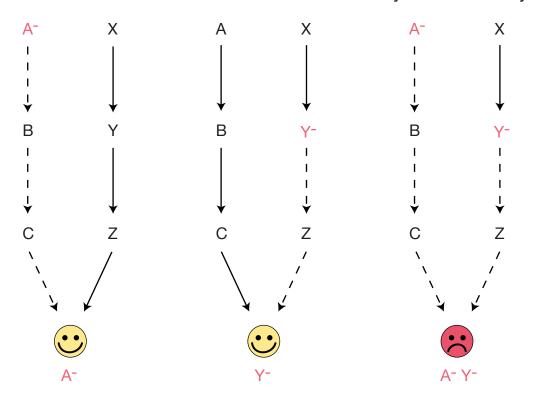
genes. This exception might be explained by the use of hypomorphic alleles when compiling the essential gene network — each mutant allele might partially reduce the flux through a linear pathway, but a combination of both mutant alleles might abolish pathway function (Bader *et al.*, 2003; Kelley and Ideker, 2005; Ye *et al.*, 2005). Most importantly, SL interactions can be used to infer pathway topology. Genes with similar SL interaction partners tend to encode components of the same biochemical pathway (Bader *et al.*, 2003; Kelley and Ideker, 2005; Ye *et al.*, 2005). Thus, genetic interaction and protein interaction networks provide complementary information. Accordingly, by using integrative approaches, such as combining SL data with protein-protein, mRNA co-expression, and phenotype data, the systematic mapping of SL interactions provides a powerful method for inferring functional relationships between genes (Wong *et al.*, 2004).

Together, these findings confirmed the classical interpretation of SL genetic interactions as the results of inactivating two functionally redundant pathways in the cell, either of which is individually dispensable (Figure 1.5.), and led to suggest the existence of abundant 'back-up' pathways conferring robustness to mutation in genetic networks (reviewed in Hartman *et al.*, 2001).

#### 1.10.2.1.4. Features of genetic interaction networks

The systematic mapping of synthetic lethal (SL) interactions in *S. cerevisiae* shed light on the global properties of gene interaction networks. First, genetic interaction networks were found to follow a power-law distribution, with many genes interacting with few others, whereas few genes were found to have numerous interaction partners (Tong *et al.*, 2004). Second, genetic interaction networks appear to have a small-world topology, with short characteristic path length and densely connected local neighborhoods (Tong *et al.*, 2004). The average interaction density of genetic networks was found to be in the range of 1%, with a higher interaction frequency between essential than between non-essential genes (Davierwala *et al.*, 2005; Pan *et al.*, 2006; Tong *et al.*, 2004).

Synthetic lethality



### Figure 1.5. Model for the interpretation of synthetic lethal interactions

In the 'classical' model, synthetic lethal interactions are considered the result of inactivating genes with functions in two redundant essential pathways in the cell. In this view, loss of function of one pathway (here A-B-C) can be compensated for by a functionally redundant pathway (here X-Y-Z), and vice versa. Inactivation of both pathways through deleterious mutations (here depicted as A- and Y-, respectively, results in nonviability ('synthetic lethality') of the organism.

Remarkably, although SL interactions were enriched for genes encoding homologous proteins, their overall contribution was negligible (Tong *et al.*, 2004). Notably, however, the proportion of gene duplicates that had been sampled in large-scale SL screens had been fairly low. The majority of genetic interactions were uncovered between pairs of unrelated genes (Tong *et al.*, 2004).

Only recently has the contribution of gene duplicates to the robustness of yeast genetic networks been tested by systematic experimental approaches. Whereas the fraction of duplicate pairs that were found to genetically interact was significantly higher as compared to random pairs in the genome of *S. cerevisiae*, SL interactions were uncovered between ~25% of duplicate gene pairs only (Ihmels *et al.*, 2007). Notably, this fraction relates well to the proportion of duplicate gene pairs in the metabolic yeast network that were predicted to have compensatory capacities by *in silico* flux analysis (Papp *et al.*, 2004).

Taken together, results obtained both from systematic experimental approaches and computational studies led to the suggestion that although gene duplicates can — to some extent — provide robustness to mutation, their overall contribution to gene dispensability is limited. Conversely, most SL interactions take place between genes that do not share sequence similarity.

#### 1.10.2.1.5. Condition-specificity of synthetic lethal interactions

Recently, a computational study has provided insights into the conditiondependence of synthetic genetic interactions. Flux balance analysis of the metabolic networks of *S. cerevisiae* was used to predict the effects of single- and double-gene deletions in 53 different nutritional environments (Harrison *et al.*, 2007). Notably, half of the predicted synthetic lethal (SL) relationships appear to be restricted to one or two nutrient conditions only, as compared to ~14% of SL interactions that appear to take place under all conditions investigated. Conversely, more than half of SL interactions remain undetected if examined in one nutritional environment only. These findings highlight the narrow condition-dependence of many SL interactions. Consequently, numerous SL interactions are likely to be missed by performing SL interactions screens

in one environmental condition only. A fraction of predicted SL interactions was tested experimentally, confirming the feasibility of the *in silico* approach. The study of condition-dependence of SL interactions in the yeast metabolic network was further extended to genetic interactions among non-metabolic genes. SL interaction data from literature were combined with available experimental data on the condition-dependence of single-gene deletion data. Remarkably, more than half of ~2,700 investigated SL interactions were found to take place between gene pairs of which either one or both appeared essential for viability under specific nutrient conditions. Furthermore, when assessing their phylogenetic distribution across species, members of SL pairs were not found to co-occur more frequently than random gene pairs. Thus, the conditiondependent restriction of SL interactions might be — at least for some interactions explained by the individual essential functions of numerous genes under specific environmental conditions. Together, these findings support the notion that robustness to mutation might have arisen as a by-product during the evolution of adaptive responses to changing environmental conditions (reviewed in Kitano, 2004; Wagner, 2005).

#### 1.10.2.1.6. Synthetic genetic interactions and disease

Enormous advances in genetics have uncovered numerous genes involved in human diseases. While many disorders are caused by mutations in single genes only, increasing numbers of human genetic diseases are identified to result from combinations of mutations in multiple genes (reviewed in Badano and Katsanis, 2002). Thus, many inherited mutations that alone have little effect can combine to result in severe defects. However, predicting and identifying such genetic interactions is a major obstacle in human genetics. Recently, synthetic lethal (SL) interactions have been systematically mapped in the yeast *S. cerevisiae* (Davierwala *et al.*, 2005; Pan *et al.*, 2006; Tong *et al.*, 2004). To date, however, approaches similar to the ones pioneered in yeast are not feasible in mammalian systems. Therefore, it is a major open question in genetics whether individual SL interactions are conserved between species and hence may be directly predicted in humans using interactions identified in simple model organisms. While functional studies in yeast have greatly contributed to our understanding of

individual gene functions in human (reviewed in Dolinski and Botstein, 2007), it remains to be determined whether SL interactions mapped in *S. cerevisiae* can be directly transferred into higher organisms and thus provide us with insights into complex human diseases.

In order to test the power of predicting candidate genetic interactions, comparative experimental approaches are needed. Ultimately, such a comparative study involves a tractable model system that is of higher complexity than yeast and that allows the analysis of systematic genetic perturbations. To date, C. elegans is the main animal model in which to carry out systematic functional studies in vivo in the context of a developing organism. The ability to inhibit gene function on a genome-wide scale by RNAi by bacterial feeding (Kamath et al., 2003), together with its small size, its simple reproductive cycle and short generation time make the nematode C. elegans an ideal animal model system (Brenner, 1974) for the systematic study of synthetic genetic interactions. In particular, the comprehensive mapping of SL interactions in C. elegans would allow the comparison of *in vivo* genetic interaction networks between yeast, a single cellular organism and a multicellular animal. Such a study would have major practical implications for the use of yeast SL interaction data to predict SL interactions between genes in complex human diseases. Beyond the direct practical implications, this approach would also increase our understanding of the evolution and conservation of SL interactions.

#### **1.11. Rationale of my study**

Studies in *S. cerevisiae*, *C. elegans*, and *D. melanogaster* have shown that inactivation of most genes has little discernable effect on the organisms' fitness under laboratory conditions (Boutros *et al.*, 2004; Giaever *et al.*, 2002; Kamath *et al.*, 2003). These findings have led to various hypotheses explaining the observed high degree of gene dispensability. Whereas many of the apparently non-essential genes might have significant biological functions under specific environmental conditions ('environmental adaptation'; Papp *et al.*, 2004), an alternative theory suggests functional genetic redundancy as the principal source underlying the observed lack of phenotype upon loss

of individual gene function ('mutational robustness'; Wagner, 2000a). This hypothesis proposes the existence of compensatory pathways as 'fail-safe' mechanisms to back-up essential biological pathways. While several lines of evidence support both the ability to adapt to new environmental conditions and the use of genetic compensatory pathways as potential sources underlying the apparent dispensability of a high proportion of genes in eukaryotic genomes, considerably more attention has been paid to the latter mechanism. This is not least because of the likely implications of non-additive, synthetic genetic interactions in complex human diseases (reviewed in Badano and Katsanis, 2002). Recently, enormous efforts have been made to systematically map synthetic lethal (SL) interactions in *S. cerevisiae* (Davierwala *et al.*, 2005; Pan *et al.*, 2006; Tong *et al.*, 2004). These studies appear to have uncovered thousands of gene pairs with redundant functions. However, at the time my study began, the systematic mapping of genetic interactions had not been extended to higher organisms.

The aim of my research was to begin to investigate functional redundancy in the genome of *C. elegans*. Therefore, I wished to systematically map SL interactions in the worm. To do so, it was crucial to establish protocols for simultaneously perturbing the functions of any pairwise combination of genes by using RNAi. First, I sought to investigate whether — and to which extent — *C. elegans* gene duplicates share redundant functions. Second, I wished to study functional redundancy in complex gene networks. In particular, I sought to investigate whether general modes of genetic redundancy are conserved between *S. cerevisiae* and *C. elegans* and whether I can find evidence for parallel pathways and back-up mechanisms in the worm. Therefore, I set out to investigate whether individual SL interactions are conserved between *S. cerevisiae* and *C. elegans*.

## Chapter 2

## **Materials and Methods**

### 2.1. Reagents

### 2.1.1. C. elegans

#### 2.1.1.1. C. elegans strains

See Table 2.1. for *C. elegans* strains that were used in this study. The *C. elegans* Genetics Center, USA (http:// www.cbs.umn.edu/CGC/) and the National Bioresources Project, Japan (http:// shigen.lab.nig.ac.jp/c.elegans/index.jsp) provided these strains.

### 2.1.1.2. Nematode Growth Medium (NGM)

NaCl	3 g
Peptone	2.5 g
Optional <sup>a</sup> : Agar	19 g
dd H <sub>2</sub> O	to 1 L
The solution was autoclaved and cooled to	55°C before addition of:
Cholesterol solution (5 mg/ml in ethanol)	1 ml
1M CaCl <sub>2</sub>	1 ml
1M MgSO <sub>4</sub>	1 ml
1M KH <sub>2</sub> PO <sub>4</sub> , pH6.0	25 ml
Fungizone	800 µ1

in the order as written, with mixing thoroughly after addition of each component. Solutions were sterile-filtrated through a membrane filter with a pore size of  $0.2 \,\mu$ m.

<sup>a</sup> For preparation of agar plates, solution was poured into sterile Petri dishes.

### 2.1.1.3. M9 Buffer

1M KH <sub>2</sub> PO <sub>4</sub>	3 g
1M Na <sub>2</sub> HPO <sub>4</sub>	6 g
1M NaCl	5 g
ddH <sub>2</sub> O	to 1 L

1 ml 1M MgSO<sub>4</sub> was added after solution had been autoclaved to sterilize.

Gene(allele)	Strain	L1 worms	Screening
		added	temperature
Wild-type	N2	~10	20°C
rrf-3(pk1426)	NL2099	~15	20°C
arx-3	tm1681	~15	20°C
C26E6.3(ok1728)	RB1477	~15	20°C
emb-27(ax81)	DS88	~15	15°C
emb-27(g48)	GG48	~10	15°C
emb-27(ye143)	HY621	~15	15°C
emb-27(g48)	TJ1047	~10-15	15°C
emb-27(g48)	TJ1049	~15	15°C
emb-27(g48)	TJ1061	~15	15°C
mat-1(ax161)	DS77	~15	15°C
mat-1(ax144)	DS80	~15	15°C
mat-1(ye121)	HY604	~15	15°C
cdc-42(ok825)	RB942	~10	20°C
dhc-1(or195)	EU828	~15	15°C
dyn-1(ky51)	CX51	~15	20°C
sel-9(ar22)	GS107	~15	20°C
pes-1(leDf1)	UL768	~10-15	20°C
pfd-4(gk430)	VC1032	~15	20°C
fkh-10(ok733)	RB884	~10	20°C
pqn-19(ok406)	RB674	~15	20°C
C43E11.2	tm1937	~15	20°C
F57C7.2(ok661)	RB836	~15	20°C
pch-2(tm1458)	CA388	~15	20°C
R06F6.2(ok1664)	RB1457	~15	20°C
div-1(or148)	EU548	~10	15°C
div-1(or148)	EU550	~15	15°C
div-1(or345)	EU879	~15	15°C
div-1(or345)	EU880	~15	15°C
xpa-1(ok698)	RB864	~10	20°C
ubc-1(gk14)	VC18	~10	20°C
F58G6.1	tm1060	~10	20°C
him-6(ok412)	VC193	~15	20°C
R07E5.3(ok622)	RB810	~15	20°C
gta-1(ok517)	RB748	~10	20°C
- K08E3.5(ok233)	MG278	~10	20°C
C17H12(ok548)	RB769	~10	20°C

## Table 2.1. Conditions for high-throughput RNA interference by liquid feeding

For each *C. elegans* strain used in this study, genotype ('Gene(allele)'), the number of L1 worms that were added per well of a 96-well plate, and the incubation temperature for RNA interference screens ('Screening temperature') are shown.

## 2.1.1.4. Freezing buffer

1M KH <sub>2</sub> PO <sub>4</sub>	3 g
0.05 M K <sub>2</sub> HPO <sub>4</sub>	129 ml
0.05 M KH <sub>2</sub> PO <sub>4</sub>	871 ml
NaCl	5.85 g
Glycerin	30% (v/v)

## 2.1.1.5. Bleach solution

NaOH	250 µl
Sodium hypochlorite	100 µl
Autoclaved H <sub>2</sub> O	to 1000 µl

## 2.1.2. Bacteria

## 2.1.2.1. Ahringer RNAi feeding library

Bacterial clones used for RNA interference (RNAi) experiments were selected from the Ahringer RNAi feeding library (Kamath *et al.*, 2003).

## 2.1.2.2. Luria-Bertani (LB) medium

Bacto-tryptone	10 g
Bacto-yeast extract	5 g
NaCl	10 g
Optional <sup>a</sup> : Bacto-Agar	15 g
ddH <sub>2</sub> O	to 1 L

pH was adjusted to 7.2 and solution was autoclaved to sterilize.

<sup>a</sup> For preparation of agar plates, solution was poured into sterile Petri dishes.

#### 2.1.2.3. 2 x Tryptone / yeast extract (TY)

Bacto-tryptone	16 g
Bacto-yeast extract	10 g
NaCl	5 g
dd H <sub>2</sub> O	to 1 L

pH was adjusted to 7.2 and solution was autoclaved to sterilize.

#### **2.2. Protocols**

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#### 2.2.1. Maintenance of C. elegans stocks

*C. elegans* was maintained on NGM agar plates seeded with OP50 *E. coli* according to standard protocols (Brenner, 1974).

#### 2.2.2. Freezing and recovery of C. elegans stocks

For freezing, worms that were approaching starvation — L1 and L2 worms survive freezing best — were washed off plates in M9 buffer, pelleted by centrifugation at 1,000 rpm for 1 minute, and resuspended in an equal volume of M9 and freezing buffer. 1 ml of suspension was aliquoted per 1.8 ml cryovial. Cryovials were placed into freezing boxes filled with isopropanol to allow a gradual 1°C decrease in temperature per minute when placed at -80°C. Cryovials were stored at -80°C.

For thawing, cryovials were placed at room temperature and worms were spotted onto NGM plates seeded with OP50 *E. coli* as soon as all ice had turned to liquid.

### 2.2.3. High-throughput RNA interference liquid-feeding assay

All RNA interference (RNAi) experiments were performed by using bacterial feeding in liquid cultures in 96-well format.

#### Preparation of bacteria:

Bacterial glycerol stocks were replica plated onto LB plus 100  $\mu$ g/ml ampicillin plates using a 96-pin replicating tool and grown overnight at 37°C. The day before starting the screen, bacteria were inoculated in 400  $\mu$ l 2 x TY containing 100  $\mu$ g/ml ampicillin in 2-ml 96-well plates and grown overnight to saturation (~15 hours) in a shaking incubator at 220 rpm at 37°C.

#### Induction of bacteria:

The following morning, expression of double-stranded RNA (dsRNA) was induced by addition of isopropyl-beta-D-thiogalactopyranoside (IPTG) to a final concentration of 4 mM to each well of bacterial cultures and incubated while shaking at 220 rpm for 1 hour at 37°C. Subsequently, bacterial culture medium was replaced by nematode growth medium (NGM). Therefore, bacterial cultures were pelleted by spinning at 3,500 rpm for 5 minutes, the supernatant discarded by quickly inverting the 2-ml 96-well plates, and pelleted bacterial clones were resuspended in 400  $\mu$ l of NGM plus 100  $\mu$ g/ml ampicillin and 4 mM IPTG.

#### Preparation of worms:

96-well RNAi liquid-feeding assays were started with L1 worms. Synchronized populations of L1 worms were obtained by filtration of mixed-stage populations through an 11 μm nylon mesh (MultiScreen<sup>TM</sup> Nylon Mesh, Millipore) or by bleaching adult worms and allowing their eggs to hatch in M9 buffer.

*Filtering:* When synchronizing worms by filtration, it is recommended to use worm populations that are approaching starvation, to avoid dilution of dsRNA-expressing bacteria with OP50 *E. coli*. Meshes were sterilized before each filtration with 70% v/v ethanol. Worms were washed off plates in M9 buffer, and transferred into a mesh placed on top of a 2-ml 96-well plate. L1 worms were passed through the mesh by centrifugation at 1,000 rpm for 30 seconds. Synchronized L1s were collected and diluted to a concentration of approximately 10 L1s (for worm strains with a brood size similar to wild-type worms) or 15 L1s (for strains with reduced brood size as compared to wild-type) per 15  $\mu$ l M9 buffer.

Bleaching: An alternative approach for obtaining synchronized populations of L1 worms was the bleaching of gravid adults and allowing their eggs to hatch overnight in M9 buffer. Therefore, gravid adult worms were washed off plates in M9 buffer and collected by centrifugation at 1,000 rpm for 1 minute. Supernatant was aspirated off, and 1-2 ml bleach solution (depending on the size of the worm pellet) was added. Worms were incubated in bleach solution with occasional vortexing until dissolved and only embryos remained. To remove bleaching solution, eggs were resuspended in 10 ml M9 buffer and subsequently centrifuged at 1,000 rpm for 1 minute. This step was repeated three times. Worms were allowed to hatch overnight in M9 buffer with gentle rocking to allow aeration. The next morning, larvae were pelleted by centrifugation at 1,000 rpm for 1 minute and diluted to a final concentration of 10 to 15 L1s per 15 µl M9 buffer.

#### RNAi feeding experiments:

Worms in a final concentration of 10 to 15 L1s per 15  $\mu$ l M9 buffer were pipetted into each well of a 96-well flat-bottom plate from a plastic tray by using a 12-well multichannel pipette. To avoid settling of worms in the plastic tray, worms were pipetted up and down before aliquoting. Subsequently, 40  $\mu$ l of resuspended bacterial culture were added to each well. For combinatorial RNAi feeding experiments, resuspended cultures of different bacterial strains were mixed to give a final volume of 40  $\mu$ l.

Plates were incubated shaking at 150 rpm, 20°C, for 4 days (15°C for 6 days for temperature-sensitive genetic mutants; see Table 2.1. for screening conditions for all strains used in this study). To avoid evaporation of liquid from wells, 96-well plates were stacked in sealable plastic boxes and covered with a wet tissue.

#### Scoring of phenotypes:

After an appropriate incubation time (4 to 6 days), worms were screened under a dissecting microscope for sterility, embryonic lethality, growth, and developmental defects. Sterility and embryonic lethality were scored semi-quantitatively on a scale from 0 (wild-type) to 3 (100% sterile or embryonic lethal). In cases where sterility or embryonic lethality appeared enhanced after targeting both genes simultaneously by combinatorial RNAi or by RNAi in a genetic mutant as compared to phenotypes of each individual gene, phenotypes were verified by quantification (see below).

# **2.2.4.** Testing post-embryonic additive RNAi phenotypes and known post-embryonic synthetic genetic interactions

To score post-embryonic phenotypes, L1 larvae were collected from the 96-well liquid-feeding assay 4 days after the screen was set up and allowed to develop further on 12-well NGM plates. Therefore, liquid-feeding cultures were filtered through an 11  $\mu$ m nylon mesh (MultiScreen<sup>TM</sup>Nylon Mesh, Millipore) by centrifugation and L1 larvae were spotted onto 12-well NGM plates containing 100  $\mu$ g/ml ampicillin and 1 mM isopropylbeta-D-thiogalactopyranoside (IPTG), seeded with bacteria expressing a non-targeting dsRNA (Ahringer library clone Y95B8A\_84.g). Adult worms were scored after further incubation at 20°C for 72 hours. Since I was assessing second-generation (postembryonic) phenotypes, I had to exclude genes that resulted in sterility, embryonic lethality, or larval growth arrest after RNAi. Only genes that were (according to the above criteria) amenable to analysis in both wild-type worms and the RNAi-hypersensitive *rrf-3* background could be included in this study.

#### 2.2.5. Investigating dilution effects induced by combinatorial RNAi

To investigate the extent to which combining dsRNA-expressing bacteria leads to a reduced strength of RNAi phenotypes, I evaluated the average failure rate for the successful generation of a phenotypically detectable knockdown for single genes at a given dilution. I therefore added unrelated control dsRNA-expressing bacteria to bacteria expressing dsRNA against genes with previously known non-viable RNAi phenotypes at 2-, 3-, 4-, 5-, and 10-fold dilution. The Ahringer library clone Y95B8A\_84.g, expressing dsRNA that does not target an expressed sequence in *C. elegans* and bacteria expressing dsRNA against *lin-31*, respectively, were used as control dsRNA-expressing bacteria.

### 2.2.6. Estimating the false-negative rate of combinatorial RNAi

Assuming each gene is an independent targeting event in combinatorial RNAi, I estimated the false-negative rate of combinatorial RNAi for identifying multigenic

interactions by calculating the detection rate of n-genic interactions to be  $x^n$ , where x is the detection rate of single-gene phenotypes at n-fold dilution.

#### 2.2.7. Identification of C. elegans gene duplicates

I used the INPARANOID algorithm (Remm *et al.*, 2001) (version 4.0) to identify genes that have been duplicated in the genome of *C. elegans* since divergence from *S. cerevisiae* and *D. melanogaster*, respectively. I therefore identified single orthologues in *S. cerevisiae* and *D. melanogaster* genomes that correlate to duplicate gene pairs in *C. elegans*.

## **2.2.8.** Identification of *C. elegans* orthologues of *S. cerevisiae* gene pairs with synthetic lethal interactions

The INPARANOID algorithm (Remm *et al.*, 2001) (version 4.0) was used to identify *C. elegans* orthologues of all *S. cerevisiae* gene pairs that were reported to have synthetic lethal or sick (SL) interactions in at least one of three genome-scale screens (Davierwala *et al.*, 2005; Pan *et al.*, 2006; Tong *et al.*, 2004). I only tested for genetic interactions between gene pairs that both had a single orthologue in *C. elegans*.

#### 2.2.9. Identification of synthetic genetic interactions using combinatorial RNAi

For the identification of synthetic genetic interactions between *C. elegans* gene duplicates, I excluded all genes that are targeted by bacterial clones from the *C. elegans* whole-genome RNAi library (Kamath and Ahringer, 2003) with inserts having more than 80% nucleotide identity over 200 bp with multiple predicted genes from the analysis. This is the threshold for cross-reaction used in Kamath *et al.* (2003). Furthermore, genes that resulted in first-generation larval growth arrest after RNAi were not included in any study for synthetic genetic interactions, since this strong phenotype cannot be enhanced any further.

When screening for genetic interactions using combinatorial RNAi, single-gene RNAi phenotypes (as references) were compared with combinatorial RNAi phenotypes side by side. To account for dilution effects arising from combining two dsRNA-expressing bacteria, equal amounts of non-targeting dsRNA-expressing bacteria (Ahringer library clone Y95B8A\_84.g) were added to bacteria expressing dsRNA targeting the reference genes. This setup allowed combinatorial RNAi to be performed in triplicates within independent screens, and RNAi against each gene individually in duplicates within independent assays.

Screens for synthetic genetic interactions were performed at least twice independently in duplicate/triplicate within independent assays. Synthetic phenotypes needed to be unambiguous and reproducible in at least two independent RNAi experiments to be scored positive.

Qualitatively observed synthetic lethal phenotypes were further verified by quantification. Therefore, larvae, unhatched eggs, and adults from each RNAi experiment were manually counted. To facilitate counting of worms and dead embryos, respectively, NaN<sub>3</sub> was added to a final concentration of 25mM to each well before worms were spotted onto empty 12-well NGM plates. Quantitative phenotype data were subject to statistical analysis as described under 'Statistical analysis of quantitative phenotype data under a multiplicative model'.

#### 2.2.10. Identification of synthetic lethal interactions using RNAi in genetic mutants

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When testing for genetic interactions using RNAi to target a single gene in a *C. elegans* strain carrying a homozygous viable loss-of-function allele (see Table 2.1. and Appendix Table 5.2.), RNAi phenotypes seen in the genetic mutants were compared to the RNAi phenotypes of wild-type worms and to the phenotypes of the genetic mutants fed on bacteria expressing a dsRNA that does not target an expressed portion of the *C. elegans* genome (Ahringer library clone Y95B8A\_84.g).

Screens for synthetic genetic interactions were performed at least twice independently in duplicate within independent assays. Synthetic phenotypes needed to be

unambiguous and reproducible in at least two independent RNAi experiments to be scored positive.

To exclude false synthetic phenotypic effects caused by non-specific additive effects of genetic mutants and RNAi phenotypes, respectively, when screening for synthetic phenotypes, mutant strains that showed enhanced phenotypes when targeting a second gene by RNAi as compared to the phenotypes observed in wild-type worms were also fed on additional RNAi clones that produce phenotypes similar to the putatively interacting gene in wild-type worms.

# 2.2.11. Statistical analysis of quantitative phenotype data under a multiplicative model

To be able to unambiguously identify SL interactions, quantitative phenotype data were subject to statistical analysis. Therefore, measurements of brood size and embryonic viability following RNAi were normalized to measurements obtained when worms were fed on bacteria expressing dsRNA against control genes that give no detectable phenotypes ('wild-type brood size' and 'wild-type embryonic survival'). In cases where measurements for brood size and embryonic viability exceeded 100% of wild-type brood and viability, values were set to 100% of wild-type values.

I analysed quantitative phenotype data under a multiplicative model. In this model, the null hypothesis for the contribution of independent genetic loci to a phenotype is that the double mutant RNAi phenotype equals the product of mutant phenotypes associated with each individual gene. Thus, to examine whether the combinatorial RNAi phenotypes were truly synthetic or merely additive, I compared the quantitative phenotypes following combinatorial RNAi with the calculated products of measurements for both individual genes of a pair. I therefore multiplied duplicate brood size and embryonic survival measurements obtained after RNAi against each gene individually (n=2) in two independent experimental setups (n=2) in all possible pairwise combinations. That way I obtained sixteen values (n=4x4) that represented the expected brood size and embryonic survival measurements if genes do not interact. This array of

calculated products was compared to six measurements (n=3x2) obtained after combinatorial RNAi in two independent experiments.

I used a Student's t-Test (two-tailed distribution, two-sample equal variance) to determine whether the observed values differed significantly from the expected values. I considered genes to be synthetic lethal if p-values were below  $5.0 \times 10^{-2}$ .

#### 2.2.12. Evolutionary analysis

The INPARANOID algorithm (version 4.0) was used to identify *C. elegans* orthologues of *C. briggsae* genes (Remm *et al.*, 2001). If both *C. elegans* duplicates had a single identifiable orthologue in *C. briggsae*, this implies that the duplication predates the divergence of *C. elegans* from *C. briggsae*. Protein sequences were aligned using the CLUSTAL W program to determine the percentage of identity between gene duplicates (Thompson *et al.*, 1994). Numbers of synonymous nucleotide substitutions per synonymous site (Ks) and non-synonymous nucleotide substitutions per non-synonymous site (Ka) were estimated using the Maximum Likelihood Method (Goldman and Yang, 1994; Muse and Gaut, 1994).

# 2.2.13. Comparative analysis of synthetic genetic interactions compiled from literature

Previously known genetic interactions were extracted from BIOGRID (for *S. cerevisiae*; Stark *et al.*, 2006), WormBase (for *C. elegans*; <u>www.wormbase.org</u>), and FlyBase (for *D. melanogaster*; Crosby *et al.*, 2007), respectively, and the INPARANOID algorithm (version 5.1) was used to identify single orthologues between these species.

#### 2.2.14. Imaging

For imaging, worms were pipetted from the 96-well RNAi liquid-feeding assay onto microscope slides. One drop of 25mM NaN<sub>3</sub> was added to worms in liquid before adding a coverslip. Worms with adult lethal phenotypes were very fragile and thus could

not be covered with a coverslip for imaging. Zeiss Stemi SV11 microscope plus Axiovision software version 7.0 were used to capture images.

#### 2.2.15. Amplification of DNA fragments by polymerase chain reaction (PCR)

To confirm the identity of RNAi clones, gene-specific DNA fragments were amplified by PCR and verified by sequencing. For each clone, a separate PCR reaction was performed. Therefore, a small amount of bacterial clones was added to ~ 5  $\mu$ mol of each primer, 1x Bioline NH<sub>4</sub> reaction buffer, ~37.5 mM MgCl<sub>2</sub>, 20 mM dNTPs (Boehringer) and 0.2  $\mu$ l *Taq* DNA polymerase (Bioline) in a 25 $\mu$ l reaction.

PCR Machines were preheated to 94°C for five minutes, followed by 34 cycles of 94°C for 30 seconds, 58°C for 30 seconds, and 72°C for 2 minutes. PCR reactions were stored at -20°C until use. Sequencing of PCR products was performed using standard protocols at The Wellcome Trust Sanger Institute using 5  $\mu$ mol of sequencing primers for each reaction.

Primers:

L4440 forward primer: 5'—AGCGAGTCAGTGAGCGAGGAAGC—3' L4440 reverse primer: 5'—GGTTTTCCCAGTCACGACGTTG—3' Sequencing primer: 5'—TCGAGGTCGACGGTATCG—3' **Chapter 3** 

# Establishing and validating protocols for high-throughput RNA-mediated interference

#### **3.1. Introduction**

RNA-mediated interference (RNAi) is a powerful tool for studying the loss-offunction phenotypes of genes. So far, RNAi has been used extensively to generate genome-scale views of gene functions in the nematode *C. elegans* and in fly cells (for examples see Boutros *et al.*, 2004; Bjorklund *et al.*, 2006; Kamath *et al.*, 2003; Kiger *et al.*, 2003; Simmer *et al.*, 2003). In particular in *C. elegans*, the feasibility of generating loss-of-function phenotypes by feeding worms on bacteria expressing double-stranded RNA (dsRNA) against a target gene of interest ('RNAi by bacterial feeding'; Timmons and Fire, 1998) has led to the generation of a whole-genome RNAi feeding library, consisting of 16,757 dsRNA-expressing bacterial clones corresponding to ~86% of predicted *C. elegans* genes (Kamath *et al.*, 2003). This resource allows for the rapid and low-cost analysis of gene functions on a large scale. Therefore, RNAi by bacterial feeding has become the method of choice for performing genome-scale loss-of-function screens in the worm.

While loss-of-function analyses of individual genes give us an unprecedented level of insight into the molecular roles of genes, genome-wide studies revealed that inactivation of most genes in any organism has little discernible effect on fitness under laboratory conditions (Bjorklund et al., 2006; Boutros et al., 2004; Giaever et al., 2002; Kamath et al., 2003). However, inactivating specific rare combinations of such nonessential genes can have profound effects on the organism under exactly the same conditions, the most dramatic being inviability (Dobzhansky, 1946; Sturtevant, 1956; reviewed in Guarente, 1993; Hartman et al., 2001). These combinatorial effects are termed 'synthetic enhancement' or 'synthetic lethal' interactions. Synthetic lethal (SL) genetic interactions are classically interpreted as the result of inactivating two functionally redundant pathways in the cell, each of which is individually dispensable (reviewed in Guarente, 1993; Hartman et al., 2001). Recently, synthetic sick and synthetic lethal (SL) interactions have been mapped systematically in the yeast S. *cerevisiae.* These large-scale studies appear to have uncovered an extensive degree of redundancy in the genome of S. cerevisiae. Strikingly, while only ~1,000 of the ~6,000 genes in the yeast genome are essential for viability under standard laboratory conditions and thus show a lethal phenotype when deleted, systematic large-scale studies have uncovered thousands of SL interactions under identical conditions. These results led to the estimation that, on a genome-wide scale, inactivation of ~ 200,000 pairwise gene combinations might have detrimental effects (reviewed in Boone *et al.*, 2007). These approximations highlight the complexity of biological functions. Thus, while studying the molecular roles of individual genes is a major advance, an understanding of how each phenotype is modulated by the activities of other genes will prove to be just as critical.

Comparable large-scale approaches to identify SL interactions in more complex systems will reveal the extent of redundancy in different genomes, and will also shed light on the evolution and conservation of gene networks (as discussed in the Introduction).

Extrapolating the estimates from large-scale yeast genetic interaction studies to the genome of *C. elegans*, it is evident that high-throughput platforms are needed for the systematic mapping of genetic interactions in the worm. At the time my study began, RNAi by feeding was conventionally performed on 12-well nematode growth medium (NGM) plates ('plate feeding'; as discussed in the Introduction, see Figure 1.3). However, the throughput of this approach is limited. It thus was critical to establish protocols that allow RNAi experiments to be performed at considerable higher throughput.

In collaboration with Ben Lehner in the lab, I sought to develop a robust highthroughput (HTP) assay for screening RNAi phenotypes in liquid cultures in 96-well format. There are numerous advantages to performing RNAi screens by liquid feeding in 96-well format over conventional plate-feeding protocols. First, all pipetting steps can be done by using multichannel tools, thereby considerably reducing the time it takes to set up screens. Second, when feeding worms in liquid culture, one can increase the amount of food as compared to plate feeding, thereby allowing multiple worms to be screened in each individual RNAi experiment. Thus, in contrast to screening progeny of individual animals — as is done when using conventional plate-feeding methods — RNAi by liquid feeding would allow the screening of populations of worms for loss-of-function phenotypes. First, this would remove the laborious manual step of transferring single worms into individual wells. Most importantly, however, considering the inherent animal-to-animal variability in RNAi, screening progeny of individual animals can lead to the observation of rather extreme phenotypes and hence to the representation of greatly biased results. In contrast, analysing the loss-of-function phenotypes of pooled adults allows to identifying the mean phenotype. Thus, screening populations of worms would average the animal-to-animal variation of RNAi phenotypes and lead to more standardized results than obtained when using single-animal plate-feeding protocols. Finally, with the smaller size of 96-well in comparison to 12-well plates, incubation space is unlikely to become a limiting factor for performing RNAi screens on a large scale.

Thus, in summary, RNAi by liquid feeding in 96-well format would allow us to study the loss-of-function phenotypes of entire worm populations, thereby avoiding the animal-to-animal variation of RNAi phenotypes. That way, we would obtain an estimate of the mean RNAi phenotype while substantially increasing the throughput.

In this chapter, I will describe the development of an experimental platform for the screening of RNAi phenotypes in liquid culture in 96-well format and demonstrate that this is an efficient and robust method for analyzing loss-of-function phenotypes in *C*. *elegans*. Moreover, I will discuss how I have adapted these protocols for using RNAi to simultaneously target two genes in the genome of *C. elegans*.

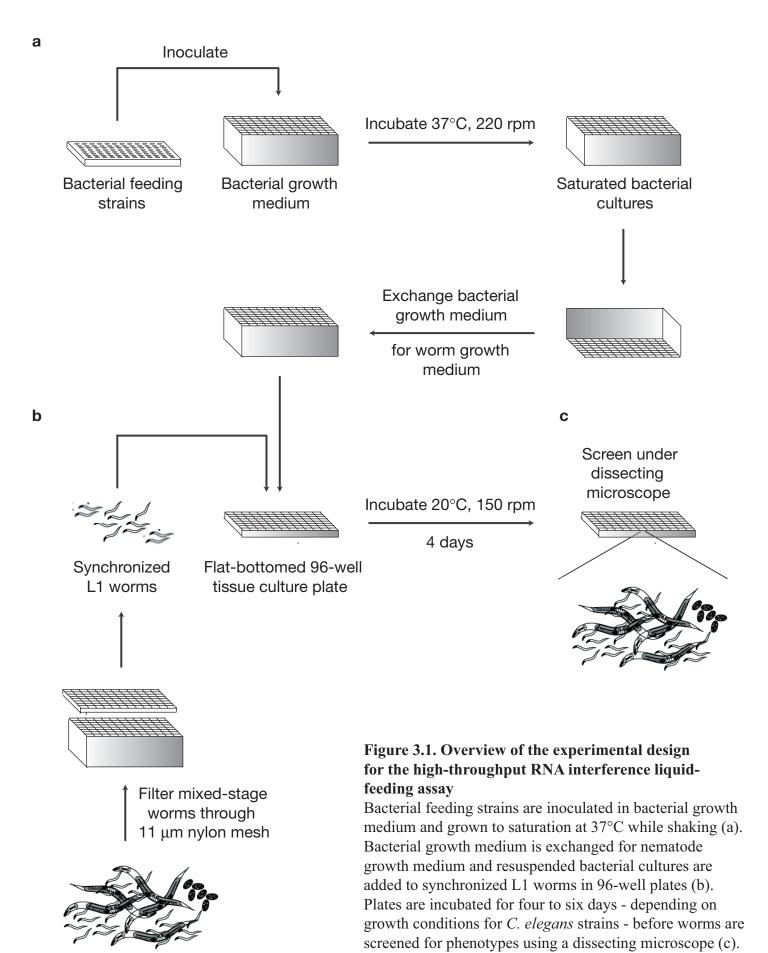
#### 3.2. Establishing a high-throughput RNAi liquid-feeding assay in 96-well format

To set up an HTP platform for RNA interference (RNAi) by liquid feeding, we considered the following criteria. First, we sought to identify an appropriate volume of liquid to ensure adequate aeration of feeding cultures. Second, we needed to identify the number of larval-stage worms that can be accurately pipetted using a multi-channel pipette while being compatible with the volume of bacterial feeding cultures. Taking into account that flat-bottomed 96-well plates can maximally contain 200  $\mu$ l per individual well, we reasoned that a total volume of 50  $\mu$ l might be suitable for liquid cultures to be sufficiently oxygenated without requiring excessive shaking. Next, we sought to determine an adequate number of worms to be dispensed into each well. We wanted to start the 96-well liquid-feeding protocol with first larval stage (L1) worms, because it is

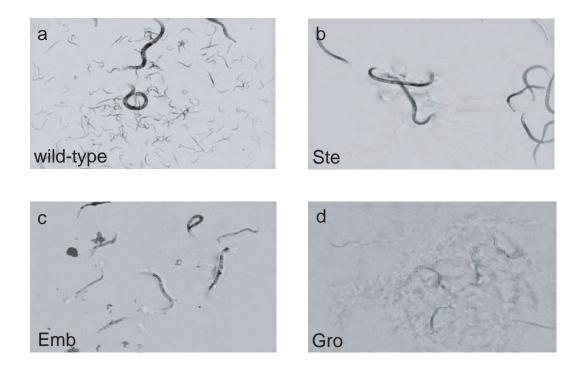
straightforward to obtain synchronized cultures of L1 worms by filtering mixed-stage populations of worms through an 11  $\mu$ m nylon mesh (MultiScreen<sup>TM</sup> Nylon Mesh, Millipore), or by bleaching adult worms and allowing their eggs to hatch over night in M9 buffer (see Materials and Methods for a detailed description). We found approximately 10 L1 worms (in a volume of 10  $\mu$ l) to be the minimum number of animals that can be reproducibly distributed. This low quantity also allows L1s to grow to adulthood, lay eggs and these eggs to hatch without food becoming a limiting factor.

#### 3.2.1. Experimental design

For RNAi experiments, selected bacterial strains of the C. elegans RNAi feeding library (Kamath et al., 2003) were inoculated in bacterial culture medium containing ampicillin in deep 96-well plates (see Figure 3.1. for an overview of the experimental procedure and Materials and Methods for a more detailed description of the protocol). Bacterial cultures were grown to saturation while shaking at 37°C before inducing dsRNA expression by adding isopropyl-beta-D-thiogalactopyranoside (IPTG) for 1 hour at 37°C. For RNAi by feeding, we exchanged the bacterial culture medium for Nematode Growth Medium (NGM) supplemented with ampicillin and IPTG. Therefore, bacterial cultures were collected by centrifugation, the supernatant discarded, and pelletet bacteria were resuspended in a volume of NGM equal to bacterial culture medium. Approximately 10 L1 worms were distributed into each well of a 96-well flat-bottom plate and 40 µl of the resuspended bacterial feeding cultures were added. For strains with lower brood size as compared to wild-type worms, roughly 15 L1 worms were used. Plates were incubated shaking at 150 rpm, 20°C, for 4 days. This time period allowed L1 worms to grow to adults, lay eggs and for these eggs to hatch and develop into larvae. After 4 days worms had consumed most of their food, which resulted in clearing of the suspension, thereby allowing easy scoring of phenotypes. Worms were manually assessed for viability, fecundity and growth defects using a dissecting microscope (for example phenotypes see Figure 3.2.). Note that at the same time, others have described similar protocols for performing RNAi screens in 96-well format (Nollen et al., 2004; van Haaften et al., 2004).



Mixed-stage worm population



## Figure 3.2. Example phenotypes generated by RNA interference by liquid feeding in 96-well format

Representative pictures of wild-type worms (a), sterile (b), embryonic lethal (c, black dots represent dead eggs), and first-generation growth defective (d) worms in 96-well plates are shown.

#### 3.2.2. Determining the sensitivity of RNAi by liquid feeding in 96-well format

To evaluate the sensitivity of RNAi by liquid feeding in 96-well format, I sought to assess the ability of this newly developed assay to recapitulate RNAi phenotypes that have been generated using conventional plate-feeding protocols. Therefore, I selected all 391 genes from *C. elegans* chromosome III that showed an RNAi phenotype in the genome-wide screen performed by Kamath *et al.* (2003) (see Appendix Table 3.1.). I chose to determine the sensitivity of the RNAi liquid-feeding assay in the RNAi-hypersensitive *rrf-3* background, which had previously been found to result in an increased penetrance of RNAi phenotypes as compared to wild-type worms.

First, I tested 282 genes that were reported to give a non-viable (embryonic lethal or sterile) RNAi phenotype and investigated these for non-viable phenotypes in two independent experimental setups. I identified 209 genes (74%) to also result in non-viable RNAi phenotypes in two independent screens by RNAi by liquid feeding. An additional 19 and 10, respectively, genes were found to show non-viable phenotypes in either screen (Table 3.1).

Next, I focused on genes that were known to result in slowed post-embryonic growth. Of 64 genes assayed, 39 genes (61%) gave a detectable RNAi phenotype in two separate screens and a further 9, and 3 genes, respectively, displayed an RNAi phenotype in either screen. The great majority of these genes, however, showed non-viable, rather than slowed growth RNAi phenotypes when screening rrf-3 worms in my experimental setting (see below for discussion).

Finally, I investigated the detection rate of post-embryonic phenotypes. Of 45 genes with any known post-embryonic RNAi phenotype identified by Kamath *et al.*, 24 genes (53%) showed an RNAi phenotype in both independent screens, and phenotypes were detected for an additional 6, and 4, respectively, genes in either assay. Roughly two thirds of these genes displayed non-viable RNAi phenotypes.

There are two possible explanations for the increased frequency of non-viable RNAi phenotypes that I observed when screening *rrf-3* worms using the 96-well liquid-feeding assay, as compared to the results reported by Kamath and co-workers. First, I used the RNAi-hypersensitive strain *rrf-3*, which is known to result in higher

Kamath et al.,	96 well RNAi liquid feeding assay								
2003	1	Detected	Identical			Non-viable			
RNAi screen	Screen	Screen	Mean	Screen	Screen	Mean	Screen	Screen	Mean
	1	2		1	2		1	2	
Non-viable	238	232	235	228	219	224	228	219	224
(n=282)	(84%)	(82%)	(83%)	(81%)	(78%)	(79%)	(81%)	(78%)	(79%)
Growth-defective	48	42	45	11	8	10	37	33	35
(n=64)	(75%)	(66%)	(70%)	(17응)	(13%)	(15%)	(58%)	(52%)	(55%)
Post-embryonic	30	28	29	4	3	4	20	17	19
(n=45)	(67%)	(62%)	(64%)	(9%)	(7왕)	(88)	(44%)	(38%)	(41%)
Total	316	303	310	243	230	237	285	269	277
(n= 391)	(81%)	(77%)	(79%)	(62%)	(59%)	(60%)	(73%)	(69%)	(71%)

## Table 3.1. Effectiveness of RNA interference by liquid feeding in 96-well format

RNA interference (RNAi) phenotypes for each gene on *C. elegans* chromosome III that was reported to result in non-viability ('Non-viable'), slowed post-embryonic growth ('Growth-defective') or defects in post-embryonic development ('Post-embryonic') in the genome-wide RNAi screen performed by Kamath *et al.* (2003) were determined when feeding the RNAi-hypersensitive *rrf-3* strain in liquid culture in 96-well format. Worms were assessed for non-viability, slowed post-embryonic growth, and defects in post-embryonic development in two independent experiments ('Screen1', 'Screen 2'). Data shown represent the total number of genes (percentages in brackets) that were detected in each phenotypic category ('Detected'), that had phenotypes identical to the ones reported by Kamath *et al.* ('Identical'), and that resulted in non-viability ('Non-viable') after RNAi, respectively. Mean values for both independent screens are rounded up.

penetrance of RNAi phenotypes as compared to wild-type worms, while Kamath *et al.* have performed their genome-wide screen in wild-type animals. Second, I delivered dsRNA to L1 worms, whereas protocols for RNAi by plate feeding start with L3-stage worms. This early interference of gene expression is likely to lead to more severe developmental defects. When comparing my results to previously reported RNAi phenotypes (www.wormbase.org), I found that the great majority (87%) of genes that resulted in non-viability rather than in slowed post-embryonic growth or other post-embryonic defects — as found by Kamath *et al.* (2003) — were shown to have a non-viable phenotype in other RNAi screens, demonstrating that my results are not false positives.

In summary, RNAi by liquid feeding in 96-well format using the RNAihypersensitive *rrf-3* strain allowed, on average, the detection of approximately 80% of genes with a previously identified RNAi phenotype in wild-type worms when using conventional plate-feeding protocols. I was able to re-discover over 80% of previously known non-viable RNAi phenotypes. In addition, approximately 70% of genes conferring growth defects and two thirds of genes resulting in any visible post-embryonic phenotype upon RNAi in wild-type worms were identified by bacterial feeding in liquid culture with roughly 90% reproducibility. Importantly, even when only scoring for non-viable phenotypes using the RNAi-hypersensitive *rrf-3* strain, this HTP RNAi liquid-feeding assay can, on average, capture approximately 60% of any phenotypes that have been detected in wild-type worms when using conventional plate-feeding protocols.

Taken together, these results demonstrate that RNAi by bacterial feeding in liquid culture in 96-well format is a powerful tool for generating loss-of-function phenotypes for *C. elegans* on a large scale. Thus, although RNAi phenotypes for some genes might be missed in this assay, RNAi by liquid feeding in 96-well format makes it feasible to perform roughly two thousand individual RNAi experiments per researcher per day, thereby increasing the throughput as compared to conventional plate-feeding protocols by approximately ten-fold. Most notably, by pooling animals, one can average the animal-to-animal variation of RNAi phenotypes. To obtain similarly standardized results by RNAi by plate feeding, phenotypes for numerous individual adults and their progeny would

need to be assessed. In that respect, the throughput of RNAi by liquid feeding is considerably higher than the estimated 10-fold, but rather ranges around 50-fold.

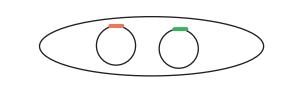
In summary, I consider the RNAi liquid-feeding assay in 96-well format using the RNAi-hypersensitive *rrf-3* background a HTP screening platform and an efficient and robust method for generating genome-scale views of gene function in *C. elegans*. I will refer to this screening tool as the 'high-throughput (HTP) RNAi liquid-feeding assay' throughout my text.

#### 3.2.3. Targeting multiple genes simultaneously by combinatorial RNAi

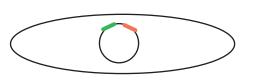
While analyzing the loss-of-function phenotypes of individual genes in an essentially wild-type background is a major advance, understanding how each phenotype is modulated by the activities of other genes will give us deeper insights into the complexity of biological functions. If mutations in one gene modulate the mutant phenotype of a second gene, these two genes are said to genetically interact (discussed in Hartman *et al.*, 2001).

To identify genetic interactions and to uncover genetic redundancy systematically in *C. elegans*, it was critical to establish methods for simultaneously perturbing two genes. Therefore, the concurrent targeting of two genes by RNAi would provide a powerful approach for unbiased searches for genetic interactions in the worm. Previously, it had been shown that injection of two dsRNAs targeting two individual loci could effectively reduce the expression of both genes simultaneously (Gotta and Ahringer, 2001; Paradis and Ruvkun, 1998; Pocock *et al.*, 2004). However, because RNAi by injection is both very labour-intensive and costly, its applications are limited. In contrast, targeting two genes simultaneously by RNAi by bacterial feeding would allow the systematic study of bigenic interactions in the genome of *C. elegans*.

Thus, to be able to carry out unbiased screens for genetic interactions in *C. elegans*, I sought to establish conditions for simultaneously targeting two genes using RNAi by bacterial feeding. Therefore, I considered three potential approaches (Figure 3.3.). One possibility would be the generation of a 'two-gene' bacterial feeding library by



b



С

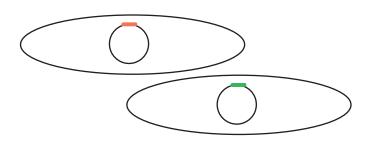


Figure 3.3. Three approaches for using RNA interference by bacterial feeding to simultaneously target two genes

Bacterial strains are transformed with two 'RNA interference (RNAi) feeding vectors' (L4440), each engineered to expressing a dsRNA against a different target gene of interest (a). Bacterial strains are transformed with one RNAi feeding vector, engineered to express two dsRNAs, each targeting a different gene of interest (b). Mixing of two RNAi feeding clones, each expressing a dsRNA targeting a different gene of interest (c). Ellipses, bacterial feeding strains. Circles, RNAi feeding vectors. Red and green rectangles, DNA fragments complementary to the coding regions of two different genes of interest.

co-transforming two 'RNAi feeding vectors' (L4440), each harbouring a different selection marker and engineered to express dsRNA against any target gene of interest, into one bacterial feeding strain. Alternatively, one might insert two DNA fragments complementary to the coding regions of any two genes of interest into the same RNAi feeding vector. This approach has previously been reported to result in the concomitant knockdown of two genes (P. Kuwabara, personal communication). However, taking into account that this method would require the laborious cloning of all pairwise combinations of gene-specific DNA fragments, this strategy might not be suitable for an exhaustive screening of bigenic interactions in C. elegans. Conversely, the most direct approach would be the feeding of worms on a mixture of two dsRNA-expressing bacterial strains. In principle, this would allow the systematic examination of interactions between any pair of genes on a large scale. Previous studies aimed at the simultaneous targeting of two genes by feeding worms on two different dsRNA-expressing bacteria, however, reported a reduced strength of phenotype produced by either gene (A.G. Fraser and R. Kamath, personal communication). However, these anecdotal negative results have come from a small number of experiments performed on wild-type worms. Given the potential power of this approach for the comprehensive mapping of genetic interactions in the genome of C. elegans, I sought to carefully assess the effectiveness of this strategy again, using the RNAi-hypersensitive *rrf-3* background. Therefore, I wished to adapt the high-throughput (HTP) RNAi liquid-feeding assay, which is very efficient and robust for studying the loss-of-function phenotypes of single genes, to targeting two genes simultaneously by mixing two dsRNA-expressing bacterial strains. I will refer to this method as 'combinatorial RNAi by bacterial feeding' or simply as 'combinatorial RNAi'.

#### 3.2.3.1. Testing additive RNAi phenotypes and known synthetic genetic interactions

To investigate whether I could target effectively more than one gene in a single animal by feeding a mixture of two different dsRNA-expressing bacterial strains, I performed three sets of test experiments. In each test set, I sought to determine the effectiveness of combinatorial RNAi both in wild-type worms and in the RNAihypersensitive strain *rrf-3*, using the HTP RNAi liquid-feeding assay. First, I sought to

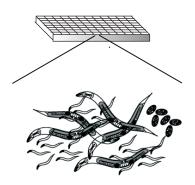
assess whether I could simultaneously target two independent genes, each with a known loss-of-function phenotype, and generate phenotypes for both genes in the same animal — for example, targeting *lin-31* by RNAi generates multivulval worms, targeting *sma-4* results in small worms, and targeting both would be expected to generate small worms with multiple vulvae if combinatorial RNAi was effective. Second, I wished to test whether I can recapitulate genetic interactions between the well-studied 'synthetic multivulval' (synMuv) genes, which have roles in two functionally redundant pathways (see page 61 for a more detailed description). Finally, I sought to investigate whether I can detect a subset of previously described synthetic lethal (SL) interactions.

For combinatorial RNAi feeding experiments, individual clones from the *C. elegans* RNAi feeding library were grown as described above (see Materials and Methods for more detail). After having dispensed first larval stage (L1) worms into each well of a flat-bottomed 96-well plate, equal volumes of two different bacterial feeding cultures were added. To be able to screen for second-generation post-embryonic phenotypes — as I intended to do when screening for additive and synMuv phenotypes — second-generation L1 worms were collected from the 96-well liquid-feeding assay by filtration through an 11  $\mu$ m nylon mesh (MultiScreen<sup>TM</sup> Nylon Mesh, Millipore), and allowed to develop further on 12-well Nematode Growth Medium (NGM) plates seeded with bacteria expressing a dsRNA that does not target a transcribed locus of the *C. elegans* genome (Ahringer RNAi feeding library clone Y95B8A\_84.g; Figure 3.4.). Growing second-generation L1s to adults on NGM plates by feeding them on non-targeting — as compared to targeting — dsRNA-expressing bacteria ensured that the observed postembryonic phenotypes were generated by using the HTP RNAi liquid-feeding assay and were not caused by RNAi by plate feeding.

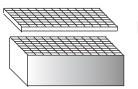
#### 3.2.3.1.1. Generating additive phenotypes by combinatorial RNAi

To examine whether I could generate loss-of-function phenotypes for two genes in the same animal by using combinatorial RNAi, I chose four well-characterized genes with non-overlapping post-embryonic phenotypes (Table 3.2.) to ensure that I could investigate each phenotype independently. Examining all possible pairwise combinations





Mixed-stage worm population from 96-well RNAi liquid feeding assay 4 days after screen had been set up



Filter mixed-stage worms through 11 µm nylon mesh

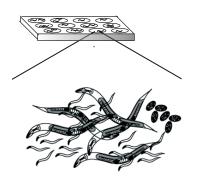
b

Spot L1 worms on pre-seeded agar plates

Synchronized L1 worms

12-well agar plate seeded with non-targeting dsRNAexpressing bacteria





Score post-embryonic phenotypes under dissecting microscope

Figure 3.4. Overview of protocol for screening secondgeneration post-embryonic phenotypes generated in the high-throughput RNA interference liquid-feeding assay

For assessing second-generation post-embryonic RNA interference (RNAi) phenotypes, L1 worms are collected from the high-throughput liquid feeding assay by filtration through a 11 $\mu$ m nylon mesh 4 days after the screen was set up (a). L1 worms are spotted onto 12-well agar plates that are seeded with non-targeting double-stranded RNA-expressing bacteria and allowed to grow to adulthood before being investigated for RNAi phenotypes (b).

Gene1	Gene2	Wild	-type	rrf-3			
		Pheno Gene1	Pheno Gene2	Pheno Gene1	Pheno Gene2		
lin-31	-	5%	-	35%	-		
sma-4	-	100%	-	100%	-		
unc-22	-	100%	-	100%	-		
lon-2	-	100%	-	100%	-		
lin-31	sma-4	2%	100%	20%	100%		
lin-31	unc-22	2%	100%	26%	100%		
lin-31	lon-2	4%	100%	13%	100%		
sma-4	unc-22	100%	100%	100%	100%		
sma-4	lon-2	100%	0%	100%	0%		
unc-22	lon-2	100%	100%	100%	100%		

#### Table 3.2. Combinatorial RNA interference effectively generates additive phenotypes

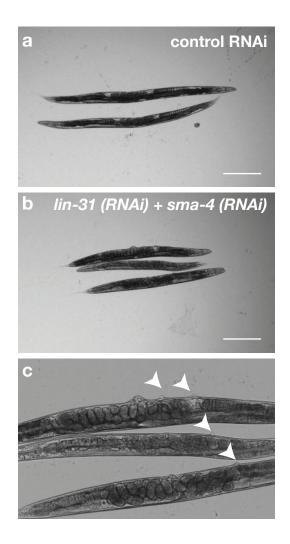
Wild-type and RNA interference- (RNAi-) hypersensitive *rrf-3* worms, respectively, were fed on selected bacterial strains of the *C. elegans* RNAi feeding library targeting the genes *lin-31*, *sma-4*, *unc-22*, and *lon-2*. Independent RNAi phenotypes ('Pheno Gene1', 'Pheno Gene2') were assessed when each gene was targeted individually and also for all possible pairwise combinations of genes. Percentages represent penetrance of phenotypes.

of my set of test genes and scoring for the known RNAi phenotypes both in wild-type animals and in the RNAi-hypersensitive *rrf-3* background, I could detect five of the five possible additive phenotypes in both wild-type and *rrf-3* worms (Table 3.2.; see Figure 3.5. for an example), demonstrating that it is feasible to target two genes in the same animal by combinatorial RNAi by bacterial feeding. In addition to generating additive phenotypes, I found that the simultaneous targeting of *sma-4* and *lon-2* produced only small worms — the phenotype of *sma-4* alone. Thus, using combinatorial RNAi, it was also possible to recapitulate a previously demonstrated epistatic relationship between SMADs and *lon-2* (Brenner, 1974). Finally, while I could detect additive RNAi phenotypes in wild-type worms, I noted that the penetrance was often higher in the *rrf-3* RNAi-hypersensitive strain, suggesting that this background might be more suitable for combinatorial RNAi. I examine this in more detail below.

#### 3.2.3.1.2. Creating synthetic post-embryonic phenotypes by cmbinatorial RNAi

Next, I investigated whether I could use combinatorial RNAi to recapitulate known genetic interactions that resulted in post-embryonic phenotypes. Therefore, I focused on the well-characterized synthetic multivulval (synMuv) genes (Ferguson and Horvitz, 1989; Poulin *et al.*, 2005). The synMuv genes are organized into two redundant genetic pathways that are required for normal development of the hermaphrodite vulva. Inactivation of either a gene functioning in the synMuv A pathway or a gene functioning in the synMuv B pathway alone does not result in a vulval defect, but inactivation of both a synMuv A and a synMuv B gene in combination leads to the generation of multiple vulvae — the multivulva (Muv) phenotype.

I set out to use combinatorial RNAi to co-target previously identified synMuv A genes (Poulin *et al.*, 2005) with the canonical class B gene *lin-15B*, and synMuv B genes (Poulin *et al.*, 2005) with the canonical synMuv A gene *lin-15A* in both wild-type animals and in the RNAi-hypersensitive strain *rrf-3*, respectively (Table 3.3.). As control, I studied the loss-of-function phenotypes of all synMuv genes individually. In each experiment, I scored progeny for the Muv phenotype; I expected to see this phenotype only if combinatorial RNAi targeted both genes effectively in the same animal. Because I



### Figure 3.5. Combinatorial RNA interference can target two genes in the same animal

Exposing worms to a mixture of two double-stranded RNA-(dsRNA-) expressing bacterial clones, one targeting *lin-31*, the other one targeting *sma-4*, resulted in small worms with multiple vulvae along their ventral side. Shown are *rrf-3* animals fed on bacteria expressing a non-targeting dsRNA (control, a) and combined bacterial clones expressing dsRNA against *lin-31* and *sma-4* (b and magnified in c). White arrowheads indicate pseudovulvae. Scale bars: 0.1 mm.

lin-15B

Predicted	Locus	synMuv	Wild-	rrf-3
Gene			type	
T27C4.4	egr-1	A	-	-
ZK678.1	lin-15A	A	Muv	Muv
K12C11.2	smo-1	А, В	n.s.	n.s.
W02A11.4	uba-2	А, В	Muv	Muv

lin-	15A
------	-----

Predicted	Locus	synMuv	Wild-	rrf-3
Gene		-	type	
K12C11.2	smo-1	А, В	n.s.	n.s.
W02A11.4	uba-2	А, В	_	Muv
C32F10.2	lin-35	В	Muv	Muv
C47D12.1	trr-1	В	n.s.	n.s.
C53A5.3	hda-1/gon- 10	В	n.s.	n.s.
E01A2.4		В	_	-
F44B9.6	lin-36	В	-	Muv
JC8.6		В	n.s.	n.s.
K07A1.12	lin- 53/rba-2	В	n.s.	n.s.
M04B2.1	mep-1/gei- 2	В	_	Muv
R05D3.11	met-2	В	-	Muv
R06C7.7	rls-1/lin- 61	В	Muv	Muv
W01G7.3		В	n.s.	n.s.
W07B3.2	gei-4	В	n.s.	n.s.
Y71G12B.9		В		Muv
Y102A5C.18	efl-1	В	Muv	Muv
ZK632.13	lin-52	В	Muv	Muv
ZK637.7	lin-9	В	Muv	Muv
ZK662.4	lin-15B	В	Muv	Muv

### Table 3.3. Genetic interactions of synthetic multivulval genes can be recapitulated by combinatorial RNA interference

Previously studied synthetic multivulval (synMuv) genes were targeted by combinatorial RNA interference (RNAi) in wild-type and *rrf-3* worms, respectively. Predicted gene names, their corresponding genetic locus names (if applicable), a definition of the gene as a component of either the synMuv A ('A'), synMuv B ('B'), or both ('A, B') pathways are shown. All synMuv A genes were targeted by RNAi in combination with a double-stranded RNA- (dsRNA-) expressing strain targeting the synMuv B gene *lin-15B*; corresponding experiments were performed with synMuv B genes and a dsRNA-expressing strain targeting *lin-15A*. In both cases, worms were scored for the presence of

was assessing second-generation post-embryonic phenotypes, I had to exclude genes that resulted in sterility, embryonic lethality, or larval growth arrest after RNAi from the screen for synMuv animals (marked as 'n.s.' in Table 3.3.). Of 3 synMuv A genes and 12 synMuv B genes that were amenable to analysis by combinatorial RNAi in both wild-type worms and the RNAi-hypersensitive *rrf-3* background, I observed Muv worms for 13 of 15 test cases in the hypersensitive *rrf-3* background, and for 8 of 15 possible viable combinations in wild-type animals (Table 3.3.).

#### 3.2.3.1.3. Generating known synthetic lethal phenotypes by combinatorial RNAi

As a final test of the efficacy of combinatorial RNAi, I investigated whether I can use combinatorial RNAi to recapitulate a set of known synthetic lethal (SL) interactions compiled from literature (Baugh et al., 2005; Davies et al., 1999; Pocock et al., 2004; Solari et al., 1999; Zhang and Emmons, 2001; Table 3.4.). To do so, I set out to compare the RNAi phenotypes resulting from simultaneously targeting both genes of a SL pair by combinatorial RNAi with the RNAi phenotypes of each gene alone, both in wild-type animals and in the RNAi-hypersensitive strain rrf-3, respectively, using the HTP RNAi liquid-feeding assay. To control for mixing two dsRNA-expressing strains when targeting both genes of a pair, I added equal amounts of bacteria expressing a dsRNA that does not target a transcribed portion of the C. elegans genome (Ahringer RNAi feeding library clone Y95B8A 84.g) to bacteria expressing dsRNA targeting each gene of a SL pair alone. In order to unambiguously identify SL interactions, I sought to quantify brood sizes per individual adult and embryonic survival rates and assessed these quantitative phenotype data under a multiplicative model (as discussed in the Introduction). Brood size, and embryonic survival rates, respectively, resulting from simultaneously targeting two genes had to be significantly lower than the calculated product of values for both individual genes for a gene pair to be considered SL.

Thus, I first determined brood sizes per individual adult and embryonic survival rates, respectively, following combinatorial RNAi against both genes simultaneously and RNAi against each gene individually in two separate experiments. I manually counted

	Wil	Wild-type								
Interaction	Gene1 Gene2		Genel &		SL	p-	<i>p</i> -			
Genel &					2			value	value	
Gene2										
	BS	ES	BS	ES	BS	ES		BS	ES	
mec-8 + sym-	88	99	82	98	78	92	ye	5.5E-	1.3E-	
1							S	01	02	
sop-3 + sop-	91	10	94	99	79	90	ye	2.8E-	8.5E-	
1		0					S	01	04	
tbx-8 + tbx-	83	99	78	97	52	11	ye	7.3E-	1.4E-	
9							s	02	24	
hlh-1 + unc-	91	99	76	99	28	91	ye	5.2E-	1.2E-	
120							s	05	02	
hlh-1 + hnd-	88	97	75	98	62	81	ye	б.бЕ-	5.7E-	
1							s	01	03	
unc-120 +	54	10	74	98	36	100	no	6.4E-	1.9E-	
hnd-1		0						01	01	
egl-27 +	93	99	79	90	90	89	no	6.0E-	7.4E-	
egr-1								02	01	

	rrf-3								
Interaction Gene1 & Gene2	ne1 & 2		SL	<i>p-</i> value	p- value				
	BS	ES	BS	ES	BS	ES		BS	ES
mec-8 + sym- 1	67	73	61	73	59	16	ye s	3.3E- 01	3.0E- 06
sop-3 + sop- 1	82	10 0	85	96	41	75	ye s	3.1E- 04	5.7E- 06
tbx-8 + tbx- 9	96	99	86	92	59	2	ye s	8.6E- 03	6.3E- 27
hlh-1 + unc- 120	90	90	31	99	1	64	ye s	8.1E- 06	2.9E- 03
hlh-1 + hnd- 1	86	87	82	94	42	24	ye s	1.6E- 03	8.2E- 14
unc-120 + hnd-1	33	10 0	87	94	7	98	ye s	5.7E- 04	4.8E- 02
egl-27 + egr-1	97	99	83	93	73	62	ye s	2.9E- 01	5.7E- 08

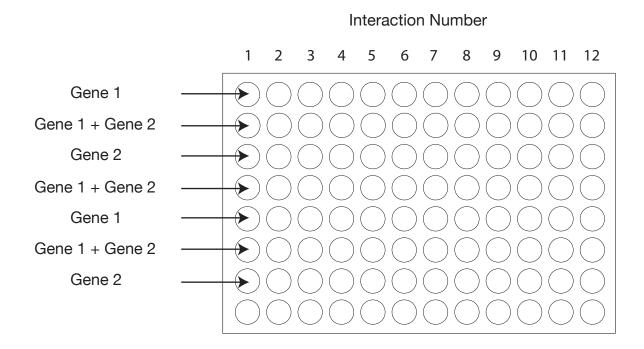
### Table 3.4. Combinatorial RNA interference can identify known synthetic lethal interactions

Quantitative analysis of known synthetic lethal interactions ('Interaction Gene1 & Gene2'; see below for references) after combinatorial RNA interference (RNAi) in wild-type and *rrf-3* worms, respectively. Percentages of average wild-type brood size ('BS')

larvae, unhatched eggs and adult worms after combinatorial RNAi (performed in triplicates within independent screens) and RNAi against each gene individually (performed in duplicates within independent assays) in two separate experiments (see Figure 3.6. for an overview of the setup for combinatorial RNAi; see Materials and Methods for a detailed description). I normalized measurements for brood size and embryonic survival to wild-type measurements obtained after feeding worms on non-targeting dsRNA-expressing bacteria (Ahringer feeding library clone Y95B8A\_84.g). If brood size or embryonic survival rates after RNAi against individual genes exceeded average wild-type measurements, I set values to 100% of wild-type values.

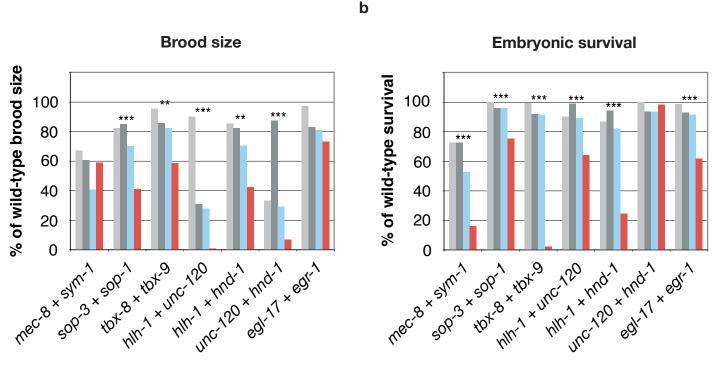
For statistical analysis, I compared the observed quantitative phenotypes resulting from simultaneously targeting both genes of a synthetic lethal pair with the calculated products of measurements for both genes individually. Therefore, I multiplied duplicate brood size and embryonic survival measurements, respectively, for both individual genes within two independent experiments in all possible pairwise combinations to generate sixteen values; these sixteen calculated products represent the predicted outcome if the double mutant phenotype was merely resulting from a simple additive effect of both single-gene RNAi phenotypes. The sixteen values for the expected quantitative phenotypes under a multiplicative model were compared to six measurements obtained after combinatorial RNAi in two independent experiments, using a Student's t-Test (two-tailed distribution, two-sample equal variance; see Materials and Methods for a detailed description of the statistical analysis). I considered SL interactions to be successfully recapitulated by combinatorial RNAi if p-values were below  $5.0 \times 10^{-2}$ .

Using the above criteria, I was able to detect all seven tested genetic interactions in *rrf-3* animals (Table 3.4., Figure 3.7.). However, in wild-type animals, only five of these interactions could be recapitulated (Table 3.4.). Not only did I fail to detect two out of seven interactions in wild-type worms, the five detected interactions were also weaker than in *rrf-3*, demonstrating that for effective combinatorial RNAi it is often essential to use RNAi-hypersensitive strains.



#### Figure 3.6. Overview of the setup for combinatorial RNA interference screens

When screening for genetic interactions, phenotypes resulting from simultaneously targeting two genes by combinatorial RNA interference (RNAi) were directly compared with the RNAi phenotypes of each gene alone. Genetic interaction screens are therefore set up such that worms were fed with bacteria expressing double-stranded RNA (dsRNA) against one gene ('Gene1'), with equal amounts of bacteria expressing dsRNAs against each of the two genes ('Gene1 + Gene2'), and bacteria expressing dsRNA against the second gene ('Gene2') in alternating rows. Using this setup, combinatorial RNAi was performed in triplicates and RNAi against each gene individually in duplicates within independent screens.



**Figure 3.7. Combinatorial RNA interference can recapitulate known synthetic lethal interactions** To test whether combinatorial RNA interference (RNAi) could recapitulate seven synthetic lethal (SL) interactions that were identified from literature (see Table 3.4. for references), brood size (BS, a) and embryonic survival (ES, b) measurements following co-targeting of both genes of a SL pair (red bars) were compared with that following the targeting of each single gene alone (light- and dark-grey bars) and with the calculated product of the single gene brood sizes and embryonic survival measurements, respectively (blue bars). Values plotted represent the percentage of average wild-type brood size and embryonic survival rates, and are the arithmetic mean of two independent experiments performed in the RNAi-hypersensitive strain *rrf-3*. BS and ES measurements, respectively, resulting from combinatorial RNAi against both genes of a pair had to be significantly lower (P < 5.0E-02, Student's t-test) than the expected multiplicative values associated with BS and ES rates, respectively, after RNAi against each gene individually for a gene pair to be considered SL. \*\*\*, P < 1.0E-03; \*\*, P < 1.0E-02.

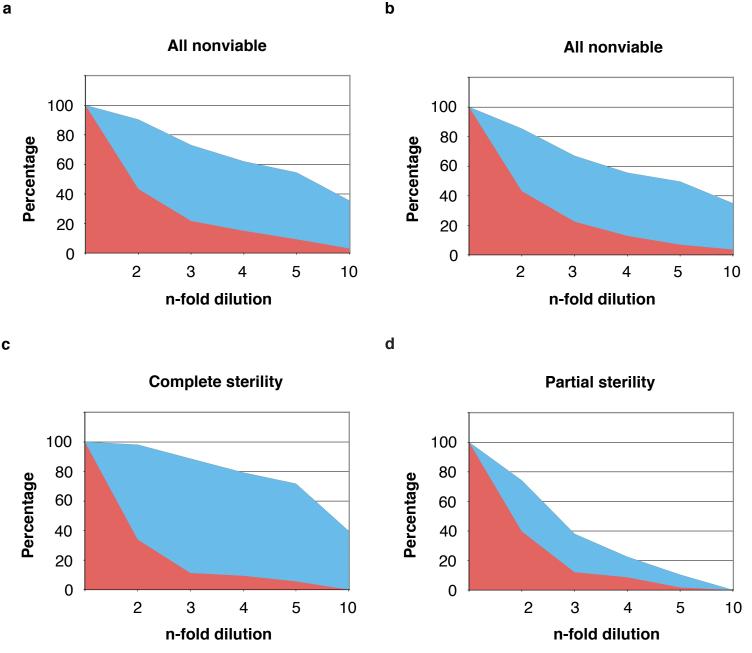
Taken together, these results demonstrate that combinatorial RNAi by feeding using our newly developed HTP liquid-feeding platform is a robust and efficient method to simultaneously perturb the expression of any two genes in the genome of *C. elegans*. I was able to generate additive phenotypes and to detect the great majority of previously described synthetic post-embryonic phenotypes and synthetic lethal interactions. However, for effective combinatorial RNAi, it is often essential to use RNAi-hypersensitive strains. I thus decided to perform all of the following experiments in the RNAi-hypersensitive *rrf-3* background.

#### **3.2.4.** Effect of dilution on phenotype strength

When analysing the phenotypes produced through combinatorial RNAi, I and others (Gonczy *et al.*, 2000; Parrish *et al.*, 2000) observed that some of the single-gene phenotypes were qualitatively weaker when two genes were targeted together than when each gene was targeted alone. Since such dilution effects will affect both the false-negative rate in large-scale screens and the possible number of genes that can be co-targeted effectively, I wished to investigate the extent to which combining dsRNA-expressing bacteria leads to a reduced strength of RNAi phenotypes. To do this, I selected 282 genes from chromosome III that were found to have a non-viable (embryonic lethal or sterile) RNAi phenotype (Kamath *et al.*, 2003) (see Appendix Table 3.2.) and examined whether their phenotypes change as the targeting bacteria are diluted with increasing amounts of unrelated dsRNA-expressing bacteria (Figure 3.8.).

Using the HTP liquid-feeding assay, I compared RNAi phenotypes in the RNAihypersensitive strain *rrf-3* for each gene alone with RNAi phenotypes generated by diluting individual bacterial feeding cultures two-, three-, four-, five-, and ten-fold, respectively, with bacteria expressing a dsRNA that does not target an expressed portion of the *C. elegans* genome (Ahringer library clone Y95B8A\_84.g), and bacteria expressing dsRNA against *lin-31*, respectively. For each gene with a non-viable RNAi phenotype in my experimental setting, I assessed the dilution level that first led to a drop in strength of phenotypes. I observed that the strength of RNAi phenotypes for many genes is indeed reduced when increasing proportions of bacteria expressing unrelated







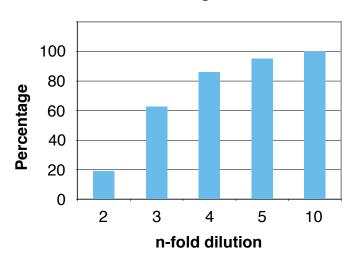
The RNA interference (RNAi) phenotype of each reported non-viable gene on chromosome III (Kamath et al., 2003) was assessed following dilution with increasing amounts of bacteria expressing unrelated double-stranded RNAs (dsRNAs). The percentage of genes with phenotypes that are either identical to that observed when targeted alone (red) or weaker than when targeted alone (blue) is shown for each dilution. This was examined for three phenotypic categories: all non-viable phenotypes (dilution with bacteria expressing a non-targeting dsRNA (Ahringer feeding library clone Y95B8A 84.g; a) and dilution with bacteria expressing dsRNA against *lin-31*; b), complete sterility (no progeny; dilution with non-targeting dsRNA-expressing bacteria; c), and partial sterility (some progeny; dilution with non-targeting dsRNA-expressing bacteria; d). Data shown are representative of two independent experiments performed in the RNAi-hypersensitive *rrf-3* background.

dsRNAs are added. I found essentially identical results when diluting with non-targeting dsRNA-expressing bacteria (Ahringer library clone Y95B8A\_84.g; Figure 3.8.a), as when adding increasing amounts of a dsRNA-expressing bacterial strain targeting *lin-31* (Figure 3.8.b), demonstrating that the observed effect is not specific to the diluting dsRNA-expressing strain. I will discuss the observed changes in phenotypic strength in more detail below, focusing on results obtained with increasing dilution of bacteria expressing a non-targeting dsRNA (Ahringer library clone Y95B8A\_84.g).

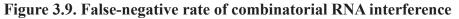
In total, I was able to detect phenotypes for ~90% of genes with non-viable RNAi phenotypes when the targeting strains were diluted with equal amounts of a bacterial strain expressing an unrelated dsRNA. This detection rate dropped further to ~70% at three-fold and to ~60% at four-fold dilution.

I next asked whether the effect of dilution on the observed phenotype is related to phenotypic strength. To this end, I determined the dilution behaviour for genes that have different strengths of brood size defects when targeted alone (Figure 3.8.c and 3.8.d). I found that genes with weak RNAi phenotypes were indeed more likely to appear wild-type following dilution — and thus to be missed in screens — than genes with strong, highly penetrant phenotypes. For example, I could still detect phenotypes for ~80% of genes, that normally have a completely sterile phenotype, at a four-fold dilution (Figure 3.8.c); however, only ~20% of genes conferring partial sterility (i.e. a reduction in brood size) have a detectable phenotype at this dilution (Figure 3.8.d). While this indicates that genes with weaker phenotypes are more likely to appear wild-type when targeted in combination with other genes, I conclude that on average ~90% of genes with a detectable RNAi phenotype still have sufficient knockdown when diluted with equal amounts of a second dsRNA-expressing bacterial strain.

Overall, these experiments allowed me to estimate the false-negative rates induced by dilution effects in combinatorial RNAi (Figure 3.9.; see Materials and Methods for calculation). Assuming each gene behaves independently, I expect that ~80% of bigenic interactions yielding visible RNAi phenotypes will be detectable by combinatorial RNAi using the HTP liquid-feeding assay.



#### False negative rate



The false negative rate (in percent) of combinatorial RNA interference (RNAi) at a given dilution was calculated by assessing the fraction of chromosome III genes with nonviable RNAi phenotypes that resulted in a weaker phenotype when increasing amounts of non-targeting double-stranded RNA- (dsRNA-) expressing bacteria were added to targeting dsRNA-expressing bacteria. Data shown are representative of two independent experiments in the RNAi-hypersensitive strain *rrf-3*.

In summary, I have systematically analysed the effects of diluting bacteria expressing dsRNAs against genes with known non-viable RNAi phenotypes with increasing amounts of unrelated dsRNA-expressing bacteria. I found that combining equal amounts of two dsRNA-expressing bacterial strains frequently results in a reduced strength of phenotypes. The implication of this dilution effect for combinatorial RNAi is that as one increases the number of genes being simultaneously targeted, the efficiency of the knockdown of each individual gene decreases. Thus, one cannot increase the number of genes being co-targeted indefinitely. However, the great majority of genes with sterile or embryonic lethal RNAi phenotype still showed non-viable phenotypes at two-fold dilution. This dilution is critical for the study of bigenic interactions using combinatorial RNAi. Thus, together with the generation of additive phenotypes within the same animal and the detection rate of known synthetic genetic interactions, these findings suggest that combinatorial RNAi using a HTP liquid-feeding assay is a powerful tool for systematically studying the effect of targeting any pairwise combination of genes in the genome of C. elegans. I conclude that this approach should allow researchers to explore genetic interactions in the nematode C. elegans in a far more systematic manner than has been possible in the past.

#### **3.3.** Conclusion

In this chapter, I have shown the development of an experimental platform for using RNAi by bacterial feeding to analyse the loss-of-function phenotypes of single genes on a large scale. By delivering dsRNA-expressing bacteria in liquid cultures in 96well format, this methodology allows RNAi screens to be performed at considerably higher throughput than has been possible in the past. Notably, this HTP liquid-feeding assay allows the screening of a population of worms in each well, thereby averaging the animal-to-animal variability of RNAi phenotypes that is observed when using singleanimal plate-feeding protocols. By using this assay, I was able to identify approximately 80% of previously identified RNAi phenotypes with 90% reproducibility.

I then established protocols to adapt these methods, which are very robust and efficient for analyzing the RNAi phenotypes of single genes, to simultaneously targeting

two genes by mixing two dsRNA-expressing bacterial strains ('combinatorial RNAi'). Using this methodology, I was able to generate loss-of-function phenotypes for two genes in the same animal and to identify the great majority of a test set of previously known synthetic lethal and synthetic post-embryonic genetic interactions.

When investigating the extent to which combining dsRNA-expressing bacteria can lead to a reduced strength of phenotype, I was able to detect phenotypes for approximately 90% of genes with a non-viable RNAi phenotype at two-fold dilution. This is the critical dilution that is needed for detecting bigenic interactions by using combinatorial RNAi. Assuming that each gene behaves independently in combinatorial RNAi, I expect that approximately 80% of bigenic interactions yielding visible RNAi phenotypes will be detectable by using this approach.

Taken together, I consider combinatorial RNAi by bacterial feeding a powerful tool for examining interactions between any pair of genes in the genome of *C. elegans* on a large scale.

Having established and validated combinatorial RNAi as a robust high-throughput method for simultaneously targeting any pairwise combination of genes by using bacterial feeding in liquid culture, I wished to use this approach to begin to investigate functional redundancy in the genome of *C. elegans*.

**Chapter 4** 

# Functional redundancy between *C. elegans* gene duplicates

#### 4.1. Introduction

Having validated combinatorial RNA interference (RNAi) as a robust method to simultaneously perturb the expression of any pairwise combination of genes, I sought to use this approach to uncover functional genetic redundancy in the *C. elegans* genome.

One obvious possible cause of genetic redundancy is through gene duplication (as discussed in the Introduction). Gene duplicates with at least partially overlapping functions can confer robustness to mutation in the other copy (Force *et al.*, 1999; Lynch and Force, 2000). While genome-wide loss-of-function screens provide indirect evidence that gene duplicates may often share redundant functions (Conant and Wagner, 2004; Gu *et al.*, 2003; Kamath *et al.*, 2003), this hypothesis has not been extensively tested with systematic experimental approaches at the time my study began.

I therefore set out to investigate whether *C. elegans* gene duplicates have redundant functions by using combinatorial RNAi. I reasoned that if gene duplicates were genuinely functionally redundant, targeting both genes of a duplicate pair would result in a more severe loss-of-function phenotype than observed when targeting each gene individually. In the most dramatic case, if gene duplicates together confer an essential redundant function, inactivation of both genes of such a pair would be expected to result in synthetic lethality.

#### 4.2. Examining the redundancy of duplicated genes in the genome of C. elegans

To investigate the extent of functional redundancy between gene duplicates in the worm, I focused on *C. elegans* gene pairs that correspond to single orthologues in *S. cerevisiae* or *D. melanogaster* genomes. These genes have thus been duplicated in the genome of *C. elegans* since divergence from either species.

Using the INPARANOID algorithm to identify such gene pairs, the *C. elegans* genome was found to comprise a total of 293 gene pairs that have been duplicated since split from yeast or fly (Table 4.1.). To determine whether these gene duplicates share redundant functions, I set out to examine whether targeting both genes of a duplicate pair affected

C. elegans gene duplicates	S. cerevisiae	D. melanogaster	S. cerevisiae &	Total
			D. melanogaster	
Identified	79	160	54	293
RNAi clones available	53	105	37	195
Amenable to analysis	49	75	29	153

### Table 4.1. C. elegans duplicate gene pairs that correspond to single orthologues in S. cerevisiae and D. melanogaster genomes

Gene pairs that have been duplicated in the genome of *C. elegans* since divergence from *S. cerevisiae* and *D. melanogaster*, respectively, were investigated for potential redundant functions. Shown are numbers for *C. elegans* gene duplicates that were identified by using the INPARANOID algorithm (Remm *et al.*, 2001) ('identified'), that could both be targeted by double-strand RNA- (dsRNA-) expressing clones using the Ahringer RNAi feeding library (Kamath *et al.*, 2003; 'RNAi clones available'), and that were amenable to analysis after excluding cross-reacting RNAi clones with inserts having more than 80% nucleotide identity over 200 base pairs with other genes ('amenable to analysis').

viability, fecundity, or growth in a non-additive, synergistic manner compared with the effects of targeting the individual genes.

For 195 out of 293 *C. elegans* gene duplicates that I had identified, RNAi clones were available from the *C. elegans* whole-genome RNAi library to target each gene of a pair. Of these, I excluded all genes that were targeted by bacterial clones with inserts having more than 80% nucleotide identity over 200 bp with the other copy — this is the threshold for cross-reaction used in Kamath *et al.* (2003) — to ensure that I am not targeting both genes of a duplicate pair with one RNAi clone. This left me with 153 duplicate gene pairs amenable to analysis for synthetic phenotypes using combinatorial RNAi (see Appendix Table 4.1.).

For each duplicate gene pair, I compared the RNAi phenotypes for each gene individually with combinatorial RNAi phenotypes side by side, using the HTP liquid-feeding assay, and the RNAi-hypersensitive *rrf-3* strain (as described in Chapter 3 and Materials and Methods; see Figure 3.6). At that stage, 10 duplicate gene pairs had to be excluded from the screen for functional redundancy, because one or other of the individual genes resulted in first-generation larval growth arrest — a phenotype that cannot be enhanced any further — following RNAi.

After two initial rounds of qualitative analysis, all duplicate gene pairs that appeared to show a stronger combinatorial RNAi phenotype as compared to the contributions of each single-gene RNAi phenotype were further verified by quantification (as described in Chapter 3 and Materials and Methods). Quantitative phenotype data were subsequently subject to statistical analysis under a multiplicative model (as described in Chapter 3 and Materials and Methods). Briefly, for each duplicate gene pair, brood size and embryonic survival, respectively, following combinatorial RNAi were compared to the measurements after RNAi against each gene individually, and the expected product associated with single-gene phenotypes using a Student's t-Test (two-tailed distribution, two-sample equal variance). I interpret a synthetic enhancement interaction under a multiplicative model — that is, where the combined phenotype is significantly stronger (as represented by a p-value below  $5.0 \times 10^{-2}$ ) than the product of the individual phenotypes — as indicating functional genetic redundancy.

In total, of 143 duplicate gene pairs amenable to analysis by combinatorial RNAi, I identified 16 gene pairs as having synthetic lethal (SL) phenotypes by the criteria discussed above (Table 4.2. and Figure 4.1.). These data thus suggest that these duplicate pairs are — at least in part — functionally redundant. Of these gene pairs, only two have been previously identified as having redundant functions (Koh *et al.*, 2002; Lambie and Kimble, 1991). The pairs of genes that when co-targeted give SL phenotypes encode diverse molecular functions, ranging from structural constituents of the ribosome (e.g. rpa-2 + C37A2.7, rpl-25.1 + rpl-25.2), signaling proteins (e.g. lin-12 + glp-1, C13G3.3 + W08G11.4), and transcription factors (e.g. elt-6 + egl-18) to polyadenylate-binding proteins (e.g. pab-1 + pab-2) (Table 4.3). Thus, the duplicate gene pairs that I have identified to share redundant functions do not appear to be enriched for specific biological function.

#### 4.3. Transferring gene functions between S. cerevisiae and C. elegans

The duplicated genes that I focused on in the worm corresponded to single genes in either *S. cerevisiae* or *D. melanogaster* genomes. I wished to investigate whether the known function of a single gene in one organism was a good predictor of the synthetic RNAi phenotype identified by co-targeting the corresponding duplicated worm genes with redundant functions. If this were the case, then it is most likely that the redundancy that I observe is due to both duplicates retaining the ancestral molecular function.

As a preliminary to this study I sought to investigate whether the known function of an individual gene in one organism can predict the molecular function of its single orthologue in *C. elegans*. Testing the conservation of individual gene functions between species would allow me to assess the potential of predicting gene functions covered by pairs of redundant genes. I chose to focus on transferring individual gene functions between *S. cerevisiae* and *C. elegans*, because to date, yeast and worm are the main model organisms in which fully systematic functional studies can be performed *in vivo*. Moreover, I will be discussing the conservation of synthetic lethal interactions between yeast and worm in the next chapter.

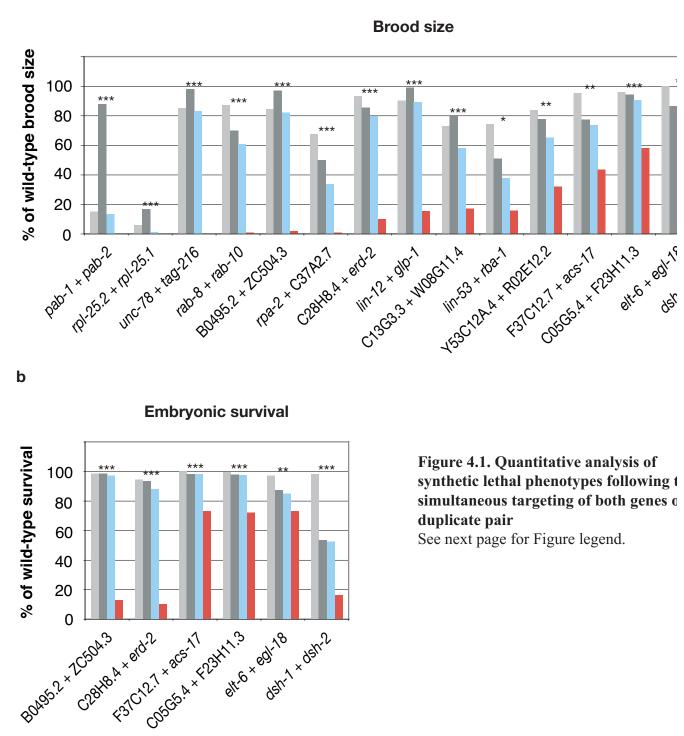
Interaction Gene1 & Gene2	Gene1 G		Gene	Gene2		1 &	p- value	p- value
	BS	ES	BS	ES	BS	ES	BS	ES
pab-1 + pab-2	15	10 0	88	10 0	0	n.s	1.9E- 04	n.s.
rpl-25.2 + rpl- 25.1	б	50	17	63	0	n.s	3.6E- 04	n.s.
ptr-2 + ptr-10	*	53	*	98	*	n.s	*	n.s.
unc-78 + tag-216	85	96	98	97	0	n.s	6.4E- 15	n.s.
rab-8 + rab-10	87	98	70	96	1	n.s	7.3E- 05	n.s
B0495.2 + ZC504.3	84	99	97	99	2	13	6.3E- 09	1.4E- 17
<i>rpa-2</i> + C37A2.7	67	74	50	81	1	n.s	1.9E- 07	n.s.
C28H8.4 + erd-2	93	95	86	94	10	10	5.6E- 08	2.2E- 15
lin-12 + glp-1	90	95	99	83	16	75	1.2E- 13	3.0E- 01
C13G3.3 + W08G11.4	73	94	80	97	17	89	1.6E- 06	3.5E- 01
lin-53 + rba-1	74	63	51	5	16	75	1.1E- 02	7.3E- 17
Y53C12A.4 + R02E12.2	84	81	78	87	32	75	1.3E- 03	6.9E- 01
F37C12.7 + acs-17	95	10 0	77	98	44	73	9.4E- 03	4.2E- 06
C05G5.4 + F23H11.3	96	10 0	94	98	58	72	5.1E- 06	1.5E- 08
elt-6 + egl-18	10 0	97	86	88	63	73	4.0E- 02	6.3E- 03
dsh-1 + dsh-2	97	98	75	54	58	17	1.6E- 02	1.1E- 11

**Table 4.2.** *C. elegans* **duplicate gene pairs with at least partially redundant functions** *C. elegans* duplicate gene pairs ('Interaction Gene1 & Gene2') displaying synthetic phenotypic effects upon combinatorial RNA interference (RNAi) in the RNAi-hypersensitive strain *rrf-3* are listed. Numbers shown are percentages of average wild-type brood size ('BS') and embryonic survival ('ES') rates after RNAi against each gene individually ('Gene1', 'Gene2') as well as after combinatorial RNAi against duplicate gene pairs ('Gene1 & 2'), and are the arithmetic mean of two independent biological repeats. Statistical significance of quantitative phenotype data (BS, ES) was evaluated under a multiplicative model (Phillips *et al.*, 2000; Puniyani *et al.*, 2004); p-values were assigned using a Student's t-test. n.s., given phenotype could not be quantified. \* Note

that combinatorial RNAi against the duplicate gene pair ptr-2 + ptr-10 resulted in an increased number of first generation larval growth arrested worms, rather than in reduced brood size; fraction of population which is wild-type, i.e. that does not arrest at an early larval stage: 70% (*ptr-2*), 100% (*ptr-10*), 0% (*ptr-2* + *ptr-10*), P = 7.3E-09.

### Figure 4.1. Quantitative analysis of synthetic lethal phenotypes following the simultaneous targeting of both genes of a duplicate pair

Phenotypes of duplicate gene pairs that yielded reproducible synthetic effects after combinatorial RNA interference (RNAi) were quantified. For each gene pair, brood size (BS) and embryonic survival (ES) after combinatorial RNAi against both duplicates (red bars), after RNAi against each gene individually (light- and dark-grey bars), and the calculated product of BS and ES measurements, respectively, of both individual genes (blue bars) are shown. Values plotted represent the percentage of average wild-type brood size and embryonic survival rates, respectively, and are the arithmetic mean of two independent RNAi experiments performed in the RNAi-hypersensitive *rrf-3* background. Duplicate gene pairs were considered to be synthetic lethal, if either BS or ES measurements were significantly reduced (P < 5.0E-02; Student's t-test) as compared to the multiplicative values of the single-gene BS and ES measurements, respectively. \*\*\*, P < 1.0E-03; \*\*, P < 1.0E-02; \*, P < 5.0E-02. Note that combinatorial RNAi against the gene pair *ptr-2* + *ptr-10* resulted in a significantly increased number of first-generation larval growth arrested worms (P = 7.3E-09, Student's t-test), rather than a brood size defect, hence these data are not shown.

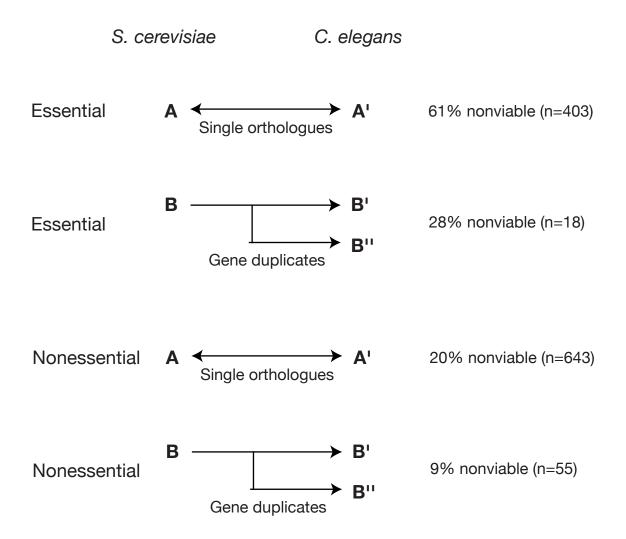


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of the redundant function covered by a pair of duplicated genes in C. elegans. Based on the gene deletion phenotypes of the single-copy orthologues in yeast, I split the set of C. elegans duplicate gene pairs into those corresponding to essential or non-essential S. *cerevisiae* genes (see Appendix Table 4.2.). I found that five of eighteen worm duplicates (28%), that are orthologous to yeast essential genes, showed synthetic lethal phenotypes by combinatorial RNAi. In contrast, only five of fifty-five C. elegans duplicate gene pairs (9%) corresponding to S. cerevisiae non-essential genes were found to result in a synthetic viability defect when co-targeted. I thus conclude that duplicated genes in C. *elegans* that are related to an essential gene in yeast are about three times more likely to have an essential redundant function than those related to a non-essential yeast gene. Strikingly, this is the same enrichment for non-viable RNAi phenotypes as for nonduplicated genes: 61% of C. elegans single-copy orthologues of S. cerevisiae essential genes have non-viable RNAi phenotypes, compared to 20% of orthologues of yeast nonessential genes (Figure 4.2.) Thus, this finding is entirely consistent with a simple model of redundancy, suggesting that the function of a single gene identified in one organism is a good predictor of the redundant function covered by a pair of duplicated genes in a second organism.

## 4.4. Duplicated genes can maintain redundant functions for more than 80 million years of evolution

Having found that over 10% of genes (16 out of 143) that have been duplicated in the genome of *C. elegans* since the divergence from either *S. cerevisiae* or *D. melanogaster* share at least partially redundant functions, I next sought to address the underlying causes for this redundancy. Therefore, I wished to study the properties of gene duplicates with redundant functions, and whether these differ from duplicated gene pairs that were not identified as having redundant functions. For reasons of compactness, I will refer to these as 'redundant' and 'non-redundant' duplicate gene pairs, although of course I recognize that failure to detect a phenotype by RNAi does not preclude a genuine function.



#### Figure 4.2. Transferring gene functions between S. cerevisiae and C. elegans

Orthologues of genes with essential functions in *S. cerevisiae* are very likely to have nonviable RNAi phenotypes in *C. elegans* ('Single orthologues'). Likewise, genes that are essential in yeast, but that have duplicated in *C. elegans* are likely to have a nonviable RNAi phenotype in *C. elegans* when both genes are targeted simultaneously by combinatorial RNAi ('Gene duplicates') The numbers indicate the percentage of tested genes or gene pairs with non-viable RNAi phenotypes in two independent experiments performed in the RNAi-hypersensitive strain *rrf-3*.

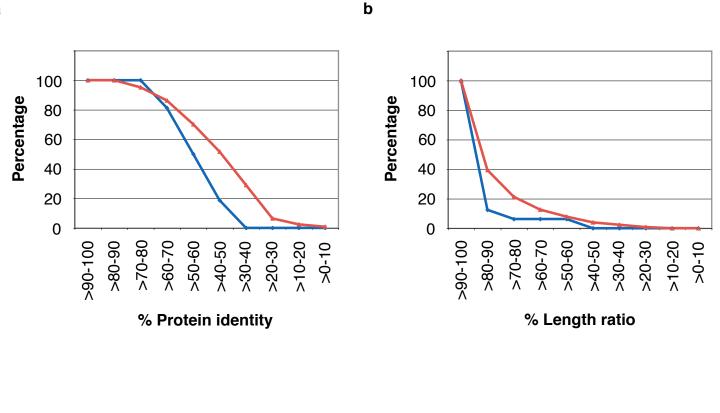
I considered two simple models that might explain why some duplicated genes appear to have redundant functions (as discussed in the Introduction). First, the redundancy may be a by-product resulting from a recent duplication event and thus represent a transient state; this initial functional overlap might get lost over time by functional divergence (Force *et al.*, 1999; Kimura and King, 1979; Lynch and Force, 2000; Ohno, 1970). In this case, the pairs of genes that I identified as having redundant essential functions would be expected to be more recent duplicates than those for which I found no functional overlap. Alternatively, several groups have established theoretical frameworks suggesting that redundant functions can be maintained by natural selection over substantial periods of evolutionary time (Nowak *et al.*, 1997; Wagner, 2000b). In this case, I would expect no clear difference in age between the sets of redundant and non-redundant duplicate gene pairs. Instead, I anticipated that there would be evidence that the redundant duplicated genes have been maintained relative to their ancestral sequence, thereby retaining their overlapping, redundant functions.

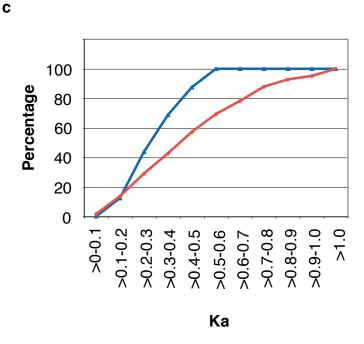
To investigate which of these two models can best explain the redundancy that I observed between some gene duplicates, I first examined whether there is evidence that the redundant gene pairs have duplicated more recently than non-redundant pairs. One would of course anticipate that more recently duplicated genes are more likely to have overlapping functions than more ancient duplicate gene pairs. Intriguingly, when investigating the number of synonymous nucleotide substitutions per synonymous site (Ks) as a measure of the evolutionary age of gene duplicates, I found the average rate of change to be 13.41 for redundant duplicates and 9.48 for non-redundant duplicates, indicating that both redundant and non-redundant duplicate gene pairs are ancient (see Appendix Table 4.3.), and their divergence time can no longer be reliably estimated. Having found no clear evidence that the redundant gene pairs represent more recent gene duplicates than the non-redundant gene pairs, I considered the possibility that the redundancy that I observe might simply be the consequence of a lack of evolutionary time for the duplicates to drift, as very unlikely.

Next, I set out to examine whether the duplicate gene pairs with essential redundant functions also do exist as gene duplicates in the related nematode *C. briggsae*. To do so, the INPARANOID algorithm was used to identify *C. briggsae* orthologues of

C. elegans genes (Remm et al., 2001); I considered the gene duplication to predate the divergence of C. elegans from C. briggsae, if both C. elegans duplicates had a single identifiable orthologue in C. briggsae. Remarkably, 14 of the 16 pairs of duplicated genes that I identified as having essential redundant functions in C. elegans appear to have also been maintained as gene pairs in the related nematode C. briggsae. These findings suggested that these 14 duplicate gene pairs with redundant functions have arisen from a duplication event that predated the split from C. briggsae. In contrast, only 100 out of 127 non-redundant duplicate gene pairs also exist as gene pairs in C. briggsae. Thus, the frequency of conservation of redundant gene pairs between C. elegans and C. briggsae is significantly higher than the frequency observed for non-redundant duplicate gene pairs  $(\chi^2 = 8.653, P = 0.0033, 1 \text{ degree of freedom; see Appendix Table 4.3.})$ . C. elegans and C. briggsae, despite being morphologically very similar, last shared a common ancestor 80-110 million years ago (Stein et al., 2003). Taking into account that C. elegans and C. *briggsae* only share ~60% of their genes as single orthologues, and a full 10% of genes encoded in either genome has no identifiable match in the other genome (Stein et al., 2003), one would anticipate less than 40% of C. elegans duplicate gene pairs to be randomly conserved as pairs in C. briggsae. I thus consider the possibility that these 14 duplicate gene pairs with redundant essential functions in C. elegans have been retained as duplicate pairs in C. briggsae simply as a result of neutral evolution to be very unlikely. Instead, these data suggest that the redundancy between these duplicated genes might have been actively maintained for more than 80 million years of evolution.

Thus, I next sought to investigate whether there is evidence that the overlap in function has been actively retained by natural selection. If there has been selection for the maintenance of redundancy between duplicate gene pairs, then I would expect these duplicates to encode more similar proteins than non-redundant duplicates. To determine the percentage of identity between gene duplicates, protein sequences were aligned using the CLUSTAL W program (Thompson *et al.*, 1994). I found pairs of redundant duplicated genes to be more similar to each other at the amino-acid level ( $P = 1.6 \times 10^{-2}$ , Wilcoxon rank sum test, Figure 4.3.a) and to also have a greater similarity in alignable protein length ( $P = 2.2 \times 10^{-2}$ , Figure 4.3.b) than non-redundant duplicates and finally to also show a lower rate of non-synonymous nucleotide substitution per non-synonymous





**Figure 4.3. Higher sequence similarity between redundant versus non-redundant gene duplicates** Percentage similarity in protein sequence (a) and alignable protein length (b), and rate of nonsynonymous nucleotide substitutions per non-synonymous site (Ka; c) are contrasted for gene duplicates with redundant functions (shown in blue) and for duplicate gene pairs that were not identified as having redundant functions (shown in red).

site (mean Ka for redundant duplicates = 0.34; mean Ka for non-redundant duplicates = 0.50;  $P = 3.8 \times 10^{-2}$ ; Figure 4.3.c) than non-redundant duplicates (see Appendix Table 4.3.). While I recognize that the redundant duplicate pairs appear only marginally more similar to each other than non-redundant gene duplicates, I found several independent lines of evidence that together suggest that redundant gene duplicates may have remained a higher degree of similarity as a consequence of stronger purifying selection than duplicate gene pairs that were not identified as having redundant functions.

Several theoretical models have been generated to explain how redundant functions can be maintained by natural selection (as discussed in the Introduction). One theory relates pleiotropy to redundancy. In this model, both copies are only redundant with respect to some sub-functions, while they also perform independent functions and thus are evolutionarily selected (sub-functionalization). While both experimental and theoretical studies support sub-functionalization as a likely evolutionary fate of gene duplicates (Kondrashov et al., 2002; Lynch and Force, 2000) and a means to maintain gene duplicates, one would anticipate that the same mechanisms act on both redundant and non-redundant gene duplicates. Therefore, the sub-functionalization model cannot explain how redundant gene duplicates have maintained a higher degree of sequence similarity as compared to non-redundant gene duplicates. Further two models for the evolutionary stability of genetic redundancy are based on the assumption of very specific mutation rates and efficacies of protein function (Nowak et al., 1997). These theories can — at least mathematically — explain how gene duplicates can maintain sequence similarity and perform the exact same function for very long or even infinite evolutionary timescales. I believe that my findings favour these latter models.

Taken together, I consider it as unlikely that the greater similarity between duplicate gene pairs with redundant functions that I observed is a trivial consequence of their having duplicated more recently. Rather, I suggest that the protein sequences of redundant gene pairs have been maintained relative to each other since duplication as the result of selective pressure to maintain their redundant functions.

#### 4.5. Conclusion

In summary, in this chapter I have described how I have used combinatorial RNAi to systematically investigate whether there is functional redundancy between *C. elegans* gene duplicates. Focusing on genes that have been duplicated in the genome of *C. elegans* since divergence from either *S. cerevisiae* or *D. melanogaster*, I was able to analyse 143 duplicate gene pairs by combinatorial RNAi for their potentially redundant functions. Of these, 16 gene pairs showed unambiguous synthetic RNAi phenotypes, demonstrating that they are at least partially functionally redundant. I found that just as single-copy worm genes are more likely to have a non-viable RNAi phenotype if they are orthologous to an essential gene in *S. cerevisiae*, duplicated worm genes are more likely to have a redundant essential function if they are co-orthologous to an essential yeast gene. It therefore should be possible to predict the redundant functions of many duplicated genes in higher organisms based on the functions of single-copy orthologues in lower organisms.

Most intriguingly, the redundancy that I observed between duplicated genes cannot be explained simply because they are derived from a recent duplication event — 14 of the 16 redundant gene pairs were duplicated before the divergence of *C. elegans* and *C. briggsae* 80-110 million years ago (Stein *et al.*, 2003). The redundancy between these 14 gene pairs has thus been maintained for more than 80 million years of evolution. Therefore, I believe that it is extremely unlikely that the functional overlap between these 14 duplicated genes is present merely due to a lack of evolutionary time since duplication. Not only is the average half-life of a gene duplicate in eukaryotes typically about 4 million years (Lynch and Conery, 2000), but also, over this time period, the *C. elegans* and *C. briggsae* genomes have diverged enormously; they only share ~60% of their genes as single orthologues, and a further 10% of genes are present exclusively in one or other genome (Stein *et al.*, 2003). Rather, my findings are consistent with theoretical models, suggesting that under appropriate — but realistic — conditions it is possible to select, directly or indirectly, for redundancy between duplicates to be maintained (Nowak *et al.*, 1997).

Having provided the first large-scale analysis in any organism of the redundant functions of gene duplicates, I wished to further examine functional redundancy in complex genetic networks.

**Chapter 5** 

Functional redundancy in genetic interaction networks

### 5.1. Introduction

While I have identified functional redundancy between some duplicate gene pairs, the majority of bigenic interactions that were uncovered when systematically mapping synthetic sick and synthetic lethal (SL) interactions in *S. cerevisiae* do not occur between gene duplicates, but rather between genes unrelated at the sequence level.

To date, however, there is still much debate about how such higher-order functional redundancy might arise, whether it is a selectable trait, and whether such redundancy can be conserved throughout evolution (discussed in Wagner, 2005). Since similar types of non-additive interactions between mutations might underlie multifactorial genetic disease in humans, it is a major open question in genetics whether these individual genetic interactions are conserved between species and thus may be directly predicted in humans using interactions identified in simple model organisms.

I therefore wished to shed light on the evolution of gene networks. To do so, I sought to investigate whether genetic interactions are conserved between the yeast *S. cerevisiae* and the nematode *C. elegans*. Using RNA interference (RNAi) in *C. elegans*, I set out to explore whether individual SL interactions uncovered in yeast are conserved in the worm. Importantly, to date, *C. elegans* is the main animal model in which to carry out systematic functional studies *in vivo* in the context of a developing organism. This study thus allows me to directly compare genetic interaction networks that have been compiled *in vivo* in yeast with *in vivo* genetic interaction networks in the worm.

# 5.2. Investigating the conservation of synthetic lethal interactions between *S*. *cerevisiae* and *C. elegans*

I based my study on three *S. cerevisiae* datasets that were compiled using three different technological approaches for the systematic identification of SL interactions: first, a 'global' genetic interaction network encompassing ~ 4,000 SL interactions, mapped by using synthetic genetic array (SGA) technology to interrogate synthetic lethality predominantly between deletion alleles of non-essential genes (Tong *et al.*, 2004); second, an essential gene network comprising 567 interactions, including

conditional alleles for almost 300 yeast essential genes, that has been compiled by using SGA analysis (Davierwala *et al.*, 2005); and third, a genome-wide analysis of DNA integrity, providing a network of almost 5,000 SL interactions, which were mapped by employing diploid synthetic lethal analysis by microarray (dSLAM) using the *S. cerevisiae* heterozygous gene deletion collection (Pan *et al.*, 2006). Together, these three screens tested ~850,000 pairwise interactions, covering ~5% of the possible bigenic interaction space, and identified ~9,000 unique interactions including both interactions between null alleles and between hypomorphic mutants. Thus, examining the conservation of these large, diverse and systematically mapped datasets of SL interactions allows me to make firm conclusions about the conservation of genetic interactions between species.

To investigate whether SL interactions are conserved between yeast and worm, I set out to test whether I can detect SL interactions between pairs of *C. elegans* genes that are orthologous to pairs of genes that have been identified as having SL interactions in at least one of these three large-scale screens in *S. cerevisiae*. The INPARANOID algorithm was used to identify *C. elegans* orthologues of *S. cerevisiae* gene pairs (Remm *et al.*, 2001). Considering genetic interactions between yeast gene pairs for which both genes had a single orthologue in *C. elegans* only, 1,148 worm gene pairs were identified.

# **5.2.1.** Using combinatorial RNAi to test whether synthetic lethal interactions are conserved between yeast and worm

Of 1,148 *C. elegans* gene pairs that were orthologous to gene pairs that were reported as having SL interactions in *S. cerevisiae*, 856 gene pairs could be targeted by combinatorial RNAi in the worm using the genome-wide feeding library (Kamath *et al.*, 2003). These gene pairs are listed in Appendix Table 5.1. For each gene pair amenable to analysis by combinatorial RNAi, I compared the phenotype resulting from simultaneously targeting both genes with the phenotypes resulting from targeting each gene individually side by side (as described in Chapter 3 and Materials and Methods; see Figure 3.6). All screens were performed at least twice independently, using the high-

throughput (HTP) RNAi liquid-feeding assay and the RNAi-hypersensitive *rrf-3* background.

First, worms were scored for SL phenotypes in a purely qualitative way. This was done for reasons of throughput. At that stage, thirteen gene pairs had to be excluded from the screen for SL interactions, because RNAi against individual genes resulted in worms that arrested growth at a late larval stage, a phenotype that cannot be enhanced any further. Thus, in total, I was able to screen 843 gene pairs that are orthologous to yeast SL interactions, for synthetic viability defects by using combinatorial RNAi in *C. elegans* (Table 5.1.). These 843 interactions are equivalent to 692 interactions in *S. cerevisiae* between two null alleles, 67 interactions between a hypomorph and a null allele, and 84 interactions between two hypomorphs.

For six out of 843 gene pairs that could be investigated for SL interactions in the worm, phenotypes generated by combinatorial RNAi are qualitatively stronger than the contributions of both individual RNAi phenotypes (Table 5.2.). In four cases, simultaneous targeting of both genes appeared to result either in reduced brood sizes or in reduced embryonic survival rates. RNAi phenotypes for these gene pairs were quantified by manually counting larvae, unhatched eggs, and adults within each experiment and subject to statistical analysis under a multiplicative model, using a Student's t-test (two-tailed distribution, two-sample equal variance; see 'Generating known synthetic lethal phenotypes by combinatorial RNAi' and Materials and Methods for a detailed description) to confirm all four gene pairs as SL interactions (Table 5.3.a and Figure 5.1.a and 5.1.b).

Combinatorial RNAi against two gene pairs (the gene pairs *lis-1* and *cap-1*, and Y6B3A.1 and *tfg-1*) resulted in pronounced synthetic adult lethal phenotypes (Table 5.2., Table 5.3.b and Figure 5.1.c and 5.1.d). Intriguingly, *lis-1* encodes an orthologue of human LIS1, which leads to lissencephaly, a disorder of neural development, when mutated (Online Mendelian Inheritance in Man, OMIM<sup>TM</sup>; www.ncbi.nlm.nih.gov/omim/). Thus, it would be interesting to investigate whether patients with a severe clinical phenotype also carry a mutant allele of the human orthologue of *C. elegans cap-1*.

Yeast SL dataset	SL interactions tested in C.	SL interactions tested in C.
	elegans	elegans
	using combinatorial RNAi	using genetic mutants + RNAi
Tong et al., 2004	<b>370</b> <sup>a</sup>	88 <sup>b</sup>
Null + null	319 <sup>a</sup>	71 <sup>b</sup>
Hypomorph + null	51	17
Davierwala et al.,	100	7
2005	16	-
Null + hypomorph	84	7
Hypomorph + hypomorph		
Pan et al., 2006	<b>416</b> <sup>a</sup>	88 <sup>b</sup>
Null + null	416 <sup>a</sup>	88 <sup>b</sup>
Total	843 <sup>a</sup>	<b>174</b> <sup>b</sup>

### Table 5.1. Overview of synthetic lethal interactions that were tested between S. cerevisiae and C. elegans

The three yeast data sets my study was based on, the number of interactions between pairs of *C. elegans* genes that are orthologous to pairs of genes identified as having synthetic lethal (SL) interactions in yeast that could be tested by combinatorial RNA interference (RNAi) and by RNAi in a worm strain homozygous for a loss-of-function genetic mutation in a second gene, respectively, and whether these correspond to null or hypomorphic alleles, are shown.

<sup>a</sup> 43 interactions are redundant between the Tong *et al.* and Pan *et al.* datasets.

<sup>b</sup>9 interactions are redundant between the Tong *et al.* and Pan *et al.* datasets.

Yeast SL dataset	SL interactions tested in <i>C.</i> <i>elegans</i> using combinatorial RNAi	Conserved interactions	SL phenotype
Tong et al.,	370	lis-1 + cap-1	AL
2004		pfd-6 +	BS
		C05D11.3	
Davierwala <i>et</i>	100	Y6B3A.1 +	AL
al., 2005		tfg-1	
Pan <i>et al.,</i>	416	rfp-1 + rack-	BS
2003		1	BS, ES
		rfp-1 + htzl	BS, ES
		rfp-1 + gfl-1	
Total	843 <sup>a</sup>	6	

## Table 5.2. Synthetic lethal interactions are not conserved between S. cerevisiae and C. elegans

*C. elegans* gene pairs that were synthetic lethal (SL) in *S. cerevisiae* and that were identified to be SL by combinatorial RNAi are shown ('Conserved interactions'). SL phenotypes are classified as adult lethal ('AL'), reduced brood size ('BS') and reduced embryonic survival ('ES'), respectively.

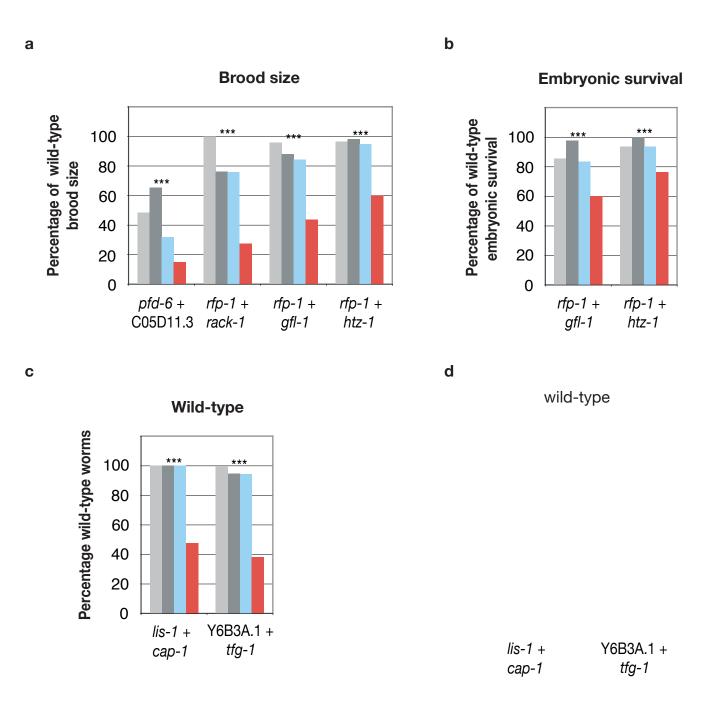
a)								
Interacting gene	Ger	le1	Ge	ne2	Gene	el &	p-va	alue
pairs					2	2		
	BS	ES	BS	ES	BS	ES	BS	ES
<i>pfd-6</i> + C05D11.3	49	75	66	72	15	48	6.22E-	1.04E-
							05	01
rfp-1 + rack-1	10	90	76	10	28	91	3.81E-	8.38E-
	0			0			19	01
rfp-1 + gfl-1	96	85	88	98	44	60	1.07E-	1.51E-
							07	05
rfp-1 + htz-1	97	94	98	10	60	76	2.30E-	6.70E-
				0			10	07

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Interacting gene pairs	Gene1	Gene2	Genel & 2	p-value
	Wt	Wt	Wt	Wt
lis-1 + cap-1	100	100	48	6.64E-17
Y6B3A.1 + <i>tfg-1</i>	99	95	38	3.93E-18

## Table 5.3. Quantitative analysis of synthetic lethal interactions that are conserved between S. cerevisiae and C. elegans

Synthetic lethal phenotypes in *C. elegans* were verified by quantification and statistical analysis under a multiplicative model (Phillips *et al.*, 2000; Puniyani *et al.*, 2004); percentages of average wild-type brood size ('BS') and embryonic survival ('ES') rate (a), and fractions of animals that appeared wild-type ('Wt'; b) after RNA interference (RNAi) against each gene individually ('Gene1', 'Gene2') and combinatorial RNAi against both genes simultaneously ('Gene1 & 2') are shown. Values presented are the arithmetic mean of two independent experiments performed in the RNAi-hypersensitive *rrf-3* background. A Student's t-test was used to assess the statistical significance of quantitative phenotype data.



## Figure 5.1. Synthetic lethal interactions that are conserved between *S. cerevisiae* and *C. elegans*

For each gene pair that yielded reproducible synthetic effects by combinatorial RNA interference (RNAi), phenotypes were quantified: brood size (a), embryonic survival rates (b), and percentage of wild-type worms (c), resulting from targeting each gene individually (light- and dark-grey bars) were compared with that generated by targeting both genes of a pair simultaneously (red bars) and with the calculated product of the single gene measurements (blue bars). Values plotted in (a) and (b) represent percentages of typical wild-type brood sizes, and embryonic survival rates, respectively. Data shown are the arithmetic mean of two independent experiments. Synthetic lethality was assessed under a multiplicative model (Phillips *et al.*, 2000; Puniyani *et al.*, 2004). \*\*\*, P < 1.0E-03; Student's t-test. Representative images of synthetic adult lethal phenotypes resulting from combinatorial RNAi against *lis-1* and *cap-1*, and Y6B3A.1 and *tfg-1*, respectively (d). Scale bars: 0.1 mm. All experiments were performed in the RNAi-hypersensitive strain *rrf-3*.

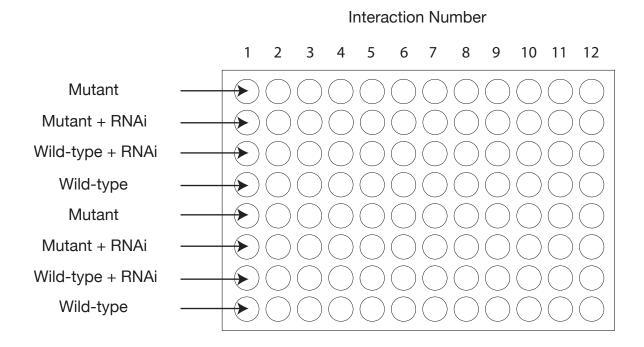
100

# **5.2.2.** Using RNAi in genetic mutants to test whether synthetic lethal interactions are conserved between yeast and worm

In addition to screening 843 pairwise orthologues of *S. cerevisiae* SL interactions by combinatorial RNAi for synthetic lethality in the worm, I sought to further test all possible gene pairs for synthetic lethality by targeting one gene of a pair by RNAi in a worm strain homozygous for a loss-of-function genetic mutation in the second gene. We have previously used this approach in our laboratory for systematically investigating ~65,000 gene pairs with functions in signal transduction and transcriptional regulation for their ability to genetically interact (Lehner *et al.*, 2006). I was able to analyse 174 gene pairs for synthetic viability defects by using RNAi in 35 *C. elegans* strains carrying defined homozygous genetic mutations; this was the entire set for which a viable mutant strain was publicly available (see Appendix Table 5.2.).

I therefore compared RNAi phenotypes observed in the genetic mutants with the RNAi phenotypes of wild-type worms and with the phenotypes of the genetic mutants fed on bacteria expressing a dsRNA that does not target an expressed portion of the *C. elegans* genome (Ahringer library clone Y95B8A\_84.g; see Figure 5.2.) side by side. Worms were screened for SL phenotypes in duplicates in at least two independent experimental setups, using the HTP RNAi liquid-feeding assay.

In few cases, brood size and embryonic survival rates, respectively, after RNAi in a genetic mutant appeared reduced as compared to RNAi against these genes in wild-type worms (Table 5.4.). These homozygous mutant strains, however, had reduced brood sizes and embryonic survival rates, respectively, on their own. I therefore sought to investigate whether the enhanced phenotypes that I observed when targeting a second gene by RNAi in these genetic mutants were the results of true synthetic lethality or rather caused by purely non-specific additive effects of the phenotypes of mutant strains and RNAi phenotypes. To examine this, I fed genetic mutants on additional RNAi clones that produced RNAi phenotypes similar to the phenotype of the putatively interacting gene in wild-type worms. I observed severely enhanced phenotypes after RNAi against all control genes in these four mutant strains carrying defined lesions. I thus considered these putative genetic interactions to be the results of non-specific additive effects between the



## Figure 5.2. Overview of the setup for genetic interaction screens using RNA interference in a genetic mutant

When screening for genetic interactions by targeting one gene by RNA interference (RNAi) in a *C. elegans* strain carrying a homozygous loss-of-function allele of a second gene, RNAi phenotypes of the genetic mutants were compared to the RNAi phenotypes of wild-type worms and to the phenotypes of genetic mutants and wild-type worms, respectively, fed on non-targeting double-stranded RNA-expressing bacteria side by side. By using this setup, genetic interaction screens were performed in duplicates within independent experiments.

C. elegans strain	RNAi clone
TJ1049	C43E11.9
DS77	C39E9.13
CX51	H20J04.d
	R151.9
	T06G6.9
	F21C3.5
RB1457	R05D3.4
	B0205.3

## Table 5.4. C. elegans strains with non-specifically enhanced RNA interference phenotypes

*C. elegans* strains carrying a defined genetic lesion that showed non-specifically enhanced phenotypes when targeted by RNAi clones (represented by Ahringer library RNA interference (RNAi) clone gene pairs names) are shown. phenotypes of the genetic mutant and the RNAi phenotypes and do not represent informative SL interactions. The logic behind excluding these interactions is analogous to excluding physical interactions between 'sticky' proteins.

# 5.3. Synthetic lethal interactions are not conserved between *S. cerevisiae* and *C. elegans*

Taken together, I have investigated 843 pairwise orthologues of genes that were identified as having SL interactions in *S. cerevisiae* for synthetic viability defects in *C. elegans* by combinatorial RNAi and a further 174 pairs by single-gene RNAi in worm strains carrying defined homozygous genetic mutations. Strikingly, I only identified 6 gene pairs (0.7%) to show synthetic lethal phenotypes when targeted by combinatorial RNAi in the worm (Table 5.2. and Figure 5.1.). This observed degree of conservation between SL interactions in *S. cerevisiae* and *C. elegans* is not significantly different to the frequency of SL interactions that we have detected in a systematic large-scale study in *C. elegans*: screening for synthetic synthetic lethality between genes with roles in signaling and transcriptional regulation, we found on average 0.6% of tested gene pairs to genetically interact in the worm (Lehner *et al.*, 2006;  $\chi^2 = 0.201$ , P = 0.6538, 1 degree of freedom). These data thus imply that individual SL interactions are not conserved between *S. cerevisiae* and *C. elegans* more than is expected by chance.

I do not see any functional similarities in the small set of genes that interact that distinguish them from the non-conserved interactions (Table 5.5.), nor is there any correlation between which yeast study the SL interaction derived from and whether it is also found in *C. elegans* (Table 5.2.). Therefore, neither interactions between null alleles nor interactions between hypomorphs appear conserved between these two species.

Moreover, the frequency of SL interactions that can be detected in yeast and worm is very similar (Lehner *et al.*, 2006), hence the non-conservation cannot simply be explained by a reduction in the number of SL interactions. Neither can it be explained by increased functional redundancy as a result of gene duplication in the worm, because I only tested for genetic interactions between gene pairs for which both genes had a single orthologue in *C. elegans*.

<i>s</i> .	С.	Gene1	Gene2
cerevisiae	elegans		
PAC1 + CAP1	lis-1 + cap-1	Orthologue of human lissencephaly gene <sup>a</sup> with functions in spindle organization and biogenesis <sup>b</sup>	F-actin capping protein, alpha subunit <sup>c</sup>
SEC7 + LAS17	Y6B3A.1 + tfg-1	ADP ribosylation factor (ARF) guanine nucleotide exchange factor <sup>c</sup>	Human TFG related <sup>d</sup> , putative apoptotic suppressor in <i>C</i> . <i>elegans</i> <sup>e</sup>
YKE2 + PLP1	<i>pfd-6</i> + C05D11.3	Prefoldin subunit 6, KE2 family <sup>c</sup>	Essential for proper microtubule organization and function <sup>f</sup>
BRE1 + ASC1	rfp-1 + rack-1	E3 ubiquitin ligase required for H2B ubiquitination <sup>c</sup>	Homolog of mammalian RACK1 (Receptor of Activated C Kinase) <sup>b</sup>
BRE1 + HTZ1	rfp-1 + htz-1	E3 ubiquitin ligase required for H2B ubiquitination <sup>c</sup>	Histone variant H2AZ homolog <sup>d</sup>
BRE1 + YAF9	rfp-1 + gfl-1	E3 ubiquitin ligase required for H2B ubiquitination <sup>c</sup>	Transcription initiation factor IIF, auxiliary subunit <sup>c</sup>

## Table 5.5. Molecular functions of C. elegans gene pairs with synthetic lethal RNA interference phenotypes

Molecular roles of synthetic lethal gene pairs that are conserved between *S. cerevisiae* and *C. elegans* are shown. *C. elegans* genes ('Gene1', 'Gene2') are represented by their <sup>a</sup> WormBase descriptions (www.wormbase.org); <sup>b</sup> Gene Ontology descriptions (Ashburner *et al.*, 2000); <sup>c</sup> NCBI eukaryotic orthologous groups (Koonin *et al.*, 2004); <sup>d</sup> WormBase ID (www.wormbase.org); <sup>e</sup> functions as described in Chen *et al.*, 2004; <sup>f</sup> functions as described in Ogawa *et al.*, 2004.

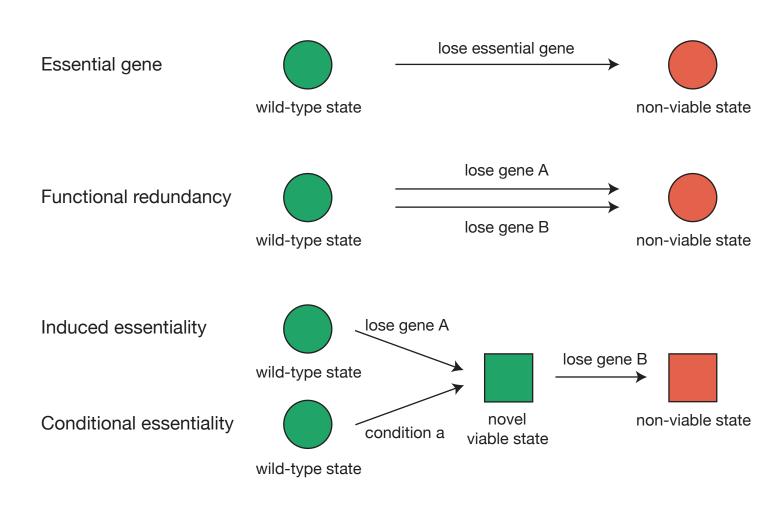
Strikingly, the lack of conservation of non-additive, synthetic genetic interactions between yeast and worms is in stark contrast to the conservation of single gene functions. Using an identical assay, I found 61% of *C. elegans* genes that are orthologous to an essential gene in *S. cerevisiae* to have a non-viable RNAi phenotype (see 'Transferring gene functions between *S. cerevisiae* and *C. elegans*'). Furthermore, 31% of tested protein interactions were found to be conserved between *S. cerevisiae* and *C. elegans* (Matthews *et al.*, 2001). Thus, although the functions of individual genes and the physical interactions between gene products are well conserved between yeast and worms, non-additive, synthetic genetic interactions are not. Consequently, SL interactions identified in *S. cerevisiae* cannot be used to directly predict genetic interactions in the nematode *C. elegans* and thus are very unlikely to be predictive of genetic interactions in humans.

# 5.4. 'Induced essentiality' as alternative model for the interpretation of synthetic lethal interactions

However, beyond the direct practical implications for using *S. cerevisiae* data to predict SL interactions in humans, I believe these results may also have important implications for the mechanistic interpretation of SL interactions. The classic interpretation of a SL interaction between two genes (gene A and B) is that the genes (or the pathways in which they act) are at least partially functionally redundant (Kelley and Ideker, 2005; reviewed in Hartman *et al.*, 2001). In this model, loss of one gene has little effect since the alternative, redundant pathway can compensate for this loss (see Figure 1.5.). This situation is most apparent for recently duplicated genes that, by their nature, are highly redundant: in some cases the loss of one duplicate has little effect on fitness, but loss of both duplicates together is catastrophic (Ihmels *et al.*, 2007; Tischler *et al.*, 2006). Most SL interactions do not take place between duplicated genes, however, but between genes that do not share sequence similarity (Tong *et al.*, 2004).

Considering the classic model for the interpretation of SL interactions, in which synthetic lethality is considered a consequence of inactivating two functionally redundant genes or pathways, one might expect SL interactions to be conserved if individual gene functions are conserved. My findings, however, do not support this theory, but rather led

me to suggest an alternative model to explain SL interactions. I consider that genetic networks that underlie viability are not constant but flexible to change under different environmental conditions. This flexibility allows biological systems to adopt a range of alternative viable states, each with their set of essential genes. Thus, a gene that is nonessential under normal laboratory growth conditions may be absolutely critical for survival in a different environmental condition. Increasing experimental evidence supports this notion (Chang et al., 2002; Davis-Kaplan et al., 2004; Dudley et al., 2005; Enyenihi and Saunders, 2003; Kuepfer et al., 2005; Martinez et al., 2004; Smith et al., 2006). I propose that loss of gene A results in a rearrangement of the genetic network into an alternative viable state, where gene B is now an essential gene (Figure 5.3.). In this view, gene B is required under a condition caused by the loss of gene A. The functions of gene A and gene B, or the pathways in which they act, are not redundant or related gene B is simply required under a condition caused by loss of gene A. In this model which I have termed 'induced essentiality' - I consider SL interactions to represent a special form of conditional lethality, where loss of gene A partly mimics the response of the cell to an environmental condition. In light of this hypothesis, SL interactions are highly unlikely to be conserved — the range of environments that yeast cells need to respond to are very different to those that affect cells in an intact animal. Furthermore, regulatory networks governing cellular responses evolve very rapidly (Maslov et al., 2004; Odom et al., 2007). Thus, while in the classical model, SL interactions are interpreted as the consequence of inactivating functionally redundant genes or pathways, I propose SL interactions to be the consequence of the ability of genetic networks to rearrange into alternative viable states driven by the evolution of adaptive responses to environmental changes.



### Figure 5.3. Two models for the interpretation of synthetic lethal interactions

In the classical model, SL interactions occur between two redundant genes or pathways ('Functional redundancy'; here gene A and gene B) that can compensate for the loss of one another. In the alternative model ('Induced essentiality'), loss of one gene (gene A) results in a rearrangement of the genetic network into a novel network; this rearrangement may mimic the response to an environmental condition. In this new network, the other gene (gene B) is now an essential gene. The rapid evolution of synthetic lethal interactions compared with individual gene functions favours this second model.

# 5.5. Investigating higher-order similarities in synthetic lethal interactions between *S*. *cerevisiae* and *C*. *elegans*

Having found that SL interactions are not conserved between *S. cerevisiae* and *C. elegans* more than expected by chance despite the very high degree of conservation of individual gene functions, I considered the possibility that there might be higher-order similarities in SL interactions between yeast and animals. I hypothesized that although gene networks might not have been conserved between species at the level of individual SL interactions, they might have been conserved at a higher level, such as at the level of pathways or molecular machines. For example, while in yeast, gene A (e.g. a specific component of the DNA repair pathway) is SL with gene B (e.g. a gene with a role in DNA replication) in worm, another gene (other than the orthologue of yeast gene A) that functions in DNA repair might be SL with another component (other than the orthologue of yeast gene B) that is involved in the process of DNA repair.

In order to test this hypothesis, I set out to screen for genetic interactions in *C. elegans* within the same set of genes that have been screened for SL interactions in *S. cerevisiae* and *C. elegans*. To do so, I selected two query genes and screened for novel genetic interactions between these and all 1,046 single orthologues between *S. cerevisiae* and *C. elegans* that could be targeted by an RNAi clone in the Ahringer library (as discussed in Chapter 4). This approach allowed me to systematically investigate genetic interactions in yeast. I chose *lis-1*, the *C. elegans* orthologue of *S. cerevisiae PAC1*, which is encoding for a component of the dynein/dynactin pathway and *mdf-2*, orthologous to yeast *MAD2*, a gene encoding for a component of the spindle-assembly checkpoint complex, respectively, as query genes (Table 5.6.). Using our HTP liquid-feeding assay, I compared the phenotypes resulting from simultaneously targeting two genes by combinatorial RNAi with the RNAi phenotypes of both genes individually in the RNAi-hypersensitive strain *rrf-3* in duplicates within two independent experimental setups.

When screening for genetic interactions with mdf-2 as query, I found combinatorial RNAi against mdf-2 and tbg-1, a gene encoding for gamma-tubulin, to

<i>S</i> .	С.	Gene 1	Gene 2
cerevisiae	elegans		
PAC1 +	lis-1 +	Orthologue of human	F-actin
CAP2	cap-2	lissencephaly gene <sup>a</sup> with functions in spindle organization	capping protein, beta subunit <sup>c</sup>
		and biogenesis <sup>b</sup>	
MAD2 +	mdf-2 +	Spindle assembly	Gamma tubulin <sup>c</sup>
TUB4	tbg-1	checkpoint protein <sup>c</sup>	

## Table 5.6. Molecular functions of novel synthetic lethal interactions between C. elegans orthologues of S. cerevisiae genes

Molecular roles of novel synthetic lethal gene pairs that were identified in *C. elegans* are shown. *C. elegans* genes ('Gene1', 'Gene2') are represented by their

<sup>a</sup> WormBase descriptions (<u>www.wormbase.org</u>); <sup>b</sup> Gene Ontology descriptions

(Ashburner et al., 2000); <sup>c</sup> NCBI eukaryotic orthologous groups (Koonin et al., 2004).

result in reduced brood and embryonic survival rates (Table 5.6., Table 5.7., and Figure 5.4.a and 5.4.b). Using *lis-1* as query gene, I identified both *cap-1* and *cap-2*, encoding for alpha- and beta-subunits, respectively, of the F-actin capping protein hetero-dimer, to result in synthetic adult lethal phenotypes with *lis-1* (Table 5.6., Table 5.7., and Figure 5.4.c and 5.4.d). While both *cap-1* and *cap-2* showed the same combinatorial RNAi phenotype with *lis-1*, combinatorial RNAi against *cap-1* and *cap-2* did not result in an enhanced phenotype as compared to each single-gene RNAi phenotype alone (Figure 5.4.e). This finding supports the notion that SL interactions are mostly uncovered between components of different molecular pathways, rather than between genes functioning within the same pathways (Bader *et al.*, 2003; Kelley and Ideker, 2005; Ye *et al.*, 2005). While I had already verified the SL interactions between worm genes *lis-1* and *cap-2*, and *mdf-2* and *tbg-1*, respectively, by quantification and statistical analysis under a multiplicative model (Table 5.7. and Figure 5.4.; as discussed in Chapter 3).

Thus, by systematically screening for SL interactions in *C. elegans* within the same set of genes that have been screened for SL interactions in *S. cerevisiae*, I uncovered two novel genetic interactions and confirmed one previously identified SL interaction in *C. elegans* by using combinatorial RNAi. While the yeast genes *PAC1* and *CAP2*, which are orthologous to the worm genes *lis-1* and *cap-2*, might not have been assayed for synthetic lethality in the large-scale screen by Tong *et al.* (2004), in which the yeast genes *PAC1* and *CAP1* were identified as an SL pair, this novel interaction in *C. elegans* might be explained functionally, considering that *cap-1* and *cap-2* encode for alpha- and beta-subunits, respectively, of a capping protein heterodimer (Table 5.6.).

Intriguingly, when searching BIOGRID, a database for all compiled interaction data for model organisms (Stark *et al.*, 2006), I found *DYN2*, a gene encoding for a microtubule motor protein, to be amongst the reported SL interaction partners of the *S. cerevisiae* gene *CAP2*. Both *PAC1* — the yeast orthologue of *C. elegans lis-1*, which I identified as being SL with both *cap-1* and *cap-2* — and *DYN2* are encoding for components of the dynein pathway. These data support the hypothesis that even though individual SL interactions are not conserved between *S. cerevisiae* and *C. elegans* more

a)

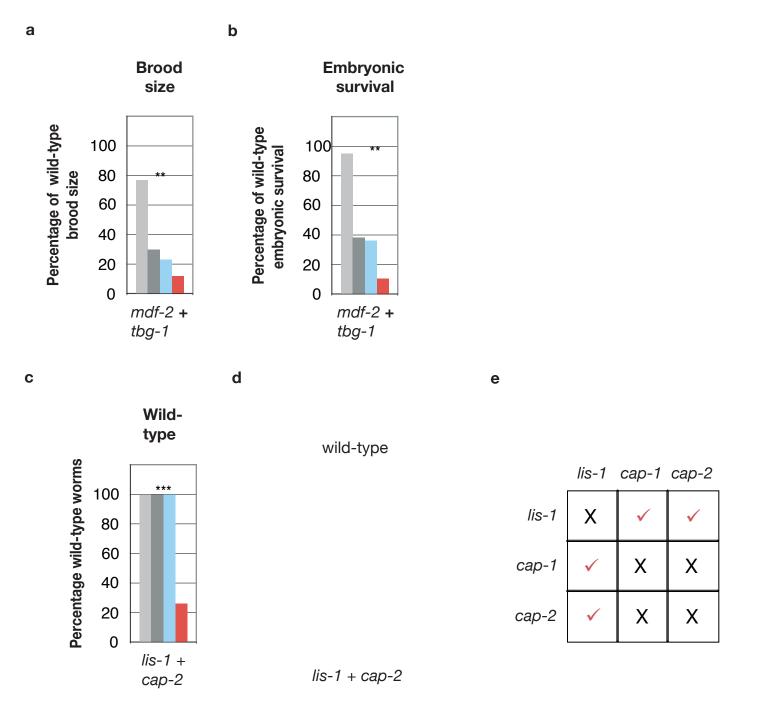
Interacting gene pair	Ger	ne1	Ger	ne2	Gene 2	el & 2	p-va	alue
	BS	ES	BS	ES	BS	ES	BS	ES
mdf-2 + tbg-1	77	95	30	38	12	11	2.23E- 03	1.82E- 03

b)

Interacting gene pair	Gene1	Gene2	Gene1 & 2	p-value
	Wt	Wt	Wt	Wt
lis-1 + cap-2	100	100	25	4.42E-20

## Table 5.7. Quantitative analysis of novel synthetic lethal interactions between *C. elegans* orthologues of *S. cerevisiae* genes

Synthetic lethal phenotypes that were identified between *C. elegans* orthologues of *S. cerevisiae* genes were quantified and subject to statistical analysis under a multiplicative model (Phillips *et al.*, 2000; Puniyani *et al.*, 2004). Percentages of average wild-type brood size ('BS'), and embryonic survival ('ES') rates, respectively (a) and fractions of worms with a wild-type ('Wt') phenotype (b) after simultaneously targeting both genes of a pair by combinatorial RNA interference (RNAi) ('Gene1 & 2') and after RNAi against each gene alone ('Gene1', 'Gene2') are shown. Numbers listed are the arithmetic mean of two independent biological repeats performed in the RNAi-hypersensitive strain *rrf-3*. p-values were assigned by comparing measurements obtained after combinatorial RNAi with the calculated product of measurements for both individual genes using a Student's t-test.



## Figure 5.4. Identification of novel synthetic lethal interactions between C. elegans orthologues of S. cerevisiae genes

See next page for Figure legend.

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## Figure 5.4. Identification of novel synthetic lethal interactions between *C. elegans* orthologues of *S. cerevisiae* genes

Brood size (a) and embryonic survival rates (b) after combinatorial RNA interference (RNAi) against *mdf-2* and *tbg-1* are represented as percentages of typical wild-type measurements. Fraction of wild-type worms after combinatorial RNAi against *lis-1* and cap-2 are shown (c). Brood size, embryonic survival, and percentages of wild-type worms, respectively, were compared after targeting both genes individually (light- and dark- grey bars), with the values after targeting both genes simultaneously (red bars) and the calculated product of both single-gene measurements (blue bars). Values plotted are the arithmetic mean of two independent experiments. Statistical significance of quantitative phenotype data was assessed under a multiplicative model (Phillips et al., 2000; Puniyani et al., 2004), using the Student's t-test. \*\*\*, P < 1.0E-03; \*\*, P < 1.0E-02. Representation of synthetic adult lethal phenotype generated by the simultaneous targeting of C. elegans lis-1 and cap-2 by combinatorial RNAi (d). Scale bars: 0.1 mm. Schematic showing the results of targeting all pairwise combinations of *C. elegans* genes *lis-1*, *cap-1*, and *cap-2* by RNAi (e).  $\checkmark$  represents a synthetic lethal phenotype. X denotes that combinatorial RNAi phenotypes did not deviate from single-gene RNAi phenotypes. All screens for genetic interactions were performed in the RNAi-hypersensitive rrf-3 background.

than expected by chance, there might be higher-order similarities in SL interactions between yeast and worm.

Interestingly, a recent study by Cuschieri *et al.* (2006) had uncovered the yeast gene *MAD2* to be synthetic lethal with *TUB4*. These genes are orthologous to *C. elegans mdf-2* and *tbg-1*, respectively, which I had identified as SL gene pair in the worm. Thus, even though on a global scale, SL interactions are not conserved between *S. cerevisiae* and *C. elegans*, isolated individual functional interactions may be conserved throughout evolution.

In summary, while I had found SL interactions to be poorly conserved between *S*. *cerevisiae* and *C. elegans*, I identified two novel genetic interactions in the worm when screening for SL interactions within *C. elegans* orthologues of *S. cerevisiae* using two genes with roles in mitosis as query genes. One of these, the interaction between *lis-1* and *cap-2* might be similar in function to the genetic interaction between *lis-1* and *cap-1*, which I found to be conserved between yeast and worm. The other one, an interaction between orthologues of the worm genes *mdf-2* and *tbg-1* has lately also been revealed in a small-scale study in the yeast *S. cerevisiae*.

Therefore, extending the search for SL interactions in *C. elegans* between the same set of genes that have been investigated for SL interactions in *S. cerevisiae* to a larger scale might provide further insights into the complexity and global organization of SL interactions in different species.

### 5.6. Comparison of literature-curated genetic interaction data

Having found that SL interactions between *S. cerevisiae* and *C. elegans* are not conserved more than expected by chance by using a directed systematic approach, I wished to supplement my experimental data with data compiled from literature. I therefore set out to compare all previously known SL data between *S. cerevisiae* and *C. elegans*. To do so, I extracted all 9,175 unique yeast SL interactions from BIOGRID, a database storing genetic interaction data for model organisms (Stark *et al.*, 2006), and all 1,006 known genetic interactions in *C. elegans* from WormBase (www.wormbase.org).

Using the INPARANOID algorithm, I identified single *C. elegans* orthologues for *S. cerevisiae* genes. I found 1,293 pairwise worm orthologues to correlate with yeast SL interactions. None of these gene pairs, however, had been previously shown to genetically interact in *C. elegans*, supporting my experimental data (Table 5.8.).

I further extended this analysis to also include literature data available on genetic interactions in *D. melanogaster* (Crosby *et al.*, 2007). Of 1,575 fly gene pairs that I identified as being orthologous to yeast SL interactions, 3 gene pairs had previously been found to also genetically interact in *D. melanogaster* (see Appendix Table 5.3.).

While I found no overlap between previously known SL interactions in yeast and worm, I next investigated whether I can find an overlap of known genetic interactions between worm and fly. I identified 212 pairwise *D. melanogaster* orthologues corresponding to previously known genetic interactions in *C. elegans*; of these, 23 were reported to also genetically interact in *D. melanogaster* (see Appendix Table 5.3.). However, it has to be noted that the nature of genetic interactions is not specified in the compiled datasets of known genetic interactions both for *C. elegans* and *D. melanogaster*. Hence, these datasets might contain both additive and non-additive genetic interactions between *C. elegans* and *D. melanogaster* than between *S. cerevisiae* and *C. elegans* might — at least in part — be explained by additive genetic interactions.

Moreover, I have to consider likely ascertainment biases in the genes that have been investigated for genetic interactions in either species when comparing literaturecurated data that have not been compiled in a comprehensive way. While enormous efforts have been made to map SL interactions on a genome-wide scale in *S. cerevisiae*, SL screens have not yet been extended to genome-scale studies in other model systems. In our laboratory, we have provided the first systematic large-scale analysis of genetic interactions in *C. elegans*. We investigated ~65,000 gene pairs with functions in the signaling and transcriptional networks that regulate development for their ability to genetically interact. Focused small-scale genetic interaction screens have also been performed to gain further insights into DNA repair and posterior patterning in *C. elegans* (Baugh *et al.*, 2005; van Haaften *et al.*, 2004).

S. cerevisiae	<i>C. elegans</i> orthologous gene pairs	<i>C. elegans</i> genetic interactions
Ц		
9,175	1,293	0

S.	D. melanogaster	D. melanogaster
cerevisiae	orthologous gene pairs	genetic interactions
SL		
9,175	1,575	3

<i>C. elegans</i> genetic interactio ns	<i>D. melanogaster</i> orthologous gene pairs	D. melanogaster genetic interactions
1,006	212	23

### Table 5.8. Comparison of genetic interaction data compiled from literature

Literature-curated synthetic lethal interactions ('SL') from *S. cerevisiae* and previously known genetic interactions between orthologous gene pairs in *C. elegans* and *D. melanogaster* were compared. Numbers for genetic interactions, their respective orthologous gene pairs in another species, and the overlap of genetic interactions are shown.

Thus, while genetic interactions have been mapped on a global scale in yeast, genetic interactions in more complex organisms have — with few exceptions — mostly been compiled on a case-by-case basis. Consequently, even though this comparative study supports my finding that SL interactions between *S. cerevisiae* and *C. elegans* are not conserved more than expected by chance, I cannot make firm conclusions about the considerable degree of conservation of genetic interactions between *C. elegans* and *D. melanogaster*.

#### 5.7. Conclusion

In summary, in this chapter, I have addressed a major open question in genetics: 'Are synthetic lethal interactions evolutionarily conserved?' I set out to investigate whether SL interactions that have recently been mapped on a genome-wide scale in the yeast S. cerevisiae are conserved in the nematode C. elegans. To do so, I examined whether I can detect SL interactions between pairs of C. elegans genes that are orthologous to pairs of genes identified as having SL interactions in at least one of three large-scale screens in S. cerevisiae. In total, I investigated 843 pairs of C. elegans genes for genetic interactions by using combinatorial RNAi. Of these, I also tested 174 pairs by targeting one gene of a pair by RNAi in a worm strain homozygous for a loss-of-function genetic mutation in the second gene. This was the entire set of yeast SL interactions that could be tested by combinatorial RNAi in *C. elegans* and for which a viable mutant strain was available, respectively. Strikingly, I found that SL interactions are not conserved despite a high degree of conservation of individual gene functions and protein interactions. These results, however, do not rule out the possibility that there might be higher-order similarities in SL interactions between S. cerevisiae and C. elegans. To test this hypothesis, I extended my search for genetic interactions to all C. elegans orthologues of S. cerevisiae genes and identified two novel interactions in the worm. I believe that a systematic large-scale analysis of the same set of genes that had been tested for SL interactions in yeast for their ability to genetically interact in the worm will provide deeper insights into the structure and general properties of complex genetic interaction networks.

Together, my findings imply that SL interactions are unlikely to be explained by simple models of redundancy and led me to propose a novel model to explain SL interactions. In this view, synthetic lethality represents a special form of conditional essentiality ('induced essentiality'). In conclusion, I suggest a substantial evolutionary plasticity in genetic interaction networks.

**Chapter 6** 

Discussion

### 6.1. Introduction

The availability of whole-genome sequences for numerous model organisms and the development of technological tools for generating loss-of-function phenotypes on a genome-wide scale have given us an unprecedented level of insight into eukaryotic gene function. It was found that inactivation of most genes in S. cerevisiae, C. elegans, and D. melanogaster has little discernable effect on viability under laboratory conditions (Bjorklund et al., 2006; Boutros et al., 2004; Giaever et al., 2002; Kamath et al., 2003). Strikingly, however, inactivating specific rare combinations of such non-essential genes under the exact same conditions can have profound effects on an organism's fitness. Such combinatorial effects are termed 'synthetic enhancement interactions'. Synthetic lethality, where mutation of a gene pair leads to non-viability, while inactivation of each gene individually has no discernible effect, represents the most severe form of synthetic enhancement. Synthetic lethal (SL) genetic interactions are classically interpreted as the result of inactivating two functionally redundant pathways in the cell, either of which is individually dispensable. Recently, enormous progress has been made in the yeast S. cerevisiae, where functional genomics tools have been established for the systematic mapping of SL interactions on a genome-wide scale (reviewed in Boone et al., 2007). These studies have identified thousands of genetic interactions in yeast and appear to have uncovered an extensive degree of redundancy. However, similar approaches are not currently feasible in any animal, so alternative strategies are needed.

### 6.2. Combinatorial RNA interference in C. elegans

In the nematode *C. elegans*, RNA-mediated interference (RNAi) by bacterial feeding has emerged as a key technique for the genome-scale analysis of individual gene functions *in vivo* (Timmons and Fire, 1998). So far, however, RNAi has only been used extensively to study the loss-of-function phenotypes of single genes. For the systematic identification of genetic interactions by RNAi, I have established and validated robust methods that allow me to target any pairwise combination of *C. elegans* genes in a high-throughput manner ('combinatorial RNAi'). Using this methodology, I was able to generate loss-of-function phenotypes for two genes in the same animal and to identify the

great majority of previously known SL and synthetic post-embryonic genetic interactions. This approach should therefore allow researchers to explore genetic interactions in the worm in a far more systematic way than has been possible in the past.

# 6.3. Functional redundancy between *C. elegans* gene duplicates can be maintained for extensive evolutionary timescales

I used combinatorial RNAi to begin to investigate functional redundancy in the genome of *C. elegans*. One obvious cause of functional redundancy is gene duplication; duplicated genes that have retained overlapping functions can compensate for inactivation of one another (Force *et al.*, 1999; Lynch and Force, 2000).

Focusing on *C. elegans* genes that correspond to single orthologues in *S. cereviaise* or *D. melanogaster* genomes, I have provided the first systematic experimental investigation into the redundancy of duplicated genes in any organism. I have identified 16 out of 143 *C. elegans* duplicate gene pairs to be at least partially functionally redundant. Intriguingly, the majority of these redundant gene pairs also do exist as gene duplicates in the related nematode *C. briggsae*, suggesting that these genes have been duplicated in the genome of *C. elegans* before the split from *C. briggsae* more than 80 million years ago. Thus, my findings strongly support models of gene evolution that suggest that redundancy is not just a transient side effect of recent gene duplication, but is instead a phenomenon that can be maintained over substantial periods of evolutionary time.

### 6.4. Higher-order redundancy in genetic interaction networks

While I have identified functional redundancy between gene duplicates, most functional redundancy in genetic networks tends to be more complex. The majority of genes that were identified as having SL interactions in genome-scale screens in *S. cereviai*se do not share sequence similarity, unlike gene duplicates, but rather occur amongst functionally unrelated genes (Tong *et al.*, 2004). This 'higher-order' redundancy appears to mechanistically differ from genuine functional redundancy, the redundancy of

gene duplicates. I like to picture this higher-order redundancy as a car. It is possible to tolerate loss of one or other function (i.e. one would be able to prevent an accident, if either the brakes or the steering wheel break), but loss of both functions is catastrophic (i.e. it is probably impossible to direct a car if both brakes and steering wheel are dysfunctional). However, while two functions (i.e. brakes and steering wheel) can somehow compensate for loss of one another, they do not so by simply fulfilling one another's genuine function (i.e. one is not able to steer a car by using the brakes).

#### 6.5. Evolutionary plasticity of genetic interaction networks

In this work, I sought to address a fundamental question in genetics: 'Are SL interactions and thus functional redundant relationships evolutionarily conserved?' I therefore set out to investigate whether SL interactions identified in the yeast *S. cerevisiae* are conserved in the nematode *C. elegans*. I used RNAi to test whether I can detect SL interactions between pairs of *C. elegans* genes that are orthologous to pairs of genes identified as having SL interactions in one of three genome-scale screens in *S. cerevisiae* (Davierwala *et al.*, 2005; Pan *et al.*, 2006; Tong *et al.*, 2004). In total, I screened 843 pairs of *C. elegans* genes for non-additive, synthetic genetic interactions by using combinatorial RNAi. Of these, I also tested 174 pairs by targeting one gene of a pair by RNAi in a worm strain homozygous for a loss-of-function genetic mutation in the second gene; this was the entire set of yeast SL interactions that could be tested by combinatorial RNAi in *C. elegans* and for which a viable mutant strain was available, respectively.

Strikingly, only 6/843 (0.7%) of the tested gene pairs that were SL in *S. cerevisiae* also resulted in a synthetic viability defect in *C. elegans*. This is not significantly different to the frequency of SL interactions that we have detected by systematically investigating ~65,000 *C. elegans* gene pairs with roles in signal transduction and transcription for their ability to genetically interact. Thus, these findings demonstrate that individual SL interactions are not conserved between *S. cerevisiae* and *C. elegans* more than expected by chance.

Moreover, this observed interaction frequency does also not differ from the average interaction density in yeast gene networks. Hence, this non-conservation of genetic interactions between *S. cerevisiae* and *C. elegans* cannot simply be explained by a reduction in the number of SL interactions.

The observed non- conservation of SL interactions between yeast and worms is in marked contrast to the conservation of single gene functions. Using the same experimental platform, I identified 61% of *C. elegans* genes corresponding to an essential gene in yeast to show a non-viable RNAi phenotype, suggesting that these genes also play an essential role in the worm. Moreover, I found 28% of *C. elegans* gene duplicates related to an essential gene in yeast to have a SL RNAi phenotype. Furthermore, 31% of a test set of protein interactions were shown to be conserved between yeast and worm (Matthews *et al.*, 2001). I thus conclude that while the knowledge of an essential gene function in yeast can strongly predict the essential function of an orthologous gene in the worm, and also — albeit to a lesser extent — the essential function covered by a pair of duplicated genes in the genome of *C. elegans*, SL interactions identified in yeast cannot be used to directly predict candidate genetic interactions in the worm.

# 6.6. Non-conservation of synthetic lethal interactions and its implications for multigenic human disease

Most obviously, if SL interactions are not conserved between yeast and worm, it is highly unlikely that they will be conserved between yeast and human. Thus, while identifying the function of a single gene in yeast is likely to be predictive of the function of its orthologue in humans, one cannot transfer genetic interactions between species so directly. For example, it is highly unlikely that yeast SL data can be used to directly identify genes that when inhibited will selectively kill cancer cells carrying a mutation in a tumour suppressor gene (Kaelin, 2005). Considering that increasing numbers of human diseases are identified as resulting from combinations of mutations in multiple genes that alone have little effect (reviewed in Badano and Katsanis, 2002), alternative integrated approaches will be required to predict modifier genes in complex genetic diseases in humans.

### 6.7. Synthetic lethal interactions and predictions of gene functions

Finally, I want to emphasize that although I have shown here that SL interactions are not conserved between yeast and a multicellular organism more than expected by chance, genetic interaction screens in *S. cerevisiae* are nonetheless informative for understanding multicellular biology. Clustering yeast genes according to their profiles of genetic interactions is a very powerful method for defining their precise molecular functions (Wong *et al.*, 2004). Thus, despite the lack of direct conservation of SL interactions between yeast and animals, SL screens in yeast are still highly informative for understanding general principles of how genes combine in non-additive modes. (Collins *et al.*, 2007; Pan *et al.*, 2006; Schuldiner *et al.*, 2005; Tong *et al.*, 2004; Wong *et al.*, 2004).

# 6.8. 'Induced essentiality' model for the interpretation of synthetic lethal interactions

Beyond the direct practical implications for the use of SL interaction data, my findings led me to suggest a novel model for the interpretation of SL interactions. In the classic model, SL interactions between two genes (gene A and B) are considered to be the result of inactivating two functionally redundant genes or pathways in which the genes act (reviewed in Guarente, 1993; Hartman *et al.*, 2001). However, I suggest that there is an alternative explanation for SL interactions, which I have termed 'induced essentiality'. In this view, the phenomenon of synthetic lethality is considered a side-effect of the evolution of adaptive responses to different environmental conditions. In my proposed model, loss of gene A induces the genetic network to rearrange so the organism's viability is maintained. In this novel network, gene B becomes indispensable. Thus, inactivating both gene A and gene B results in synthetic lethality, without gene A and gene B being functionally redundant. I believe that my finding that SL interactions are not conserved favours the 'induced essentiality' model.

### 6.9. Conclusion

In summary, during my PhD training, I have established robust methods ('combinatorial RNAi') to study genetic interactions between any pair of genes in *C. elegans*. I used this technique to provide the first extensive systematic analysis in any organism of the potentially redundant functions of duplicated genes and found that redundancy between some *C. elegans* gene duplicates has been maintained for long evolutionary timescales. When investigating whether SL interactions are conserved between yeast and worms, I found that genetic interaction networks evolve much faster than both the functions of individual genes and protein-protein interaction networks.

I thus consider the current hypothesis that SL interactions represent functional redundant relationships to be very unlikely. Instead, I propose a novel model for the interpretation of SL interactions. In this view, SL interactions are suggested to represent a special form of conditional essentiality ('induced essentiality').

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# Appendix

CE RNAi clone	Pheno Screen 1	Pheno Screen 2	Pheno Kamath et al., 2003
F54C4.1	0	NonV	NonV
F54C4.3	NonV	NonV	Gro
C29F9.1	Gro	0	Gro
C29F9.7	NonV	NonV	NonV
F40G9.1	NonV	NonV	Gro
W10C4.b	NonV	NonV	Gro
W07B3.2	NonV	NonV	NonV
F10C5.1	NonV	NonV	NonV
F10C5.2	NonV	NonV	NonV
F30H5.1	NonV	NonV	NonV
W06E11.1	NonV	NonV	NonV
T17H7.5	NonV	NonV	NonV
B0412.4	NonV	NonV	NonV
T24C4.5	NonV		NonV
F23H11.5		NonV	
	NonV	NonV	NonV
F58B6.3	NonV	NonV	NonV
Y71D11A.b	NonV	NonV	NonV
F53A3.3	NonV	NonV	NonV
W04B5.4	0	Gro	NonV
H19M22.1	NonV	NonV	NonV
H19M22.2	NonV	NonV	Рер
H19M22.3	NonV	NonV	NonV
H06I04.a	NonV	NonV	NonV
H06I04.f	NonV	NonV	NonV
H06I04.h	NonV	NonV	Gro
H06I04.i	NonV	NonV	Gro
R148.7	0	0	Gro
F59A2.1	NonV	NonV	NonV
C34C12.8	NonV	NonV	NonV
M01F1.3	NonV	NonV	NonV
C54C6.1	NonV	NonV	NonV
C32A3.1	NonV	NonV	NonV
R13G10.1	NonV	NonV	Рер
C36A4.4	0	0	NonV
F13B10.2	NonV	NonV	NonV
ZK1058.2			
	NonV	NonV	NonV
C36E8.5	NonV	NonV	NonV
T02C12.2	NonV	NonV	Gro
E03A3.3	NonV	NonV	NonV
C03C10.3	NonV	NonV	NonV
C16C10.2	NonV	NonV	Gro
C16C10.6	NonV	NonV	NonV
R74.1	NonV	NonV	NonV
F43C1.2	NonV	NonV	NonV
F43C1.3	NonV	Gro	Gro
F43C1.5	0	Gro	NonV
Y44F5A.1	NonV	NonV	Gro
T08A11.2	NonV	NonV	NonV
R10E4.4	NonV	NonV	NonV
H38K22.2	0	Gro	NonV
B0285.1	NonV	NonV	Gro
B0285.2	NonV	NonV	NonV
R07E5.1	0	Gro	Pep
R07E5.3	NonV	NonV	NonV
R07E5.7	Gro	Gro	Gro
R07E5.7 R07E5.10			NonV
	NonV	NonV	
R07E5.14	NonV	NonV	NonV
F56F3.2	NonV	Gro	NonV
F56F3.5	NonV	NonV	NonV
C07G2.3	NonV	NonV	NonV
M88.2	Gro	0	NonV
M88.6	NonV	NonV	Pep
F35G12.8	NonV	NonV	NonV
F35G12.10	NonV	0	NonV
T04A8.6	NonV	NonV	NonV
T04A8.7	NonV	0	NonV

Appendix Table 3.1. C. eleg	ans chromosome III gene	es with previously known RN	A interference phenotypes

T04A8.11	NonV	0	NonV	
B0393.1	NonV	NonV	NonV	
B0393.6	NonV	0	NonV	
C38D4.3	NonV	0	NonV	
C38D4.6	NonV	NonV	NonV	
C35D10.1	0	NonV	NonV	
C35D10.5	Gro	0	NonV	
C35D10.6	Gro	0	Pep	
C35D10.13	0	0	NonV	
F26F4.10	NonV	NonV	NonV	
F26F4.11	NonV	NonV	NonV	
C26E6.4	NonV	NonV	NonV	
C26E6.6	NonV	NonV	NonV	
C26E6.8	0	0	NonV	
C27F2.4	0	0	Gro	
C27F2.7	Gro	Gro/Pep	NonV	
C27F2.8	NonV	NonV	Gro	
R144.2	NonV	NonV	NonV	
R144.3	NonV	0	NonV	
R144.7	Gro	0	NonV	
C45G9.5	NonV	NonV	NonV	
F54D8.1	NonV	NonV	Рер	
F21H11.4	0	0	NonV	
T10F2.1	NonV	NonV	NonV	
T10F2.3	Gro	0	Pep	
T10F2.4	NonV	NonV	NonV	
K10D2.2	Gro	Gro	Gro	
K10D2.4	0	Gro	NonV	
K10D2.6	NonV	NonV	NonV	
C34E10.1	0	0	NonV	
C34E10.2	0	0	NonV	
C34E10.4	Gro	0	Gro	
C34E10.6	NonV	NonV	NonV	
ZC395.3	Gro	0	Gro	
ZC395.8	0	0	Pep	
F48E8.2	0	0	NonV	
F48E8.5	0	0	NonV	
R02F2.7	NonV	NonV	Gro	
F09F7.2	Pep	0	Pep	
F09F7.3	NonV	NonV	NonV	
F56D2.1	NonV	NonV	NonV	
F56D2.6	NonV	NonV	NonV	
F54E7.2	NonV	NonV	NonV	
F54E7.3	NonV	NonV	NonV	
F54E7.4	0	0	NonV	
B0336.1	0	0	NonV	
B0336.2	NonV	NonV	NonV	
B0336.3	Gro	0	Gro	
B0336.6	NonV	NonV	NonV	
B0336.10	NonV	NonV	NonV	
R12B2.1	0	Pep	Pep	
R12B2.4	NonV	NonV	NonV	
R12B2.5	NonV	NonV	NonV	
F01F1.7	NonV	NonV	NonV	
F01F1.8	NonV			
		NonV	NonV	
F01F1.12	0	NonV	NonV	
C28H8.6	NonV	NonV	NonV	
F25B5.4	NonV	NonV	NonV	
ZK328.1	0	0	NonV	
ZK328.2	NonV	NonV	NonV	
ZK328.5	NonV	NonV	NonV	
T17E9.1	Gro	Gro	NonV	
T17E9.2	NonV	NonV	NonV	
Y42G9A.c	Gro	nd	NonV	
C23G10.3	NonV	NonV	NonV	
C23G10.4	NonV	NonV	NonV	
C23G10.4	NonV	NonV	NonV	
C23G10.9	NonV	NonV	NonV	
T12A2.2	NonV	NonV	NonV	

T12A2.7	0	0	NonV	
F47D12.4	NonV	NonV	Рер	
C56G2.2	0	0	NonV	
C56G2.6	NonV	NonV	NonV	
C16A3.3	NonV	NonV	Gro	
C16A3.4	NonV	NonV	NonV	
C16A3.5	NonV	NonV	NonV	
C16A3.6				
	NonV	NonV	NonV	
C16A3.9	NonV	NonV	NonV	
C05D11.2	0	0	NonV	
C05D11.3	0	0	NonV	
C05D11.9	0	0	Gro	
C05D11.10	0	0	NonV	
C05D11.11	0	Gro	NonV	
C05D11.12	NonV	NonV	NonV	
T26A5.3	NonV	NonV	NonV	
T26A5.7	Gro	NonV	Рер	
T26A5.9	NonV	NonV	NonV	
F23F12.2	0	0	NonV	
F23F12.6	NonV	NonV	NonV	
F20H11.2	NonV	NonV	Gro	
F20H11.3	Gro	0	NonV	
F20H11.6	NonV	0	Gro	
C13B9.3	NonV	NonV	NonV	
F37A4.8	Gro	Gro	NonV	
R13F6.1	NonV	NonV	NonV	
R13F6.9	Рер	Pep	Pep	
R13F6.10	0	0	NonV	
K04C2.2	NonV	NonV	Gro	
F57B9.2	NonV	NonV	NonV	
F57B9.3	NonV	NonV	NonV	
F57B9.5	NonV	NonV	NonV	
F57B9.6				
	NonV	NonV	NonV	
F57B9.10	NonV	NonV	NonV	
F31E3.1	NonV	Gro	Pep	
F31E3.3	0	0	NonV	
F11H8.4	NonV	NonV	NonV	
B0280.9	NonV	NonV	Gro	
K04G7.1	NonV	NonV	NonV	
K04G7.4	NonV	NonV	NonV	
F37C12.1	NonV	NonV	NonV	
F37C12.3	Gro	Gro	NonV	
F37C12.4	NonV	NonV	NonV	
F37C12.9	NonV	NonV	NonV	
F37C12.11	NonV	NonV	NonV	
F37C12.11	NonV	NonV	NonV	
R151.3	NonV	NonV	NonV	
R151.9	0	NonV	NonV	
T20H4.3	NonV	NonV	NonV	
T20H4.5	NonV	NonV	NonV	
B0361.5	0	0	Gro	
B0361.6	0	0	Gro	
B0361.8	NonV	NonV	Gro	
B0361.10	NonV	NonV	NonV	
F08F8.2	NonV	NonV	NonV	
T20B12.1	NonV	NonV	NonV	
T20B12.2	NonV	NonV	NonV	
T20B12.3	NonV	NonV	Gro	
T20B12.7	0	0	NonV	
T20B12.7	NonV			
		NonV	NonV	
H14A12.2	0	NonV	NonV	
H14A12.6	NonV	NonV	Pep	
K07D8.1	NonV	NonV	Pep	
C07H6.2	0	0	Gro	
C07H6.5	NonV	NonV	NonV	
С07Н6.7	0	0	Pep	
	0	Gro	Pep	
R13A5.5				
R13A5.5 R13A5.8	NonV	NonV	NonV	

R13A5.13	NonV	NonV	NonV
ZK783.1	NonV	NonV	Pep
			_
ZK686.1	NonV	NonV	Gro
ZK686.2	NonV	NonV	Gro
ZK686.3	NonV	NonV	NonV
C08C3.4	0		
	-	NonV	NonV
C27D11.1	NonV	NonV	NonV
ZK652.1	NonV	NonV	NonV
ZK652.4	NonV	NonV	NonV
C02C2.6	0	0	
	-	-	Pep
C29E4.2	NonV	NonV	NonV
C29E4.8	NonV	NonV	NonV
F54H12.1	NonV	NonV	NonV
F54H12.6	NonV	NonV	
			NonV
F44B9.7	0	Gro	NonV
K12H4.1	Рер	Рер	Pep
K12H4.3	NonV	NonV	NonV
K12H4.4	NonV	NonV	NonV
к12н4.5	NonV	NonV	NonV
КО6Н7.1	NonV	NonV	NonV
КО6Н7.6	NonV	0	NonV
C14B9.4	NonV	NonV	NonV
C14B9.7	NonV	NonV	NonV
D2007.4	0	0	NonV
C30A5.7	0	0	Рер
			_
C02F5.1	NonV	NonV	NonV
C02F5.9	NonV	NonV	NonV
F09G8.3	NonV	NonV	NonV
F10E9.4	NonV	NonV	Gro
F10E9.7	NonV	NonV	NonV
F10E9.8	NonV	NonV	NonV
R05D3.4	NonV	NonV	Gro
R05D3.7	Gro	Gro	Рер
			_
ZK1236.3	NonV	NonV	NonV
ZK1236.5	0	NonV	Gro
C30C11.1	NonV	0	NonV
C30C11.2	NonV	NonV	NonV
C30C11.4	NonV	NonV	NonV
C06E1.10	NonV	NonV	NonV
F22B7.5	NonV	NonV	NonV
B0303.5	NonV	0	Gro
B0303.15	NonV	0	NonV
K02D10.5	NonV	NonV	NonV
F54F2.1	NonV	NonV	Рер
F54F2.8	Gro	Gro	Gro
	0		
ZK637.7		Gro	Gro
ZK637.8	NonV	NonV	NonV
R08D7.1	NonV	NonV	NonV
R08D7.2	NonV	0	NonV
R08D7.3	NonV	NonV	NonV
R107.6	0	NonV	NonV
R107.8	NonV	NonV	Pep
F02A9.2	NonV	0	Pep
F02A9.4	0	0	
	-		NonV
F02A9.6	NonV	NonV	NonV
T23G5.1	NonV	NonV	NonV
К04Н4.1	NonV	NonV	NonV
C38C10.4			
	NonV	NonV	NonV
T26G10.1	NonV	NonV	NonV
F54C8.2	NonV	NonV	NonV
F54C8.3	NonV	0	NonV
F54C8.5	0	Gro	Pep
	NonV	NonV	NonV
B0464.1		NonV	NonV
B0464.1 B0464.7	NonV		
B0464.7			NonV
B0464.7 ZK1098.7	0	NonV	NonV
B0464.7 ZK1098.7 C48B4.9	0 NonV	NonV NonV	Gro
B0464.7 ZK1098.7	0	NonV	
B0464.7 ZK1098.7 C48B4.9	0 NonV	NonV NonV	Gro
B0464.7 ZK1098.7 C48B4.9 F58A4.3	0 NonV NonV	NonV NonV NonV	Gro NonV

r	I.	1		
F58A4.11	NonV	NonV	Pep	
C07A9.2	NonV	NonV	NonV	
C07A9.3	NonV	NonV	NonV	
T05G5.3	NonV	NonV	NonV	
T05G5.6	0	Gro	Gro	
T05G5.10	0	NonV	NonV	
R10E11.1 R10E11.2	NonV NonV	NonV	NonV	
R10E11.2 R10E11.8	NonV	NonV NonV	NonV NonV	
ZK632.1	NonV	NonV	NonV	
ZK632.2	0	0	Pep	
K03H1.2	NonV	NonV	NonV	
T16G12.5	NonV	NonV	Pep	
T16H12.4	NonV	0	NonV	
ZK1128.3	NonV	NonV	Gro	
ZK1128.5	0	0	Pep	
T20G5.1	NonV	NonV	NonV	
T20G5.2	NonV	NonV	NonV	
T20G5.3	NonV	NonV	NonV	
T20G5.6	Рер	0	Рер	
R01H10.1	NonV	NonV	NonV	
T07C4.1	NonV	0	Gro	
T07C4.7	Gro	Gro	NonV	
M03C11.7	NonV	NonV	NonV	
D2045.1	NonV	0	NonV	
D2045.6	NonV	NonV	NonV	
F43D9.3	NonV	NonV	NonV	
F43D9.5	0	0	Gro	
W09D10.1	NonV	Gro	Gro	
W09D10.3	0	0	Gro	
K01G5.1	NonV	NonV	NonV	
K01G5.4	NonV	NonV	NonV	
K01G5.7	NonV	NonV	NonV	
Y39A1B.3	NonV	Gro/Pep	NonV	
K11D9.1	0	0	NonV	
K11D9.2	NonV	NonV	NonV	
M142.4	Gro	Gro	Pep	
M142.6	Gro	Gro	Gro	
Y48A6B.3	Gro	0	Gro	
Y48A6B.5	0	0	Gro	
Y48A6B.11	0	0	NonV	
Y48A6C.4	NonV	0	Gro	
Y47D3A.aa	Gro	NonV	Gro	
Y47D3A.c	NonV	NonV	NonV	
Y47D3A.d	NonV	NonV	NonV	
Y47D3A.1 Y47D3B.7	0 NonV	0 NonV	Pep	
Y47D3B.7 Y47D3B.10	NonV 0	NonV 0	NonV	
Y47D3B.10 Y66A7A.8	NonV	NonV	Pep NonV	
Y41C4A.9	0	0		
Y41C4A.10	0	0	Pep NonV	
C24H11.6	0	0	Gro	
C24H11.7	NonV	NonV	NonV	
C18D11.4	NonV	NonV	Gro	
Y56A3A.18	NonV	NonV	Gro	
Y56A3A.19	0	0	Gro	
Y56A3A.32	0	0	NonV	
Y75B8A.2	NonV	NonV	NonV	
Y75B8A.7	NonV	NonV	Gro	
Y75B8A.25	Gro	Gro	Pep	
Y49E10.1	NonV	NonV	NonV	
Y49E10.2	0	0	NonV	
Y49E10.6	NonV	NonV	NonV	
Y49E10.14	NonV	NonV	NonV	
Y49E10.15	NonV	NonV	NonV	
	NonV	NonV	NonV	
Y49E10.19				
Y49E10.19 Y49E10.21	NonV	NonV	NonV	
	NonV NonV	NonV NonV	NonV NonV	

Y111B2D.c	NonV	0	Рер
Y111B2D.h	NonV	NonV	NonV
Y37D8A.1	NonV	Pep	Рер
Y37D8A.9	0	0	Рер
Y37D8A.10	NonV	NonV	NonV
Y37D8A.14			
	NonV	NonV	NonV
Y37D8A.16	NonV	NonV	Gro
Y37D8A.18	NonV	0	NonV
ZK1010.1	NonV	NonV	NonV
ZK1010.3	Gro	Gro	Gro
Y39E4B.1	NonV	NonV	NonV
F56A8.6	NonV	NonV	NonV
Y43F4B.5	NonV	NonV	Gro
Y43F4B.6	NonV	NonV	NonV
F53A2.4	NonV	0	NonV
T03F6.5	NonV	0	NonV
F45G2.5	NonV	NonV	Рер
F45G2.11	NonV	NonV	Рер
Y76A2A.2	NonV	NonV	Рер
T27E9.1	NonV	NonV	NonV
Y76A2B.1	NonV	NonV	NonV
T05D4.4	NonV	NonV	Gro
T25C8.2	NonV	NonV	NonV
T12D8.1	NonV	NonV	NonV
T12D8.6	NonV	NonV	NonV
T12D8.7	0	NonV	NonV
ZK520.1	0	0	Gro
W06F12.1	NonV	NonV	NonV
K08E3.5	NonV	NonV	NonV
K08E3.6	NonV	NonV	NonV
C37G2.7	NonV	NonV	NonV
Y119D3_444.b	NonV	NonV	NonV
Y119D3 446.a	NonV	NonV	NonV
Y119D3 446.c	NonV	NonV	NonV
Y119D3_440.C Y119D3_456.a	NonV	NonV	Gro
Y53G8A_9248.c	NonV	NonV	NonV
Y53G8A_9248.d	0	Gro	NonV
	-		
Y53G8B_93.d	NonV	NonV	Gro
Y53G8B_1025.a	NonV	NonV	NonV
Y53G8B_1025.b	NonV	NonV	NonV
Y55B1A_115.c	NonV	0	NonV
Y55B1A_115.e	NonV	NonV	Pep
Y71H2_375.b	NonV	NonV	NonV
Y71H2_378.a	NonV	NonV	NonV
Y71H2_381.a	0	0	Gro
Y71H2_388.c	NonV	NonV	NonV
Y71H2_388.d	NonV	NonV	NonV
Y71H2_388.f	0	0	Рер
Y71H2_389.e	NonV	NonV	NonV

#### Appendix Table 3.1. C. elegans chromosome III genes with previously known RNA interference phenotypes

For each gene on *C. elegans* chromosome III with a previously known RNA interference (RNAi) phenotype (Kamath *et al.*, 2003), the Ahringer library RNAi clone gene pairs name ('CE RNAi clone'), the phenotypes observed in this study in two independent experimental setups ('Pheno Screen 1, 'Pheno Screen 2') by using the high-throughput RNAi liquid feeding assay and the RNAi-hypersensitive strain *rrf-3* ), and the phenotype observed in the plate feeding screen performed by Kamath *et al.* (Pheno Kamath *et al.*, 2003), are shown. NonV, non-viable RNAi phenotype (sterility and embryonic lethality, respectively). Gro, slowed post-embryonic growth. Pep, defect in post-embryonic development. 0, no RNAi phenotype observed.

non-targeting	(Ahringer	library cl	Lone Y95B8A	84.g)	
CE RNAi	Emb	Ste	Lga	Weaker	No
clone				Pheno	Pheno
F54C4.1	0	0	0	0	0
C29F9.7	0	3	0	3-fold	10-fold
W07B3.2	0	3	0	10-fold	0
F10C5.1	0	2	0	2-fold	4-fold
F10C5.2	0	2	0	4-fold	5-fold
F30H5.1	0	3	0	10-fold	0
W06E11.1	0	2	0	4-fold	10-fold
T17H7.5	0	0	1	2-fold	10-fold
B0412.4	0	0	1	2-fold	0
T24C4.5	0	3	0	2-fold	0
F23H11.5	0	3	0	2-fold	10-fold
F58B6.3	2	2	0	2-fold	0
Y71D11A.b	0	0	1	4-fold	0
F53A3.3	0	0	1	2-fold	0
W04B5.4	0	0	0	0	0
H19M22.1	0	0	1	2-fold	0
H19M22.3	0	3	0	2-fold	0
H06I04.a	0	3	0	5-fold	0
H06I04.f	0	0	1	2-fold	0
F59A2.1	0	3	0	2-fold	10-fold
C34C12.8	0	2	0	3-fold	4-fold
M01F1.3	0	3	0	2-fold	5-fold
C54C6.1	0	0	1	2-fold	0
C32A3.1	2	2	0	2-fold	4-fold
C36A4.4	0	0	0	0	0
F13B10.2	0	0	1	5-fold	0
ZK1058.2	0	0	1	3-fold	0
C36E8.5	0	3	0	3-fold	0
E03A3.3	0	3	0	2-fold	10-fold
C03C10.3	0	3	0	3-fold	0
C16C10.6	3	2	0	2-fold	10-fold
R74.1	0	3	0	2-fold	10-fold
F43C1.2	0	2	0	2-fold	3-fold
F43C1.5	0	0	0	0	0
T08A11.2	0	0	1	2-fold	10-fold
R10E4.4	0	3	0	2-fold	10-fold
H38K22.2	0	0	0	0	0
B0285.2	2	2	0	0	2-fold
R07E5.3	0	3	0	2-fold	10-fold
R07E5.10	0	2	0	2-fold	4-fold
R07E5.14	0	3	0	2-fold	10-fold
F56F3.2	2	2	0	0	2-fold
F56F3.5	0	0	1	10-fold	0
C07G2.3	0	0	1	3-fold	0
M88.2	0	0	0	0	0
F35G12.8	0	3	0	3-fold	0
F35G12.10	0	2	0	0	2-fold
T04A8.6	0	3	0	2-fold	5-fold
T04A8.7	1	1	0	3-fold	5-fold
T04A8.11	0	2	0	0	2-fold
B0393.1	0	0	1	5-fold	0
B0393.6	0	1	0	0	2-fold
C38D4.3	1	2	0	2-fold	3-fold
C38D4.6	3	0	0	2-fold	0
C35D10.1	0	0	0	0	0
C35D10.5	0	0	0	0	0
C35D10.13	0	0	0	0	0
F26F4.10	0	2	0	2-fold	3-fold
F26F4.11	0	2	0	0	3-fold
C26E6.4	0	0	1	2-fold	0
C26E6.6	0	2	0	0	2-fold
C26E6.8	0	0	0	0	0
	0	0	0	0	0
C27F2.7	0	0	0	0	0

Appendix Table 3.2. C. elegans chromosome III genes with non-viable RNA interference phenotypes

R144.3	0	1	0	0	2-fold
R144.7	0	0	0	0	0
	-	-	-	-	-
C45G9.5	0	2	0	2-fold	4-fold
F21H11.4	0	0	0	0	0
T10F2.1	0	0	1	2-fold	0
T10F2.4	3	2	0	2-fold	10-fold
K10D2.4	0	0	0	0	0
K10D2.6	2	2	0	2-fold	5-fold
C34E10.1	0	0	0	0	0
C34E10.2	0	0	0	0	0
C34E10.6	0	0	1	4-fold	0
F48E8.2	0	0	0	0	0
F48E8.5	0	0	0	0	0
F09F7.3	0	3	0	2-fold	10-fold
	-		-		
F56D2.1	0	3	0	2-fold	5-fold
F56D2.6	0	3	0	2-fold	3-fold
F54E7.2	0	3	0	2-fold	3-fold
F54E7.3	3	2	0	2-fold	0
F54E7.4	0	0	0	0	0
B0336.1	0	0	0	0	0
	0	3	0	-	3-fold
B0336.2	-		-	2-fold	
B0336.6	0	2	0	2-fold	4-fold
B0336.10	0	0	1	10-fold	0
R12B2.4	0	2	0	2-fold	3-fold
R12B2.5	0	0	1	2-fold	0
F01F1.7	2	2	0	2-fold	4-fold
F01F1.7	0	0	1	2-fold	10-fold
	-	-			
F01F1.12	0	0	0	0	0
C28H8.6	2	2	0	2-fold	4-fold
F25B5.4	0	0	1	0	0
ZK328.1	0	0	0	0	0
ZK328.2	0	0	1	2-fold	0
ZK328.5	0	0	1	4-fold	0
T17E9.1	0	0	0	0	0
T17E9.2	0	2	0	0	2-fold
Y42G9A.c	0	0	0	0	0
C23G10.3	0	0	1	3-fold	0
C23G10.4	0	0	1	0	0
C23G10.8	0	3	0	10-fold	0
	-	3	-		-
C23G10.9	0		0	2-fold	4-fold
T12A2.2	0	0	1	2-fold	10-fold
T12A2.7	0	0	0	0	0
C56G2.2	0	0	0	0	0
C56G2.6	0	0	1	5-fold	0
C16A3.4	0	2	0	0	5-fold
C16A3.5			-	-	3-fold
	0	2	0	0	
C16A3.6	0	3	0	2-fold	4-fold
C16A3.9	0	0	1	2-fold	10-fold
C05D11.2	0	0	0	0	0
C05D11.3	0	0	0	0	0
C05D11.10	0	0	0	0	0
C05D11.11	0	0	0	0	0
	2	0	0		
C05D11.12				2-fold	3-fold
T26A5.3	0	2	0	0	3-fold
T26A5.9	2	2	0	2-fold	10-fold
F23F12.2	0	0	0	0	0
F23F12.6	0	0	1	10-fold	0
F20H11.3	0	0	0	0	0
	0	0	1	10-fold	0
C13B9.3					
F37A4.8	0	0	0	0	0
R13F6.1	2	2	0	2-fold	3-fold
R13F6.10	0	0	0	0	0
F57B9.2	0	0	1	4-fold	0
F57B9.3	0	0	1	2-fold	5-fold
F57B9.5	0	3	0	2-fold	4-fold
F57B9.6	0	0	1	3-fold	10-fold
F57B9.10	0	0	1	10-fold	0
F31E3.3	0	0	0	0	0
F11H8.4	0	2	0	0	3-fold
	1	1	1	1	

K04G7.1	0	2	0	3-fold	4-fold
K04G7.4	0	2	0	0	10-fold
F37C12.1	2	2	0	2-fold	3-fold
F37C12.3	0	0	0	0	0
F37C12.4	0	3	0	0	2-fold
F37C12.9	0	0	1	5-fold	0
F37C12.11	0	0	1	3-fold	0
	2	2	0		0 4-fold
F37C12.13			-	2-fold	
R151.3	0	0	1	2-fold	0
R151.9	0	0	0	0	0
Т20Н4.3	0	0	1	4-fold	0
Т20Н4.5	0	2	0	0	2-fold
B0361.10	0	2	0	2-fold	3-fold
F08F8.2	0	2	0	0	2-fold
T20B12.1	0	2	0	0	5-fold
T20B12.2	0	2	0	0	3-fold
T20B12.7	0	0	0	0	0
T20B12.8	0	2	0	0	5-fold
H14A12.2	0	0	0	0	0
С07н6.5	0	2	0	5-fold	10-fold
R13A5.8	0	0	1	5-fold	0
R13A5.12	0	3	0	3-fold	0
R13A5.13	0	3	0	3-fold	0
ZK686.3	0	2	0	3-fold	4-fold
C08C3.4	0	0	0	0	0
C08C3.4 C27D11.1	0	0	1	3-fold	0
ZK652.1	0	0	1	2-fold	10-fold
		0	1		0
ZK652.4	0	-		3-fold	
C29E4.2	0	3	0	3-fold	0
C29E4.8	0	2	0	3-fold	10-fold
F54H12.1	0	2	0	2-fold	5-fold
F54H12.6	0	2	0	3-fold	4-fold
F44B9.7	0	0	0	0	0
K12H4.3	0	3	0	2-fold	3-fold
K12H4.4	0	2	0	2-fold	3-fold
K12H4.5	0	2	0	2-fold	3-fold
КО6Н7.1	0	3	0	2-fold	0
КО6Н7.6	0	2	0	2-fold	3-fold
C14B9.4	0	3	0	2-fold	0
C14B9.7	0	0	1	5-fold	0
D2007.4	0	0	0	0	0
C02F5.1	0	3	0	4-fold	0
C02F5.9	0	0	1	3-fold	0
F09G8.3	0	2	0	0	3-fold
F10E9.7	0	0	1	2-fold	10-fold
F10E9.8	2	2	0	2-fold	3-fold
ZK1236.3	0	3	0	3-fold	10-fold
C30C11.1	0	2	0	0	2-fold
C30C11.1 C30C11.2	0	0	1	0 3-fold	0
	0	2	0	3-101d 3-fold	0 4-fold
C30C11.4		2	0		4-101d 5-fold
C06E1.10	0			2-fold	
F22B7.5	0	2	0	0	2-fold
B0303.15	0	2	0	0	2-fold
K02D10.5	0	0	1	4-fold	10-fold
ZK637.8	0	3	0	2-fold	10-fold
R08D7.1	2	2	0	2-fold	4-fold
R08D7.2	0	2	0	0	2-fold
R08D7.3	0	3	0	2-fold	0
R107.6	0	0	0	0	0
F02A9.4	0	0	0	0	0
F02A9.6	2	2	0	2-fold	3-fold
T23G5.1	0	3	0	3-fold	0
K04H4.1	0	2	0	2-fold	3-fold
C38C10.4	0	2	0	2-fold	3-fold
T26G10.1	0	3	0	2-fold	10-fold
F54C8.2	2	2	0	2-fold	3-fold
F54C8.3	0	2	0	0	2-fold
B0464.1	0	0	1	2-fold	0
B0464.7	0	2	0	0	3-fold
L	1	1			

ZK1098.7	0	0	0	0	0
F58A4.3	3	2	0	3-fold	10-fold
F58A4.4	0	3	0	3-fold	0
F58A4.8	0	2	0	0	2-fold
C07A9.2	2	2	0	3-fold	5-fold
C07A9.3	2	2	0	0	3-fold
T05G5.3	0	3	0	2-fold	0
T05G5.10	0	0	0	0	0
R10E11.1	0	0	1	10-fold	0
R10E11.2	0	0	1	3-fold	0
R10E11.8	0	0	1	0	0
ZK632.1	0	3	0	3-fold	0
K03H1.2	2	2	0	2-fold	3-fold
T16H12.4	0	1	0	0	2-fold
T20G5.1	0	0	1	0	0
T20G5.2	0	3	0	2-fold	10-fold
T20G5.3	0	0	1	0	0
R01H10.1	1	1	0	0	4-fold
T07C4.7	0	0	0	0	0
M03C11.7	2	2	0	2-fold	3-fold
D2045.1	0	2	0	0	2-fold
D2045.6	1	2	0	0	3-fold
F43D9.3	0	0	1	4-fold	0
K01G5.1	0	3	0	2-fold	3-fold
K01G5.4	0	0	1	4-fold	0
K01G5.7	0	3	0	2-fold	5-fold
Y39A1B.3	1	1	0	2-fold	4-fold
K11D9.1	0	0	0	0	0
K11D9.2	0	0	1	2-fold	0
Y48A6B.11	0	0	0	0	0
Y47D3A.c	0	3	0	5-fold	0
Y47D3A.d	0	3	0	2-fold	10-fold
Y47D3B.7	0	0	1	2-fold	0
Y66A7A.8	2	2	0	2-fold	4-fold
Y41C4A.10	0	0	0	0	0
C24H11.7	0	0	1	2-fold	5-fold
Y56A3A.32	0	0	0	0	0
Y75B8A.2	1	1	0	3-fold	4-fold
Y49E10.1	0	0	1	10-fold	0
Y49E10.2	0	0	0	0	0
Y49E10.6	0	0	1	2-fold	10-fold
Y49E10.14	2	2	0	10-fold	0
Y49E10.15	0	0	1	2-fold	10-fold
Y49E10.19	2	2	0	10-fold	0
Y49E10.21	0	2	0	2-fold	3-fold
Y111B2C.e	0	3	0	2-fold	4-fold
Y111B2D.b	0	0	1	0	0
Y111B2D.h	3	2	0	2-fold	10-fold
Y37D8A.10	0	3	0	2-fold	10-fold
Y37D8A.14	0	3	0	2-fold	4-fold
Y37D8A.18	0	2	0	0	2-fold
ZK1010.1	0	0	1	10-fold	0
Y39E4B.1	1	2	0	0	2-fold
F56A8.6	0	3	0	2-fold	10-fold
Y43F4B.6	1	2	0	2-fold	3-fold
F53A2.4	0	2	0	2-fold	3-fold
T03F6.5	0	1	0	0	2-fold
T27E9.1	0	2	0		10-fold
Y76A2B.1	2	2	0	3-fold	10-fold
T25C8.2	0	0	1		0 4 fold
T12D8.1	2	2	0	2-fold	4-fold
T12D8.6	3	2	0	3-fold	0
T12D8.7	0	0	0		0
W06F12.1	0	3	0	2-fold	10-fold
K08E3.5	2	2	0	2-fold	4-fold
K08E3.6	0	3	0	3-fold	0
C37G2.7	2	2	0	2-fold	3-fold
Y119D3_444.b Y119D3_446.a	0	2	0	0 2-fold	3-fold
1119U3_440.a	J	J	1	2-1010	10-fold

Y119D3_446.c       0       2       0       2-fold       3-fold         Y53G8A_9248.       0       2       0       0       2-fold       0         c       0       0       0       0       0       0       2-fold       0         y53G8A_9248.       0       0       1       4-fold       10-fold       10-fold         d       0       0       1       3-fold       0       3-fold       0         y53G8B_1025.       0       1       0       0       3-fold       3-fold       3-fold         a       2       2       0       3-fold       10-fold       3-fold       10-fold         a       2       2       0       3-fold       10-fold       3-fold       10-fold         b       0       2       0       3-fold       10-fold       5-fold						
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Y119D3_446.c	0	2	0	2-fold	3-fold
Y53G8A_9248.       0       0       1       4-fold       10-fold         d       0       0       1       3-fold       0         Y53G8B_1025.       0       1       0       0       3-fold       0         y53G8B_1025.       0       1       0       0       3-fold       3-fold         y53G8B_1025.       0       2       0       3-fold       10-fold         b       0       2       0       3-fold       10-fold         b       0       2       0       3-fold       5-fold         Y55B1A_115.c       0       2       0       2-fold       3-fold         Y71H2_375.b       0       0       1       3-fold       0         Y71H2_388.c       1       1       1       1       0	Y53G8A_9248.	0	2	0	0	2-fold
d       0       1       3-fold       0         Y53G8B_1025.       0       1       0       0       3-fold         a       2       2       0       2-fold       3-fold         Y53G8B_1025.       0       2       0       3-fold       10-fold         b       0       2       0       3-fold       5-fold         Y55B1A_115.c       0       2       0       2-fold       3-fold         Y71H2_375.b       0       0       1       3-fold       0         Y71H2_388.c       771H2_388.d       0       0       1       3-fold	С	0	0	0	0	0
Y53G8B_1025.       0       1       0       0       3-fold         a       2       2       0       2-fold       3-fold         Y53G8B_1025.       0       2       0       3-fold       10-fold         b       0       2       0       3-fold       5-fold         Y55B1A_115.c       0       2       0       2-fold       3-fold         Y71H2_375.b       0       0       1       3-fold       0         Y71H2_388.c       771H2_388.d       0       0       1       3-fold	Y53G8A_9248.	0	0	1	4-fold	10-fold
a       2       2       0       2-fold       3-fold         Y53G8B_1025.       0       2       0       3-fold       10-fold         b       0       2       0       3-fold       5-fold         Y55B1A_115.c       0       2       0       2-fold       3-fold         Y71H2_375.b       0       0       1       3-fold       0         Y71H2_378.a       Y71H2_388.c       V71H2_388.d       V       V       V	d	0	0	1	3-fold	0
Y53G8B_1025.       0       2       0       3-fold       10-fold         b       0       2       0       3-fold       5-fold         Y55B1A_115.c       0       2       0       2-fold       3-fold         Y71H2_375.b       0       0       1       3-fold       0         Y71H2_378.a       Y71H2_388.c       Y71H2_388.d       Image: state of the state of t	Y53G8B_1025.	0	1	0	0	3-fold
b       0       2       0       3-fold       5-fold         Y55B1A_115.c       0       2       0       2-fold       3-fold         Y71H2_375.b       0       0       1       3-fold       0         Y71H2_378.a       Y71H2_388.c       Y71H2_388.d       Image: state of the state of t	a	2	2	0	2-fold	3-fold
Y55B1A_115.c       0       2       0       2-fold       3-fold         Y71H2_375.b       0       0       1       3-fold       0         Y71H2_378.a       Y71H2_388.c       Y71H2_388.d       0       0       1	Y53G8B_1025.	0	2	0	3-fold	10-fold
Y71H2_375.b 0 0 1 3-fold 0 Y71H2_378.a Y71H2_388.c Y71H2_388.d	b	0	2	0	3-fold	5-fold
Y71H2_378.a Y71H2_388.c Y71H2_388.d	Y55B1A_115.c	0	2	0	2-fold	3-fold
Y71H2_388.c Y71H2_388.d	Y71H2_375.b	0	0	1	3-fold	0
Y71H2_388.d	Y71H2_378.a					
_	Y71H2_388.c					
Y71H2_389.e	Y71H2_388.d					
	Y71H2_389.e					

CE RNAi clone	Emb	Ste	Lga	Weaker Pheno	No Pheno
F54C4.1	0	2	0	2-fold	2-fold
C29F9.7	3	3	0	3-fold	10-fold
W07B3.2	0	0	1	2-fold	0
F10C5.1	0	2	0	3-fold	3-fold
F10C5.2	0	2	0	2-fold	2-fold
F30H5.1	0	3	0	5-fold	0
W06E11.1	0	2	0	3-fold	3-fold
T17H7.5	nd	nd	nd	nd	nd
B0412.4	0	0	1	2-fold	0
T24C4.5	0	3	0	2-fold	10-fold
F23H11.5	0	3	0	2-fold	4-fold
F58B6.3	2	2	0	2-fold	4-fold
Y71D11A.b	0	0	1	3-fold	0
	-	-	_		-
F53A3.3	0	0	1	3-fold	10-fold
W04B5.4	0	0	-	0	0 10 fold
H19M22.1	0	0	1	10-fold	10-fold
H19M22.3	0	0	1	2-fold	0
H06I04.a	0	0	1	2-fold	0
H06I04.f	0	0	1	3-fold	0
F59A2.1	0	3	0	2-fold	5-fold
C34C12.8	0	2	0	2-fold	2-fold
M01F1.3	0	2	0	2-fold	3-fold
C54C6.1	0	0	1	2-fold	10-fold
C32A3.1	2	2	0	2-fold	2-fold
C36A4.4	0	0	0	0	0
F13B10.2	0	0	1	0	0
ZK1058.2	0	0	1	2-fold	0
C36E8.5	0	0	1	2-fold	10-fold
E03A3.3	0	0	1	2-fold	3-fold
C03C10.3	0	3	0	2-fold	10-fold
C16C10.6	0	3	0	2-fold	10-fold
R74.1	0	3	0	3-fold	10-fold
F43C1.2	0	2	0	2-fold	2-fold
F43C1.5	0	0	0	0	0
T08A11.2	0	0	1	2-fold	0
R10E4.4	0	3	0	2-fold	5-fold
H38K22.2	0	0	0	0	0
B0285.2	0	2	0	2-fold	0 2-fold
R07E5.3	0	3	0	2-fold	10-fold
R07E5.10	0	0	0	2-fold	2-fold
R07E5.10 R07E5.14	0	3	0	2-fold	5-fold
	-		-		
F56F3.2	0	0	0	0	0
F56F3.5	0	Ũ	1	0	
C07G2.3	0	0	1	2-fold	10-fold
M88.2	0	0	0	0	0
F35G12.8	0	3	0	4-fold	10-fold
F35G12.10	0	0	0	0	0
T04A8.6	0	3	0	2-fold	3-fold
T04A8.7	0	0	0	0	0
T04A8.11	0	0	0	0	0

B0393.1         0         0         1         3-fold         0           C3893.4         0         0         0         0         0         0           C3804.3         0         0         0         0         0         0         0           C3804.6         3         2         0         2-fold         1-fold         1-fold           C3804.6         3         2         0         2-fold         3-fold         2-fold           C35010.13         0         0         0         2-fold         3-fold         2-fold           C2666.6         0         2         0         2-fold         3-fold         2-fold           C2678.7         0         0         0         0         0         0         0           C2678.7         0         0         0         0         0         0         0           C2678.7         0         0         0         0         0         0         0           C2678.7         0         3         0         2-fold         1-fold           T1072.1         0         3         0         2-fold         1-fold           C						
C38D4.3         0         0         0         0         0         0         0           C38D4.6         3         2         0         2-fold         10-fold         10-fold           C35D10.1         0         2         0         2-fold         4-fold         4-fold           C35D10.13         0         2         0         2-fold         3-fold         3-fold           C25E6.4         0         0         1         4-fold         0         0           C25E6.6         0         2         0         2-fold         2-fold         2-fold           C25E6.6         0         0         0         0         0         0         0           C27E2.7         0         0         0         0         0         0         0           C45E9.5         0         2         0         2-fold         4-fold         10-fold           C45E9.5         0         2         0         0         0         0         0           C45E9.5         0         2         0         2-fold         10-fold         10-fold           K144.7         0         0         0         0         0<	B0393.1	0	0	1	3-fold	0
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C35D10.5         0         0         0         0         0         0           C35D10.13         0         2         0         2-fold         3-fold           C25D10.13         0         2-fold         3-fold         3-fold           C26B6.4         0         0         1         4-fold         0           C26B6.6         0         2         0         2-fold         2-fold         2-fold           C26B6.7         0         0         0         0         0         0         0           R144.2         0         0         0         0         0         0         0           C2569.5         0         2         0         2-fold         4-fold         10-fold           T1072.1         0         3         0         4-fold         10-fold         10-fold           K1002.4         0         0         0         0         0         0         0           C34B10.2         0         0         0         0         0         0         0           C34B10.6         0         2         0         3-fold         5-fold         0         0           F6077.3 </td <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td>				-		
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R144.20012-fold5-foldR144.7000000C4569.50202-fold4-foldF21H1.4000000T10F2.10304-fold10-foldR10D2.40302-fold10-foldR10D2.400000C34E10.100000C34E10.200000C34E10.200000C34E10.302-fold5-fold0F48E8.500000F9P7.30302-fold5-foldF56D2.60203-fold3-foldF54E7.20302-fold2-foldF54E7.400000B0336.1202-fold2-foldB0336.61202-fold3-foldB0336.61202-fold2-foldB0336.61202-fold2-foldB0336.100000B0336.2202-fold2-foldB12240202-fold2-foldB1225.50014-fold0C23816.60202-fold2-foldB1224.7		-	-	-	-	-
R144.3         0         0         0         0         0         0           R144.7         0         0         0         0         0         0           C45G9.5         0         2         0         2-fold         4-fold         10-fold           T10F2.1         0         3         0         2-fold         10-fold         10-fold           T10F2.4         0         3         0         2-fold         10-fold         10-fold           K10D2.4         0         0         0         0         0         0         0           C34E10.1         0         0         0         0         0         0         0         0           C34E10.2         0         0         0         0         0         0         0         0           C34E10.2         0         10         10		-		-	-	-
R14.7         0         0         0         0         0         0           C4569.5         0         2         0         2-fold         4-fold           T1072.1         0         3         0         2-fold         10-fold           T1072.4         0         3         0         2-fold         10-fold           K10D2.4         0         0         0         0         0           C34E10.1         0         0         0         0         0           C34E10.2         0         0         0         0         0           C34E10.6         0         0         1         5-fold         0           F8622.0         0         0         0         0         0           F5622.1         0         2         0         3-fold         5-fold           F5622.6         0         2         0         2-fold         2-fold         2-fold           F5487.3         3         2         0         2-fold         2-fold         2-fold           B0336.1         0         0         0         0         0         0         0           B0336.2         2 <t< td=""><td></td><td>-</td><td>-</td><td></td><td></td><td></td></t<>		-	-			
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P21H11.4         0         0         0         0         0         0           T10F2.1         0         3         0 $4$ -fold         10-fold           T10F2.4         0         3         0 $2$ -fold $10$ -fold           K10D2.6         1         1         0 $2$ -fold $2$ -fold $2$ -fold           C34E10.1         0         0         0         0         0         0           C34E10.2         0         0         0         0         0         0           C34E10.6         0         0         1 $5$ -fold $5$ -fold $5$ -fold           F9802.6         0         2         0 $3$ -fold $3$ -fold $5$ -fold           F56D2.1         0         0         0         0         0         0           F56D2.6         0         2         0 $2$ -fold $3$ -fold $5$ -fold           F54E7.3         3         2         0 $2$ -fold $2$ -fold $6$ -fold           B0336.1         0         0         0         0         0         0           B0336.6         1<	R144.7	0		0	0	0
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	C45G9.5	0	2	0	2-fold	4-fold
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	F21H11.4	0	0	0	0	0
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K10D2.4000000K10D2.6110 $2-fold$ $2-fold$ $2-fold$ C34E10.2000000C34E10.600000C34E10.700000C34E10.600000F48E8.200000F502.1001 $2-fold$ $5-fold$ F562.6020 $3-fold$ $3-fold$ F54E7.2030 $2-fold$ $2-fold$ F54E7.3320 $2-fold$ $3-fold$ B0336.100000B0336.2220 $2-fold$ $2-fold$ B0336.10001 $5-fold$ $0$ R12B2.4020 $2-fold$ $4-fold$ B0336.1001 $2-fold$ $4-fold$ B0336.1001 $2-fold$ $2-fold$ R12B2.5001 $2-fold$ $2-fold$ R12B2.4020 $2-fold$ $2-fold$ B0336.10001 $4-fold$ 0R12B2.4020 $2-fold$ $2-fold$ R12B2.5001 $4-fold$ 0R12B2.5001 $4-fold$ 0R12B2.5001 $4-fold$ 0R	T10F2.4	0		0	2-fold	10-fold
K10D2.61102-fold2-foldC34E10.100000C34E10.200000C34E10.60015-fold0F48E8.200000P48E8.500000P48E7.30302-fold5-foldF56D2.60203-fold3-foldF54E7.20302-fold2-foldF54E7.33202-fold3-foldF54E7.400000B0336.100000B0336.61202-fold2-foldB0336.61202-fold2-foldB0336.10015-fold00R12B2.40202-fold2-foldP01F1.70302-fold2-foldP11F1.80014-fold0P285.400100R12B2.50015-fold0R12B2.40202-fold2-foldP285.4001000R328.20015-fold0R328.50014-fold0C3361.40012-fold4-foldR328					0	
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F48E8.5000000F99F7.30302-fold5-foldF56D2.10012-fold5-foldF56D2.60203-fold3-foldF54E7.20302-fold2-foldF54E7.400000B0336.100000B0336.61202-fold2-foldB0336.61202-fold2-foldB0336.61202-fold2-foldB0336.61202-fold2-foldB0336.61202-fold2-foldB0336.100012-fold0R12B2.40202-fold0F01F1.70302-fold2-foldF01F1.80014-fold0F01F1.800100ZX328.10015-fold0ZX328.20015-fold0T17E9.100000C23G10.30014-foldT12A2.700000C23G10.80202-foldC23G10.93202-foldC23G10.93202-foldC23G10.900<		-				
F09F7.30302-fold5-foldF56D2.10012-fold5-foldF56D2.60203-fold3-foldF54F7.20302-fold2-foldF54F7.33202-fold10-foldF54F7.400000B0336.100000B0336.22202-fold2-foldB0336.100015-fold0B0336.10015-fold0R12B2.40202-foldP01F1.70302-foldP1F1.80014-foldP01F1.80010P28B5.40015-foldC2848.6015-fold0R17P9.10000C23G10.3014-foldC23G10.40100C23G10.70010C23G10.8305-fold0C23G10.8015-fold0C23G10.70000C3G10.80202-foldC23G10.40202-foldC23G10.70000C23G10.80202-foldC23G10.93202-fold	F48E8.2	0	0	0	0	0
F56D2.10012-fold5-foldF56D2.60203-fold3-foldF54F7.20302-fold2-foldF54F7.33202-fold10-foldF54F7.400000B0336.100000B0336.22202-fold3-foldB0336.61202-fold2-foldB0336.100015-fold0R12B2.40202-fold2-foldR12B2.50012-fold0F0IF1.70302-fold0F0IF1.80014-fold0F2B5.400100ZX328.20015-fold0ZX328.30015-fold0T17E9.100000C23G10.400100C23G10.40302-fold4-foldT12A2.7001000C23G10.80202-fold3-foldC16A3.50202-fold3-foldC23G10.400100C23G10.401000C23G10.700000C23G10.	F48E8.5	0	0	0	0	0
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F54E7.20302-fold2-foldF54E7.33202-fold $10-fold$ F54E7.400000B0336.10000B0336.22202-fold $3-fold$ B0336.61202-fold $2-fold$ B0336.10001 $5-fold$ $0$ B0336.10001 $2-fold$ $2-fold$ B12B2.4020 $2-fold$ $2-fold$ B12B2.4001 $4-fold$ $0$ F01F1.7030 $2-fold$ $2-fold$ C28B8.6020 $2-fold$ $2-fold$ C28B8.60200 $0$ CX328.5001 $5-fold$ $0$ T17E9.1000 $0$ $0$ C23G10.3001 $4-fold$ C23G10.4001 $2-fold$ $0$ C23G10.8030 $5-fold$ $0$ <	F56D2.1	0	0	1	2-fold	5-fold
F54E7.20302-fold2-foldF54E7.33202-fold $10-fold$ F54E7.400000B0336.10000B0336.22202-fold $3-fold$ B0336.61202-fold $2-fold$ B0336.10001 $5-fold$ $0$ B0336.10001 $2-fold$ $2-fold$ B12B2.4020 $2-fold$ $2-fold$ B12B2.4001 $4-fold$ $0$ F01F1.7030 $2-fold$ $2-fold$ C28B8.6020 $2-fold$ $2-fold$ C28B8.60200 $0$ CX328.5001 $5-fold$ $0$ T17E9.1000 $0$ $0$ C23G10.3001 $4-fold$ C23G10.4001 $2-fold$ $0$ C23G10.8030 $5-fold$ $0$ <	F56D2.6	0	2	0	3-fold	3-fold
F54E7.33202-fold10-foldF54E7.400000B0336.10000B0336.22202-fold3-foldB0336.61202-fold2-foldB0336.100015-fold0R12E2.40202-foldrdddF01F1.70302-fold2-foldF01F1.80014-fold0F01F1.122002-fold2-foldC28H8.60202-fold2-foldF2555.400100ZK328.10015-fold0T17E9.100000C23G10.30014-fold0C23G10.400100C23G10.80302-fold1-foldT12A2.20012-fold0C3G10.93202-fold1-foldT12A2.700000C562.60015-fold0C16A3.40202-fold3-foldC16A3.40202-fold3-foldC23G10.300000C23G10.400000C23G10.73<		-		-		
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C05D11.10         0         0         0         0         0         0           C05D11.11         0         0         0         0         0         0         0           C05D11.12         1         1         0         2-fold         2-fold         2-fold         3-fold           T26A5.3         0         2         0         2-fold         3-fold         3-fold	C05D11.2	0	0	0	0	0
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K12H4.40202-fold $3-fold$ K12H4.5020 $2-fold$ $3-fold$ K06H7.1320 $2-fold$ 0K06H7.600000C14B9.4030 $3-fold$ 0C14B9.7001 $5-fold$ 0D2007.400000C02F5.1030 $4-fold$ 0C02F5.9001 $3-fold$ 0F10E9.7001 $3-fold$ $10-fold$ F10E9.8320 $2-fold$ $3-fold$ ZK1236.3030 $2-fold$ $3-fold$ C30C11.100000C30C11.4020 $3-fold$ C66E1.10020 $2-fold$ $2-fold$ B0303.1500000K02D10.5001 $4-fold$ $10-fold$		F44B9.7	0	0	0	0	0
K12H4.50202-fold $3-fold$ K06H7.1320 $2-fold$ 0K06H7.600000C14B9.4030 $3-fold$ 0C14B9.7001 $5-fold$ 0D2007.400000C02F5.1030 $4-fold$ 0C02F5.9001 $3-fold$ 0F09G8.3020 $3-fold$ $10-fold$ F10E9.8320 $2-fold$ $3-fold$ ZK1236.3030 $2-fold$ $3-fold$ C30C11.100000C30C11.4020 $3-fold$ C66E1.10020 $2-fold$ $2-fold$ B0303.1500000K02D10.5001 $4-fold$ $10-fold$		K12H4.3	0	3	0	2-fold	3-fold
K12H4.50202-fold $3-fold$ K06H7.1320 $2-fold$ 0K06H7.600000C14B9.4030 $3-fold$ 0C14B9.7001 $5-fold$ 0D2007.400000C02F5.1030 $4-fold$ 0C02F5.9001 $3-fold$ 0F09G8.3020 $3-fold$ $10-fold$ F10E9.8320 $2-fold$ $3-fold$ ZK1236.3030 $2-fold$ $3-fold$ C30C11.100000C30C11.4020 $3-fold$ C66E1.10020 $2-fold$ $2-fold$ B0303.1500000K02D10.5001 $4-fold$ $10-fold$		K12H4.4	0	2	0	2-fold	3-fold
K06H7.13202-fold0K06H7.600000C14B9.40303-fold0C14B9.70015-fold0D2007.400000C02F5.10304-fold0C02F5.90013-fold5-foldF09G8.30203-fold5-foldF10E9.70013-fold10-foldF10E9.83202-fold3-foldC30C11.100000C30C11.2013-fold3-foldC66E1.100202-fold2-foldB0303.1500000K02D10.50014-fold10-fold		K12H4.5	0		0	2-fold	3-fold
K06H7.600000C14B9.4030 $3-fold$ 0C14B9.7001 $5-fold$ 0D2007.400000C02F5.1030 $4-fold$ 0C02F5.9001 $3-fold$ 0F09G8.3020 $3-fold$ $5-fold$ F10E9.7001 $3-fold$ $10-fold$ F10E9.8320 $2-fold$ $3-fold$ ZK1236.3030 $2-fold$ $10-fold$ C30C11.100000C30C11.4020 $3-fold$ $2-fold$ F22B7.5020 $2-fold$ $2-fold$ B0303.1500000K02D10.5001 $4-fold$ $10-fold$							
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$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		D2007.4	0		0	0	0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		C02F5.1	0	3	0	4-fold	0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		C02F5.9	0	0	1	3-fold	0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		F09G8.3	0	2	0	3-fold	5-fold
F10E9.8         3         2         0         2-fold         3-fold           ZK1236.3         0         3         0         2-fold         10-fold           C30C11.1         0         0         0         0         0         0           C30C11.2         0         0         1         3-fold         0         0         0           C30C11.4         0         2         0         3-fold         3-fold         0           C30C11.4         0         2         0         3-fold         3-fold         3-fold           C06E1.10         0         2         0         2-fold         2-fold         2-fold           F22B7.5         0         2         0         2-fold         2-fold         2-fold           B0303.15         0         0         0         0         0         0           K02D10.5         0         0         1         4-fold         10-fold							
ZK1236.3         0         3         0         2-fold         10-fold           C30C11.1         0         0         0         0         0         0           C30C11.2         0         0         1         3-fold         0           C30C11.4         0         2         0         3-fold         3-fold           C30C11.4         0         2         0         3-fold         3-fold           C06E1.10         0         2         0         2-fold         2-fold           F22B7.5         0         2         0         2-fold         2-fold           B0303.15         0         0         0         0         0           K02D10.5         0         0         1         4-fold         10-fold							
C30C11.1       0       0       0       0       0       0         C30C11.2       0       0       1       3-fold       0         C30C11.4       0       2       0       3-fold       3-fold         C06E1.10       0       2       0       2-fold       2-fold         F22B7.5       0       2       0       2-fold       2-fold         B0303.15       0       0       0       0       0         K02D10.5       0       0       1       4-fold       10-fold							
C30C11.2       0       0       1       3-fold       0         C30C11.4       0       2       0       3-fold       3-fold         C06E1.10       0       2       0       2-fold       2-fold         F22B7.5       0       2       0       2-fold       2-fold         B0303.15       0       0       0       0       0         K02D10.5       0       0       1       4-fold       10-fold							
C30C11.4         0         2         0         3-fold         3-fold           C06E1.10         0         2         0         2-fold         2-fold           F22B7.5         0         2         0         2-fold         2-fold           B0303.15         0         0         0         0         0           K02D10.5         0         0         1         4-fold         10-fold							
C06E1.10         0         2         0         2-fold         2-fold           F22B7.5         0         2         0         2-fold         2-fold         2-fold           B0303.15         0         0         0         0         0         0         0           K02D10.5         0         0         1         4-fold         10-fold							
F22B7.5         0         2         0         2-fold         2-fold           B0303.15         0         0         0         0         0         0           K02D10.5         0         0         1         4-fold         10-fold		C30C11.4	0		0	3-fold	3-fold
F22B7.5         0         2         0         2-fold         2-fold           B0303.15         0         0         0         0         0         0           K02D10.5         0         0         1         4-fold         10-fold		C06E1.10	0	2	0	2-fold	2-fold
B0303.15         0         0         0         0         0         0           K02D10.5         0         0         1         4-fold         10-fold			0				
K02D10.5 0 0 1 4-fold 10-fold							
	ļ	21(057.0	5	2	5	1 1010	10 101U

R08D7.1	2	2	0	2-fold	4-fold
R08D7.2	0	0	0	0	0
R08D7.3	0	3	0	2-fold	10-fold
R107.6	0	2	0	2-fold	3-fold
F02A9.4	0	0	0	0	0
F02A9.6	0	1	0	2-fold	2-fold
T23G5.1	0	3	0	3-fold	0
K04H4.1	2	2	0	2-fold	3-fold
C38C10.4	2	2	0	2-fold	3-fold
			-		
T26G10.1	0	2	0	4-fold	10-fold
F54C8.2	2	2	0	2-fold	3-fold
F54C8.3	0	0	0	0	0
B0464.1	0	0	1	2-fold	0
в0464.7	0	2	0	3-fold	4-fold
ZK1098.7	0	2	0	2-fold	2-fold
F58A4.3	3	2	0	3-fold	0
			-		
F58A4.4	0	3	0	3-fold	0
F58A4.8	0	2	0	2-fold	3-fold
C07A9.2	2	2	0	4-fold	4-fold
C07A9.3	2	2	0	3-fold	4-fold
T05G5.3	0	3	0	3-fold	0
T05G5.10	0	2	0	2-fold	3-fold
	-		-		
R10E11.1	0	0	1	10-fold	0
R10E11.2	0	0	1	3-fold	0
R10E11.8	0	0	1	0	0
ZK632.1	0	3	0	5-fold	0
K03H1.2	2	2	0	2-fold	2-fold
T16H12.4	0	0	0	0	0
T20G5.1	0	0	1	0	0
	-			-	-
T20G5.2	0	2	0	4-fold	5-fold
T20G5.3	0	0	1	0	0
R01H10.1	1	2	0	2-fold	2-fold
T07C4.7	0	0	0	0	0
M03C11.7	2	2	0	2-fold	3-fold
D2045.1	0	0	0	0	0
				-	-
D2045.6	0	2	0	2-fold	4-fold
F43D9.3	0	0	1	4-fold	0
K01G5.1	2	2	0	2-fold	4-fold
K01G5.4	0	0	1	3-fold	0
K01G5.7	0	0	1	2-fold	4-fold
Y39A1B.3	0	0	0	0	0
K11D9.1	0	0	0	0	0
	-			-	
K11D9.2	0	2	0	10-fold	0
Y48A6B.11	0	0	0	0	0
Y47D3A.c	0	3	0	4-fold	0
Y47D3A.d	0	3	0	2-fold	10-fold
Y47D3B.7	0	0	1	2-fold	0
Y66A7A.8	2	2	0	2-fold	4-fold
Y41C4A.10	0	0	0	0	0
			1		
C24H11.7	0	0		2-fold	10-fold
Y56A3A.32	0	0	0	0	0
Y75B8A.2	1	1	0	2-fold	0
Y49E10.1	0	0	1	4-fold	0
Y49E10.2	0	0	0	0	0
Y49E10.6	0	0	1	3-fold	10-fold
Y49E10.14	3	2	0	2-fold	0
Y49E10.15	0	0	1		0
				2-fold	
Y49E10.19	0	3	0	2-fold	0
Y49E10.21	0	2	0	2-fold	2-fold
Y111B2C.e	2	2	0	2-fold	3-fold
Y111B2D.b	0	0	1	10-fold	0
Y111B2D.h	3	2	0	2-fold	0
Y37D8A.10	2	2	0	4-fold	10-fold
Y37D8A.14	0	3	0	2-fold	10-fold
Y37D8A.18	0	0	0	0	0
ZK1010.1	0	0	1	5-fold	0
Y39E4B.1	0	2	0	2-fold	2-fold
F56A8.6	0	2	0	5-fold	5-fold
Y43F4B.6	0	2	0	2-fold	2-fold
	<u>ц</u>	L	L	-	

F53A2.4	0	0	0	0	0
T03F6.5	0	0	0	0	0
T27E9.1	0	3	0	4-fold	10-fold
Y76A2B.1	0	2	0	3-fold	5-fold
T25C8.2	0	0	1	0	0
T12D8.1	2	2	0	2-fold	3-fold
T12D8.6	3	2	0	2-fold	0
T12D8.7	0	2	0	2-fold	2-fold
W06F12.1	3	2	0	3-fold	0
K08E3.5	2	2	0	2-fold	4-fold
K08E3.6	0	3	0	10-fold	10-fold
C37G2.7	2	2	0	2-fold	2-fold
Y119D3_444.b	0	2	0	2-fold	3-fold
Y119D3_446.a	0	2	0	3-fold	3-fold
Y119D3_446.c	0	2	0	3-fold	3-fold
Y53G8A_9248.c	0	2	0	2-fold	2-fold
Y53G8A_9248.d	0	0	0	0	0
Y53G8B_1025.a	0	0	1	3-fold	0
Y53G8B_1025.b	0	0	1	3-fold	0
Y55B1A_115.c	0	0	0	0	0
Y71H2_375.b	0	2	0	3-fold	3-fold
Y71H2_378.a	0	2	0	3-fold	5-fold
Y71H2_388.c	0	3	0	2-fold	3-fold
Y71H2_388.d	0	2	0	2-fold	2-fold
Y71H2_389.e	0	0	1	5-fold	5-fold

#### Appendix Table 3.2. C. elegans chromosome III genes with non-viable RNA interference phenotypes

For each gene on *C. elegans* chromosome III with a previously reported nonviable RNA interference (RNAi) phenotype (Kamath *et al.*, 2003), the Ahringer library RNAi clone gene pairs name ('CE RNAi clone'), its nonviable RNAi phenotype ('Emb', 'Ste', 'Lga') observed in *rrf-3* when using the high-throughput RNAi liquid feeding assay, the n-fold dilution of targeting bacteria with unrelated double-stranded RNA- (dsRNA) expressing bacteria (non-targeting (Ahringer library clone Y95B8A\_84.g) and *lin-31*, respectively), which first resulted in a weaker detectable phenotype of nonviable genes ('Weaker phenotype') and the n-fold dilution that resulted in the loss of any detectable phenotype ('No phenotype'). Emb, embryonic lethal. Ste, sterile. Lga, larval growth arrest. Strengths of phenotypes were encoded numerically ranging from 1 (weak), 2 (medium), to 3 (strong). 0, no observed phenotype or no observed dilution effect in a given category, respectively.

Appendix Table 4.1. C. elegans duplicate gene pairs corresponding to single orthologues in S. cerevisiae and D. melanogaster genomes

SC ID/DM ID	SC	CE RNAi	CE Name	Comments
-	essentialit	clone		
	У			
S00000042/CG7758	non-	D1025.2	WBGene00008354	
S000000042/CG7758	essential	F52A8.5	WBGene00009918	
S00000071	non-	F19H6.1	WBGene00008956	
S00000071	essential	Y39G10AR.3	WBGene00021461	
S000000136/CG5183	non-	C28H8.4	WBGene00016195	
S000000136/CG5183	essential	F09B9.3	WBGene00001331	
S000000194	non-	R07B7.5	WBGene00011089	
S000000194	essential	R07B7.4	WBGene00011088	
S00000245	essential	D1009.1	WBGene00017012	
S00000245	essential	F28D1.9	WBGene00009218	
S00000313	non-	T21H3.3	WBGene00000552	Lga
S00000313	essential	C13C12.1	WBGene00000285	
S00000331	non-	F20B6.2	WBGene00006921	Lga
S00000331	essential	Y110A7A.12	WBGene00006921	
S00000339	non-	Y71G12B.27	WBGene00022162	
S00000339	essential	C09G4.3	WBGene00001051	
S00000426	non-	C50H11.1	WBGene00016849	
S00000426	essential	F41C3.3	WBGene00018269	
S00000730	essential	C53B4.6	WBGene00008275	
S00000730	essential	F15B10.1	WBGene00017480	
S00000782	non-	K07A1.12	WBGene00003036	
S00000782	essential	K07A1.11	WBGene00004312	
S00000807	non-	R07E4.4	WBGene00003254	
S00000807	essential	C33H5.14	WBGene00016380	
S000000967/CG5119	essential	Y106G6H.2	WBGene00003902	
S000000967/CG5119	essential	F18H3.3	WBGene00003903	
S000001156	non-	F09E10.8	WBGene00017298	
S000001156	essential	K08E3.3	WBGene00010663	
S000001219	non-	C46H11.2	WBGene00016728	
S000001219	essential	C01H6.4	WBGene00007254	
S000001285	non-	H13N06.5	WBGene00010398	
S000001285	essential	T28F3.3	WBGene00012129	
S000001324/CG9881	non-	M01B12.3	WBGene00000205	
S000001324/CG9881	essential	C46H11.3	WBGene00016729	
S000001327/CG1751	non-	F13B9.8	WBGene00001425	
0	essential	F41G3.4	WBGene00001424	
S000001327/CG1751	non-	T25G3.4	WBGene00012031	
0	essential	Y50E8A.6	WBGene00013049	
S000001417	non-	K08D10.3	WBGene00004386	
S000001417	essential	K08D10.4	WBGene00004385	
S000001448	non-	K06A9.1	WBGene00019435	
S000001448	essential	H02F09.3	WBGene00019146	
S000001458	essential	С33Н5.7	WBGene00016374	
S000001458	essential	С33Н5.6	WBGene00016373	
S000001501	non-	C29F7.3	WBGene00007812	
S000001501	essential	F40F8.1	WBGene00009575	
S000001507/CG6092	non-	Y53C12A.4	WBGene00013140	
S000001507/CG6092	essential	R02E12.2	WBGene00019827	
S000001672/CG4083	non-	T09A5.9	WBGene00011637	
S000001672/CG4083	essential	C06A8.6	WBGene00015516	
S000001676	non-	Y51H7C.9	WBGene00021787	
S000001676	essential	K01C8.1	WBGene00010456	
S000001701	non-	F52C12.5	WBGene00001253	
S000001701	essential	F55A8.1	WBGene00001186	
S000001873	non-	B0024.12	WBGene00001646	
S000001873	essential	T23G11.2	WBGene00001647	
S000001877/CG1969	essential	D1037.4	WBGene00004272	
S000001877/CG1969	essential	T23H2.5	WBGene00004273	
S000001889	non-	K08A8.3	WBGene00000591	
S000001889	essential	F10G7.4	WBGene00004737	
	non-	C25G4 1	WBGeneuuuu////	
S000002161 S000002161	non- essential	C25G4.1 C49C3.13	WBGene00007729 WBGene00008203	

S000002195	essential	F59F4.4	WBGene00010339	
S000002210	non-	F57B9.10	WBGene00004462	Lga
S000002210	essential	F59B2.5	WBGene00010309	
S000002255	non-	D2045.6	WBGene00000836	
S000002255	essential	K08E7.7	WBGene00000841	
S000002290/CG1877	non-	B0286.4	WBGene00003825	
S000002290/CG1877	essential	F44A2.1	WBGene00006499	
S000002324	non-	K04D7.4	WBGene00010558	
	-			
S000002324	essential	C09D8.1	WBGene00004215	
S000002389	non-	Y22D7AR.6	WBGene00021260	
S000002389	essential	F30A10.3	WBGene00009262	
S000002424	essential	F43H9.2	WBGene00018398	
S000002424	essential	T22G5.5	WBGene00011932	
			WBGene00021952	
S000002469	essential	Y57E12AL.1		
S000002469	essential	R11H6.2	WBGene00011250	
S000002512/CG4672	essential	F27D9.1	WBGene00006757	
S000002512/CG4672	essential	T07A9.10	WBGene00020298	
S000002571	essential	F40G9.3	WBGene00006715	
S000002571	essential	C06E2.3	WBGene00006716	
S000002584	non-	ZK265.5	WBGene00013957	
S000002584	essential	F36D1.2	WBGene00009462	
S000002727/CG1067	non-	C44C1.3	WBGene00003563	
1	essential	K03E6.3	WBGene00003565	
S000002727/CG1067	non-	F13H8.3	WBGene00017436	
1	essential	Y43F8C.13	WBGene00012834	
S000002781	non-	F21F3.3	WBGene00017673	
S000002781	essential	M01E11.1	WBGene00019710	
S000002808	essential	R151.6	WBGene00020109	
S000002808	essential	F25D7.1	WBGene00009111	
S000002818/CG1126	essential	T01C8.1	WBGene00020142	
8	essential	PAR2.3	WBGene00019801	
S000002818/CG1126	essential	F49E12.9	WBGene00009902	
8	essential	F49E12.10	WBGene00009903	
S000002819	non-	R03A10.4	WBGene00010984	
S000002819	essential	F28H6.3	WBGene00009232	
S000002885	non-	Y110A7A.6	WBGene00022456	
S000002885	essential	K02B2.1	WBGene00019295	
S000003292/CG1998	non-	F35H8.7	WBGene00006938	
S000003292/CG1998		Y53C12A.1	WBGene00006940	
	essential			
S000003596/CG6950	non-	C15F1.7	WBGene00004930	
S000003596/CG6950	essential	ZK430.3	WBGene00007036	
S000003691/CG3400	essential	R57.1	WBGene00020082	
S000003691/CG3400	essential	C35C5.2	WBGene00007954	
S000003723	essential	C44E4.3	WBGene00016652	
S000003723	essential	C14F11.1	WBGene00015778	
S000003865/CG1179	non-	F59B2.7	WBGene00004269	
3	essential	T25G12.4	WBGene00004270	
S000003865/CG1179	non-	T03F7.7	WBGene00011404	
3	essential	C34C12.6	WBGene00007925	
S000003887	non-	ZK370.4	WBGene00022718	
S000003887	essential	M110.7	WBGene00010915	
S000003887 S000004017/CG4233	essential non-	M110.7 B0280.4	WBGene00010915 WBGene00003845	
		B0280.4		
S000004017/CG4233 S000004017/CG4233	non- essential	B0280.4 C34H3.2	WBGene00003845 WBGene00003846	
S000004017/CG4233 S000004017/CG4233 S000004252	non- essential non-	B0280.4 C34H3.2 C04F6.4	WBGene00003845 WBGene00003846 WBGene00006810	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252	non- essential non- essential	B0280.4 C34H3.2 C04F6.4 K08F9.2	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00010685	
S000004017/CG4233 S000004017/CG4233 S000004252	non- essential non-	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00010685 WBGene00000110	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252	non- essential non- essential	B0280.4 C34H3.2 C04F6.4 K08F9.2	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00010685	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248	non- essential non- essential non-	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00010685 WBGene00000110	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248	non- essential non- essential non- essential essential	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00010685 WBGene00000110 WBGene00000111 WBGene00006388	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248 5	non- essential non- essential essential essential	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1 Y111B2A.16	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00000100 WBGene00000111 WBGene00006388 WBGene00006389	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248 5 S000004524	non- essential non- essential essential essential non-	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1 Y111B2A.16 C42C1.11	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00000100 WBGene00000111 WBGene00006388 WBGene00006389 WBGene00016589	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248 5 S000004524 S000004524	non- essential non- essential essential essential non- essential	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1 Y111B2A.16 C42C1.11 ZC416.6	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00000100 WBGene00000111 WBGene00006388 WBGene00006389 WBGene00016589 WBGene00022610	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248 5 S000004524	non- essential non- essential essential essential non-	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1 Y111B2A.16 C42C1.11	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00000100 WBGene00000111 WBGene00006388 WBGene00006389 WBGene00016589	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248 5 S000004524 S000004524	non- essential non- essential essential essential non- essential	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1 Y111B2A.16 C42C1.11 ZC416.6	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00000100 WBGene00000111 WBGene00006388 WBGene00006389 WBGene00016589 WBGene00022610	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248 5 S000004524 S000004524 S000004524 S000004640 S000004640	non- essential non- essential essential essential non- essential non- essential	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1 Y111B2A.16 C42C1.11 ZC416.6 F17E5.2 F55A11.4	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00000110 WBGene00000111 WBGene00006388 WBGene00006389 WBGene00016589 WBGene00022610 WBGene00008924 WBGene00010077	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248 5 S000004524 S000004524 S000004524 S000004640 S000004640 S000004698/CG1072	non- essential non- essential essential essential non- essential non- essential essential	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1 Y111B2A.16 C42C1.11 ZC416.6 F17E5.2 F55A11.4 ZK370.3	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00000110 WBGene00000111 WBGene00006388 WBGene00006389 WBGene00016589 WBGene00022610 WBGene00008924 WBGene00010077 WBGene00022717	
S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248 5 S000004524 S000004524 S000004524 S000004640 S000004640 S000004698/CG1072 4	non- essential non- essential essential essential non- essential non- essential essential essential	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1 Y111B2A.16 C42C1.11 ZC416.6 F17E5.2 F55A11.4 ZK370.3 F08A8.6	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00000110 WBGene00000111 WBGene00006388 WBGene00006389 WBGene00016589 WBGene00022610 WBGene00008924 WBGene00010077 WBGene00022717	
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S000004017/CG4233 S000004017/CG4233 S000004252 S000004252 S000004372/CG3248 5 S000004372/CG3248 5 S000004524 S000004524 S000004640 S000004640 S000004698/CG1072 4 S000004698/CG1072 4	non- essential non- essential essential essential non- essential non- essential essential essential essential non- essential	B0280.4 C34H3.2 C04F6.4 K08F9.2 T05H4.13 T08B1.3 F54F7.1 Y111B2A.16 C42C1.11 ZC416.6 F17E5.2 F55A11.4 ZK370.3 F08A8.6 C53A5.3 R06C1.1	WBGene00003845 WBGene00003846 WBGene00006810 WBGene00000110 WBGene00006388 WBGene00006388 WBGene00016589 WBGene00016589 WBGene00016589 WBGene00010077 WBGene00010077 WBGene000022717 WBGene00006484 WBGene00001834	

S000004716/CG1114         non-         C13G3.3         WBGene00007           0         essential         W08G11.4         WBGene00012           S000004840/CG2670         non-         C05G5.4         WBGene00007           S000004990/CG1060         essential         F23H11.3         WBGene00017           S000004990/CG1060         essential         C54G7.2         WBGene00007           S000004990/CG1060         non-         F02E8.6         WBGene00003           2         essential         F09G8.4         WBGene00003           S000005027/CG3210         non-         R12H7.2         WBGene00009           3         essential         F53C11.7         WBGene00009           S000005027/CG3210         non-         F53C11.7         WBGene00009           S000005027/CG3210         non-         F53C11.7         WBGene00009           S000005187/CG1097         non-         K11D2.3         WBGene00008           S000005274         essential         F52E1.10         WBGene00018           S000005274         non-         R13A5.10         WBGene00012           S00000540         non-         F2GA3.1         WBGene00012           S000005540         essential         F11C1.4         WBGene000012 <th>348 350 759 934 446 561 562 217 216 977 829 977 829 977 150 1ga 698 052 968 140 693 443 956 530</th>	348 350 759 934 446 561 562 217 216 977 829 977 829 977 150 1ga 698 052 968 140 693 443 956 530
0         essential         W08G11.4         WBGene00012           S000004840/CG2670         non-         C05G5.4         WBGene00007           S000004840/CG2670         essential         F23H11.3         WBGene00017           S000004990/CG1060         essential         C54G7.2         WBGene00003           2         essential         C08F8.4         WBGene00003           2         essential         F09G8.4         WBGene00003           S000005027/CG3210         non-         R12H7.2         WBGene00000           3         essential         H22K11.1         WBGene00003           S000005027/CG3210         non-         F53C11.7         WBGene00009           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.7         WBGene00000           S000005187/CG1097         non-         K11D2.3         WBGene00008           S000005274         non-         F55G1.5         WBGene00020           S000005274         essential         F52E1.10         WBGene00018           S000005487/CG7977         non-         R13A5.10         WBGene00012           S000005540         non-         F1C1.4         WBGene00012           S0000055	348 350 759 934 446 561 562 217 216 977 829 977 829 977 150 1ga 698 052 968 140 693 443 956 530
S000004840/CG2670         non-         C05G5.4         WBGene00007           S000004840/CG2670         essential         F23H11.3         WBGene00017           S000004990/CG1060         essential         C54G7.2         WBGene00007           S000004990/CG1060         non-         F02E8.6         WBGene00003           2         essential         F09G8.4         WBGene00003           2         essential         F09G8.4         WBGene00003           S000005027/CG3210         non-         R12H7.2         WBGene00000           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.7         WBGene00000           S000005187/CG1097         non-         K11D2.3         WBGene00000           S000005187/CG1097         non-         F55G1.5         WBGene00018           1         essential         F20D1.9         WBGene00020           S000005274         essential         F52E1.10         WBGene00018           S000005487/CG7977         non-         R13A5.10         WBGene00012           S000005540         non-         F26A3.1         WBGene00012           S000005540         essential         F11C1.4         WBGene00012	350 759 934 446 561 562 217 216 977 829 977 829 150 Lga 901 979 507 Lga 698 052 968 140 693 443 956 530
S000004840/CG2670         essential         F23H11.3         WBGene00017           S000004990/CG1060         essential         C54G7.2         WBGene00016           2         essential         C08F8.4         WBGene00003           2         essential         F02E8.6         WBGene00003           2         essential         F09G8.4         WBGene00003           2         essential         H22K11.1         WBGene00003           3         essential         H22K11.1         WBGene00009           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.8         WBGene00009           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.7         WBGene00009           \$000005187/CG1097         non-         K11D2.3         WBGene00008           1         essential         F55A12.7         WBGene00018           \$000005274         non-         T14F9.1         WBGene00020           \$000005274         essential         F22E1.10         WBGene00018           \$000005487/CG7977         non-         R13A5.10         WBGene00012           \$000005540         non-	759 934 446 561 562 217 216 977 829 150 Lga 901 979 507 Lga 698 140 693 443 956 530
S000004990/CG1060         essential         C54G7.2         WBGene00016           2         essential         C08F8.4         WBGene00003           S000004990/CG1060         non-         F02E8.6         WBGene00003           2         essential         F09G8.4         WBGene00003           S000005027/CG3210         non-         R12H7.2         WBGene00000           3         essential         H22K11.1         WBGene00009           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.8         WBGene00006           1         essential         F55A12.7         WBGene00000           S000005187/CG1097         non-         F55G1.5         WBGene00018           1         essential         F20D1.9         WBGene00008           S000005274         non-         T14F9.1         WBGene00018           S000005274         essential         F52E1.10         WBGene00018           S000005487/CG7977         non-         R13A5.10         WBGene00012           S000005540         non-         F26A3.1         WBGene00012           S000005540         essential         F11C1.4         WBGene00012           S000005668/CG1065	934 446 561 562 217 216 976 977 829 150 Lga 901 979 9507 Lga 698 140 693 443 956 530
2         essential         C08F8.4         WBGene00007           S000004990/CG1060         non-         F02E8.6         WBGene00003           2         essential         F09G8.4         WBGene00003           S000005027/CG3210         non-         R12H7.2         WBGene00000           3         essential         H22K11.1         WBGene00009           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.8         WBGene00009           S000005187/CG1097         non-         K11D2.3         WBGene00006           1         essential         F55A12.7         WBGene00008           S000005187/CG1097         non-         F55G1.5         WBGene00018           1         essential         F20D1.9         WBGene00020           S000005274         essential         F52E1.10         WBGene00018           S000005274         essential         F52E1.10         WBGene00012           S000005487/CG7977         non-         R13A5.10         WBGene00012           S000005540         non-         F26A3.1         WBGene00012           S000005540         essential         F11C1.4         WBGene000012           S00000568/CG1065	446 561 562 217 216 976 977 829 150 Lga 901 979 507 Lga 698 140 693 443 956 530
S000004990/CG1060         non-         F02E8.6         WBGene00003           2         essential         F09G8.4         WBGene00003           S000005027/CG3210         non-         R12H7.2         WBGene00000           3         essential         H22K11.1         WBGene00009           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.8         WBGene00009           3         essential         F53C11.8         WBGene00009           3         essential         F53C11.7         WBGene00008           5000005187/CG1097         non-         K11D2.3         WBGene00008           1         essential         F55G1.5         WBGene00018           1         essential         F20D1.9         WBGene00020           S000005274         non-         T14F9.1         WBGene00012           S000005274         essential         F52E1.10         WBGene00012           S000005487/CG7977         non-         R13A5.10         WBGene00012           S000005540         non-         F26A3.1         WBGene00012           S000005540         essential         F01C1.4         WBGene00012           S000005540         essential	561 562 217 216 976 977 829 150 Lga 901 979 507 Lga 698 140 693 443 956 530
2         essential         F09G8.4         WBGene00003           S000005027/CG3210         non-         R12H7.2         WBGene00000           3         essential         H22K11.1         WBGene00009           S000005027/CG3210         non-         F53C11.7         WBGene00009           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.8         WBGene00009           S000005187/CG1097         non-         K11D2.3         WBGene00000           S000005187/CG1097         non-         F55G1.5         WBGene00008           S000005274         non-         T14F9.1         WBGene00020           S000005274         essential         F52E1.10         WBGene00018           S000005274         non-         R13A5.10         WBGene00018           S000005487/CG7977         non-         R13A5.10         WBGene00012           S000005540         non-         F26A3.1         WBGene00008           S000005540         essential         F0121.4         WBGene00012           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005668/CG1065         essential         Y47H9C.14         WBGene00012	562 217 216 976 977 8299 150 Lga 901 979 507 Lga 698 052 968 140 693 443 956 530
2         essential         F09G8.4         WBGene00003           S000005027/CG3210         non-         R12H7.2         WBGene00000           3         essential         H22K11.1         WBGene00009           S000005027/CG3210         non-         F53C11.7         WBGene00009           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.8         WBGene00009           S000005187/CG1097         non-         K11D2.3         WBGene00000           S000005187/CG1097         non-         F55G1.5         WBGene00008           S000005274         non-         T14F9.1         WBGene00020           S000005274         essential         F52E1.10         WBGene00018           S000005274         non-         R13A5.10         WBGene00018           S000005487/CG7977         non-         R13A5.10         WBGene00012           S000005540         non-         F26A3.1         WBGene00008           S000005540         essential         F0121.4         WBGene00012           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005668/CG1065         essential         Y47H9C.14         WBGene00012	562 217 216 976 977 8299 150 Lga 901 979 507 Lga 698 052 968 140 693 443 956 530
S000005027/CG3210         non-         R12H7.2         WBGene00000           3         essential         H22K11.1         WBGene00009           3         onn-         F53C11.7         WBGene00009           3         essential         F53C11.7         WBGene00009           3         essential         F53C11.8         WBGene00009           3         essential         F53C11.8         WBGene00009           3         essential         F53C11.8         WBGene00000           1         essential         F55A12.7         WBGene00000           \$000005187/CG1097         non-         F55G1.5         WBGene00008           1         essential         F20D1.9         WBGene00020           \$000005274         non-         T14F9.1         WBGene00020           \$000005274         essential         F52E1.10         WBGene00018           \$000005274         essential         F52E1.10         WBGene00012           \$000005487/CG7977         non-         R13A5.10         WBGene00012           \$000005540         non-         F26A3.1         WBGene000012           \$000005540         essential         B0513.3         WBGene00012           \$000005668/CG1065         essential<	217 216 976 977 829 150 901 979 507 Lga 698 052 968 140 693 443 956 530
3         essential         H22K11.1         WBGene00000           S000005027/CG3210         non-         F53C11.7         WBGene00009           3         essential         F53C11.7         WBGene00009           S000005187/CG1097         non-         K11D2.3         WBGene00000           1         essential         F55A12.7         WBGene00000           S000005187/CG1097         non-         F55G1.5         WBGene00008           1         essential         F20D1.9         WBGene00020           S000005274         non-         T14F9.1         WBGene00020           S000005274         essential         F52E1.10         WBGene00018           S000005274         non-         R13A5.10         WBGene00018           S000005487/CG7977         non-         R13A5.10         WBGene00012           S000005540         non-         F26A3.1         WBGene00012           S000005540         essential         F01C1.4         WBGene00008           S000005540         essential         B0513.3         WBGene00012           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00011           S	216 976 977 829 150 901 979 507 Lga 698 052 968 140 693 443 956 530
S000005027/CG3210         non-         F53C11.7         WBGene00009           3         essential         F53C11.8         WBGene00009           S000005187/CG1097         non-         K11D2.3         WBGene00000           1         essential         F55A12.7         WBGene00000           S000005187/CG1097         non-         F55G1.5         WBGene00008           1         essential         F20D1.9         WBGene00020           S000005274         non-         T14F9.1         WBGene00018           S000005274         essential         F52E1.10         WBGene00020           S000005487/CG7977         non-         R13A5.10         WBGene00012           S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00008           S000005540         essential         B0513.3         WBGene00012           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00011           5         essential         C46A5.4         WBGene00012	976 977 829 150 901 979 507 Lga 698 052 968 140 693 443 956 530
3         essential         F53C11.8         WBGene00009           S000005187/CG1097         non-         K11D2.3         WBGene00006           1         essential         F55A12.7         WBGene00008           S000005187/CG1097         non-         F55G1.5         WBGene00008           1         essential         F20D1.9         WBGene00020           S000005274         non-         T14F9.1         WBGene00020           S000005274         essential         F52E1.10         WBGene00020           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         essential         F26A3.1         WBGene00012           S000005540         essential         F11C1.4         WBGene00008           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00012           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	977 829 150 901 979 507 698 052 968 140 693 443 956 530
S000005187/CG1097         non-         K11D2.3         WBGene00006           1         essential         F55A12.7         WBGene00000           S000005187/CG1097         non-         F55G1.5         WBGene00018           1         essential         F20D1.9         WBGene00008           S000005274         non-         T14F9.1         WBGene00020           S000005274         essential         F52E1.10         WBGene00020           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         essential         Y48A6B.7         WBGene00012           S000005540         non-         F26A3.1         WBGene00008           S000005540         essential         F11C1.4         WBGene00004           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	829 150 Lga 901 979 507 Lga 698 052 968 140 693 443 956 530
1         essential         F55A12.7         WBGene00000           S000005187/CG1097         non-         F55G1.5         WBGene00018           1         essential         F20D1.9         WBGene00008           S000005274         non-         T14F9.1         WBGene00020           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00004           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00011           5         essential         C46A5.4         WBGene00012	150 Lga 901 979 Lga 698 052 968 140 693 443 956 530
1         essential         F55A12.7         WBGene00000           S000005187/CG1097         non-         F55G1.5         WBGene00018           1         essential         F20D1.9         WBGene00008           S000005274         non-         T14F9.1         WBGene00020           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00004           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00011           5         essential         C46A5.4         WBGene00012	150 Lga 901 979 Lga 698 052 968 140 693 443 956 530
S000005187/CG1097         non-         F55G1.5         WBGene00018           1         essential         F20D1.9         WBGene00008           S000005274         non-         T14F9.1         WBGene00020           S000005274         essential         F52E1.10         WBGene00020           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         essential         Y48A6B.7         WBGene00012           S000005540         non-         F26A3.1         WBGene00008           S000005668/CG1065         essential         F11C1.4         WBGene00004           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00011           5         essential         C46A5.4         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	901 979 507 Lga 698 052 968 140 693 443 956 530
1         essential         F20D1.9         WBGene00008           S000005274         non-         T14F9.1         WBGene00020           S000005274         essential         F52E1.10         WBGene00020           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         essential         Y48A6B.7         WBGene00012           S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00004           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00011           5         essential         C46A5.4         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	979 507 Lga 698 052 968 140 693 443 956 530
S000005274         non-         T14F9.1         WBGene00020           S000005274         essential         F52E1.10         WBGene00018           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         essential         Y48A6B.7         WBGene00012           S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00008           S000005668/CG1065         essential         B0513.3         WBGene00012           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	507 Lga 698 052 968 140 693 443 956 530
S000005274         essential         F52E1.10         WBGene00018           S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         essential         Y48A6B.7         WBGene00012           S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00008           S000005668/CG1065         essential         B0513.3         WBGene00004           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	698 052 968 140 693 443 956 530
S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         essential         Y48A6B.7         WBGene00012           S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00008           S000005668/CG1065         essential         B0513.3         WBGene00004           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	052 968 140 693 443 956 530
S000005487/CG7977         non-         R13A5.10         WBGene00020           S000005487/CG7977         essential         Y48A6B.7         WBGene00012           S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00008           S000005668/CG1065         essential         B0513.3         WBGene00004           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	052 968 140 693 443 956 530
S000005487/CG7977         essential         Y48A6B.7         WBGene00012           S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00008           S000005668/CG1065         essential         B0513.3         WBGene00004           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	968 140 693 443 956 530
S000005540         non-         F26A3.1         WBGene00009           S000005540         essential         F11C1.4         WBGene00008           S000005668/CG1065         essential         B0513.3         WBGene00004           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	140 693 443 956 530
S000005540         essential         F11C1.4         WBGene00008           S000005668/CG1065         essential         B0513.3         WBGene00004           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00016           S000005701/CG1844         non-         C46A5.4         WBGene00012           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	693 443 956 530
S000005668/CG1065         essential         B0513.3         WBGene00004           S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00011           5         essential         C46A5.4         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	443 956 530
S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00011           5         essential         C46A5.4         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	956 530
S000005668/CG1065         essential         Y47H9C.14         WBGene00012           S000005701/CG1844         non-         T06D8.10         WBGene00011           5         essential         C46A5.4         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	530
S000005701/CG1844         non-         T06D8.10         WBGene00011           5         essential         C46A5.4         WBGene00016           S000005701/CG1844         non-         VF13D12L.3         WBGene00012	530
5 essential C46A5.4 WBGene00016 S000005701/CG1844 non- VF13D12L.3 WBGene00012	
S000005701/CG1844 non- VF13D12L.3 WBGene00012	700
	149
5 essential F36A2.3 WBGene00009	453
S000005927 non- H17B01.1 WBGene00019	207
S000005927 essential R09B5.11 WBGene00019	
S000006075 non- C25B8.3 WBGene00000	
S000006075 essential F57F5.1 WBGene00010	204 Lga
S000006168 non- K06B9.5 WBGene00003	938
S000006168 essential C04G2.7 WBGene00001	204
S000006180 non- C32E8.8 WBGene00004	
S000006225 non- ZK994.3 WBGene00004	
S000006225 essential K09C8.5 WBGene00004	257
S000006240 non- C28C12.7 WBGene00004	995
S000006240 essential C28C12.5 WBGene00004	993
S000006266 non- C50B8.2 WBGene00000	
S000006266 essential T27F2.3 WBGene00000	
S000006351/CG9186 non- T20B3.1 WBGene00011	850
S000006351/CG9186 essential F41E7.6 WBGene00009	622
S000006437/CG1007 non- F46E10.1 WBGene00018	488 Lga
1 essential F28F8.2 WBGene00009	-
S000006437/CG1007 non- B0416.6 WBGene00001	
1 essential M01F1.1 WBGene00001	
CG10211 non- F26H9.4 WBGene00009	176
CG10211 essential W06B3.1 WBGene00012	295
CG10512 non- ZK945.8 WBGene00014	170
CG10512 essential K10H10.7 WBGene00010	
CG1086 non- C47E12.8 WBGene00000	
CG1086 essential R06C7.3 WBGene00000	
CG10992 non- C44H4.3 WBGene00006	366
CG10992 essential C44H4.2 WBGene00006	370 Lga
CG11049 non- C03H5.4 WBGene00015	-
CG11049 essential C07E3.9 WBGene00007	
CG11212 non- F27C8.1 WBGene00000	
CG11212 essential F52H2.2 WBGene00000	
CG12002 non- F16C3.1 WBGene00008	885
CG12002 essential C24B5.1 WBGene00016	044
CG12070 non- R06C7.7 WBGene00003	
CG12070 essential Y48G1A.6 WBGene00021	
CG12265 non- C25H3.3 WBGene00016	
CG12265 essential C25H3.14 WBGene00016	123
CG12428 non- T05A6.1 WBGene00000	516
CG12428 essential T05A6.2 WBGene00000	
CG12512 non- F23H11.1 WBGene00017	1.5.1

CG12512	essential	F54B11.6	WBGene00010029
CG13431	non-	C34F11.9	WBGene00001101
CG13431	essential	C27A2.6	WBGene00001102
CG13645	essential	C37H5.3	WBGene00016507
CG13645	essential	C37H5.2	WBGene00016506
CG13994		K10B2.5	WBGene00019608
	non-		
CG13994	essential	Y43F8C.14	WBGene00012835
CG1411	non-	C28D4.2	WBGene00000509
CG1411	essential	C52B9.1	WBGene00000510
CG14351	non-	ZK688.6	WBGene00022801
CG14351	essential	ZK112.1	WBGene00003956
CG14507	non-	C24H12.5	WBGene00016074
CG14507	essential	C24H12.2	WBGene00016072
CG1607	non-	H23L24.5	WBGene00004052
CG1607	essential	F20C5.1	WBGene00004051
CG16726		F35G2.4	WBGene00004025
	non-		
CG16726	essential	Y47D3B.10	WBGene00001077
CG16975	non-	K06A1.5	WBGene00019427
CG16975	essential	F02E8.5	WBGene00017178
CG16986	non-	F45H7.4	WBGene00004183
CG16986	essential	C06E8.3	WBGene00004182
CG1772	essential	F57A10.3	WBGene00001813
CG1772	essential	С30Н6.6	WBGene00001811
CG1815	non-	T07D4.1	WBGene00011578
CG1815	essential	T23C6.5	WBGene00020727
		T05G5.10	
CG18361	non-		WBGene00002064
CG18361	essential	F54C9.1	WBGene00002065
CG1882	non-	F46G10.7	WBGene00004801
CG1882	essential	F46G10.3	WBGene00004802
CG2092	non-	C50D2.8	WBGene00016811
CG2092	essential	Y119D3B.12	WBGene00022489
CG2201	non-	T04G9.4	WBGene00020215
CG2201	essential	T28H10.1	WBGene00012142
CG2493	non-	T13G4.3	WBGene00020490
CG2493	essential	B0416.1	WBGene00015177
CG2669	non-	C10E2.6	WBGene00015676
CG2669	essential	T02G5.12	WBGene00020168
CG2864	non-	F54D8.3	WBGene00000107
CG2864	essential	K04F1.15	WBGene00000108
CG31022	non-	C35C5.3	WBGene00007955
CG31022	essential	F28H7.4	WBGene00009238
CG31033	non-	C55B7.4	WBGene00016943
CG31033	essential	K06A5.6	WBGene00019433
CG3105	non-	R107.8	WBGene00003001
CG3105	essential	F02A9.6	WBGene00001609
CG3156	non-	C01H6.9	WBGene00007258
CG3156 CG3156	essential	Y18H1A.10	WBGene00021214
CG31645	non-	Y57A10A.28	WBGene00013268
CG31645	essential	Y57A10A.10	WBGene00013255
CG3186	non-	B0495.2	WBGene00015203
CG3186	essential	ZC504.3	WBGene00013917
CG3187	non-	D1037.3	WBGene00001501
CG3187	essential	C54F6.14	WBGene00001500
CG3198	non-	Y62E10A.1	WBGene00004410
CG3198	essential	C37A2.7	WBGene00016493
CG32099	non-	F16B4.8	WBGene00000387
CG32099	essential	ZK637.11	WBGene00000388
CG3280	non-	F33D11.11	WBGene00018008
CG3280	essential	F42G2.5	WBGene00018354
CG3456	non-	F16H9.1	WBGene00004345
CG3456	essential	C05B5.7	WBGene00004344
CG3752	non-	F47G6.4	WBGene00004969
CG3752	essential	Y66H1A.6	WBGene00002041
CG3887	non-	F13G3.7	WBGene00008767
CG3887	essential	Y43C5B.3	WBGene00012786
CG3902	non-	Y49A3A.1	WBGene00013024
CG3902	essential	F22E10.5	WBGene00009057
CG3936	non-	F57C12.5	WBGene00003407
CG3936	essential	F57C12.4	WBGene00003408
	Concincial		

	1			T
CG40080	non-	T14G11.3	WBGene00020511	
CG40080 CG4239	essential	W06H3.1 C24G6.6	WBGene00012315 WBGene00016061	
CG4239		F25C8.2	WBGene00000139	
CG4268		F21A10.2	WBGene00008999	
CG4268		F59B10.1	WBGene00004134	Lga
CG4349		C56C10.3	WBGene00016961	Lga
CG4349		C37C3.3	WBGene00016497	Lga
CG4918		F55F3.1 Y47D3A.15	WBGene00010115	
CG4918 CG4965		C09B8.4	WBGene00012928 WBGene00015623	
CG4965		T10B11.6	WBGene00020402	
CG5014		C55B6.2	WBGene00001025	
CG5014		Y54E10BL.4	WBGene00001046	
CG5036		Y111B2A.19	WBGene00013739	
CG5036 CG5695		C13C4.5 T21D12.9	WBGene00007549 WBGene00020649	
CG5695		R13.3	WBGene00011258	
CG5805		C44C1.2	WBGene00016642	
CG5805		R09B5.12	WBGene00019980	
CG6016		F37C12.7	WBGene00018152	
CG6016		C46F4.2	WBGene00016716	
CG6214 CG6214		F53B1.6 C03F11.2	WBGene00018738 WBGene00015388	
CG6214 CG6455		ZK1098.3	WBGene00015388 WBGene00014220	
CG6455		ZK1098.8	WBGene00003504	
CG8032		F53C3.12	WBGene00018755	
CG8032		Y46G5A.24	WBGene00012914	
CG3328		F37H8.5	WBGene00009514	
CG3328 CG8055		K07D4.8 Y25C1A.13	WBGene00004135 WBGene00021296	
CG8055		F58A6.1	WBGene00021290 WBGene00019022	
CG8057		F42G10.2	WBGene00003368	
CG8057		VZC374L.1	WBGene00012162	
CG8245		C30G12.7	WBGene00004244	
CG8245		W06B11.2	WBGene00004245	
CG8286 CG8286				
CG8428				
CG8428				
CG8434				
CG8434				
CG8460 CG8460				
CG8732				
CG8732				
CG9117				
CG9117				
CG9247				
CG9247 CG9347				
CG9347 CG9347				
CG9427				
CG9427				
CG9577				
CG9577				
CG9738 CG9738				
CG9755				
CG9755				
L	1			

# Appendix Table 4.2. C. elegans 1:1 orthologues of S. cerevisiae genes

SC Gene	SC	CE RNAi	CE Name	NonV
	essentialit	Clone		
	У			
2AAA_YEAST	non-	F48E8.5	WBGene00003901	
2ABA_YEAST	essential	F26E4.1	WBGene00006352	х
3HAO_YEAST	non-	K06A4.5	WBGene00010595	
ABC1_YEAST	essential	C35D10.4	WBGene00000767	
ABD1_YEAST	non-	C25A1.3	WBGene00006447	
ABP1_YEAST	essential	K08E3.4	WBGene00010664	
ABPX_YEAST	non-	ZK1058.5	WBGene00014205	
ACBP_YEAST ACON_YEAST	essential essential	C44E4.6 F54H12.1	WBGene00016655 WBGene00000041	3.6
ACON_TEAST ADA YEAST	non-	C06G3.5	WBGene00015551	x
ADA_IEASI ADA1_YEAST	essential	T20B5.1	WBGene00000161	
ADA1_TEAST ADA2_YEAST	non-	F32A5.1	WBGene00017967	
ADB2_YEAST	essential	Y71H2_389.e	WBGene00000160	x
ADB6_YEAST	non-	R11A5.1	WBGene00000163	
ADK_YEAST	essential	R07H5.8	WBGene00011128	
ADPP_YEAST	non-	W02G9.1	WBGene00003579	
ADRO_YEAST	essential	Y62E10A.f	WBGene00013376	
	non-	C30F12.2	WBGene00016261	
AGM1_YEAST	essential	F21D5.1	WBGene00009006	
ALG1_YEAST	non-	T26A5.4	WBGene00020820	
ALG2_YEAST	essential	F09E5.2	WBGene00017282	x
ALG3_YEAST	non-	K09E4.2	WBGene00010720	
ALG6_YEAST	essential	C08B11.8	WBGene00007435	
ALG9_YEAST	non-	C14A4.3	WBGene00007556	
AMDM_YEAST	essential	C34F11.3	WBGene00016415	
AMP2_YEAST	non-	Y116A8A.9	WBGene00003130	
AP10_YEAST	essential	F15H10.3	WBGene00000144	
AP17_YEAST	non-	F02E8.3	WBGene00000157	
AP19_YEAST	essential	F29G9.3	WBGene00000159	
APG6_YEAST	non-	T19E7.3	WBGene00000247	
APG6_YEAST	essential	T19E7.4	WBGene00000247	
APG7_YEAST	essential non-	M7.5 C32D5.9	WBGene00010882 WBGene00002980	
APG8_YEAST APN1_YEAST	essential	T05H10.2	WBGene00000151	
APN2_YEAST	essential	R09B3.1	WBGene00001372	
AR21_YEAST	essential	Y37D8A.1	WBGene00000203	
AR41_YEAST	essential	Y79H2A.6	WBGene00000201	
ARG1_YEAST	non-	D1081.2	WBGene00006844	x
ARGI_YEAST	essential	T21F4.1	WBGene00020658	
ARL1_YEAST	non-	F54C9.10	WBGene00000187	x
ARP2_YEAST	essential	K07C5.1	WBGene00000200	
ARP6_YEAST	non-	C08B11.6	WBGene00007434	
ATC6_YEAST	essential	C10C6.6	WBGene00007514	
ATPB_YEAST	non-	C34E10.6	WBGene00000229	x
ATPD_YEAST	essential	F58F12.1	WBGene00019061	
ATPO_YEAST	non-	F27C1.7	WBGene00017856	x
ATU2_YEAST	essential	Y76A2A.3	WBGene00000834	
ATU2_YEAST	non-	F45G2.11	WBGene00000834	
ATU2_YEAST	essential	Y76A2A.2	WBGene00000834	
ATX1_YEAST	non-	ZK652.2	WBGene00000835	
ATX2_YEAST	essential	T01D3.5	WBGene00011329	
AUT1_YEAST	non-	Y55F3A_746.a	WBGene00021922	
AUT1_YEAST	essential	Y55F3A_746.e	WBGene00021922	
BCS1_YEAST	non-	F54C9.6	WBGene00010042	
BET2_YEAST	essential	B0280.11	WBGene00015099	
BET3_YEAST BET4_YEAST	non- essential	ZK1098.5 M57.2	WBGene00014222 WBGene00019778	
BE14_YEAST BMS1_YEAST	non-	M57.2 Y61A9LA_74.b	WBGene00019778 WBGene00022021	
BMS1_YEAST BMS1_YEAST	essential	Y61A9LA_75.a	WBGene00022021 WBGene00022021	x
BPH1_YEAST	non-	VT23B5.2	WBGene00012154	^
BRX1_YEAST	essential	K12H4.3	WBGene00012134 WBGene00019678	x
BU31_YEAST	non-	C07A9.2	WBGene00007400	x
BUB2_YEAST	essential	C33F10.2	WBGene00016352	
CAC2_YEAST	non-	Y71G12A_202.	WBGene00022141	
~~~		-, -012A_202.		1

CAPE_VEAST         essential         D2024.6         WBGene0000233           CAT5_VEAST         non-         M106.5         WBGene00010478           CSF5_VEAST         essential         C35D10.5         WBGene00011642           CC16_VEAST         essential         F10B5.6         WBGene0000132           CC27_VEAST         essential         F10B5.6         WBGene0000132           CC42_VEAST         essential         F10B5.6         WBGene00000330           CC42_VEAST         essential         F34D10.2         WBGene0000330           CC44_VEAST         essential         F34D10.3         WBGene00003159           CC44_VEAST         essential         F34D10.4         WBGene0000372           CC41_VEAST         non-         F34D10.4         WBGene0000376           CCL1_VEAST         essential         c         WBGene0000376           CCL1_VEAST         non-         Y49F6B.r         WBGene000038667           CCM_VEAST         non-         C43H5.18         WBGene00010676           CH1_VEAST         essential         F10G8.9         WBGene00010676           CH1_VEAST         essential         K0874.1         WBGene00010676           CH1_VEAST         non-         D0280.9         WBGene0001067	1		
CACP_YEAST         non-         R07H5.2         WBGene0000175           CALX_YEAST         essential         B0395.3         WBGene00000294           CAPA_YEAST         essential         D244.6         WBGene00000292           CAPA_YEAST         essential         D224.6         WBGene00000292           CAPS_YEAST         essential         C395.2         WBGene000010478           CCFS_YEAST         essential         C395.2         WBGene00001312           CC27_YEAST         essential         F1085.6         WBGene00001312           CC24_YEAST         essential         F1085.6         WBGene00003130           CC44_YEAST         essential         F34D10.2         WBGene00003156           CC44_YEAST         essential         F32D1.10         WBGene00013156           CC44_YEAST         essential         P53A3.7         WBGene00001376           CC41_YEAST         essential         C6B.6         WBGene00001376           CC1L_YEAST         essential         C6B.6         WBGene00001376           CC44_YEAST         non-         Y49F6B.r         WBGene00001676           CD5_YEAST         essential         C6B.6         WBGene00001676           CCH_YEAST         non-         D1081.8         WB	CACM YEAST	1122	WBGene0001112
CAL_YEAST         essential         B0395.3         WBGene00000294           CAPA_YEAST         non-         F41G4.2         WBGene00000293           CAPB_YEAST         non-         F41G4.2         WBGene00000293           CAT5_YEAST         non-         M06.5         WBGene00000293           CCT5_YEAST         essential         CC395.2         WBGene0001281           CC27_YEAST         essential         C35D10.5         WBGene00001281           CC27_YEAST         essential         F1085.6         WBGene00003132           CC24_YEAST         essential         T0565.3         WBGene0000390           CC45_YEAST         non-         F34D10.2         WBGene00003156           CC44_YEAST         essential         F34D10.3         WBGene00003159           CC45_YEAST         non-         Y39G10A_246.         WBGene00003156           CC44_YEAST         essential         CC51.4         WBGene00003166           CC64_YEAST         non-         Y39G10A_246.         WBGene0000376           CC45_YEAST         non-         Y39G10A_246.         WBGene0000376           CC1_YEAST         essential         C518.3         WBGene0000376           CC44_YEAST         essential         C518.3         WBGene0			
CAP_TEAST         essential         ZK632.6         WBGene00000294           CAPA_YEAST         essential         D2024.6         WBGene00000293           CATS_YEAST         essential         D2024.6         WBGene00000293           CCF5_YEAST         essential         C395.2         WBGene00001478           CCSF5_YEAST         essential         C35D10.5         WBGene00001313           CC27_YEAST         essential         F10B5.6         WBGene00003392           CC45_YEAST         essential         F34D10.2         WBGene000033972           CC45_YEAST         non-         F34D10.2         WBGene00003316           CC64_YEAST         non-         F34D10.3         WBGene00003316           CC54_YEAST         essential         F32D1.10         WBGene0000332           CC41_YEAST         essential         F65A3.7         WBGene0000332           CC54_YEAST         non-         Y39G10A_246.         WBGene0001332           CCC1_YEAST         non-         Y49F6B.r         WBGene0001332           CC75_YEAST         non-         D1081.8         WBGene0001362           CC1_YEAST         non-         D1081.8         WBGene0001363           CC51_YEAST         non-         D1084.8         WBGene000	CACP_YEAST	7175	WBGene0000717
CAP_TEAST         essential         ZK632.6         WBGene00000294           CAPA_YEAST         essential         D2024.6         WBGene00000293           CATS_YEAST         essential         D2024.6         WBGene00000293           CCF5_YEAST         essential         C395.2         WBGene00001478           CCSF5_YEAST         essential         C35D10.5         WBGene00001313           CC27_YEAST         essential         F10B5.6         WBGene00003392           CC45_YEAST         essential         F34D10.2         WBGene000033972           CC45_YEAST         non-         F34D10.2         WBGene00003316           CC64_YEAST         non-         F34D10.3         WBGene00003316           CC54_YEAST         essential         F32D1.10         WBGene0000332           CC41_YEAST         essential         F65A3.7         WBGene0000332           CC54_YEAST         non-         Y39G10A_246.         WBGene0001332           CCC1_YEAST         non-         Y49F6B.r         WBGene0001332           CC75_YEAST         non-         D1081.8         WBGene0001362           CC1_YEAST         non-         D1081.8         WBGene0001363           CC51_YEAST         non-         D1084.8         WBGene000			WD0 00000 FC
CAPE_VEAST         non-         F41G4.2         WBGene00000292           CAPB_VEAST         essential         D2024.6         WBGene00000293           CAT5_VEAST         non-         M106.5         WBGene00010478           CCB9_VEAST         essential         C35D10.5         WBGene00010442           CC16_VEAST         essential         C35D10.5         WBGene00003132           CC27_VEAST         non-         Y110A7A.d         WBGene00000372           CC45_VEAST         essential         F34D10.2         WBGene00003129           CC44_VEAST         essential         F34D10.3         WBGene00003129           CC44_VEAST         essential         F34D10.4         WBGene00003156           CC54_VEAST         non-         Y39G10A_246.         WBGene00003152           CC47_VEAST         essential         F34D10.3         WBGene00003162           CC54_VEAST         non-         Y39G10A_246.         WBGene0000382           CC1_VEAST         non-         Y39G10A_246.         WBGene0000382           CD2_VEAST         non-         Y49F6B.r         WBGene0000382           CD2_VEAST         non-         H0501.2         WBGene00016384           CSH_VEAST         non-         Y49F6B.r         WBGene	CALA_IEASI	1901	MBGelle0000056
CAPE_VEAST         non-         F41G4.2         WBGene00000292           CAPB_VEAST         essential         D2024.6         WBGene00000293           CAT5_VEAST         non-         M106.5         WBGene00010478           CCB9_VEAST         essential         C35D10.5         WBGene00010442           CC16_VEAST         essential         C35D10.5         WBGene00003132           CC27_VEAST         non-         Y110A7A.d         WBGene00000372           CC45_VEAST         essential         F34D10.2         WBGene00003129           CC44_VEAST         essential         F34D10.3         WBGene00003129           CC44_VEAST         essential         F34D10.4         WBGene00003156           CC54_VEAST         non-         Y39G10A_246.         WBGene00003152           CC47_VEAST         essential         F34D10.3         WBGene00003162           CC54_VEAST         non-         Y39G10A_246.         WBGene0000382           CC1_VEAST         non-         Y39G10A_246.         WBGene0000382           CD2_VEAST         non-         Y49F6B.r         WBGene0000382           CD2_VEAST         non-         H0501.2         WBGene00016384           CSH_VEAST         non-         Y49F6B.r         WBGene	CAP YEAST	1294	WBGene0000029
CAPE_VEAST         essential         D2024.6         WBGene0000233           CAT5_VEAST         non-         M106.5         WBGene00010478           CCF5_VEAST         essential         C35D10.5         WBGene00011281           CC16_VEAST         essential         F10B5.6         WBGene00001281           CC27_VEAST         essential         F10B5.6         WBGene00000312           CC42_VEAST         essential         F34D10.2         WBGene0000372           CC47_VEAST         essential         F34D10.3         WBGene00003156           CC42_VEAST         essential         F34D10.4         WBGene00003156           CC42_VEAST         non-         F34D10.3         WBGene00003156           CC41_VEAST         essential         e         WBGene00003166           CCLL_VEAST         essential         C668.6         WBGene0000382           CCL1_VEAST         non-         Y49F68.r         WBGene0000382           CCS1_VEAST         non-         C43E1.10         WBGene0000382           CCL1_VEAST         essential         T068.6         WBGene000038667           CCL2_VEAST         non-         D1081.8         WBGene00010676           CM1_VEAST         essential         F10G9.9         WBGene0001	_		
CATS_TEAST         non-         M106.5         WEGene00010478           CBF5_YEAST         non-         K01G5.5         WEGene00016442           CC16_YEAST         essential         C3D10.5         WEGene00001281           CC27_YEAST         essential         F10B5.6         WEGene00003122           CC27_YEAST         non-         N10A7A.d         WEGene00003122           CC45_YEAST         non-         R07G3.1         WEGene0000372           CC45_YEAST         essential         F34D10.2         WEGene00003159           CC44_YEAST         essential         F34D10.3         WEGene00003152           CC47_YEAST         essential         e         WEGene00003156           CC64_YEAST         non-         Y39G10A_246.         WEGene00001362           CC14_YEAST         essential         ZC518.3         WEGene0000376           CC44_YEAST         non-         Y49F6B.r         WEGene000016384           CF1_YEAST         non-         D1081.8         WEGene00016367           CC44_YEAST         non-         D1081.8         WEGene0001676           CH1_YEAST         non-         D1081.8         WEGene000101676           CH1_YEAST         non-         D1081.8         WEGene0001174	CAPA_YEAST	)292   x	WBGene0000029
CATS_TEAST         non-         M106.5         WEGene00010478           CBF5_YEAST         non-         K01G5.5         WEGene00016442           CC16_YEAST         essential         C3D10.5         WEGene00001281           CC27_YEAST         essential         F10B5.6         WEGene00003122           CC27_YEAST         non-         N10A7A.d         WEGene00003122           CC45_YEAST         non-         R07G3.1         WEGene0000372           CC45_YEAST         essential         F34D10.2         WEGene00003159           CC44_YEAST         essential         F34D10.3         WEGene00003152           CC47_YEAST         essential         e         WEGene00003156           CC64_YEAST         non-         Y39G10A_246.         WEGene00001362           CC14_YEAST         essential         ZC518.3         WEGene0000376           CC44_YEAST         non-         Y49F6B.r         WEGene000016384           CF1_YEAST         non-         D1081.8         WEGene00016367           CC44_YEAST         non-         D1081.8         WEGene0001676           CH1_YEAST         non-         D1081.8         WEGene000101676           CH1_YEAST         non-         D1081.8         WEGene0001174	CADD VEACT	1202 15	WDCopo000020
CBF5_TEAST         essential         ZC39.2         WBGene00010478           CBP3_YEAST         non-         K01G5.5         WBGene00001281           CC16_YEAST         essential         F10B5.6         WBGene00001321           CC28_YEAST         non-         W10A7A.d         WBGene00000300           CC45_YEAST         non-         R07G3.1         WBGene00009372           CC45_YEAST         non-         F34D10.3         WBGene00003159           CC45_YEAST         non-         F34D10.4         WBGene0000372           CC47_YEAST         essential         F32D1.10         WBGene00003159           CC4_YEAST         essential         F55A3.7         WBGene0000372           CC47_YEAST         essential         C60.4         WBGene0000376           CC4_YEAST         essential         C518.3         WBGene0000376           CC4_YEAST         essential         C33H5.18         WBGene000016384           CEM1_YEAST         essential         C3185.18         WBGene00010676           CH1_YEAST         essential         F10G8.9         WBGene00010676           CH1_YEAST         essential         K03F4.1         WBGene00010879           CH1_YEAST         essential         K0474.1         WBGene0001	CAPB_ILASI	0293   x	WBGeneouooza
CBF5_TEAST         essential         ZC39.2         WBGene00010478           CD6_YEAST         essential         C165.5         WBGene00011281           CC26_YEAST         essential         F10B5.6         WBGene000031281           CC28_YEAST         non-         W10A7A.d         WBGene0000372           CC45_YEAST         non-         R07G3.1         WBGene0000372           CC45_YEAST         non-         F34D10.2         WBGene0000372           CC47_YEAST         essential         F32D1.10         WBGene0000372           CC47_YEAST         essential         F32D1.10         WBGene00003159           CC44_YEAST         essential         F55A3.7         WBGene0000376           CC44_YEAST         essential         C6B.6         WBGene0000376           CC44_YEAST         essential         C5B.6         WBGene0000376           CC44_YEAST         essential         C33H5.18         WBGene00003667           CC44_YEAST         non-         C43E11.10         WBGene00010676           CH1_YEAST         essential         F10G8.9         WBGene00010676           CH1_YEAST         essential         K02F4.1         WBGene00010879           CH1_YEAST         non-         L0601.2         WBGene000108	CAT5 VEAST	1536	WBGene0000053
CBP3_TEAST         non-         K01G5.5         WBGene00016442           CC16_VEAST         essential         C35D10.5         WBGene0000132           CC27_VEAST         essential         F10B5.6         WBGene00000332           CC42_VEAST         essential         F3055.3         WBGene00000372           CC45_VEAST         essential         F34D10.3         WBGene0000375           CC47_VEAST         non-         F34D10.3         WBGene00003159           CC47_VEAST         essential         F32D1.10         WBGene00001849           CC1L_VEAST         non-         F34D10.3         WBGene00001761           CC1_VEAST         essential         F32D1.10         WBGene0000176           CC1_VEAST         essential         C518.3         WBGene0000376           CC44_VEAST         essential         ZC518.3         WBGene00001634           CS1_VEAST         essential         ZC518.3         WBGene00016386           CC44_VEAST         essential         F1068.9         WBGene0001676           CH1_VEAST         essential         F1068.9         WBGene00010389           CH1_VEAST         essential         F1068.9         WBGene00010676           CH1_VEAST         non-         C2449.5         WBGe	_		
CC16_TEAST         essential         C35D10.5         WBGene00001281           CC27_VEAST         essential         F1085.6         WBGene00001302           CC28_VEAST         non-         RV10A7A.d         WBGene00000372           CC45_VEAST         essential         T55G5.3         WBGene0000372           CC45_VEAST         essential         F34D10.2         WBGene0000372           CC47_VEAST         essential         F34D10.3         WBGene00003156           CC54_VEAST         essential         F32D1.10         WBGene00001714           CCL1_VEAST         essential         F55A3.7         WBGene0000372           CC44_VEAST         essential         T05D8.6         WBGene0000372           CCL1_VEAST         essential         T05D8.6         WBGene0000372           CCS4_VEAST         non-         C43E1.10         WBGene0000382           CS1_VEAST         essential         T06B8.7         WBGene0001634           CEM1_VEAST         essential         F1068.9         WBGene00016364           CEM1_VEAST         essential         F1068.9         WBGene00016369           CMBC_VEAST         non-         D0280.9         WBGene00016369           CHL_VEAST         essential         F1068.9	CBF5_YEAST	)478	WBGene0001047
CC16_TEAST         essential         C35D10.5         WBGene00001281           CC27_VEAST         essential         F1085.6         WBGene00001302           CC28_VEAST         non-         RV10A7A.d         WBGene00000372           CC45_VEAST         essential         T55G5.3         WBGene0000372           CC45_VEAST         essential         F34D10.2         WBGene0000372           CC47_VEAST         essential         F34D10.3         WBGene00003156           CC54_VEAST         essential         F32D1.10         WBGene00001714           CCL1_VEAST         essential         F55A3.7         WBGene0000372           CC44_VEAST         essential         T05D8.6         WBGene0000372           CCL1_VEAST         essential         T05D8.6         WBGene0000372           CCS4_VEAST         non-         C43E1.10         WBGene0000382           CS1_VEAST         essential         T06B8.7         WBGene0001634           CEM1_VEAST         essential         F1068.9         WBGene00016364           CEM1_VEAST         essential         F1068.9         WBGene00016369           CMBC_VEAST         non-         D0280.9         WBGene00016369           CHL_VEAST         essential         F1068.9		- 1 1 0	WDC 0 0 0 1 C 4 4
CC27_VEAST         essential         F1085.6         WBGene00003132           CC28_VEAST         non-         Y110A7A.d         WBGene0000390           CC45_VEAST         non-         R07G3.1         WBGene0000390           CC45_VEAST         non-         R07G3.1         WBGene00003972           CC45_VEAST         non-         F34D10.2         WBGene00003159           CC47_VEAST         non-         F34D10.2         WBGene00003159           CC47_VEAST         essential         F32D1.10         WBGene00003159           CC56_VEAST         non-         Y39G10A_246         WBGene0000376           CC6_VEAST         non-         Y9568.r         WBGene0000376           CD51_VEAST         essential         C2518.         WBGene0000376           CC44_VEAST         essential         C3451.10         WBGene00010386           CML_VEAST         essential         F1068.9         WBGene00010676           CH1_VEAST         essential         F1068.9         WBGene00010839           CH1_VEAST         non-         H06801.2         WBGene00010839           CH1_VEAST         essential         T2065.1         WBGene00010839           CH1_VEAST         non-         Z449.5         WBGene00010839     <	CBP3_YEAST	5442	WBGene0001644
CC27_VEAST         essential         F1085.6         WBGene00003132           CC28_VEAST         non-         Y110A7A.d         WBGene0000390           CC45_VEAST         non-         R07G3.1         WBGene0000390           CC45_VEAST         non-         R07G3.1         WBGene00003972           CC45_VEAST         non-         F34D10.2         WBGene00003159           CC47_VEAST         non-         F34D10.2         WBGene00003159           CC47_VEAST         essential         F32D1.10         WBGene00003159           CC56_VEAST         non-         Y39G10A_246         WBGene0000376           CC6_VEAST         non-         Y9568.r         WBGene0000376           CD51_VEAST         essential         C2518.         WBGene0000376           CC44_VEAST         essential         C3451.10         WBGene00010386           CML_VEAST         essential         F1068.9         WBGene00010676           CH1_VEAST         essential         F1068.9         WBGene00010839           CH1_VEAST         non-         H06801.2         WBGene00010839           CH1_VEAST         essential         T2065.1         WBGene00010839           CH1_VEAST         non-         Z449.5         WBGene00010839     <	CC16 VEAST	1281 x	WBCono0000128
CC28_YEAST         non-         Y110A7A.d         WBGene0000405           CC45_YEAST         non-         R07G3.1         WBGene00003972           CC45_YEAST         essential         F34D10.2         WBGene00003159           CC45_YEAST         non-         F34D10.3         WBGene00003159           CC47_YEAST         essential         F34D10.3         WBGene00003156           CC44_YEAST         essential         e         WBGene000131527           CCL1_YEAST         essential         e         WBGene0001322           CCL1_YEAST         essential         CA451.10         WBGene00003362           CC54_YEAST         essential         ZC518.3         WBGene0000382           CD51_YEAST         essential         ZC518.3         WBGene000038667           CC41_YEAST         essential         C1381.10         WBGene00010369           CH1_YEAST         essential         K0874.1         WBGene000103667           CH1_YEAST         non-         D1081.8         WBGene00010369           CH1_YEAST         essential         K0874.1         WBGene00010369           CH1_YEAST         non-         YG4955.1         WBGene00010867           CND_YEAST         non-         YG49.5         WBGene00010676 <td>_</td> <td></td> <td></td>	_		
CC28_YEAST         non-         Y110A7A.d         WBGene0000405           CC45_YEAST         non-         R07G3.1         WBGene00003972           CC45_YEAST         essential         F34D10.2         WBGene00003159           CC45_YEAST         non-         F34D10.3         WBGene00003159           CC47_YEAST         essential         F34D10.3         WBGene00003156           CC44_YEAST         essential         e         WBGene000131527           CCL1_YEAST         essential         e         WBGene0001322           CCL1_YEAST         essential         CA451.10         WBGene00003362           CC54_YEAST         essential         ZC518.3         WBGene0000382           CD51_YEAST         essential         ZC518.3         WBGene000038667           CC41_YEAST         essential         C1381.10         WBGene00010369           CH1_YEAST         essential         K0874.1         WBGene000103667           CH1_YEAST         non-         D1081.8         WBGene00010369           CH1_YEAST         essential         K0874.1         WBGene00010369           CH1_YEAST         non-         YG4955.1         WBGene00010867           CND_YEAST         non-         YG49.5         WBGene00010676 <td>CC27 YEAST</td> <td>3132 x</td> <td>WBGene0000313</td>	CC27 YEAST	3132 x	WBGene0000313
CC42_YEAST         essential         T05G5.3         WBGene0000301           CC45_YEAST         essential         F34D10.2         WBGene0000372           CC47_YEAST         essential         F34D10.3         WBGene00003156           CC54_YEAST         essential         F32D1.10         WBGene00003156           CC54_YEAST         essential         F32D1.10         WBGene00013849           CCL_YEAST         essential         e         WBGene0001376           CC6_YEAST         non-         Y39G10A_246         WBGene0000376           CC6_YEAST         non-         Y956B.r         WBGene0000376           CC6_YEAST         non-         C43E11.10         WBGene00003866           CDS1_YEAST         essential         F1068.9         WBGene00010676           CHL_YEAST         essential         F1068.9         WBGene00010676           CHL_YEAST         non-         B0280.9         WBGene00010839           CHL_YEAST         essential         T2065.1         WBGene00012784           COD1_YEAST         non-         Y39418.3         WBGene00012784           COD1_YEAST         non-         Y51H7C_255.0         WBGene00012784           COD1_YEAST         essential         Y51H7C_255.0         WBGen	_		UDG 0000040
CC45_YEAST         non-         R07G3.1         WBGene00009372           CC45_YEAST         essential         F34D10.2         WBGene00003159           CC47_YEAST         non-         Y34D10.3         WBGene0003159           CC54_YEAST         essential         F32D1.10         WBGene0003159           CC4_YEAST         essential         e         WBGene00011527           CCL1_YEAST         essential         e         WBGene0001327           CCC4_YEAST         non-         Y49F6B.r         WBGene0000382           CD51_YEAST         essential         ZC518.3         WBGene0000382           CCM_YEAST         essential         C33H5.18         WBGene00016667           CH4_YEAST         essential         F1068.9         WBGene00010369           CH1_YEAST         essential         F1068.9         WBGene00010369           CH1_YEAST         essential         K0874.1         WBGene00012667           CH4_YEAST         non-         B0280.9         WBGene00012667           CND_YEAST         non-         ZC449.5         WBGene0001867           CND_YEAST         non-         Y39A18.3         WBGene0001867           CND_YEAST         non-         Y39A18.3         WBGene0001867      <	CC28_YEAST	0405   x	WBGene0000040
CC45_YEAST         non-         R07G3.1         WBGene00009372           CC45_YEAST         essential         F34D10.2         WBGene00003159           CC47_YEAST         non-         Y34D10.3         WBGene0003159           CC54_YEAST         essential         F32D1.10         WBGene0003159           CC4_YEAST         essential         e         WBGene00011527           CCL1_YEAST         essential         e         WBGene0001327           CCC4_YEAST         non-         Y49F6B.r         WBGene0000382           CD51_YEAST         essential         ZC518.3         WBGene0000382           CCM_YEAST         essential         C33H5.18         WBGene00016667           CH4_YEAST         essential         F1068.9         WBGene00010369           CH1_YEAST         essential         F1068.9         WBGene00010369           CH1_YEAST         essential         K0874.1         WBGene00012667           CH4_YEAST         non-         B0280.9         WBGene00012667           CND_YEAST         non-         ZC449.5         WBGene0001867           CND_YEAST         non-         Y39A18.3         WBGene0001867           CND_YEAST         non-         Y39A18.3         WBGene0001867      <	CC42 VEAST	0390 x	WBCono0000039
CC45_YEAST         essential         F34D10.2         WBGene0000372           CC47_YEAST         non-         F34D10.3         WBGene00003156           CC54_YEAST         essential         P         WBGene00003156           CC64_YEAST         essential         e         WBGene00003156           CCL_YEAST         non-         Y39G10A_246.         WBGene00001727           CCL_YEAST         essential         T06D8.6         WBGene0000376           CCC5_YEAST         essential         T05D8.6         WBGene0000382           CDS1_YEAST         essential         C3151.10         WBGene00008386           CEML_YEAST         non-         C43E11.10         WBGene0001634           CHL_YEAST         essential         F1068.9         WBGene00010636           CHL_YEAST         essential         K08F4.1         WBGene00010839           CHL_YEAST         non-         B0280.9         WBGene00010867           CND_YEAST         non-         ZC449.5         WBGene0001087           CND_YEAST         non-         Y39A1B.3         WBGene0001784           CODLYEAST         non-         Y39A1B.3         WBGene0001784           CODLYEAST         non-         Y39A1B.3         WBGene0001784	_	JJJ0 A	WDGene0000055
CC45_YEAST         essential         F34D10.2         WBGene0000372           CC47_YEAST         non-         F34D10.3         WBGene00003156           CC54_YEAST         essential         P         WBGene00003156           CC64_YEAST         essential         e         WBGene00003156           CCL_YEAST         non-         Y39G10A_246.         WBGene00001727           CCL_YEAST         essential         T06D8.6         WBGene0000376           CCC5_YEAST         essential         T05D8.6         WBGene0000382           CDS1_YEAST         essential         C3151.10         WBGene00008386           CEML_YEAST         non-         C43E11.10         WBGene0001634           CHL_YEAST         essential         F1068.9         WBGene00010636           CHL_YEAST         essential         K08F4.1         WBGene00010839           CHL_YEAST         non-         B0280.9         WBGene00010867           CND_YEAST         non-         ZC449.5         WBGene0001087           CND_YEAST         non-         Y39A1B.3         WBGene0001784           CODLYEAST         non-         Y39A1B.3         WBGene0001784           CODLYEAST         non-         Y39A1B.3         WBGene0001784	CC45 YEAST	9372	WBGene0000937
CC47_YEAST         non-         F34D10.3         WBGene0003159           CC54_YEAST         essential         F32D1.10         WBGene00013159           CC56_YEAST         non-         Y39G10A_246.         WBGene00013849           CCLL_YEAST         essential         e         WBGene0000376           CCC4_YEAST         essential         T05D8.6         WBGene0000376           CCC4_YEAST         essential         ZC518.3         WBGene0000382           CDS1_YEAST         essential         C33H5.18         WBGene00008866           CEM1_YEAST         essential         C33H5.18         WBGene00010676           CH1_YEAST         essential         K08F4.1         WBGene00010676           CH1_YEAST         essential         K08F4.1         WBGene00010839           CHS_YEAST         non-         B0280.9         WBGene0001222515           CH_YEAST         essential         M03C11.2         WBGene00012784           COD1_YEAST         non-         Y51H7C_255.f         WBGene00021784           COD1_YEAST         non-         Y51H7C_255.f         WBGene00012784           COD1_YEAST         essential         Y51H7C_255.f         WBGene00012784           COD1_YEAST         essential         Y71F9A_282.b <td>_</td> <td></td> <td></td>	_		
CC54_YEAST         essential         F32D1.10         WBGene0003156           CC64_YEAST         non-         Y39G10A_246.         WBGene00011527           CCL1_YEAST         essential         e         WBGene00011527           CC4_YEAST         essential         T06D8.6         WBGene0000376           CD56_YEAST         non-         Y49F6B.r         WBGene00003866           CCM1_YEAST         essential         ZC518.3         WBGene00008667           CCH1_YEAST         essential         C33H5.18         WBGene00016384           CEF1_YEAST         non-         D1081.8         WBGene00016364           CH1_YEAST         essential         F10G8.9         WBGene00010839           CH55_YEAST         non-         B0280.9         WBGene00010839           CH55_YEAST         non-         ZC449.5         WBGene0001867           CND1_YEAST         essential         T20G5.1         WBGene00021784           COD1_YEAST         essential         C17G10.2         WBGene00021784           COD1_YEAST         essential         Y5H7C_255.f         WBGene00021784           COD1_YEAST         essential         Y5H7C_255.c         WBGene00021784           COD1_YEAST         essential         Y5H7C_255.c	CC45_YEAST	3372	WBGene0000937
CC54_YEAST         essential         F32D1.10         WBGene0003156           CC64_YEAST         non-         Y39G10A_246.         WBGene00011527           CCL1_YEAST         essential         e         WBGene00011527           CC4_YEAST         essential         T06D8.6         WBGene0000376           CD56_YEAST         non-         Y49F6B.r         WBGene00003866           CCM1_YEAST         essential         ZC518.3         WBGene00008667           CCH1_YEAST         essential         C33H5.18         WBGene00016384           CEF1_YEAST         non-         D1081.8         WBGene00016364           CH1_YEAST         essential         F10G8.9         WBGene00010839           CH55_YEAST         non-         B0280.9         WBGene00010839           CH55_YEAST         non-         ZC449.5         WBGene0001867           CND1_YEAST         essential         T20G5.1         WBGene00021784           COD1_YEAST         essential         C17G10.2         WBGene00021784           COD1_YEAST         essential         Y5H7C_255.f         WBGene00021784           COD1_YEAST         essential         Y5H7C_255.c         WBGene00021784           COD1_YEAST         essential         Y5H7C_255.c	CC47 VENCT	3159 x	WPConc0000315
CC68_YEAST         non-         Y39G10A_246.         WBGene0001849           CCLL_YEAST         essential         e         WBGene00011527           CCLL_YEAST         non-         Y55A3.7         WBGene0000376           CD6_YEAST         essential         T06D8.6         WBGene0000382           CD51_YEAST         essential         ZC518.3         WBGene000016384           CEF1_YEAST         essential         C3H5.18         WBGene00008366           CG48_YEAST         non-         D1081.8         WBGene00016376           CH1_YEAST         essential         F10G8.9         WBGene00010676           CH1_YEAST         essential         K0874.1         WBGene00010839           CHS_YEAST         non-         B0280.9         WBGene0001839           CHS_YEAST         non-         C449.5         WBGene0001867           CND1_YEAST         essential         T20G5.1         WBGene0001874           COD1_YEAST         non-         Y39A18.3         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.f         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.g         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.g         WBGe	_	JTJJ X	MDGene0000313
CC68_YEAST         non-         Y39G10A_246.         WBGene0001849           CCLL_YEAST         essential         e         WBGene00011527           CCLL_YEAST         non-         Y55A3.7         WBGene0000376           CD6_YEAST         essential         T06D8.6         WBGene0000382           CD51_YEAST         essential         ZC518.3         WBGene000016384           CEF1_YEAST         essential         C3H5.18         WBGene00008366           CG48_YEAST         non-         D1081.8         WBGene00016376           CH1_YEAST         essential         F10G8.9         WBGene00010676           CH1_YEAST         essential         K0874.1         WBGene00010839           CHS_YEAST         non-         B0280.9         WBGene0001839           CHS_YEAST         non-         C449.5         WBGene0001867           CND1_YEAST         essential         T20G5.1         WBGene0001874           COD1_YEAST         non-         Y39A18.3         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.f         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.g         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.g         WBGe	CC54 YEAST	3156 x	WBGene0000315
CCHL_YEAST         essential         e         WBGene00011527           CCL1_YEAST         non-         F55A3.7         WBGene00012714           CCR4_YEAST         essential         T06D8.6         WBGene0000376           CDC5_YEAST         essential         ZCS18.3         WBGene00003826           CDS1_YEAST         essential         C3H5.18         WBGene00008866           CCM1_YEAST         essential         C3H5.18         WBGene0001676           CH1_YEAST         essential         F1068.9         WBGene0001676           CH1_YEAST         essential         K08F4.1         WBGene0001839           CH1_YEAST         non-         B0280.9         WBGene0001867           CN1_YEAST         non-         ZC449.5         WBGene0001867           CN1_YEAST         essential         M03C11.2         WBGene0001877           CN1_YEAST         essential         Y51H7C_255.f         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.c         WBGene000121784           COD1_YEAST         essential         Y51H7C_255.c         WBGene00012174           COPA_YEAST         essential         Y71F9A_282.b         WBGene00001761           COPA_YEAST         essential         Y71F9A_282.b <td></td> <td></td> <td></td>			
CCL1_YEAST         non-         F55A3.7         WBGene00021714           CCR4_YEAST         essential         TOGD8.6         WBGene00000382           CDS1_YEAST         essential         ZC518.3         WBGene000016384           CEF1_YEAST         non-         C43E11.10         WBGene00008667           CG48_YEAST         non-         D1081.8         WBGene00016304           CH1_YEAST         essential         F10G8.9         WBGene00016369           CH1_YEAST         essential         K08F4.1         WBGene00016369           CH1_YEAST         essential         K08F4.1         WBGene00016839           CHS5_YEAST         non-         B0280.9         WBGene00016837           CND1_YEAST         essential         T20G5.1         WBGene00015916           CD1_YEAST         non-         Y39A18.3         WBGene00021784           COD1_YEAST         non-         Y39A18.3         WBGene00021784           COD1_YEAST         non-         Y39A18.3         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.5         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.5         WBGene0001775           COPP_YEAST         essential         Y1F9A_282.5 <t< td=""><td>CC68_YEAST</td><td>3849</td><td>WBGene0001884</td></t<>	CC68_YEAST	3849	WBGene0001884
CCL1_YEAST         non-         F55A3.7         WBGene00021714           CCR4_YEAST         essential         TOGD8.6         WBGene00000382           CDS1_YEAST         essential         ZC518.3         WBGene000016384           CEF1_YEAST         non-         C43E11.10         WBGene00008667           CG48_YEAST         non-         D1081.8         WBGene00016304           CH1_YEAST         essential         F10G8.9         WBGene00016369           CH1_YEAST         essential         K08F4.1         WBGene00016369           CH1_YEAST         essential         K08F4.1         WBGene00016839           CHS5_YEAST         non-         B0280.9         WBGene00016837           CND1_YEAST         essential         T20G5.1         WBGene00015916           CD1_YEAST         non-         Y39A18.3         WBGene00021784           COD1_YEAST         non-         Y39A18.3         WBGene00021784           COD1_YEAST         non-         Y39A18.3         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.5         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.5         WBGene0001775           COPP_YEAST         essential         Y1F9A_282.5 <t< td=""><td>COUL VEVCL</td><td>1527</td><td>WPConc0001152</td></t<>	COUL VEVCL	1527	WPConc0001152
CCR4_YEAST         essential         T06D8.6         WBGene00000376           CDC5_YEAST         non-         Y49F6B.r         WBGene0000382           CDS1_YEAST         essential         CCS18.3         WBGene00008386           CEM1_YEAST         essential         C33H5.18         WBGene0001667           Cd48_YEAST         non-         D1081.8         WBGene00018667           CH1_YEAST         essential         F10G8.9         WBGene00010867           CH1_YEAST         essential         K0874.1         WBGene0001869           CH1_YEAST         non-         H06001.2         WBGene0001867           CN1_YEAST         essential         T2049.5         WBGene0001867           CN1_YEAST         non-         Y39A1B.3         WBGene0001867           CN1_YEAST         essential         T2045.1         WBGene00021784           CO01_YEAST         non-         Y51H7C_255.f         WBGene00021784           CO1_YEAST         essential         Y51H7C_255.c         WBGene0001784           CO2_YEAST         essential         Y71F9A_282.b         WBGene0001774           COPP_YEAST         essential         Y71F9A_282.b         WBGene00001775           COPP_YEAST         essential         T14610.5	_	1527	WEGENEOUUIISZ
CCR4_YEAST         essential         T06D8.6         WBGene00000376           CDC5_YEAST         non-         Y49F6B.r         WBGene0000382           CDS1_YEAST         essential         CCS18.3         WBGene00008386           CEM1_YEAST         essential         C33H5.18         WBGene0001667           Cd48_YEAST         non-         D1081.8         WBGene00018667           CH1_YEAST         essential         F10G8.9         WBGene00010867           CH1_YEAST         essential         K0874.1         WBGene0001869           CH1_YEAST         non-         H06001.2         WBGene0001867           CN1_YEAST         essential         T2049.5         WBGene0001867           CN1_YEAST         non-         Y39A1B.3         WBGene0001867           CN1_YEAST         essential         T2045.1         WBGene00021784           CO01_YEAST         non-         Y51H7C_255.f         WBGene00021784           CO1_YEAST         essential         Y51H7C_255.c         WBGene0001784           CO2_YEAST         essential         Y71F9A_282.b         WBGene0001774           COPP_YEAST         essential         Y71F9A_282.b         WBGene00001775           COPP_YEAST         essential         T14610.5	CCL1 YEAST	1714	WBGene0002171
CDC6_YEAST         non-         Y49F6B.r         WBGene00010382           CDS1_YEAST         essential         ZC518.3         WBGene00016384           CEF1_YEAST         non-         C43E11.10         WBGene00008667           CG48_YEAST         non-         D1081.8         WBGene00016369           CH1_YEAST         essential         F1068.9         WBGene00010867           CH12_YEAST         non-         B0280.9         WBGene00010839           CHS_YEAST         non-         H06001.2         WBGene0001087           CNS1_YEAST         non-         ZC449.5         WBGene0001087           CNS1_YEAST         non-         ZC449.5         WBGene00012784           COD1_YEAST         non-         Y39A1B.3         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.5         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.5         WBGene0001784           COD2_YEAST         essential         Y51H7C_255.5         WBGene0001784           COPE_YEAST         essential         Y251A.5         WBGene0001774           COPE_YEAST         essential         Y251A.5         WBGene00001774           COPE_YEAST         essential         Y251A.5         WBGen	_		
CDS1_YEAST         essential         ZC518.3         WBGene00016384           CEF1_YEAST         non-         C43E11.10         WBGene00008667           CG48_YEAST         non-         D1081.8         WBGene0001676           CH1_YEAST         essential         F1068.9         WBGene0001676           CH1_YEAST         essential         K08F4.1         WBGene00010839           CHL1_YEAST         essential         K08F4.1         WBGene0001087           CNS1_YEAST         essential         T2065.1         WBGene000187           CNS1_YEAST         essential         T2065.1         WBGene000187           CNS1_YEAST         essential         T2075.1         WBGene0001784           COD1_YEAST         non-         Y39A1B.3         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.6         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.6         WBGene00021292           COPD_YEAST         essential         Y71F9A_282.b         WBGene00015734           COPA_YEAST         essential         Y71F9A_282.b         WBGene0000761           COQ1_YEAST         essential         T38511.5         WBGene0000761           COQ1_YEAST         essential         T3851.	CCR4_YEAST	13/6	wBGene0000037
CDS1_YEAST         essential         ZC518.3         WBGene00016384           CEF1_YEAST         non-         C43E11.10         WBGene00008667           CG48_YEAST         non-         D1081.8         WBGene0001676           CH1_YEAST         essential         F1068.9         WBGene0001676           CH1_YEAST         essential         K08F4.1         WBGene00010839           CHL1_YEAST         essential         K08F4.1         WBGene0001087           CNS1_YEAST         essential         T2065.1         WBGene000187           CNS1_YEAST         essential         T2065.1         WBGene000187           CNS1_YEAST         essential         T2075.1         WBGene0001784           COD1_YEAST         non-         Y39A1B.3         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.6         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.6         WBGene00021292           COPD_YEAST         essential         Y71F9A_282.b         WBGene00015734           COPA_YEAST         essential         Y71F9A_282.b         WBGene0000761           COQ1_YEAST         essential         T38511.5         WBGene0000761           COQ1_YEAST         essential         T3851.	CDC6 VEACT	1382	WRGenedooooo
CEF1_YEAST         non-         C43E11.10         WBGene00008386           CEM1_YEAST         essential         C33H5.18         WBGene00008667           CG48_YEAST         non-         D1081.8         WBGene0001676           CH12_YEAST         essential         F10C8.9         WBGene00010369           CH1_YEAST         essential         K08F4.1         WBGene00012615           CLH_YEAST         non-         H06001.2         WBGene00012615           CLH_YEAST         non-         ZC449.5         WBGene0001287           CNN1_YEAST         non-         Y39A1B.3         WBGene000121784           COD1_YEAST         non-         Y39A1B.3         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.5         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.5         WBGene00021784           COD2_YEAST         essential         Y71H7A_282.b         WBGene00021784           COPA_YEAST         essential         Y71H7A_255.c         WBGene0001784           COPA_YEAST         essential         Y71H7A_282.b         WBGene00015734           COPA_YEAST         essential         Y25C1A.5         WBGene0001775           COPA_YEAST         essential         T44010.	_		
CEF1_YEAST         non-         C43E11.10         WBGene00008386           CEM1_YEAST         essential         C33H5.18         WBGene00008667           CG48_YEAST         non-         D1081.8         WBGene0001676           CH12_YEAST         essential         F10C8.9         WBGene00010369           CH1_YEAST         essential         K08F4.1         WBGene00012615           CLH_YEAST         non-         H06001.2         WBGene00012615           CLH_YEAST         non-         ZC449.5         WBGene0001287           CNN1_YEAST         non-         Y39A1B.3         WBGene000121784           COD1_YEAST         non-         Y39A1B.3         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.5         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.5         WBGene00021784           COD2_YEAST         essential         Y71H7A_282.b         WBGene00021784           COPA_YEAST         essential         Y71H7A_255.c         WBGene0001784           COPA_YEAST         essential         Y71H7A_282.b         WBGene00015734           COPA_YEAST         essential         Y25C1A.5         WBGene0001775           COPA_YEAST         essential         T44010.	CDS1 YEAST	5384	WBGene0001638
CEM1_YEAST         essential         C33H5.18         WBGene00008667           CG48_YEAST         non-         D1081.8         WBGene00015104           CH12_YEAST         essential         F10G8.9         WBGene00010369           CHL1_YEAST         essential         K08F4.1         WBGene00010839           CHL5_YEAST         non-         H06001.2         WBGene0001867           CND_YEAST         essential         T20G5.1         WBGene0001784           COD_YEAST         non-         Y39AlB.3         WBGene00021784           COD_YEAST         essential         Y51H7C_255.f         WBGene00021784           COD_YEAST         essential         Y51H7C_255.c         WBGene00021784           COD_YEAST         essential         Y51H7C_255.c         WBGene00012784           COP_YEAST         essential         Y71F9A_282.b         WBGene00012784           COP_YEAST         essential         Y71F9A_282.b         WBGene00012784           COP_YEAST         essential         Y71F9A_282.b         WBGene00012784           COP_YEAST         essential         Y71F9A_282.b         WBGene0001774           COP_YEAST         essential         Y1F9A_282.b         WBGene0001774           COP_YEAST         essential	_		
CEM1_YEAST         essential         C33H5.18         WBGene00008667           CG48_YEAST         non-         D1081.8         WBGene00015104           CH12_YEAST         essential         F10G8.9         WBGene00010369           CHL1_YEAST         essential         K08F4.1         WBGene00010839           CHL5_YEAST         non-         H06001.2         WBGene0001867           CND_YEAST         essential         T20G5.1         WBGene0001784           COD_YEAST         non-         Y39AlB.3         WBGene00021784           COD_YEAST         essential         Y51H7C_255.f         WBGene00021784           COD_YEAST         essential         Y51H7C_255.c         WBGene00021784           COD_YEAST         essential         Y51H7C_255.c         WBGene00012784           COP_YEAST         essential         Y71F9A_282.b         WBGene00012784           COP_YEAST         essential         Y71F9A_282.b         WBGene00012784           COP_YEAST         essential         Y71F9A_282.b         WBGene00012784           COP_YEAST         essential         Y71F9A_282.b         WBGene0001774           COP_YEAST         essential         Y1F9A_282.b         WBGene0001774           COP_YEAST         essential	CEFI_YEAST	3386 x	wBGene0000838
CG46_YEAST         non-         D1081.8         WBGene00015104           CH12_YEAST         essential         F1068.9         WBGene00010676           CH1_YEAST         essential         K08F4.1         WBGene00010369           CHL_YEAST         essential         K08F4.1         WBGene00010839           CHS5_YEAST         non-         H06001.2         WBGene0001867           CND_YEAST         essential         T2065.1         WBGene0001187           CNS1_YEAST         essential         T2065.1         WBGene00021784           COD1_YEAST         non-         Y51H7C_255.f         WBGene00021784           COD1_YEAST         non-         Y51H7C_255.c         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.c         WBGene00021292           COPA_YEAST         essential         Y51H7C_255.c         WBGene00019481           COPA_YEAST         essential         Y1F9A_282.b         WBGene0001774           COPA_YEAST         essential         Y1F9A_282.b         WBGene00000761           COQ1_YEAST         essential         T14610.5         WBGene0000761           COQ1_YEAST         essential         C30H7.1         WBGene00000761           COQ1_YEAST         essential		2667	WPConclose
CH12_YEAST         essential         F10G8.9         WBGene00010676           CHD1_YEAST         non-         B0280.9         WBGene00010369           CHL1_YEAST         essential         K08F4.1         WBGene00010839           CHS5_YEAST         non-         H06001.2         WBGene00012615           CLH_YEAST         essential         M03C11.2         WBGene0001867           CND1_YEAST         non-         ZC449.5         WBGene0001871           COD1_YEAST         non-         Y39A1B.3         WBGene0001784           COD1_YEAST         non-         Y51H7C_255.f         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.c         WBGene00011784           COD2_YEAST         essential         Y0779A282.b         WBGene00012784           COPA_YEAST         essential         Y71F9A_282.b         WBGene00012784           COPA_YEAST         essential         Y7251A.5         WBGene00012734           COPA_YEAST         essential         Y1460.5         WBGene00001333           COPA_YEAST         essential         T14610.5         WBGene00000761           COQ1_YEAST         essential         C24A11.3         WBGene00000761           COQ1_YEAST         essential         C307.1<	_		
CH12_YEAST         essential         F10G8.9         WBGene00010676           CHD1_YEAST         non-         B0280.9         WBGene00010369           CHL1_YEAST         essential         K08F4.1         WBGene00010839           CHS5_YEAST         non-         H06001.2         WBGene00012615           CLH_YEAST         essential         M03C11.2         WBGene0001867           CND1_YEAST         non-         ZC449.5         WBGene0001871           COD1_YEAST         non-         Y39A1B.3         WBGene0001784           COD1_YEAST         non-         Y51H7C_255.f         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.c         WBGene00011784           COD2_YEAST         essential         Y0779A282.b         WBGene00012784           COPA_YEAST         essential         Y71F9A_282.b         WBGene00012784           COPA_YEAST         essential         Y7251A.5         WBGene00012734           COPA_YEAST         essential         Y1460.5         WBGene00001333           COPA_YEAST         essential         T14610.5         WBGene00000761           COQ1_YEAST         essential         C24A11.3         WBGene00000761           COQ1_YEAST         essential         C307.1<	CG48 YEAST	5104 x	WBGene0001510
CHD1_YEAST         non-         B0280.9         WBGene00010369           CHL1_YEAST         essential         K08F4.1         WBGene00022615           CHS5_YEAST         non-         H06001.2         WBGene0001867           CLH_YEAST         essential         T2065.1         WBGene0001784           COD1_YEAST         non-         Y39AlB.3         WBGene00021784           COD1_YEAST         non-         Y51H7C_255.f         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.g         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.c         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.c         WBGene00019481           COPA_YEAST         essential         Y51H7C_255.c         WBGene000122192           COPD_YEAST         essential         Y071F9A_282.b         WBGene00012922           COPD_YEAST         essential         Y17F9A_282.b         WBGene00001773           COPZ_YEAST         essential         T14610.5         WBGene00001733           COQ1_YEAST         essential         F38E11.5         WBGene0000761           COQ1_YEAST         non-         C24A11.8         WBGene0000763           COQ2_YEAST         non-	_		
CHD1_YEAST         non-         B0280.9         WBGene00010369           CHL1_YEAST         essential         K08F4.1         WBGene00022615           CHS5_YEAST         non-         H06001.2         WBGene0001867           CLH_YEAST         essential         T2065.1         WBGene0001784           COD1_YEAST         non-         Y39AlB.3         WBGene00021784           COD1_YEAST         non-         Y51H7C_255.f         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.g         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.c         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.c         WBGene00019481           COPA_YEAST         essential         Y51H7C_255.c         WBGene000122192           COPD_YEAST         essential         Y071F9A_282.b         WBGene00012922           COPD_YEAST         essential         Y17F9A_282.b         WBGene00001773           COPZ_YEAST         essential         T14610.5         WBGene00001733           COQ1_YEAST         essential         F38E11.5         WBGene0000761           COQ1_YEAST         non-         C24A11.8         WBGene0000763           COQ2_YEAST         non-	CH12_YEAST	16./6	WBGene0001067
CHL1_YEASTessentialK08F4.1WBGene00010839CHS5_YEASTnon-H06001.2WBGene00022615CLH_YEASTessentialM03C11.2WBGene00011867CND1_YEASTnon-ZC449.5WBGene000187COD1_YEASTessentialT20G5.1WBGene00021784COD1_YEASTnon-Y39AlB.3WBGene00021784COD1_YEASTessentialC17G10.2WBGene00021784COD1_YEASTessentialY51H7C_255.fWBGene00021784COD2_YEASTessentialY51H7C_255.cWBGene00021784COD2_YEASTessentialY71F9A_282.bWBGene0002192COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00010333COQ1_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene0000761COQ1_YEASTessentialC30H7.1WBGene0000761COQ1_YEASTessentialC30H7.1WBGene0000764COQ4_YEASTnon-Y57G11C.11WBGene0000764COQ6_YEASTnon-Y57G11C.11WBGene00012553COXE_YEASTessentialF348.2WBGene00012895COXC_YEASTessentialF348.2WBGene00012855COX_YEASTessentialF348.2WBGene00012895COX_YEASTessentialF348.2WBGene00012895COX_YEASTessentialF348.2WBGene00012895COX_YEASTnon-Y37D8A.14WBGene00012895COX	_	1369	WBGene0001026
CHS5_YEAST         non-         H06001.2         WBGene00022615           CLH_YEAST         essential         M03C11.2         WBGene00011867           CND1_YEAST         non-         ZC449.5         WBGene0001087           CNS1_YEAST         essential         T2065.1         WBGene00021784           COD1_YEAST         essential         C17G10.2         WBGene00021784           COD1_YEAST         essential         C17G10.2         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.f         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.c         WBGene00019481           COPA_YEAST         essential         Y51H7C_255.c         WBGene000121292           COPD_YEAST         essential         Y71F9A_282.b         WBGene000121292           COPD_YEAST         essential         Y125C1A.5         WBGene00001753           COPLYEAST         essential         T14G10.5         WBGene00000761           COQ1_YEAST         essential         F38E11.5         WBGene00000763           COQ1_YEAST         essential         C24A11.8         WBGene00000764           COQ1_YEAST         essential         C24A11.3         WBGene00000764           COQ2_YEAST         non-	CHDI_IEASI	1309	MPGelle0001030
CHS5_YEAST         non-         H06001.2         WBGene00022615           CLH_YEAST         essential         M03C11.2         WBGene00011867           CND1_YEAST         non-         ZC449.5         WBGene0001087           CNS1_YEAST         essential         T2065.1         WBGene00021784           COD1_YEAST         essential         C17G10.2         WBGene00021784           COD1_YEAST         essential         C17G10.2         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.f         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.c         WBGene00019481           COPA_YEAST         essential         Y51H7C_255.c         WBGene000121292           COPD_YEAST         essential         Y71F9A_282.b         WBGene000121292           COPD_YEAST         essential         Y125C1A.5         WBGene00001753           COPLYEAST         essential         T14G10.5         WBGene00000761           COQ1_YEAST         essential         F38E11.5         WBGene00000763           COQ1_YEAST         essential         C24A11.8         WBGene00000764           COQ1_YEAST         essential         C24A11.3         WBGene00000764           COQ2_YEAST         non-	CHL1 YEAST	)839	WBGene0001083
CLH_YEAST         essential         M03C11.2         WBGene00011867           CND1_YEAST         non-         ZC449.5         WBGene00015916           CON1_YEAST         non-         Y39A1B.3         WBGene00021784           COD1_YEAST         essential         C17G10.2         WBGene00021784           COD1_YEAST         essential         C17G10.2         WBGene00021784           COD1_YEAST         essential         Y51H7C_255.f         WBGene00021784           COD2_YEAST         essential         Y51H7C_255.c         WBGene00021784           COPA_YEAST         essential         Y51H7C_255.c         WBGene00021292           COPA_YEAST         essential         Y71F9A_282.b         WBGene00012734           COPA_YEAST         essential         Y71F9A_282.b         WBGene00012734           COPA_YEAST         essential         Y1F9A_282.b         WBGene000012734           COPA_YEAST         essential         Y1F9A_282.b         WBGene00012734           COPA_YEAST         essential         Y1F9A_282.b         WBGene00001233           COQ1_YEAST         essential         T14G10.5         WBGene0000761           COQ1_YEAST         essential         C24A11.8         WBGene00000761           COQ2_YEAST <t< td=""><td>_</td><td></td><td></td></t<>	_		
CND1_YEASTnon-ZC449.5WBGene0001087CNS1_YEASTessentialT20G5.1WBGene00021784COD1_YEASTnon-Y39AlB.3WBGene00021784COD1_YEASTnon-Y51H7C_255.fWBGene00021784COD1_YEASTessentialY51H7C_255.fWBGene00021784COD2_YEASTessentialY51H7C_255.cWBGene00021292COPA_YEASTessentialY51H7C_255.cWBGene00021292COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00015734COPG_YEASTessentialY1F9A_282.bWBGene0000761COPP_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialC24Al1.8WBGene0000761COQ1_YEASTessentialC24Al1.3WBGene0000761COQ1_YEASTessentialC30H7.1WBGene0000763COQ1_YEASTessentialC30H7.1WBGene0000763COQ4_YEASTessentialT03F1.2WBGene00012553COX6_YEASTnon-K07B1.2WBGene00012553COX6_YEASTnon-Y37D8A.14WBGene000122170COX6_YEASTnon-Y71H2_388.cWBGene000122170COX6_YEASTnon-Y71H2_388.fWBGene000122170COX6_YEASTnon-Y71H2_388.fWBGene0001763COX2_YEASTessentialF54D8.2WBGene0001763COX2_YEASTessentialY71H2_388.fWBGene0001763COX2_YEASTnon-Y71H2_388.fWBGene0001763	CHS5_YEAST	2615	WBGene0002261
CND1_YEASTnon-ZC449.5WBGene0001087CNS1_YEASTessentialT20G5.1WBGene00021784COD1_YEASTnon-Y39AlB.3WBGene00021784COD1_YEASTnon-Y51H7C_255.fWBGene00021784COD1_YEASTessentialY51H7C_255.fWBGene00021784COD2_YEASTessentialY51H7C_255.cWBGene00021292COPA_YEASTessentialY51H7C_255.cWBGene00021292COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00015734COPG_YEASTessentialY1F9A_282.bWBGene0000761COPP_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialC24Al1.8WBGene0000761COQ1_YEASTessentialC24Al1.3WBGene0000761COQ1_YEASTessentialC30H7.1WBGene0000763COQ1_YEASTessentialC30H7.1WBGene0000763COQ4_YEASTessentialT03F1.2WBGene00012553COX6_YEASTnon-K07B1.2WBGene00012553COX6_YEASTnon-Y37D8A.14WBGene000122170COX6_YEASTnon-Y71H2_388.cWBGene000122170COX6_YEASTnon-Y71H2_388.fWBGene000122170COX6_YEASTnon-Y71H2_388.fWBGene0001763COX2_YEASTessentialF54D8.2WBGene0001763COX2_YEASTessentialY71H2_388.fWBGene0001763COX2_YEASTnon-Y71H2_388.fWBGene0001763	CTU VEACT	1867 x	WPConc0001186
CNS1_YEASTessentialT20G5.1WBGene00015916COD1_YEASTnon-Y39A1B.3WBGene00021784COD1_YEASTessentialC17G10.2WBGene00021784COD1_YEASTnon-Y51H7C_255.fWBGene00021784COD1_YEASTessentialY51H7C_255.gWBGene00021784COD2_YEASTessentialY51H7C_255.cWBGene00021784COPA_YEASTessentialY71F9A_282.bWBGene00021292COPB_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY1F9A_282.bWBGene0001775COPT_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene00000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTnon-F59E10.3WBGene00000761COQ1_YEASTnon-C24A11.8WBGene00000761COQ4_YEASTessentialC30H7.1WBGene00000763COX6_YEASTnon-Y77G11C.11WBGene00012553COXE_YEASTnon-Y37D8A.14WBGene00012553COXE_YEASTessentialF54D8.2WBGene00012895COXZ_YEASTnon-Y71H2_388.cWBGene00012895COXZ_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTnon-Y685.5WBGene00012895COXZ_YEASTnon-Y685.aWBGene00012875 <tr<< td=""><td>CLR_IEASI</td><td>L00/ X</td><td>MPGEHEOOOTT00</td></tr<<>	CLR_IEASI	L00/ X	MPGEHEOOOTT00
CNS1_YEASTessentialT20G5.1WBGene00015916COD1_YEASTnon-Y39A1B.3WBGene00021784COD1_YEASTessentialC17G10.2WBGene00021784COD1_YEASTnon-Y51H7C_255.fWBGene00021784COD1_YEASTessentialY51H7C_255.gWBGene00021784COD2_YEASTessentialY51H7C_255.cWBGene00021784COPA_YEASTessentialY71F9A_282.bWBGene00021292COPB_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY1F9A_282.bWBGene0001775COPT_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene00000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTnon-F59E10.3WBGene00000761COQ1_YEASTnon-C24A11.8WBGene00000761COQ4_YEASTessentialC30H7.1WBGene00000763COX6_YEASTnon-Y77G11C.11WBGene00012553COXE_YEASTnon-Y37D8A.14WBGene00012553COXE_YEASTessentialF54D8.2WBGene00012895COXZ_YEASTnon-Y71H2_388.cWBGene00012895COXZ_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTnon-Y685.5WBGene00012895COXZ_YEASTnon-Y685.aWBGene00012875 <tr<< td=""><td>CND1 YEAST</td><td>1087</td><td>WBGene0000108</td></tr<<>	CND1 YEAST	1087	WBGene0000108
COD1_YEASTnon-Y39A1B.3WBGene00021784COD1_YEASTessentialC17G10.2WBGene00021784COD1_YEASTnon-Y51H7C_255.fWBGene00021784COD1_YEASTessentialY51H7C_255.gWBGene00021784COD2_YEASTessentialY51H7C_255.cWBGene00021784COPA_YEASTessentialY51H7C_255.cWBGene00021292COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00015734COPT_YEASTessentialT14G10.5WBGene00009542COPT_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTessentialC24A11.8WBGene00000761COQ1_YEASTessentialC30H7.1WBGene00000764COQ6_YEASTnon-Y57G11C.11WBGene00000764COQ6_YEASTnon-Y37BA.14WBGene00012553COXE_YEASTessentialF54D8.2WBGene00012853COXE_YEASTessentialF54D8.2WBGene00012853COXE_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene0001763CSE1_YEASTessentialY46G5.aWBGene0001763CSE1_YEASTessentialF49E8.5WBGene0001763CK1_YEASTessentialF49E8.5WBGene00002079CK1_YEASTessentialF49E8.5 <td< td=""><td>_</td><td></td><td></td></td<>	_		
COD1_YEASTessentialC17G10.2WBGene00021784COD1_YEASTnon-Y51H7C_255.fWBGene00021784COD2_YEASTessentialY51H7C_255.gWBGene00021784COD2_YEASTessentialY51H7C_255.cWBGene00022119COPA_YEASTessentialY51H7C_255.cWBGene00021292COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00019542COPT_YEASTessentialT14G10.5WBGene00009542COPT_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene0000761COQ1_YEASTessentialC24A11.8WBGene0000763COQ4_YEASTessentialC30H7.1WBGene0000764COQ6_YEASTnon-Y57G11C.11WBGene0000768COXG_YEASTnon-Y37D8A.14WBGene00012553COXE_YEASTessentialF54D8.2WBGene00012850COXG_YEASTnon-Y71H2_388.cWBGene00012895COXG_YEASTnon-Y71H2_388.cWBGene00012895COXG_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTessentialY46G5.aWBGene00012895COXZ_YEASTnon-JC8.5WBGene00012895COXZ_YEASTnon-Y64S1A_54.bWBGene0001763CSE1_YEASTessentialY44G1A_54.cWBGene0000279CSE1_YEASTessentialF49E8.5WBGene0000735 <td>CNS1_YEAST</td> <td>5916</td> <td>WBGene0001591</td>	CNS1_YEAST	5916	WBGene0001591
COD1_YEASTessentialC17G10.2WBGene00021784COD1_YEASTnon-Y51H7C_255.fWBGene00021784COD2_YEASTessentialY51H7C_255.gWBGene00021784COD2_YEASTessentialY51H7C_255.cWBGene00022119COPA_YEASTessentialY51H7C_255.cWBGene00021292COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00019542COPT_YEASTessentialT14G10.5WBGene00009542COPT_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene0000761COQ1_YEASTessentialC24A11.8WBGene0000763COQ4_YEASTessentialC30H7.1WBGene0000764COQ6_YEASTnon-Y57G11C.11WBGene0000768COXG_YEASTnon-Y37D8A.14WBGene00012553COXE_YEASTessentialF54D8.2WBGene00012850COXG_YEASTnon-Y71H2_388.cWBGene00012895COXG_YEASTnon-Y71H2_388.cWBGene00012895COXG_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTessentialY46G5.aWBGene00012895COXZ_YEASTnon-JC8.5WBGene00012895COXZ_YEASTnon-Y64S1A_54.bWBGene0001763CSE1_YEASTessentialY44G1A_54.cWBGene0000279CSE1_YEASTessentialF49E8.5WBGene0000735 <td>COD1 VEACT</td> <td>170/ 17</td> <td>WDCopo0002179</td>	COD1 VEACT	170/ 17	WDCopo0002179
COD1_YEASTnon-Y51H7C_255.fWBGene00021784COD1_YEASTessentialY51H7C_255.gWBGene00021784COD2_YEASTessentialY51H7C_255.bWBGene00022119COPA_YEASTessentialY51H7C_255.cWBGene00021292COPD_YEASTessentialK07C11.9WBGene00012734COPD_YEASTessentialY71F9A_282.bWBGene00017734COPD_YEASTessentialY25C1A.5WBGene00015734COPT_YEASTessentialT14G10.5WBGene00009542COPT_YEASTessentialF38E11.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene0000761COQ1_YEASTessentialC24A11.8WBGene0000763COQ4_YEASTessentialC30H7.1WBGene0000764COQ4_YEASTessentialT03F1.2WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012553COXE_YEASTessentialF54D8.2WBGene00012553COXE_YEASTessentialF54D8.2WBGene00012855COXE_YEASTessentialF54D8.2WBGene00012855COXE_YEASTessentialF54D8.2WBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTnon-JC8.5WBGene00017763CSE1_YEASTessentialF49E8.5WBGene00017763CSE1_YEASTnon-F23H11.9WBGene0000279CSE1_YEASTnon-Y48G1A_54.cWBGe	CODI_IEASI	1784   x	MPGelle00021/0
COD1_YEASTnon-Y51H7C_255.fWBGene00021784COD1_YEASTessentialY51H7C_255.gWBGene00021784COD2_YEASTessentialY51H7C_255.bWBGene00022119COPA_YEASTessentialY51H7C_255.cWBGene00021292COPD_YEASTessentialK07C11.9WBGene00012734COPD_YEASTessentialY71F9A_282.bWBGene00017734COPD_YEASTessentialY25C1A.5WBGene00015734COPT_YEASTessentialT14G10.5WBGene00009542COPT_YEASTessentialF38E11.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene0000761COQ1_YEASTessentialC24A11.8WBGene0000763COQ4_YEASTessentialC30H7.1WBGene0000764COQ4_YEASTessentialT03F1.2WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012553COXE_YEASTessentialF54D8.2WBGene00012553COXE_YEASTessentialF54D8.2WBGene00012855COXE_YEASTessentialF54D8.2WBGene00012855COXE_YEASTessentialF54D8.2WBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTnon-JC8.5WBGene00017763CSE1_YEASTessentialF49E8.5WBGene00017763CSE1_YEASTnon-F23H11.9WBGene0000279CSE1_YEASTnon-Y48G1A_54.cWBGe	COD1 YEAST	1784 x	WBGene0002178
COD1_YEASTessentialY51H7C_255.gWBGene00021784COD2_YEASTessentialY51H7C_255.bWBGene00019481COPA_YEASTessentialY51H7C_255.cWBGene00021292COPB_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY175A_282.bWBGene00015734COPG_YEASTessentialY169A_282.bWBGene00015734COPG_YEASTessentialY169A_282.bWBGene00015734COPT_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTessentialC24A11.8WBGene00000763COQ4_YEASTessentialC30H7.1WBGene00000764COQ6_YEASTnon-Y57G11C.11WBGene00000766COX6_YEASTnon-Y37D8A.14WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012800COXG_YEASTnon-Y71H2_388.cWBGene00012870COXG_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene0001763CRC1_YEASTessentialY465.aWBGene0001763CRC1_YEASTessentialY4665.aWBGene0001763CRC1_YEASTessentialF49E8.5WBGene00002079CK1_YEASTnon-JC8.5 </td <td>_</td> <td></td> <td></td>	_		
COD1_YEASTessentialY51H7C_255.gWBGene00021784COD2_YEASTessentialY51H7C_255.bWBGene00019481COPA_YEASTessentialY51H7C_255.cWBGene00021292COPB_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY175A_282.bWBGene00015734COPG_YEASTessentialY169A_282.bWBGene00015734COPG_YEASTessentialY169A_282.bWBGene00015734COPT_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTessentialC24A11.8WBGene00000763COQ4_YEASTessentialC30H7.1WBGene00000764COQ6_YEASTnon-Y57G11C.11WBGene00000766COX6_YEASTnon-Y37D8A.14WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012800COXG_YEASTnon-Y71H2_388.cWBGene00012870COXG_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene0001763CRC1_YEASTessentialY465.aWBGene0001763CRC1_YEASTessentialY4665.aWBGene0001763CRC1_YEASTessentialF49E8.5WBGene00002079CK1_YEASTnon-JC8.5 </td <td>COD1_YEAST</td> <td>1784</td> <td>WBGene0002178</td>	COD1_YEAST	1784	WBGene0002178
COD2_YEASTessentialY51H7C_255.bWBGene00019481COPA_YEASTessentialY51H7C_255.cWBGene00022119COPB_YEASTessentialK07C11.9WBGene00021292COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00011775COPP_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene00000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTessentialC24A11.8WBGene00000761COQ1_YEASTessentialC30H7.1WBGene00000764COQ4_YEASTessentialT03F1.2WBGene00000764COQ6_YEASTnon-K77G11C.11WBGene00000768COX6_YEASTnon-K07B1.2WBGene00012553COXE_YEASTessentialF04B4.2WBGene00012553COXE_YEASTessentialF54D8.2WBGene000122170COXG_YEASTnon-Y71H2_388.cWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY46G5.aWBGene00012895COXZ_YEASTessentialF49E8.5WBGene00002079CS1_YEASTessentialF49E8.5WBGene00002079CS1_YEASTessentialF49E8.5WBGene00002079CXX_YEASTessentialF49E8.5WBGene00002079CXX_YEASTessentialF49E8.5WBGene00002079CXX_YEASTessentialF49E8.5WBGene00002079<	COD1 VEACE	1704	WDCom 0000170
COPA_YEASTessentialY51H7C_255.cWBGene00022119COPB_YEASTessentialK07C11.9WBGene00021292COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00011775COPP_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTessentialC24A11.8WBGene00000761COQ3_YEASTnon-C24A11.3WBGene00000763COQ4_YEASTessentialC30H7.1WBGene00000764COQ6_YEASTnon-Y57G11C.11WBGene00000766COR0_YEASTessentialT03F1.2WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012853COXE_YEASTnon-Y71B2_388.cWBGene000122170COXG_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTessentialY1H2_388.fWBGene00012895COXZ_YEASTessentialY46G5.aWBGene0001763CRC1_YEASTessentialF49E8.5WBGene0001763CS1_YEASTessentialF49E8.5WBGene0001763CS2_YEASTnon-JC8.5WBGene0001763CXX_YEASTessentialY1H2_388.fWBGene00012895COXZ_YEASTnon-Y28.5WBGene0001763CS1_YEASTnon-Y48G1A_54.bWBGene00002079CS1_YEASTessentialF49E8.5WBGene00007135CW41_Y	CODI_IEASI	1784 x	MPGelle00021/0
COPA_YEASTessentialY51H7C_255.cWBGene00022119COPB_YEASTessentialK07C11.9WBGene00021292COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00011775COPP_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTessentialC24A11.8WBGene00000761COQ3_YEASTnon-C24A11.3WBGene00000763COQ4_YEASTessentialC30H7.1WBGene00000764COQ6_YEASTnon-Y57G11C.11WBGene00000766COR0_YEASTessentialT03F1.2WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012853COXE_YEASTnon-Y71B2_388.cWBGene000122170COXG_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTessentialY1H2_388.fWBGene00012895COXZ_YEASTessentialY46G5.aWBGene0001763CRC1_YEASTessentialF49E8.5WBGene0001763CS1_YEASTessentialF49E8.5WBGene0001763CS2_YEASTnon-JC8.5WBGene0001763CXX_YEASTessentialY1H2_388.fWBGene00012895COXZ_YEASTnon-Y28.5WBGene0001763CS1_YEASTnon-Y48G1A_54.bWBGene00002079CS1_YEASTessentialF49E8.5WBGene00007135CW41_Y	COD2 YEAST	9481	WBGene0001948
COPB_YEASTessentialK07C11.9WBGene00021292COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00009542COPP_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene0000761COQ1_YEASTessentialF38E11.5WBGene0000761COQ1_YEASTnon-F59E10.3WBGene00000761COQ1_YEASTessentialC24A11.8WBGene00000761COQ3_YEASTnon-C24A11.3WBGene00000763COQ4_YEASTessentialC30H7.1WBGene00000766COQ6_YEASTnon-Y57G11C.11WBGene00000768COX6_YEASTnon-K07B1.2WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012553COXE_YEASTnon-Y37D8A.14WBGene000122170COXG_YEASTnon-Y71H2_388.cWBGene00012895COXZ_YEASTnon-Y71H2_388.fWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene0001763CSE1_YEASTnon-JC8.5WBGene0001763CSE1_YEASTnon-JC8.5WBGene0001763CSE1_YEASTnon-F23H11.9WBGene0001763CTK1_YEASTessentialY48G1A_54.bWBGene00007135CW41_YEASTessentialB0285.1WBGene00011413	_		
COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00009542COPP_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene00000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTnon-F59E10.3WBGene00000761COQ1_YEASTessentialC24A11.8WBGene00000761COQ3_YEASTnon-C24A11.3WBGene00000763COQ4_YEASTessentialC30H7.1WBGene00000766COQ6_YEASTnon-Y57G11C.11WBGene00000766COX6_YEASTnon-K07B1.2WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012553COXE_YEASTnon-Y37D8A.14WBGene000122170COXG_YEASTnon-Y71H2_388.cWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTnon-T06D8.5WBGene00010437CRC1_YEASTessentialY46G5.aWBGene0001763CSE1_YEASTnon-F23H11.9WBGene0001763CSE1_YEASTnon-F23H11.9WBGene0001763CSE1_YEASTnon-F49E8.5WBGene0001735CTK1_YEASTessentialY48G1A_54.bWBGene00007135CW41_YEASTessentialB0285.1WBGene00001743	COPA_YEAST	2119   x	WBGene0002211
COPD_YEASTessentialY71F9A_282.bWBGene00015734COPG_YEASTessentialY25C1A.5WBGene00009542COPP_YEASTnon-C13B9.3WBGene00009542COPZ_YEASTessentialT14G10.5WBGene00000761COQ1_YEASTessentialF38E11.5WBGene00000761COQ1_YEASTnon-F59E10.3WBGene00000761COQ1_YEASTessentialC24A11.8WBGene00000761COQ3_YEASTnon-C24A11.3WBGene00000763COQ4_YEASTessentialC30H7.1WBGene00000766COQ6_YEASTnon-Y57G11C.11WBGene00000766COX6_YEASTnon-K07B1.2WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012553COXE_YEASTnon-Y37D8A.14WBGene000122170COXG_YEASTnon-Y71H2_388.cWBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTnon-T06D8.5WBGene00010437CRC1_YEASTessentialY46G5.aWBGene0001763CSE1_YEASTnon-F23H11.9WBGene0001763CSE1_YEASTnon-F23H11.9WBGene0001763CSE1_YEASTnon-F49E8.5WBGene0001735CTK1_YEASTessentialY48G1A_54.bWBGene00007135CW41_YEASTessentialB0285.1WBGene00001743		1 2 0 2	WDCom 0000100
COPG_YEAST       essential       Y25C1A.5       WBGene00011775         COPP_YEAST       non-       C13B9.3       WBGene00009542         COPZ_YEAST       essential       T14G10.5       WBGene00000761         COQ1_YEAST       essential       F38E11.5       WBGene00000761         COQ1_YEAST       essential       C24A11.8       WBGene00000761         COQ3_YEAST       non-       C24A11.3       WBGene00000763         COQ4_YEAST       essential       C30H7.1       WBGene00000764         COQ6_YEAST       non-       Y57G11C.11       WBGene00000768         COX6_YEAST       non-       Y57G11C.11       WBGene00012553         COX6_YEAST       non-       K07B1.2       WBGene00012553         COX6_YEAST       non-       Y37D8A.14       WBGene00012553         COXG_YEAST       essential       F54D8.2       WBGene00012805         COXG_YEAST       non-       Y71H2_388.c       WBGene00012895         COXG_YEAST       non-       Y71H2_388.c       WBGene00012895         COXZ_YEAST       non-       T06D8.5       WBGene00012895         COXZ_YEAST       non-       J28.5       WBGene0001279         COXZ_YEAST       non-       J28.5       WBGene000020	COPB_ILASI	1292   x	WEGENEOUOZIZS
COPG_YEAST       essential       Y25C1A.5       WBGene00011775         COPP_YEAST       non-       C13B9.3       WBGene00009542         COPZ_YEAST       essential       T14G10.5       WBGene00000761         COQ1_YEAST       essential       F38E11.5       WBGene00000761         COQ1_YEAST       essential       C24A11.8       WBGene00000761         COQ3_YEAST       non-       C24A11.3       WBGene00000763         COQ4_YEAST       essential       C30H7.1       WBGene00000764         COQ6_YEAST       non-       Y57G11C.11       WBGene00000768         COX6_YEAST       non-       Y57G11C.11       WBGene00012553         COX6_YEAST       non-       K07B1.2       WBGene00012553         COX6_YEAST       non-       Y37D8A.14       WBGene00012553         COXG_YEAST       essential       F54D8.2       WBGene00012805         COXG_YEAST       non-       Y71H2_388.c       WBGene00012895         COXG_YEAST       non-       Y71H2_388.c       WBGene00012895         COXZ_YEAST       non-       T06D8.5       WBGene00012895         COXZ_YEAST       non-       J28.5       WBGene0001279         COXZ_YEAST       non-       J28.5       WBGene000020	COPD YEAST	5734 x	WBGene0001573
COPP_YEAST         non-         C13B9.3         WBGene00009542           COPZ_YEAST         essential         T14G10.5         WBGene00010333           COQ1_YEAST         essential         F38E11.5         WBGene00000761           COQ1_YEAST         non-         F59E10.3         WBGene00000761           COQ1_YEAST         essential         C24A11.8         WBGene00000763           COQ4_YEAST         essential         C30H7.1         WBGene00000764           COQ6_YEAST         non-         Y57G11C.11         WBGene00000766           CORO_YEAST         essential         T03F1.2         WBGene00000768           COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         non-         X37D8A.14         WBGene00012850           COXG_YEAST         non-         Y7H2_388.c         WBGene00012805           COXG_YEAST         non-         Y7H42_388.c         WBGene00012895           COXG_YEAST         non-         Y7H2_388.c         WBGene00012895           COXG_YEAST         non-         Y7H2_388.c         WBGene00012895           COXZ_YEAST         non-         J7H2_388.c         WBGene00012895           COXZ_YEAST         non-         J28.5         WBGene0000			
COPP_YEAST         non-         C13B9.3         WBGene00009542           COPZ_YEAST         essential         T14G10.5         WBGene00010333           COQ1_YEAST         essential         F38E11.5         WBGene00000761           COQ1_YEAST         non-         F59E10.3         WBGene00000761           COQ1_YEAST         essential         C24A11.8         WBGene00000763           COQ4_YEAST         essential         C30H7.1         WBGene00000764           COQ6_YEAST         non-         Y57G11C.11         WBGene00000766           CORO_YEAST         essential         T03F1.2         WBGene00000768           COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         non-         X37D8A.14         WBGene00012850           COXG_YEAST         non-         Y7H2_388.c         WBGene00012805           COXG_YEAST         non-         Y7H42_388.c         WBGene00012895           COXG_YEAST         non-         Y7H2_388.c         WBGene00012895           COXG_YEAST         non-         Y7H2_388.c         WBGene00012895           COXZ_YEAST         non-         J7H2_388.c         WBGene00012895           COXZ_YEAST         non-         J28.5         WBGene0000	COPG_YEAST	1775   x	WBGene0001177
COPZ_YEAST         essential         T14G10.5         WBGene00010333           COQ1_YEAST         essential         F38E11.5         WBGene00000761           COQ1_YEAST         non-         F59E10.3         WBGene00000761           COQ1_YEAST         essential         C24A11.8         WBGene00000763           COQ4_YEAST         non-         C24A11.3         WBGene00000764           COQ6_YEAST         non-         C24A11.3         WBGene00000764           COQ6_YEAST         non-         Y57G11C.11         WBGene00000766           COX6_YEAST         essential         T03F1.2         WBGene00000768           COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00012850           COXG_YEAST         non-         Y37D8A.14         WBGene00012800           COXG_YEAST         non-         Y71H2_388.c         WBGene00012895           COXZ_YEAST         non-         Y71H2_388.c         WBGene0001437           COXZ_YEAST         non-         J668.5         WBGene0001763           COXZ_YEAST         non-         J78.5         WBGene00012895           COXZ_YEAST         non-         J68.5         WBGene0001279		9542 x	WPConclose4
COQ1_YEAST       essential       F38E11.5       WBGene00000761         COQ1_YEAST       non-       F59E10.3       WBGene00000761         COQ1_YEAST       essential       C24A11.8       WBGene00000761         COQ3_YEAST       non-       C24A11.3       WBGene00000763         COQ4_YEAST       essential       C30H7.1       WBGene00000764         COQ6_YEAST       non-       Y57G11C.11       WBGene00000766         CORO_YEAST       essential       T03F1.2       WBGene00000768         COX6_YEAST       non-       K07B1.2       WBGene00012553         COXE_YEAST       essential       R01H10.3       WBGene00012853         COXG_YEAST       non-       Y37D8A.14       WBGene000128170         COXG_YEAST       non-       Y71H2_388.c       WBGene000122170         COXG_YEAST       non-       Y71H2_388.c       WBGene000122170         COXM_YEAST       non-       Y71H2_388.f       WBGene00012895         COXZ_YEAST       non-       T06D8.5       WBGene0001437         CRC1_YEAST       essential       Y46G5.a       WBGene0001763         CNZ_YEAST       non-       J28.5       WBGene00002079         CSE1_YEAST       non-       J28.5       WBGene0000	COPP_IEASI	JIZ A	MPG6II60000334
COQ1_YEAST       essential       F38E11.5       WBGene00000761         COQ1_YEAST       non-       F59E10.3       WBGene00000761         COQ1_YEAST       essential       C24A11.8       WBGene00000761         COQ3_YEAST       non-       C24A11.3       WBGene00000763         COQ4_YEAST       essential       C30H7.1       WBGene00000764         COQ6_YEAST       non-       Y57G11C.11       WBGene00000766         CORO_YEAST       essential       T03F1.2       WBGene00000768         COX6_YEAST       non-       K07B1.2       WBGene00012553         COXE_YEAST       essential       R01H10.3       WBGene00012853         COXG_YEAST       non-       Y37D8A.14       WBGene000128170         COXG_YEAST       non-       Y71H2_388.c       WBGene000122170         COXG_YEAST       non-       Y71H2_388.c       WBGene000122170         COXM_YEAST       non-       Y71H2_388.f       WBGene00012895         COXZ_YEAST       non-       T06D8.5       WBGene0001437         CRC1_YEAST       essential       Y46G5.a       WBGene0001763         CNZ_YEAST       non-       J28.5       WBGene00002079         CSE1_YEAST       non-       J28.5       WBGene0000	COPZ YEAST	)333 x	WBGene0001033
COQ1_YEAST       non-       F59E10.3       WBGene00000761         COQ1_YEAST       essential       C24A11.8       WBGene00000761         COQ3_YEAST       non-       C24A11.3       WBGene00000763         COQ4_YEAST       essential       C30H7.1       WBGene00000764         COQ6_YEAST       non-       Y57G11C.11       WBGene00000766         CORO_YEAST       essential       T03F1.2       WBGene00000768         COX6_YEAST       non-       K07B1.2       WBGene00012553         COXE_YEAST       essential       R01H10.3       WBGene00012853         COXG_YEAST       non-       Y37D8A.14       WBGene00022170         COXG_YEAST       non-       Y71H2_388.c       WBGene00012895         COXG_YEAST       non-       Y71H2_388.f       WBGene00012895         COXZ_YEAST       non-       T06D8.5       WBGene0001437         CRC1_YEAST       cssential       Y46G5.a       WBGene0001763         CSE1_YEAST       non-       J28.5       WBGene00002079         CSE1_YEAST       essential       F49E8.5       WBGene00002079         CTK1_YEAST       essential       Y48G1A_54.b       WBGene00007135         CTK1_YEAST       essential       B0285.1       W	_		
COQ1_YEASTessentialC24A11.8WBGene00000761COQ3_YEASTnon-C24A11.3WBGene00000763COQ4_YEASTessentialC30H7.1WBGene00000764COQ6_YEASTnon-Y57G11C.11WBGene00000766COR0_YEASTessentialT03F1.2WBGene00000768COX6_YEASTnon-K07B1.2WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012850COXG_YEASTnon-Y37D8A.14WBGene00022170COXG_YEASTnon-Y71H2_388.cWBGene00012895COXZ_YEASTessentialF54D8.2WBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY46G5.aWBGene00010437CRC1_YEASTessentialF49E8.5WBGene00017763CSE1_YEASTessentialF49E8.5WBGene00002079CSE1_YEASTessentialY48G1A_54.bWBGene00007135CTK1_YEASTessentialY48G1A_54.cWBGene00007135CW41_YEASTessentialB0285.1WBGene00001413	COQ1_YEAST	J761	WBGene0000076
COQ1_YEASTessentialC24A11.8WBGene00000761COQ3_YEASTnon-C24A11.3WBGene00000763COQ4_YEASTessentialC30H7.1WBGene00000764COQ6_YEASTnon-Y57G11C.11WBGene00000766COR0_YEASTessentialT03F1.2WBGene00000768COX6_YEASTnon-K07B1.2WBGene00012553COXE_YEASTessentialR01H10.3WBGene00012850COXG_YEASTnon-Y37D8A.14WBGene00022170COXG_YEASTnon-Y71H2_388.cWBGene00012895COXZ_YEASTessentialF54D8.2WBGene00012895COXZ_YEASTessentialY71H2_388.fWBGene00012895COXZ_YEASTessentialY46G5.aWBGene00010437CRC1_YEASTessentialF49E8.5WBGene00017763CSE1_YEASTessentialF49E8.5WBGene00002079CSE1_YEASTessentialY48G1A_54.bWBGene00007135CTK1_YEASTessentialY48G1A_54.cWBGene00007135CW41_YEASTessentialB0285.1WBGene00001413	COOL VENCT	1761	WPC00000076
COQ3_YEAST         non-         C24A11.3         WBGene00000763           COQ4_YEAST         essential         C30H7.1         WBGene00000764           COQ6_YEAST         non-         Y57G11C.11         WBGene00000766           CORO_YEAST         essential         T03F1.2         WBGene00000768           COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00012850           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00012895           COXW_YEAST         non-         Y71H2_388.c         WBGene00012895           COXZ_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00012895           COXZ_YEAST         non-         JC8.5         WBGene00012877           CRC1_YEAST         essential         Y46G5.a         WBGene0001763           CSE1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGe			
COQ3_YEAST         non-         C24A11.3         WBGene00000763           COQ4_YEAST         essential         C30H7.1         WBGene00000764           COQ6_YEAST         non-         Y57G11C.11         WBGene00000766           CORO_YEAST         essential         T03F1.2         WBGene00000768           COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00012850           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00012895           COXW_YEAST         non-         Y71H2_388.c         WBGene00012895           COXZ_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00012895           COXZ_YEAST         non-         JC8.5         WBGene00012877           CRC1_YEAST         essential         Y46G5.a         WBGene0001763           CSE1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGe	COQ1 YEAST	J761	WBGene0000076
COQ4_YEAST         essential         C30H7.1         WBGene00000764           COQ6_YEAST         non-         Y57G11C.11         WBGene00000766           CORO_YEAST         essential         T03F1.2         WBGene00000768           COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00012800           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00012895           COXG_YEAST         essential         F54D8.2         WBGene000122170           COXG_YEAST         non-         Y71H2_388.c         WBGene000122170           COXX_YEAST         non-         Y71H2_388.c         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y4695.a         WBGene0001763           CSE1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGen			
COQ6_YEAST         non-         Y57G11C.11         WBGene00000766           CORO_YEAST         essential         T03F1.2         WBGene00000768           COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00022170           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00022170           COXG_YEAST         non-         Y71H2_388.c         WBGene00012895           COXX_YEAST         non-         T06D8.5         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00012895           COXZ_YEAST         non-         JC8.5         WBGene00012895           COXI_YEAST         non-         JC8.5         WBGene0001763           CRC1_YEAST         non-         JC8.5         WBGene00002079           CRS1_YEAST         non-         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135	COQ3_TEAST	2011	wBGene00000/6
COQ6_YEAST         non-         Y57G11C.11         WBGene00000766           CORO_YEAST         essential         T03F1.2         WBGene00000768           COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00022170           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00022170           COXG_YEAST         non-         Y71H2_388.c         WBGene00012895           COXX_YEAST         non-         T06D8.5         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00012895           COXZ_YEAST         non-         JC8.5         WBGene00012895           COXI_YEAST         non-         JC8.5         WBGene0001763           CRC1_YEAST         non-         JC8.5         WBGene00002079           CRS1_YEAST         non-         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135	COO4 YEAST	)764	WBGene0000076
CORO_YEAST         essential         T03F1.2         WBGene00000768           COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00012553           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00022170           COXW_YEAST         non-         Y71H2_388.c         WBGene00011526           COXX_YEAST         essential         Y71H2_388.c         WBGene00012895           COXZ_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00017763           CSE1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1			
COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00018800           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00022170           COXM_YEAST         non-         Y71H2_388.c         WBGene00012895           COXX_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00017763           CSE1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00011413	COQ6_YEAST	J'/66	WBGene0000076
COX6_YEAST         non-         K07B1.2         WBGene00012553           COXE_YEAST         essential         R01H10.3         WBGene00018800           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00022170           COXM_YEAST         non-         Y71H2_388.c         WBGene00012895           COXX_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00017763           CSE1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00011413	~ —	1768	WRGeno0000076
COXE_YEAST         essential         R01H10.3         WBGene00018800           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00022170           COXW_YEAST         non-         Y71H2_388.c         WBGene00011526           COXX_YEAST         essential         Y71H2_388.c         WBGene00012895           COXZ_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00017763           CSE1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00011413			
COXE_YEAST         essential         R01H10.3         WBGene00018800           COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00022170           COXW_YEAST         non-         Y71H2_388.c         WBGene00011526           COXX_YEAST         essential         Y71H2_388.c         WBGene00012895           COXZ_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00017763           CSE1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00011413	COX6 YEAST	2553 x	WBGene0001255
COXG_YEAST         non-         Y37D8A.14         WBGene00022170           COXG_YEAST         essential         F54D8.2         WBGene00022170           COXW_YEAST         non-         Y71H2_388.c         WBGene00011526           COXX_YEAST         essential         Y71H2_388.c         WBGene00012895           COXZ_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00000996           CRD1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00001413			
COXG_YEAST         essential         F54D8.2         WBGene00022170           COXW_YEAST         non-         Y71H2_388.c         WBGene00011526           COXX_YEAST         essential         Y71H2_388.c         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00010996           CRD1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	COXE_YEAST	3800	wBGene0001880
COXG_YEAST         essential         F54D8.2         WBGene00022170           COXW_YEAST         non-         Y71H2_388.c         WBGene00011526           COXX_YEAST         essential         Y71H2_388.c         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00010996           CRD1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	COXC VENCT	2170 x	WRGenelloogia
COXW_YEAST         non-         Y71H2_388.c         WBGene00011526           COXX_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00000996           CRD1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	_		
COXW_YEAST         non-         Y71H2_388.c         WBGene00011526           COXX_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00000996           CRD1_YEAST         non-         JC8.5         WBGene00002079           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	COXG YEAST	2170	WBGene0002217
COXX_YEAST         essential         Y71H2_388.f         WBGene00012895           COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00010996           CRD1_YEAST         non-         JC8.5         WBGene00017763           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413			
COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00000996           CRD1_YEAST         non-         JC8.5         WBGene000017763           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	COXW_YEAST	1526	wBGene0001152
COXZ_YEAST         non-         T06D8.5         WBGene00010437           CRC1_YEAST         essential         Y46G5.a         WBGene00000996           CRD1_YEAST         non-         JC8.5         WBGene000017763           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	COXX VEACT	2895	WBGene0001200
CRC1_YEAST         essential         Y46G5.a         WBGene00000996           CRD1_YEAST         non-         JC8.5         WBGene00017763           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	_		
CRC1_YEAST         essential         Y46G5.a         WBGene00000996           CRD1_YEAST         non-         JC8.5         WBGene00017763           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	COXZ YEAST	)437	WBGene0001043
CRD1_YEAST         non-         JC8.5         WBGene00017763           CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413			
CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	CRC1_YEAST	סצבו	wBGene0000098
CSE1_YEAST         essential         F49E8.5         WBGene00002079           CSE1_YEAST         non-         F23H11.9         WBGene00002079           CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	CRD1 YEAST	7763	WBGene0001776
CSE1_YEASTnon-F23H11.9WBGene00002079CTK1_YEASTessentialY48G1A_54.bWBGene00007135CTK1_YEASTnon-Y48G1A_54.cWBGene00007135CW41_YEASTessentialB0285.1WBGene00008775CW43_YEASTessentialB0285.2WBGene00011413	_		
CSE1_YEASTnon-F23H11.9WBGene00002079CTK1_YEASTessentialY48G1A_54.bWBGene00007135CTK1_YEASTnon-Y48G1A_54.cWBGene00007135CW41_YEASTessentialB0285.1WBGene00008775CW43_YEASTessentialB0285.2WBGene00011413	CSE1_YEAST	2079 x	WBGene0000207
CTK1_YEAST         essential         Y48G1A_54.b         WBGene00007135           CTK1_YEAST         non-         Y48G1A_54.c         WBGene00007135           CW41_YEAST         essential         B0285.1         WBGene00008775           CW43_YEAST         essential         B0285.2         WBGene00011413	_		
CTK1_YEASTnon-Y48G1A_54.cWBGene00007135CW41_YEASTessentialB0285.1WBGene00008775CW43_YEASTessentialB0285.2WBGene00011413	COLT_IFASI		
CTK1_YEASTnon-Y48G1A_54.cWBGene00007135CW41_YEASTessentialB0285.1WBGene00008775CW43_YEASTessentialB0285.2WBGene00011413	CTK1 YEAST	7135 x	WBGene0000713
CW41_YEASTessentialB0285.1WBGene00008775CW43_YEASTessentialB0285.2WBGene00011413			
CW41_YEASTessentialB0285.1WBGene00008775CW43_YEASTessentialB0285.2WBGene00011413	CTK1_YEAST	7135   x	WBGene0000713
CW43_YEAST essential B0285.2 WBGene00011413	_		
—	CMAT_TEAST	5//5	MBGette00008//
—	CW43 YEAST	1413	WBGene0001141
	_		
CY1_YEAST non- F13H10.4 WBGene00000869	CY1_YEAST	1869	WBGene0000086
	_		
—		204/	wbgeneuuuuy64
CYB2_YEAST essential C54G4.8 WBGene00018286	CYB2 YEAST	3286	WBGene0001828

DAN4_YEAST	essential	F43C1.1	WBGene00021761	
DAP1_YEAST	essential	F41E6.5	WBGene00006890	
DBP5 YEAST	essential	Y51B11A.a	WBGene00011580	
DBP9_YEAST	essential	K07E3.8	WBGene00016073	x
DBR1_YEAST	essential	T07D4.4	WBGene00000937	
DCAM_YEAST	essential	C24H12.4	WBGene00004875	
DCAM_IEASI DCTD YEAST		C55B7.8	WBGene00014034	
_	essential			
DF10_YEAST	essential	F47G4.7	WBGene00007102	
DHH1_YEAST	non-	ZK643.2	WBGene00000479	х
DHR1_YEAST	essential	B0024.13	WBGene00015525	x
DHSB_YEAST	essential	С07Н6.5	WBGene00006433	х
DIE2_YEAST	non-	C06E1.10	WBGene00011987	
DIM1_YEAST	essential	F42A8.2	WBGene00008455	x
DIP2_YEAST	essential	T24D1.4	WBGene00017435	
DLDH YEAST	essential	E02H1.1	WBGene00010794	x
DNA2_YEAST	essential	F13H8.2	WBGene00001016	
DNLI_YEAST	non-	LLC1.3	WBGene00002985	x
DNM1_YEAST	essential	F43G6.1	WBGene00001093	<b>X</b>
_				
DNPE_YEAST	non-	C29A12.3	WBGene00017163	
DO34_YEAST	essential	T12E12.4	WBGene00011280	
DOA1_YEAST	non-	F01F1.9	WBGene00007333	
DOR1_YEAST	essential	R74.6	WBGene00011736	
DPB2_YEAST	non-	C05C10.6	WBGene00017237	
DPB3_YEAST	essential	T12D8.9	WBGene00013150	
DPD2_YEAST	non-	F08B4.5	WBGene00008722	x
DPD3_YEAST	essential	Y53F4B.d	WBGene00011016	
DPH2_YEAST	non-	F12F6.7	WBGene00007488	
DPH5_YEAST	essential	R04F11.3	WBGene00007194	
DPO2_YEAST	non-	C09G5.3	WBGene00001002	x
_	-			
DPOA_YEAST	essential	B0491.7	WBGene00012936	x
DPOA_YEAST	essential	R01H10.1	WBGene00012936	x
DPOD_YEAST	essential	Y47D3A.c	WBGene00008645	х
DPOE_YEAST	essential	Y47D3A.d	WBGene00009368	x
DPOG_YEAST	essential	F10C2.4	WBGene00013258	
DPP3_YEAST	essential	F33H2.5	WBGene00008532	
DR48_YEAST	essential	Y57A10A.m	WBGene00004118	
DRS1_YEAST	non-	F02E9.8	WBGene00022148	
DRS1 YEAST	essential	F10F2.9	WBGene00022148	
DSK2_YEAST	essential	Y71G12A_201.	WBGene00008852	
DTD_YEAST	essential	a	WBGene00004151	
DUR3_YEAST	essential	Y71G12A_203.	WBGene00000501	
DYHC YEAST	essential	C	WBGene00000962	
_		F15C11.2		x
DYL1_YEAST	essential		WBGene00001005	x
DYR_YEAST	essential	T16G1.10	WBGene00007974	
E2BA_YEAST	non-	C48D1.3	WBGene00014221	
E2BD_YEAST	essential	T21E12.4	WBGene00008670	x
E2BE_YEAST	non-	T26A5.9	WBGene00008428	х
EF2_YEAST	essential	C36B1.7	WBGene00001167	x
EFG1_YEAST	non-	ZK1098.4	WBGene00009246	x
EFTU_YEAST	essential	F11A3.2	WBGene00007000	x
EGD2_YEAST	non-	D2085.3	WBGene00022042	x
EGD2 YEAST	essential	F25H5.4	WBGene00022042	x
EM24 YEAST	non-	F29C12.4	WBGene00004766	
END1_YEAST	essential	Y71H2_378.a	WBGene00011067	
END1_TEAST ENP1_YEAST	non-	Y65B4B_10.b	WBGene00000276	x
_	-			~
ER19_YEAST	essential	Y65B4B_10.d	WBGene00012984	
ERF1_YEAST	non-	W02D7.7	WBGene00020269	х
ERS1_YEAST	essential	R06F6.2	WBGene00008052	
ERV1_YEAST	non-	F57B9.5	WBGene00018955	
ESA1_YEAST	essential	Y48B6A.13a	WBGene00007029	х
ETFA_YEAST	non-	Т05Н4.6	WBGene00009187	x
ETFB_YEAST	essential	C41C4.7	WBGene00017734	
ETFD_YEAST	non-	F56C11.3	WBGene00002855	x
F16P_YEAST	essential	VC5.4	WBGene00001404	
FAB1_YEAST	non-	F27D4.1	WBGene00004089	
FAB1_YEAST	essential	F23C8.5	WBGene00004089	
FAD1_YEAST	non-	C05D11.12	WBGene00011271	
FBRL_YEAST	essential	K07A3.b	WBGene00001423	v
_	non-	C05E7.5	WBGene00001425 WBGene00001426	х
FKB2_YEAST		L		
	11011	0002710	WEGGIIC00001120	

FKH2_YEAST         essential         VF11C1L.1         WBGene000176           FXL1_YEAST         essential         T01C3.7         WBGene0000137           FOLE_YEAST         essential         T01C3.7         WBGene00001737           FOLE_YEAST         essential         T28H11.4         WBGene00001708           FTUA_YEAST         essential         R13G10.3         WBGene00001708           FTUA_YEAST         essential         R13G10.3         WBGene00001708           FTUA_YEAST         essential         F558.6         WBGene00001708           G6D1_YEAST         non-         M03A8.1         WBGene00001397           GALX_YEAST         non-         H4412.2         WBGene00001303           GALX_YEAST         non-         H442.2         WBGene00001337           GALX_YEAST         non-         YBG2A.4         WBGene0001337           GALX_YEAST         non-         YBG2A.4         WBGene00011794           GALY_YEAST         non-         YBG2A.4         WBGene00011794           GC14_YEAST         non-         Y66H1A.4         WBGene00011794           GC14_YEAST         non-         Y66H1A.4         WBGene0001298           GC14_YEAST         non-         Y416A_2312.0         WBGene00012656 <th></th> <th></th> <th></th> <th></th> <th></th>					
FLX1_YEAST         non-         R53.1         WBGene000137           FWS1_YEAST         essential         TOIC3.7         WBGene0000137           FOSL_YEAST         essential         T28H11.4         WBGene0000137           FOX2_YEAST         essential         R13G10.3         WBGene00001870           FTHC_YEAST         essential         R13G10.3         WBGene00001503           FTHC_YEAST         essential         F5561.7         WBGene0001503           G6D1_YEAST         essential         F5612.2         WBGene00001503           G6D1_YEAST         essential         F5612.2         WBGene00001503           GALY_EAST         essential         F0612.2         WBGene00001379           GALY_EAST         essential         F0612.2         WBGene00001503           GALY_EAST         essential         F0622.4         WBGene00001056           GALY_EAST         essential         C248.2         WBGene0001503           GC14_YEAST         non-         Y4062A.2         WBGene0001503           GC20_YEAST         essential         C248.2         WBGene0012150           GC21_YEAST         essential         K0407.3         WBGene0012150           GC22_YEAST         essential         K0417.3         W	FKH2 YEAST	essential	VF11C1L.1	WBGene00003976	
FWS1_YEAST         essential         T01C3.7         WBGene00000137           FMS1_YEAST         essential         T28H11.4         WBGene00000137           FCLE_YEAST         essential         T28H11.4         WBGene00001486           FTDA_YEAST         essential         R13G10.3         WBGene00001486           FTLA_YEAST         essential         R13G10.3         WBGene00001486           FTLA_YEAST         essential         F25B.6         WBGene00001337           G6D1_YEAST         essential         F59G1.7         WBGene00001399           GALX_YEAST         non-         H066E.4         WBGene00001397           GALX_YEAST         essential         F3G12.2         WBGene00001397           GALX_YEAST         non-         VBG24.2         WBGene00001397           GALX_YEAST         essential         F3G11.9         WBGene00021508           GALY_YEAST         essential         C472.6         WBGene00012192           GC14_YEAST         essential         C4782.6         WBGene00012193           GC14_YEAST         essential         C24A8.2         WBGene00012192           GC14_YEAST         non-         Y41494_3192.1         WBGene00012192           GC20_YEAST         non-         Y41494_3192.1 </td <td>_</td> <td></td> <td></td> <td></td> <td></td>	_				
FMSI_YEAST         non-         F36H1.1         WBGene00001377           FOLE_YEAST         essential         R13G10.3         WBGene0001370           FTHC_YEAST         essential         R13G10.3         WBGene0001370           FTHC_YEAST         essential         R13G10.7         WBGene00001370           FUEX_YEAST         essential         F75B5.6         WBGene00001370           FUEX_YEAST         essential         F59G1.7         WBGene00001533         x           GGPL_YEAST         essential         F36H2.2         WBGene0001806         GALX_YEAST           GALX_YEAST         essential         F36H2.2         WBGene00018123         GALX_YEAST           GALX_YEAST         essential         F36H1.4         WBGene00018123         GALX_YEAST           GALX_YEAST         non-         V4702A.4         WBGene00012568         x           GC14_YEAST         essential         C24A8.3         WBGene00012192         GCC2.YEAST           GC20_YEAST         essential         F42A10.1         WBGene00012339         GCM3_YEAST           GCX3_YEAST         essential         F42A10.1         WBGene00012365         x           GCS1_YEAST         essential         F42A10.1         WBGene00012370         GCC3_YEAST	_				
FOLE_YEAST         essential         T28H11.4         WBGene00017777           FV02_YEAST         essential         R13G10.3         WBGene000013708           FV12_FVEAST         essential         R13G10.2         WBGene000013708           FV12_VEAST         essential         R13G10.2         WBGene000013708           GFD_YEAST         essential         F75561.7         WBGene00001503         X           GFD_YEAST         essential         F0561.7         WBGene00001503         X           GAL_YEAST         ono-         V10606E.4         WBGene0001320         GALX_YEAST           GAL_YEAST         non-         YFG2A.qWBGene00004106         GALX_YEAST         essential         F30D1.9         WBGene00001794           GALX_YEAST         essential         C24A8.3         WBGene00012192         GC20_VEAST         essential         C44A8.3         WBGene00012192         GC20_VEAST         non-         Y41DA_3192.         WBGene00012036         x         GC14_YEAST         essential         F42A10.1         WBGene00012036         x         GC21_YEAST         essential         F42A10.1         WBGene00012022         GC33_YEAST         non-         Y41GAA.3192.         WBGene00012037         GC14_YEAST         essential         F42A10.1         WBGene00012036		essential	T01C3.7	WBGene00000137	
FOLE_YEAST         essential         T28H11.4         WBGene00017777           FV02_YEAST         essential         R13G10.3         WBGene000013708           FV12_FVEAST         essential         R13G10.2         WBGene000013708           FV12_VEAST         essential         R13G10.2         WBGene000013708           GFD_YEAST         essential         F75561.7         WBGene00001503         X           GFD_YEAST         essential         F0561.7         WBGene00001503         X           GAL_YEAST         ono-         V10606E.4         WBGene0001320         GALX_YEAST           GAL_YEAST         non-         YFG2A.qWBGene00004106         GALX_YEAST         essential         F30D1.9         WBGene00001794           GALX_YEAST         essential         C24A8.3         WBGene00012192         GC20_VEAST         essential         C44A8.3         WBGene00012192         GC20_VEAST         non-         Y41DA_3192.         WBGene00012036         x         GC14_YEAST         essential         F42A10.1         WBGene00012036         x         GC21_YEAST         essential         F42A10.1         WBGene00012022         GC33_YEAST         non-         Y41GAA.3192.         WBGene00012037         GC14_YEAST         essential         F42A10.1         WBGene00012036	FMS1 YEAST	non-	F36H1.1	WBGene00000137	
FOX2_YEAST         non-         KD1C8.7         WBGene00001991           FRDA_YEAST         essential         R13G10.3         WBGene00001970           FTHC_YEAST         essential         F25B5.6         WBGene000013708           FUZG_YEAST         essential         F55G1.7         WBGene000013579           GGPL_YEAST         essential         F56G1.7         WBGene000018006           GAL_YEAST         essential         F36H2.2         WBGene000018006           GAL_YEAST         essential         F36H2.2         WBGene000018006           GALY_YEAST         essential         F3011.9         WBGene000018006           GALY_YEAST         essential         C4482.4         WBGene00022046           GATA_YEAST         non-         C44B2.4         WBGene0001794           GATH_YEAST         essential         C24A8.3         WBGene00012508           GCL_YEAST         essential         K04D7.3         WBGene00012856         x           GCC2_YEAST         essential         W02A11.1         WBGene00012636         x           GCS_YEAST         essential         F3268.6         WBGene00017650         x           GCS_YEAST         essential         F3268.1         WBGene00017217         x					
FFDA_YEAST         essential         R13G10.3         WBGene00013708           FTU2_YEAST         essential         R13G10.2         WBGene00013708           FU2&_YEAST         essential         F25B5.6         WBGene000013708           GGED_YEAST         essential         F55G1.7         WBGene00001503         x           GGED_YEAST         essential         F56G1.7         WBGene00013597           GALX_YEAST         non-         H14A12.2         WBGene00004106           GALX_YEAST         non-         H14A12.2         WBGene00001794           GATA_YEAST         essential         F32D11.9         WBGene00021508           GATA_YEAST         essential         C24A8.2         WBGene00012192           GCC1_YEAST         essential         K04D7.3         WBGene00013591           GCC1_YEAST         essential         A         WBGene00013591           GCCS_YEAST         essential         F42A10.1         WBGene0001356         x           GCS_YEAST         essential         F42A10.1         WBGene0001237           GCS_YEAST         essential         F25B4.1         WBGene0001237           GCS_YEAST         essential         F2624.1         WBGene0001237           GCS_YEAST         essentia	_	essential			
THC_YEAST         essential         R13G10.2         WBGene0001708           FU26_YEAST         essential         F25B5.6         WBGene00001503         x           G6PD_YEAST         essential         F59G1.7         WBGene00013537         x           G6PL_YEAST         essential         F36H2.2         WBGene00013537         x           GAL_YEAST         essential         F36H2.2         WBGene00004106         GALX_YEAST         essential         F36H2.2         WBGene00001556         x           GAL_YEAST         essential         F36H2.4         WBGene00021568         x         GATA_YEAST         essential         C47B2.6         WBGene0001794         GATA_YEAST         essential         C24A8.3         WBGene00018339         GCC2.7YEAST         essential         C24A8.3         WBGene00018339         GCC2.7YEAST         essential         K04D7.1         WBGene00018359         X         GCC3_YEAST         essential         F42A8.11.1         WBGene00017656         x         GCS1_YEAST         essential         F42A8.2         WBGene0001765         X         GCS1_YEAST         essential         F42A8.2         WBGene00017231         GCM3_TXEAT         essential         F42A8.3         WBGene00017231         GCM3_TXEAT         essential         F42A8.3         WBGEne00017251 </td <td>FOX2_YEAST</td> <td>non-</td> <td>K01C8.7</td> <td>WBGene00000991</td> <td></td>	FOX2_YEAST	non-	K01C8.7	WBGene00000991	
THC_YEAST         essential         R13G10.2         WBGene0001708           FU26_YEAST         essential         F25B5.6         WBGene00001503         x           G6PD_YEAST         essential         F59G1.7         WBGene00013537         x           G6PL_YEAST         essential         F36H2.2         WBGene00013537         x           GAL_YEAST         essential         F36H2.2         WBGene00004106         GALX_YEAST         essential         F36H2.2         WBGene00001556         x           GAL_YEAST         essential         F36H2.4         WBGene00021568         x         GATA_YEAST         essential         C47B2.6         WBGene0001794         GATA_YEAST         essential         C24A8.3         WBGene00018339         GCC2.7YEAST         essential         C24A8.3         WBGene00018339         GCC2.7YEAST         essential         K04D7.1         WBGene00018359         X         GCC3_YEAST         essential         F42A8.11.1         WBGene00017656         x         GCS1_YEAST         essential         F42A8.2         WBGene0001765         X         GCS1_YEAST         essential         F42A8.2         WBGene00017231         GCM3_TXEAT         essential         F42A8.3         WBGene00017231         GCM3_TXEAT         essential         F42A8.3         WBGEne00017251 </td <td>FRDA YEAST</td> <td>essential</td> <td>R13G10.3</td> <td>WBGene00001486</td> <td></td>	FRDA YEAST	essential	R13G10.3	WBGene00001486	
FUGE_VEAST         essential         F285.6         WBGene00001503         x           GGPD_VEAST         essential         F59G1.7         WBGene00001503         x           GGPD_VEAST         essential         F59G1.7         WBGene0001503         x           GGPD_VEAST         essential         F56G1.7         WBGene0001505         x           GAL_VEAST         non-         Y10666E.4         WBGene0001506         GALX_VEAST           GALY_VEAST         non-         Y87G2A.q         WBGene00001416         GALX_VEAST         non-         C47B2.6         WBGene00001794           GATA_VEAST         non-         Y67B2.6         WBGene00012192         GCC24VEAST         non-         Y66H1A.4         WBGene00012192           GCC1_VEAST         essential         C42A8.3         WBGene00012192         GCC14_VEAST         non-         Y60H1A.4         WBGene00012038         GCC14_VEAST         non-         Y01DA.3192.         WBGene00012036         GCC3_VEAST         essential         F42A10.1         WBGene00012036         GCC3_VEAST         essential         F42A10.1         WBGene00012022         GCSE_VEAST         non-         Y1G5A.3         WBGene00012237         GCST_VEAST         essential         Y47G6A_241.b         WBGene00012237         GCST_VEAST	_				
FUME_YEAST         non-         M03A8.1         WBGene00001503         x           GGPD_YEAST         non-         Y106G6E.4         WBGene00013597         GA1_YEAST         essential         F59G1.7         WBGene00013597         GA1_YEAST         essential         F36H2.2         WBGene00008132         GALY_YEAST         essential         B0035.5         WBGene00004106         GALX_YEAST         essential         F36H2.4         WBGene0002166         GACK_YEAST         essential         C24A8.2         WBGene00021568         GC14_YEAST         essential         C24A8.2         WBGene00021568         GC20_YEAST         essential         C24A8.3         WBGene000121508         GC20_YEAST         essential         C24A8.3         WBGene000121508         GC20_YEAST         essential         C4AD7.3         WBGene000121508         GC20_YEAST         essential         K04D7.1         WBGene000121636         GCC3_YEAST         essential         W02A11.1         WBGene00012636         GCC3_YEAST         essential         F32G8.6         WBGene00012637         GCS1_YEAST         essential         F32G8.6         WBGene00012637         GCS1_YEAST         essential         F32G8.6         WBGene00012637         GCS1_YEAST         essential         F25B4.1         WBGene00012637         GCS1_YEAST         essential         F22EA1.1         WBGene	_				
G6PD_YEAST         essential         F59G1.7         WEGene00013597           G6PI_YEAST         essential         F36H2.2         WEGene00018006           GAL_YEAST         essential         B035.5         WEGene0004166           GAL_YEAST         essential         B035.5         WEGene0004166           GALY_YEAST         essential         C24A8.2         WEGene00001794           GATA_YEAST         essential         C24A8.3         WEGene000121508           GC1_YEAST         essential         C24A8.3         WEGene00012152           GC20_YEAST         essential         C24A8.3         WEGene00012393           GCC1_YEAST         non-         Y66H1A.4         WEGene00012366         x           GC20_YEAST         essential         a         WEGene00012363         x           GCST_YEAST         essential         F42A10.1         WEGene00013591         x           GCST_YEAST         essential         F42A10.1         WEGene00010223         x           GCST_YEAST         essential         F42A10.1         WEGene0001232         x           GCST_YEAST         essential         F42A10.1         WEGene0001232         x           GCST_YEAST         essential         K04D7.1         WEGene000	FU26_YEAST	essential	F25B5.6	WBGene00009499	
G6PD_YEAST         essential         F59G1.7         WEGene00013597           G6PI_YEAST         essential         F36H2.2         WEGene00018006           GAL_YEAST         essential         B035.5         WEGene0004166           GAL_YEAST         essential         B035.5         WEGene0004166           GALY_YEAST         essential         C24A8.2         WEGene00001794           GATA_YEAST         essential         C24A8.3         WEGene000121508           GC1_YEAST         essential         C24A8.3         WEGene00012152           GC20_YEAST         essential         C24A8.3         WEGene00012393           GCC1_YEAST         non-         Y66H1A.4         WEGene00012366         x           GC20_YEAST         essential         a         WEGene00012363         x           GCST_YEAST         essential         F42A10.1         WEGene00013591         x           GCST_YEAST         essential         F42A10.1         WEGene00010223         x           GCST_YEAST         essential         F42A10.1         WEGene0001232         x           GCST_YEAST         essential         F42A10.1         WEGene0001232         x           GCST_YEAST         essential         K04D7.1         WEGene000	FUMH YEAST	non-	M03A8.1	WBGene00001503	x
G6PT_YEAST         non-         Y106G6E.4         WBGene00013597           GAA1_YEAST         non-         H14A12.2         WBGene00018006           GALX_YEAST         non-         H4A12.2         WBGene00004106           GALY_YEAST         non-         Y87G2A.q         WBGene0001744           GALY_YEAST         non-         C47B2.6         WBGene0001756           GC14_YEAST         essential         C24A8.3         WBGene0001256           GC14_YEAST         essential         C24A8.3         WBGene0001258           GC14_YEAST         non-         Y41D4A_3192.         WBGene0001258           GC14_YEAST         non-         Y41D4A_3192.         WBGene00012636           GCN2_YEAST         essential         a         WBGene00012636           GCN2_YEAST         essential         F42A10.1         WBGene00012022           GCST_YEAST         essential         F42A10.1         WBGene00010697           GDAL_YEAST         essential         K02B12.7         WBGene00012022           GCST_YEAST         non-         F31G3A.3         WBGene0001237           GLGB_YEAST         non-         R12C2.1         WBGene0001237           GLGB_YEAST         essential         F02B.4         WBGene00012324	_				
GAAL_YEAST         essential         F36H2.2         WBGene0003806           GALX_YEAST         essential         B0035.5         WBGene00004106           GALX_YEAST         essential         B0035.5         WBGene00021508           GATA_YEAST         essential         C24A8.2         WBGene00012192           GATA_YEAST         non-         C24A8.3         WBGene00012192           GC14_YEAST         essential         C24A8.3         WBGene00012192           GC20_YEAST         essential         C24A8.3         WBGene00012365         x           GC14_YEAST         non-         Y66H1A.4         WBGene00012365         x           GC20_YEAST         non-         Y104A_3192.         WBGene00012363         x           GCS1_YEAST         non-         Y41D4A_3192.         WBGene00012636         x           GCS2_YEAST         essential         F42A10.1         WBGene00017765         x           GCS1_YEAST         non-         Y81G3A.3         WBGene0001697         X           GDIR_YEAST         non-         F37E3.1         WBGene00017765         X           GCA1_YEAST         non-         K12C12.1         WBGene0001237         X           GL2A_YEAST         non-         K12C12.1 <td>_</td> <td>essential</td> <td></td> <td></td> <td></td>	_	essential			
GALZ_YEAST         non-         H14A12.2         WBGene00008132           GALY_YEAST         non-         Y87G2A.q         WBGene00004106           GALY_YEAST         non-         Y87G2A.q         WBGene00022046           GATA_YEAST         non-         C47B2.6         WBGene00021508           GATA_YEAST         essential         C24A8.3         WBGene00012192           GC14_YEAST         essential         C24A8.4         WBGene00012192           GC20_YEAST         essential         K04D7.3         WBGene00012361           GCN_YEAST         essential         K04D7.1         WBGene00012566         x           GCST_YEAST         essential         F42A10.1         WBGene00012636         gccs           GCST_YEAST         essential         F42A10.1         WBGene00010657         gbcs           GDIR_YEAST         essential         F42G6_241.b         WBGene00012022         gccs           GCST_YEAST         non-         F37E3.1         WBGene0001267         gcdgs         gdgs           GDIR_YEAST         non-         F37E3.1         WBGene0001267         gdgs         gdgs           GCST_YEAST         non-         F37E3.1         WBGene0001269         x         gdgs         gdgs         g	G6PI_YEAST	non-	Y106G6E.4	WBGene00013597	
GALZ_YEAST         non-         H14A12.2         WBGene00008132           GALY_YEAST         non-         Y87G2A.q         WBGene00004106           GALY_YEAST         non-         Y87G2A.q         WBGene00022046           GATA_YEAST         non-         C47B2.6         WBGene00021508           GATA_YEAST         essential         C24A8.3         WBGene00012192           GC14_YEAST         essential         C24A8.4         WBGene00012192           GC20_YEAST         essential         K04D7.3         WBGene00012361           GCN_YEAST         essential         K04D7.1         WBGene00012566         x           GCST_YEAST         essential         F42A10.1         WBGene00012636         gccs           GCST_YEAST         essential         F42A10.1         WBGene00010657         gbcs           GDIR_YEAST         essential         F42G6_241.b         WBGene00012022         gccs           GCST_YEAST         non-         F37E3.1         WBGene0001267         gcdgs         gdgs           GDIR_YEAST         non-         F37E3.1         WBGene0001267         gdgs         gdgs           GCST_YEAST         non-         F37E3.1         WBGene0001269         x         gdgs         gdgs         g	GAA1 YEAST	essential	F36H2.2	WBGene00018006	
GALX_YEAST         essential         B0035.5         WBGene00004106           GALY_YEAST         non-         Y87G2A.q         WBGene00022046           GARL_YEAST         non-         C47B2.6         WBGene00021508           GATH_YEAST         essential         C24A8.2         WBGene00012152           GC14_YEAST         essential         C24A8.3         WBGene0001256         x           GC14_YEAST         essential         C24A8.3         WBGene0001256         x           GC20_YEAST         essential         C44D7.3         WBGene0001256         x           GCN_YEAST         essential         A         WBGene00012636         x           GCN_YEAST         essential         F42A10.1         WBGene00012636         x           GCST_YEAST         essential         F42A10.1         WBGene00012636         x           GCST_YEAST         essential         F42A6.4         WBGene00012022         CGST_YEAST         essential         F32G8.6         WBGene00012037           GLA_YEAST         non-         Y47G6A_241.b         WBGene0001237         GLGA_YEAST         essential         F25B4.1         WBGene0001237         GLGA_YEAST         essential         F26B4.1         WBGene00012376         GLN_YEAST         essential	_				
GALX_YEAST         non-         Y87G2A.q         WBGene000014106           GARA_YEAST         non-         C47B2.6         WBGene00021508           GATA_YEAST         non-         C47B2.6         WBGene0001794           GATH_YEAST         essential         C24A8.2         WBGene000121508           GBLP_YEAST         essential         C24A8.3         WBGene00012192           GC0_YEAST         non-         Y4D4A_3192.         WBGene0001298           GCN_YEAST         essential         a         WBGene00012636           GCR3_YEAST         essential         F42A10.1         WBGene00010500           GCST_YEAST         essential         F42A10.1         WBGene00010697           GDIR_YEAST         essential         F37G3.1         WBGene00010697           GDIR_YEAST         essential         K02B1.7         WBGene00012037           GLM_YEAST         non-         F37G3.1         WBGene00012037           GLM_YEAST         non-         R12C12.1         WBGene0001237           GLM_YEAST         non-         R12C12.1         WBGene00012326           GCST_YEAST         non-         C07H4.2         WBGene00012326           GLM_YEAST         non-         C07F6.4         WBGene00013131 <td>_</td> <td></td> <td></td> <td></td> <td></td>	_				
GAR1_YEAST         essential         F33D11.9         WBGene00022046           GATA_YEAST         non-         C47B2.6         WBGene00021508           GALL         WBGene00012192         GC14_YEAST         essential         C24A8.2         WBGene00012192           GC14_YEAST         essential         C24A8.3         WBGene00012839         GC14_YEAST         essential         K04D7.3         WBGene0001283           GC14_YEAST         non-         Y41D4A_3192.         WBGene00012636         x           GCN5_YEAST         non-         Y41D4A_3192.         WBGene00012636         x           GCS1_YEAST         essential         F42A10.1         WBGene00012022         CCST_YEAST         non-         Y81G3A.3         WBGene00010650           GCSP_YEAST         essential         F42A10.1         WBGene00010657         GD1_YEAST         non-         Y81G3A.3         WBGene00010237           GLR_YEAST         non-         R12C12.7         WBGene00012037         GLG2_YEAST         essential         F25B4.1         WBGene00012037           GLGJ_YEAST         essential         F25B4.1         WBGene00012326         x           GLT_YEAST         non-         K07F6.4         WBGene00012326         x           GLT_YEAST	GALY_YEAST	essential	B0035.5	WBGene00004106	
GAR1_YEAST         essential         F33D11.9         WBGene00022046           GATA_YEAST         non-         C47B2.6         WBGene00021508           GALL         WBGene00012192         GC14_YEAST         essential         C24A8.2         WBGene00012192           GC14_YEAST         essential         C24A8.3         WBGene00012839         GC14_YEAST         essential         K04D7.3         WBGene0001283           GC14_YEAST         non-         Y41D4A_3192.         WBGene00012636         x           GCN5_YEAST         non-         Y41D4A_3192.         WBGene00012636         x           GCS1_YEAST         essential         F42A10.1         WBGene00012022         CCST_YEAST         non-         Y81G3A.3         WBGene00010650           GCSP_YEAST         essential         F42A10.1         WBGene00010657         GD1_YEAST         non-         Y81G3A.3         WBGene00010237           GLR_YEAST         non-         R12C12.7         WBGene00012037         GLG2_YEAST         essential         F25B4.1         WBGene00012037           GLGJ_YEAST         essential         F25B4.1         WBGene00012326         x           GLT_YEAST         non-         K07F6.4         WBGene00012326         x           GLT_YEAST	GALY YEAST	non-	Y87G2A.q	WBGene00004106	
GATA_YEAST         non-         C47B2.6         WBGene00010794           GATH_YEAST         essential         C24A8.2         WBGene00012508           GLP_YEAST         essential         C24A8.3         WBGene00012508           GC14_YEAST         non-         Y66H1A.4         WBGene00012508           GC20_YEAST         essential         K04D7.3         WBGene0000238           GCN1_YEAST         non-         K14D4_3192.         WBGene00012566           GCN2_YEAST         essential         w02A11.1         WBGene00012666           GCST_YEAST         essential         F42A10.1         WBGene00012676           GCST_YEAST         essential         F42A10.1         WBGene00012677           GCST_YEAST         essential         K02B12.7         WBGene00012037           GLGT_YEAST         non-         R12C12.1         WBGene00012037           GLGB_YEAST         non-         R12C12.1         WBGene00012037           GLGB_YEAST         non-         K02B12.7         WBGene00012037           GLGB_YEAST         non-         R12C12.1         WBGene00012037           GLGB_YEAST         non-         K04B10.4         WBGene0001236           GLM_YEAST         non-         K06H0.4         WBGene0001232	_		-		
GATH_YEAST         essential         C24A8.2         WBGene00012508         x           GBLP_YEAST         essential         C24A8.3         WBGene0001292         x           GC14_YEAST         non-         Y66H1A.4         WBGene0001292         x           GC20_YEAST         essential         x         WBGene0001293         x           GCN2_YEAST         essential         a         WBGene00013591         x           GCN2_YEAST         essential         W24D1.1         WBGene00016500         x           GCS1_YEAST         essential         F32G8.6         WBGene00010500         x           GCST_YEAST         essential         F32G8.6         WBGene00010697         x           GIR2_YEAST         essential         K02B12.7         WBGene00010237         x           GIR2_YEAST         essential         F25B4.1         WBGene00012037         x           GL3_YEAST         essential         T26E3.4         WBGene0001236         x           GL1_YEAST         non-         K03H10.4         WBGene0001236         x           GL3_YEAST         essential         T26E3.4         WBGene0001236         x           GL1_YEAST         essential         T04A6.7         WBGene00013131					
GBLP_YEAST         essential         C24A8.3         WBGene00010556         x           GC14_YEAST         non-         Y66H1A.4         WBGene00012192           GC20_YEAST         essential         NBGene00013591           GCN5_YEAST         essential         WBGene00013591           GCN2_YEAST         essential         W02A11.1         WBGene00012366           GCST_YEAST         essential         F42A10.1         WBGene00012022           GCST_YEAST         essential         F73G8.6         WBGene00012037           GDR_YEAST         essential         Y47G6A_241.b         WBGene00012037           GLGB_YEAST         non-         R173C3.1         WBGene00001237           GLGB_YEAST         essential         F25B4.1         WBGene00012037           GLGB_YEAST         non-         R12C12.1         WBGene0001236           GLM3_YEAST         non-         K08H10.4         WBGene00012326           GLAY_YEAST         non-         C07H4.2         WBGene00012326         x           GLY_YEAST         essential         T04A8.7         WBGene00012326         x           GLY_YEAST         non-         R11F4.1         WBGene00012326         x           GLY_YEAST         non-         R11F4.	GATA_YEAST	non-	C47B2.6	WBGene00001794	
GBLP_YEAST         essential         C24A8.3         WBGene00010556         x           GC14_YEAST         non-         Y66H1A.4         WBGene00012192           GC20_YEAST         essential         NBGene00013591           GCN5_YEAST         essential         WBGene00013591           GCN2_YEAST         essential         W02A11.1         WBGene00012366           GCST_YEAST         essential         F42A10.1         WBGene00012022           GCST_YEAST         essential         F73G8.6         WBGene00012037           GDR_YEAST         essential         Y47G6A_241.b         WBGene00012037           GLGB_YEAST         non-         R173C3.1         WBGene00001237           GLGB_YEAST         essential         F25B4.1         WBGene00012037           GLGB_YEAST         non-         R12C12.1         WBGene0001236           GLM3_YEAST         non-         K08H10.4         WBGene00012326           GLAY_YEAST         non-         C07H4.2         WBGene00012326         x           GLY_YEAST         essential         T04A8.7         WBGene00012326         x           GLY_YEAST         non-         R11F4.1         WBGene00012326         x           GLY_YEAST         non-         R11F4.	GATH YEAST	essential	C24A8.2	WBGene00021508	
GC14_YEAST         non-         Y66HlA.4         WEGene00012192           GC20_YEAST         essential         K04D7.3         WEGene0000238           GCN2_YEAST         essential         a         WEGene0000238           GCN2_YEAST         essential         a         WEGene00002363           GCN5_YEAST         essential         F42A10.1         WEGene00013561         x           GCST_YEAST         essential         F42A10.1         WEGene00010600         x           GCST_YEAST         essential         F42A10.1         WEGene00010607         x           GCST_YEAST         essential         Y47G6A_241.b         WEGene00001697         x           GDAL_YEAST         essential         K02E12.7         WEGene000012037         x           GLM3_YEAST         essential         F45B4.1         WEGene0001249         x           GLO3_YEAST         non-         K08H10.4         WEGene00012326         x           GLT_YEAST         essential         F46H6.1         WEGene00012326         x           GLT_YEAST         essential         T04A8.7         WEGene00012326         x           GLT_YEAST         essential         WO7E1.3         WEGene000013131           GLT_YEAST         essent	CBLD VEAST	Aggential	C2478 3	WBGene00010556	v
GC20_YEAST         essential         K04D7.3         WBGene0018339           GCH_YEAST         non-         Y41D4A_3192.         WBGene00013591           GCN2_YEAST         essential         a         WBGene00013591           GCS1_YEAST         essential         W02A11.1         WBGene00018365         x           GCS1_YEAST         essential         F32G8.6         WBGene00010500         g           GCS1_YEAST         essential         F32G8.6         WBGene00017657         g           GDAL_YEAST         essential         K02B12.7         WBGene00012037         G           GLGB_YEAST         essential         F2SB4.1         WBGene00012037         G           GLGB_YEAST         essential         F2SB4.1         WBGene00012037         G           GLM3_YEAST         non-         K08H10.4         WBGene00012037         G           GLM3_YEAST         non-         C07H4.2         WBGene00012326         x           GLT1_YEAST         essential         T048.7         WBGene0001331         G           GP11_YEAST         essential         W07F1.3         WBGene00013131         G           GLM1_YEAST         essential         T048.7         WBGene00013131         G <t< td=""><td></td><td></td><td></td><td></td><td>~</td></t<>					~
GCH1_YEAST         non-         Y41D4A_3192.         WBGene0000298           GCN2_YEAST         essential         a         WBGene00013591           GCN5_YEAST         non-         K04D7.1         WBGene00021636           GCST_YEAST         essential         F42A10.1         WBGene0002022           GCST_YEAST         essential         F42A10.1         WBGene0001765           GCST_YEAST         essential         Y47G6A_241.b         WBGene0001765           GDAL_YEAST         essential         K02B12.7         WBGene00012037           GLGB_YEAST         essential         F25B4.1         WBGene0001237           GLM3_YEAST         non-         K08H10.4         WBGene0001249         x           GLM3_YEAST         non-         K08H10.4         WBGene00012326         x           GLT_YEAST         essential         T04A8.7         WBGene00012326         x           GLT_YEAST         essential         T04A8.7         WBGene00012326         x           GLT_YEAST         essential         T04A8.7         WBGene00012326         x           GLT_YEAST         essential         T07F6.4         WBGene00013214         x           GP11_YEAST         essential         WO7E11.3         WBGene00001482<	_	non-		wBGene00012192	
GCH1_YEAST         non-         Y41D4A_3192.         WBGene0000298           GCN2_YEAST         essential         a         WBGene00013591           GCN5_YEAST         non-         K04D7.1         WBGene00021636           GCST_YEAST         essential         F42A10.1         WBGene0002022           GCST_YEAST         essential         F42A10.1         WBGene0001765           GCST_YEAST         essential         Y47G6A_241.b         WBGene0001765           GDAL_YEAST         essential         K02B12.7         WBGene00012037           GLGB_YEAST         essential         F25B4.1         WBGene0001237           GLM3_YEAST         non-         K08H10.4         WBGene0001249         x           GLM3_YEAST         non-         K08H10.4         WBGene00012326         x           GLT_YEAST         essential         T04A8.7         WBGene00012326         x           GLT_YEAST         essential         T04A8.7         WBGene00012326         x           GLT_YEAST         essential         T04A8.7         WBGene00012326         x           GLT_YEAST         essential         T07F6.4         WBGene00013214         x           GP11_YEAST         essential         WO7E11.3         WBGene00001482<	GC20_YEAST	essential	K04D7.3	WBGene00018339	
GCN2_YEAST         essential         a         WBGene00013591           GCN5_YEAST         non-         K04D7.1         WBGene00013591           GCR3_YEAST         essential         F42A10.1         WBGene00018156         x           GCS1_YEAST         essential         F42A10.1         WBGene00010500         x           GCST_YEAST         essential         F42A10.1         WBGene00010697         x           GCST_YEAST         essential         Y47G6A_241.b         WBGene00012037         x           GLR_YEAST         essential         F25B4.1         WBGene00012037         x           GLM3_YEAST         essential         F25B4.1         WBGene00012249         x           GLO3_YEAST         essential         T0648.7         WBGene0001236         x           GLT_YEAST         non-         C07H4.2         WBGene00012326         x           GLT_YEAST         essential         T0648.7         WBGene00012326         x           GLT_YEAST         essential         F07F6.4         WBGene00012326         x           GP13_YEAST         essential         W07E11.3         WBGene00013131         x           GP13_YEAST         essential         W07E11.3         WBGene0001841         x	GCH1 YEAST	non-	Y41D4A 3192	WBGene00000298	
GCN5_YEAST         non-         K04D7.1         WBGene000121636           GCR3_YEAST         essential         W02A11.1         WBGene000108165         x           GCS1_YEAST         essential         F42A10.1         WBGene00010500         g           GCSP_YEAST         essential         F42A10.1         WBGene0001765         g           GDA1_YEAST         non-         Y81G3A.3         WBGene0001697         g           GDIR_YEAST         essential         Y47G6A_241.b         WBGene0001326         g           GIR_YEAST         essential         F25B4.1         WBGene00012037         G           GLGB_YEAST         essential         F25B4.1         WBGene00012007         g           GLTA_YEAST         essential         T26E3.4         WBGene00012326         x           GLT_YEAST         essential         F04H4.2         WBGene00012326         x           GLT_YEAST         essential         F07F6.4         WBGene00012326         x           GP1_YEAST         essential         W07E11.1         WBGene00013131         g           GP1_YEAST         essential         W07E11.1         WBGene0001442         g           GYE_YEAST         essential         N07E11.1         WBGene0001442	_		_		
GCR3_YEAST         essential         W02A11.1         WBGene00018156         x           GCS1_YEAST         essential         F42A10.1         WBGene00010500           GCST_YEAST         essential         F32G8.6         WBGene0001765           GDAL_YEAST         essential         Y47G6A_241.b         WBGene0001697           GDIR_YEAST         essential         K02B12.7         WBGene00012037           GLGB_YEAST         essential         F25B4.1         WBGene0001249         x           GLO3_YEAST         essential         F26H6.1         WBGene0001226         x           GLO3_YEAST         essential         F46H6.1         WBGene00012326         x           GLT_YEAST         essential         T0448.7         WBGene00012326         x           GLT_YEAST         essential         F07F6.4         WBGene00012326         x           GP12_YEAST         essential         W07E11.1         WBGene00003214         x           GP13_YEAST         essential         W07E11.1         WBGene00001249         x           GP13_YEAST         essential         W07E11.1         WBGene00008431         GP13_YEAST           GP13_YEAST         essential         V07E11.1         WBGene00001827         S      <	_				
GCS1_YEAST         essential         F42A10.1         WBGene00010500           GCSP_YEAST         essential         F32G8.6         WBGene00017765           GCST_YEAST         non-         Y8IG3A.3         WBGene00017765           GDA1_YEAST         essential         Y47G6A_241.b         WBGene00014356           GEF1_YEAST         non-         F37E3.1         WBGene00012037           GLGB_YEAST         essential         F25B4.1         WBGene0001249         x           GLO3_YEAST         essential         F25B4.1         WBGene00012326         x           GLO3_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T048.7         WBGene00012326         x           GLT1_YEAST         essential         F07F6.4         WBGene00012326         x           GP12_YEAST         non-         R11F4.1         WBGene00003214         x           GP13_YEAST         essential         W07E11.3         WBGene00001247         x           GP12_YEAST         essential         NO7E11.3         WBGene00001247         x           GP13_YEAST         essential         R02.4         WBGene00001247         x           GSH1_YEAST	GCN5_YEAST	non-	K04D7.1	WBGene00021636	
GCS1_YEAST         essential         F42A10.1         WBGene00010500           GCSP_YEAST         essential         F32G8.6         WBGene00017765           GCST_YEAST         non-         Y8IG3A.3         WBGene00017765           GDA1_YEAST         essential         Y47G6A_241.b         WBGene00014356           GEF1_YEAST         non-         F37E3.1         WBGene00012037           GLGB_YEAST         essential         F25B4.1         WBGene0001249         x           GLO3_YEAST         essential         F25B4.1         WBGene00012326         x           GLO3_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T048.7         WBGene00012326         x           GLT1_YEAST         essential         F07F6.4         WBGene00012326         x           GP12_YEAST         non-         R11F4.1         WBGene00003214         x           GP13_YEAST         essential         W07E11.3         WBGene00001247         x           GP12_YEAST         essential         NO7E11.3         WBGene00001247         x           GP13_YEAST         essential         R02.4         WBGene00001247         x           GSH1_YEAST	GCR3 YEAST	essential	W02A11.1	WBGene00018156	x
GCSP_YEAST         essential         F32G8.6         WBGene00020022           GCST_YEAST         non-         Y81G3A.3         WBGene0001765           GDA1_YEAST         essential         Y47G6A_241.b         WBGene00014356           GEF1_YEAST         non-         F37E3.1         WBGene00014356           GEF1_YEAST         essential         K02B12.7         WBGene0001249           GLGS_YEAST         essential         F25B4.1         WBGene0001249         x           GLO3_YEAST         essential         F46H6.1         WBGene00012326         x           GLT1_YEAST         essential         T04A8.7         WBGene00012326         x           GLY_YEAST         non-         W09C2.1         WBGene00012326         x           GLY_YEAST         essential         T04A8.7         WBGene00012326         x           GLY_YEAST         essential         W07E1.3         WBGene00003214         x           GP13_YEAST         essential         W07E11.3         WBGene0001244         x           GP13_YEAST         essential         NO7E11.3         WBGene0001244         x           GP13_YEAST         essential         NO7E11.1         WBGene0001527           GSH_YEAST         essential         <	_				
GCST_VEAST         non-         Y81G3A.3         WBGene00017765           GDAL_YEAST         essential         Y47G6A_241.b         WBGene0001697           GDIR_YEAST         essential         K02B12.7         WBGene00012037           GLGE_YEAST         essential         F25B4.1         WBGene00012037           GLGE_YEAST         essential         F25B4.1         WBGene00012237           GLG_YEAST         essential         F26H6.1         WBGene00017217           GLN3_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T048.7         WBGene00012326         x           GLYI_YEAST         essential         F07F6.4         WBGene00012326         x           GP12_YEAST         essential         WO7E11.3         WBGene00003214         x           GP13_YEAST         essential         WO7E11.3         WBGene0001249         x           GP13_YEAST         essential         R124.4         WBGene00001242         x           GP13_YEAST         essential         R02.4         WBGene00001242         x           GP13_YEAST         essential <td>_</td> <td></td> <td></td> <td></td> <td></td>	_				
GDA1_YEAST         essential         Y47G6A_241.b         WBGene00010697           GDIR_YEAST         non-         F37E3.1         WBGene00004356           GEF1_YEAST         essential         K02B12.7         WBGene00012037           GLGE_YEAST         essential         F25B4.1         WBGene0001249         x           GLG3_YEAST         essential         F46H6.1         WBGene0001249         x           GLA3_YEAST         non-         C07H4.2         WBGene00012326         x           GLT_YEAST         essential         T26E3.4         WBGene00012326         x           GLY_YEAST         non-         W09C2.1         WBGene00012326         x           GLY_YEAST         essential         F07F6.4         WBGene00012326         x           GP12_YEAST         essential         W07F1.1         WBGene00003214         x           GP13_YEAST         essential         W07F1.1         WBGene00008504           GP13_YEAST         essential         R102.4         WBGene00001247           GSH1_YEAST         essential         R102.4         WBGene00001247           GSH1_YEAST         essential         P0164.5         WBGene00001247           GSH1_YEAST         essential         D2085.6	GCSP_YEAST	essential	F32G8.6	WBGene00020022	
GDIR_YEAST         non-         F37E3.1         WBGene00004356           GFF_YEAST         essential         K02B12.7         WBGene00012037           GLGE_YEAST         essential         F25B4.1         WBGene0001249         x           GLGE_YEAST         essential         F46H6.1         WBGene0001249         x           GLOS_YEAST         essential         F46H6.1         WBGene00012207         x           GLT_YEAST         essential         T048.7         WBGene00012326         x           GLT_YEAST         essential         T048.7         WBGene00012326         x           GLT_YEAST         essential         T048.7         WBGene00012326         x           GLY_YEAST         non-         K09C2.1         WBGene00012326         x           GP11_YEAST         essential         W07E11.3         WBGene00003214         x           GP13_YEAST         essential         W07E11.1         WBGene00001343         x           GP13_YEAST         essential         F01G4.5         WBGene00001827         x           GSH_YEAST         essential         F01G4.5         WBGene0001927         x           GSH_YEAST         essential         F01G4.5         WBGene00012497         x	GCST_YEAST	non-	Y81G3A.3	WBGene00017765	
GDIR_YEAST         non-         F37E3.1         WBGene00004356           GFF_YEAST         essential         K02B12.7         WBGene00012037           GLGE_YEAST         essential         F25B4.1         WBGene0001249         x           GLGE_YEAST         essential         F46H6.1         WBGene0001249         x           GLOS_YEAST         essential         F46H6.1         WBGene00012207         x           GLT_YEAST         essential         T048.7         WBGene00012326         x           GLT_YEAST         essential         T048.7         WBGene00012326         x           GLT_YEAST         essential         T048.7         WBGene00012326         x           GLY_YEAST         non-         K09C2.1         WBGene00012326         x           GP11_YEAST         essential         W07E11.3         WBGene00003214         x           GP13_YEAST         essential         W07E11.1         WBGene00001343         x           GP13_YEAST         essential         F01G4.5         WBGene00001827         x           GSH_YEAST         essential         F01G4.5         WBGene0001927         x           GSH_YEAST         essential         F01G4.5         WBGene00012497         x	GDA1 YEAST	essential	Y47G6A 241 h	WBGene00010697	
GEF1_YEAST         essential         K02B12.7         WBGene00000532           GIR2_YEAST         non-         R12C12.1         WBGene00012037           GLGB_YEAST         essential         F25B4.1         WBGene0001249         x           GLO3_YEAST         essential         F46H6.1         WBGene0001249         x           GLO3_YEAST         essential         T46H6.1         WBGene00012326         x           GLT1_YEAST         essential         T04A8.7         WBGene00012326         x           GLT1_YEAST         essential         F07F6.4         WBGene00012326         x           GP12_YEAST         non-         W09C2.1         WBGene00003214         x           GP12_YEAST         essential         F07F6.4         WBGene00003214         x           GP12_YEAST         essential         W07E11.3         WBGene00008504         GP13_YEAST           GP13_YEAST         essential         W07E11.1         WBGene00001227         GSH1_YEAST         essential         F01G4.5         WBGene00001227           GSHL_YEAST         essential         F01G4.5         WBGene00001817         GTR1_YEAST         essential         F01G4.5         WBGene00001817           GTR1_YEAST         non-         T05E11.6 <t< td=""><td>_</td><td></td><td>_</td><td></td><td></td></t<>	_		_		
GIR2_YEAST         non-         R12C12.1         WBGene00012037           GLGB_YEAST         essential         F25B4.1         WBGene00011409           GLO3_YEAST         non-         K08H10.4         WBGene0001249         x           GLO3_YEAST         essential         F46H6.1         WBGene00012326         x           GLT1_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T04A8.7         WBGene00012326         x           GLY1_YEAST         essential         T04A8.7         WBGene00012326         x           GLY1_YEAST         essential         T07F6.4         WBGene00012314         x           GP12_YEAST         essential         W07E11.3         WBGene00008311         GP13_YEAST           GP13_YEAST         essential         W07E11.1         WBGene00001482         GRPE_YEAST           GRPE_YEAST         essential         F25B11C.1         WBGene00001927         GSH1_YEAST           GSHLYEAST         essential         F01G4.5         WBGene00001941         GTR2_YEAST           GSHE_YEAST         essential         F01G4.5         WBGene0001941         GTR2_YEAST           GSHLYEAST         essential         F01G4.5					
GLGE_YEAST         essential         F25B4.1         WBGene00011409           GL03_YEAST         non-         K08H10.4         WBGene0001249         x           GL03_YEAST         essential         F46H6.1         WBGene00012326         x           GLT1_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T04A8.7         WBGene00012326         x           GLT1_YEAST         essential         F07F6.4         WBGene00013131         g           GP11_YEAST         essential         F07F6.4         WBGene00003214         x           GP13_YEAST         essential         W07E11.3         WBGene00008504         g           GP13_YEAST         essential         W07E11.1         WBGene00008431         g           GP18_YEAST         essential         R102.4         WBGene00001227         g           GSH1_YEAST         essential         F01G4.5         WBGene00001527         g           GSH2_YEAST         essential         D2085.6         WBGene00001627         g           GUAD_YEAST         essential         M76.2         WBGene00012497         g           GUAL_YEAST         non-         F37B12.2         WBGene00012868	GEF1_YEAST	essential	K02B12.7	WBGene00000532	
GLGE_YEAST         essential         F25B4.1         WBGene00011409         x           GLO3_YEAST         non-         K08H10.4         WBGene0001249         x           GLO3_YEAST         essential         F46H6.1         WBGene0001249         x           GLT_YEAST         essential         T26E3.4         WBGene00012326         x           GLT_YEAST         essential         T04A8.7         WBGene00012326         x           GLY_YEAST         essential         F07F6.4         WBGene00013131         g           GP11_YEAST         essential         F07F6.4         WBGene00013131         g           GP13_YEAST         essential         W07E11.1         WBGene0001482         g           GP14_YEAST         essential         W07E11.1         WBGene0001482         g           GPE_YEAST         essential         F01G4.5         WBGene00001527         g           GSHLYEAST         essential         D2085.6         WBGene00001414         g           GTA_YEAST         essential         M76.2         WBGene0000175         g           GUA_YEAST         non-         F37B12.2         WBGene00012868         g           GY2_YEAST         essential         T76.2         WBGene00012868 </td <td>GIR2 YEAST</td> <td>non-</td> <td>R12C12.1</td> <td>WBGene00012037</td> <td></td>	GIR2 YEAST	non-	R12C12.1	WBGene00012037	
GLN3_YEAST         non-         K08H10.4         WBGene00001249         x           GLO3_YEAST         essential         F46H6.1         WBGene00017217           GLPK_YEAST         non-         C07H4.2         WBGene00012326         x           GLT1_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T04A8.7         WBGene00012326         x           GLY1_YEAST         essential         F07F6.4         WBGene00013131         x           GP12_YEAST         essential         WO7E11.3         WBGene00008504         GP13_YEAST         essential         W07E11.1         WBGene00007927           GSH1_YEAST         essential         R102.4         WBGene00001227         GSH2YEAST         essential         F01G4.5         WBGene00001527           GSH2_YEAST         essential         D2085.6         WBGene000012497         GUAA_YEAST         essential         C34C12.8         WBGene00012497           GUA_YEAST         essential         T24F1.2         WBGene00012862         GYP1_YEAST         essential         T24F1.4         WBGene00012862           GYP2_YEAST         essential         T24F1.1         WBGene00012868         GYP2_YEAST         essential         T24F1.1 <td></td> <td>Aggential</td> <td>F25B4 1</td> <td>WBCone00011409</td> <td></td>		Aggential	F25B4 1	WBCone00011409	
GL03_YEAST         essential         F46H6.1         WBGene00017217           GLPK_YEAST         non-         C07H4.2         WBGene00012326         x           GLT1_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T04A8.7         WBGene00012326         x           GLY1_YEAST         essential         F07F6.4         WBGene0001221         x           GP12_YEAST         essential         F07F6.4         WBGene00003214         x           GP12_YEAST         essential         W07E11.3         WBGene00008431           GP13_YEAST         essential         R1F4.1         WBGene00008431           GP14_YEAST         essential         R102.4         WBGene00001482           GRPE_YEAST         non-         C05D11.11         WBGene00001227           GSHB_YEAST         essential         F01G4.5         WBGene00008117           GTT_YEAST         essential         C34C12.8         WBGene00002497           GUAA_YEAST         essential         M176.2         WBGene000022662           GYP1_YEAST         essential         T24F1.1         WBGene00012868           GY2_YEAST         essential         T24F1.2         WBGene00012868     <					
GLPK_YEAST         non-         C07H4.2         WBGene00020007           GLT1_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T04A8.7         WBGene00012326         x           GLT1_YEAST         non-         W09C2.1         WBGene00012326         x           GP12_YEAST         non-         R09C2.1         WBGene00013214         x           GP12_YEAST         essential         W07E11.3         WBGene00008431           GP13_YEAST         essential         W07E11.1         WBGene00008431           GRPE_YEAST         essential         R102.4         WBGene00007927           GSH1_YEAST         essential         Y52B11C.1         WBGene00001247           GSHE_YEAST         essential         F01G4.5         WBGene00008417           GTR1_YEAST         essential         D2085.6         WBGene00012497           GWAA_YEAST         essential         C34C12.8         WBGene00012497           GUAD_YEAST         essential         M176.2         WBGene00012497           GUAD_YEAST         essential         T24F1.1         WBGene00012862           GYP1_YEAST         non-         C46F11.2         WBGene00012868 <t< td=""><td>_</td><td></td><td></td><td></td><td>x</td></t<>	_				x
GLT1_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T04A8.7         WBGene00012326         x           GLY1_YEAST         non-         W09C2.1         WBGene00012326         x           GLY2_YEAST         essential         F07F6.4         WBGene00012314         x           GP12_YEAST         essential         W07E11.3         WBGene00008504         x           GP13_YEAST         essential         W07E11.1         WBGene00007927         x           GSH1_YEAST         essential         Y52B11C.1         WBGene0001527         x           GSHLYEAST         essential         P1045.5         WBGene00010941         x           GSHLYEAST         essential         D2085.6         WBGene00012497         x           GUAA_YEAST         essential         C34C12.8         WBGene00012497         x           GUAA_YEAST         essential         T24F1.2         WBGene000022862         x           GYP1_YEAST         essential         T24F1.1         WBGene00012868         x           GYP2_YEAST         non-         Y24F12A.a         WBGene00012868         x           GYP2_YEAST         essential         ZK1236.1         <	GLO3_YEAST	essential	F46H6.1	WBGene00017217	
GLT1_YEAST         essential         T26E3.4         WBGene00012326         x           GLT1_YEAST         essential         T04A8.7         WBGene00012326         x           GLY1_YEAST         non-         W09C2.1         WBGene00012326         x           GLY2_YEAST         essential         F07F6.4         WBGene00012314         x           GP12_YEAST         essential         W07E11.3         WBGene00008504         x           GP13_YEAST         essential         W07E11.1         WBGene00007927         x           GSH1_YEAST         essential         Y52B11C.1         WBGene0001527         x           GSHLYEAST         essential         P1044.5         WBGene00010941         x           GSHLYEAST         essential         D2085.6         WBGene00012497         x           GUAA_YEAST         essential         C34C12.8         WBGene00012497         x           GUAA_YEAST         essential         T24F1.2         WBGene000022862         x           GYP1_YEAST         essential         T24F1.1         WBGene00012868         x           GYP2_YEAST         non-         Y24F12A.a         WBGene00012868         x           GYP2_YEAST         essential         ZK1236.1         <	GLPK YEAST	non-	C07H4.2	WBGene00020007	
GLT1_YEAST       essential       T04A8.7       WBGene00012326         GLY1_YEAST       non-       W09C2.1       WBGene0001291         GLYC_YEAST       essential       F07F6.4       WBGene0003214       x         GP12_YEAST       essential       W07E11.3       WBGene0003214       x         GP13_YEAST       essential       W07E11.1       WBGene00008504         GP13_YEAST       essential       R102.4       WBGene00008431         GPE_YEAST       essential       R102.4       WBGene00007927         GSH1_YEAST       essential       Y52B11C.1       WBGene00001527         GSHB_YEAST       essential       F01G4.5       WBGene00008414         GTR1_YEAST       essential       D2085.6       WBGene00008414         GTR2_YEAST       essential       C34C12.8       WBGene00012497         GUAA_YEAST       non-       T05E11.6       WBGene00010912         GUAD_YEAST       essential       T24F1.1       WBGene00012862         GYP1_YEAST       essential       T24F1.1       WBGene00012868         GY2_YEAST       non-       F38E11.3       WBGene00012868         H2AV_YEAST       non-       F38E11.3       WBGene00013778         HAS1_YEAST       essent	_	Aggential	T26F3 4	WBCone00012326	v
GLY1_YEAST         non-         W09C2.1         WBGene00011291           GLYC_YEAST         essential         F07F6.4         WBGene00003214         x           GP12_YEAST         non-         R11F4.1         WBGene00008504           GP13_YEAST         essential         W07E11.3         WBGene00008431           GP13_YEAST         essential         W07E11.1         WBGene00008431           GRPE_YEAST         essential         R102.4         WBGene00007927           GSH1_YEAST         essential         Y52B11C.1         WBGene00001527           GSHB_YEAST         essential         F01G4.5         WBGene00001941           GSHR_YEAST         essential         D2085.6         WBGene00006414           GTR2_YEAST         essential         C34C12.8         WBGene00010912           GUAD_YEAST         essential         M176.2         WBGene00000775           GUF1_YEAST         non-         C46F11.2         WBGene00012868           GYP2_YEAST         essential         T24F1.1         WBGene00012868           GYP2_YEAST         non-         F38E11.3         WBGene00013178           HAS1_YEAST         essential         F32B6.8         WBGene0001841           HCM1_YEAST         essential					~
GLYC_YEAST       essential       F07F6.4       WBGene00003214       x         GP12_YEAST       non-       R11F4.1       WBGene00013131         GP11_YEAST       essential       W07E11.3       WBGene00008504         GP13_YEAST       essential       W07E11.1       WBGene00008431         GP18_YEAST       essential       R102.4       WBGene00007927         GSH1_YEAST       essential       F01G4.5       WBGene0001527         GSHB_YEAST       essential       D2085.6       WBGene00008414         GTR1_YEAST       essential       D2085.6       WBGene00012497         GUAA_YEAST       essential       C34C12.8       WBGene00012497         GUAA_YEAST       non-       F37B12.2       WBGene00012497         GUAL_YEAST       essential       M176.2       WBGene000122862         GYP1_YEAST       essential       T24F1.1       WBGene00012868         GYP2_YEAST       essential       T24F1.2       WBGene00012868         GYP2_YEAST       essential       F32B6.8       WBGene00013178         HAS1_YEAST       essential       F32B6.8       WBGene0001841         HCM1_YEAST       non-       Y38H8A.1       WBGene0001841         HAC1_YEAST       essential	GLTI_YEAST	essential	T04A8.7	WBGene00012326	
GP12_YEAST         non-         R11F4.1         WBGene00013131           GP11_YEAST         essential         W07E11.3         WBGene00008504           GP13_YEAST         essential         R102.4         WBGene00008431           GP18_YEAST         essential         R102.4         WBGene00007927           GSH1_YEAST         essential         Y52B11C.1         WBGene0001527           GSHB_YEAST         essential         D2085.6         WBGene00006414           GTR1_YEAST         essential         C34C12.8         WBGene00012497           GUAA_YEAST         non-         T05E11.6         WBGene00012497           GUAA_YEAST         essential         C34C12.8         WBGene00012497           GUAA_YEAST         non-         F37B12.2         WBGene000122862           GYP1_YEAST         essential         T24F1.1         WBGene00012868           GYP2_YEAST         essential         T24F1.1         WBGene00012868           H2AV_YEAST         non-         F38E11.3         WBGene00012868           H2AV_YEAST         non-         F38E11.3         WBGene00012868           H2AV_YEAST         non-         F38E11.3         WBGene00013178           HAS1_YEAST         essential         F32B6.8	GLY1_YEAST	non-	W09C2.1	WBGene00011291	
GP12_YEAST         non-         R11F4.1         WBGene00013131           GP11_YEAST         essential         W07E11.3         WBGene00008504           GP13_YEAST         essential         R102.4         WBGene00008431           GP18_YEAST         essential         R102.4         WBGene00007927           GSH1_YEAST         essential         Y52B11C.1         WBGene0001527           GSHB_YEAST         essential         D2085.6         WBGene00006414           GTR1_YEAST         essential         C34C12.8         WBGene00012497           GUAA_YEAST         non-         T05E11.6         WBGene00012497           GUAA_YEAST         essential         C34C12.8         WBGene00012497           GUAA_YEAST         non-         F37B12.2         WBGene000122862           GYP1_YEAST         essential         T24F1.1         WBGene00012868           GYP2_YEAST         essential         T24F1.1         WBGene00012868           H2AV_YEAST         non-         F38E11.3         WBGene00012868           H2AV_YEAST         non-         F38E11.3         WBGene00012868           H2AV_YEAST         non-         F38E11.3         WBGene00013178           HAS1_YEAST         essential         F32B6.8	GLYC YEAST	essential	F07F6.4	WBGene00003214	x
GPI1_YEASTessentialW07E11.3WBGene00008504GPI3_YEASTessentialR07E11.1WBGene00008431GPI8_YEASTessentialR102.4WBGene00011482GRPE_YEASTnon-C05D11.11WBGene00007927GSH1_YEASTessentialY52B11C.1WBGene00001527GSHB_YEASTessentialF01G4.5WBGene00008117GTR1_YEASTessentialD2085.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-T05E11.6WBGene00012497GUAA_YEASTnon-C46F11.2WBGene0000775GUF1_YEASTessentialT24F1.1WBGene000022862GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTessentialF32B6.8WBGene00013178HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HCM1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTessentialC25A1.2WBGene00004723HX9_YEASTnon-F41H10.6WBGene00004723	_	non-	D11E/ 1	WPCono00012121	
GPI3_YEASTessentialW07E11.1WBGene00008431GPI8_YEASTessentialR102.4WBGene00011482GRPE_YEASTnon-C05D11.11WBGene00007927GSH1_YEASTessentialY52B11C.1WBGene0001527GSHB_YEASTessentialD2085.6WBGene00008117GTR1_YEASTessentialD2085.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-T05E11.6WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUALYEASTnon-C46F11.2WBGene000022862GYP1_YEASTessentialT24F1.1WBGene00012868GY2_YEASTessentialM106.4WBGene00012868H2AV_YEASTnon-F38E11.3WBGene00013178HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HMCS_YEASTnon-Y53H1A.dWBGene0001841HCM1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00017769xHMT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTessentialB0511.6WBGene00003202HAS1_YEASTessentialC25A1.2WBGene00004723KMS1_YEASTnon-F41H10.6WBGene00004723	_	-			
GP18_YEASTessentialR102.4WBGene00011482GRPE_YEASTnon-C05D11.11WBGene00007927GSH1_YEASTessentialY52B11C.1WBGene00001527GSHB_YEASTessentialF01G4.5WBGene00008117GTR1_YEASTessentialD2085.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene000022862GYP1_YEASTnon-C46F11.2WBGene00012868GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTnon-F38E11.3WBGene00012868H2AV_YEASTnon-F38E11.3WBGene00013178HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTessentialY45F10A.6WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HMT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialR08C7.3WBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTessentialC25A1.2WBGene00004723HS49_YEASTnon-F41H10.6WBGene00004723	GPII_YEAST	essential	WO7EII.3	WBGene00008504	
GRPE_YEASTnon-C05D11.11WBGene00007927GSH1_YEASTessentialY52B11C.1WBGene00001527GSHB_YEASTessentialF01G4.5WBGene00008117GTR1_YEASTessentialD2085.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene000022862GYP1_YEASTnon-C46F11.2WBGene00012868GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialZK1236.1WBGene0001378HAS1_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialY45F10A.6WBGene0001841HCM1_YEASTnon-Y38H8A.1WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HMT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialR08C7.3WBGene00013766HNT1_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	GPI3_YEAST	essential	W07E11.1	WBGene00008431	
GRPE_YEASTnon-C05D11.11WBGene00007927GSH1_YEASTessentialY52B11C.1WBGene00001527GSHB_YEASTessentialF01G4.5WBGene00008117GTR1_YEASTessentialD2085.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene000022862GYP1_YEASTnon-C46F11.2WBGene00012868GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialZK1236.1WBGene0001378HAS1_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialY45F10A.6WBGene0001841HCM1_YEASTnon-Y38H8A.1WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HMT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialR08C7.3WBGene00013766HNT1_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	GPT8 YEAST	essential	R102 4	WBGene00011482	
GSH1_YEASTessentialY52B11C.1WBGene00001527GSHB_YEASTessentialF01G4.5WBGene00008117GTR1_YEASTessentialD2085.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene000022862GYP1_YEASTnon-C46F11.2WBGene00012868GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTessentialM106.4WBGene00012868GYP2_YEASTessentialZK1236.1WBGene0001378HAS1_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialY45F10A.6WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HCM1_YEASTessentialR08C7.3WBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	_				
GSHB_YEASTessentialF01G4.5WBGene00010941GSHR_YEASTessentialD2085.6WBGene00008117GTR1_YEASTnon-T05E11.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene000022862GYP1_YEASTnon-C46F11.2WBGene00012868GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTessentialZK1236.1WBGene0001378HAS1_YEASTessentialZK1236.1WBGene00013178HAT1_YEASTnon-Y38H8A.1WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	_				
GSHR_YEASTessentialD2085.6WBGene00008117GTR1_YEASTnon-T05E11.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene00002862GYP1_YEASTnon-C46F11.2WBGene00009322GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868HA2V_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTessentialY45F10A.6WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HMT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	GSH1_YEAST	essential	Y52B11C.1	WBGene00001527	
GSHR_YEASTessentialD2085.6WBGene00008117GTR1_YEASTnon-T05E11.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene00002862GYP1_YEASTnon-C46F11.2WBGene00009322GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868HA2V_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTessentialY45F10A.6WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HMT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	GSHB_YEAST	essential	F01G4.5	WBGene00010941	
GTR1_YEASTnon-T05E11.6WBGene00006414GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene000022862GYP1_YEASTnon-C46F11.2WBGene00009322GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868HA2V_YEASTnon-F38E11.3WBGene00019947HAP2_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HCM1_YEASTessentialR08C7.3WBGene00018419HMT1_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	GSHR YEAST		D2085.6	WBGene00008117	
GTR2_YEASTessentialC34C12.8WBGene00012497GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene000022862GYP1_YEASTnon-C46F11.2WBGene00022862GYP2_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTnon-F38E11.3WBGene0001947HAP2_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene00012822HAT1_YEASTnon-Y38H8A.1WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HMCS_YEASTnon-Y53H1A.dWBGene00013766HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene0000202HR25_YEASTessentialC25A1.2WBGene00004723K39_YEASTnon-F41H10.6WBGene00004723	_				
GUAA_YEASTnon-F37B12.2WBGene00010912GUAD_YEASTessentialM176.2WBGene00000775GUF1_YEASTnon-C46F11.2WBGene00022862GYP1_YEASTessentialT24F1.1WBGene00012868GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTnon-F38E11.3WBGene0001947HAP2_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene00018319HAT1_YEASTnon-Y38H8A.1WBGene0001841HCM1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00017769HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene0000202HR25_YEASTnon-F41H10.6WBGene00004723	_				
GUAD_YEASTessentialM176.2WBGene00000775GUF1_YEASTnon-C46F11.2WBGene00022862GYP1_YEASTessentialT24F1.1WBGene0009322GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTnon-F38E11.3WBGene00019947HAP2_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTessentialR08C7.3WBGene0001841HCM1_YEASTessentialR08C7.3WBGene00018319HMT1_YEASTnon-Y53H1A.dWBGene00017769HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	_	essential			
GUF1_YEASTnon-C46F11.2WBGene00022862GYP1_YEASTessentialT24F1.1WBGene00009322GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTnon-F38E11.3WBGene00019947HAP2_YEASTessentialZK1236.1WBGene00015232HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTnon-Y38H8A.1WBGene0001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00002202HR25_YEASTnon-F41H10.6WBGene0004723	GUAA_YEAST	non-	F37B12.2	WBGene00010912	
GUF1_YEASTnon-C46F11.2WBGene00022862GYP1_YEASTessentialT24F1.1WBGene00009322GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTnon-F38E11.3WBGene00019947HAP2_YEASTessentialZK1236.1WBGene00015232HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTnon-Y38H8A.1WBGene0001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00002202HR25_YEASTnon-F41H10.6WBGene0004723	GUAD YEAST	essential	M176.2	WBGene00000775	
GYP1_YEASTessentialT24F1.1WBGene00009322GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTnon-F38E11.3WBGene00019947HAP2_YEASTessentialZK1236.1WBGene00015232HAS1_YEASTessentialF32B6.8WBGene0001841HCM1_YEASTnon-Y38H8A.1WBGene0001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene0000202HR25_YEASTnon-F41H10.6WBGene00004723					
GYP2_YEASTnon-Y24F12A.aWBGene00012868GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTnon-F38E11.3WBGene00019947HAP2_YEASTessentialZK1236.1WBGene00015232HAS1_YEASTessentialF32B6.8WBGene00015232HAT1_YEASTnon-Y38H8A.1WBGene0001424HCM1_YEASTessentialY45F10A.6WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00017769HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene0000202HR25_YEASTnon-F41H10.6WBGene00004723					
GYP2_YEASTessentialM106.4WBGene00012868H2AV_YEASTnon-F38E11.3WBGene00019947HAP2_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene00015232xHAT1_YEASTnon-Y38H8A.1WBGene0001841HCM1_YEASTessentialY45F10A.6WBGene0001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00013766HNT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene0000202HR25_YEASTnon-F41H10.6WBGene00004723	_	essential			
H2AV_YEASTnon-F38E11.3WBGene00019947HAP2_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene00015232xHAT1_YEASTnon-Y38H8A.1WBGene0001841HCM1_YEASTessentialY45F10A.6WBGene0001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00013766HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene0000202HR25_YEASTnon-F41H10.6WBGene00004723	GYP2_YEAST	non-	Y24F12A.a	WBGene00012868	
H2AV_YEASTnon-F38E11.3WBGene00019947HAP2_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene00015232xHAT1_YEASTnon-Y38H8A.1WBGene0001841HCM1_YEASTessentialY45F10A.6WBGene0001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00013766HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene0000202HR25_YEASTnon-F41H10.6WBGene00004723	GYP2 YEAST	essential	M106.4	WBGene00012868	
HAP2_YEASTessentialZK1236.1WBGene00013178HAS1_YEASTessentialF32B6.8WBGene00015232xHAT1_YEASTnon-Y38H8A.1WBGene00010841HCM1_YEASTessentialY45F10A.6WBGene0001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00013766HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00009002HR25_YEASTnon-F41H10.6WBGene00004723	_				
HAS1_YEASTessentialF32B6.8WBGene00015232xHAT1_YEASTnon-Y38H8A.1WBGene00010841HCM1_YEASTessentialY45F10A.6WBGene0001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00017769xHMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00009002HR25_YEASTessentialC25A1.2WBGene00004723x					
HAT1_YEASTnon-Y38H8A.1WBGene00010841HCM1_YEASTessentialY45F10A.6WBGene00001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00017769xHMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00009002HR25_YEASTessentialC25A1.2WBGene00004723x	HAP2_YEAST	essential	ZK1236.1	WBGene00013178	
HCM1_YEASTessentialY45F10A.6WBGene00001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00017769xHMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00009002HR25_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	HAS1_YEAST	essential	F32B6.8	WBGene00015232	х
HCM1_YEASTessentialY45F10A.6WBGene00001442HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00017769xHMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00009002HR25_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	HAT1 YEAST	non-	Y38H8A.1	WBGene00010841	
HDA1_YEASTessentialR08C7.3WBGene00018319HMCS_YEASTnon-Y53H1A.dWBGene00017769xHMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00009002HR25_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723					
HMCS_YEASTnon-Y53H1A.dWBGene00017769xHMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00009002HR25_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723	_				
HMT1_YEASTessentialB0511.6WBGene00013766HNT1_YEASTnon-M03C11.4WBGene00009002HR25_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723x					
HNT1_YEAST         non-         M03C11.4         WBGene00009002           HR25_YEAST         essential         C25A1.2         WBGene00002202           HS49_YEAST         non-         F41H10.6         WBGene00004723         x	HMCS_YEAST	non-	Y53H1A.d	WBGene00017769	х
HNT1_YEAST         non-         M03C11.4         WBGene00009002           HR25_YEAST         essential         C25A1.2         WBGene00002202           HS49_YEAST         non-         F41H10.6         WBGene00004723         x	HMT1 YEAST	essential	B0511.6	WBGene00013766	
HR25_YEASTessentialC25A1.2WBGene00002202HS49_YEASTnon-F41H10.6WBGene00004723x	_				
HS49_YEAST non- F41H10.6 WBGene00004723 x	_				
	_	essential			
HST2_YEAST essential F25B4.6 WBGene00004800	HS49_YEAST	non-	F41H10.6	WBGene00004723	х
	HST2_YEAST	essential	F25B4.6	WBGene00004800	
	· · · ·	1	1		·

HUL5_YEAST	essential	Y113G7B.17	WBGene00003898	
IDH2_YEAST	essential	F21C3.3	WBGene00009664	x
IF1A_YEAST	essential	C03C10.1	WBGene00019162	x
IF2B_YEAST	essential	C08B11.5	WBGene00010560	x
IF2G_YEAST	essential	R11A8.4	WBGene00021466	x
IF2G_YEAST	non-	Y39A1C.2	WBGene00021466	x
IF2M_YEAST	essential	F43G9.1	WBGene00009771	
IF32_YEAST	non-	H06H21.3	WBGene00001232	x
IF34_YEAST	essential	K04G2.1	WBGene00001230	x
	non-	Y39G10A_246.	WBGene00001225	x
IF3A YEAST	essential	h –	WBGene00001209	x
IF3X YEAST	essential	Y39G10A 246.	WBGene00000550	
IF3Y_YEAST	essential	c	WBGene00014120	
IF5_YEAST	non-	F46B6.6	WBGene00016496	
IF6_YEAST	essential	Y39G10A_237.	WBGene00001234	x
IKI3_YEAST	non-	b	WBGene00022463	
IM13_YEAST	essential	~ F22B5.2	WBGene00006574	
IM17_YEAST	non-	Y54E2A.11	WBGene00017119	x
IM44_YEAST	essential	C27D11.1	WBGene00020383	x
IMA1_YEAST	non-	F55H2.6	WBGene000020505	x
IMB2 YEAST	essential	ZK858.7	WBGene00002074 WBGene00002076	x
—		C37C3.2	WBGene00002077	
IMB3_YEAST	non- essential	C47B2.5		x
IMB3_YEAST			WBGene00002077	x
IME2_YEAST	essential	Y110A7A.e	WBGene00010860	
IMP3_YEAST	non-	DY3.1	WBGene00016740	х
IMP4_YEAST	essential	E04A4.5	WBGene00014083	x
INO1_YEAST	essential	T09B4.9	WBGene00012148	
IPYR_YEAST	essential	F32E10.4	WBGene00008149	х
IRE1_YEAST	non-	R06A4.4	WBGene00002147	
ISC1_YEAST	essential	C53D5.a	WBGene00012105	
ISY1_YEAST	non-	C53D5.i	WBGene00009966	x
KAD1_YEAST	essential	M04C9.5	WBGene00016205	х
KAPR_YEAST	non-	C48B6.2	WBGene00002190	
KAR3_YEAST	essential	ZK795.3	WBGene00002216	
KC2C_YEAST	non-	VF13D12L.1	WBGene00002196	
KEM1_YEAST	essential	C47E12.4	WBGene00012730	
KEM1_YEAST	non-	C41C4.4	WBGene00012730	
KGUA_YEAST	essential	T27F6.6	WBGene00020190	
KIME_YEAST	non-	F53B7.3	WBGene00021534	
KIP1_YEAST	essential	C29E4.8	WBGene00000257	
KYNU_YEAST	non-	R07E4.6	WBGene00015802	
LA17_YEAST	essential	T09A5.2	WBGene00006565	x
LAH1_YEAST	essential	T01G9.6	WBGene00016653	x
LCB1_YEAST	essential	Y39G8C.1	WBGene00016020	x
LCP5_YEAST	essential	Y39G8C.b	WBGene00003059	x
LEO1_YEAST	non-	T03F1.8	WBGene00007110	
LIP5_YEAST	essential	Y42G9A.c	WBGene00010809	x
LONM_YEAST	essential	F23B12.8	WBGene00016391	
LOS1_YEAST	essential	C15H9.7	WBGene00002080	
LSM1_YEAST	non-	Y63D3A.5	WBGene00003076	
LSM2_YEAST	essential	C44E4.4	WBGene00001808	
LSM3_YEAST	non-	С23Н3.4	WBGene00003077	
LSM4 YEAST	essential	C48E7.3	WBGene00003078	
LSM5_YEAST	non-	B0035.11	WBGene00003079	
LSM6_YEAST	essential	M01F1.3	WBGene00003080	
LSM7_YEAST	non-	C34B2.6	WBGene00003081	
LYS9_YEAST	essential	C49H3.10	WBGene00019819	
MAD2_YEAST	non-	F40F8.9	WBGene00003161	
MAF1_YEAST	essential	T10G3.6	WBGene00016622	
MAK3_YEAST		Y62E10A.1		
MAK5_YEAST	non- essential	F32A5.7	WBGene00015074 WBGene00018890	x
	essential			^
MAOX_YEAST		F28F8.3 Y71G12A_187.	WBGene00012983	v
MCM2_YEAST	essential		WBGene00003154	x
MCM5_YEAST	non-	b grees 7	WBGene00003157	x
MCX1_YEAST	essential	ZK593.7	WBGene00008412	
MDHM_YEAST	non-	R02D3.1	WBGene00003162	x
MDN1_YEAST	essential	Y69A2A_2326.	WBGene00018898	x
MDN1_YEAST	non-	a a4200 2	WBGene00018898	x
MED7_YEAST	essential	C43H8.2	WBGene00002324	

MEU1_YEAST	non-	B0238.10	WBGene00015064	1
MEDI_IEASI MK16_YEAST	non- essential	F55F8.2	WBGene00015811	x
MK10_TEAST MK21 YEAST	non-	Y48B6A.12	WBGene00009084	x
MLH1_YEAST	essential	Y17G7B.5	WBGene00003373	~
MMS2_YEAST	non-	R10E4.4	WBGene00006730	
MOD5_YEAST	essential	D2030.2	WBGene00001740	
MODJ_TEAST MOT1_YEAST	non-	F20H11.3	WBGene00000274	
MP10_YEAST	essential	F55F10.1	WBGene00013544	x
MPG1_YEAST		F55F10.2	WBGene00016583	
_	non-	Y54E5B.3		x
MPPB_YEAST	essential		WBGene00013880	
MR11_YEAST	non- essential	B0228.7 C16A3.6	WBGene00003405 WBGene00003418	
MSH2_YEAST MSH4 YEAST		F23B12.7		
—	non-		WBGene00001872	
MSH4_YEAST	essential	T28A8.7	WBGene00001872	
MSH5_YEAST	non-	F39B2.2	WBGene00003421	
MSH5_YEAST	essential	ZC395.6	WBGene00003421	
MSH6_YEAST	non-	F15D4.1	WBGene00003422	
MSN4_YEAST	essential	Y75B8A.7	WBGene00018990	
MSP1_YEAST	non-	C42C1.5	WBGene00010557	
MSRA_YEAST	essential	ZC410.2	WBGene00018393	
MSS1_YEAST	essential	ZC302.1	WBGene00009557	
MSS4_YEAST	non-	H26D21.2	WBGene00004087	х
MTHS_YEAST	essential	ZK1127.11	WBGene00015512	
MTO1_YEAST	non-	ZK1127.1	WBGene00009944	
MTR4_YEAST	essential	F09E8.3	WBGene00012342	х
MTRA_YEAST	non-	F09E8.4	WBGene00006647	х
N145_YEAST	essential	Y47G6A_242.c	WBGene00003796	х
NAB4_YEAST	essential	F56F11.3	WBGene00003423	
NADE_YEAST	non-	K04D7.2	WBGene00007698	
NAH2_YEAST	essential	F43E2.5	WBGene00003733	
NAP1_YEAST	non-	F39B2.7	WBGene00017075	
NAT1_YEAST	essential	F55A12.3	WBGene00021754	
NAT1_YEAST	non-	C06A8.1	WBGene00021754	
NB35_YEAST	essential	F52H3.2	WBGene00008664	
NCL1_YEAST	essential	W08D2.7	WBGene00021686	
NCPR_YEAST	non-	F53G2.6	WBGene00019632	x
NDK_YEAST	essential	ZK328.5	WBGene00009119	
NEP1_YEAST	essential	R10E9.1	WBGene00012652	
NFU1_YEAST	non-	C24F3.4	WBGene00003064	
NHP2_YEAST	essential	F57C7.2	WBGene00012964	x
NHPX_YEAST	non-	D2096.8	WBGene00010896	x
NIP7_YEAST	essential	Y50D7_162.b	WBGene00016607	x
NMD3_YEAST	non-	Y50D7_164.a	WBGene00012030	x
NMT_YEAST	essential	F10G8.6	WBGene00020549	x
NOG1_YEAST	non-	Y48G8A 2614.	WBGene00020297	x
NOP2_YEAST	essential	a	WBGene00021073	x
NOP4_YEAST	non-	K10D2.6	WBGene00011043	x
NOP5_YEAST	essential	F25H2.5	WBGene00020915	
NOT1_YEAST	non-	Y39A1A.14	WBGene00003824	
NPR2_YEAST	essential	R10H10.1	WBGene00018635	
NRD1_YEAST	non-	Y48A6B.3	WBGene00017004	
NRK1_YEAST	essential	M28.5	WBGene00001526	
NTF2 YEAST	non-	C43E11.9	WBGene00004305	x
NU49 YEAST	essential	T25G3.3	WBGene00003790	x
014467	non-	T17E9.2	WBGene00003148	~
OAT_YEAST	essential	T07A9.9	WBGene00015814	
ODO1_YEAST	non-	W07E6.1	WBGene00020679	
_		R05H10.2	WBGene00020950	x
ODO2_YEAST	essential			x
ODP2_YEAST	non-	W01B11.3	WBGene00009082	x
ODPA_YEAST	essential	F57B9.2	WBGene00011510	х
ODPB_YEAST	non-	F49E8.1	WBGene00015413	
OM20_YEAST	essential	D1007.7	WBGene00009092	
OM40_YEAST	non-	T19A5.2	WBGene00007686	x
ORC2_YEAST	essential	R05D11.3	WBGene00003882	
ORN_YEAST	non-	Y54E5A.4	WBGene00007429	
OSTA_YEAST	essential	H21P03.1	WBGene00020683	
OSTB_YEAST	non-	C16A3.10	WBGene00011638	x
OSTE_YEAST	essential	T22B11.5	WBGene00000896	x
OSTG_YEAST	non-	W02F12.5	WBGene00022793	x

OXAL YEAST         Resential         F23B12.5         WBGene0003047           PACL YEAST         non-         TC5H10.6         WBGene0003047           PACL YEAST         non-         F23H12.2         WBGene0003185         x           PANJ YEAST         essential         C1889.6         WBGene0003186         x           PS2_YEAST         non-         C0886.8         WBGene0003186         x           PS2_YEAST         essential         T22D1.4         WBGene00003186         x           PS2_YEAST         essential         T23F.5         WBGene0001322         p           PDS5_YEAST         essential         T03F.5         WBGene0003163         x           PES_YEAST         essential         C565.9         WBGene0003163         x           PES_YEAST         non-         Y54E10B_152.         WBGene00041231         x           PES_YEAST         non-         Y54E10B_152.         WBGene0004191         x           PEX_YEAST         non-         Y54E10B_152.         WBGene0004194         x           PEX_YEAST         non-         F1085.5         WBGene0004194         x           PES_YEAST         non-         F1085.4         WBGene0004194         x           PEX_YEA					
PAC2_VEAST         essential         C04C3.3         WBGene00018033         x           PAR1_VEAST         essential         C18E9.6         WBGene00018018         x           PBS2_VEAST         essential         F59E10.1         WBGene00018016         x           PPS2_VEAST         essential         T2D1.4         WBGene00003186         x           PCH2_VEAST         essential         T2D1.4         WBGene00008611         x           PDS5_VEAST         essential         F57B10.10         WBGene0001872         PDS3_VEAST         essential         C0182.3         WBGene00014234           PDS5_VEAST         essential         C55A6.9         WBGene00003163         x         PESC_VEAST         non-         K6732.7         WBGene00003163         x           PESC_VEAST         non-         K76410.52.1         WBGene00004191         x         PESC_VEAST         non-         Y54E10B_152.         WBGene00004191         x           PEX_VEAST         non-         Y54E10B_152.         WBGene00004191         x         PEX_VEAST         non-         P1085.5         WBGene00004191         x           PEX_VEAST         non-         F1085.5         WBGene00004195         PEX_VEAST         non-         P1382.21.1         WBGene000020686 </td <td>OXA1_YEAST</td> <td>essential</td> <td>F23B12.5</td> <td>WBGene00007215</td> <td>x</td>	OXA1_YEAST	essential	F23B12.5	WBGene00007215	x
PAC2_VEAST         essential         C04C3.3         WBGene00018033         x           PAR1_VEAST         essential         C18E9.6         WBGene00018018         x           PBS2_VEAST         essential         F59E10.1         WBGene00018016         x           PPS2_VEAST         essential         T2D1.4         WBGene00003186         x           PCH2_VEAST         essential         T2D1.4         WBGene00008611         x           PDS5_VEAST         essential         F57B10.10         WBGene0001872         PDS3_VEAST         essential         C0182.3         WBGene00014234           PDS5_VEAST         essential         C55A6.9         WBGene00003163         x         PESC_VEAST         non-         K6732.7         WBGene00003163         x           PESC_VEAST         non-         K76410.52.1         WBGene00004191         x         PESC_VEAST         non-         Y54E10B_152.         WBGene00004191         x           PEX_VEAST         non-         Y54E10B_152.         WBGene00004191         x         PEX_VEAST         non-         P1085.5         WBGene00004191         x           PEX_VEAST         non-         F1085.5         WBGene00004195         PEX_VEAST         non-         P1382.21.1         WBGene000020686 </td <td>PAC1 YEAST</td> <td>non-</td> <td>T05H10.6</td> <td>WBGene00003047</td> <td></td>	PAC1 YEAST	non-	T05H10.6	WBGene00003047	
PARJ_VEAST         non-         F23H12.2         WBGene00003838         x           PAN3_VEAST         essential         C18E9.6         WBGene00017816         x           PBS2_VEAST         essential         F59E10.1         WBGene00003186         x           PBS2_VEAST         essential         T09A5.11         WBGene00003186         x           PDST_VEAST         essential         T09A5.11         WBGene00018956           PDAT_VEAST         essential         T07F5.5         WBGene00014234           PDSS_VEAST         non-         K07H8.1         WBGene00014234           PESC_VEAST         non-         K07H8.1         WBGene00003063         x           PESC_VEAST         non-         YAST         WBGene00003063         x           PESC_VEAST         non-         YAST         WBGene00004191         x           PEX_VEAST         non-         Y54E10B_152.         WBGene00004194         x           PEX_VEAST         non-         Y54E10B_152.         WBGene00004194         x           PEX_VEAST         non-         H1085.5         WBGene00004195         x           PEX_VEAST         non-         H1085.5         WBGene00004195         x           PEX_VEAST			C04C3.3	WBGene00019503	
PAND_VEAST         essential         CIBES.6         WBGene00017816           PBS2_VEAST         non-         CO8B6.8         WBGene00003186         ×           PSS2_VEAST         non-         CO8B6.8         WBGene00003186         ×           PCH2_VEAST         essential         T22D1.4         WBGene00003186         ×           PCH2_VEAST         essential         T75710.10         WBGene00014234           PDS5_VEAST         essential         T7676.5         WBGene00014234           PES2_VEAST         non-         C0142.3         WBGene00014234           PES2_VEAST         essential         C55A6.9         WBGene00003163         ×           PES2_VEAST         essential         F26E10B_152.         WBGene00004191         ×           PEX1_VEAST         essential         b         WBGene00004193         ×           PEX5_VEAST         essential         b         WBGene00004194         ×           PEX0_VEAST         essential         MSGene00004194         ×         WBGene00004194         ×           PEX0_VEAST         essential         WSGene00004194         ×         WBGene00004194         ×           PEX0_VEAST         essential         RO555.4         WBGene000004195         × <td>_</td> <td></td> <td></td> <td></td> <td>v</td>	_				v
PBPL_VEAST         essential         F59E10.1         WBGene0003186         x           PBS2_VEAST         essential         T22D1.4         WBGene0003186         x           PCH2_VEAST         essential         T09A5.11         WBGene00003186         x           PDAT_VEAST         essential         T09A5.11         WBGene0001382           PDS5_VEAST         essential         ZK686.3         WBGene0001382           PDS3_VEAST         non-         C01A2.3         WBGene0001383           PES_VEAST         essential         C55A6.9         WBGene0000363         x           PSC_VEAST         essential         C56A.9         WBGene0000363         x           PSC_VEAST         essential         F26E1.2         WBGene00004191         x           PSC_VEAST         essential         F02B.5         WBGene00004191         x           PEX_VEAST         essential         F57B.1         WBGene00004194         x           PSC_VEAST         non-         Y4E10B_152.         WBGene000019220         x           PFD_VEAST         non-         K1228.8         WBGene00001920         x           PFD_VEAST         non-         D145.3         WBGene00001920         x           PFD_VEAST </td <td>—</td> <td></td> <td></td> <td></td> <td>~</td>	—				~
PBS2_YEAST         non-         COBB6.8         WBGene00003186         x           PBS2_YEAST         essential         T2D1.4         WBGene00003864         x           PCH2_YEAST         essential         T72D1.4         WBGene00008641         x           PDS5_YEAST         essential         F57B10.10         WBGene0001872           PDS5_YEAST         essential         T366.5         WBGene00014234           PPST_YEAST         essential         C55A6.9         WBGene00003063         x           PSC_YEAST         non-         ZK632.7         WBGene00003163         x           PSC_YEAST         non-         Y54E10B_152.         WBGene00004191         x           PEX_YEAST         essential         P56.4         WBGene00004195         x           PEX_YEAST         non-         Y54E10B_152.         WBGene00004195         x           PEX_YEAST         non-         F5105.5         WBGene00004195         x           PEX_YEAST         essential         MSGEne000004195         x           PEX_YEAST         essential         R138.8         WBGene000004185         x           PEX_YEAST         sesential         R138.13         WBGene00020666         x           PES_YEAST </td <td>_</td> <td></td> <td></td> <td></td> <td></td>	_				
PBSYEAST         essential         T22D1.4         WBGene00003186         x           PCH2_YEAST         essential         T09A5.11         WBGene00010872           PDST_YEAST         essential         ZK686.3         WBGene00018956           PDX3_YEAST         non-         C01A2.3         WBGene00013053           PES_YEAST         non-         K07H8.1         WBGene00003063         x           PES_YEAST         non-         K07H8.1         WBGene00004191         x           PES_YEAST         essential         F26E1.2         WBGene00004191         x           PEX_YEAST         essential         b         WBGene00004191         x           PEX_YEAST         essential         b         WBGene00004191         x           PEX_YEAST         non-         F10B5.5         WBGene00004195         x           PEX_YEAST         non-         F10B5.4         WBGene00004195         x           PEX_YEAST         non-         R10B5.4         WBGene0000112         x           PES_YEAST         non-         R13A5.12         WBGene0002012         x           PED_YEAST         non-         R13A5.12         WBGene00020696         x           PEG_YEAST         non-	_				
PCRL_YEAST         essential         T09A5.11         WBGene00010872           PDAT_YEAST         essential         F57B10.10         WBGene0001352           PDX3_YEAST         essential         F57B10.10         WBGene0001352           PDX3_YEAST         essential         C01A2.3         WBGene0001352           PDX3_YEAST         essential         C01A2.3         WBGene0001352           PESC_YEAST         non-         C01A2.3         WBGene0000363         x           PESC_YEAST         non-         ZK632.7         WBGene0000363         x           PESC_YEAST         non-         ZK632.7         WBGene00004191         x           PEXLYEAST         essential         e         WBGene00004191         x           PEXLYEAST         essential         b         WBGene00004195         x           PEXC_YEAST         essential         MO5B5.4         WBGene00004198         x           PEXLYEAST         essential         MO5B5.4         WBGene00004198         x           PEXLYEAST         essential         MS5B5.4         WBGene000020120         x           PEXLYEAST         essential         R3A5.12         WBGene00020104         x           PED4_YEAST         non-	PBS2_YEAST	non-	C08B6.8	WBGene00003186	х
PDNT_TEAST         essential         F5TB10.10         WBGene00010872           PDS5_YEAST         non-         CO1A2.3         WBGene0001352           PPS1_YEAST         non-         CO1A2.3         WBGene00014234           PES2_YEAST         non-         KOTH8.1         WBGene00021658           PES2_YEAST         essential         C55A6.9         WBGene0000363         x           PESC_YEAST         essential         F26B1.2         WBGene00004191         y           PEX1_YEAST         essential         e         WBGene00004191         y           PEX4_YEAST         essential         b         WBGene00004195         y           PEX5_YEAST         non-         Y54E10B_152.         WBGene00004195         y           PEX6_YEAST         essential         PS5789.1         WBGene00004195         y           PFD4_YEAST         non-         R1385.4         WBGene00002012         y           PFD4_YEAST         non-         R1385.12         WBGene00020185         y           PFD4_YEAST         non-         R13A5.13         WBGene00020696         y           PHSG_YEAST         non-         C1414.4         WBGene00020696         y           PHSG_YEAST         non-	PBS2_YEAST	essential	T22D1.4	WBGene00003186	x
PDST_VEAST         essential         F57B10.10         WBGene00010872           PDSS_VEAST         non-         C01A2.3         WBGene0001352           PPSJ_VEAST         non-         C01A2.3         WBGene00016396           PESJ_VEAST         essential         C55A6.9         WBGene0000363         x           PESS_VEAST         essential         C55A6.9         WBGene0000363         x           PESS_VEAST         essential         e         WBGene00004191         y           PEX_VEAST         essential         e         WBGene00004191         y           PEX_VEAST         essential         b         WBGene00004195         y           PEX_VEAST         essential         MO5B5.4         WBGene00004195         y           PEX_VEAST         essential         F57B9.1         WBGene00007017         y           PFD_YEAST         essential         F57B9.1         WBGene00020182         y           PFD_YEAST         essential         C34C6.6         WBGene00020185         y           PHS_YEAST         non-         R13A5.13         WBGene00020696         y         y           PHS_YEAST         non-         F39G3.7         WBGene00020696         y         y         y	PCH2 YEAST	essential	T09A5.11	WBGene00008641	
PDS5_TEAST         essential         ZK686.3         WBGene0001352           PDX3_YEAST         non-         C01A2.3         WBGene00014324           PPS1_YEAST         essential         C01A2.3         WBGene00014234           PPS2_YEAST         essential         C05A6.9         WBGene0000363         x           PESC_YEAST         essential         F26B1.2         WBGene0000363         x           PEX1_YEAST         non-         ZK632.7         WBGene00004191         p           PEX1_YEAST         non-         Y54E10B_152.         WBGene00004191         p           PEX5_YEAST         non-         F10B5.5         WBGene00004195         p           PEX5_YEAST         non-         F10B5.5         WBGene00001498         p           PPD4_YEAST         essential         F57B9.1         WBGene00002112         p           PPD4_YEAST         essential         R13A5.12         WBGene000201696         p           PHSG_YEAST         non-         R13A5.12         WBGene00020696         p           PHSG_YEAST         non-         C1411.6         WBGene00020696         p         p           PHSG_YEAST         non-         F333.7         WBGene00020696         p         p         <	—				
PDX3_TEAST         non-         C01A2.3         WBGene00018996           PP11_YEAST         essential         T03F6.5         WBGene0003063         x           PESC_YEAST         non-         X632.7         WBGene0003063         x           PESC_YEAST         essential         F2681.2         WBGene0000363         x           PESC_YEAST         essential         e         WBGene00004191         y           PEXL_YEAST         essential         b         WBGene00004191         y           PEXL_YEAST         essential         b         WBGene00004195         y           PEXC_YEAST         non-         Y54E10B_152.         WBGene00004195         y           PEXC_YEAST         essential         M05B5.4         WBGene00002102         y           PFD2_YEAST         essential         F57B9.1         WBGene00020112         y           PFD2_YEAST         essential         C1H1.4         WBGene00020112         y           PGK_YEAST         non-         R13A5.13         WBGene00020666         y           PHSG_YEAST         non-         F39G3.7         WBGene00020666         y           PHSG_YEAST         non-         F39G3.7         WBGene000020696         y	—				
PEIL_VEAST         essential         T03F6.5         WBGene00014234           PEBS_VEAST         essential         C55A6.9         WBGene00003063         x           PESC_VEAST         essential         C55A6.9         WBGene0000363         x           PESC_VEAST         essential         P2611.2         WBGene0000363         x           PETS_VEAST         essential         P2611.2         WBGene00004191         x           PEXS_VEAST         non-         Y54E10B_152.         WBGene00004194         x           PEXC_VEAST         essential         b         WBGene00004197         x           PEXC_VEAST         essential         M05B5.4         WBGene00004198         x           PFD3_VEAST         non-         H36K22.1         WBGene00020188         x           PFD4_VEAST         non-         ZK128.8         WBGene00020168         x           PFD5_VEAST         non-         ZK128.8         WBGene00020696         x           PFSG_VEAST         non-         ZK128.4         WBGene00020696         x           PHSG_VEAST         non-         ZX128.5         WBGene00020696         x           PHSG_VEAST         non-         F303.7         WBGene00020696         x	_				
PEB_YEAST         non-         K07H8.1         WBGene00021058         x           PESC_YEAST         non-         Z55A6.9         WBGene00003063         x           PESC_YEAST         non-         Y54E10B_152.         WBGene00004191         x           PEXLYEAST         essential         e         WBGene00004191         x           PEXLYEAST         non-         Y54E10B_152.         WBGene00004195         x           PEXC_YEAST         non-         Y54E10B_152.         WBGene00004195         x           PEXC_YEAST         non-         F10B5.5         WBGene00004197         x           PEXD_YEAST         essential         F57B9.1         WBGene000019220         x           PFD4_YEAST         essential         F57B9.1         WBGene00020112         x           PFD4_YEAST         non-         R13A5.12         WBGene0002066         x           PFGX_YEAST         essential         C1H1.4         WBGene00020696         x           PHSG_YEAST         essential         C34C6.6         WBGene00020696         x           PHSG_YEAST         essential         F08G12.2         WBGene00004028         x           PIF1_YEAST         essential         F03G13.7         WBGene000104028	_				
PESC_YEAST         essential         C55A6.9         WBGene00003063         x           PESC_YEAST         essential         F26B1.2         WBGene000036364           PEXL_YEAST         non-         Y54E10B_152.         WBGene00004191           PEXL_YEAST         essential         e         WBGene00004191           PEXL_YEAST         essential         b         WBGene00004194           PEXC_YEAST         non-         Y54E10B_152.         WBGene00004197           PEXC_YEAST         essential         M05B5.4         WBGene00006889         x           PFD3_YEAST         essential         R1385.12         WBGene00020112         x           PFD4_YEAST         essential         R13A5.13         WBGene00020696         x           PHSG_YEAST         essential         C11H1.4         WBGene00020696         x           PHSG_YEAST         essential         C34C6.6         WBGene00020696         pHSG_YEAST         non-         C11H1.6         WBGene00020696         pHSG_YEAST         non-         F32A5.6         WBGene00020696         pHSG_YEAST         essential         PC04.4         WBGene000120897         x           PIF1_YEAST         essential         PC06.5.6         WBGene000120896         pHSG_YEAST         non-	PE11_YEAST	essential	T03F6.5	WBGene00014234	
PESC_YEAST         non-         ZK632.7         WBGene00003634           PETA_YEAST         essential         F26B1.2         WBGene00004191           PEXL_YEAST         non-         Y54E10B_152.         WBGene00004191           PEXS_YEAST         non-         F10B5.5         WBGene00004194           PEXS_YEAST         non-         F10B5.5         WBGene00004194           PEXS_YEAST         essential         b         WBGene00004194           PEXS_YEAST         non-         F10B5.5         WBGene00001920           PFDA_YEAST         essential         MSEC.1         WBGene00006889         x           PFD4_YEAST         essential         R13A5.12         WBGene00020696         x           PFSG_YEAST         essential         R13A5.13         WBGene00020696         x           PHSG_YEAST         non-         C11H1.4         WBGene00020696         x           PHSG_YEAST         non-         F32A5.6         WBGene00020696         x           PHSG_YEAST         non-         F32A5.6         WBGene00020696         x           PHSG_YEAST         non-         F32A5.6         WBGene00004028         x           PIF1_YEAST         essential         T0666.9         WBGene00004028	PEP3_YEAST	non-	К07Н8.1	WBGene00021058	
PESC_YEAST         non-         ZK632.7         WBGene00003634           PETA_YEAST         essential         F26B1.2         WBGene00004191           PEXL_YEAST         non-         Y54E10B_152.         WBGene00004191           PEXS_YEAST         non-         F10B5.5         WBGene00004194           PEXS_YEAST         non-         F10B5.5         WBGene00004194           PEXS_YEAST         essential         b         WBGene00004194           PEXS_YEAST         non-         F10B5.5         WBGene00001920           PFDA_YEAST         essential         MSEC.1         WBGene00006889         x           PFD4_YEAST         essential         R13A5.12         WBGene00020696         x           PFSG_YEAST         essential         R13A5.13         WBGene00020696         x           PHSG_YEAST         non-         C11H1.4         WBGene00020696         x           PHSG_YEAST         non-         F32A5.6         WBGene00020696         x           PHSG_YEAST         non-         F32A5.6         WBGene00020696         x           PHSG_YEAST         non-         F32A5.6         WBGene00004028         x           PIF1_YEAST         essential         T0666.9         WBGene00004028	PESC_YEAST	essential	C55A6.9	WBGene00003063	x
PETB_YEAST         essential         F26B1.2         WBGene00003864           PEXI_YEAST         non-         Y54E10B_152.         WBGene00004191           PEX5_YEAST         non-         Y54E10B_152.         WBGene00004191           PEX6_YEAST         essential         b         WBGene00004195           PEX6_YEAST         essential         M05B5.4         WBGene00004197           PEX0_YEAST         essential         F57B9.1         WBGene00001220           PFD3_YEAST         essential         F57B9.1         WBGene000020112           PFD5_YEAST         non-         R13A5.12         WBGene00020165           PHS0_YEAST         non-         R13A5.13         WBGene00020696           PHSG_YEAST         non-         F3933.7         WBGene00020696           PHSG_YEAST         non-         F393.7         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene000120897           PIF1_YEAST         essential         T0666.9         WBGene00014028           PIF1_YEAST         essential         T0665.9         WBGene00018076           PIS_YEAST         non-         F40C5.b         WBGene00018076 <td></td> <td>non-</td> <td>ZK632.7</td> <td>WBGene00003063</td> <td>x</td>		non-	ZK632.7	WBGene00003063	x
PEX1_YEAST         non-         Y54E10B_152.         WBGene00004191           PEX5_YEAST         non-         ry54E10B_152.         WBGene00004194           PEX6_YEAST         essential         b         WBGene00004194           PEX6_YEAST         essential         b         WBGene00004194           PEX6_YEAST         essential         b         WBGene00004197           PEX6_YEAST         non-         F10B5.5         WBGene000019220           PFD3_YEAST         essential         F57B9.1         WBGene00007107           PFD5_YEAST         essential         R13A5.12         WBGene000020185           PHS6_YEAST         non-         D1046.3         WBGene00020696           PHS6_YEAST         non-         C11H1.4         WBGene00020696           PHS6_YEAST         essential         F303.7         WBGene00020696           PHS6_YEAST         essential         F3245.6         WBGene00020696           PHS6_YEAST         essential         F08B12.2         WBGene00004028           PIF1_YEAST         essential         T0666.9         WBGene00014028           PIF1_YEAST         essential         R107.3         WBGene00014028           PIF1_YEAST         essential         F40C5.6         WBGene00					
PEX1_YEAST         essential         e         WBGene00004191         x           PEX5_YEAST         non-         Y54E10B_152.         WBGene00004195           PEX6_YEAST         essential         b         WBGene00004195           PEX0_YEAST         essential         M05B5.4         WBGene00004195           PFD2_YEAST         essential         FS7B9.1         WBGene00002200           PFD3_YEAST         essential         FS7B9.1         WBGene000020112           PFD5_YEAST         essential         R13A5.12         WBGene000020121           PFD5_YEAST         essential         R13A5.13         WBGene00020696           PHSG_YEAST         essential         C11H1.6         WBGene00020696           PHSG_YEAST         non-         F3283.7         WBGene00020696           PHSG_YEAST         non-         F3285.6         WBGene00020696           PHSG_YEAST         non-         F3285.6         WBGene00020696           PHSG_YEAST         non-         F3285.6         WBGene00020696           PHSG_YEAST         non-         F3285.6         WBGene00020696           PHST_YEAST         essential         T0666.9         WBGene00012089           PIF1_YEAST         essential         R10656.9	—				
PEX5_YEAST         non-         Y54E10B_152.         WBGene00004194         x           PEX6_YEAST         essential         b         WBGene00004195         WBGene00004197           PEXD_YEAST         essential         MO5B5.4         WBGene00004197           PEXD_YEAST         essential         F57B9.1         WBGene00006889         x           PFD3_YEAST         essential         F57B9.1         WBGene00009004         x           PFD4_YEAST         non-         R13A5.12         WBGene00020696         x           PFG5_YEAST         essential         C11H1.4         WBGene00020696         x           PHSG_YEAST         essential         C11H1.4         WBGene00020696         x           PHSG_YEAST         essential         C34C6.6         WBGene00020696         x           PHSG_YEAST         essential         C34C6.6         WBGene00020696         x           PHSG_YEAST         non-         F32G3.7         WBGene00020696         x           PHSG_YEAST         non-         F32G3.6         WBGene000120696         x           PIF1_YEAST         essential         T0565.4         WBGene00012087         x           PIF1_YEAST         non-         F21C3.5         WBGene00012087	_		_		
PEX6_YEAST         essential         b         WBGene00004195           PEXC_YEAST         non-         F10B5.5         WBGene00004197           PEXD_YEAST         essential         M05B5.4         WBGene00004198           PFD2_YEAST         essential         F57B9.1         WBGene00007107           PFD5_YEAST         essential         W06B4.3         WBGene000020112           PFD5_YEAST         non-         R13A5.12         WBGene00020185           PKG_YEAST         non-         R13A5.13         WBGene00020696           PHSG_YEAST         essential         C14H.4         WBGene00020696           PHSG_YEAST         essential         C34C6.6         WBGene0020696           PHSG_YEAST         non-         F39G3.7         WBGene0020696           PHSG_YEAST         non-         F39G3.7         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00020696           PHS_YEAST         essential         T0056.9         WBGene00012897           PIF1_YEAST         essential         T03F1.3         WBGene00012897           PIS_YEAST         essential         T03F1.3         WBGene00012897           PIS_YEAST         essential         F40C5.d         WBGene00012897 <td>—</td> <td>essential</td> <td></td> <td></td> <td></td>	—	essential			
PEXC_YEAST         non-         FIDES.5         WBGene00004197           PED_YEAST         essential         M05B5.4         WBGene00004197           PFD2_YEAST         non-         H38K22.1         WBGene000019220           PFD3_YEAST         essential         F57B9.1         WBGene00007107           PFD5_YEAST         essential         W06B4.3         WBGene00020112           PFD6_YEAST         non-         R13A5.12         WBGene00020696           PHSG_YEAST         essential         C11H1.4         WBGene00020696           PHSG_YEAST         non-         C11H1.4         WBGene00020696           PHSG_YEAST         non-         C34C6.6         WBGene00020696           PHSG_YEAST         essential         C34C6.6         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00004028           PIF1_YEAST         essential         R051.9         WBGene00018076           PIS_YEAST         non-         F21C3.5         WBGene00018076           PIS_YEAST         non-         F21C3.5         WBGene00018076           PIS_YEAST         non-         F40C5.b         WBGene0001287	PEX5_YEAST	non-	Y54E10B_152.	WBGene00004194	х
PEXD_YEAST         essential         M05B5.4         WBGene00004198           PFD2_YEAST         non-         H38K22.1         WBGene00006889         x           PFD4_YEAST         essential         W66B4.3         WBGene00007107           PFD5_YEAST         essential         R13A5.12         WBGene00009004         x           PFD5_YEAST         essential         R13A5.13         WBGene00020185         x           PFGK_YEAST         essential         C11H1.4         WBGene00020696         x           PHSG_YEAST         essential         C14C6.6         WBGene00020696         x           PHSG_YEAST         essential         C14H1.6         WBGene00020696         x           PHSG_YEAST         essential         F08B12.2         WBGene00020696         x           PHSG_YEAST         non-         F32A5.6         WBGene00004028         x           PIF1_YEAST         essential         T06G6.9         WBGene00018076         x           PIS_YEAST         non-         F21C3.5         WBGene00018076         x           PIS_YEAST         non-         F40C5.b         WBGene00018078         x           PNH_YEAST         essential         F40C5.c         WBGene00015486         x	PEX6_YEAST	essential	b	WBGene00004195	
PEXD_YEAST         essential         M05B5.4         WBGene00004198           PFD2_YEAST         non-         H38K22.1         WBGene00006889         x           PFD4_YEAST         essential         W66B4.3         WBGene00007107           PFD5_YEAST         essential         R13A5.12         WBGene00009004         x           PFD5_YEAST         essential         R13A5.13         WBGene00020185         x           PFGK_YEAST         essential         C11H1.4         WBGene00020696         x           PHSG_YEAST         essential         C14C6.6         WBGene00020696         x           PHSG_YEAST         essential         C14H1.6         WBGene00020696         x           PHSG_YEAST         essential         F08B12.2         WBGene00020696         x           PHSG_YEAST         non-         F32A5.6         WBGene00004028         x           PIF1_YEAST         essential         T06G6.9         WBGene00018076         x           PIS_YEAST         non-         F21C3.5         WBGene00018076         x           PIS_YEAST         non-         F40C5.b         WBGene00018078         x           PNH_YEAST         essential         F40C5.c         WBGene00015486         x	PEXC YEAST	non-	F10B5.5	WBGene00004197	
PFD2_YEAST         non-         H38K22.1         WBGene00019220           PFD3_YEAST         essential         P57B9.1         WBGene00006889         x           PFD4_YEAST         non-         ZK1128.8         WBGene00020112         y           PFD5_YEAST         essential         W06B4.3         WBGene00020696         x           PGK_YEAST         non-         R13A5.12         WBGene00020696         y           PHSG_YEAST         essential         C11H1.4         WBGene00020696         y           PHSG_YEAST         non-         C11H1.6         WBGene00020696         y           PHSG_YEAST         essential         C34C6.6         WBGene00020696         y           PHSG_YEAST         non-         F33G3.7         WBGene00020696         y         y         y           PHSG_YEAST         non-         F32G3.7         WBGene00020696         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y         y	_	essential	M05B5.4	WBGene00004198	
PFD3_YEAST         essential         F57B9.1         WBGene00006889         x           PFD4_YEAST         non-         ZK1128.8         WBGene00020112           PFD5_YEAST         essential         WB684.3         WBGene00020185           PFD6_YEAST         non-         R13A5.12         WBGene00020696           PHSG_YEAST         essential         C11H1.4         WBGene00020696           PHSG_YEAST         essential         C11H1.6         WBGene00020696           PHSG_YEAST         essential         C34C6.6         WBGene00020696           PHSG_YEAST         non-         F3303.7         WBGene00020696           PHSG_YEAST         non-         F3303.7         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00004028           PIF1_YEAST         essential         T0666.9         WBGene00004028           PIF1_YEAST         essential         T03F1.3         WBGene0001287           PLC1_YEAST         essential         F40C5.c         WBGene0001265           PNPH_YEAST         essential         F40C5.c         WBGene0001265           PO1_YEAST         essential         F40C5.c	—				
PFD4_YEAST         non-         ZK1128.8         WBGene00007107           PFD5_YEAST         essential         W06B4.3         WBGene00020112           PFD6_YEAST         non-         R13A5.12         WBGene00020185           PHSG_YEAST         essential         R13A5.13         WBGene00020696           PHSG_YEAST         essential         C1H1.4         WBGene00020696           PHSG_YEAST         non-         C1H1.6         WBGene00020696           PHSG_YEAST         non-         F39G3.7         WBGene00020696           PHSG_YEAST         non-         F39G3.7         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00020696           PHST_YEAST         essential         T0666.9         WBGene00020896           PIF1_YEAST         essential         T0666.9         WBGene00004028           PIF1_YEAST         non-         F212.5         WBGene0001287           PLC1_YEAST         essential         T03F1.3         WBGene0001287           PLC1_YEAST         essential         F40C5.c         WBGene0001266           POP2_YEAST         non-         F40C5.h         WBGene00012665	—				
PFD5_YEAST         essential         W06B4.3         WBGene00020112           PFD6_YEAST         non-         R13A5.12         WBGene0002004         x           PGK_YEAST         essential         R13A5.13         WBGene00020696           PHSG_YEAST         non-         D1046.3         WBGene00020696           PHSG_YEAST         essential         C1H1.4         WBGene00020696           PHSG_YEAST         essential         C34C6.6         WBGene00020696           PHSG_YEAST         non-         F39G3.7         WBGene00020696           PHSG_YEAST         non-         F39G3.7         WBGene00020696           PHSG_YEAST         non-         F325.6         WBGene00020696           PHST_YEAST         essential         120J04.d         WBGene00004028           PIF1_YEAST         essential         R151.9         WBGene00012897           PIL_YEAST         essential         R151.9         WBGene00012897           PLC1_YEAST         essential         F40C5.c         WBGene00012887           PD1_YEAST         essential         F40C5.c         WBGene0001928           PO21_YEAST         non-         F40C5.c         WBGene0001265           PP1_YEAST         non-         F40C5.c         WB	_				x
PFD6_YEAST         non-         R13A5.12         WBGene00009004         x           PGK_YEAST         essential         R13A5.13         WBGene0002085           PHSG_YEAST         non-         D1046.3         WBGene00020696           PHSG_YEAST         essential         C11H1.4         WBGene00020696           PHSG_YEAST         essential         C34C6.6         WBGene00020696           PHSG_YEAST         non-         F38G3.7         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00004028           PIF1_YEAST         essential         T0666.9         WBGene00004028           PIF1_YEAST         essential         R151.9         WBGene00012897           PLC1_YEAST         essential         R10751.3         WBGene00004038         x           PMM_YEAST         non-         F40C5.b         WBGene00015466           POP1_YEAST         essential         F40C5.4         WBGene00016486           POP1_YEAST         essential         F40C5.4         WBGene00018625         x           PP1_YEAST         essential<		non-			
PGK_VEAST         essential         R13A5.13         WBGene00020185           PHSG_YEAST         non-         D1046.3         WBGene00020696           PHSG_YEAST         non-         C11H1.4         WBGene00020696           PHSG_YEAST         non-         C11H1.6         WBGene00020696           PHSG_YEAST         essential         C34C6.6         WBGene00020696           PHSG_YEAST         essential         F03B12.2         WBGene00020696           PHSG_YEAST         essential         H20J04.d         WBGene00020696           PIF1_YEAST         essential         H20J04.d         WBGene00004028           PIF1_YEAST         essential         R151.9         WBGene00004028           PIF1_YEAST         essential         R151.9         WBGene00018076           PIS_YEAST         non-         F21C3.5         WBGene00018076           PIS_YEAST         essential         F40C5.c         WBGene00012897           PMM_YEAST         essential         F40C5.d         WBGene0000138         x           PPMH_YEAST         essential         F40C5.c         WBGene0001369         p004_YEAST           POP1_YEAST         essential         F40C5.c         WBGene00012665         pr31_YEAST         non-         F40C	PFD5_YEAST	essential	W06B4.3	WBGene00020112	
PHSG_YEAST         non-         D1046.3         WBGene00020696           PHSG_YEAST         essential         Cl1H1.4         WBGene00020696           PHSG_YEAST         non-         Cl1H1.6         WBGene00020696           PHSG_YEAST         non-         F39G3.7         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         essential         T0666.9         WBGene00004028           PIF1_YEAST         essential         T0666.9         WBGene00010287           PIK1_YEAST         essential         R151.9         WBGene0001897           PLC1_YEAST         non-         F21C3.5         WBGene0001925         x           PNM_YEAST         essential         F40C5.c         WBGene0001928         x           PDP1_YEAST         essential         F40C5.d         WBGene0000389         x           PPT1_YEAST         essential         T22F3.3         WBGene00018625         x           PPT1_YEAST         essential         T22F3.3         WBGene00018625         x <tr< td=""><td>PFD6_YEAST</td><td>non-</td><td>R13A5.12</td><td>WBGene00009004</td><td>x</td></tr<>	PFD6_YEAST	non-	R13A5.12	WBGene00009004	x
PHSG_YEAST         non-         D1046.3         WBGene00020696           PHSG_YEAST         essential         Cl1H1.4         WBGene00020696           PHSG_YEAST         essential         C34C6.6         WBGene00020696           PHSG_YEAST         essential         C34C6.6         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         essential         T00-         F32A5.6         WBGene00004028           PIF1_YEAST         essential         T0666.9         WBGene000104028         PIF1_YEAST           PIK1_YEAST         essential         R151.9         WBGene00012897           PLC1_YEAST         non-         F21C3.5         WBGene00012897           PLC1_YEAST         essential         F40C5.0         WBGene0001925         x           PNPH_YEAST         essential         F40C5.4         WBGene0000389         x           PPT1_YEAST         essential         F40C5.6         WBGene00012665         x           PR12_YEAST         non-         F40C5.h         WBGene00018625 </td <td>PGK YEAST</td> <td>essential</td> <td>R13A5.13</td> <td>WBGene00020185</td> <td></td>	PGK YEAST	essential	R13A5.13	WBGene00020185	
PHSG_YEAST         essential         C11H1.4         WBGene00020696           PHSG_YEAST         non-         C11H1.6         WBGene00020696           PHSG_YEAST         essential         C34C6.6         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         essential         H20J04.d         WBGene00004028           PIF1_YEAST         essential         T0666.9         WBGene000104028           PIF1_YEAST         essential         T0366.9         WBGene00012897           PLC1_YEAST         essential         T03F1.3         WBGene00012897           PLC1_YEAST         essential         F40C5.b         WBGene0001928         x           PMM_YEAST         non-         F40C5.c         WBGene0001846         p092_YEAST         essential         F40C5.6         WBGene00017603         pPF1_YEAST         essential         F40C5.6         WBGene0001788         x           PPT1_YEAST         essential         F40C5.6         WBGene00018625         x         pP21_YEAST         essential         T22F3.3         WBGene00018625         x         pP21_YEAST         essential         Y18H1A_67.d </td <td>—</td> <td></td> <td></td> <td></td> <td></td>	—				
PHSG_YEAST         non-         C11H1.6         WBGene00020696           PHSG_YEAST         essential         F39G3.7         WBGene00020696           PHSG_YEAST         non-         F39G3.7         WBGene00020696           PHSG_YEAST         essential         F30B31.2         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00020696           PHSG_YEAST         essential         H20J04.d         WBGene00004028           PIF1_YEAST         essential         T0666.9         WBGene00004028           PIF1_YEAST         non-         F31C3.5         WBGene00004028           PIF1_YEAST         non-         F21C3.5         WBGene00012897           PLS_YEAST         non-         F40C5.6         WBGene00009925         x           PMM_YEAST         non-         F40C5.a         WBGene000015486         POP1_YEAST         essential         F40C5.a         WBGene0000369         x           PD1_YEAST         non-         F40C5.h         WBGene00012665         x         x           PR1_YEAST         non-         Y18H1A_67.d         WBGene00013893         x           PR1_YEAST         essential         Y18H1A_67.c         WBGene000017162         x           PR	_				
PHSG_YEAST         essential         C34C6.6         WBGene00020696           PHSG_YEAST         non-         F39G3.7         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         essential         F02B12.2         WBGene00020696           PHSG_YEAST         essential         H20J04.d         WBGene00020696           PIF1_YEAST         essential         T06G6.9         WBGene00004028           PIF1_YEAST         essential         R151.9         WBGene00018076           PIS_YEAST         non-         F21C3.5         WBGene00012897           PLC1_YEAST         essential         T03F1.3         WBGene0001928           POPLYEAST         essential         F40C5.c         WBGene0001928           POP1_YEAST         essential         F40C5.d         WBGene00001665           PO1_YEAST         essential         F40C5.h         WBGene000012665           PR1_YEAST         essential         T22F3.3         WBGene0001888         x           PPT1_YEAST         essential         Y18H1A_67.f         WBGene00018655         x           PR2_YEAST         essential         Y18H1A_67.c         WBGene00017162         x           PR3_YEAS					
PHSG_YEAST         non-         F39G3.7         WBGene00020696           PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00020696           PIFL_YEAST         essential         H20J04.d         WBGene00004028           PIFL_YEAST         essential         T0666.9         WBGene00004028           PIFL_YEAST         essential         R151.9         WBGene00012897           PLC1_YEAST         essential         T03F1.3         WBGene00012897           PLC1_YEAST         essential         F40C5.b         WBGene00012897           PDM_YEAST         non-         F40C5.c         WBGene00019298           POP1_YEAST         essential         F40C5.a         WBGene00015486           POP2_YEAST         non-         F40C5.a         WBGene00015486           POP4_YEAST         essential         F40C5.c         WBGene00001688         x           PPT1_YEAST         essential         F40C5.c         WBGene00015486         x           POP1_YEAST         essential         F40C5.h         WBGene0001763         x           PPT1_YEAST         essential         T22F3.3         WBGene00012655         x           PR1	—				
PHSG_YEAST         essential         F08B12.2         WBGene00020696           PHSG_YEAST         non-         F32A5.6         WBGene00004028           PIF1_YEAST         essential         T06G6.9         WBGene00004028           PIF1_YEAST         essential         T06G6.9         WBGene00004028           PIF1_YEAST         non-         B0035.4         WBGene00004028           PIK1_YEAST         essential         R151.9         WBGene00012897           PLC1_YEAST         non-         F21C3.5         WBGene00009925         x           PMM_YEAST         essential         F40C5.b         WBGene00019298         x           POP1_YEAST         essential         F40C5.c         WBGene00007603         x           PP01_YEAST         essential         F40C5.c         WBGene00007603         x           PP1_YEAST         essential         F40C5.h         WBGene00007603         x           PP1_YEAST         essential         T22F3.3         WBGene00012665         x           PR17_YEAST         essential         Y18H1A_67.d         WBGene0001389         x           PR21_YEAST         non-         F35H12.4         WBGene0001762         x           PR3_YEAST         non-         F35H12.4	PHSG_YEAST	essential	C34C6.6	WBGene00020696	
PHSG_YEAST         non-         F32A5.6         WBGene00020696           PIF1_YEAST         essential         H20J04.d         WBGene00004028           PIF1_YEAST         essential         T06G6.9         WBGene00004028           PIF1_YEAST         non-         B0035.4         WBGene00004028           PIK1_YEAST         non-         B0035.4         WBGene00012897           PIL1_YEAST         non-         F21C3.5         WBGene00012897           PLC1_YEAST         essential         T03F1.3         WBGene00012897           PLC1_YEAST         essential         F40C5.b         WBGene00019298           POP1_YEAST         essential         F40C5.a         WBGene00019298           POP1_YEAST         essential         F40C5.a         WBGene0000369           POP4_YEAST         essential         F40C5.h         WBGene00007603           PPE1_YEAST         essential         T22F3.3         WBGene00012665           PR16_YEAST         non-         Y18H1A_67.d         WBGene0001389 x           PR1_YEAST         essential         Y18H1A_67.c         WBGene00018625 x           PR2_YEAST         non-         F35H12.4         WBGene00014218           PR2_YEAST         essential         Y46G5.e <td< td=""><td>PHSG_YEAST</td><td>non-</td><td>F39G3.7</td><td>WBGene00020696</td><td></td></td<>	PHSG_YEAST	non-	F39G3.7	WBGene00020696	
PIFI_YEASTessentialH20J04.dWBGene00004028PIF1_YEASTessentialT06G6.9WBGene00004028PIF1_YEASTnon-B0035.4WBGene00004028PIK1_YEASTessentialR151.9WBGene00012897PLC1_YEASTessentialT03F1.3WBGene00012897PLC1_YEASTessentialT03F1.3WBGene00012897PLC1_YEASTessentialF40C5.cWBGene00019298POM_YEASTnon-F40C5.dWBGene00019298POP1_YEASTessentialF40C5.cWBGene0000369POP4_YEASTessentialF40C5.eWBGene0000369POP4_YEASTessentialF40C5.hWBGene00007603PPE1_YEASTessentialT22F3.3WBGene00012665PR1_YEASTessentialY18H1A_67.fWBGene00018625PR1_YEASTessentialY18H1A_67.cWBGene00018625PR1_YEASTessentialY18H1A_67.cWBGene00017162PR2_YEASTessentialY46G5.eWBGene00017162PR3_YEASTessentialF52B11.2WBGene00014218PR40_YEASTnon-K02D7.1WBGene00014218PR40_YEASTessentialC5D11.9WBGene0000481PR40_YEASTessentialS6A3A.20WBGene0000481PR4_YEASTessentialC15C6.4WBGene0000481PR4_YEASTessentialC15C6.4WBGene0001924PR5_YEASTessentialS0464.7WBGene0000481PR4_YEASTessentialS0464.7WBGene0000481PR4_YEAST	PHSG_YEAST	essential	F08B12.2	WBGene00020696	
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PR16_YEASTnon-Y18H1A_67.dWBGene00003389xPR17_YEASTessentialY18H1A_67.fWBGene00018625xPR21_YEASTessentialY18H1A_67.cWBGene00004188xPR22_YEASTnon-F35H12.4WBGene00003393xPR28_YEASTessentialY46G5.eWBGene00017162xPR31_YEASTnon-T01E8.3WBGene00012458xPR40_YEASTessentialF52B11.2WBGene00014218PR40_YEASTessentialC05D11.9WBGene00014218PR43_YEASTessentialC15C6.4WBGene0000481PR46_YEASTessentialC15C6.4WBGene00011938PR0A_YEASTessentialY39B6B.ffWBGene0001924PR0A_YEASTessentialF49D11.1WBGene0001924PR0F_YEASTessentialF49D11.1WBGene00010844PR4_YEASTessentialF49D11.7WBGene0001772PR4_YEASTessentialF01F1.7WBGene00011758PR56_YEASTessentialF01F1.7WBGene00011758	PPE1_YEAST	non-	F40C5.h	WBGene00007188	x
PR16_YEASTnon-Y18H1A_67.dWBGene00003389xPR17_YEASTessentialY18H1A_67.fWBGene00018625xPR21_YEASTessentialY18H1A_67.cWBGene00004188xPR22_YEASTnon-F35H12.4WBGene00003393xPR28_YEASTessentialY46G5.eWBGene00017162xPR31_YEASTnon-T01E8.3WBGene00012458xPR40_YEASTessentialF52B11.2WBGene00014218PR40_YEASTessentialC05D11.9WBGene00014218PR43_YEASTessentialC15C6.4WBGene0000481PR46_YEASTessentialC15C6.4WBGene00011938PR0A_YEASTessentialY39B6B.ffWBGene0001924PR0A_YEASTessentialF49D11.1WBGene0001924PR0F_YEASTessentialF49D11.1WBGene00010844PR4_YEASTessentialF49D11.7WBGene0001772PR4_YEASTessentialF01F1.7WBGene00011758PR56_YEASTessentialF01F1.7WBGene00011758	PPT1_YEAST	essential	T22F3.3	WBGene00012665	
PR17_YEASTessentialY18H1A_67.fWBGene00018625xPR21_YEASTessentialY18H1A_67.cWBGene00004188xPR22_YEASTnon-F35H12.4WBGene00003393xPR28_YEASTessentialY46G5.eWBGene00017162xPR31_YEASTnon-T01E8.3WBGene00012458xPR40_YEASTessentialF52B11.2WBGene00014218PR40_YEASTessentialC05D11.9WBGene00014218PR43_YEASTessentialC15C6.4WBGene0001867xPR46_YEASTessentialC15C6.4WBGene00011938xPR0A_YEASTessentialY39B6B.ffWBGene0001924xPR0A_YEASTessentialF49D11.1WBGene0001924xPR0F_YEASTessentialF49D11.1WBGene00010844xPR9_YEASTessentialF01F1.7WBGene0001772xPR4_YEASTessentialF01F1.7WBGene0001772x	PR16 YEAST	non-	Y18H1A 67.d	WBGene00003389	x
PR21_YEASTessentialY18H1A_67.cWBGene00004188xPR22_YEASTnon-F35H12.4WBGene00003393xPR28_YEASTessentialY46G5.eWBGene00017162xPR31_YEASTnon-T01E8.3WBGene00022458xPR39_YEASTessentialF52B11.2WBGene00014218PR40_YEASTnon-K02D7.1WBGene00014218PR40_YEASTessentialC05D11.9WBGene00014218PR43_YEASTessentialC15C6.4WBGene0001481PR46_YEASTessentialC15C6.4WBGene00011938PR0A_YEASTessentialY39B6B.ffWBGene0001924PR0F_YEASTessentialF49D11.1WBGene0001924PR0F_YEASTessentialF49D11.1WBGene00010844PR4_YEASTessentialF6.4WBGene00010844PR4_YEASTessentialF01F1.7WBGene0001758PR56_YEASTessentialF01F1.7WBGene00011758					
PR22_YEASTnon-F35H12.4WBGene00003393xPR28_YEASTessentialY46G5.eWBGene00017162xPR31_YEASTnon-T01E8.3WBGene00022458xPR39_YEASTessentialF52B11.2WBGene00014218PR40_YEASTnon-K02D7.1WBGene00014218PR43_YEASTessentialC05D11.9WBGene00014218PR46_YEASTessentialC15C6.4WBGene00018967xPR46_YEASTessentialC15C6.4WBGene00011938xPR0A_YEASTessentialY39B6B.ffWBGene0001924xPR0C_YEASTessentialF49D11.1WBGene00010924xPR9_YEASTessentialF49D11.1WBGene00010844xPRP4_YEASTessentialEED8.5WBGene0001772xPR9_YEASTessentialF01F1.7WBGene00011758xPR56_YEASTessentialY110A7A.mWBGene00004503x					
PR28_YEASTessentialY46G5.eWBGene00017162xPR31_YEASTnon-T01E8.3WBGene00022458xPR39_YEASTessentialF52B11.2WBGene00017768PR40_YEASTnon-K02D7.1WBGene00014218PR40_YEASTessentialC05D11.9WBGene00014218PR45_YEASTessentialC15C6.4WBGene00006481PR0A_YEASTessentialC15C6.4WBGene000011938PR0A_YEASTessentialY39B6B.ffWBGene00010924PR0F_YEASTessentialF49D11.1WBGene00003991PR93_YEASTessentialEEED8.5WBGene00010844PR4_YEASTessentialF01F1.7WBGene00011758PR9_YEASTessentialF01F1.7WBGene00011758					
PR31_YEASTnon-T01E8.3WBGene00022458xPR39_YEASTessentialF52B11.2WBGene00017768PR40_YEASTnon-K02D7.1WBGene00014218PR40_YEASTessentialC05D11.9WBGene00014218PR45_YEASTessentialC15C6.4WBGene00006481PR0A_YEASTessentialC15C6.4WBGene000014181PR0A_YEASTessentialB0464.7WBGene00011938PR0C_YEASTessentialY39B6B.ffWBGene00010924PR0F_YEASTessentialF49D11.1WBGene00003991PR93_YEASTessentialEEED8.5WBGene00010844PR94_YEASTessentialF01F1.7WBGene00011758PR56_YEASTessentialY110A7A.mWBGene00004503					
PR39_YEASTessentialF52B11.2WBGene00017768PR40_YEASTnon-K02D7.1WBGene00014218PR40_YEASTessentialC05D11.9WBGene00014218PR43_YEASTessentialY56A3A.20WBGene00018967xPR46_YEASTessentialC15C6.4WBGene00006481xPR0A_YEASTessentialB0464.7WBGene000011938xPR0A_YEASTessentialY39B6B.ffWBGene00010924PR0F_YEASTessentialF49D11.1WBGene00003991PR93_YEASTessentialEEED8.5WBGene00007972PR9_YEASTessentialF01F1.7WBGene00011758PR56_YEASTessentialY110A7A.mWBGene00004503	_	essential			x
PR40_YEASTnon-K02D7.1WBGene00014218PR40_YEASTessentialC05D11.9WBGene00014218PR43_YEASTessentialY56A3A.20WBGene00018967xPR46_YEASTessentialC15C6.4WBGene00006481xPR12_YEASTessentialB0464.7WBGene000011938xPR0A_YEASTessentialY39B6B.ffWBGene00010924PR0F_YEASTessentialF49D11.1WBGene00003991PR93_YEASTessentialEEED8.5WBGene00010844xPR94_YEASTessentialF01F1.7WBGene0001758xPR56_YEASTessentialY110A7A.mWBGene00004503x	_	non-		WBGene00022458	х
PR40_YEASTessentialC05D11.9WBGene00014218PR43_YEASTessentialY56A3A.20WBGene00018967xPR46_YEASTessentialC15C6.4WBGene00006481xPR12_YEASTessentialB0464.7WBGene00004181xPR0A_YEASTessentialY39B6B.ffWBGene00011938PR0C_YEASTnon-K03H1.2WBGene00010924PR0F_YEASTessentialF49D11.1WBGene00010844PR9_YEASTessentialEEED8.5WBGene00017972PR9_YEASTessentialF01F1.7WBGene00011758PR56_YEASTessentialY110A7A.mWBGene00004503	PR39_YEAST	essential	F52B11.2	WBGene00017768	
PR40_YEASTessentialC05D11.9WBGene00014218PR43_YEASTessentialY56A3A.20WBGene00018967xPR46_YEASTessentialC15C6.4WBGene00006481xPR12_YEASTessentialB0464.7WBGene00004181xPR0A_YEASTessentialY39B6B.ffWBGene00011938PR0C_YEASTnon-K03H1.2WBGene00010924PR0F_YEASTessentialF49D11.1WBGene00010844PR9_YEASTessentialEEED8.5WBGene00017972PR9_YEASTessentialF01F1.7WBGene00011758PR56_YEASTessentialY110A7A.mWBGene00004503	PR40 YEAST	non-	K02D7.1	WBGene00014218	
PR43_YEASTessentialY56A3A.20WBGene00018967xPR46_YEASTessentialC15C6.4WBGene00006481xPR12_YEASTessentialB0464.7WBGene00004181xPR0A_YEASTessentialY39B6B.ffWBGene00011938PR0C_YEASTnon-K03H1.2WBGene00010924PR0F_YEASTessentialF49D11.1WBGene00010924PR93_YEASTessentialEEED8.5WBGene00010844xPRP4_YEASTessentialF01F1.7WBGene0001758xPR56_YEASTessentialY110A7A.mWBGene00004503x	_	essential			
PR46_YEASTessentialC15C6.4WBGene00006481xPR12_YEASTessentialB0464.7WBGene00004181xPR0A_YEASTessentialY39B6B.ffWBGene00011938PR0C_YEASTnon-K03H1.2WBGene00010924PR0F_YEASTessentialF49D11.1WBGene00010844PR93_YEASTessentialEEED8.5WBGene000107972PR9_YEASTessentialF01F1.7WBGene00011758PR56_YEASTessentialY110A7A.mWBGene00004503					v
PRI2_YEASTessentialB0464.7WBGene00004181xPROA_YEASTessentialY39B6B.ffWBGene00011938PROC_YEASTnon-K03H1.2WBGene00010924PROF_YEASTessentialF49D11.1WBGene00003991PRP3_YEASTessentialEEED8.5WBGene00010844xPRP4_YEASTessentialF01F1.7WBGene0001758xPRS6_YEASTessentialY110A7A.mWBGene00004503x					
PROA_YEASTessentialY39B6B.ffWBGene00011938PROC_YEASTnon-K03H1.2WBGene00010924PROF_YEASTessentialF49D11.1WBGene00003991PRP3_YEASTessentialW07E6.4WBGene00010844xPRP4_YEASTessentialEEED8.5WBGene00007972xPRP9_YEASTessentialF01F1.7WBGene00011758xPRS6_YEASTessentialY110A7A.mWBGene00004503x	_				
PROC_YEASTnon-K03H1.2WBGene00010924PROF_YEASTessentialF49D11.1WBGene00003991PRP3_YEASTessentialW07E6.4WBGene00010844xPRP4_YEASTessentialEEED8.5WBGene00007972xPRP9_YEASTessentialF01F1.7WBGene00011758xPRS6_YEASTessentialY110A7A.mWBGene00004503x	_				x
PROF_YEASTessentialF49D11.1WBGene00003991PRP3_YEASTessentialW07E6.4WBGene00010844xPRP4_YEASTessentialEEED8.5WBGene00007972xPRP9_YEASTessentialF01F1.7WBGene00011758xPRS6_YEASTessentialY110A7A.mWBGene00004503x		essential			
PRP3_YEASTessentialW07E6.4WBGene00010844xPRP4_YEASTessentialEEED8.5WBGene00007972xPRP9_YEASTessentialF01F1.7WBGene00011758xPRS6_YEASTessentialY110A7A.mWBGene00004503x	PROC_YEAST	non-	K03H1.2	WBGene00010924	
PRP3_YEASTessentialW07E6.4WBGene00010844xPRP4_YEASTessentialEEED8.5WBGene00007972xPRP9_YEASTessentialF01F1.7WBGene00011758xPRS6_YEASTessentialY110A7A.mWBGene00004503x	PROF_YEAST	essential	F49D11.1	WBGene00003991	
PRP4_YEASTessentialEEED8.5WBGene00007972xPRP9_YEASTessentialF01F1.7WBGene00011758xPRS6_YEASTessentialY110A7A.mWBGene00004503x	_				x
PRP9_YEASTessentialF01F1.7WBGene00011758xPRS6_YEASTessentialY110A7A.mWBGene00004503x	_				
PRS6_YEAST essential Y110A7A.m WBGene00004503 x					
PRS7_YEAST   non-   F25B4.5   WBGene00004501   x					
	PRS7_YEAST	non-	F25B4.5	WBGene00004501	x

PFSA_YEAST         essential         ZK1098.1         WBGene00003927         x           PSA_YEAST         essential         P56D2.6         WBGene00003927         x           PSA_YEAST         non-         WO2D9.1         WBGene00003925         x           PSB_YEAST         non-         WO2D9.1         WBGene00003925         x           PSB_YEAST         non-         MIS3.1         WBGene00003950         x           PSB_YEAST         essential         T22H6.2         WBGene00003951         x           PSB_YEAST         essential         C36B1.5         WBGene00003953         x           PSB_YEAST         essential         C36B1.5         WBGene00003951         x           PSD_YEAST         essential         C52E4.4         WBGene00018239         x           PSD_YEAST         essential         C52H.4         WBGene0002726         yPSF_YEAST           PSF_YEAST         essential         C02F5.3         WBGene00012864         x           PUF3_YEAST         essential         C32H.4         WBGene00012864         x           PUF3_YEAST         essential         C32H.4         WBGene00012864         x           PUF3_YEAST         essential         C32H.4         WBGene00002726					
PSA1_YEAST         essential         FSD2.6         WBGene00003923         x           PSA5_YEAST         essential         D1054.15         WBGene00003926         x           PSA5_YEAST         essential         D1054.15         WBGene00003926         x           PSB1_YEAST         essential         T286.2         WBGene00003926         x           PSB1_YEAST         essential         T286.2         WBGene00003951         x           PSB3_YEAST         essential         M03C11.7         WBGene00003951         x           PSB5_YEAST         essential         C361.5         WBGene00003951         x           PSB5_YEAST         essential         C561.4         WBGene00003951         x           PSD_YEAST         essential         C561.4         WBGene00018239         x           PSD_YEAST         essential         C561.4         WBGene00018239         x           PSD_YEAST         essential         C361.4         WBGene0012823         x           PSD_YEAST         essential         C361.4         WBGene0012823         x           PSD_YEAST         essential         C361.4         WBGene0012823         x           PSP_YEAST         non-         Z0F5.2         WBGene0012765 </td <td>PRSA YEAST</td> <td>essential</td> <td>ZK1098.7</td> <td>WBGene00004505</td> <td>x</td>	PRSA YEAST	essential	ZK1098.7	WBGene00004505	x
PSA5_YEAST         essential         F5D2.6         WBGene00003923           PSA5_YEAST         non-         W02D9.1         WBGene0003925         x           PSB1_YEAST         essential         T22H6.2         WBGene00003950         x           PSB2_YEAST         essential         K03E6.6         WBGene00003951         x           PSB4_YEAST         essential         C36E1.5         WBGene00003951         x           PSB7_YEAST         essential         C36E1.5         WBGene00015159         y           PSD7_YEAST         essential         C52E4.4         WBGene00015233         x           PSD7_YEAST         essential         C52E4.4         WBGene00012383         x           PSD7_YEAST         essential         C25E4.4         WBGene00012864         y           PSD7_YEAST         essential         C25E4.4         WBGene00012864         y           PST2_YEAST         essential         C25E3.3         WBGene00012864         y           PT56_YEAST         essential         C35E4.4         WBGene00012864         y           PUR1_YEAST         essential         C35E4.4         WBGene00012864         y           PUR1_YEAST         non-         T20F5.2         WBGene00012425	_				
PSA7_YEAST         essential         D1054.15         WBGene00003925         x           PSA7_YEAST         essential         T22H6.2         WBGene00003955         x           PSB3_YEAST         essential         M03E1.7         WBGene00003950         x           PSB3_YEAST         essential         M03E1.7         WBGene00003951         x           PSB5_YEAST         essential         C36B1.5         WBGene00003951         x           PSB5_YEAST         essential         C36B1.5         WBGene00003951         x           PSB5_YEAST         essential         C52E4.4         WBGene00016233         x           PSDA_YEAST         essential         C52E4.4         WBGene00012375         x           PSDA_YEAST         essential         C36B1.4         WBGene00012823         x           PSF2_YEAST         essential         C36B1.4         WBGene00012863         x           PUF3_YEAST         essential         C36B1.4         WBGene00012483         x           PUF3_YEAST         essential         C36B1.5         WBGene00016474           PUR4_YEAST         non-         K05C4.1         WBGene0001126         x           PUR4_YEAST         non-         F31C5.5         WBGene0001271	_				x
PSRJ_YEAST         non-         W02D9.1         WBGene00003952         x           PSBJ_YEAST         essential         T22H6.2         WBGene00003951         x           PSBJ_YEAST         essential         K03E6.6         WBGene00003951         x           PSBJ_YEAST         essential         C36E1.5         WBGene00003951         x           PSBJ_YEAST         essential         C36E1.5         WBGene00018239         x           PSDJ_YEAST         essential         C52E4.4         WBGene00018239         x           PSDJ_YEAST         essential         C52E4.4         WBGene00018239         x           PSDJ_YEAST         essential         C52E4.4         WBGene00018239         x           PSDJ_YEAST         essential         C36E1.4         WBGene00018239         x           PSF2_YEAST         non-         D1054.2         WBGene00018239         x           PSF2_YEAST         essential         C36E1.4         WBGene00012864         Y           PVTS_YEAST         essential         C36E1.4         WBGene00012485         Y           PVTS_YEAST         essential         C37F5.3         WBGene00012485         Y           PVTA_YEAST         non-         K05C4.1         WBGene00	PSA2_YEAST	essential	F56D2.6	WBGene00003923	
PSBL_VEAST         essential         T22H6.2         WBGene00003950         x           PSB2_VEAST         essential         K03E6.6         WBGene00003950         x           PSB4_VEAST         essential         K03E6.6         WBGene00003951         x           PSB5_VEAST         essential         C3EL.5         WBGene00003951         x           PSB5_VEAST         essential         C3EL.5         WBGene00003954         x           PSD_VEAST         essential         C52E4.4         WBGene00016623         x           PSDA_VEAST         essential         C52E4.4         WBGene00012325         x           PSDA_VEAST         essential         C3EH.4         WBGene00012864         y           PSDA_VEAST         essential         C3EH.4         WBGene00012864         y           PUF3_VEAST         essential         C3FH.2         WBGene00012864         y           PUF3_VEAST         essential         C3FH.2         WBGene00012864         y           PUF3_VEAST         essential         C3FH.2         WBGene00012864         y           PUF3_VEAST         essential         C4FB.2.4         WBGene00012425         y           PUR1_VEAST         essential         C4HB.1         W	PSA5_YEAST	essential	D1054.15	WBGene00003926	x
PSBL_VEAST         essential         T22H6.2         WBGene00003950         x           PSB2_VEAST         essential         K03E6.6         WBGene00003950         x           PSB4_VEAST         essential         K03E6.6         WBGene00003951         x           PSB5_VEAST         essential         C3EL.5         WBGene00003951         x           PSB5_VEAST         essential         C3EL.5         WBGene00003954         x           PSD_VEAST         essential         C52E4.4         WBGene00016623         x           PSDA_VEAST         essential         C52E4.4         WBGene00012325         x           PSDA_VEAST         essential         C3EH.4         WBGene00012864         y           PSDA_VEAST         essential         C3EH.4         WBGene00012864         y           PUF3_VEAST         essential         C3FH.2         WBGene00012864         y           PUF3_VEAST         essential         C3FH.2         WBGene00012864         y           PUF3_VEAST         essential         C3FH.2         WBGene00012864         y           PUF3_VEAST         essential         C4FB.2.4         WBGene00012425         y           PUR1_VEAST         essential         C4HB.1         W	PSA7 YEAST	non-	W02D9 1	WBGene00003925	x
PSB2_YEAST         non-         M153.1         WBGene00003950         x           PSB3_YEAST         essential         K0386.6         WBGene00003951         x           PSB5_YEAST         essential         C36B1.5         WBGene00003951         x           PSB7_YEAST         essential         C36B1.5         WBGene00016623           PSD7_YEAST         essential         F25F2.4         WBGene00018239         x           PSD7_YEAST         essential         C52E4.4         WBGene00018239         x           PSD7_YEAST         essential         C52E4.4         WBGene00018239         x           PSD7_YEAST         essential         C36E1.4         WBGene00018239         x           PSF2_YEAST         essential         C36E1.4         WBGene00018244         x           PTS6_YEAST         essential         C27E5.3         WBGene00014407         y           PUR_YEAST         essential         C37E7.3         WBGene0001664         y           PUR_YEAST         essential         C47B2.4         WBGene0001664         y           PUR_YEAST         essential         C44B7.1         WBGene0000122         y           PUT2_YEAST         essential         C44B7.1         WBGene0000122	_				
PSBYEAST         essential         K03E6.6         WBGene00003949         x           PSB_YEAST         essential         C36B1.5         WBGene00003953         x           PSB_YEAST         essential         C36B1.5         WBGene00003951         x           PSD_YEAST         essential         C36B1.5         WBGene000135159           PSD_YEAST         essential         C52E4.4         WBGene00018239         x           PSD_YEAST         essential         C52E4.4         WBGene00022726         y           PSP_YEAST         essential         C36B1.4         WBGene00022726         y           PSP_YEAST         essential         C36B1.4         WBGene000122864         y           PUT3_YEAST         essential         C36B1.4         WBGene00014245         y           PUT3_YEAST         essential         C36B1.5         WBGene00011407         y           PUR4_YEAST         essential         C44B7.1         WBGene0001124         y           PUT2_YEAST         essential         C44B7.1         WBGene0001125         y           PUT2_YEAST         essential         T23C5.2         WBGene0001122         y           PUT2_YEAST         non-         F31C3.5         WBGene00012355					
PSB5_YEAST         essential         M03C11.7         WBGene0003951         x           PSB5_YEAST         essential         C36B1.5         WBGene0003951         x           PSB7_YEAST         essential         T13H5.4         WBGene00016623           PSD9_YEAST         essential         F52F1.4         WBGene00016623           PSDA_YEAST         essential         F52H.4         WBGene00018239         x           PSF2_YEAST         essential         C36B1.4         WBGene00012864         y           PYF5_YEAST         essential         C36B1.4         WBGene00012864         y           PYT5_YEAST         essential         C02F5.3         WBGene00012864         y           PUR1_YEAST         essential         C37F5.2         WBGene00011407         y           PUR4_YEAST         non-         K05C4.1         WBGene0001164         x           PUR4_YEAST         non-         K05C4.1         WBGene0000112         y           PUR2_YEAST         essential         C44B7.1         WBGene0000112         x           PUT2_YEAST         essential         T036.2         WBGene0000122         x           PYR1_YEAST         essential         T048.5         WBGene0001229         x	PSB2_YEAST	non-	M153.1	WBGene00003950	x
PSB5_YEAST         essential         C36B1.5         WBGene0003951         x           PSB7_YEAST         essential         T13H5.4         WBGene00013948         x           PSD1_YEAST         essential         C52E4.4         WBGene00016623           PSDA_YEAST         essential         C52E4.4         WBGene00018239         x           PSDA_YEAST         essential         C52E4.4         WBGene00012823         x           PSDA_YEAST         essential         C36B1.4         WBGene00012864         x           PSP2_YEAST         essential         C36B1.4         WBGene00012864         x           PUT3_YEAST         essential         C36B1.4         WBGene00012864         x           PUR1_YEAST         essential         C36B1.4         WBGene00012664         x           PUR2_YEAST         essential         C47B2.4         WBGene00016474         y           PUR2_YEAST         non-         K05C4.1         WBGene00016509         y         y         y         y         y         y         y         y         x         y         wBGene000112         y         y         y         y         y         y         y         y         y         y         y         y	PSB3_YEAST	essential	K03E6.6	WBGene00003949	x
PSB5_YEAST         essential         C36B1.5         WBGene0003951         x           PSB7_YEAST         essential         T13H5.4         WBGene00013948         x           PSD1_YEAST         essential         C52E4.4         WBGene00016623           PSDA_YEAST         essential         C52E4.4         WBGene00018239         x           PSDA_YEAST         essential         C52E4.4         WBGene00012823         x           PSDA_YEAST         essential         C36B1.4         WBGene00012864         x           PSP2_YEAST         essential         C36B1.4         WBGene00012864         x           PUT3_YEAST         essential         C36B1.4         WBGene00012864         x           PUR1_YEAST         essential         C36B1.4         WBGene00012664         x           PUR2_YEAST         essential         C47B2.4         WBGene00016474         y           PUR2_YEAST         non-         K05C4.1         WBGene00016509         y         y         y         y         y         y         y         y         x         y         wBGene000112         y         y         y         y         y         y         y         y         y         y         y         y	PSB4 YEAST	essential	M03C11 7	WBGene00003953	x
PSET_TEAST         essential         T13H5.4         WBGene0003948         x           PSD_YEAST         essential         C52E4.4         WBGene00016623           PSDA_YEAST         essential         F56H1.4         WBGene00018239         x           PSDA_YEAST         essential         C52E4.4         WBGene00012339         x           PSPA_YEAST         essential         C36B1.4         WBGene00012463         x           PSP2_YEAST         essential         C36B1.4         WBGene00012464         PT91_YEAST         essential         C36B1.4         WBGene00012464           PUR3_YEAST         essential         C36B1.4         WBGene00012864         PUR3_YEAST         essential         C36B1.4         WBGene00018174           PUR4_YEAST         non-         K05C4.1         WBGene0001164         x         PUR4_YEAST         non-         F0361.5         WBGene00006473         PUR3_YEAST         essential         C44B7.1         WBGene0000112         PUR2_YEAST         non-         F31C3.5         WBGene0000112         x         PVR1_YEAST         essential         C44B7.1         WBGene00020932         x         PYR1_YEAST         essential         Y13B10A.16         WBGene00020932         x         PYR1_YEAST         essential         Y13B10A.16	_				
PSD1_YEAST         non-         F23F12.6         WBGene00015159           PSD9_YEAST         essential         C52E4.4         WBGene00018239           PSDA_YEAST         essential         CD4.6         WBGene00018239           PSP2_YEAST         essential         C261.4         WBGene00012824           PSP2_YEAST         essential         C261.4         WBGene00012864           PT91_YEAST         essential         C36B1.4         WBGene00012864           PT91_YEAST         essential         C36B1.4         WBGene00012463           PUR1_YEAST         essential         C36B1.4         WBGene0001467           PUR1_YEAST         essential         C378A.2         WBGene00016643           PUR2_YEAST         non-         K05C4.1         WBGene0000112           PUR3_YEAST         essential         C44B7.1         WBGene0000112           PUT2_YEAST         non-         F31C3.5         WBGene0000112           PUT2_YEAST         non-         Y45F3A.9         WBGene00012891         x           PYRD_YEAST         essential         T246.2         WBGene00012859         x           Q2804         non-         Y45F3A.9         WBGene00012859         x           Q2804         non-	_				
PSD9_TEAST         essential         C5284.4         WBGene00016623           PSDA_YEAST         essential         F56H1.4         WBGene00018239         x           PSP2_YEAST         essential         C74.6         WBGene00018239         x           PSP2_YEAST         essential         C2451.4         WBGene0002264         x           PSP2_YEAST         essential         C36B1.4         WBGene00012664         y           PUT3_YEAST         essential         C36B1.4         WBGene00012454         y           PUT3_YEAST         essential         C36B1.4         WBGene00012454         y           PUT4_YEAST         non-         rtd0554.1         WBGene0001664 x         y           PUR4_YEAST         non-         F4059.1         WBGene00001167 x         y           PUT2_YEAST         non-         F4069.1         WBGene0000112 x         y           PVT2_YEAST         non-         F4069.1         WBGene0001281 x         y           PVT2_YEAST         non-         F31073.5         WBGene00012841 x         y           Q02804         non-         F3686.4         WBGene00014259 x         y           PYRD_YEAST         non-         F3886.4         WBGene00014212 x         x	PSB7_YEAST	essential	T13H5.4	WBGene00003948	х
PSDA_YEAST         essential         F56H1.4         WBGene00018239         x           PSDA_YEAST         essential         CD4.6         WBGene00012827         x           PSP2_YEAST         essential         F25H2.9         WBGene00022726           PT56_YEAST         essential         C36B1.4         WBGene00012483           PUT1_YEAST         essential         C36B1.4         WBGene00012483           PUT2_YEAST         essential         Y38A8.2         WBGene00011407           PUR1_YEAST         essential         F39H11.5         WBGene00011647           PUR4_YEAST         essential         C47B2.4         WBGene00001164         x           PUR4_YEAST         essential         C44B7.1         WBGene0000112         y           PUT2_YEAST         essential         T31C3.5         WBGene0000112         y           PUT2_YEAST         essential         T23C6.2         WBGene0001281         x           PYRD_YEAST         essential         T145D1A.16         WBGene0001282         y           PYR_YEAST         essential         T123C6.2         WBGene00012714         x           Q02804         non-         F36B6.4         WBGene00012714         x           Q02849         non-<	PSD1_YEAST	non-	F23F12.6	WBGene00015159	
PSDA_YEAST         essential         F56H1.4         WBGene00018239         x           PSDA_YEAST         essential         CD4.6         WBGene00012827         x           PSP2_YEAST         essential         F25H2.9         WBGene00022726           PT56_YEAST         essential         C36B1.4         WBGene00012483           PUT1_YEAST         essential         C36B1.4         WBGene00012483           PUT2_YEAST         essential         Y38A8.2         WBGene00011407           PUR1_YEAST         essential         F39H11.5         WBGene00011647           PUR4_YEAST         essential         C47B2.4         WBGene00001164         x           PUR4_YEAST         essential         C44B7.1         WBGene0000112         y           PUT2_YEAST         essential         T31C3.5         WBGene0000112         y           PUT2_YEAST         essential         T23C6.2         WBGene0001281         x           PYRD_YEAST         essential         T145D1A.16         WBGene0001282         y           PYR_YEAST         essential         T123C6.2         WBGene00012714         x           Q02804         non-         F36B6.4         WBGene00012714         x           Q02849         non-<	PSD9 YEAST	essential	C52E4 4	WBGene00016623	
PSDA_YEAST         essential         CD4.6         WBGene00018239         x           PSF2_YEAST         non-         D1054.2         WBGene00020726         x           PSP2_YEAST         essential         C36E1.4         WBGene00012864           PT91_YEAST         essential         C36E1.4         WBGene00012864           PUT3_YEAST         non-         T20F5.2         WBGene00012483           PUR1_YEAST         essential         Y38A8.2         WBGene00011407           PUR2_YEAST         sesential         C47B2.4         WBGene00006854           PUR4_YEAST         non-         B0361.5         WBGene00006473           PUR4_YEAST         non-         F303.5         WBGene0000122           PUT2_YEAST         non-         F31C3.5         WBGene0000122           PUT2_YEAST         non-         F31C3.5         WBGene0001289         x           PYRD_YEAST         non-         Y45F3A.9         WBGene0001281         x           PYR1_YEAST         essential         T04A8.5         WBGene0001281         x           Q02804         non-         F386.4         WBGene00014123         y           Q02105         essential         F55F8.3         WBGene00012826         y	_				
PSF2_YEAST         non-         D164.2         WBGene0009287         x           PSP2_YEAST         essential         F25H2.9         WBGene00012864           PT56_YEAST         essential         C02F5.3         WBGene00012864           PUF1_YEAST         essential         C02F5.3         WBGene00012864           PUF3_YEAST         non-         T20F5.2         WBGene00011407           PUR4_YEAST         essential         F39H11.5         WBGene00008544           PUR4_YEAST         non-         B0361.5         WBGene000011604         x           PUR4_YEAST         non-         B0361.5         WBGene0000112         y           PUT2_YEAST         non-         F31C3.5         WBGene0000112         y           PUT2_YEAST         essential         T23C6.2         WBGene00001259         x           PYRL_YEAST         essential         T3468.5         WBGene0001559         x           Q02804         non-         F38B6.4         WBGene00012159         x           Q02805         essential         F577A.10         WBGene00012160         x           Q02808         non-         R06C7.5         WBGene00012160         x           Q03761         essential         F55F0.3	_				
PSP2_YEAST         essential         F25H2.9         WBGene00020726           PT56_YEAST         essential         C36B1.4         WBGene00012863           PUT9_YEAST         essential         C02F5.3         WBGene00012863           PUR1_YEAST         essential         Y38A8.2         WBGene00018174           PUR4_YEAST         essential         Y38A8.2         WBGene00018174           PUR4_YEAST         non-         K05C4.1         WBGene00018174           PUR4_YEAST         essential         C44B7.1         WBGene000011664         x           PUR2_YEAST         essential         C44B7.1         WBGene0000112         y           PUT2_YEAST         essential         W10C4.b         WBGene0000112         y           PUT2_YEAST         essential         Y18D10A.16         WBGene00012839         x           PYRL_YEAST         non-         F313B6.4         WBGene00012841         y           Q02875         essential         F10F2.2         WBGene00016002         y           Q02880         non-         F38B6.4         WBGene00012714         x           Q03195         essential         F10F2.2         WBGene00012714         x           Q03201         non-         F25F8.3	PSDA_YEAST	essential	CD4.6	WBGene00018239	x
PT56_YEAST         essential         C36B1.4         WBGene00012864           PT91_YEAST         essential         C02F5.3         WBGene00004245           PURJ_YEAST         essential         F39H11.5         WBGene00004245           PURL_YEAST         essential         F39H11.5         WBGene00008544           PURA_YEAST         essential         C47B2.4         WBGene00008654           PURA_YEAST         essential         C44B7.1         WBGene00001679           PURA_YEAST         essential         C44B7.1         WBGene0000122           PUT2_YEAST         non-         F4069.1         WBGene0000122           PUT2_YEAST         non-         F31C3.5         WBGene000018991         x           PUT2_YEAST         non-         F31C3.5         WBGene000012932         x           PYRP_YEAST         essential         T23C6.2         WBGene000014259         x           Q02804         non-         W66B11.2         WBGene000014123         Q02875         essential         F10F2.2         WBGene00014123         Q02804         Q02890         essential         F50F3.1         WBGene00012744         x         Q02804         non-         F02H1.3         WBGene00012744         x         Q03201         non-         F02H1	PSF2_YEAST	non-	D1054.2	WBGene00009287	x
PT56_YEAST         essential         C36B1.4         WBGene00012864           PT91_YEAST         essential         C02F5.3         WBGene00004245           PURJ_YEAST         essential         F39H11.5         WBGene00004245           PURL_YEAST         essential         F39H11.5         WBGene00008544           PURA_YEAST         essential         C47B2.4         WBGene00008654           PURA_YEAST         essential         C44B7.1         WBGene00001679           PURA_YEAST         essential         C44B7.1         WBGene0000122           PUT2_YEAST         non-         F4069.1         WBGene0000122           PUT2_YEAST         non-         F31C3.5         WBGene000018991         x           PUT2_YEAST         non-         F31C3.5         WBGene000012932         x           PYRP_YEAST         essential         T23C6.2         WBGene000014259         x           Q02804         non-         W66B11.2         WBGene000014123         Q02875         essential         F10F2.2         WBGene00014123         Q02804         Q02890         essential         F50F3.1         WBGene00012744         x         Q02804         non-         F02H1.3         WBGene00012744         x         Q03201         non-         F02H1	PSP2 YEAST	essential	F25H2.9	WBGene00020726	
PT91_YEAST         essential         C02F5.3         WBGene00012483           PUF3_YEAST         non-         T20F5.2         WBGene00014245           PUR1_YEAST         essential         F39H11.5         WBGene00011407           PUR2_YEAST         essential         F39H11.5         WBGene00011407           PURA_YEAST         essential         C47B2.4         WBGene00016509           PUR3_YEAST         essential         C44B7.1         WBGene0000112           PUT2_YEAST         essential         C44B7.1         WBGene0000112           PUT2_YEAST         essential         W10C4.b         WBGene0000122           PUT2_YEAST         essential         T123C6.2         WBGene00001259           PURD_YEAST         non-         Y45F3A.9         WBGene00016002           PYRP_YEAST         essential         T14810A.16         WBGene00016002           Q02804         non-         F38B6.4         WBGene00016002           Q02808         non-         F38B6.4         WBGene0001256           Q03201         non-         E02H1.3         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene0001224         x           Q03786         non-         D2085.1	_				
PUF3_YEAST         non-         T20F5.2         WBGene00014245           PUR1_YEAST         essential         Y38A8.2         WBGene00018174           PUR2_YEAST         essential         C3742.4         WBGene00018174           PUR4_YEAST         essential         C47B2.4         WBGene00016509           PUR3_YEAST         essential         C44B7.1         WBGene00016509           PUT2_YEAST         essential         C44B7.1         WBGene0000122           PUT2_YEAST         essential         C44B7.4         WBGene0000122           PUT2_YEAST         non-         F40G9.1         WBGene000012891         x           PVR1_YEAST         non-         F31C3.5         WBGene00001295         x           PYR1_YEAST         essential         T23C6.2         WBGene00012032         x           PYR1_YEAST         essential         T04A8.5         WBGene00016002         x           Q02804         non-         F33B6.4         WBGene00016002         x         x           Q03195         essential         F5072.1         WBGene00012556         x         x           Q03201         non-         E02H1.3         WBGene00012556         x         x         x         x <td< td=""><td>_</td><td></td><td></td><td></td><td></td></td<>	_				
PUR1_YEAST         essential         Y38A8.2         WBGene00011407           PUR2_YEAST         essential         F39H11.5         WBGene00018147           PUR4_YEAST         essential         C47B2.4         WBGene0001664         x           PUR4_YEAST         non-         B0361.5         WBGene0006673           PUR3_YEAST         essential         C44B7.1         WBGene00006473           PUT2_YEAST         essential         C44B7.1         WBGene00001122           PUT2_YEAST         essential         T23C6.2         WBGene000004259         x           PYR1_YEAST         non-         F31C3.5         WBGene00011559         x           PYRP_YEAST         essential         T23C6.2         WBGene00012841         x           Q02804         non-         Y45F3A.9         WBGene00011559         x           Q02805         essential         F10F2.2         WBGene00011600         x           Q02806         non-         R667.5         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012856         x           Q03761         essential         F55F8.3         WBGene00016837         x           Q04048         non-         D2085.1	PT91_YEAST	essential	C02F5.3	WBGene00012483	
PUR2_YEAST         essential         F39H11.5         WBGene00018174           PUR4_YEAST         non-         K05C4.1         WBGene0001664         x           PURA_YEAST         essential         C47B2.4         WBGene0001664         x           PURA_YEAST         essential         C44B7.1         WBGene00006173           PUT2_YEAST         essential         W10C4.b         WBGene00000112           PUT2_YEAST         non-         F31C3.5         WBGene00002932           PYR1_YEAST         essential         T23C6.2         WBGene0001559         x           QV2804         non-         Y45F3A.9         WBGene0001559         x           Q02804         non-         Y45F3A.9         WBGene00016002         y02890         essential         T04A8.5         WBGene00016002         y02890         essential         F10F2.2         WBGene0001820         y02890         y03195         essential         F37F3.6         WBGene0001256         y03390         y03761         essential         F55F12.1         WBGene00018290         y03761         essential         F55F8.3         WBGene0001724         x           Q04049         non-         D27C4.1         WBGene00017814         x         y04049         non-         Y54210B_159.	PUF3_YEAST	non-	T20F5.2	WBGene00004245	
PUR2_YEAST         essential         F39H11.5         WBGene00018174           PUR4_YEAST         non-         K05C4.1         WBGene0001664         x           PURA_YEAST         essential         C47B2.4         WBGene0001664         x           PURA_YEAST         essential         C44B7.1         WBGene00006173           PUT2_YEAST         essential         W10C4.b         WBGene00000112           PUT2_YEAST         non-         F31C3.5         WBGene00002932           PYR1_YEAST         essential         T23C6.2         WBGene0001559         x           QV2804         non-         Y45F3A.9         WBGene0001559         x           Q02804         non-         Y45F3A.9         WBGene00016002         y02890         essential         T04A8.5         WBGene00016002         y02890         essential         F10F2.2         WBGene0001820         y02890         y03195         essential         F37F3.6         WBGene0001256         y03390         y03761         essential         F55F12.1         WBGene00018290         y03761         essential         F55F8.3         WBGene0001724         x           Q04049         non-         D27C4.1         WBGene00017814         x         y04049         non-         Y54210B_159.	PUR1 YEAST	essential	Y38A8 2	WBGene00011407	
PUR4_YEAST         non-         K05C4.1         WBGene00008654         x           PUR8_YEAST         essential         C47B2.4         WBGene00016509         x           PURA_YEAST         non-         B0361.5         WBGene00006473         x           PUT2_YEAST         non-         F40G9.1         WBGene00000112         x           PUT2_YEAST         essential         Y10C4.b         WBGene0000122         x           PUT2_YEAST         essential         T23C6.2         WBGene000020322         x           PYRP_YEAST         essential         Y18D10A.16         WBGene00011559         x           Q02804         non-         W06E11.2         WBGene00016002         x           Q02804         non-         R06C7.5         WBGene00014123         x           Q03195         essential         F10F2.2         WBGene00014123         x           Q03195         essential         F56D12.1         WBGene00012256         x           Q03761         essential         F55F8.3         WBGene00017818         x           Q04048         essential         Y542F07.10         WBGene00017818         x           Q04049         non-         T07C4.1         WBGene00017818         x					
PUR8_YEAST         essential         C47B2.4         WBGene00011064         x           PURA_YEAST         non-         B0361.5         WBGene00006473           PUT2_YEAST         essential         C44B7.1         WBGene00000112           PUT2_YEAST         essential         W10C4.b         WBGene00000121           PUT2_YEAST         essential         T3C3.5         WBGene00004259         x           PYR1_YEAST         essential         T3C3.6.2         WBGene00012831         x           PYR1_YEAST         essential         T12D10A.16         WBGene00021854         y           Q02804         non-         W06E11.2         WBGene00011559         y         Q02805         essential         F10F2.2         WBGene00012841         x           Q0280         essential         F10F2.2         WBGene00012756         WBGene00012756         y         Q03195         essential         F55D12.1         WBGene00012256         Q03390         essential         F55D12.1         WBGene00012244         X         Q03761         essential         F55D12.1         WBGene00017818         WBGene00017818         Y         Q04048         essential         Y54E10B_159.         WBGene00017814         x         Q04048         essential         Y54E10B_159.	—				
PURA_YEAST         non-         B0361.5         WBGene00016509           PUS3_YEAST         essential         C44B7.1         WBGene000006473           PUT2_YEAST         non-         F40G9.1         WBGene0000112           PWT2_YEAST         essential         W10C4.b         WBGene00001259         x           PYR1_YEAST         essential         T23C6.2         WBGene00012932         x           PYR1_YEAST         non-         Y45F3A.9         WBGene0001801         x           Q02804         non-         W06B11.2         WBGene0001801         x           Q02875         essential         T04A8.5         WBGene0001801         x           Q02804         non-         R06C7.5         WBGene0001801         x           Q03195         essential         C37H5.6         WBGene00012256         x           Q03201         non-         E02H1.3         WBGene0001224         x           Q03761         essential         F55F8.3         WBGene00013290         x           Q03786         non-         D2085.1         WBGene0001734         x           Q04048         essential         Y54E108_159.         WBGene0001737         x           Q04048         essential	_		KU5C4.1		
PURA_YEAST         non-         B0361.5         WBGene00016509           PUS3_YEAST         essential         C44B7.1         WBGene000006473           PUT2_YEAST         non-         F40G9.1         WBGene0000112           PWT2_YEAST         essential         W10C4.b         WBGene00001259         x           PYR1_YEAST         essential         T23C6.2         WBGene00012932         x           PYR1_YEAST         non-         Y45F3A.9         WBGene0001801         x           Q02804         non-         W06B11.2         WBGene0001801         x           Q02875         essential         T04A8.5         WBGene0001801         x           Q02804         non-         R06C7.5         WBGene0001801         x           Q03195         essential         C37H5.6         WBGene00012256         x           Q03201         non-         E02H1.3         WBGene0001224         x           Q03761         essential         F55F8.3         WBGene00013290         x           Q03786         non-         D2085.1         WBGene0001734         x           Q04048         essential         Y54E108_159.         WBGene0001737         x           Q04048         essential	PUR8_YEAST	essential	C47B2.4	WBGene00011064	x
PUS3_YEAST         essential         C44B7.1         WBGene00006473           PUT2_YEAST         non-         F40G9.1         WBGene00000112           PUT2_YEAST         essential         W10C4.b         WBGene0000125           PWP2_YEAST         essential         T23C6.2         WBGene00012559           PYRL_YEAST         essential         T18D10A.16         WBGene00012559           PYRD_YEAST         essential         T0488.5         WBGene00011559           Q02804         non-         W06B11.2         WBGene00011559           Q02805         essential         F10F2.2         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012256         y           Q03761         essential         F55F8.3         WBGene0001224         y           Q03766         non-         D2085.1         WBGene0001781         x           Q04048         essential         Y54E10B_159.         WBGene0001781         x           Q04048         essential         Y54E10B_159.         WBGene0001737         x           Q04048         essential         Y54E10B_159.         WBGene00016602	—	non-			
PUT2_YEAST         non-         F40G9.1         WBGene00000112           PUT2_YEAST         essential         W10C4.b         WBGene00008812           PWP2_YEAST         non-         F31C3.5         WBGene00020932           PYR1_YEAST         essential         T23C6.2         WBGene00020932           PYRD_YEAST         essential         T23C6.2         WBGene00020932           PYRP_YEAST         essential         T04A8.5         WBGene00016002           Q02804         non-         W06B1.2         WBGene00016002           Q02889         essential         T04A8.5         WBGene00016002           Q02808         essential         F10F2.2         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00017818         x           Q03778         essential         F55F8.3         WBGene0001784         x           Q03940         non-         T07C4.1         WBGene0001784         x           Q04048         essential         Y54E10B_159.         WBGene0001787         x           Q04049         non-         F15D4.3         WBGene000018637         x	_				
PUT2_YEAST         essential         W10C4.b         WBGene00010112           PWP2_YEAST         non-         F31C3.5         WBGene00014259         x           PYR1_YEAST         essential         T23C6.2         WBGene00014259         x           PYRD_YEAST         non-         Y45F3A.9         WBGene00011559         y           Q02804         non-         W06B11.2         WBGene0001801         y           Q02804         non-         F38B6.4         WBGene0001801         y           Q02808         non-         F38B6.4         WBGene00012123         y           Q03195         essential         F10F2.2         WBGene00012124         x           Q03201         non-         E0271.3         WBGene00012556         y           Q03761         essential         F55F8.3         WBGene0001224         y           Q03766         non-         D2085.1         WBGene00017818         y           Q03920         essential         Y54E10B_159.         WBGene00018371         x           Q04048         essential         Y54E10B_159.         WBGene00016837         x           Q04049         non-         F15D4.3         WBGene00016837         x           Q04049	—				
PWP2_YEAST         non-         F31C3.5         WBGene00018891         x           PYRL_YEAST         essential         T23C6.2         WBGene00020932         x           PYRL_YEAST         essential         Y18D10A.16         WBGene00012559         x           Q02804         non-         W06B11.2         WBGene0001559         x           Q02875         essential         T04A8.5         WBGene00016002         x           Q0280         essential         F10F2.2         WBGene00016002         x           Q0280         essential         F10F2.2         WBGene00012714         x           Q03195         essential         Y57G7A.10         WBGene00012556         x           Q03761         essential         F55F8.3         WBGene0001224         x           Q03766         non-         T07C4.1         WBGene0001784         x           Q04048         essential         Y54E10B_159.         WBGene00018371         x           Q04049         non-         I         WBGene0001737         x           Q04041         essential         Y54E10B_159.         WBGene00018371         x           Q04048         essential         Y54E10B_159.         WBGene00018375         x	PUT2_YEAST	non-	F40G9.1	WBGene00000112	
PYR1_YEAST PYRD_YEAST PYRD_YEAST Non-CSSential Y45F3A.9WBGene00004259 WBGene00020932PYRF_YEAST Q02804 Q02805 Q02889 Q02889 Q02806 Q02890 Q02889 Q02806 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q03195 Q03195 Q03201 Q03761 Q03390 Q03761 Q03761 Q03761 Q03920 Q03761 Q03920 Q03761 Q03940 Q01778 Q04048 Q03940 Q01778 Q04048 Q04048 Q04048 Q04048 Q04048 Q04048 Q04048 Q04048 Q04048 Q05521 Q04396 Q0449 Q0411 Q04048 Q05521 Q04396 Q04396 Q04311 Q05521 Q04336 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04440 Q04430 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440	PUT2_YEAST	essential	W10C4.b	WBGene00000112	
PYR1_YEAST PYRD_YEAST PYRD_YEAST Non-CSSential Y45F3A.9WBGene00004259 WBGene00020932PYRF_YEAST Q02804 Q02805 Q02889 Q02889 Q02806 Q02890 Q02889 Q02806 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q02890 Q03195 Q03195 Q03201 Q03761 Q03390 Q03761 Q03761 Q03761 Q03920 Q03761 Q03920 Q03761 Q03940 Q01778 Q04048 Q03940 Q01778 Q04048 Q04048 Q04048 Q04048 Q04048 Q04048 Q04048 Q04048 Q04048 Q05521 Q04396 Q0449 Q0411 Q04048 Q05521 Q04396 Q04396 Q04311 Q05521 Q04336 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04430 Q04440 Q04430 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440 Q04440	PWP2 YEAST	non-	F31C3 5	WBGene00018891	x
PYRD_YEASTnon-Y45F3A.9WBGene00020932PYRF_YEASTessentialY18D10A.16WBGene00011559Q02804non-W06B11.2WBGene0001841Q02875essentialT04A8.5WBGene00010602Q02889non-F38B6.4WBGene00014123Q03195essentialF10F2.2WBGene00012714Q03195essentialC37K5.6WBGene00012556Q03390essentialF55F8.3WBGene00012556Q03761essentialF55F8.3WBGene0001224Q03778essentialF55F8.3WBGene0001224Q03786non-D2085.1WBGene00018371Q04048essentialY54E10B_159.WBGene00018721Q04049non-iWBGene00018721Q04081essentialC18H9.3WBGene00016602Q04311essentialZX63.3WBGene00016602Q04430essentialZX663.3WBGene00016613Q04600non-Y37D8A.18WBGene00018756Q05521non-Y56A3A.4WBGene00018475Q05498essentialR10H10.6WBGene00018475Q05102essentialC33C12.9WBGene00013143XX06102essentialC30F2.3Q05445non-F26D11.1WBGene00013143Q0512essentialC30F2.3WBGene0001315Q0513essentialC30F2.3WBGene0001315Q05583essentialC30F2.3WBGene0001315Q06166non-C27H6.2WBGe	_	-			
PYRF_YEAST         essential         Y18D10A.16         WBGene00011559           Q02804         non-         W06B11.2         WBGene0001841           Q02875         essential         T04A8.5         WBGene0001802           Q02889         non-         F3B6.4         WBGene0001800           Q02890         essential         F10F2.2         WBGene00012714         x           Q03195         essential         C37H5.6         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012556         Q03390         essential         F55F8.3         WBGene0001224         x           Q03761         essential         F55F8.3         WBGene0001224         x         Q03786         non-         D2085.1         WBGene0001784         x           Q03920         essential         Y54E10B_159.         WBGene00018371         x         Q04048         essential         Y54E10B_159.         WBGene00018721         x           Q04048         essential         C18H9.3         WBGene00018721         x         x           Q04049         non-         I         WBGene00018721         x         x           Q04149         non-         Y53H1C.a         WBGene00018637         x	_				x
Q02804         non-         W06B11.2         WBGene00021841           Q02875         essential         T04A8.5         WBGene00008860           Q02889         non-         F38B6.4         WBGene0001860           Q02890         essential         F10F2.2         WBGene0001860           Q02908         non-         R06C7.5         WBGene00012714         x           Q03195         essential         C37H5.6         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012714         x           Q03761         essential         F55F8.3         WBGene00018290         Q03776           Q03778         essential         F55F8.3         WBGene00017818         Q03920         essential         F02A5.1         WBGene0001784         x           Q04048         essential         Y54E10B_159.         WBGene00016337         x         Q04049         non-         i         WBGene00018721         Q04048         essential         Y54E10B_159.         WBGene00016602         Q04311         essential         Y354H2.a         WBGene00016623         x           Q04049         non-         F15D4.3         WBGene00016427         Q04396         essential         X737BA.18         WBGene00016602	PYRD_YEAST	non-	Y45F3A.9	WBGene00020932	
Q02804         non-         W06B11.2         WBGene00021841           Q02875         essential         T04A8.5         WBGene00008860           Q02889         non-         F38B6.4         WBGene0001860           Q02890         essential         F10F2.2         WBGene0001860           Q02908         non-         R06C7.5         WBGene00012714         x           Q03195         essential         C37H5.6         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012714         x           Q03761         essential         F55F8.3         WBGene00018290         Q03776           Q03778         essential         F55F8.3         WBGene00017818         Q03920         essential         F02A5.1         WBGene0001784         x           Q04048         essential         Y54E10B_159.         WBGene00016337         x         Q04049         non-         i         WBGene00018721         Q04048         essential         Y54E10B_159.         WBGene00016602         Q04311         essential         Y354H2.a         WBGene00016623         x           Q04049         non-         F15D4.3         WBGene00016427         Q04396         essential         X737BA.18         WBGene00016602	PYRF_YEAST	essential	Y18D10A.16	WBGene00011559	
Q02875         essential         T04A8.5         WBGene00016002           Q02889         non-         F38B6.4         WBGene0001860           Q02890         essential         F10F2.2         WBGene00014123           Q03195         essential         C37H5.6         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012744         x           Q03201         non-         E02H1.3         WBGene00012246           Q03761         essential         F56D12.1         WBGene0001224           Q03786         non-         D2085.1         WBGene00017818           Q03920         essential         V54E10B_159.         WBGene00018721           Q04048         essential         Y54E10B_159.         WBGene00018721           Q04049         non-         i         WBGene00018721           Q04049         non-         F15D4.3         WBGene00018721           Q04049         non-         Y39E4B.1         WBGene00018721           Q04430         essential         Y39E4B.1         WBGene00018756           Q04430         essential         Y39E4B.1         WBGene00018756	002804		W06B11 2	WBGene00021841	
Q02889         non-         F38B6.4         WBGene00008860           Q02890         essential         F10F2.2         WBGene0001160           Q02908         non-         R06C7.5         WBGene00012714         x           Q03195         essential         C37H5.6         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012556           Q03390         essential         F55F8.3         WBGene00018290           Q03761         essential         F55F8.3         WBGene00017818           Q03786         non-         D2085.1         WBGene00016341           Q03940         non-         T07C4.1         WBGene00016371         x           Q04048         essential         Y54E10B_159.         WBGene00018271         x           Q04048         essential         C18H9.3         WBGene00018721         x           Q04049         non-         I         WBGene00019457         x           Q04149         non-         Y53H1C.a         WBGene00018756         x           Q04430         essential         ZX863.3         WBGene00018756         x           Q04430         essential         F30A.18         WBGene00018756         x	~	-			
Q02890         essential         F10F2.2         WBGene00010160           Q02908         non-         R06C7.5         WBGene00012714         x           Q03195         essential         C37H5.6         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012714         x           Q03761         essential         Y5767A.10         WBGene00012244         x           Q03761         essential         F56D12.1         WBGene00017818         x           Q03786         non-         D2085.1         WBGene00017814         x           Q04048         essential         Y54E10B_159.         WBGene00016341         x           Q04049         non-         T07C4.1         WBGene00018721         x           Q04049         non-         F15D4.3         WBGene00018457         x           Q04049         non-         F15D4.3         WBGene00018457         x           Q04149         non-         F15D4.3         WBGene00018457         x           Q04311         essential         Y39E4B.1         WBGene00018457         x           Q04430         essen	~				
Q02908         non-         R06C7.5         WBGene00014123           Q03195         essential         C37H5.6         WBGene00012714         x           Q03201         non-         E02H1.3         WBGene00012556           Q03390         essential         Y57G7A.10         WBGene00018290           Q03761         essential         F55D12.1         WBGene00016326           Q03778         essential         F55F8.3         WBGene00016341           Q03940         non-         T07C4.1         WBGene00016371         x           Q04048         essential         Y54E10B_159.         WBGene00018721         x           Q04048         essential         C18H9.3         WBGene00018721         x           Q04049         non-         i         WBGene00018721         x           Q04041         essential         C18H9.3         WBGene00018721         x           Q04081         essential         Y5H1C.a         WBGene00018757         x           Q04396         essential         Y3P84.18         WBGene00019457         x           Q04430         essential         F41E6.9         WBGene00018766         x           Q05521         non-         Y56A3A.4         WBGene00013143	Q02889	non-	F38B6.4	WBGene00008860	
	Q02890	essential	F10F2.2	WBGene00010160	
	002908	non-	R06C7.5	WBGene00014123	
Q03201         non-         E02H1.3         WBGene00012556           Q03390         essential         Y57G7A.10         WBGene00018290           Q03761         essential         F55D12.1         WBGene00013256           Q03778         essential         F55F8.3         WBGene0001224           Q03766         non-         D2085.1         WBGene00017818           Q03920         essential         W02D3.2         WBGene00017814           Q04048         essential         Y54E10B_159.         WBGene00018721           Q04049         non-         i         WBGene00018721           Q04049         non-         F15D4.3         WBGene00018721           Q04049         non-         F15D4.3         WBGene00018721           Q04049         non-         F15D4.3         WBGene00018751           Q04149         non-         Y34H1C.a         WBGene00019457           Q04396         essential         Y384B.1         WBGene00019457           Q04396         essential         Y37D8A.18         WBGene00018756           Q04400         non-         Y37D8A.18         WBGene00018756           Q05521         non-         Y56A3A.4         WBGene00012479           Q05102         essen	~				
Q03390         essential         Y57G7A.10         WBGene00018290           Q03761         essential         F56D12.1         WBGene0006396           Q03778         essential         F55F8.3         WBGene00011224           Q03786         non-         D2085.1         WBGene00017818           Q03920         essential         W02D3.2         WBGene00016341           Q03940         non-         T07C4.1         WBGene00016837         x           Q04048         essential         C18H9.3         WBGene00016877         x           Q04049         non-         i         WBGene00016602         x           Q04081         essential         C18H9.3         WBGene00019457         x           Q04149         non-         F15D4.3         WBGene00019457         x           Q04311         essential         Y3H1C.a         WBGene00019457         x           Q04430         essential         ZX863.3         WBGene00019457         x           Q04430         essential         F41E6.9         WBGene00018756         x           Q05498         essential         F41E6.9         WBGene00018756         x           Q05521         non-         F26D11.1         WBGene0001843	~				x
Q03761         essential         F56D12.1         WBGene00006396           Q03778         essential         F55F8.3         WBGene00011224           Q03786         non-         D2085.1         WBGene00016341           Q03920         essential         W02D3.2         WBGene00016341           Q03940         non-         T07C4.1         WBGene00016837         x           Q04048         essential         Y54E10B_159.         WBGene00018721         x           Q04049         non-         I         WBGene00016602         x           Q04081         essential         C18H9.3         WBGene00018751         x           Q04311         essential         Y53H1C.a         WBGene00019457         x           Q0430         essential         Y39E4B.1         WBGene00016602         x           Q04430         essential         Y39E4B.1         WBGene0001648         x           Q05498         essential         F41E6.9         WBGene00018756         x           Q05521         non-         Y56A3A.4         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00013143         x           Q06102         essential         C3G72.3	Q03201	non-	E02H1.3	WBGene00012556	
Q03778         essential         F55F8.3         WBGene00011224           Q03786         non-         D2085.1         WBGene00017818           Q03920         essential         W02D3.2         WBGene00016341           Q03940         non-         T07C4.1         WBGene00016341           Q04048         essential         Y54E10B_159.         WBGene00018377         x           Q04049         non-         i         WBGene00018721         x           Q04081         essential         Y54E10B_159.         WBGene00016602         x           Q04149         non-         F15D4.3         WBGene00016602         x           Q04311         essential         Y53H1C.a         WBGene00019457         x           Q0430         essential         Y39E4B.1         WBGene00019457         x           Q04430         essential         F41E6.9         WBGene00018756         x           Q05521         non-         Y56A3A.4         WBGene00018756         x           Q05102         essential         C33C12.9         WBGene00013143         x           Q06102         essential         C3GC12.9         WBGene00013143         x           Q06103         non-         F53A3.2         W	Q03390	essential	Y57G7A.10	WBGene00018290	
Q03778         essential         F55F8.3         WBGene00011224           Q03786         non-         D2085.1         WBGene00017818           Q03920         essential         W02D3.2         WBGene00016341           Q03940         non-         T07C4.1         WBGene00016341           Q04048         essential         Y54E10B_159.         WBGene00018377         x           Q04049         non-         i         WBGene00018721         x           Q04081         essential         Y54E10B_159.         WBGene00016602         x           Q04149         non-         F15D4.3         WBGene00016602         x           Q04311         essential         Y53H1C.a         WBGene00019457         x           Q0430         essential         Y39E4B.1         WBGene00019457         x           Q04430         essential         F41E6.9         WBGene00018756         x           Q05521         non-         Y56A3A.4         WBGene00018756         x           Q05102         essential         C33C12.9         WBGene00013143         x           Q06102         essential         C3GC12.9         WBGene00013143         x           Q06103         non-         F53A3.2         W	003761	essential	F56D12.1	WBGene00006396	
Q03786         non-         D2085.1         WBGene00017818           Q03920         essential         W02D3.2         WBGene00016341           Q03940         non-         T07C4.1         WBGene00016837         x           Q04048         essential         Y54E10B_159.         WBGene00018721         x           Q04049         non-         i         WBGene00018721         x           Q04081         essential         C18H9.3         WBGene00018721         x           Q04149         non-         F15D4.3         WBGene00018622         x           Q04311         essential         Y53H1C.a         WBGene00019457         x           Q04396         essential         X863.3         WBGene000020895         x           Q04430         essential         Y3P4B.1         WBGene00016113         x           Q05498         essential         F41E6.9         WBGene00018756         x           Q05521         non-         Y56A3A.4         WBGene00012479         x           Q05102         essential         R10H10.6         WBGene00013143         x           Q06102         essential         C30C12.9         WBGene00013129         x           Q06103         non-					
Q03920         essential         W02D3.2         WBGene00016341           Q03940         non-         T07C4.1         WBGene00007784         x           Q04048         essential         Y54E10B_159.         WBGene00016837         x           Q04049         non-         i         WBGene00018721         x           Q04081         essential         C18H9.3         WBGene00018721         x           Q04149         non-         F15D4.3         WBGene00016602         x           Q04311         essential         Y53H1C.a         WBGene00019457         x           Q04396         essential         Y53H1C.a         WBGene00020895         x           Q04430         essential         ZK863.3         WBGene00016133         x           Q05498         essential         F41E6.9         WBGene00018756         x           Q05521         non-         Y56A3A.4         WBGene00012479         x           Q05583         essential         R10H10.6         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143	~				
Q03940         non-         T07C4.1         WBGene00007784         x           Q04048         essential         Y54E10B_159.         WBGene00016837         x           Q04049         non-         i         WBGene00018721         x           Q04081         essential         C18H9.3         WBGene00018721         x           Q04149         non-         F15D4.3         WBGene00016602         x           Q04311         essential         Y53H1C.a         WBGene00019457         x           Q04430         essential         ZK863.3         WBGene00019457         x           Q04430         essential         Y39E4B.1         WBGene000104068         x           Q05498         essential         F41E6.9         WBGene00012479         x           Q05521         non-         Y56A3A.4         WBGene00012479         x           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00012851         x           Q063	QU3786		D2085.1		
Q04048         essential         Y54E10B_159.         WBGene00016837         x           Q04049         non-         i         WBGene00018721         x           Q04081         essential         C18H9.3         WBGene00018721         x           Q04049         non-         F15D4.3         WBGene00016602         x           Q04311         essential         Y53H1C.a         WBGene00019457         x           Q04396         essential         ZK863.3         WBGene00020895         x           Q04430         essential         Y39E4B.1         WBGene00016113         x           Q05498         essential         F41E6.9         WBGene00018756         x           Q05521         non-         Y56A3A.4         WBGene00012479         x           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00013143         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00012656         x           Q06338         essential         C43E11.2         WBGene0001231         x	Q03920	essential	W02D3.2	WBGene00016341	
Q04048         essential         Y54E10B_159.         WBGene00016837         x           Q04049         non-         i         WBGene00018721         x           Q04081         essential         C18H9.3         WBGene00018721         x           Q04049         non-         F15D4.3         WBGene00016602         x           Q04311         essential         Y53H1C.a         WBGene00019457         x           Q04396         essential         ZK863.3         WBGene00020895         x           Q04430         essential         Y39E4B.1         WBGene00016113         x           Q05498         essential         F41E6.9         WBGene00018756         x           Q05521         non-         Y56A3A.4         WBGene00012479         x           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00013143         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00012656         x           Q06338         essential         C43E11.2         WBGene0001231         x	003940	non-	T07C4.1	WBGene00007784	x
Q04049         non-         i         WBGene00018721           Q04081         essential         C18H9.3         WBGene0007137           Q04149         non-         F15D4.3         WBGene00016602           Q04311         essential         Y53H1C.a         WBGene00019457           Q04396         essential         ZK863.3         WBGene00020895           Q04430         essential         Y39E4B.1         WBGene00016113           Q05498         essential         F41E6.9         WBGene00018756           Q05521         non-         Y56A3A.4         WBGene00018756           Q05946         non-         F26D11.1         WBGene00018756           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00013129         x           Q06338         essential         C43E11.2         WBGene00012851         x           Q06344         essential         C43E11.2         WBGene0001231         x           Q06385         essential<	004048	aggential			v
Q04081         essential         C18H9.3         WBGene0007137           Q04149         non-         F15D4.3         WBGene00016602           Q04311         essential         Y53H1C.a         WBGene00019457           Q04396         essential         ZK863.3         WBGene00020895           Q04430         essential         ZX863.3         WBGene00004068           Q04430         essential         Y39E4B.1         WBGene00016113           Q05498         essential         F41E6.9         WBGene00018756           Q05521         non-         Y56A3A.4         WBGene00012479           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00013143         x           Q06102         essential         C50F2.3         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06338         essential         C43E11.2         WBGene00012851         x           Q06338         essential         C43E11.2         WBGene00012851         x           Q06385         essential         C10G11.5         WBGene000022851         x	~				~
Q04149         non-         F15D4.3         WBGene00016602           Q04311         essential         Y53H1C.a         WBGene00019457           Q04396         essential         ZX863.3         WBGene00020895           Q04430         essential         ZX863.3         WBGene00004068           Q04430         essential         Y39E4B.1         WBGene00016113           Q05498         essential         F41E6.9         WBGene00018756           Q05521         non-         Y56A3A.4         WBGene00012479           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00013143         x           Q06106         non-         C27H6.2         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00013129         x           Q0638         essential         C43E11.2         WBGene00012851         x           Q0638         essential         C43E11.2         WBGene0001231         x           Q06385         essential         C10G11.5         WBGene000022651         x <t< td=""><td></td><td></td><td>1</td><td></td><td></td></t<>			1		
Q04311         essential         Y53H1C.a         WBGene00019457           Q04396         essential         ZK863.3         WBGene00020895           Q04430         essential         Y39E4B.1         WBGene00004068           Q04600         non-         Y37D8A.18         WBGene00016113           Q05498         essential         F41E6.9         WBGene00018756           Q05521         non-         Y56A3A.4         WBGene00018756           Q05583         essential         R10H10.6         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00004315         x           Q06106         non-         C27H6.2         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene0001451         x           Q0638         essential         C43E11.2         WBGene00012851         x           Q0638         essential         T28D9.3         WBGene00022851         x           Q06385         essential         C10G11.5         WBGene00008729         x <td>Q04081</td> <td>essential</td> <td>C18H9.3</td> <td>WBGene00007137</td> <td></td>	Q04081	essential	C18H9.3	WBGene00007137	
Q04396         essential         ZK863.3         WBGene00020895           Q04430         essential         Y39E4B.1         WBGene00004068           Q04600         non-         Y37D8A.18         WBGene00004068           Q05498         essential         F41E6.9         WBGene00009266         x           Q05521         non-         Y56A3A.4         WBGene00018756         x           Q05583         essential         R10H10.6         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00004315         x           Q06102         essential         C50F2.3         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00013129         x           Q06152         essential         C43E11.2         WBGene0001451         x           Q0638         essential         C43E11.2         WBGene00012281         x           Q06385         essential         T28D9.3         WBGene00022651         x           Q06385         essential         C10G11.5         WBGene00002644         x           Q06505         essential	Q04149	non-	F15D4.3	WBGene00016602	
Q04396         essential         ZK863.3         WBGene00020895           Q04430         essential         Y39E4B.1         WBGene00004068           Q04600         non-         Y37D8A.18         WBGene00004068           Q05498         essential         F41E6.9         WBGene00009266         x           Q05521         non-         Y56A3A.4         WBGene00018756         x           Q05583         essential         R10H10.6         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00004315         x           Q06102         essential         C50F2.3         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00013129         x           Q06152         essential         C43E11.2         WBGene0001451         x           Q0638         essential         C43E11.2         WBGene00012281         x           Q06385         essential         T28D9.3         WBGene00022651         x           Q06385         essential         C10G11.5         WBGene00002644         x           Q06505         essential			Y53H1C.a	WBGene00019457	
Q04430         essential         Y39E4B.1         WBGene00004068           Q04600         non-         Y37D8A.18         WBGene00016113           Q05498         essential         F41E6.9         WBGene00009266         x           Q05521         non-         Y56A3A.4         WBGene00018756         x           Q05583         essential         R10H10.6         WBGene00012479         x           Q05946         non-         F26D11.1         WBGene00008689         x           Q06102         essential         C33C12.9         WBGene00013143         x           Q06106         non-         C27H6.2         WBGene00004315         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00013219         x           Q0638         essential         C43E11.2         WBGene00012851         x           Q0638         essential         C43E11.2         WBGene00012231         x           Q06385         essential         T28D9.3         WBGene00022651         x           Q06505         essential         C10G11.5         WBGene00008729         y           Q06510         non-					
Q04600         non-         Y37D8A.18         WBGene00016113           Q05498         essential         F41E6.9         WBGene00009266         x           Q05521         non-         Y56A3A.4         WBGene00018756         x           Q05983         essential         R10H10.6         WBGene00012479         x           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00004315         x           Q06106         non-         C27H6.2         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00019656         x           Q06152         essential         C43E11.2         WBGene00012851         x           Q06338         essential         C43E11.2         WBGene00012231         x           Q06344         essential         T28D9.3         WBGene00022651         x           Q06505         essential         C10G11.5         WBGene00008729         x           Q06510         non-         C25H3.4         WBGene00022301         x					
Q05498         essential         F41E6.9         WBGene00009266         x           Q05521         non-         Y56A3A.4         WBGene00018756         x           Q05583         essential         R10H10.6         WBGene00012479         x           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00008689         x           Q06106         non-         C27H6.2         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00019656         x           Q06338         essential         C43E11.2         WBGene00012851         x           Q06344         essential         T28D9.3         WBGene0001231         x           Q06505         essential         C10G11.5         WBGene00008729         x           Q06510         non-         C25H3.4         WBGene000022301         x	Q04430	essential		WBGene00004068	
Q05521         non-         Y56A3A.4         WBGene00018756           Q05583         essential         R10H10.6         WBGene00012479           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00004315         x           Q06106         non-         C27H6.2         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00019656         x           Q06152         essential         B0285.4         WBGene00012851         x           Q06338         essential         C43E11.2         WBGene0001231         x           Q06385         essential         T28D9.3         WBGene00022851         x           Q06505         essential         C10G11.5         WBGene00008729         y           Q06510         non-         C25H3.4         WBGene000022301         x	Q04600	non-	Y37D8A.18	WBGene00016113	
Q05521         non-         Y56A3A.4         WBGene00018756           Q05583         essential         R10H10.6         WBGene00012479           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00004315         x           Q06106         non-         C27H6.2         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00019656         x           Q06152         essential         B0285.4         WBGene00012851         x           Q06338         essential         C43E11.2         WBGene0001231         x           Q06385         essential         T28D9.3         WBGene00022851         x           Q06505         essential         C10G11.5         WBGene00008729         y           Q06510         non-         C25H3.4         WBGene000022301         x	005498	essential	F41E6.9	WBGene00009266	x
Q05583         essential         R10H10.6         WBGene00012479           Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00008689         x           Q06106         non-         C27H6.2         WBGene00013129         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00019656         x           Q06338         essential         C43E11.2         WBGene00012851         x           Q06344         essential         K06H7.3         WBGene0001231         x           Q06385         essential         C10G11.5         WBGene00008729         y           Q06510         non-         C25H3.4         WBGene00006491         x           Q06632         essential         F30A10.9         WBGene00022301         x			V56333 4	WBGene00018756	
Q05946         non-         F26D11.1         WBGene00013143         x           Q06102         essential         C33C12.9         WBGene00008689         x           Q06106         non-         C27H6.2         WBGene00004315         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00019656         x           Q06338         essential         B0285.4         WBGene00012851         x           Q06338         essential         C43E11.2         WBGene0001231         x           Q06385         essential         T28D9.3         WBGene00022651         x           Q06505         essential         C10G11.5         WBGene00008729         y           Q06510         non-         C25H3.4         WBGene000022301         x		-			
Q06102         essential         C33C12.9         WBGene00008689         x           Q06106         non-         C27H6.2         WBGene00004315         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00019656         x           Q06338         essential         B0285.4         WBGene00012851         x           Q06338         essential         C43E11.2         WBGene0001231         x           Q06385         essential         T28D9.3         WBGene00021644         x           Q06505         essential         C10G11.5         WBGene00008729         y           Q06510         non-         C25H3.4         WBGene00022301         x					
Q06106         non-         C27H6.2         WBGene00004315         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00019656         x           Q06152         essential         B0285.4         WBGene0001451         x           Q06338         essential         C43E11.2         WBGene0001231         x           Q06344         essential         K06H7.3         WBGene0001231         x           Q06385         essential         C10G11.5         WBGene00008729         x           Q06505         essential         C10G11.5         WBGene00006491         x           Q06632         essential         F30A10.9         WBGene00022301         x	Q05946	non-	F26D11.1	WBGene00013143	х
Q06106         non-         C27H6.2         WBGene00004315         x           Q06132         essential         C50F2.3         WBGene00013129         x           Q06143         non-         F53A3.2         WBGene00019656         x           Q06152         essential         B0285.4         WBGene0001451         x           Q06338         essential         C43E11.2         WBGene0001231         x           Q06344         essential         K06H7.3         WBGene0001231         x           Q06385         essential         C10G11.5         WBGene00008729         x           Q06505         essential         C10G11.5         WBGene00006491         x           Q06632         essential         F30A10.9         WBGene00022301         x	Q06102	essential	C33C12.9	WBGene00008689	x
Q06132         essential         C50F2.3         WBGene00013129           Q06143         non-         F53A3.2         WBGene00019656           Q06152         essential         B0285.4         WBGene0001451           Q06338         essential         C43E11.2         WBGene0001231         x           Q06344         essential         K06H7.3         WBGene0001231         x           Q06385         essential         T28D9.3         WBGene00021644         x           Q06505         essential         C10G11.5         WBGene00008729         Q           Q06510         non-         C25H3.4         WBGene00002301         x           Q06632         essential         F30A10.9         WBGene00022301         x					
Q06143         non-         F53A3.2         WBGene00019656           Q06152         essential         B0285.4         WBGene00011451           Q06338         essential         C43E11.2         WBGene00022851         x           Q06344         essential         K06H7.3         WBGene0001231         x           Q06385         essential         T28D9.3         WBGene00021644         x           Q06505         essential         C10G11.5         WBGene00008729         y           Q06510         non-         C25H3.4         WBGene00002301         x           Q06632         essential         F30A10.9         WBGene00022301         x					
Q06152         essential         B0285.4         WBGene00011451           Q06338         essential         C43E11.2         WBGene00022851         x           Q06344         essential         K06H7.3         WBGene0001231         x           Q06385         essential         T28D9.3         WBGene00021644         x           Q06505         essential         C10G11.5         WBGene00008729           Q06510         non-         C25H3.4         WBGene00006491           Q06632         essential         F30A10.9         WBGene00022301         x					
Q06338         essential         C43E11.2         WBGene00022851         x           Q06344         essential         K06H7.3         WBGene00010231         x           Q06385         essential         T28D9.3         WBGene00021644         x           Q06505         essential         C10G11.5         WBGene00008729         y           Q06510         non-         C25H3.4         WBGene00006491         y           Q06632         essential         F30A10.9         WBGene00022301         x					
Q06344         essential         K06H7.3         WBGene00010231         x           Q06385         essential         T28D9.3         WBGene00021644         x           Q06505         essential         C10G11.5         WBGene00008729         y           Q06510         non-         C25H3.4         WBGene00006491         x           Q06632         essential         F30A10.9         WBGene00022301         x	Q06152	essential	B0285.4	WBGene00011451	
Q06344         essential         K06H7.3         WBGene00010231         x           Q06385         essential         T28D9.3         WBGene00021644         x           Q06505         essential         C10G11.5         WBGene00008729         y           Q06510         non-         C25H3.4         WBGene00006491         x           Q06632         essential         F30A10.9         WBGene00022301         x	006338	essential	C43E11.2	WBGene00022851	x
Q06385         essential         T28D9.3         WBGene00021644         x           Q06505         essential         C10G11.5         WBGene00008729            Q06510         non-         C25H3.4         WBGene00006491            Q06632         essential         F30A10.9         WBGene00022301         x					
Q06505         essential         C10G11.5         WBGene00008729           Q06510         non-         C25H3.4         WBGene00006491           Q06632         essential         F30A10.9         WBGene00022301         x					
Q06510         non-         C25H3.4         WBGene00006491           Q06632         essential         F30A10.9         WBGene00022301         x					x
Q06632 essential F30A10.9 WBGene00022301 x	Q06505	essential	C10G11.5	WBGene00008729	
Q06632 essential F30A10.9 WBGene00022301 x	Q06510	non-	С25Н3.4	WBGene00006491	
~					x
QU0032 non- F53C3.13 WBGeneUUU22301 x					
	VU0032	110II-	r53C3.13	wBGene00022301	x

QC	)6672	essential	Y18D10A.9	WBGene00013109	х
QC	06685	non-	Y53C12B.1	WBGene00018508	
QC	06696	essential	F11A10.3	WBGene00008919	
QC	07381	non-	T23F6.4	WBGene00006497	x
00	)7457	essential	Y52B11A.10	WBGene00007008	
	07508	non-	K11G12.5	WBGene00015207	
	07830	essential	T04H1.5	WBGene00016159	
	07896	non-	ZK1127.4	WBGene00016508	x
	)7914	essential	F58B3.4	WBGene00001039	
	08004	essential	Y47G6A_247.a	WBGene00013236	
	08023	non-	F13B12.1	WBGene00010768	
~ -	08444	essential	ZK809.2	WBGene00021843	
	08444	essential	Y76B12C_65.a	WBGene00021843	
	08685	essential	Y76B12C 66.c	WBGene00010304	
	08723	non-	Y51H4A.m	WBGene00004464	x
~	08726	essential	F46F11.1	WBGene00015029	21
	08920	non-	F17C11.8	WBGene00009141	x
	08951	essential	F10G7.1	WBGene00000162	A
	)8952	essential	R05D3.4	WBGene000018700	
	)8963	essential	B0495.8	WBGene00019223	
~	)8971	non-	C27A12.9	WBGene00013200	
	L2000	essential	C37H5.5	WBGene00009189	
~	L2000	non-	C37H5.5 T19B4.4	WBGene00014230	
		essential	119B4.4 Y56A3A.18		
	12028			WBGene00000158	х
	2029	essential	K11D2.1	WBGene00005150	
	12035	essential	Y54E10B_159.	WBGene00021715	
~	L2049	non-	e	WBGene00017158	
	12052	essential	Y54E10B_159.	WBGene00011631	х
	L2059	non-	g	WBGene00006735	
	L2090	essential	F59A2.4	WBGene00004095	
	12102	non-	R12E2.3	WBGene00017313	х
	12118	essential	B0207.6	WBGene00019893	
	2142	essential	F26A3.2	WBGene00020706	
	12186	essential	W09G10.4	WBGene00013808	x
	L2199	essential	F52E1.13	WBGene00022803	
	12275	essential	H20J04.c	WBGene00017882	x
	12280	non-	Y54E5A.5	WBGene00003980	
	2309	essential	F27D4.4	WBGene00019762	
	12311	non-	ZK1128.4	WBGene00003034	
	2354	essential	Y105E8C.n	WBGene00010564	
	2368	non-	C41C4.2	WBGene00022794	
~	2383	essential	Y49F6B.q	WBGene00013026	
	2395	non-	F01F1.1	WBGene00010428	x
	L2400	essential	T08G11.4	WBGene00009131	
	2449	non-	C26E6.8	WBGene00007235	
	L2453	essential	F52C9.4	WBGene00012337	
	12463	non-	F09G2.4	WBGene00022107	
	12463	essential	R05F9.10	WBGene00022107	
	2464	non-	Т22Н9.2	WBGene00020687	x
~	L2468	essential	Y116A8C.32	WBGene00000817	
Q1	L2481	non-	C02C2.6	WBGene00020705	
	L2483	essential	F28B3.1	WBGene00016167	
Q1	L2500	non-	F09C3.1	WBGene00020822	
Q1	L2511	essential	M03F8.3	WBGene00022832	
Q8	374G8	non-	F42A9.2	WBGene00013025	x
QS	92317	essential	K04G2.5	WBGene00001092	
Qg	99190	non-	ZK686.4	WBGene00000198	
Qg	9207	essential	Y49A3A.3	WBGene00021660	x
Qg	99216	essential	H38K22.2	WBGene00013144	
Qg	9247	non-	F25H8.1	WBGene00009441	
Qg	99344	essential	C01G10.8	WBGene00004341	
QC	DR_YEAST	non-	W07G4.3	WBGene00009554	
QF	RI7_YEAST	essential	Y71F9A_270.a	WBGene00007237	
R1	LOA_YEAST	essential	Y71F9A_270.b	WBGene00004412	x
R1	L61_YEAST	non-	T22D1.10	WBGene00010272	
R1	L67_YEAST	essential	B0547.1	WBGene00020209	
R1	L67_YEAST	essential	Т22Н9.1	WBGene00020209	
	A14_YEAST	essential	C27F2.5	WBGene00006963	
	A23_YEAST	essential	T26A5.6	WBGene00013924	

RA	27_yeast	non-	ZK973.a	WBGene00000794	x
RA!	50_yeast	essential	Y49A3A.2	WBGene00004296	
	51_yeast	non-	F53A2.5	WBGene00004297	
RA	54_yeast	essential	C15F1.c	WBGene00004298	
	D1_YEAST	non-	Y48G1A_54.d	WBGene00008140	
	D2 YEAST	essential	Y53C12B.2	WBGene00019004	
	D5_YEAST	non-	F35G12.4	WBGene00010061	
	M1_YEAST	essential	F11H8.1	WBGene00009083	
	M1_TEAST M2_YEAST	essential	F39B2.3	WBGene00019823	
				WBGene00008548	
	SK_YEAST	non-	C01G10.10		
	X1_YEAST	essential	Y71F9A_294.c	WBGene00004320	x
	C1_YEAST	non-	F58G6.1	WBGene00004304	x
	L1_YEAST	essential	T04C9.1	WBGene00022852	x
	R1_YEAST	non-	ZK328.3	WBGene00009783	
REV	V1_YEAST	essential	K07G5.2	WBGene00014066	x
RF	1M_YEAST	essential	ZK20.3	WBGene00020993	
RFA	A1_YEAST	non-	Y47G6A_247.i	WBGene00017546	x
RFO	C1_YEAST	essential	T04H1.4	WBGene00004337	
RFC	C2_YEAST	essential	Y43C5A.6	WBGene00004340	
RFC	C4_YEAST	non-	W06D4.6	WBGene00004338	
RFO	C5_YEAST	essential	C47D12.8	WBGene00004339	
	D1_YEAST	essential	F57B10.6	WBGene00001559	
	D1_YEAST	essential	F54E12.2	WBGene00001559	
	M2_YEAST	essential	F23B12.6	WBGene00011662	
	D1_YEAST	essential	R02D3.5	WBGene00011002 WBGene00019698	
	R2_YEAST	essential	F07A11.5	WBGene00004392	x
	RZ_YEASI 10_YEAST	essential	ZK287.5	WBGene00004392 WBGene00004421	x
	12 YEAST				
	—	essential	C26D10.1	WBGene00004424	x
	18_YEAST	essential	ZK1127.5	WBGene00004430	х
	19_YEAST	non-	F46C5.8	WBGene00004431	х
	2_YEAST	essential	ZK675.2	WBGene00004413	х
	20_YEAST	essential	W03F8.3	WBGene00004432	x
	20_yeast	essential	F18A1.5	WBGene00004432	x
RL	23_YEAST	essential	C54G10.2	WBGene00004435	x
RL	3_yeast	essential	F31E3.3	WBGene00004414	x
RL	30_yeast	non-	F58F6.4	WBGene00004444	x
RL	35_yeast	essential	C39E9.13	WBGene00004449	x
RL	38_yeast	non-	F45H7.2	WBGene00004452	x
RL	39_yeast	essential	F45H7.3	WBGene00004453	
RL4	43_yeast	non-	T09F3.2	WBGene00004456	
RL!	5_yeast	essential	M01B12.5	WBGene00004416	x
RL	AO YEAST	non-	C03C10.3	WBGene00004408	x
	R1_YEAST	essential	F10B5.1	WBGene00015813	
	09_YEAST	non-	JC8.3	WBGene00016142	x
	19_YEAST	essential	Y45F10D.12	WBGene00015133	
	15_YEAST	non-	C09D4.5	WBGene00000774	x
	H1_YEAST	essential	B0250.1	WBGene00019088	л
	K1_YEAST	non-	E04A4.8	WBGene00011032	
	X1_YEAST	essential	Y17G9B.e	WBGene00001560	
			B0336.10		
	X1_YEAST	non-		WBGene00001560	
	A2_YEAST	essential	F13B10.2	WBGene00008781	x
	A9_YEAST	essential	Y106G6H.3	WBGene00007616	х
	B1_YEAST	essential	ZK652.4	WBGene00000123	
	B2_YEAST	non-	C06B8.8	WBGene00016140	x
	B3_YEAST	essential	C26F1.9	WBGene00007971	x
	B6_YEAST	essential	Y48B6A.2	WBGene00007355	
	B7_YEAST	essential	F54C9.5	WBGene00021845	x
RPI	B8_YEAST	essential	F25H2.10	WBGene00017830	x
	BY_YEAST	non-	C16A3.8	WBGene00012187	x
RPO	C1_YEAST	essential	C26E6.6	WBGene00004411	x
	C2_YEAST	non-	B0303.15	WBGene00017300	х
RPO	C5_YEAST	essential	F56A8.6	WBGene00019275	х
RPO	C6_YEAST	non-	F59A6.6	WBGene00021112	
RPO	C9_YEAST	essential	R05D11.4	WBGene00010230	
RPO	CY_YEAST	non-	Т22Н6.6	WBGene00014111	x
	 CZ_YEAST	essential	C52G5.1	WBGene00022309	
	F1_YEAST	non-	F14B4.3	WBGene00009711	x
	IA_YEAST	essential	C15H11.8	WBGene00015101	
	N1_YEAST	non-	F36A4.7	WBGene00004458	x
		-			ı

RPN2_YEAST	essential	C26E6.4	WBGene00004459	x
RPN3_YEAST	non-	C36B1.3	WBGene00004460	x
RPN5_YEAST	essential	C06A1.5	WBGene00004461	
RPN7_YEAST	non-	Y54E10B_159.	WBGene00004463	
RPN9_YEAST	essential	c	WBGene00004465	
RPNA_YEAST	non-	F26F4.11	WBGene00004466	
RPNC YEAST	essential	W01G7.3	WBGene00004468	
RR40_YEAST	non-	C42D4.8	WBGene00010325	x
RR41_YEAST	essential	F09F7.3	WBGene00007201	
				х
RR44_YEAST	non-	H43I07.2	WBGene00001001	х
RR45_YEAST	essential	W09C3.4	WBGene00018154	x
RRN3_YEAST	essential	F58A4.9	WBGene00007980	
RRP1_YEAST	non-	ZK856.10	WBGene00008151	x
RRP3_YEAST	essential	Y77E11A_3443	WBGene00012059	x
RRP5_YEAST	non-	.q	WBGene00015808	
RRP6_YEAST	essential	F44G4.1	WBGene00000796	x
RRS1_YEAST	non-	B0280.3	WBGene00007617	x
RS11_YEAST	essential	T22D1.9	WBGene00004480	x
RS13_YEAST	essential	C23G10.4	WBGene00004482	
RS15_YEAST	essential	C30C11.2	WBGene00004484	x
RS16_YEAST	non-	F10G7.8	WBGene00004485	x
RS18 YEAST	essential	F49C12.8	WBGene00004487	x
RS2_YEAST	non-	T06D8.8	WBGene00004471	x
RS20_YEAST	essential	B0205.3	WBGene00004489	x
_		ZK20.5		
RS21_YEAST	non-		WBGene00004490	х
RS22_YEAST	essential	F59C6.4	WBGene00004491	х
RS23_YEAST	non-	B0564.1	WBGene00004492	x
RS24_YEAST	essential	C04G2.6	WBGene00004493	x
RS25_YEAST	non-	F37C12.13	WBGene00004494	
RS28_YEAST	essential	C36E8.1	WBGene00004497	
RS3_YEAST	non-	C47E12.7	WBGene00004472	x
rs30_yeast	essential	T26G10.1	WBGene00004499	
RS37_YEAST	non-	C16A3.3	WBGene00006725	x
RS37_YEAST	essential	C14A4.4	WBGene00006725	x
RS37_YEAST	non-	C15H11.9	WBGene00006725	x
RS37_YEAST	essential	F40F11.1	WBGene00006725	x
RS5_YEAST	non-	C16A3.9	WBGene00004474	x
RS8_YEAST	essential	F36A2.6	WBGene00004477	x
RS8_YEAST	non-	T01C3.6	WBGene00004477	x
RSD1_YEAST	essential	Y57G11C.16	WBGene00009264	x
RSMB_YEAST	non-	C49H3.11	WBGene00009204	x
RSP5_YEAST	essential	Y105E8C.e	WBGene00007009	^
RSP5_YEAST	non-	F37C12.11	WBGene00007009	
RSP5_YEAST	essential	F53A3.3	WBGene00007009	x
RT04_YEAST	non-	F28D1.7	WBGene00020718	
RTF1_YEAST	essential	T07A9.11	WBGene00009103	x
RTS2_YEAST	non-	K02B2.5	WBGene00013128	x
RUXE_YEAST	essential	Y41D4A_3613.	WBGene00004919	x
RUXF_YEAST	non-	a	WBGene00004918	x
RUXG_YEAST	essential	C23G10.3	WBGene00004920	x
S160_YEAST	non-	C26F1.4	WBGene00007463	
S3B1_YEAST	essential	H06I04.a	WBGene00011605	x
SAHH_YEAST	non-	H06I04.f	WBGene00019322	x
SAR1_YEAST	essential	Y53G8B_1025.	WBGene00022678	x
SC10_YEAST	non-	a	WBGene00016376	
SC13_YEAST	essential	Y53G8B_1025.	WBGene00003806	x
SC15_YEAST	non-	b	WBGene00016188	
SC17_YEAST	essential	T05E11.1	WBGene00017016	
SC18_YEAST	non-	F42C5.8	WBGene00003818	x
SC18_YEAST	essential	F42C5.1	WBGene00003818	
SC18_YEAST SC22_YEAST		F30A10.6	WBGene00018853	х
_	non-			v
SC23_YEAST	essential	W08E3.1	WBGene00004754	х
SC62_YEAST	non-	Y65B4B_10.a	WBGene00007683	
SC65_YEAST	essential	Y65B4B_10.e	WBGene00018159	
SCD6_YEAST	non-	Y65B4B_11.a	WBGene00012484	
SCS7_YEAST	essential	T23B12.3	WBGene00007707	x
SEC6_YEAST	essential	F25B3.6	WBGene00017284	x
SEC7_YEAST	essential	Y52B11A.9	WBGene00012386	x
SEC7_YEAST	non-	Y49E10.15	WBGene00012386	x

SED5_YEAST	essential	ZK652.1	WBGene00006373	x
SEH1_YEAST	essential	Y71F9B_286.b	WBGene00003804	
SERB_YEAST	non-	С08Н9.2	WBGene00013379	
SET2_YEAST	essential	T08A11.2	WBGene00021515	
	essential	K02F2.2	WBGene00021515	
SFT2_YEAST	non-	ZK180.4	WBGene00007690	
SFT2_YEAST	essential	С33H5.9	WBGene00007690	x
SGPL_YEAST	essential	Y77E11A_3670	WBGene00004981	
SGS1_YEAST	non-	.c	WBGene00001865	
SGT1_YEAST	essential	C28G1.3	WBGene00001805	
SIK1_YEAST	non-	D1014.3	WBGene00000571 WBGene00010627	x
SIN3 YEAST	essential	ZK1014.1	WBGene00004117	^
SIS1_YEAST		H15N14.1	WBGene00004117 WBGene00001031	
_	essential	F55A4.1		
SKI2_YEAST	non-		WBGene00008502	
SLU7_YEAST	essential	Y113G7A.3	WBGene00010629	x
SLY1_YEAST	essential	C18E9.2	WBGene00009654	х
SMC1_YEAST	non-	F37F2.2	WBGene00001860	x
SMC2_YEAST	essential	Y18D10A.17	WBGene00003367	
SMC2_YEAST	essential	C25A1.5	WBGene00003367	x
SMC3_YEAST	essential	F09E5.6	WBGene00004873	
SMC4_YEAST	essential	Y87G2A.y	WBGene00004874	х
SMD1_YEAST	essential	Y6B3A.1	WBGene00004916	x
SMD2_YEAST	essential	F55A11.2	WBGene00004917	x
SMD3_YEAST	essential	Y43F4B.4	WBGene00004914	x
SMM1_YEAST	essential	Y62E10A.m	WBGene00013201	
SMP2_YEAST	essential	Y41D4A_2615.	WBGene00010425	
SMT3_YEAST	non-	a	WBGene00004888	х
SNF4_YEAST	essential	Y41D4A_3457.	WBGene00013732	
SNF5_YEAST	essential	b	WBGene00011111	х
SNX3_YEAST	essential	C18E9.10	WBGene00006503	
SNX4_YEAST	essential	C18E9.4	WBGene00003086	
SNX4_YEAST	essential	Y66H1B.4	WBGene00003086	
SOF1_YEAST	essential	T04A11.6	WBGene00022742	x
SOK1_YEAST	essential	D1054.3	WBGene00010875	
SP11_YEAST	essential	K07C5.4	WBGene00004985	
SP14_YEAST	non-	F02E9.4	WBGene00004040	
SP14_YEAST	essential	F54D5.8	WBGene00004040	
SP14_YEAST	essential	F01G4.3	WBGene00004040	
SPB1_YEAST	essential	K07C5.6	WBGene00019168	x
SPC3_YEAST	essential	F43D9.3	WBGene00019679	x
SPEE_YEAST	essential	F28B3.7	WBGene00012909	
SPT4_YEAST	essential	M106.1	WBGene00005014	
SPT5_YEAST	essential	R06F6.10	WBGene00005015	x
SR40_YEAST	essential	Y47D3A.aa	WBGene00000931	
SR54_YEAST	essential	F35G12.8	WBGene00009012	
SR68_YEAST	essential	T28D9.10	WBGene00010097	x
SRPR_YEAST	essential	C52E4.3	WBGene00009521	x
SSL1_YEAST	non-	Y116A8C.42	WBGene00011814	x
ST20_YEAST	essential	Y54E5A.6	WBGene00003911	
ST22_YEAST	non-	H37A05.1	WBGene00015658	
ST24_YEAST	essential	K12C11.2	WBGene00001405	
STI1_YEAST	non-	Y111B2C.h	WBGene00019983	
STT3_YEAST	essential	R07E5.3	WBGene00020437	x
SUB2_YEAST	non-	W06D4.5	WBGene00001840	x
SUCB_YEAST	essential	Y37A1B.2a	WBGene00009812	
SUG2_YEAST	essential	Y37A1B.3	WBGene00004504	x
SULX_YEAST	non-	ZK430.7	WBGene00017464	
SUV3_YEAST	essential	M05D6.2	WBGene00007444	
SYAC_YEAST	non-	T05E11.4	WBGene00000197	x
SYC_YEAST	essential	C04G6.5	WBGene00000800	x
SYDC_YEAST	non-	C04G6.2	WBGene00001094	x
SYDM_YEAST	essential	C04G6.3	WBGene00001095	
SYEM_YEAST	non-	H06I04.h	WBGene00001338	
SYFA_YEAST	essential	K12H4.4	WBGene00001497	x
SYFB_YEAST	non-	Y46G5.w	WBGene00001498	x
SYH_YEAST	essential	F54C4.2	WBGene00002001	x
SYIC_YEAST	non-	K08E4.1	WBGene00002152	x
SYIM_YEAST	essential	C25A1.10	WBGene00002153	x
SYKC_YEAST	non-	F21D5.7	WBGene00002238	x

		75585 0		-
SYLC_YEAST	essential	F55C5.8	WBGene00003073	х
SYMC_YEAST	essential	F38A1.8	WBGene00003415	х
SYNC_YEAST	non-	T16H12.4	WBGene00003815	x
SYPC_YEAST	essential	C09B8.7	WBGene00004190	
SYQ_YEAST	non-	C09G12.9	WBGene00001336	x
SYSC_YEAST	essential	C04F12.10	WBGene00005663	x
SYTC_YEAST	non-	R09E12.3	WBGene00006617	x
SYV_YEAST	essential	T12A2.2	WBGene00006936	x
SYWC_YEAST	non-	C26D10.2	WBGene00006945	x
SYWC_YEAST	essential	F47B10.1	WBGene00006945	
SYWM YEAST	essential	F23F1.8	WBGene00006946	
SYYM_YEAST	non-	F14D12.5	WBGene00006968	x
T145 YEAST	essential	C08F8.2	WBGene00006382	x
_				
T145_YEAST	non-	F28H1.3	WBGene00006382	x
T145_YEAST	essential	Y23H5A.7	WBGene00006382	x
T145_YEAST	non-	B0464.1	WBGene00006382	
T2D4_YEAST	essential	F10C2.6	WBGene00006386	x
T2D5_YEAST	non-	T07A9.2	WBGene00006387	
T2EA_YEAST	essential	T08B2.9	WBGene00013998	x
T2FA_YEAST	non-	F22B5.9	WBGene00015296	
T2FB_YEAST	essential	T11G6.1	WBGene00012694	
TAD2 YEAST	non-	R11A8.6	WBGene00010436	
TBG_YEAST	essential	C25A1.7	WBGene00006540	x
TBP YEAST	non-	T02G5.9	WBGene00006542	x
TBP7_YEAST	essential	R74.1	WBGene00008682	
TCPA YEAST	non-	F58B3.5	WBGene00000377	x
TCPB YEAST	essential	F22D6.3	WBGene00011889	
				x
TCPD_YEAST	essential	T27F6.5	WBGene00000379	х
TCPE_YEAST	essential	Y41E3.4	WBGene00000380	x
TCPG_YEAST	non-	C47E12.1	WBGene00018782	x
TCPH_YEAST	essential	C47D12.6	WBGene00020391	x
TCPQ_YEAST	essential	Y87G2A.1	WBGene00021934	x
TCPQ_YEAST	essential	Y80D3A.a	WBGene00021934	x
TCPZ_YEAST	non-	Y80D3A.b	WBGene00000381	x
TCTP_YEAST	essential	C34E10.4	WBGene00009122	x
TEL1_YEAST	non-	K08F11.4	WBGene00000227	
TF3B YEAST	essential	W04A8.7	WBGene00000271	x
TFC5_YEAST	essential	Y71A12B.a	WBGene00015091	x
TFS2_YEAST	essential	Y71A12B.b	WBGene00012000	
TLG2_YEAST	non-	Y71A12B.c	WBGene00022534	
TOP1_YEAST	essential	F30F8.8	WBGene00006595	
TPIS_YEAST	non-	W09B6.2	WBGene00006601	
TR20_YEAST	essential	ZK550.4	WBGene00021046	
TRM8_YEAST	non-	C01F1.1	WBGene00012205	
TRMU_YEAST	essential	Y39B6A.f	WBGene00007114	
TWF1_YEAST	non-	JC8.4	WBGene00018187	
TXTP_YEAST	essential	F58A4.8	WBGene00010780	
TYDP_YEAST	non-	T20B12.2	WBGene00018678	
TYSY_YEAST	essential	F11A10.1	WBGene00022455	
UBA1_YEAST	essential	T05C12.7	WBGene00006699	
UBA2_YEAST	non-	T21B10.7	WBGene00006700	
UBC2_YEAST	essential	K01C8.10	WBGene00006701	
UBC3_YEAST	essential	C07G2.3	WBGene00006702	
UBC9_YEAST	non-	F54A3_31.e	WBGene00006706	
UBPE_YEAST	essential	T10B5.5	WBGene00020839	
UBR1_YEAST	essential	Y55F3A_750.c	WBGene00016326	
UCR7 YEAST	essential	Y55F3A_750.d	WBGene00020181	
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UDPG_YEAST	essential	F01F1.8	WBGene00010665	х
UFD1_YEAST	essential	F25H2.11	WBGene00006733	x
UFD2_YEAST	essential	Y48G1C_55.a	WBGene00006734	
UGA2_YEAST	non-	F45E12.2	WBGene00000113	
ULP1_YEAST	essential	B0261.1	WBGene00006736	
UME3_YEAST	non-	T24H10.1	WBGene00000506	
UME5_YEAST	essential	ZC155.7	WBGene00000409	
UNG_YEAST	essential	M01E5.5	WBGene00013241	
UT11_YEAST	essential	Y17G7B.7	WBGene00007623	x
UTR4_YEAST	non-	W05H7.3	WBGene00010286	
VATC_YEAST	essential	W02B12.10	WBGene00006920	
VATD_YEAST	essential	B0035.16	WBGene00010130	
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VATE_YEAST	non-	F38E9.5	WBGene00006917	х
VATF_YEAST	essential	K11H3.3	WBGene00006918	x
VATG_YEAST	essential	F52C12.1	WBGene00006919	x
VATO_YEAST	essential	Y110A7A.q	WBGene00011347	x
VP13_YEAST	non-	C47E12.5	WBGene00011629	
VP15_YEAST	essential	W02A11.4	WBGene00014151	
VP15_YEAST	non-	C35B1.1	WBGene00014151	
VP16_YEAST	essential	Y71G12A_187.	WBGene00006516	
VP26_YEAST	non-	a	WBGene00006931	
VP27_YEAST	essential	F29B9.6	WBGene00004101	x
VP28_YEAST	essential	T27A3.2	WBGene00013598	x
VP34_YEAST	non-	C32E8.11	WBGene00006932	
VP35_YEAST	essential	Т02Н6.11	WBGene00006933	
VP45_YEAST	non-	K08E3.5	WBGene00016643	
VP45_YEAST	essential	F19B6.2	WBGene00016643	
VPS4_YEAST	essential	T05H10.5	WBGene00021334	x
VPS5_YEAST	essential	F45H10.1	WBGene00004927	
VPS9_YEAST	essential	T10F2.3	WBGene00012644	
WEB1_YEAST	non-	H14E04.5	WBGene00011338	
XPO1 YEAST	essential	F39H11.3	WBGene00002078	x
Y08L_YEAST	non-	Y56A3A.29	WBGene00011303	
YAB9 YEAST	essential	C16C10.2	WBGene00010845	
YAD2_YEAST	essential	F58H1.3	WBGene00004806	x
YAD6 YEAST	essential	Y38F2A 5743.	WBGene00012126	~
YAD6_YEAST	essential	130F2A_3743.	WBGene00012120 WBGene00012126	
YAE2_YEAST	essential	F55H2.2	WBGene00012120 WBGene00010725	
YAE6 YEAST		C17H12.14	WBGene00013671	
YAH3_YEAST	essential	ZK970.4	WBGene00013671 WBGene00017683	
_	non-	F46F11.5		
YAK1_YEAST	essential		WBGene00003149	
YB78_YEAST	non-	T01H3.1	WBGene00018909	
YB85_YEAST	essential	T08G11.1	WBGene00020207	
YBA4_YEAST	non-	ZK930.1	WBGene00017558	
YBD6_YEAST	essential	ZK930.7	WBGene00017286	
YBF5_YEAST	non-	C05D11.2	WBGene00000795	
YBF7_YEAST	essential	T20D3.7	WBGene00016062	
YBN5_YEAST	non-	C07G1.5	WBGene00012344	
YBS0_YEAST	essential	Y87G2A.s	WBGene00019725	
YBV8_YEAST	non-	B0025.1	WBGene00004110	
YBY3_YEAST	essential	F59G1.3	WBGene00016408	
YCE5_YEAST	essential	C44C1.1	WBGene00019209	
YCF9_YEAST	non-	C44C1.4	WBGene00015461	x
YCT4_YEAST	essential	Y34D9A_152.a	WBGene00019806	
YCT7_YEAST	non-	C05D9.1	WBGene00016166	
YCU1_YEAST	essential	Y39A1A.5	WBGene00009376	
YCU9_YEAST	essential	T01G1.3	WBGene00013122	
YCW2_YEAST	non-	ZK742.1	WBGene00021074	x
YD13_YEAST	essential	R166.3	WBGene00011275	x
YD23_YEAST	non-	M03C11.8	WBGene00014017	
YD61_YEAST	essential	T27F2.1	WBGene00020296	
YD66_YEAST	non-	Y47D3A.gg	WBGene00016400	
YD83_YEAST	essential	T28D6.6	WBGene00015482	
YDAK_YEAST	non-	K09E9.2	WBGene00017301	
YDB6_YEAST	essential	Y105E8C.j	WBGene00008458	
YEC0_YEAST	essential	F21H12.1	WBGene00007143	
YEJ4_YEAST	non-	T04C10.1	WBGene00016353	
YEJ6_YEAST	essential	F56A3.2	WBGene00003821	х
YEM6_YEAST	non-	T04B8.5	WBGene00012097	
YEM6_YEAST	essential	F18C5.3	WBGene00012097	
YEO1_YEAST	essential	F09E5.8	WBGene00020821	
YEQ8_YEAST	non-	CD4.2	WBGene00020088	
YER2_YEAST	essential	C24G6.8	WBGene00009211	x
YET7_YEAST	non-	W08E3.3	WBGene00003803	x
YEV6_YEAST	essential	M02B7.4	WBGene00012351	
YEX0_YEAST	non-	C37A2.2	WBGene00009172	
YEY6_YEAST	essential	C34E10.5	WBGene00007787	
YEZ3_YEAST	essential	H17B01.4	WBGene00017724	
YFD0_YEAST	non-	C05C8.2	WBGene00011767	
YFH5_YEAST	essential	R01B10.4	WBGene00017280	x
11110_10101	essencial	ROIDIO.1	MDGCIIC0001/200	~
YFH6_YEAST	non-	C27F2.4	WBGene00019673	л

YFI8         YEAT         essential         Y52BIA.2         WBGene00010476         x           Y012         YEAST         non-         W0786.2         WBGene00021757         x           Y01D         YEAST         non-         ZK632.10         WBGene00021757         x           Y01D         YEAST         non-         CX64.4         WBGene00021757         x           Y022         YEAST         non-         CS404.4         WBGene00017534         x           Y024         YEAST         non-         B0334.3         WBGene00017534         x           Y024         YEAST         non-         K0334.3         WBGene00017534         x           Y034         YEAST         non-         K0334.3         WBGene00017534         x           Y034         YEAST         non-         K0344.1         WBGene00017534         x           Y034         YEAST         non-         T2645.5         WBGene00017534         x           Y034         YEAST         non-         F265.7         WBGene00017622         x           Y055         YEAST         essential         F1063.3         WBGene00017334         x           Y054         YEAST         essential <t< th=""><th></th><th></th><th></th><th></th><th></th></t<>					
YG1D_YEAST         non-         W07E6.2         WBGene00021757           YG1D_YEAST         non-         ZK632.10         WBGene00021757           YG1W_YEAST         non-         ZK632.10         WBGene00021757           YG1W_YEAST         non-         CX632.10         WBGene00021757           YG2W_YEAST         non-         CX632.10         WBGene00017534           YG2W_YEAST         non-         F02H1.6         WBGene00017534           YG2W_YEAST         non-         F02H1.6         WBGene00017534           YG2W_YEAST         non-         F02H1.6         WBGene00015366         x           YG3Y_YEAST         non-         T77B9.7         WBGene00016568         x           YG3Y_YEAST         non-         T72B9.7         WBGene00017676         x           YG5V_YEAST         essential         R16A5.5         WBGene00013191         x           YG5V_YEAST         essential         R106S.3         WBGene00013191         x           YG5V_YEAST         essential         F106S.3         WBGene00011467         x           YG4W_YEAST         essential         R104S.3         WBGene00011193         x           YG5V_YEAST         non-         F26F2.7         WBGene00011633	YFI8_YEAST	essential	F34D10.6	WBGene00010418	
YG1D_YEAST         non-         W07E6.2         WBGene00021757           YG1D_YEAST         non-         ZK632.10         WBGene00021757           YG1W_YEAST         non-         ZK632.10         WBGene00021757           YG1W_YEAST         non-         CX632.10         WBGene00021757           YG2W_YEAST         non-         CX632.10         WBGene00017534           YG2W_YEAST         non-         F02H1.6         WBGene00017534           YG2W_YEAST         non-         F02H1.6         WBGene00017534           YG2W_YEAST         non-         F02H1.6         WBGene00015366         x           YG3Y_YEAST         non-         T77B9.7         WBGene00016568         x           YG3Y_YEAST         non-         T72B9.7         WBGene00017676         x           YG5V_YEAST         essential         R16A5.5         WBGene00013191         x           YG5V_YEAST         essential         R106S.3         WBGene00013191         x           YG5V_YEAST         essential         F106S.3         WBGene00011467         x           YG4W_YEAST         essential         R104S.3         WBGene00011193         x           YG5V_YEAST         non-         F26F2.7         WBGene00011633	YG12 YEAST	essential	Y52B11A.2	WBGene00013676	x
YG1U_YEAST         eesential         R53.6         WBGene00022126           YG1W_YEAST         essential         T07A9.8         WBGene00022126           YG2Z_YEAST         essential         T07A9.8         WBGene00022126           YG2Z_YEAST         essential         T07A9.8         WBGene000127534           YG2Z_YEAST         essential         CS4D4.4         WBGene00017534           YG2M_YEAST         essential         CS4D4.4         WBGene00017534           YG2M_YEAST         essential         CS4D4.1         WBGene00017536         x           YG3Y_YEAST         essential         T76A2A.1         WBGene00017622         x           YG5Y_YEAST         essential         T26A5.5         WBGene00012676         x           YG5O_YEAST         essential         T26A5.1         WBGene00012376         x           YG5U_YEAST         essential         W09C5.1         WBGene00012367         x           YG5U_YEAST         essential         W09C5.1         WBGene0001133         y           YG6U_YEAST         essential         Y007.1         WBGene0001133         y           YG6U_YEAST         essential         Y1007.1         WBGene00011342         x           YG6U_YEAST         essential <td></td> <td>non-</td> <td>W07E6.2</td> <td>WBGene00021757</td> <td></td>		non-	W07E6.2	WBGene00021757	
YG1W_YEAST         non-         ZK32.10         WBGene00022126           YG1W_YEAST         non-         C34D4.4         WBGene0002126           YG2Z_YEAST         non-         C4D4.4         WBGene00017534           YG2M_YEAST         essential         C05D11.3         WBGene00017534           YG2M_YEAST         essential         E02H1.6         WBGene00017534           YG2M_YEAST         non-         K0314.3         WBGene00017534           YG3Y_YEAST         non-         K01C8.9         WBGene00017534           YG3Y_YEAST         essential         C3F10.3         WBGene00012576         x           YG5D_YEAST         essential         R1265.5         WBGene00012867         x           YG5D_YEAST         essential         R1065.3         WBGene00013191         x           YG5U_YEAST         essential         K0810.8         WBGene00012367         x           YG5U_YEAST         non-         F26F2.7         WBGene0001133         x           YG6Z_YEAST         non-         F26F2.7         WBGene00011538         x           YG6Z_YEAST         non-         F277.7         WBGene00012346         x           YG6Z_YEAST         non-         H2742.1         WBGene00012366	_				
YG10_YEAST         essential         TOTA9.8         WBGene00022126           YG22_YEAST         essential         CG5D11.3         WBGene00019770           YG2M_YEAST         essential         CG5D11.3         WBGene00017534           YG2M_YEAST         essential         CG5D11.3         WBGene00017534           YG2M_YEAST         essential         CG5D11.3         WBGene00017534           YG2M_YEAST         essential         YG4X.1         WBGene00017546         x           YG3Y_YEAST         essential         Y76A2A.1         WBGene00012676         x           YG5S_YEAST         essential         T2FS.7         WBGene00012676         x           YG5C_YEAST         essential         F1068.3         WBGene0002957         x           YG4S_YEAST         essential         F1068.3         WBGene00012361         x           YG4S_YEAST         essential         F1077.7         WBGene00012676         x           YG4S_YEAST         essential         K12C11.1         WBGene00012677         x           YG4S_YEAST         essential         K12C11.1         WBGene00012676         x           YG4S_YEAST         essential         K12C11.1         WBGene00012676         x           YG4S_YEAST <td>_</td> <td></td> <td></td> <td></td> <td></td>	_				
YQ22_YEAST         non- essential         COSD11.3         WBGene00017534           YQ2M_YEAST         non- F09F7.4         WBGene00017534           YQ2M_YEAST         non- F09F7.4         WBGene00017534           YQ2M_YEAST         non- F09F7.4         WBGene00017534           YQ2M_YEAST         essential         COSD11.3         WBGene00017534           YQ3M_YEAST         essential         COSTAL         WBGene00015346           YQ3Y_YEAST         non- KOIC8.9         WBGene00015366         x           YQ5F_YEAST         essential         TA765.7         WBGene00012676         x           YQ5D_YEAST         essential         R16A5.5         WBGene00021676         x           YQ5D_YEAST         essential         F1068.3         WBGene00021467         x           YG4A_YEAST         non-         F26F2.7         WBGene00021467         x           YG62_YEAST         non-         F26F7.7         WBGene0001133         Y           YG2J_YEAST         essential         T14D7.1         WBGene00012344           YG4_YEAST         non-         F277.7         WBGene00012366         x           YG4J_YEAST         essential         Y105D_165.d         WBGene00012366         x           YG	_				
YG25_YEAST         essential         COSDI1.3         WBGene00017534           YG2M_YEAST         essential         E02H1.6         WBGene00017534           YG2M_YEAST         essential         E02H1.6         WBGene00017534           YG3J_YEAST         essential         E02H1.6         WBGene00017534           YG3J_YEAST         non-         K01C8.9         WBGene00012676         x           YG4W_YEAST         essential         T26A5.5         WBGene00012676         x           YG5O_YEAST         non-         F72B2.7         WBGene00012676         x           YG5O_YEAST         essential         T26A5.5         WBGene00012762         x           YG5U_YEAST         essential         W00C5.1         WBGene00002787         x           YG4W_YEAST         essential         W00C5.1         WBGene0001133         x           YG6W_YEAST         non-         F22F7.7         WBGene00011538         x           YG3J_YEAST         essential         Y105E8C.d         WBGene0001158         x           YG4W_YEAST         essential         Y105E8C.d         WBGene00011424         x           YG4W_YEAST         essential         Y105E8C.d         WBGene00011424         x           YG4W_YEAS	—				
YQ2M_YEAST         non-         F09F7.4         WBGene00017534           YQ2D_YEAST         non-         B0334.3         WBGene00016534           YQ3D_YEAST         non-         B0334.3         WBGene00016536           YQ3T_YEAST         essential         C33F10.3         WBGene00016536           YQ3T_YEAST         essential         Y762A.1         WBGene00017612           YQ5D_YEAST         essential         R168.5         WBGene0001762           YQ5D_YEAST         essential         R108.3         WBGene0002187           YG5U_YEAST         essential         F1068.3         WBGene0001133           YG64_YEAST         non-         F26F2.7         WBGene00011933           YG67_YEAST         essential         K108H10.8         WBGene0001133           YG63_YEAST         non-         F26F2.7         WBGene0001133         X           YG64_YEAST         non-         F26F7.7         WBGene0001133         X           YG20_YEAST         non-         F277.7         WBGene00021264         X           YG41_YEAST         essential         Y1057165.d         WBGene00021264         X           YG41_YEAST         essential         Y105726.d         WBGene00021266         X <td< td=""><td>—</td><td></td><td></td><td></td><td></td></td<>	—				
YG20_YEAST         essential         E02H1.6         WEGene00017534           YG20_YEAST         essential         C33F10.3         WEGene00017584           YG3J_YEAST         essential         C33F10.3         WEGene00017586           YG3Y_YEAST         essential         C76A2A.1         WEGene00016586           YG5Y_YEAST         essential         T76A2A.1         WEGene00012676           YG5Y_YEAST         essential         R119.2         WEGene00013191           YG5Y_YEAST         essential         R1068.3         WEGene00013367           YG5Y_YEAST         essential         W09C5.1         WEGene00012676           YG6A_YEAST         essential         K08H10.8         WEGene0001331           YG6A_YEAST         essential         K08H10.8         WEGene0001331           YG7A_YEAST         essential         K08H10.8         WEGene0001331           YG6A_YEAST         essential         K02C1.1         WEGene0001331           YG7A_YEAST         essential         K02C1.1         WEGene0001331           YG7A_YEAST         essential         YC2C1.1         WEGene0001331           YG7A_YEAST         essential         YC2C1.1         WEGene00016807           YG1_YEAST         essential         YC0D	YG25_YEAST	essential	C05D11.3	WBGene00019770	
YG20_YEAST         non-         B0334.3         WBGene00016588         X           YG3Y_YEAST         non-         K01C8.9         WBGene000165346         x           YG4W_YEAST         non-         T77E9.7         WBGene0001676         x           YG5K_YEAST         non-         T77E9.7         WBGene00012676         x           YG5C_YEAST         essential         T265.5         WBGene00013191         y           YG5C_YEAST         non-         F28D1.1         WBGene00002957         x           YG5C_YEAST         non-         F26F2.7         WBGene000133         y           YG4A_YEAST         non-         F22F7.7         WBGene00012361         x           YG3O_YEAST         non-         F22F7.7         WBGene00012361         x           YG4J_YEAST         essential         T14D7.1         WBGene00012361         x           YG3J_YEAST         non-         H27A22.1         WBGene00011242         x           YG4J_YEAST         essential         Y105D7_165.6         WBGene0001142         x           YG4L_YEAST         essential         Y71F9B_275.6         WBGene0001848         x           YG4L_YEAST         essential         Y71F9B_277.6         WBGene00001847	YG2M_YEAST	non-	F09F7.4	WBGene00017534	
YG3J_YEAST         essential         C33F10.3         WBGene00017989         x           YG3Y_YEAST         non-         K01C8.9         WBGene00015346         x           YG4W_YEAST         essential         T7F527.7         WBGene00016762         x           YG5F_YEAST         essential         R119.2         WBGene00013191         y           YG5U_YEAST         essential         R119.2         WBGene00013191         x           YG5U_YEAST         essential         W09C5.1         WBGene00002957         x           YG4A_YEAST         essential         K08H10.8         WBGene0001333         x           YG6Z_YEAST         non-         F22F7.7         WBGene00012361         x           YG3U_YEAST         essential         Y105D7.165.0         WBGene00012361         x           YG3U_YEAST         non-         H27A22.1         WBGene0001142         x           YG44_YEAST         essential         Y105D7.165.0         WBGene0001142         x           YG44_YEAST         essential         Y10F9.270.4         WBGene00017928         x           YHA2_YEAST         essential         Y11F9B_275.0         WBGene00017928         x           YG44_YEAST         essential         Y11F9B_275.0 <td>YG2M_YEAST</td> <td>essential</td> <td>E02H1.6</td> <td>WBGene00017534</td> <td></td>	YG2M_YEAST	essential	E02H1.6	WBGene00017534	
YG3Y_TEAST         non-         KD1C8.9         WBGene00015346         x           YG4W_YEAST         non-         T77E9.7         WBGene00012676         x           YG50_YEAST         essential         T27E9.7         WBGene00012676         x           YG50_YEAST         essential         T27E9.7         WBGene00013191         x           YG50_YEAST         essential         F10G8.3         WBGene00002957         x           YG4X_YEAST         essential         V09C5.1         WBGene00001788         x           YG4X_YEAST         essential         K08H10.8         WBGene00012167         x           YG48_YEAST         essential         T14D7.1         WBGene00012361         x           YG3Y_YEAST         essential         Y1071.1         WBGene00012361         x           YG3Y_YEAST         essential         Y1071.65.b         WBGene0001388         x           YG41_YEAST         essential         Y107D_165.b         WBGene0001142         x           YG44_YEAST         essential         Y107B_275.b         WBGene000012874         x           YH42_YEAST         essential         Y71F9B_275.b         WBGene000012862         x           YH42_YEAST         essential         Y71F9B_275.	YG20 YEAST	non-	в0334.3	WBGene00016588	
YG3Y_TEAST         non-         KD1C8.9         WBGene00015346         x           YG4W_YEAST         non-         T77E9.7         WBGene00012676         x           YG50_YEAST         essential         T27E9.7         WBGene00012676         x           YG50_YEAST         essential         T27E9.7         WBGene00013191         x           YG50_YEAST         essential         F10G8.3         WBGene00002957         x           YG4X_YEAST         essential         V09C5.1         WBGene00001788         x           YG4X_YEAST         essential         K08H10.8         WBGene00012167         x           YG48_YEAST         essential         T14D7.1         WBGene00012361         x           YG3Y_YEAST         essential         Y1071.1         WBGene00012361         x           YG3Y_YEAST         essential         Y1071.65.b         WBGene0001388         x           YG41_YEAST         essential         Y107D_165.b         WBGene0001142         x           YG44_YEAST         essential         Y107B_275.b         WBGene000012874         x           YH42_YEAST         essential         Y71F9B_275.b         WBGene000012862         x           YH42_YEAST         essential         Y71F9B_275.	YG3J YEAST	essential	C33F10.3	WBGene00017989	x
YG4M_TEAST         essential         Y76A2A.1         WBGene0001015         x           YG5F_YEAST         essential         T27E9.7         WBGene00017622           YG5C_YEAST         essential         R119.2         WBGene00013191           YG5U_YEAST         essential         F10G8.3         WBGene00013191           YG5U_YEAST         essential         F10G8.3         WBGene0001333           YGA4_YEAST         essential         W09C5.1         WBGene0001133           YG6Z_YEAST         essential         K08H10.8         WBGene0001133           YG6Z_YEAST         essential         YL2F7.7         WBGene0001138         x           YG6Z_YEAST         non-         F26F2.7         WBGene0001138         x           YG6Z_YEAST         essential         YL2C1.1         WBGene00012361         x           YG4L_YEAST         essential         Y10D7_165.b         WBGene0001134         x           YG4L_YEAST         essential         Y1F95_275.b         WBGene00011728         x           YG4L_YEAST         essential         Y1F95_275.b         WBGene0001728         x           YG4L_YEAST         essential         Y1F95_275.b         WBGene0001728         x           YH0_YEAST         essenti	_				
YG5E_YEAST         non-         T27E9.7         WBGene00012676         x           YG5D_YEAST         essential         T26A5.5         WBGene00013191           YG5O_YEAST         essential         T126A5.5         WBGene00013191           YG5U_YEAST         essential         F10G8.3         WBGene00002762           YG5Y_YEAST         essential         W09C5.1         WBGene0000133           YGAA_YEAST         essential         K08H10.8         WBGene0001133           YGE7_YEAST         essential         T14D7.1         WBGene00012361           YG39_YEAST         non-         F22F7.7         WBGene00012361           YG2_YEAST         non-         H27A22.1         WBGene00012364           YG2_YEAST         essential         Y105D7_165.4         WBGene00011142         x           YG4U_YEAST         essential         Y105D7_165.4         WBGene0001142         x           YG4U_YEAST         essential         Y11F9B_275.4         WBGene00004109         y           YH43_YEAST         non-         E04D5.1         WBGene00018474         y           YH42_YEAST         non-         E04D5.1         WBGene00018474         y           YH43_YEAST         non-         C24D5.2         WBGene000018	_				
YGSF_VEAST         essential         TZ6A5.5         WBGene00013191           YGSO_VEAST         non-         F28D1.1         WBGene00013191           YGSU_YEAST         essential         F10G8.3         WBGene00002457         x           YGSV_YEAST         essential         W09C5.1         WBGene0000133         x           YGA4_YEAST         essential         K08H10.8         WBGene00012361         x           YGRY_YEAST         essential         T14D7.1         WBGene00012361         x           YGG2_YEAST         non-         F72F7.7         WBGene00012361         x           YGG1_YEAST         essential         T14D7.1         WBGene00012361         x           YGG2_YEAST         non-         F72F7.7         WBGene000133         x           YGG2_YEAST         non-         H07252.1         WBGene00022868         x           YGG1_YEAST         essential         Y1507_165.4         WBGene00017928         x           YGS4_YEAST         essential         Y1507_165.4         WBGene0001848         x           YHA2_YEAST         essential         Y179P_275.5         WBGene00004189         x           YHA2_YEAST         essential         F77A9.3         WBGene00001862         x	_				
YG50_YEAST         essential         R119.2         WBGene00013191           YG5U_YEAST         non-         F28D1.1         WBGene0002357         x           YG5U_YEAST         essential         W09C5.1         WBGene00021467         x           YG8U_YEAST         essential         K08H10.8         WBGene0001033         y           YG7_YEAST         essential         T14D7.1         WBGene0001033         y           YG7_YEAST         essential         T14D7.1         WBGene00012361         x           YG02_YEAST         essential         Y105E8C.d         WBGene000120868         x           YGR1_YEAST         essential         Y105D7_165.b         WBGene000010907         x           YGM1_YEAST         essential         Y105D7_165.b         WBGene000010928         x           YHA_YEAST         essential         Y71F9E_275.b         WBGene000010907         x           YHA2_YEAST         essential         Y71F9E_277.d         WBGene0000108148         x           YHA2_YEAST         essential         Y71F9E_275.b         WBGene000018148         x           YHA2_YEAST         non-         E04D5.1         WBGene000018662         x           YHN0_YEAST         non-         C42C1.10         <	_				x
YGSO_YEAST         non-         F28D1.1         WBGene00013191         x           YGSY_YEAST         essential         F10G8.3         WBGene00002957         x           YGSY_YEAST         non-         F26F2.7         WBGene0000133         x           YGRY_YEAST         essential         K08H10.8         WBGene0001133         x           YGSY_YEAST         essential         T14D7.1         WBGene0001193         x           YGG2_YEAST         non-         F20F7.7         WBGene00011538         x           YGG1_YEAST         essential         T14D7.1         WBGene00012048         x           YGG1_YEAST         essential         Y105E8C.4         WBGene00021294         x           YGR1_YEAST         essential         Y50D7_165.b         WBGene000017928         x           YH04_YEAST         essential         Y71F9B_297.d         WBGene00008148         x           YHA2_YEAST         essential         Y71F9B_297.d         WBGene000018263         x           YHN0_YEAST         non-         C42C1.10         WBGene00008263         x           YHN0_YEAST         non-         Y32BGE.a         WBGene000018357         x           YHN6_YEAST         essential         T24H1.1 <td< td=""><td>_</td><td></td><td></td><td></td><td></td></td<>	_				
YGSU_YEAST         essential         F10G8.3         WBGene0002957         x           YGSY_YEAST         essential         W09CS.1         WBGene00021467           YGA4_YEAST         non-         F26F2.7         WBGene00013361           YGG8_YEAST         essential         K08H10.8         WBGene00013361           YGG9_YEAST         non-         F22F7.7         WBGene00012361           YGG2_YEAST         non-         F20F7.7         WBGene00012361           YGG2_YEAST         non-         F20F7.7         WBGene0001361           YGG2_YEAST         non-         F20F7.7         WBGene0001361           YGC2_YEAST         non-         F20F7.7         WBGene0001361           YGC2_YEAST         non-         H27A22.1         WBGene00012361           YGC2_YEAST         essential         Y10D_T65.0         WBGene00001428           YGM1_YEAST         essential         Y1F9E_275.0         WBGene00001907           YH42_YEAST         essential         Y1F9E_275.0         WBGene00018474           YHH1_YEAST         essential         Y1F9E_275.0         WBGene00018474           YHH2_YEAST         non-         F17A9.2         WBGene00018474           YHH1_YEAST         essential         Y1F7A9.2 <td>YG50_YEAST</td> <td>essential</td> <td>R119.2</td> <td>WBGene00013191</td> <td></td>	YG50_YEAST	essential	R119.2	WBGene00013191	
YGSY_VEAST         essential         W065.1         WBGene00001478         x           YGA4_VEAST         non-         F26F2.7         WBGene00001033         y           YGRS_VEAST         essential         T14D7.1         WBGene0001033         y           YGS9_VEAST         non-         F22F7.7         WBGene0001033         x           YGG9_VEAST         non-         F909D1.1         WBGene0001507         x           YGG1_VEAST         essential         K12C11.1         WBGene00012294         x           YGR1_VEAST         essential         Y50D7.165.b         WBGene000021294         x           YGW1_VEAST         essential         Y50D7.165.b         WBGene000017928         x           YH44_VEAST         essential         Y71F9B_275.b         WBGene00008148         x           YH45_YEAST         ono-         F17A9.3         WBGene00008263         x           YHN0_YEAST         non-         F17A9.3         WBGene000018367         x           YHN0_YEAST         non-         Y39B61.a         WBGene000018367         x           YHN0_YEAST         non-         Y39B62.a         WBGene00002719         x           YHK1_YEAST         non-         Y39G10A_246.WBGene00002719         <	YG50_YEAST	non-	F28D1.1	WBGene00013191	
YGA4_YEAST         non-         F26F2.7         WBGene00021467           YGB8_YEAST         essential         K08H10.8         WBGene0001133           YGG7_YEAST         non-         F72F7.7         WBGene00012361           YGG9_YEAST         non-         F09D1.1         WBGene00012361           YGL1_YEAST         essential         K12C11.1         WBGene00012364           YGC2_YEAST         non-         H27A22.1         WBGene00017928           YGS4_YEAST         essential         Y50D7_165.b         WBGene00011142           YGW1_YEAST         essential         Y50D7_165.d         WBGene00004109           YHA2_YEAST         essential         Y11F9B_275.d         WBGene00004109           YHB3_YEAST         non-         E04D5.1         WBGene00004109           YHB3_YEAST         non-         F17A9.2         WBGene00001744           YHME_YEAST         non-         C22F5.2         WBGene000012362           YHN0_YEAST         essential         F17A9.3         WBGene00012362           YHN0_YEAST         essential         F24F7.1         WBGene00012362           YHN0_YEAST         essential         T24H7.1         WBGene00012362           YHN0_YEAST         essential         T24H7.1         <	YG5U_YEAST	essential	F10G8.3	WBGene00002957	x
YGB8_YEAST         essential         K08H10.8         WBGene0001033           YGE7_YEAST         non-         F22F7.7         WBGene00012361           YGJ9_YEAST         essential         T14D7.1         WBGene00012361           YGJ9_YEAST         essential         K12C11.1         WBGene00012363         x           YGC2_YEAST         non-         H27A22.1         WBGene0001294         x           YGR1_YEAST         essential         Y50D7_165.6         WBGene00017928         x           YH4_YEAST         essential         Y5D7_165.6         WBGene00008148         x           YH4_YEAST         essential         Y1F9B_277.6         WBGene00008148         x           YHA2_YEAST         essential         Y1F9B_277.6         WBGene00008184         x           YHA2_YEAST         essential         M17F9A.2         WBGene0000818474         x           YHN_YEAST         non-         F17A9.3         WBGene00018263         x           YHN0_YEAST         non-         C2F5.2         WBGene00018263         x           YHN6_YEAST         non-         Y39B6B.a         WBGene00018357         x           YH%2YEAST         non-         Y39G10A_246.         WBGene00012765           YHA_YEAST	YG5Y_YEAST	essential	W09C5.1	WBGene00004788	x
YGB8_YEAST         essential         K08H10.8         WBGene0001033           YGE7_YEAST         non-         F22F7.7         WBGene00012361           YGJ9_YEAST         essential         T14D7.1         WBGene00012361           YGJ9_YEAST         essential         K12C11.1         WBGene00012363         x           YGC2_YEAST         non-         H27A22.1         WBGene0001294         x           YGR1_YEAST         essential         Y50D7_165.6         WBGene00017928         x           YH4_YEAST         essential         Y5D7_165.6         WBGene00008148         x           YH4_YEAST         essential         Y1F9B_277.6         WBGene00008148         x           YHA2_YEAST         essential         Y1F9B_277.6         WBGene00008184         x           YHA2_YEAST         essential         M17F9A.2         WBGene0000818474         x           YHN_YEAST         non-         F17A9.3         WBGene00018263         x           YHN0_YEAST         non-         C2F5.2         WBGene00018263         x           YHN6_YEAST         non-         Y39B6B.a         WBGene00018357         x           YH%2YEAST         non-         Y39G10A_246.         WBGene00012765           YHA_YEAST	YGA4 YEAST	non-	F26F2.7	WBGene00021467	
YGE7_YEAST         non-         F22F7.7         WBGene0001193           YGG8_YEAST         essential         T14D7.1         WBGene00012361           YGY9_YEAST         non-         F09D1.1         WBGene0001593         x           YGQ1_YEAST         non-         H27A22.1         WBGene00021294           YGR1_YEAST         essential         Y10D7_165.b         WBGene00011422         x           YGR1_YEAST         essential         Y50D7_165.cd         WBGene0001142         x           YMG4_YEAST         essential         Y10F9E275.cb         WBGene00008148           YHA2_YEAST         essential         Y1F9B_297.cd         WBGene000018474           YHH1_YEAST         essential         W17F9B_297.cd         WBGene000018474           YHH2_YEAST         essential         P17A9.2         WBGene000018474           YHH1_YEAST         essential         F32E10.1         WBGene000018357           YHN0_YEAST         non-         C22F5.2         WBGene00018357           YHW8_YEAST         non-         Y39B6B.a         WBGene00018357           YHW8_YEAST         non-         Y39G10A_246.         WBGene00012366           YHYE_YEAST         essential         Y54E2A.6         WBGene00012366	_				
YGG8_YEAST         essential         T14D7.1         WBGene00012361           YGJ9_YEAST         non-         F09D1.1         WBGene00016907         x           YGL1_YEAST         essential         K12C11.1         WBGene00021294         x           YGQ_YEAST         essential         Y105E8C.d         WBGene0001142         x           YGM_YEAST         essential         Y50D7_165.d         WBGene0001142         x           YGM_YEAST         essential         Y10F9E_275.b         WBGene00001142         x           YGM_YEAST         essential         Y1F9E_275.b         WBGene00008148         x           YHA2_YEAST         essential         Y1F9E_297.d         WBGene00008474         x           YHA1_YEAST         essential         F17A9.2         WBGene00008183         x           YHN0_YEAST         non-         C42C1.10         WBGene0000728         x           YHN0_YEAST         non-         Y39B6B.a         WBGene0000728         x           YHR_YEAST         non-         Y39B6B.a         WBGene00017818         x           YHRYEAST         non-         Y39B6B.a         WBGene00022717         x           YHRYEAST         non-         Y39G10A_246.         WBGene0012756	_				
YGJ9_YEAST         non-         F09D1.1         WBGene00016907         x           YGL1YEAST         essential         Kl2C11.1         WBGene0001538         x           YGQ2YEAST         non-         H27A22.1         WBGene00012344         x           YGR1YEAST         essential         Y50D7_165.b         WBGene00017928         x           YHG4YEAST         essential         Y50D7_165.d         WBGene000017928         x           YH04YEAST         essential         Y1F9B_275.b         WBGene000017928         x           YH04YEAST         essential         Y1F9B_277.d         WBGene000017928         x           YH42YEAST         essential         Y1F9B_277.d         WBGene000081847         x           YHH1YEAST         non-         E04D5.1         WBGene00008263         x           YHN0_YEAST         non-         C42C1.10         WBGene00012362         x           YHN0_YEAST         non-         C22F5.2         WBGene00012362         x           YHR2YEAST         non-         Y39B68.a         WBGene00012357         x           YHW8_YEAST         non-         Y54E2A.6         WBGene00012756         x           YHYEAYEAST         non-         Y39G10A_246.         WBGene000					
YGL1_YEAST         essential         K12C11.1         WBGene00011538         x           YGQ2_YEAST         non-         H27A22.1         WBGene00021294         Y           YGR1_YEAST         essential         Y105E8C.d         WBGene00011142         x           YGM1_YEAST         essential         Y50D7_165.b         WBGene000117928         Y           YH04_YEAST         essential         Y71F9B_275.b         WBGene00004109         YHB3_YEAST           YHA2_YEAST         essential         Y71F9B_297.d         WBGene00009007           YH4_YEAST         essential         Y17F9B_297.d         WBGene000081474           YHH1_YEAST         non-         F17A9.2         WBGene00008263           YHN0_YEAST         essential         F17A9.3         WBGene00012362           YHN2_YEAST         non-         C02F5.2         WBGene00012856           YHK2_YEAST         non-         Y39B6B.a         WBGene00002710           YHW8_YEAST         non-         Y39B6B.a         WBGene00002719           YHK4_YEAST         non-         Y39G10A_246.         WBGene00012756           YHYB_YEAST         non-         Y39G10A_246.         WBGene00012766           YHYE_YEAST         non-         Y39G10A_246.         WBGe	—				
YGO2_YEAST         non-         H27A22.1         WBGene00020868         x           YGR1_YEAST         essential         Y105E8C.d         WBGene00021294           YGS4_YEAST         essential         Y50D7_165.d         WBGene0001142         x           YGM1_YEAST         essential         Y71F9B_275.b         WBGene00008148           YHA2_YEAST         essential         Y71F9B_297.d         WBGene00008148           YHA2_YEAST         non-         E04D5.1         WBGene000081474           YHH1_YEAST         non-         F17A9.3         WBGene00008263           YHN0_YEAST         non-         C42C1.10         WBGene00008263           YHN0_YEAST         non-         C42C1.10         WBGene00008263           YHN0_YEAST         non-         C02F5.2         WBGene00018357           YHW3_YEAST         non-         Y39B6B.a         WBGene0001805           YHYEXST         essential         C16C10.1         WBGene00022719           YHX4_YEAST         non-         Y39B6B.a         WBGene00022719           YHX4_YEAST         non-         Y39B10A_246.         WBGene00022719           YHX4_YEAST         non-         Y39G10A_246.         WBGene00012756           YIG4_YEAST         essential	_	non-			х
YGR1_YEAST       essential       Y105E8C.d       WBGene00021294         YG84_YEAST       essential       Y50D7_165.b       WBGene0001142       x         YGW1_YEAST       essential       Y50D7_165.d       WBGene00008148         YH04_YEAST       essential       Y71F9B_275.b       WBGene00008148         YHA2_YEAST       essential       Y71F9B_297.d       WBGene00008148         YHA2_YEAST       essential       Y71F9B_297.d       WBGene00008623         YHH1_YEAST       essential       F17A9.3       WBGene00008263         YHN0_YEAST       non-       C42C1.10       WBGene00012362         YHP9_YEAST       non-       C42C1.10       WBGene00012362         YHN2_YEAST       essential       F32E10.1       WBGene00012362         YHN4_YEAST       non-       C02F5.2       WBGene00012362         YHN4_YEAST       non-       Y39B6B.a       WBGene00012710         YHY8_YEAST       non-       Y54E2A.6       WBGene00018855         YIG4_YEAST       essential       C54H2.5       WBGene00022719         YIE4_YEAST       non-       Y39G10A_246.       WBGene00012756         YIJ7_YEAST       non-       Y39G10A_246.       WBGene00016245         YIA_YEAST       n	YGL1_YEAST	essential	K12C11.1	WBGene00011538	х
YGR1_YEAST       essential       Y105E8C.d       WBGene00021294         YG84_YEAST       essential       Y50D7_165.b       WBGene0001142       x         YGW1_YEAST       essential       Y50D7_165.d       WBGene00008148         YH04_YEAST       essential       Y71F9B_275.b       WBGene00008148         YHA2_YEAST       essential       Y71F9B_297.d       WBGene00008148         YHA2_YEAST       essential       Y71F9B_297.d       WBGene00008623         YHH1_YEAST       essential       F17A9.3       WBGene00008263         YHN0_YEAST       non-       C42C1.10       WBGene00012362         YHP9_YEAST       non-       C42C1.10       WBGene00012362         YHN2_YEAST       essential       F32E10.1       WBGene00012362         YHN4_YEAST       non-       C02F5.2       WBGene00012362         YHN4_YEAST       non-       Y39B6B.a       WBGene00012710         YHY8_YEAST       non-       Y54E2A.6       WBGene00018855         YIG4_YEAST       essential       C54H2.5       WBGene00022719         YIE4_YEAST       non-       Y39G10A_246.       WBGene00012756         YIJ7_YEAST       non-       Y39G10A_246.       WBGene00016245         YIA_YEAST       n	YGO2_YEAST	non-	H27A22.1	WBGene00020868	x
YGS4_YEAST         essential         Y50D7_165.b         WBGene00011142         x           YGM1_YEAST         essential         Y50D7_165.d         WBGene00017928           YH04_YEAST         essential         Y71F9B_275.b         WBGene00008148           YHA2_YEAST         essential         Y71F9B_297.d         WBGene0000807           YHB3_YEAST         non-         E04D5.1         WBGene00018474           YH1_YEAST         onn-         F17A9.2         WBGene00008263           YH10_YEAST         non-         C42C1.10         WBGene00012362           YHN0_YEAST         non-         C02F5.2         WBGene00018263           YHR1_YEAST         non-         C02F5.2         WBGene00018357           YHR4_YEAST         non-         Y54E2A.6         WBGene0001805           YHY4_YEAST         non-         Y39B6B.a         WBGene00007510           YHY4_YEAST         non-         Y39G10A_246.         WBGene00022719           YIE4_YEAST         non-         Y39G10A_246.         WBGene00012366           YIJ2_YEAST         essential         C54H2.5         WBGene00012756           YIJ4_YEAST         non-         Y39G10A_246.         WBGene00012366           YIJ2_YEAST         non-         Y39G10	_	essential	Y105E8C.d	WBGene00021294	
YGW1_YEAST       essential       Y50D7_165.d       WBGene00017928         YH04_YEAST       essential       Y71F9B_275.b       WBGene00008148         YHA2_YEAST       essential       Y71F9B_297.d       WBGene0000907         YHG4_YEAST       non-       E04D5.1       WBGene00008662         YH10_YEAST       non-       F17A9.2       WBGene00008662         YHN0_YEAST       non-       C42C1.10       WBGene00008263         YHN0_YEAST       non-       C02F5.2       WBGene00012362         YHN4_YEAST       non-       C02F5.2       WBGene0001837         YHW4_YEAST       non-       Y54E2A.6       WBGene00018357         YHN4_YEAST       non-       Y54E2A.7       WBGene000022719         YIE4_YEAST       non-       Y3986B.a       WBGene00012750         YHY6_YEAST       essential       C16C10.1       WBGene00022719         YIE4_YEAST       non-       Y39810A_246.       WBGene00012756         YIJ7_YEAST       non-       Y39910A_246.       WBGene00012756         YIL3_YEAST       non-       Y0910.3       WBGene0001256         YIL4_YEAST       non-       Y0666.1       WBGene00016245         YIL3_YEAST       non-       Y0666.1       WBGene00016		essential	Y50D7 165.b	WBGene00011142	x
YH04_YEAST       essential       Y71F9B_275.b       WBGene00008148         YHA2_YEAST       essential       Y71F9B_297.d       WBGene00009007         YHB3_YEAST       non-       E04D5.1       WBGene000081474         YHH1_YEAST       essential       M04F3.4       WBGene00008263         YHN0_YEAST       essential       F17A9.3       WBGene00008263         YHN0_YEAST       essential       F22E10.1       WBGene00012362         YHP_YEAST       non-       C02F5.2       WBGene0001805         YHK2_YEAST       non-       Y39B6B.a       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene0000818         YHE2_YEAST       essential       C16C10.1       WBGene000022719         YH44_YEAST       non-       Y54E2A.6       WBGene00012756         YHG4_YEAST       non-       Y39G10A_246.       WBGene00012756         YIL3_YEAST       non-       Y39G10A_246.       WBGene00012365         YIL4_YEAST       non-       K08D10.2       WBGene00012365         YIL3_YEAST       non-       K08D10.2       WBGene00012365         YIL4_YEAST       non-       Y09D10.3       WBGene00012365         YIL4_YEAST       non-       Y09D10.3	_		—		
YHA2_YEAST       essential       Y71F9B_297.d       WBGene00004109         YHB3_YEAST       non-       E04D5.1       WBGene0000807         YHG4_YEAST       essential       M04F3.4       WBGene00008662         YHN0_YEAST       essential       F17A9.2       WBGene00008263         YHN0_YEAST       non-       C42C1.10       WBGene00002262         YHN0_YEAST       non-       C02F5.2       WBGene00012362         YHN1_YEAST       essential       T24H7.1       WBGene0001805         YHY6_YEAST       non-       Y54E2A.6       WBGene0000751         YHY8_YEAST       non-       Y54E2A.6       WBGene000022719         YH12_YEAST       essential       Y54E2A.7       WBGene000022719         YI13_YEAST       non-       Y3930A_246.       WBGene00012366         YIJ4_YEAST       essential       C54H2.5       WBGene00012756         YIJ3_YEAST       non-       Y3930A_246.       WBGene00012366         YIK4_YEAST       non-       K08D10.2       WBGene00012365         YIK4_YEAST       non-       K08D10.2       WBGene00012365         YIK4_YEAST       non-       Y05C1A.73       WBGene00016255         YIK4_YEAST       non-       Y06E66.1       WBGene0	—		—		
YHB3_YEAST       non-       E04D5.1       WBGene00009007         YHB4_YEAST       essential       M04F3.4       WBGene00018474         YHH1_YEAST       non-       F17A9.2       WBGene0000662         YHN0_YEAST       essential       F17A9.3       WBGene00008263         YHN0_YEAST       non-       C42C1.10       WBGene00012362         YHN4_YEAST       essential       F32E10.1       WBGene00018357         YHR4_YEAST       non-       C02F5.2       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene00018055         YHY4_YEAST       essential       C16C10.1       WBGene00002719         YHE4_YEAST       non-       Y39B610A_246.       WBGene00002719         YH24_YEAST       non-       F33A8.1       WBGene00012766         YH3_YEAST       non-       Y39G10A_246.       WBGene00012766         YHX4_YEAST       non-       W39G00.2       WBGene00012766         YHX4_YEAST       non-       K08D10.2       WBGene00012766         YHX4_YEAST       non-       K08D10.2       WBGene00012766         YHX4_YEAST       non-       Y29C1A.7a       WBGene00016245	_		—		
YHG4_YEAST       essential       M04F3.4       WBGene00018474         YHH1_YEAST       non-       F17A9.2       WBGene00008662         YHN0_YEAST       essential       F17A9.3       WBGene00008263         YHN0_YEAST       non-       C42C1.10       WBGene00012362         YHN0_YEAST       essential       F32E10.1       WBGene000108263         YHN4_YEAST       essential       T24H7.1       WBGene00010805         YHY8_YEAST       non-       Y39B6B.a       WBGene00007510         YHY8_YEAST       non-       Y54E2A.6       WBGene00002719         YIE4_YEAST       essential       C54H2.5       WBGene0000565         YIG4_YEAST       non-       F3388.1       WBGene000022171         YIL3_YEAST       non-       Y39G10A_246.       WBGene00012756         YIT3_YEAST       non-       K08D10.2       WBGene00012756         YIL3_YEAST       non-       K09D10.3       WBGene00012655         YIL4_YEAST       non-       Y25C1A.7a       WBGene00016245         YIL4_YEAST       non-       Y25C1A.7a       WBGene00016245         YIL4_YEAST       non-       Y25C1A.7a       WBGene00016245         YJ14_YEAST       non-       F29C4.6       WBGene00016245<	_		—		
YHH1_YEAST       non-       F17A9.2       WBGene00005662         YHI0_YEAST       essential       F17A9.3       WBGene00008263         YHN0_YEAST       non-       C42C1.10       WBGene00012362         YHN6_YEAST       essential       F32E10.1       WBGene00012362         YHP9_YEAST       non-       C02F5.2       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene00007028       x         YHY6_YEAST       essential       C16C10.1       WBGene00007510         YHY8_YEAST       non-       Y54E2A.6       WBGene000022719         YIE4_YEAST       essential       C54H2.5       WBGene00012756         YIJ_YIJ_YEAST       essential       C54H2.5       WBGene00012756         YIJJ_YEAST       non-       Y39G10A_246.       WBGene00012756         YIJJ_YEAST       non-       W09D10.3       WBGene00012756         YIL4_YEAST       non-       W09D10.3       WBGene00016245         YIL4_YEAST       non-       Y25C1A.7a       WBGene00016245         YJ14_YEAST       essential       C47F12.3       WBGene00016245         YJ42_YEAST       non-       F29C4.6       WBGene00016171         YJ72_YEAST       essential       C47E12.3 </td <td>_</td> <td></td> <td></td> <td></td> <td></td>	_				
YHI0_YEAST       essential       F17A9.3       WBGene00004189       x         YHN0_YEAST       non-       C42C1.10       WBGene00012362         YHP9_YEAST       non-       C02F5.2       WBGene00012362         YHR1_YEAST       essential       T24H7.1       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene0001805         YHY6_YEAST       essential       C16C10.1       WBGene00007510         YHY8_YEAST       non-       Y54E2A.6       WBGene000022719         YIE4_YEAST       essential       C16C10.1       WBGene0000565         YIG4_YEAST       essential       C54H2.5       WBGene00017919         YII3_YEAST       non-       Y39G10A_246.       WBGene00012756         YIK3_YEAST       non-       Y39G10A_246.       WBGene00012756         YIL1_YEAST       essential       R10D12.12       WBGene00012655         YIL0_YEAST       essential       C53H9.2       WBGene00016255         YIL3_YEAST       non-       Y09D10.3       WBGene00016245         YIL3_YEAST       essential       C27F7.3       WBGene00016245         YIL4_YEAST       non-       Y25C1A.7a       WBGene00016244         YJ40_YEAST       essential	—	essential		WBGene00018474	
YHN0_YEAST       non-       C42C1.10       WBGene00008263         YHN6_YEAST       essential       F32E10.1       WBGene00007028       x         YHR1_YEAST       essential       T24H7.1       WBGene00018357       x         YHR1_YEAST       essential       T24H7.1       WBGene0001805       x         YHW8_YEAST       non-       Y39B6B.a       WBGene0001805       x         YHY6_YEAST       essential       C16C10.1       WBGene00007510       x         YHY8_YEAST       non-       Y54E2A.6       WBGene000022719       y         YIE4_YEAST       essential       C54H2.5       WBGene00017919       y         YII3_YEAST       non-       Y39G10A_246.       WBGene00012756         YIJ7_YEAST       essential       C54H2.5       WBGene00012366         YIL4_YEAST       non-       K08D10.2       WBGene00012366         YIL4_YEAST       non-       W09D10.3       WBGene00012655         YIL0_YEAST       essential       C53H9.2       WBGene00016245         YIL4_YEAST       non-       Y25C1A.7a       WBGene00016245         YJ42_YEAST       non-       Y25C1A.7a       WBGene00016245         YJ42_YEAST       non-       F29C4.6       WBGene0	YHH1_YEAST	non-	F17A9.2	WBGene00005662	
YHNG_YEAST       essential       F32E10.1       WBGene00012362         YHP9_YEAST       non-       C02F5.2       WBGene00018357         YHR1_YEAST       essential       T24H7.1       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene00018357         YHY6_YEAST       essential       C16C10.1       WBGene00007510         YHY8_YEAST       non-       Y54E2A.6       WBGene00022719         YIE4_YEAST       essential       C54H2.5       WBGene00012716         YIJ1_YEAST       essential       C54H2.5       WBGene00012756         YIJ1_YEAST       non-       Y39G10A_246.       WBGene00012766         YIJ1_YEAST       non-       K08D10.2       WBGene00012366         YIK3_YEAST       essential       R10D12.12       WBGene00012365         YIL0_YEAST       essential       C53H9.2       WBGene00016245         YIL1_YEAST       non-       Y25C1A.7a       WBGene00016245         YIJ4_YEAST       non-       Y25C1A.7a       WBGene00016244         YJ40_YEAST       essential       C47E12.3       WBGene00016171         YJ72_YEAST       non-       C34G6.7	YHI0_YEAST	essential	F17A9.3	WBGene00004189	х
YHP9_YEAST       non-       C02F5.2       WBGene00007028       x         YHR1_YEAST       essential       T24H7.1       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene0001805         YHY6_YEAST       essential       C16C10.1       WBGene00007510         YHY8_YEAST       non-       Y54E2A.6       WBGene00022719         YIE2_YEAST       essential       Y54E2A.7       WBGene00022719         YIE4_YEAST       non-       F33A8.1       WBGene00022719         YII3_YEAST       essential       C54H2.5       WBGene00022711         YIJ1_YEAST       essential       C54H2.5       WBGene00022716         YIJ7_YEAST       non-       Y39G10A_246.       WBGene00012756         YIJ7_YEAST       non-       K08D10.2       WBGene00012366         YIX4_YEAST       non-       K08D10.3       WBGene00012455         YIL0_YEAST       essential       C53H9.2       WBGene00016245         YIL3_YEAST       essential       T27F7.3       WBGene00016245         YJ14_YEAST       non-       Y25C1A.7a       WBGene00016244         YJ40_YEAST       essential       C47E12.3       WBGene00016171         YJ72_YEAST       essential       C47E12	YHN0_YEAST	non-	C42C1.10	WBGene00008263	
YHP9_YEAST       non-       C02F5.2       WBGene00007028       x         YHR1_YEAST       essential       T24H7.1       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene0001805         YHY6_YEAST       essential       C16C10.1       WBGene00007510         YHY8_YEAST       non-       Y54E2A.6       WBGene00022719         YIE4_YEAST       essential       Y54E2A.7       WBGene00022719         YIE4_YEAST       essential       C54H2.5       WBGene00022711         YIJ1_YEAST       essential       C54H2.5       WBGene00022717         YIJ1_YEAST       essential       C54H2.5       WBGene00022717         YIJ1_YEAST       essential       C54H2.5       WBGene00012756         YIJ7_YEAST       non-       Y39G10A_246.       WBGene00012756         YIJ1_YEAST       essential       R10D12.12       WBGene00012366         YIX5_YEAST       essential       C53H9.2       WBGene00016255         YIL0_YEAST       essential       C53H9.2       WBGene00016255         YIL1_YEAST       non-       T06E6.1       WBGene00016244         YJ40_YEAST       essential       C47E12.3       WBGene00016171         YJ72_YEAST       essential	YHN6 YEAST	essential	F32E10.1	WBGene00012362	
YHR1_YEAST       essential       T24H7.1       WBGene00018357         YHW8_YEAST       non-       Y39B6B.a       WBGene00010805         YHY6_YEAST       essential       C16C10.1       WBGene00007510         YHY8_YEAST       non-       Y54E2A.6       WBGene000022719         YIE2_YEAST       essential       Y54E2A.7       WBGene000022719         YIE4_YEAST       non-       F33A8.1       WBGene000022171         YII3_YEAST       non-       Y39G10A_246.       WBGene00012756         YIJ7_YEAST       essential       C54H2.5       WBGene00012756         YIJ7_YEAST       non-       K08D10.2       WBGene00012366         YIK4_YEAST       non-       K08D10.3       WBGene00012366         YIX3_YEAST       non-       W09D10.3       WBGene0001655         YIL0_YEAST       essential       C53H9.2       WBGene00016245         YIL1_YEAST       non-       Y25C1A.7a       WBGene00016244         YJ4_YEAST       non-       Y25C1A.7a       WBGene0001661       x         YJ54_YEAST       essential       R08D7.1       WBGene00012193       x         YJ72_YEAST       non-       C34G6.7       WBGene00012193       x         YJ74_YEAST       esse	_				v
YHW8_YEAST       non-       Y39B6B.a       WBGene00010805         YHY6_YEAST       essential       C16C10.1       WBGene00007510         YHY8_YEAST       non-       Y54E2A.6       WBGene00008918         YIE2_YEAST       essential       Y54E2A.7       WBGene00022719         YIE4_YEAST       non-       F33A8.1       WBGene00017919         YII3_YEAST       essential       C54H2.5       WBGene00012376         YIJ1_YEAST       non-       Y39G10A_246.       WBGene00012366         YIJ7_YEAST       non-       K08D10.2       WBGene00012366         YIK3_YEAST       essential       R10D12.12       WBGene00012366         YIK4_YEAST       non-       W09D10.3       WBGene0001655         YIL0_YEAST       essential       C53H9.2       WBGene00016245         YI14_YEAST       non-       Y25C1A.7a       WBGene00016244         YJ4_YEAST       non-       Y25C1A.7a       WBGene00016244         YJ4_YEAST       essential       C47E12.3       WBGene00016171         YJ72_YEAST       non-       C34G6.7       WBGene00003571         YJ80_YEAST       essential       F21D5.2       WBGene00003478         YJ89_YEAST       essential       W03B1.4       WBG	_				
YHY6_YEAST       essential       C16C10.1       WBGene00007510         YHY8_YEAST       non-       Y54E2A.6       WBGene00022719         YIE2_YEAST       essential       Y54E2A.7       WBGene00002655         YIE4_YEAST       non-       F33A8.1       WBGene00017919         YII3_YEAST       essential       C54H2.5       WBGene00012756         YIJ1_YEAST       essential       R10D12.12       WBGene00012366         YIK4_YEAST       non-       K08D10.2       WBGene00012366         YIK4_YEAST       non-       K08D10.2       WBGene00012366         YIK4_YEAST       non-       K08D10.3       WBGene00012366         YIK4_YEAST       non-       W09D10.3       WBGene00012655         YIL0_YEAST       essential       C53H9.2       WBGene00016245         YIX1_YEAST       non-       Y25C1A.7a       WBGene00016245         YJ14_YEAST       non-       Y25C1A.7a       WBGene00016244         YJ40_YEAST       essential       C47E12.3       WBGene00016171         YJ72_YEAST       non-       F20C4.6       WBGene00016171         YJ74_YEAST       non-       F20C4.6       WBGene00003571         YJ80_YEAST       essential       F21D5.2       WBGene000	_				
YHY8_YEASTnon-Y54E2A.6WBGene00008918YIE2_YEASTessentialY54E2A.7WBGene00022719YIE4_YEASTnon-F33A8.1WBGene0000565YIG4_YEASTessentialC54H2.5WBGene00017919YI13_YEASTnon-Y39G10A_246.WBGene00012756YIJ7_YEASTessentialbWBGene00012756YIJ7_YEASTessentialR10D12.12WBGene00012366YIK3_YEASTessentialR10D12.12WBGene00016266YIK4_YEASTnon-W09D10.3WBGene0001655YIL0_YEASTessentialT27F7.3WBGene00016245YJ42_YEASTnon-Y25C1A.7aWBGene00016245YJ42_YEASTessentialR08D7.1WBGene00016244YJ42_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTessentialF21D5.2WBGene00012193YJ76_YEASTessentialF21D5.2WBGene00003571YJ80_YEASTnon-F45E12.1WBGene00003478YJ99_YEASTessentialC53A5.2WBGene00011148YJ99_YEASTnon-W09D10.4WBGene0001590YJ68_YEASTnon-W09D10.4WBGene0001590YJ68_YEASTnon-F42G8.6WBGene00013018YJ1_YEASTessentialC47D12.1WBGene00013018	_				
YIE2_YEASTessentialY54E2A.7WBGene00022719YIE4_YEASTnon-F33A8.1WBGene0000565YIG4_YEASTessentialC54H2.5WBGene00017919YII3_YEASTnon-Y39G10A_246.WBGene00022171YIJ1_YEASTessentialbWBGene00012756YIJ7_YEASTnon-K08D10.2WBGene00012366YIK3_YEASTessentialR10D12.12WBGene0001655YIL0_YEASTessentialC53H9.2WBGene00016450YIL3_YEASTessentialT27F7.3WBGene00016244YJ40_YEASTessentialR08D7.1WBGene00016244YJ40_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTnon-C34G6.7WBGene00003571YJ80_YEASTessentialF21D5.2WBGene00003571YJ80_YEASTessentialC53A5.2WBGene00004682YJ99_YEASTessentialC53A5.2WBGene0001590YJ92_YEASTnon-T20H4.3WBGene0001590YJ64_YEASTnon-K09D10.4WBGene0001590YJ64_YEASTnon-F42G8.6WBGene00013018YJ91_YEASTessentialC47D12.1WBGene00013018	_				
YIE4_YEASTnon-F33A8.1WBGene00000565YIG4_YEASTessentialC54H2.5WBGene00017919YII3_YEASTnon-Y39G10A_246.WBGene00022171YIJ1_YEASTessentialbWBGene00012756YIJ7_YEASTnon-K08D10.2WBGene00012366YIK3_YEASTessentialR10D12.12WBGene00007576YIK4_YEASTnon-W09D10.3WBGene0001655YIL0_YEASTessentialC53H9.2WBGene00016450YIL3_YEASTnon-T06E6.1WBGene00016245YJ14_YEASTnon-Y25C1A.7aWBGene00016245YJ42_YEASTessentialC47F12.3WBGene00016244YJ40_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTessentialC47E12.1WBGene00012193YJ76_YEASTessentialF21D5.2WBGene00003571YJ80_YEASTnon-T20H4.3WBGene00004319YJ95_YEASTessentialC53A5.2WBGene0001590YJ92_YEASTessentialC47D12.1WBGene0001590YJ62_YEASTnon-F42G8.6WBGene00013018YJ91_YEASTessentialC47D12.1WBGene00013018	YHY8_YEAST	non-		WBGene00008918	
YIG4_YEASTessentialC54H2.5WBGene00017919YI13_YEASTnon-Y39G10A_246.WBGene00022171YIJ1_YEASTessentialbWBGene00012756YIJ7_YEASTnon-K08D10.2WBGene00012366YIK3_YEASTessentialR10D12.12WBGene00007576YIK4_YEASTnon-W09D10.3WBGene0001655YIL0_YEASTessentialC53H9.2WBGene00016450YIL3_YEASTnon-T06E6.1WBGene00016245YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialC47F12.3WBGene0001661XXXJ54_YEASTessentialC47E12.3YJ54_YEASTessentialC47E12.1WBGene0003571YJ80_YEASTessentialF2D5.2WBGene00004319YJ95_YEASTessentialC53A5.2WBGene00014319YJ99_YEASTessentialC53A5.2WBGene0001590YJ62_YEASTnon-T2OH4.3WBGene0001590YJ62_YEASTessentialC47D12.1WBGene0001590YJ62_YEASTnon-F42G8.6WBGene00013018YJ91_YEASTessentialC47D12.1WBGene00013018	YIE2_YEAST	essential	Y54E2A.7	WBGene00022719	
YII3_YEASTnon-Y39G10A_246.WBGene00022171YIJ1_YEASTessentialbWBGene00012756YIJ7_YEASTnon-K08D10.2WBGene00012366YIK3_YEASTessentialR10D12.12WBGene00007576YIK4_YEASTnon-W09D10.3WBGene00012655YIL0_YEASTessentialC53H9.2WBGene00016450YIL3_YEASTnon-T06E6.1WBGene00016245YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialR08D7.1WBGene00016244YJ42_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTessentialC47E12.1WBGene00016171YJ76_YEASTessentialF2D5.2WBGene00003571YJ80_YEASTnon-T20H4.3WBGene00004319YJ95_YEASTessentialC53A5.2WBGene0001590YJ62_YEASTnon-T20H4.3WBGene0001590YJ62_YEASTnon-K09D10.4WBGene0001590YJ62_YEASTessentialC47D12.1WBGene00013018YJ91_YEASTessentialC47D2.4WBGene00013018	YIE4_YEAST	non-	F33A8.1	WBGene00000565	
YII3_YEASTnon-Y39G10A_246.WBGene00022171YIJ1_YEASTessentialbWBGene00012756YIJ7_YEASTnon-K08D10.2WBGene00012366YIK3_YEASTessentialR10D12.12WBGene00007576YIK4_YEASTnon-W09D10.3WBGene00012655YIL0_YEASTessentialC53H9.2WBGene00016450YIL3_YEASTnon-T06E6.1WBGene00016245YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialR08D7.1WBGene00016244YJ42_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTessentialC47E12.1WBGene00016171YJ76_YEASTessentialF2D5.2WBGene00003571YJ80_YEASTnon-T20H4.3WBGene00004319YJ95_YEASTessentialC53A5.2WBGene0001590YJ62_YEASTnon-T20H4.3WBGene0001590YJ62_YEASTnon-K09D10.4WBGene0001590YJ62_YEASTessentialC47D12.1WBGene00013018YJ91_YEASTessentialC47D2.4WBGene00013018	YIG4 YEAST	essential	C54H2.5	WBGene00017919	
YIJ1_YEASTessentialbWBGene00012756YIJ7_YEASTnon-K08D10.2WBGene00012366YIK3_YEASTessentialR10D12.12WBGene00007576YIK4_YEASTnon-W09D10.3WBGene00012655YIL0_YEASTessentialC53H9.2WBGene00016203YIS5_YEASTessentialT27F7.3WBGene00016245YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialR08D7.1WBGene00016244YJ42_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTessentialC47E12.1WBGene00016171YJ76_YEASTessentialF2D5.2WBGene00003571YJ80_YEASTnon-T20H4.3WBGene00004319YJ99_YEASTessentialC53A5.2WBGene0001590YJ62_YEASTnon-T20H4.3WBGene0001590YJ62_YEASTnon-F42G8.6WBGene00013018YJ91_YEASTessentialC47D12.1WBGene00013018					
YIJ7_YEASTnon-K08D10.2WBGene00012366YIK3_YEASTessentialR10D12.12WBGene00007576YIK4_YEASTnon-W09D10.3WBGene00010450YIL0_YEASTessentialC53H9.2WBGene00006923YIS5_YEASTessentialT27F7.3WBGene00016245YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialR08D7.1WBGene00016244YJ42_YEASTnon-F29C4.6WBGene0001661XXX354_YEASTessentialC47E12.3YJ75_YEASTessentialF21D5.2WBGene00012193YJ76_YEASTessentialF21D5.2WBGene00003571YJ80_YEASTessentialC53A5.2WBGene00004319YJ95_YEASTnon-T20H4.3WBGene0001590YJ92_YEASTessentialC47D12.1WBGene00001590YJ62_YEASTessentialC47D12.1WBGene00013018YJ91_YEASTessentialC47D2.4WBGene00013018	—				
YIK3_YEASTessentialR10D12.12WBGene00007576YIK4_YEASTnon-W09D10.3WBGene00021655YIL0_YEASTessentialC53H9.2WBGene00006923YIS5_YEASTnon-T06E6.1WBGene00016245YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialR08D7.1WBGene00016244YJ42_YEASTnon-F29C4.6WBGene00016171YJ72_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTessentialF21D5.2WBGene0003571YJ80_YEASTessentialF21D5.2WBGene00003478YJ95_YEASTnon-T20H4.3WBGene0004319YJ92_YEASTnon-R08D1.4WBGene0001590YJ92_YEASTessentialC53A5.2WBGene0001590YJ62_YEASTessentialC47D12.1WBGene00003971YJ62_YEASTnon-F42G8.6WBGene00013018YJ91_YEASTessentialC47D12.1WBGene0001590	_				
YIK4_YEAST       non-       W09D10.3       WBGene00021655         YIL0_YEAST       essential       C53H9.2       WBGene00010450         YIL3_YEAST       non-       T06E6.1       WBGene00016245         YJ14_YEAST       essential       T27F7.3       WBGene00016244         YJ40_YEAST       essential       R08D7.1       WBGene00016244         YJ42_YEAST       non-       Y25C1A.7a       WBGene00016244         YJ42_YEAST       essential       R08D7.1       WBGene0001661       x         YJ54_YEAST       essential       C47E12.3       WBGene0001671       x         YJ76_YEAST       essential       F21D5.2       WBGene0003571       x         YJ80_YEAST       non-       F45E12.1       WBGene00003478       x         YJ95_YEAST       non-       T20H4.3       WBGene00004319       x         YJ92_YEAST       essential       C53A5.2       WBGene0001590       x         YJ62_YEAST       non-       W09D10.4       WBGene00001590       x         YJG2_YEAST       essential       C47D12.1       WBGene00013018       x         YJ94_YEAST       essential       C47D12.1       WBGene00013018       x	_				
YIL0_YEASTessentialC53H9.2WBGene00010450YIL3_YEASTnon-T06E6.1WBGene00006923xYIS5_YEASTessentialT27F7.3WBGene00016245YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialR08D7.1WBGene0001661YJ54_YEASTnon-F29C4.6WBGene00016171YJ72_YEASTessentialC47E12.3WBGene00012193YJ76_YEASTessentialF21D5.2WBGene0003571YJ80_YEASTnon-F45E12.1WBGene00004319YJ95_YEASTnon-T20H4.3WBGene00014682YJ99_YEASTessentialC53A5.2WBGene0001590YJ62_YEASTnon-F42G8.6WBGene00013018YJ91_YEASTessentialC47D12.1WBGene00013018	—				
YIL3_YEAST       non-       T06E6.1       WBGene00006923       x         YIS5_YEAST       essential       T27F7.3       WBGene00016245         YJ14_YEAST       non-       Y25C1A.7a       WBGene00016244         YJ40_YEAST       essential       R08D7.1       WBGene00016244         YJ42_YEAST       non-       F29C4.6       WBGene0001661       x         YJ54_YEAST       essential       C47E12.3       WBGene00012193       x         YJ76_YEAST       essential       F21D5.2       WBGene0003571       x         YJ80_YEAST       non-       F45E12.1       WBGene00003478       x         YJ95_YEAST       non-       T20H4.3       WBGene00004319       x         YJ95_YEAST       non-       T20H4.3       WBGene00001590       x         YJ62_YEAST       non-       W09D10.4       WBGene00001590       x         YJ62_YEAST       essential       C47D12.1       WBGene00001590       x         YJ62_YEAST       non-       F42G8.6       WBGene00013018       x         YJ91_YEAST       essential       C47D12.1       WBGene00013018       x					
YIS5_YEASTessentialT27F7.3WBGene00016245YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialR08D7.1WBGene00007555YJ42_YEASTnon-F29C4.6WBGene0001661YJ54_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTnon-C34G6.7WBGene00003571YJ80_YEASTessentialF21D5.2WBGene00003478YJ95_YEASTessentialW03B1.4WBGene00004319YJ95_YEASTessentialC53A5.2WBGene0001148YJ62_YEASTessentialC47D12.1WBGene0000590YJ62_YEASTnon-F42G8.6WBGene00013018YJ11_YEASTessentialM01E5.2WBGene00022447	YILO_YEAST	essential		WBGene00010450	
YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialR08D7.1WBGene00007555YJ42_YEASTnon-F29C4.6WBGene00001661YJ54_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTnon-C34G6.7WBGene00003571YJ80_YEASTessentialF21D5.2WBGene00003478YJ95_YEASTessentialW03B1.4WBGene00004319YJ95_YEASTessentialC53A5.2WBGene0001148YJ62_YEASTessentialC47D12.1WBGene00001590YJ62_YEASTnon-F42G8.6WBGene00013018YJ11_YEASTessentialM01E5.2WBGene00022447	YIL3_YEAST	non-	T06E6.1	WBGene00006923	х
YJ14_YEASTnon-Y25C1A.7aWBGene00016244YJ40_YEASTessentialR08D7.1WBGene00007555YJ42_YEASTnon-F29C4.6WBGene00001661YJ54_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTnon-C34G6.7WBGene00003571YJ80_YEASTessentialF21D5.2WBGene00003478YJ95_YEASTessentialW03B1.4WBGene00004319YJ95_YEASTessentialC53A5.2WBGene0001148YJ62_YEASTessentialC47D12.1WBGene00001590YJ62_YEASTnon-F42G8.6WBGene00013018YJ11_YEASTessentialM01E5.2WBGene00022447		essential	T27F7.3	WBGene00016245	
YJ40_YEASTessentialR08D7.1WBGene00007555YJ42_YEASTnon-F29C4.6WBGene00001661xYJ54_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTnon-C34G6.7WBGene00003571YJ76_YEASTessentialF21D5.2WBGene00003478YJ80_YEASTnon-F45E12.1WBGene00004319YJ95_YEASTessentialC53A5.2WBGene00004682YJ99_YEASTessentialC53A5.2WBGene00011148YJ62_YEASTnon-W09D10.4WBGene0000590YJ62_YEASTnon-F42G8.6WBGene00013018YJ11_YEASTessentialM01E5.2WBGene00022447					
YJ42_YEASTnon-F29C4.6WBGene00001661xYJ54_YEASTessentialC47E12.3WBGene00016171YJ72_YEASTnon-C34G6.7WBGene00003571YJ76_YEASTessentialF21D5.2WBGene00003478YJ80_YEASTnon-F45E12.1WBGene00004319YJ95_YEASTessentialC53A5.2WBGene00004682YJ92_YEASTessentialC47D12.1WBGene00001590YJ62_YEASTnon-F42G8.6WBGene00013018YJ91_YEASTessentialC47D12.2WBGene00013018					
YJ54_YEAST       essential       C47E12.3       WBGene00016171         YJ72_YEAST       non-       C34G6.7       WBGene00012193         YJ76_YEAST       essential       F21D5.2       WBGene00003571         YJ80_YEAST       non-       F45E12.1       WBGene00003478         YJ95_YEAST       essential       W03B1.4       WBGene00004319         YJ95_YEAST       non-       T20H4.3       WBGene00004682         YJ99_YEAST       essential       C53A5.2       WBGene00011148         YJ62_YEAST       non-       W09D10.4       WBGene00001590         YJG2_YEAST       essential       C47D12.1       WBGene00003018         YJJ1_YEAST       essential       M01E5.2       WBGene00022447	_				v
YJ72_YEAST       non-       C34G6.7       WBGene00012193         YJ76_YEAST       essential       F21D5.2       WBGene00003571         YJ80_YEAST       non-       F45E12.1       WBGene00003478         YJ89_YEAST       essential       W03B1.4       WBGene00004319         YJ95_YEAST       non-       T20H4.3       WBGene00004682         YJ99_YEAST       essential       C53A5.2       WBGene00011148         YJE6_YEAST       non-       W09D10.4       WBGene00001590         YJG2_YEAST       essential       C47D12.1       WBGene00003018         YJJ1_YEAST       essential       M01E5.2       WBGene00022447	_				x
YJ76_YEAST       essential       F21D5.2       WBGene00003571         YJ80_YEAST       non-       F45E12.1       WBGene00003478         YJ89_YEAST       essential       W03B1.4       WBGene00004319         YJ95_YEAST       non-       T20H4.3       WBGene00004682         YJ99_YEAST       essential       C53A5.2       WBGene00011148         YJ66_YEAST       non-       W09D10.4       WBGene00001590         YJG2_YEAST       essential       C47D12.1       WBGene00009204         YJ68_YEAST       non-       F42G8.6       WBGene00013018         YJJ1_YEAST       essential       M01E5.2       WBGene00022447	_				
YJ80_YEAST         non-         F45E12.1         WBGene00003478           YJ89_YEAST         essential         W03B1.4         WBGene00004319           YJ95_YEAST         non-         T20H4.3         WBGene00004682           YJ99_YEAST         essential         C53A5.2         WBGene000011148           YJE6_YEAST         non-         W09D10.4         WBGene00001590           YJG2_YEAST         essential         C47D12.1         WBGene00009204           YJG8_YEAST         non-         F42G8.6         WBGene00013018           YJJ1_YEAST         essential         M01E5.2         WBGene00022447					
YJ89_YEAST         essential         W03B1.4         WBGene00004319           YJ95_YEAST         non-         T20H4.3         WBGene00004682           YJ99_YEAST         essential         C53A5.2         WBGene000011148           YJE6_YEAST         non-         W09D10.4         WBGene00001590           YJG2_YEAST         essential         C47D12.1         WBGene00009204           YJG8_YEAST         non-         F42G8.6         WBGene00013018           YJJ1_YEAST         essential         M01E5.2         WBGene00022447	_	essential		WBGene00003571	
YJ95_YEAST         non-         T20H4.3         WBGene00004682           YJ99_YEAST         essential         C53A5.2         WBGene00011148           YJE6_YEAST         non-         W09D10.4         WBGene00001590           YJG2_YEAST         essential         C47D12.1         WBGene00009204           YJG8_YEAST         non-         F42G8.6         WBGene00013018           YJJ1_YEAST         essential         M01E5.2         WBGene00022447		non-	F45E12.1	WBGene00003478	
YJ95_YEAST         non-         T20H4.3         WBGene00004682           YJ99_YEAST         essential         C53A5.2         WBGene00011148           YJE6_YEAST         non-         W09D10.4         WBGene00001590           YJG2_YEAST         essential         C47D12.1         WBGene00009204           YJG8_YEAST         non-         F42G8.6         WBGene00013018           YJJ1_YEAST         essential         M01E5.2         WBGene00022447	YJ89_YEAST	essential	W03B1.4	WBGene00004319	
YJ99_YEAST         essential         C53A5.2         WBGene00011148           YJE6_YEAST         non-         W09D10.4         WBGene00001590           YJG2_YEAST         essential         C47D12.1         WBGene00009204           YJG8_YEAST         non-         F42G8.6         WBGene00013018           YJJ1_YEAST         essential         M01E5.2         WBGene00022447					
YJE6_YEAST         non-         W09D10.4         WBGene00001590           YJG2_YEAST         essential         C47D12.1         WBGene00009204           YJG8_YEAST         non-         F42G8.6         WBGene00013018           YJJ1_YEAST         essential         M01E5.2         WBGene00022447					
YJG2_YEASTessentialC47D12.1WBGene00009204YJG8_YEASTnon-F42G8.6WBGene00013018YJJ1_YEASTessentialM01E5.2WBGene00022447					
YJG8_YEASTnon-F42G8.6WBGene00013018YJJ1_YEASTessentialM01E5.2WBGene00022447	_				
YJJ1_YEAST essential M01E5.2 WBGene00022447	_				
YJJ1_YEAST   essential   C10C5.6   WBGene00022447					
<u>_</u>	YJJ1_YEAST	essential	C10C5.6	WBGene00022447	

YJJ1_YEAST	non-	F17C11.7	WBGene00022447	
YJJ7_YEAST	essential	ZK370.5	WBGene00020517	
YJK0_YEAST	essential	Y17G7B.15	WBGene00008346	
YJK9_YEAST	essential	F29B9.1	WBGene00022739	x
YJK9_YEAST	essential	Y71H2_388.b	WBGene00022739	x
YJU1_YEAST	non-	Y41C4A.9	WBGene00012203	
YJX8_YEAST	essential	W09G3.2	WBGene00016500	
YJY3_YEAST	non-	C14B1.5	WBGene00007189	
YJZ4_YEAST	essential	Y48A5A.1	WBGene00013870	
YK10_YEAST	non-	K01A11.2	WBGene00011555	
YK18_YEAST	essential	F08B1.1	WBGene00022166	
YK31_YEAST	essential	C30B5.4	WBGene00009574	
YK50_YEAST	essential	C30B5.2	WBGene00019255	
YK59_YEAST	essential	C14A4.1	WBGene00001983	
YKA2_YEAST	essential	C34E10.2	WBGene00012903	
YKA9_YEAST	essential	C27F2.7	WBGene00017347	
YKE1_YEAST	non-	W02A11.2	WBGene00020866	
YKE1_YEAST	essential	C07A9.4	WBGene00020866	
YKF4_YEAST	non-	F53A2.8	WBGene00001081	
YKF9_YEAST	essential	ZK593.4	WBGene00009477	x
YKI2_YEAST	non-	C34E11.1	WBGene00022765	x
YKJ5_YEAST	essential	R08D7.4	WBGene00018149	
YKL7_YEAST	essential	C45G3.3	WBGene00022599	
YKP1_YEAST	essential	F28C6.4	WBGene00011298	
YKQ0_YEAST	essential	Y48G10B.b	WBGene00013219	
YKQ5_YEAST	non-	Y110A2A_54.a	WBGene00021840	
YKO5 YEAST	essential	Y110A2A 1898	WBGene00021840	
YKT6_YEAST	non-	.d	WBGene00015164	
YKV5_YEAST	essential	Y110A2A_1898	WBGene00021429	
	non-	.e –	WBGene00021377	
YL05_YEAST	essential	T15B7.2	WBGene00016674	
YL09_YEAST	non-	C56A3.8	WBGene00012887	x
YL16_YEAST	essential	ZK430.1	WBGene00016323	x
yl22_yeast	non-	T12C9.2	WBGene00021063	
yl27_yeast	essential	W02B12.8	WBGene00012666	x
yl34_yeast	non-	C37C3.8	WBGene00003119	
	essential	B0491.1	WBGene00003585	
YL53_YEAST	non-	ZC373.5	WBGene00008410	
YL86_YEAST	essential	T07A5.2	WBGene00010565	
YM62_YEAST	essential	Y71H2_385.b	WBGene00016311	
YM8L_YEAST	essential	F40E10.6	WBGene00012803	
YM8T_YEAST	non-	K02B2.2	WBGene00018270	x
YMB4_YEAST	essential	E04A4.4	WBGene00016448	
YMD6_YEAST	non-	Y46G5.m	WBGene00020994	
YME1_YEAST	essential	F10E7.5	WBGene00010842	
YME9_YEAST	non-	T27F7.1	WBGene00019323	x
YMI0_YEAST	essential	F59A6.7	WBGene00009452	
YMJ3_YEAST	non-	F47A4.2	WBGene00017855	
YMJ3_YEAST	essential	F36F2.3	WBGene00017855	x
YMJ6_YEAST	essential	ZK546.14	WBGene00010889	
YMN1_YEAST	essential	F37C12.14	WBGene00010911	
YMO2_YEAST	non-	ZC395.10	WBGene00007630	
YMO9_YEAST	essential	R107.2	WBGene00009636	
YMT1_YEAST	non-	Y54G11A.11	WBGene00003176	
YMT8_YEAST	essential	M01B12.2	WBGene00017738	
YMT9_YEAST	non-	Y54E10B_159.	WBGene00012978	x
YMW7_YEAST	essential	a	WBGene00022027	
YMW7_YEAST	essential	B0361.10	WBGene00022027	x
YN03_YEAST	non-	Y38F2A_6126.	WBGene00010178	
YN15_YEAST	essential	b	WBGene00009920	
YN26_YEAST	essential	Y37E11B.5	WBGene00022025	
YN26_YEAST	non-	C45G9.2	WBGene00022025	
YN26_YEAST	essential	Y45F10D.8	WBGene00022025	
YN28_YEAST	non-	C32E8.5	WBGene00016139	
YN48_YEAST	essential	W06E11.4	WBGene00010044	x
YN53_YEAST	essential	Y39B6B.ee	WBGene00020600	x
YN65_YEAST	non-	Y48C3A.i	WBGene00007912	
YN8K_YEAST	essential	Y87G2A.b	WBGene00011391	
YN8Q_YEAST	essential	D2023.6	WBGene00007312	

TNRU, TEAST         essential         CV422.6         WBGene00039905           YNRU, TEAST         essential         C42D5.3         WBGene000150905           YNC2, TEAST         essential         C35D10.12         WBGene00013151           YNC2, TEAST         essential         C35D10.12         WBGene0001622           YNC5, TEAST         essential         NGC11.5         WBGene0001622           YNK7, YEAST         essential         F362A.2         WBGene0001685           YNK7, YEAST         essential         F27C1.6         WBGene0001886           YNM, YEAST         essential         F27C1.6         WBGene00020422           YNM, YEAST         essential         F27C1.6         WBGene00018285         X           YNU, YEAST         essential         F27C1.6         WBGene00018285         X           YNU, YEAST         essential         F27C1.2         WBGene00018285         X           YNU, YEAST         essential         F26A4.182.0         WBGene00018285         X           YNU, YEAST         essential         F56A4.124.0         WBGene00018679         X           YNOS_YEAST         essential         F56A4.174.8         WBGene00018679         X           YNOS_YEAST         essential					
YNAC.YEAST         essential         Y43F4B.5         WBGene00015151           YNC2.YEAST         essential         C35D10.12         WBGene00013151           YNC3.YEAST         essential         W03F8.4         WBGene00013151           YNC5.YEAST         essential         N03F8.4         WBGene0001585           YNC7.YEAST         essential         C24A11.9         WBGene000120842           YNN.YZYEAST         essential         C24A11.9         WBGene00020842           YNN.YZYEAST         essential         C16C10.11         WBGene00020842           YNN.YZYEAST         essential         C16C10.11         WBGene00022798           YNNS_YEAST         essential         F7012.12         WBGene00012285           YNU1_YEAST         essential         F7022.12         WBGene00018285           YNWTYYEAST         essential         Y6584A.182.b         WBGene00018285           YNWTYYEAST         essential         Y6584A.174.a         WBGene00019537           YD25_YEAST         essential         Y6584A.174.a         WBGene00019431         x           Y070_YEAST         essential         Y6584A.174.a         WBGene00007413         x           Y071_YEAST         essential         T20812.1         WBGene000015481         x </td <td>YN8U_YEAST</td> <td>essential</td> <td>K04G2.6</td> <td>WBGene00003596</td> <td>х</td>	YN8U_YEAST	essential	K04G2.6	WBGene00003596	х
YNAC.YEAST         essential         Y43F4B.5         WBGene00015151           YNC2.YEAST         essential         C35D10.12         WBGene00013151           YNC3.YEAST         essential         W03F8.4         WBGene00013151           YNC5.YEAST         essential         N03F8.4         WBGene0001585           YNC7.YEAST         essential         C24A11.9         WBGene000120842           YNN.YZYEAST         essential         C24A11.9         WBGene00020842           YNN.YZYEAST         essential         C16C10.11         WBGene00020842           YNN.YZYEAST         essential         C16C10.11         WBGene00022798           YNNS_YEAST         essential         F7012.12         WBGene00012285           YNU1_YEAST         essential         F7022.12         WBGene00018285           YNWTYYEAST         essential         Y6584A.182.b         WBGene00018285           YNWTYYEAST         essential         Y6584A.174.a         WBGene00019537           YD25_YEAST         essential         Y6584A.174.a         WBGene00019431         x           Y070_YEAST         essential         Y6584A.174.a         WBGene00007413         x           Y071_YEAST         essential         T20812.1         WBGene000015481         x </td <td>_</td> <td></td> <td></td> <td></td> <td></td>	_				
YNC2_YEAST         essential         C35D10.12         WBGene00013151           YNC3_YEAST         essential         W03F8.4         WBGene00013151           YNC7_YEAST         essential         W03C11.5         WBGene00013151           YNC7_YEAST         essential         W03C1.5         WBGene00007772           YNC7_YEAST         essential         F72C.1.6         WBGene00011408         x           YNN2_YEAST         essential         F7C1.6         WBGene00012885         x           YNN2_YEAST         essential         C16C10.11         WBGene00012885         x           YNU1_YEAST         essential         F7C12.12         WBGene00018285         x           YNU1_YEAST         essential         F7C12.12         WBGene00018285         x           YNU1_YEAST         essential         F5C84A.182.c         WBGene00019537         y005.7825         non-         F5285.1         WBGene00019537         y005.78257         non-         F5284A.174.a         WBGene00019537         y005.78257         non-         Y6584A.174.b         WBGene00019537         y005.78257         non-         Y6584A.174.b         WBGene00012692         x           Y07T_YEAST         essential         F54C9.9         WBGene00007101         x         y027.YEAST <td>_</td> <td></td> <td></td> <td></td> <td></td>	_				
YNC3_YEAST         cessential         C35D10.12         WBGene00015812           YNC3_YEAST         cessential         W0378.4         WBGene00001662           YNC7_YEAST         cessential         N03C11.5         WBGene00001662           YNC7_YEAST         cessential         N272.3         WBGene00001785           YNN7_YEAST         cessential         C24A11.9         WBGene00020842           YNN9_YEAST         cessential         N16.3         WBGene0002798           YNN2_YEAST         cessential         N16.3         WBGene000122798           YNN2_YEAST         cessential         F3C12.12         WBGene000122788         x           YNU1_YEAST         cessential         F3C12.12         WBGene000122788         x           YNU1_YEAST         cessential         F3C2.9         WBGene00012828         x           YNU1_YEAST         cessential         F53C3.4         WBGene00012537         xx5           YNZ5_YEAST         cessential         F52B5.1         WBGene00015431         x           YO26_YEAST         cessential         F54C9.9         WBGene00017413         x           YO71_YEAST         cessential         F54C9.9         WBGene00017461         x           YO71_YEAST         cessential	_				
YNCG_YEAST         eesential         W03F8.4         WBGene00015812           YNCG_YEAST         essential         K02F1.5         WBGene00011682           YNCT_YEAST         essential         F36A2.2         WBGene00011408         x           YNLG_YEAST         essential         F27C1.6         WBGene00011408         x           YNNL_YEAST         essential         F27C1.6         WBGene00007111         x           YNNZ_YEAST         essential         M106.3         WBGene000018285         x           YNUL_YEAST         essential         F37C12.12         WBGene00018285         x           YNUL_YEAST         essential         F37C12.12         WBGene00018285         x           YNUL_YEAST         essential         Y6554A.182.0         WBGene00018285         x           YNUZ_YEAST         essential         Y6554A.182.0         WBGene00018285         x           YNUZ_YEAST         essential         Y6554A.174.8         WBGene00018285         x           YNUZ_YEAST         essential         Y654A.174.8         WBGene00018679         x           Y02C_YEAST         essential         Y654A.174.8         WBGene00001316         x           Y02T_YEAST         essential         F5454.174.8	YNC2_YEAST	essential	F41C3.4	WBGene00013151	
YNCG_YEAST         eesential         W03F8.4         WBGene00015812           YNCG_YEAST         essential         K02F1.5         WBGene00011682           YNCT_YEAST         essential         F36A2.2         WBGene00011408         x           YNLG_YEAST         essential         F27C1.6         WBGene00011408         x           YNNL_YEAST         essential         F27C1.6         WBGene00007111         x           YNNZ_YEAST         essential         M106.3         WBGene000018285         x           YNUL_YEAST         essential         F37C12.12         WBGene00018285         x           YNUL_YEAST         essential         F37C12.12         WBGene00018285         x           YNUL_YEAST         essential         Y6554A.182.0         WBGene00018285         x           YNUZ_YEAST         essential         Y6554A.182.0         WBGene00018285         x           YNUZ_YEAST         essential         Y6554A.174.8         WBGene00018285         x           YNUZ_YEAST         essential         Y654A.174.8         WBGene00018679         x           Y02C_YEAST         essential         Y654A.174.8         WBGene00001316         x           Y02T_YEAST         essential         F5454.174.8	YNC2 YEAST	essential	C35D10.12	WBGene00013151	
YNC7_YEAST         essential         M03C11.5         NBGene00001662           YNC7_YEAST         essential         F36A2.2         WBGene00001585           YNLO_YEAST         essential         F27C1.6         WBGene00001585           YNMD_YEAST         essential         C24A11.9         WBGene000020842           YNMS_YEAST         essential         NB3.3         WBGene00012708           YNNS_YEAST         essential         C16C10.11         WBGene000122798           YNNT_YEAST         essential         C16C10.11         WBGene00018285         X           YNUL_YEAST         essential         F23C8.9         WBGene00018285         X           YNUT_YEAST         essential         Y65B4A_182.6         WBGene00019537         Y005CYEAST         essential         Y65B4A_174.8         WBGene00019537           Y025_YEAST         essential         C2656.3         WBGene00019537         Y005CYEAST         essential         C2656.3         WBGene00015481           Y07J_YEAST         essential         C2654A_174.4         WBGene00016622         X           Y07J_YEAST         essential         C2666.3         WBGene00013628         X           Y125_YEAST         essential         C2667.2         WBGene00013628         X	_				
YNC7_YEAST         essential         KO2F2.1         WBGene0001772           YNK7_YEAST         essential         C24A11.9         WBGene00011408 x           YNM9_YEAST         essential         F27C1.6         WBGene00011408 x           YNN2_YEAST         essential         F27C1.6         WBGene00018665 x           YNN2_YEAST         essential         M106.3         WBGene00018285 x           YNU1_YEAST         essential         F37C12.12         WBGene00018285 x           YNU2_YEAST         essential         F37A8.2         WBGene00018285 x           YNZ5_YEAST         essential         F57A8.2         WBGene00018285 x           YNZ5_YEAST         essential         F55A4.174.4         WBGene00018577 y           Y026_YEAST         essential         F5654A.174.4         WBGene00007101 x           Y07T_YEAST         essential         F3654A.174.4         WBGene00007236 x           YP45_YE	_				
YNKC_TEAST         essential         F362.2         WBGene00011585           YNLO_YEAST         essential         C24A11.9         WBGene00011865         x           YNN9_YEAST         essential         M105.3         WBGene000220842         x           YNN9_YEAST         essential         M105.3         WBGene00022788         x           YNR5_YEAST         essential         C16C10.11         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU7_YEAST         essential         F36A2.12         WBGene00018285         x           YNW7_YEAST         essential         F576A2.182.b         WBGene00018285         x           YNU7_YEAST         essential         F55A4.182.b         WBGene00019537         XZ5_YEAST         essential         F565A4.174.a         WBGene00017413         x           Y074_YEAST         essential         C265A4.174.b         WBGene00012692         x           Y074_YEAST         essential         C265A4.174.b         WBGene00012692         x           Y074_YEAST         essential         C265A3.170.b         WBGene00012692         x           Y126_YEAST         essential         C264B7.2         WBGene00012692 <td></td> <td></td> <td></td> <td></td> <td></td>					
YNL0_TEAST         essential         C24A11.9         WBGene00011408         x           YNNP_YEAST         essential         P7C1.6         WBGene00022798           YNR5_YEAST         essential         M106.3         WBGene00018285         x           YNR5_YEAST         essential         P101.1         WBGene00018285         x           YNU1_YEAST         essential         P37C12.12         WBGene00018285         x           YNU1_YEAST         essential         P42F12.4         WBGene00018285         x           YNU1_YEAST         essential         P436A4.182.b         WBGene00019537         x           YNZ5_YEAST         essential         Y65B4A_174.a         WBGene00018679         x           YO7T_YEAST         essential         Y65B4A_174.a         WBGene00018679         x           YO7T_YEAST         essential         Y65B4A_174.b         WBGene0001236         x           YO7T_YEAST         essential         Y65B4A_174.b         WBGene00012622         x           YP6_YEAST         non-         C34B7.2         WBGene00012626         x           YP75_YEAST         essential         T03B8.2         WBGene00013218         x           YP71_YEAST         essential         F07B10.8	YNC7_YEAST	essential	K02F2.3	WBGene00007772	
YNL0_TEAST         essential         C24A11.9         WBGene00011408         x           YNNP_YEAST         essential         P7C1.6         WBGene00022798           YNR5_YEAST         essential         M106.3         WBGene00018285         x           YNR5_YEAST         essential         P101.1         WBGene00018285         x           YNU1_YEAST         essential         P37C12.12         WBGene00018285         x           YNU1_YEAST         essential         P42F12.4         WBGene00018285         x           YNU1_YEAST         essential         P436A4.182.b         WBGene00019537         x           YNZ5_YEAST         essential         Y65B4A_174.a         WBGene00018679         x           YO7T_YEAST         essential         Y65B4A_174.a         WBGene00018679         x           YO7T_YEAST         essential         Y65B4A_174.b         WBGene0001236         x           YO7T_YEAST         essential         Y65B4A_174.b         WBGene00012622         x           YP6_YEAST         non-         C34B7.2         WBGene00012626         x           YP75_YEAST         essential         T03B8.2         WBGene00013218         x           YP71_YEAST         essential         F07B10.8	YNK7 YEAST	essential	F36A2.2	WBGene00001585	
YNN2_YEAST         essential         F27C1.6         WBGene00020842           YNN2_YEAST         essential         M10.3         WBGene00007111         x           YNN2_YEAST         essential         C16C10.11         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         F32C8.9         WBGene00018285         x           YNU7_YEAST         essential         Y65B4A_182.b         WBGene00019537         YM25.YEAST         essential         Y65B4A_174.a         WBGene00007101         x           Y026_YEAST         essential         Y65B4A_174.b         WBGene00007413         x           Y077_YEAST         essential         Y65B4A_174.b         WBGene00007413         x           Y074_YEAST         essential         C265A3_174.b         WBGene00007413         x           Y074_YEAST         essential         F246.9.9         WBGene00012662         x           YP46_YEAST         essential         F2781.0         WBGene00012662         x           YP57_YEAST         essential         F2781.0         WBGene0001262         x           YP75_YEAST         essential         F19A6.2         WBGene0000271	_				
YNN2_TEAST         essential         M18.3         WBGene00018866         x           YNN2_TEAST         essential         C16C10.11         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         Y65B4A_182.b         WBGene00019537         x           YNZ5_YEAST         essential         Y65B4A_174.a         WBGene00018679         x           YO7T_YEAST         essential         Y65B4A_174.a         WBGene0001816         x           YO7T_YEAST         essential         C56B4A_174.a         WBGene00007413         x           YO7T_YEAST         essential         C26C6.3         WBGene00012692         x           YP46_YEAST         essential         C20H5.1         WBGene0001262         x           YP7T_YEAST         essential         C04H5.1         WBGene0001262         x           YP7T_YEAST         essential         C16A3.7         WBGene0001262         x           YP7T_YEAST         essential	_				x
YNG8_YEAST         essential         M106.3         WBGene00022798           YNR5_YEAST         essential         C16C10.11         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         F32C8.9         WBGene00018285         x           YNU7_YEAST         essential         Y65B4A_182.c         WBGene00019537         y           YNZ5_YEAST         essential         Y65B4A_174.a         WBGene00019537         y           YO26_YEAST         essential         Y65B4A_174.b         WBGene0001269         x           YO21_YEAST         essential         C2686.3         WBGene00012692         x           YP18_YEAST         essential         C2686.3         WBGene00012692         x           YP18_YEAST         essential         C2081.2         WBGene00013029         x           YP67_YEAST         essential         C2487.2         WBGene00013029         x           YP67_YEAST         essential         C0485.1         WBGene0001328         x           YPT_YEAST         essential         C0485.1	_	essential	F27C1.6	WBGene00020842	
YNG8_YEAST         essential         M106.3         WBGene00022798           YNR5_YEAST         essential         C16C10.11         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         F32C8.9         WBGene00018285         x           YNU7_YEAST         essential         Y65B4A_182.c         WBGene00019537         y           YNZ5_YEAST         essential         Y65B4A_174.a         WBGene00019537         y           YO26_YEAST         essential         Y65B4A_174.b         WBGene0001269         x           YO21_YEAST         essential         C2686.3         WBGene00012692         x           YP18_YEAST         essential         C2686.3         WBGene00012692         x           YP18_YEAST         essential         C2081.2         WBGene00013029         x           YP67_YEAST         essential         C2487.2         WBGene00013029         x           YP67_YEAST         essential         C0485.1         WBGene0001328         x           YPT_YEAST         essential         C0485.1	YNN2_YEAST	essential	M18.3	WBGene00018866	x
YNR5_YEAST         essential         C16C10.11         WBGene0007111         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU1_YEAST         essential         F37C12.12         WBGene00018285         x           YNU7_YEAST         essential         Y6584A_182.b         WBGene00019537           YNZ5_YEAST         essential         Y6584A_174.a         WBGene00019537           YO06_YEAST         non-         F57A8.2         WBGene00019537           Y026_YEAST         non-         Y6584A_174.a         WBGene00007413         x           Y07T_YEAST         essential         Y6584A_174.a         WBGene00007236         x           Y07T_YEAST         essential         Y0584A_174.b         WBGene00012692         x           Y18_YEAST         essential         T20B12.1         WBGene00012692         x           YP18_YEAST         essential         T19A6.2         WBGene00012692         x           YP17_YEAST         essential         F19A6.2         WBGene00012692         x           YP17_YEAST         essential         F19A6.2         WBGene00012692	YNO8 YEAST	essential	M106.3	WBGene00022798	
YNUL_YEAST         non-         F42F12.4         WBGene00018285         x           YNUL_YEAST         essential         F37C12.12         WBGene00018285         x           YNUL_YEAST         essential         Y48B6A.1         WBGene00018285         x           YNUT_YEAST         essential         Y45B4A.182.b         WBGene00019537           YNZ5_YEAST         essential         Y65B4A.174.a         WBGene0001879           YO26_YEAST         non-         Y65B4A.174.a         WBGene0001879           Y026_YEAST         essential         Y65B4A.174.a         WBGene0001879           Y026_YEAST         non-         Y65B4A.174.a         WBGene000071101           Y073_YEAST         essential         Y265B4A.174.a         WBGene00012691         x           Y074_YEAST         essential         C26B6.3         WBGene00012692         x           Y146_YEAST         essential         C20H5.1         WBGene00012692         x           YP57_YEAST         essential         C10H5.1         WBGene00012692         x           YP71_YEAST         essential         C10H5.1         WBGene00002699         x           YUT1_YEAST         essential         C10H1.8         WBGene0000129         x           Y					
YNUL_YEAST         essential         F7Cl2.12         WBGene00018285           YNUL_YEAST         essential         F23C8.9         WBGene0001035           YNX7_YEAST         essential         Y65B4A_182.c         WBGene00019537           YNZ5_YEAST         essential         Y65B4A_182.c         WBGene00019537           YNZ5_YEAST         essential         Y65B4A_174.a         WBGene00019537           YO26_YEAST         non-         F52B5.1         WBGene0001713         x           YO71_YEAST         essential         Y65B4A_174.a         WBGene0000713         x           YO71_YEAST         essential         C2666.3         WBGene00017481         x           YO21_YEAST         essential         C2666.3         WBGene00012692         x           YP59_YEAST         non-         C34B7.2         WBGene00013029         x           YP67_YEAST         essential         T03N8.2         WBGene00013218         x           YP71_YEAST         essential         C10H11.8         WBGene00012692         x           YP71_YEAST         essential         C10H11.8         WBGene0001289         x           YTMN_YEAST         essential         C10H11.8         WBGene0001299         x           ZUO1_YEAS	_				
YNUL_VEAST         essential         Y23C3.9         WBGene00018285           YNW7_VEAST         essential         Y4886A.1         WBGene0000931           YNZ3_VEAST         essential         Y6584A.182.c         WBGene00019537           YNZ5_YEAST         essential         F5788.2         WBGene00019537           YO26_YEAST         non-         F5285.1         WBGene00018679           Y077_YEAST         essential         Y6584A.174.b         WBGene0000711           Y077_YEAST         essential         Y2684A.174.b         WBGene000012672           Y077_YEAST         essential         Y2684A.179.b         WBGene00007236           Y074_YEAST         essential         T20812.1         WBGene00012692         x           YP67_YEAST         essential         T0312.1         WBGene00013218         x           YP77_YEAST         essential         T0312.1         WBGene00002662         x           YP67_YEAST         essential         T0445.1         WBGene00003795         x           YP17_YEAST         essential         C0445.1         WBGene00000271         x           YR1_YEAST         essential         C1643.7         essential         C34810.1           non-         K5374B.6         WBGene0000	YNU1_YEAST	non-	F42F12.4		x
YNW7_YEAST         essential         Y48B6A.1         WBGene0001035           YNZ5_YEAST         essential         Y65B4A_182.c         WBGene00019537           YNZ5_YEAST         essential         F5788.2         WBGene00019537           Y006_YEAST         non-         F52B5.1         WBGene00019537           Y006_YEAST         non-         Y65B4A_174.a         WBGene00007413         x           Y07T_YEAST         essential         Y65B4A_179.b         WBGene00019527           Y018_YEAST         essential         C2666.3         WBGene00007413         x           Y071_YEAST         essential         C2666.3         WBGene00013029         x           Y101_YEAST         essential         C20487.2         WBGene00013029         x           YP69_YEAST         non-         C34B7.2         WBGene00013029         x           YP71_YEAST         essential         T19A6.2         WBGene00013029         x           YTMY_YEAST         essential         C104H5.1         WBGene0001266         x           YTT_YEAST         essential         T19A6.2         WBGene0001209         x           ZVEA_YEAST         essential         C1643.7         essential         C34E10.1         non-         K2688.3	YNU1_YEAST	essential	F37C12.12	WBGene00018285	
YNW7_YEAST         essential         Y48B6A.1         WBGene0001035           YNZ5_YEAST         essential         Y65B4A_182.c         WBGene00019537           YNZ5_YEAST         essential         F5788.2         WBGene00019537           Y006_YEAST         non-         F52B5.1         WBGene00019537           Y006_YEAST         non-         Y65B4A_174.a         WBGene00007413         x           Y07T_YEAST         essential         Y65B4A_179.b         WBGene00019527           Y018_YEAST         essential         C2666.3         WBGene00007413         x           Y071_YEAST         essential         C2666.3         WBGene00013029         x           Y101_YEAST         essential         C20487.2         WBGene00013029         x           YP69_YEAST         non-         C34B7.2         WBGene00013029         x           YP71_YEAST         essential         T19A6.2         WBGene00013029         x           YTMY_YEAST         essential         C104H5.1         WBGene0001266         x           YTT_YEAST         essential         T19A6.2         WBGene0001209         x           ZVEA_YEAST         essential         C1643.7         essential         C34E10.1         non-         K2688.3	YNUI YEAST	essential	F23C8.9	WBGene00018285	
YN23_YEAST         essential         Y65B4A_182.c         WBGene00019537           YN25_YEAST         essential         Y65B4A_182.c         WBGene00019537           YN25_YEAST         essential         Y65B4A_174.a         WBGene00019537           Y026_YEAST         non-         F52B5.1         WBGene00019537           Y07T_YEAST         non-         Y65B4A_174.a         WBGene00007101           Y07X_YEAST         essential         C2656.3         WBGene00003166           Y021_YEAST         essential         C2686.3         WBGene0000326           Y18_YEAST         essential         C2686.3         WBGene0000326           Y18_YEAST         essential         C2686.3         WBGene0000326           Y18_YEAST         essential         C0485.1         WBGene0000326           YP46_YEAST         essential         C0485.1         WBGene00003275           YP47_YEAST         essential         C10411.8         WBGene00003775         x           YTM1_YEAST         essential         C10411.8         WBGene0000129         x           ZV01_YEAST         essential         C1643.7         essential         C34E10.1           non-         C27C12.2         wBGene00001029         x           ZV01_YEA					
YNZ5_YEAST         essential         Y65HA_182.c         WBGene00019537           YNZ5_YEAST         essential         F57A8.2         WBGene00018679           YO26_YEAST         essential         Y65B4A_174.a         WBGene00018679           YO26_YEAST         essential         Y65B4A_174.b         WBGene00018679           YO7T_YEAST         essential         Y65B4A_179.b         WBGene00018481           YO28_YEAST         essential         Y65B4A_179.b         WBGene00012692         x           YP46_YEAST         essential         F54C9.9         WBGene00012692         x           YP46_YEAST         essential         T03B8.2         WBGene00012692         x           YP57_YEAST         essential         T03B8.2         WBGene00004266         x           YPT7_YEAST         essential         T57B10.8         WBGene00004276         x           YTM_YEAST         essential         C10H1.8         WBGene00001299         x           ZVD1_YEAST         essential         C16A3.7         essential         C16A3.7           essential         C16A3.7         WBGene00001029         x         x           ZVD1_YEAST         essential         C16A3.7         essential         c3818.6           e					
YNZ5_YEAST       essential       F57A8.2       WBGene00019537         Y006_YEAST       non-       F52B5.1       WBGene0007413       x         Y07T_YEAST       essential       Y65B4A_174.b       WBGene0007413       x         Y07T_YEAST       essential       C265E4A_174.b       WBGene0007413       x         Y07T_YEAST       essential       C265E4A_174.b       WBGene0007336       x         Y02A_YEAST       essential       C2665.3       WBGene00013029       x         YP59_YEAST       essential       T03D8.2       WBGene00013029       x         YP59_YEAST       essential       T19A6.2       WBGene00013029       x         YP7T_YEAST       essential       T19A6.2       WBGene00004271       x         YRB_YEAST       essential       F57B10.8       WBGene00001329       x         YTM_YEAST       essential       C16A3.7       essential       C34F1.4       x         YRM_YEAST       essential       C2468.3       non-       ESsential       C34E10.1       non-       Essential       F57E12.2       essential       F67E12.2       essential       F61E6.3       essential       F622.2       essential       F622.2       essential       F622.2       essential	YNZ3_YEAST	essential	Y65B4A_182.b	WBGene00009341	
Y006_YEAST         non-         F52E5.1         WBGene00018679         x           Y07T_YEAST         non-         Y65B4A_174.b         WBGene0007101         x           Y07T_YEAST         essential         Y65B4A_179.b         WBGene000736         x           Y07T_YEAST         essential         Y65B4A_179.b         WBGene000736         x           Y07L_YEAST         essential         F54C9.9         WBGene000736         x           YP46_YEAST         essential         T20B12.1         WBGene00012692         x           YP57_YEAST         essential         T03B8.2         WBGene00013218         yTTT_YEAST           YP7T_YEAST         essential         C04H5.1         WBGene00004261         x           YP7T_YEAST         essential         F57B10.8         WBGene00001795         x           YTM_YEAST         essential         C10H1.8         WBGene00018393         x           ZPR1_YEAST         essential         C16A3.7         essential         C16A3.7           gessential         T27A3.6         Non-         C27C12.2         essential         F3E2.4           Non-         F52L2.8         essential         F3E2.4         Non-         F52C12.2           essential         F	YNZ5_YEAST	essential	Y65B4A_182.c	WBGene00019537	
Y006_YEAST         non-         F52E5.1         WBGene00018679         x           Y07T_YEAST         non-         Y65B4A_174.b         WBGene0007101         x           Y07T_YEAST         essential         Y65B4A_179.b         WBGene000736         x           Y07T_YEAST         essential         Y65B4A_179.b         WBGene000736         x           Y07L_YEAST         essential         F54C9.9         WBGene000736         x           YP46_YEAST         essential         T20B12.1         WBGene00012692         x           YP57_YEAST         essential         T03B8.2         WBGene00013218         yTTT_YEAST           YP7T_YEAST         essential         C04H5.1         WBGene00004261         x           YP7T_YEAST         essential         F57B10.8         WBGene00001795         x           YTM_YEAST         essential         C10H1.8         WBGene00018393         x           ZPR1_YEAST         essential         C16A3.7         essential         C16A3.7           gessential         T27A3.6         Non-         C27C12.2         essential         F3E2.4           Non-         F52L2.8         essential         F3E2.4         Non-         F52C12.2           essential         F	YNZ5 YEAST	essential	F57A8 2	WBGene00019537	
Y026_YEAST         essential         Y65B4A_174.a         WBGene00007413         x           Y07T_YEAST         non-         Y65B4A_174.b         WBGene00007413         x           Y07T_YEAST         essential         Y65B4A_179.b         WBGene00007436         x           Y021_YEAST         essential         C26E6.3         WBGene0007236         x           YP46_YEAST         essential         T20B12.1         WBGene00012692         x           YP59_YEAST         essential         T03D8.2         WBGene00013209         x           YP7_YEAST         essential         C04H5.1         WBGene00004266         x           YP7_YEAST         essential         C10H1.8         WBGene00001329         x           YTM_YEAST         essential         C10H1.8         WBGene00001893         x           YTM_YEAST         essential         C10H1.8         WBGene00001899         x           ZU01_YEAST         essential         C34E10.1         non-         C37748.6           essential         C34E10.1         non-         Essential         C34E10.1           non-         F55A12.8         essential         F41E6.3           essential         F41E6.4         essential         F32H2.4 <td< td=""><td>—</td><td></td><td></td><td></td><td></td></td<>	—				
YO7T_YEAST         non-         Y65B4A_174.b         WBGene00007101           Y078_YEAST         essential         C2656.3         WBGene00008316           YP18_YEAST         essential         F54C9.9         WBGene0001328           YP45_YEAST         essential         T20B12.1         WBGene00013282           YP59_YEAST         non-         C34B7.2         WBGene0001328           YP77_YEAST         essential         T038.2         WBGene00004266           YP11_YEAST         essential         C04H5.1         WBGene00004266           YP1_YEAST         essential         C10H11.8         WBGene00003795         x           YR1_YEAST         essential         C10H11.8         WBGene000020999         x           ZU01_YEAST         essential         C16A3.7         essential         C34E10.1           non-         C37F4B.6         WBGene0001029         x           ZU01_YEAST         essential         C16A3.7         essential         c34E10.1           non-         C37F4B.6         WBGene00001029         x           ZU01_YEAST         essential         C16A3.7         essential         c34E10.1           non-         ESsential         C07E3.2         essential         c34E10.1 </td <td></td> <td></td> <td></td> <td></td> <td></td>					
YOJB_YEAST essential Y65B4A_179.b WBGene00015481 Y021_YEAST essential C2626.3 WBGene00007236 YP46_YEAST essential T20B12.1 WBGene00012692 x YP59_YEAST non- C3487.2 WBGene00013218 YPT1_YEAST essential C04H5.1 WBGene00013218 YPT1_YEAST essential C10H1.8 WBGene00018893 X YTM1_YEAST essential C10H1.8 WBGene00018893 x YTM1_YEAST essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C34E10.1 non- C37C12.2 essential T27A3.6 non- B0035.12 essential F41E6.3 essential F41E6.4 essential F41E6.6 essential F41E6.4 essential F32H2.4 non- B0035.12 essential C05D1.1 non- B0024.11 essential C05D1.1 non- B0025.12 essential C34E10.4 non- C37F2.2 essential F41E6.4 essential F41E6.4 essential C368.3 non- B0035.12 essential C364.6 essential F41E6.4 essential C368.3 non- B0024.11 essential C05D1.1 non- C39F7.4 essential Y49E10.2 essential Y49E10.2 essential Y49E10.2 essential Y49E10.2 essential F558.5 non- W03F9.1 essential F558.5 NON- ESSENT essential F558.5 NON- ESSENT essential F558.	YO26_YEAST	essential		WBGene00007413	х
YOJB_YEAST essential Y65B4A_179.b WBGene00015481 Y021_YEAST essential C2626.3 WBGene00007236 YP46_YEAST essential T20B12.1 WBGene00012692 x YP59_YEAST non- C3487.2 WBGene00013218 YPT1_YEAST essential C04H5.1 WBGene00013218 YPT1_YEAST essential C10H1.8 WBGene00018893 X YTM1_YEAST essential C10H1.8 WBGene00018893 x YTM1_YEAST essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C34E10.1 non- C37C12.2 essential T27A3.6 non- B0035.12 essential F41E6.3 essential F41E6.4 essential F41E6.6 essential F41E6.4 essential F32H2.4 non- B0035.12 essential C05D1.1 non- B0024.11 essential C05D1.1 non- B0025.12 essential C34E10.4 non- C37F2.2 essential F41E6.4 essential F41E6.4 essential C368.3 non- B0035.12 essential C364.6 essential F41E6.4 essential C368.3 non- B0024.11 essential C05D1.1 non- C39F7.4 essential Y49E10.2 essential Y49E10.2 essential Y49E10.2 essential Y49E10.2 essential F558.5 non- W03F9.1 essential F558.5 NON- ESSENT essential F558.5 NON- ESSENT essential F558.	YO7T_YEAST	non-	Y65B4A_174.b	WBGene00007101	
Y021_YEAST essential C26E6.3 WBGene00008316 YP18_YEAST essential T20B12.1 WBGene00012692 x YP59_YEAST non- C34B7.2 WBGene00013029 YP67_YEAST essential T03B8.2 WBGene00013218 YPT1_YEAST essential C04H5.1 WBGene00014271 x YRB1_YEAST essential T19A6.2 WBGene00014271 x YRB1_YEAST essential C10H1.8 WBGene00004271 x YRM1_YEAST essential C10H1.8 WBGene00001893 x ZPR1_YEAST essential C34E10.1 non- C27C12.2 essential C16A3.7 essential C16A3.7 essential T27A3.6 non- F55A12.8 essential F41E6.10 non- B0035.12 essential F41E6.10 non- F52C12.2 essential F41E6.10 non- S0035.12 essential C07E3.2 non- S004.11 essential C07E1.2 essential C07E3.2 non- S464.6 essential C05D11.1 non- C39F7.4 essential Y54E1A.9 non- S69A2.1 essential Y54E1A.9 non- S75A2.1 essential Y54E1A.9 non- S75A2.1 essential C07E3.2 non- S75A2.1 essential C07E3.2 non- S75A2.1 essential C07E3.2 non- S75A2.1 essential C05D1.1 non- C39F7.4 essential F55F8.5 non- W03F9.1 essential F55F8.5 NF8.5 NF8.5 P58.5 P58.5 P58.5 P58.5 P58.5 P58.5 P58.5	_	essential	—		
YP18_YEAST YP46_YEAST essentialF54C9.9 F200130292 WBGene00012692 WBGene00013292 WBGene00013218 WBGene00013218 WBGene00013218 WBGene00013218 WBGene00013218 WBGene00013218 WBGene00013218 WBGene00013218 WBGene00013218 WBGene00013218 WBGene00003795 x YTM1_YEAST essentialC04H5.1 T19A6.2 WBGene00003795 x WBGene00003795 x WBGene00018893 x ZPR1_YEAST essentialC10H11.8 VBGene000120999 WBGene0001029 WBGene0001029 WBGene0001029ZU01_YEAST essentialC16A3.7 essentialC34E10.1 non- C27C12.2 essentialWBGene0001029 VBGene0001029ZU01_YEAST essentialC16A3.7 essentialC34E10.1 non- C27C12.2 essentialWBGene0001029 VBGene00001029ZU01_YEAST essentialC16A3.7 essentialC34E10.1 non- C27C12.2 essentialWBGene00001029 resentialadditional essentialC16A3.7 essentialC34E10.1 ron- ron- C27C12.2 essentialWBGene0001029 resentialadditional essentialC0781.2 ron- ron- ros22.2 ron- essentialC0783.2 ron- ros297.4 essentialC01G10.9 ron- ros297.4 essentialadditional essentialC01G10.9 ron- ron- ros297.4 essentialC01G10.9 ron- ros297.4 essentialadditional essentialF55R5.5 ron- ron- ron- ron- ros297.4 essentialS365.13 ron- ron- ros385.13 ron-	—		—		
YP46_YEAST YP59_YEAST NON- C3487.2WBGene00012692 WBGene00013029YP67_YEAST YP71_YEAST essentialC04H5.1 T03D8.2 WBGene00004266 WBGene00004271 X WBGene00004271 WBGene00004883 X YTM1_YEAST essentialF57B10.8 WBGene00018893 WBGene00018893 X WBGene000102999 ZU01_YEAST essentialZU01_YEAST essentialC16A3.7 essentialC34E10.1 non- C27C12.2 essential ressentialNON- essentialT04A8.6 essential T04A8.6 essential ressential F55A12.8 essential F41E6.10 non- mon- mon- mon- F55A12.8 essential F41E6.10 non- mon- mon- S764L.6 essential F41E6.10 non- mon- mon- S764L.6 essential F41E6.10 non- essential F41E6.10 non- mon- S764L.6 essential F41E6.10 non- mon- S762L.2 essential cssential F52C12.2 essential cssential C07E3.2 non- B0024.11 essential C01G10.9 non- c54G4.6 essential C01G10.9 non- c39F7.4 essential V49E10.2 essential S578.5 non- w03F9.1 essential F55R5.5 non- w03F9.1 essential F55R5.5 non- w03F9.1 essential F578.5 non- w03F9.1 essential F578.5 non- w03F9.1 essential F578.5 non- w03F9.1 essential F578.5 non- w03F9.1 essential F578.5 non-WBGene00012692 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGene0001029 WBGe	_				
YP59_YEASTnon-C34B7.2WBGene00013029YP67_YEASTessentialT03D8.2WBGene00013218YPT1_YEASTessentialC04H5.1WBGene00004271YRB1_YEASTessentialF57B10.8WBGene00004271YRB1_YEASTessentialC10H11.8WBGene0001893ZV01_YEASTessentialC16A3.7essentialC16A3.7essentialC34E10.1non-C27C12.2essentialC34E10.1non-C27C12.2essentialT04A8.6essentialT04A8.6essentialF41E6.3essentialF41E6.4essentialF41E6.10non-T03F6.2essentialF41E6.10non-B0024.11essentialC05D1.1non-C39D24.11essentialC05Q1.2essentialC01G10.9non-C39F7.4essentialY54G11A.9non-F55P8.5non-F55P8.1non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5non-F55P8.5<	YP18_YEAST	essential	F54C9.9	WBGene00007236	
YP59_YEASTnon-C34B7.2WBGene00013029YP67_YEASTessentialT03B8.2WBGene00013218YPT1_YEASTessentialC04H5.1WBGene00004266xYPT7_YEASTessentialF57B10.8WBGene00004271xYRB1_YEASTessentialC10H11.8WBGene00018933xZPR1_YEASTessentialC16A3.7essentialC34E10.1non-C27C12.2essentialC34E10.1non-non-C27C12.2essentialT04A8.6essentialT04A8.6essentialF41E6.3essentialF41E6.10non-F55A12.8essentialF41E6.10non-F52C12.2essentialF41E6.10non-non-K08D12.hessentialessentialC07E3.2non-non-C34G10.9non-mon-C34G10.9non-sesentialC01G10.9non-C39F7.4essentialY54G11A.9non-F55P8.5non-M03F9.1essentialF55F8.5non-W03F9.1essentialF55F8.5non-W03F9.1essentialF55F8.5non-W03F9.1essentialF55F8.5non-W03F9.1essentialF55F8.5non-W03F9.1essentialF55F8.5non-W03F9.1essentialF55F8.5non-W03F9.1essentialF38A5.13non- <td>YP46 YEAST</td> <td>essential</td> <td>T20B12.1</td> <td>WBGene00012692</td> <td>x</td>	YP46 YEAST	essential	T20B12.1	WBGene00012692	x
YP67_YEAST YPT1_YEAST essentialT03D8.2WBGene00013218 WBGene00004266 xYPT1_YEAST YRB1_YEAST essentialT19A6.2WBGene00004266 xYRB1_YEAST essentialF57B10.8WBGene00003795 xYTM1_YEAST essentialC10H11.8WBGene00018893 xZPR1_YEAST essentialC10H11.8WBGene00001029ZU01_YEAST essentialC34E10.1 non-WBGene00001029essentialC34E10.1 non-C27C12.2 essentialessentialT04A8.6 essentialT04A8.6 essentialessentialT07A3.6 non-B0035.12 essentialessentialF41E6.3 essentialF41E6.10 non-non-T03F6.2 essentialF32H2.4 non-essentialF41E6.10 non-F55212.2 essentialessentialF41E6.10 non-F52C12.2 essentialessentialC07E3.2 non-B0024.11 essentialessentialC07E3.2 non-C39F7.4 essentialessentialY54G11A.9 non-C39F7.4 essentialessentialF55F8.5 non- w03F9.1 essentialF55F8.5 non- w03F9.1 essential	_	non-	C34B7 2	WBGene00013029	
YPT1_YEAST YPT3_YEAST YRB1_YEAST YRB1_YEAST essentialC04H5.1WBGene00004266 xxYRB1_YEAST YTM1_YEAST essentialF57B10.8WBGene00004271 xxYTM1_YEAST essentialF57B10.8WBGene00018893 vxZD01_YEAST essentialY53F4B.eWBGene000102999 vxZU01_YEAST essentialC16A3.7 essentialC16A3.7 essentialC34E10.1 non-non-C27C12.2 essentialmodelwBGene0001029essentialT04A8.6 essentialcssential r27A3.6 non-mon-mon-F55A12.8 essentialEssential r41E6.3 essentialF41E6.10 r41E6.4 essentialessentialF41E6.10 non-non-K08D12.c non-mon-K08D12.c non-mon-F52C12.2 essentialessentialC07E3.2 non-mon-C39E7.4 essentialessentialC01G10.9 non-c39F7.4 essentialY49E10.2 essentialessentialY55F8.5 non-W03F9.1 essentialF55F8.5 non-mon-F59A2.1 essentialF55F8.5 non-essentialF55F8.5 non-W03F9.1 essential	_				
YPT7_YEASTessentialT19A6.2WBGene00004271xYRB1_YEASTessentialF57B10.8WBGene00003795xYTM1_YEASTessentialC10H11.8WBGene00018893xZPR1_YEASTessentialY53F4B.eWBGene00001029ZU01_YEASTnon-Y53F4B.fWBGene00001029essentialC16A3.7essentialC34E10.1non-C27C12.2essentialT04A8.6essentialT27A3.6non-B0035.12essentialF41E6.4essentialF41E6.10non-T03F6.2essentialF32H2.4non-K08D12.hessentialK08D12.cnon-B0024.11essentialC07E3.2non-B0024.11essentialC05D11.1non-C39F7.4essentialY49E10.2essentialY49E10.2essentialF55F8.5non-G39F7.1essentialF55F8.5non-F59A2.1essentialF55F8.5non-W03F9.1essentialF55F8.53non-W03F9.1essentialF55F8.53non-W03F9.1essentialF55F8.53non-W03F9.1essentialF55F8.53non-W03F9.1essentialF55F8.53non-W03F9.1essentialF55F8.53non-W03F9.1essentialF38A5.13non-	—				
YRB1_YEASTessentialF57B10.8WBGene00003795xYTM1_YEASTessentialC10H11.8WBGene00018893xZPR1_YEASTessentialC16A3.7WBGene00001029ZU01_YEASTnon-C257C12.2essentialC34E10.1non-C27C12.2essentialT04A8.6essentialT27A3.6non-B035.12essentialF41E6.3essentialF41E6.4essentialF42E2.2essentialF32H2.4non-K08D12.hessentialC07E3.2non-B024.11essentialC07E3.2non-C39F7.4essentialY49E10.2essentialY49E10.2essentialY54C11A.9non-C39F7.4essentialF55F8.5non-F59A2.1essentialF55F8.5non-F55F8.53non-W3F9.1essentialF55F8.53non-W3F9.1essentialF38A5.13non-W3F9.1essentialF38A5.13non-W3F9.1	YPT1_YEAST	essential	C04H5.1	WBGene00004266	x
YRB1_YEASTessentialF57B10.8WBGene00003795xYTM1_YEASTessentialC10H11.8WBGene00018893xZPR1_YEASTessentialC16A3.7WBGene00001029ZU01_YEASTnon-C257C12.2essentialC34E10.1non-C27C12.2essentialT04A8.6essentialT27A3.6non-B035.12essentialF41E6.3essentialF41E6.4essentialF42E2.2essentialF32H2.4non-K08D12.hessentialC07E3.2non-B024.11essentialC07E3.2non-C39F7.4essentialY49E10.2essentialY49E10.2essentialY54C11A.9non-C39F7.4essentialF55F8.5non-F59A2.1essentialF55F8.5non-F55F8.53non-W3F9.1essentialF55F8.53non-W3F9.1essentialF38A5.13non-W3F9.1essentialF38A5.13non-W3F9.1	YPT7 YEAST	essential	T19A6.2	WBGene00004271	x
YTM1_YEASTessentialC10H11.8WBGene00018893xZPR1_YEASTessentialY53F4B.eWBGene00020999ZU01_YEASTnon-Y53F4B.fWBGene0001029essentialC16A3.7essentialC16A3.7essentialC34E10.1non-essentialnon-C27C12.2essentialT04A8.6essentialT04A8.6essentialT27A3.6non-F55A12.8essentialF41E6.3essentialF41E6.10non-sesentialnon-T03F6.2essentialF41E6.10non-K08D12.hessentialF32H2.4non-B0024.11essentialC07E3.2non-B0024.11essentialC05D11.1non-C54G4.6essentialY39B6B.0essentialY49E10.2essentialY49E10.2essentialY54G1LA.9non-C39F7.4essentialF55F8.5non-W03F9.1essentialF55F8.51.33non-					
ZPR1_YEAST ZU01_YEAST CU01_YEAST NON- essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential C16A3.7 essential T2A3.6 NON- Essential C1753.2 NON- Essential C07E3.2 NON- Essential C07E3.2 NON- Essential C05D11.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.2 essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential C05D1.1 NON- Essential F5F8.5 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- W03F9.1 Essential F38A5.13 NON- Essential F38A5.13 NON- Essential F38A5.13 NON- Essential F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F38A5.13 C16A2 F37A5 F37A5 F37A5 F37A5 F37A5 F37A5 F37A5 F37A5 F37A	_				
ZUO1_YEAST non- Y53F4B.f WBGene00001029 essential C16A3.7 essential C34E10.1 non- C27C12.2 essential M04B2.3 essential T04A8.6 essential T27A3.6 non- F55A12.8 essential F41E6.3 essential F41E6.4 essential F41E6.10 non- T03F6.2 essential F32H2.4 non- K08D12.h essential K08D12.c non- F52C12.2 essential C07E3.2 non- B0024.11 essential C07E3.2 non- B0024.11 essential C05D11.1 non- C54G4.6 essential C01G10.9 non- Y39B6B.0 essential Y49E10.2 essential Y49E10.2 essential Y49E10.2 essential S5F8.5 non- F59A2.1 essential F55F8.5 non- W03F9.1 essential F38A5.13 non-	_				x
-       essential       C16A3.7         essential       C34E10.1         non-       C27C12.2         essential       M04B2.3         essential       T04A8.6         essential       T27A3.6         non-       F55A12.8         essential       ZK688.3         non-       B035.12         essential       F41E6.3         essential       F41E6.4         essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       K08D12.c         non-       B0024.11         essential       C07E3.2         non-       B0024.11         essential       C01G10.9         non-       C39F7.4         essential       Y49E10.2         essential       W03C9.3         non-       F5PA2.1         essential       F5F8.5         non-       W03F9.1         essential       F5F8.5         non-       W03F9.1	ZPR1_YEAST	essential	Y53F4B.e	WBGene00020999	
-       essential       C16A3.7         essential       C34E10.1         non-       C27C12.2         essential       M04B2.3         essential       T04A8.6         essential       T27A3.6         non-       F55A12.8         essential       ZK688.3         non-       B035.12         essential       F41E6.3         essential       F41E6.4         essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       K08D12.c         non-       B0024.11         essential       C07E3.2         non-       B0024.11         essential       C01G10.9         non-       C39F7.4         essential       Y49E10.2         essential       W03C9.3         non-       F5PA2.1         essential       F5F8.5         non-       W03F9.1         essential       F5F8.5         non-       W03F9.1	ZUO1 YEAST	non-	Y53F4B.f	WBGene00001029	
essential C34E10.1 non- C27C12.2 essential M04B2.3 essential T04A8.6 essential T27A3.6 non- F55A12.8 essential ZK688.3 non- B0035.12 essential F41E6.3 essential F41E6.4 essential F41E6.10 non- T03F6.2 essential F32H2.4 non- K08D12.h essential K08D12.c non- F52C12.2 essential C07E3.2 non- B0024.11 essential C05D11.1 non- C54G4.6 essential C01G10.9 non- Y39B6B.0 essential Y49E10.2 essential Y49E10.2 essential Y54G11A.9 non- C39F7.4 essential W03C9.3 non- F59A2.1 essential F5F8.5 non- W03F9.1 essential F38A5.13 non- W03F9.1					
non-       C27C12.2         essential       M04B2.3         essential       T04A8.6         essential       T27A3.6         non-       F55A12.8         essential       ZK688.3         non-       B0035.12         essential       F41E6.3         essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       S0396B.0         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y49E10.2         essential       W03C9.3         non-       F59A2.1         essential       F5F8.5         non-       W03F9.1         essential       F38A5.13         non-       mo3F9.1					
essential M04B2.3 essential T04A8.6 essential T27A3.6 non- F55A12.8 essential ZK688.3 non- B0035.12 essential F41E6.3 essential F41E6.3 essential F41E6.10 non- T03F6.2 essential F32H2.4 non- K08D12.c non- F52C12.2 essential C07E3.2 non- B0024.11 essential C05D11.1 non- C54G4.6 essential C05D11.1 non- S4G4.6 essential Y49E10.2 essential Y49E10.2 essential Y49E10.2 essential W03C9.3 non- F55R3.5 non- W03F9.1 essential F38A5.13 non-		essential			
essential T04A8.6 essential T27A3.6 non- F55A12.8 essential ZK688.3 non- B0035.12 essential F41E6.3 essential F41E6.4 essential F41E6.4 essential F41E6.10 non- T03F6.2 essential F32H2.4 non- K08D12.h essential K08D12.c non- F52C12.2 essential C07E3.2 non- B0024.11 essential C05D11.1 non- C54G4.6 essential C05D11.1 non- C54G4.6 essential C01G10.9 non- Y39B6B.0 essential Y49E10.2 essential Y49E10.2 essential Y49E10.2 essential W03C9.3 non- F59A2.1 essential F55F8.5 non- W03F9.1 essential F38A5.13 non-		non-	C27C12.2		
essential T04A8.6 essential T27A3.6 non- F55A12.8 essential ZK688.3 non- B0035.12 essential F41E6.3 essential F41E6.4 essential F41E6.4 essential F41E6.10 non- T03F6.2 essential F32H2.4 non- K08D12.h essential K08D12.c non- F52C12.2 essential C07E3.2 non- B0024.11 essential C05D11.1 non- C54G4.6 essential C05D11.1 non- C54G4.6 essential C01G10.9 non- Y39B6B.0 essential Y49E10.2 essential Y49E10.2 essential Y49E10.2 essential W03C9.3 non- F59A2.1 essential F55F8.5 non- W03F9.1 essential F38A5.13 non-		essential	M04B2.3		
essential       T27A3.6         non-       F55A12.8         essential       ZK688.3         non-       B0035.12         essential       F41E6.3         essential       F41E6.4         essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       K08D12.c         non-       F52C12.2         essential       C07E3.2         non-       E5024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       C39F7.4         essential       W03C9.3         non-       F55A2.1         essential       F55R5.5         non-       F59A2.11         essential       W03C9.3         non-       F59A2.1         essential       F55R5.5         non-       W03F9.1         essential       F38A5.13         non-       W03F9.1					
non-       F55A12.8         essential       ZK688.3         non-       B0035.12         essential       F41E6.3         essential       F41E6.4         essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       K08D12.cc         non-       B0024.11         essential       C07E3.2         non-       B0024.11         essential       C01G10.9         non-       Y39B6B.o         essential       Y49E10.2         essential       Y49E10.2         essential       W3C9.3         non-       F55F8.5         non-       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       S8A5.13					
essential       ZK688.3         non-       B0035.12         essential       F41E6.3         essential       F41E6.4         essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       V3029.3         non-       C39F7.4         essential       W3C9.3         non-       F59A2.1         essential       F55F8.5         non-       W3F9.1         essential       F38A5.13         non-       S65F3.13					
non-       B0035.12         essential       F41E6.3         essential       F41E6.4         essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y49E10.2         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13		non-	F55A12.8		
non-       B0035.12         essential       F41E6.3         essential       F41E6.4         essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y49E10.2         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13		essential	ZK688.3		
essential F41E6.3 essential F41E6.4 essential F41E6.10 non- T03F6.2 essential F32H2.4 non- K08D12.h essential K08D12.c non- F52C12.2 essential C07E3.2 non- B0024.11 essential C05D11.1 non- C54G4.6 essential C01G10.9 non- Y39B6B.0 essential Y49E10.2 essential Y49E10.2 essential W03C9.3 non- C39F7.4 essential W03C9.3 non- F59A2.1 essential F55F8.5 non- W03F9.1 essential F38A5.13 non-					
essential       F41E6.4         essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       K08D12.c         non-       F52C12.2         essential       C07E3.2         non-       B024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.o         essential       Y49E10.2         essential       Y49E10.2         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       N03F9.1					
essential       F41E6.10         non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       K08D12.c         non-       F52C12.2         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.o         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       Sab5.13					
non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       K08D12.c         non-       F52C12.2         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.o         essential       Y49E10.2         essential       Y49E10.2         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       Sab5.13		essential	F41E6.4		
non-       T03F6.2         essential       F32H2.4         non-       K08D12.h         essential       K08D12.c         non-       F52C12.2         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.o         essential       Y49E10.2         essential       Y49E10.2         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       Sab5.13		essential	F41E6.10		
essential       F32H2.4         non-       K08D12.h         essential       K08D12.c         non-       F52C12.2         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.o         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       F55R3.5         non-       W03F9.1         essential       F38A5.13         non-       F38A5.13					
non-       K08D12.h         essential       K08D12.c         non-       F52C12.2         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.o         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       F55P8.5         non-       K03F9.1         essential       F55F8.53         non-       W03F9.1         essential       F38A5.13		-			
essential       K08D12.c         non-       F52C12.2         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C0IG10.9         non-       Y39B6B.o         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       F55P8.5         non-       F55P8.5         non-       W03F9.1         essential       F38A5.13         non-       F38A5.13					
non-       F52C12.2         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13		non-	K08D12.h		
non-       F52C12.2         essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13		essential	K08D12.c		
essential       C07E3.2         non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       F38A5.13					
non-       B0024.11         essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       F38A5.13					
essential       C05D11.1         non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       F38A5.13					
non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       W03C9.3         non-       F55P8.5         non-       W03F9.1         essential       F38A5.13         non-       K03F9.1		non-	B0024.11		
non-       C54G4.6         essential       C01G10.9         non-       Y39B6B.0         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       W03C9.3         non-       F55P8.5         non-       W03F9.1         essential       F38A5.13         non-       K03F9.1		essential	C05D11.1		
essential C01G10.9 non- Y39B6B.0 essential Y49E10.2 essential Y54G11A.9 non- C39F7.4 essential W03C9.3 non- F59A2.1 essential F55F8.5 non- W03F9.1 essential F38A5.13 non-					
non-       Y39B6B.0         essential       Y49E10.2         essential       Y54G11A.9         non-       C39F7.4         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       K18A5.13					
essential Y49E10.2 essential Y54G11A.9 non- C39F7.4 essential W03C9.3 non- F59A2.1 essential F55F8.5 non- W03F9.1 essential F38A5.13 non-					
essential Y54G11A.9 non- C39F7.4 essential W03C9.3 non- F59A2.1 essential F55F8.5 non- W03F9.1 essential F38A5.13 non-					
non-       C39F7.4         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       W03F9.1		essential	Y49E10.2		
non-       C39F7.4         essential       W03C9.3         non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       W03F9.1		essential	Y54G11A.9		
essential W03C9.3 non- F59A2.1 essential F55F8.5 non- W03F9.1 essential F38A5.13 non-					
non-       F59A2.1         essential       F55F8.5         non-       W03F9.1         essential       F38A5.13         non-       W03F9.1					
essential F55F8.5 non- W03F9.1 essential F38A5.13 non-		essential			
non- W03F9.1 essential F38A5.13 non-		non-	F59A2.1		
non- W03F9.1 essential F38A5.13 non-		essential	F55F8.5		
essential F38A5.13 non-					
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# Appendix Table 4.3. Features of C. elegans duplicate gene pairs

			-		
CE Name	CB Name	Prot_	Lengt	Ka	Ks
		id	h		
WBGene00008354	WBGene00029517	69.86	148	0.233	13.691
WBGene00009918	WBGene00032946	69.86	146	3	9
WBGene00008956	WBGene00023610	32.2	302	0.233	13.691
WBGene00021461	WBGene00026730	32.2	998	3	9
WBGene00016195	WBGene00030711	68.08	213	0.760	3.4968
^ WDCome00001221	WBGene00036885	68.08 41.69	213	7	3.4968
WBGene00001331	WBGene00041735 WBGene00041735	41.69	461 464	0.760 7	14.567 1
WBGene00011089	WBGene00023673	50.93	655	0.259	14.567
WBGene00011088	WBGene00025075	50.93	650	2	1
WBGene00017012	WBGene00033086	54.44	118	0.259	7.3706
WBGene00009218	WBGene00035798	54.44	94	2	7.3706
WBGene00022162	WBGene00035798	69.7	517	0.560	18.767
WBGene00001051	WBGene00039574	69.7	505	1	4
WBGene00016849	WBGene00040435	40.51	318	0.560	18.767
WBGene00018269	WBGene00027856	40.51	324	1	4
WBGene00008275	WBGene00026512	54.79	417	0.440	18.928
WBGene00017480	WBGene00026513	54.79	412	3	2
WBGene00003036	WBGene00035179	45.45	552	0.440	18.928
*	WBGene00037242	45.45	485	3	2
WBGene00004312	WBGene00025293	66.3	646	0.443	2.8373
*	WBGene00029486	66.3	692	9	2.8373
WBGene00003254	WBGene00036366	31.66	592	0.443	5.0746
WBGene00016380	WBGene00037717	31.66	608	9	5.0746
WBGene00003902	WBGene00032079	52.23	408	0.189	20.823
	WBGene00040600	52.23	423	6	9
WBGene00003903	WBGene00029678	n.d.	462	0.189 6	20.823 9
WBGene00017298	WBGene00023775 WBGene00026926	n.d. 50	393 152	0.629	-
WBGene00010663	WBGene00028928 WBGene00032071	50	146	1	16.399 3
WBGene00016728	WBGene00041223	29.71	138	0.629	16.399
WBGene00007254	WBGene00032315	29.71	143	1	3
WBGene00010398	WBGene00032933	46.35	722	0.367	11.586
WBGene00012129	WBGene00027197	46.35	673	2	3
WBGene00000205	WBGene00034641	52.45	217	0.367	11.586
WBGene00016729	WBGene00034640	52.45	206	2	3
WBGene00001425	WBGene00025033	34.72	1032	0.514	15.025
WBGene00001424	WBGene00025033	34.72	1275	6	6
WBGene00012031	WBGene00037234	37.96	326	0.514	15.025
WBGene00013049	WBGene00037235	37.96	248	6	6
WBGene00004386	WBGene00027801	81.15	191	0.268	18.806
WBGene00004385	WBGene00025918	81.15	191	1	7
WBGene00019435	WBGene00024343	71.01	338	0.268	18.806
WBGene00019146	WBGene00034868	71.01	634	1	7
WBGene00016374 WBGene00016373	WBGene00026186 WBGene00033815	43.53 43.53	326 349	0.888 6	n.d. n.d.
WBGene00007812	WBGene00029321	43.53	448	0.888	1.d. 2.7613
WBGene00009575	WBGene00029321 WBGene00024026	52.51	499	6	2.7613
WBGene00013140	WBGene00034303	46.25	367	0.368	10.565
*	WBGene00034302	46.25	376	3	4
WBGene00019827	WBGene00031144	51.88	165	0.368	10.565
*	WBGene00038538	51.88	347	3	4
WBGene00011637	WBGene00033040	65.5	211	n.d.	16.900
WBGene00015516	WBGene00033549	65.5	201	n.d.	5
WBGene00021787	WBGene00036571	30.82	652	0.384	16.900
WBGene00010456	WBGene00027003	30.82	645	5	5
WBGene00001253	WBGene00026215	30.54	708	0.384	17.638
*	WBGene00023788	30.54	481	5	9
WBGene00001186	WBGene00027436	32.82	282	0.869	17.638
*	WBGene00036088	32.82	262	3	9
WBGene00001646	WBGene00037818	50.21	780	0.869	9.1
WBGene00001647	WBGene00037818	50.21	729	3	9.1
WBGene00004272	WBGene00026485	19.18	444	0.457	18.25
* WBGene00004273	WBGene00038506 WBGene00026268	19.18 24.89	497 1156	4 0.457	18.25 2.9571
MDGEITE000042/3	MDGEITEOOOZOZOO	47.07	110	0.407	2.2011

WBGene00025942         24.89         21.80         4         2.9571           WBGene00004751         WBGene00042593         34.16         323         0.364         13           WBGene0007729         WBGene00032560         48.05         558         1.58         16.815           WBGene0000810         WBGene0003815         67.19         442         6         3           WBGene000881         WBGene0003825         57.19         442         3         1.50           WBGene000884         WBGene0003557         53.27         199         0.633         1.3.150           WBGene0004215         WBGene00042250         70.11         339         0.113         11.256           WBGene0004215         WBGene0002520         70.11         338         0.113         6.895           WBGene0002226         WBGene0002526         70.13         3293         1         9.2763           WBGene00021956         WBGene0002579         1.3.3         293         1         9.587           WBGene00021956         WBGene0002528         S.18.8         624         0.623         1.587           WBGene0002268         WBGene0002563         S.1.8         624         0.521         1.583           WBGene0002767 <th></th> <th>1</th> <th>T</th> <th>1</th> <th></th> <th></th>		1	T	1		
WBGene00004729         WBGene0003250         43.16         31.2         0.364         3           WBGene0007729         WBGene0003250         48.05         558         1.158         15.01           WBGene0001339         WBGene0003250         67.19         442         6         3           WBGene0000339         WBGene00034213         67.19         442         6         3           WBGene0000381         WBGene0003728         53.27         199         0.633         11.256           WBGene00004295         WBGene00032728         53.27         199         0.633         11.256           WBGene00004295         WBGene00022945         64.02         191         0.113         6.895           WBGene00012356         WBGene0002350         70.11         383         1         9.2763           WBGene00012395         WBGene00023950         1.4.022         199         2.6837           WBGene0001399         1.3.3295         0.161         9.587           WBGene0002195         WBGene0002595         1.4.275         0.625         8.633           WBGene0002195         WBGene00022195         1.18         614         9         10.831           WBGene000022195         WBGene00022107         51.18 <td>*</td> <td></td> <td></td> <td></td> <td></td> <td>2.9571</td>	*					2.9571
WBGene00008203         WBGene00032510         44.05         558         1.158         1.3150           WBGene0001343         WBGene0003350         67.19         449         6         3           WBGene0000836         WBGene00034278         38.66         552         4         3           WBGene00003425         WBGene00034278         38.66         552         4         3           WBGene0003425         WBGene00035728         53.27         260         4         2           WBGene00004215         WBGene0002950         70.11         359         2         2         6.8952           WBGene00029202         G4.02         199         2         6.8952         WBGene00029293         64.02         199         2         6.8952           WBGene0001932         WBGene0002932         1.3         3.81         9.2763         3         9.2763           WBGene00012935         WBGene0002359         n.d.         227         0.625         8.633           WBGene00012940         S1.18         624         0.625         10.831           WBGene0001284         WBGene0002268         S2.11         269         0.429         1.414           WBGene00012835         WBGene0002268         S2.14						
WBGene00012543         WBGene00032560         64.05         512         6         3           WBGene0001333         WBGene0003613         38.66         511         0.633         13.150           WBGene0000841         WBGene00037221         67.19         442         6         3           WBGene0000845         WBGene0003728         53.27         199         0.633         11.256           WBGene00004295         WBGene00022956         70.11         359         2         2           WBGene00012360         WBGene00022945         64.02         191         0.113         6.895           WBGene00012964         WBGene00021956         WBGene00011391         71.33         293         1         19.6773           WBGene00012956         WBGene00012528         n.d.         245         8.633           WBGene00021956         WBGene000225286         n.d.         245         8.633           WBGene0002408         WBGene0002408         59.11         260         0.429         10.831           WBGene0002408         WBGene0002408         59.11         266         0.429         10.831           WBGene0002407         S9.11         266         0.429         10.831           WBGene0003563						-
NBGene0011543         WBGene0003850         67.19         459         1.158         1.150           WBGene0000366         WBGene00036613         38.66         591         0.633         13.150           WBGene00003825         WBGene0003728         53.27         199         0.633         11.256           WBGene0003558         WBGene00035728         53.27         260         4         2           WBGene00004255         WBGene00042950         70.11         359         2         2           WBGene0001958         WBGene00029932         64.02         199         2         6.8952           WBGene0001932         WBGene00029932         64.02         199         2         6.8952           WBGene0001935         WBGene00023957         1.3         295         0.196         19.587           WBGene0001256         WBGene00023653         51.18         624         0.625         10.831           WBGene00012357         WBGene00023668         5.74         441         0.429         1.41.81           WBGene00017436         WBGene0002408         59.11         266         1.9         9           WBGene00017436         WBGene0002408         59.11         269         0.429         1.0.811						
WBGene00010339         WBGene00027221         67.19         442         6         3           WBGene0000841         WBGene0003613         38.66         591         0.633         11.250           WBGene0000849         WBGene0003728         53.27         199         0.633         11.256           WBGene0004295         WBGene00042950         70.11         333         0.113         11.256           WBGene00042950         70.11         359         2         2           WBGene00042950         70.11         359         2         2           WBGene0001439         WBGene00029620         70.11         359         2         2           WBGene0001439         WBGene00029630         70.11         359         2         2           WBGene00013280         WBGene00029930         70.4         227         0.625         8.633           WBGene00002980         R.d.         245         8         6.633           WBGene00002065         WBGene0002006         51.18         624         0.625         8.633           WBGene00002668         RC:74         411         0.429         10.831           WBGene00003655         WBGene0002707         51.18         624         0.521					-	-
WBGene00000841         WBGene0003613         38.66         511         0.633         11.150           WBGene00003425         WBGene0003571         53.27         199         0.633         11.256           WBGene0001558         WBGene0002950         70.11         383         0.113         11.256           WBGene00022950         70.11         383         0.113         11.256           WBGene00029262         WBGene00029932         64.02         199         2         6.8952           WBGene0001932         WBGene00029932         64.02         199         2         6.8952           WBGene0001938         WBGene00029932         64.02         199         2         6.8952           WBGene0001935         WBGene00023959         n.d.         227         0.625         8.633           WBGene00006715         WBGene00023053         51.18         624         0.625         10.831           WBGene00006715         WBGene00029068         52.74         441         0.429         10.811           WBGene00003563         WBGene00029068         62.74         441         0.429         10.811           WBGene0001735         WBGene00032307         53.82         450         0.531         6.3726						
WBGene00003825         WBGene00038271         53.27         199         0.633         11.256           WBGene00006499         WBGene0002728         53.27         260         4         2           WBGene00014215         WBGene0002950         70.11         383         0.113         11.256           WBGene00012950         70.11         383         0.113         6.8952           WBGene00012926         WBGene00013838         WBGene00013956         64.02         199         2         6.8952           WBGene00013838         WBGene00013957         VBGene00013957         19.587         VBGene00012528         n.1.         227         0.625         8.633           WBGene00006715         WBGene00022906         51.18         624         0.625         10.831           WBGene00006715         WBGene00022906         52.11         269         0.429         10.831           WBGene00003557         WBGene00022906         52.11         266         8.633         WBGene0001745         WBGene00022966         62.74         441         0.429         10.811           WBGene0001745         WBGene00023060         63.22         450         0.531         3.4483           WBGene0001743         WBGene00023260         68.54         <					-	
WBGene0003528         WBGene00035728         53.27         199         0.633         11.256           WBGene0001558         WBGene00042950         70.11         385         2         2           WBGene00012126         WBGene00029945         64.02         199         2         6.8952           WBGene00018398         WBGene00029945         64.02         199         2         6.8952           WBGene0001932         WBGene00021500         WBGene00021901         38.81         34         1         9.2763           WBGene00011935         WBGene00022867         n.13         293         1         9.587           WBGene0001256         WBGene0002286         n.d.         227         0.625         8.633           WBGene00002288         MBGene0002286         62.74         41         0.429         10.831           WBGene0000355         WBGene00024008         51.18         606         8         9           WBGene0001355         WBGene00024068         62.74         437         1         9.4114           WBGene00012864         WBGene0001237         51.28         0.531         6.3726           WBGene00012844         WBGene00012844         35.24         677         9         3.4483						
WBGene00016558WBGene0001295070.113830.11311.256WBGene000121260WBGene0002294564.021910.1136.895WBGene000121260WBGene0002563238.813740.1969.2763WBGene000212932WBGene00021932(4.021926.8952WBGene00011932WBGene00021932(4.0219926.8952WBGene00011932WBGene000119171.33293119.587WBGene00012156WBGene00025286n.d.24588.633WBGene00006757WBGene00025268n.d.24588.633WBGene00006715WBGene0002210651.1860689WBGene00003565WBGene0002210651.186240.62510.831WBGene00003565WBGene0002266862.744410.4299.4114WBGene0001763WBGene000230963.824500.5316.3726WBGene0001763WBGene000320963.824500.33713.468WBGene001773WBGene000326068.5417821WBGene001773WBGene000326068.5417821WBGene001911WBGene000236068.5417821WBGene0019210WBGene0002777166.184140.173WBGene0019380WBGene0002775166.184190.26810.173WBGene0001930WBGene000247174.54855WBGene0001930WBGene000247174.54 <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td>						-
WBGene00010558         WBGene00042950         70.11         383         0.113         11.256           WBGene00021260         WBGene00029935         64.02         191         0.113         6.895           WBGene00018398         WBGene00029935         64.02         199         2         6.8955           WBGene00018398         WBGene0002150         WBGene00021950         10.113         6.1955           WBGene00021250         WBGene00022580         n.d.         227         0.625         8.633           WBGene00022288         MBGene0002288         n.d.         227         0.625         10.831           WBGene00006715         WBGene0002286         n.d.         227         0.625         8.633           WBGene0000355         WBGene00024008         55.11         8         6.33           WBGene0000355         WBGene00024008         55.11         266         9           WBGene0001355         WBGene0002366         62.74         437         1         9.4114           WBGene0001373         WBGene0002366         62.74         437         1         9.4114           WBGene0012384         WBGene001377         35.42         468         0.531         3.4483           WBGene00012834 <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td></th<>						
WBGene000421260         WBGene00029945         64.02         191         0.113         66.8952           WBGene00029263         64.02         191         0.113         66.8952           WBGene00011925         WBGene00029932         64.02         191         0.1163         66.8952           WBGene00011925         WBGene00011901         38.81         374         0.196         9.2763           WBGene00011256         WBGene00035270         71.33         293         1         19.587           WBGene00006757         WBGene00025253         61.4         245         8         8.633           WBGene00000755         WBGene00022006         51.18         606         8         9           WBGene00003555         WBGene00022066         62.74         441         0.429         9.4114           WBGene0001763         WBGene0003266         62.74         441         0.429         9.4114           WBGene00017743         WBGene0003266         62.74         437         1         9.4114           WBGene00017743         WBGene0003260         68.54         180         0.387         13.468           WBGene001773         WBGene0002366         62.74         437         1         4414 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td></t<>						
WBGene00029260         WBGene00029932         64.02         191         0.113         6.8952           WBGene00018398         WBGene00025632         38.81         374         0.196         9.2763           WBGene00011920         WBGene00023527         71.33         293         1         19.587           WBGene00012956         WBGene00023258         n.d.         227         0.625         8.633           WBGene00006715         WBGene00024005         51.18         624         0.625         10.831           WBGene00003563         WBGene00024006         59.11         286         9         9           WBGene0003565         WBGene00024066         62.74         437         1         9.4114           WBGene0003565         WBGene00031037         63.82         450         0.531         6.3726           WBGene00012834         WBGene00031037         63.82         450         0.531         6.3726           WBGene0012844         MBGene000330         81.5         770         9         3.4483           WBGene0012844         WBGene0003303         81.5         775         2         1           WBGene0002911         WBGene0003303         81.5         775         2         1						
WBGene00018398         WBGene0002932         64.02         199         2         6.8952           WBGene00011932         WBGene00041901         38.81         374         0.196         9.2763           WBGene00011950         WBGene00035270         71.33         295         0.196         19.587           WBGene00020298         WBGene00025286         n.d.         227         0.625         8.633           WBGene0000715         WBGene00025286         n.d.         245         8         8.633           WBGene0000716         WBGene00024007         51.18         606         8         9           WBGene0003462         WBGene00024007         59.11         266         0.429         10.831           WBGene0001743         WBGene00031037         63.82         450         0.531         6.3726           WBGene0001743         WBGene00031037         63.82         450         0.531         3.4483           WBGene0001710         WBGene00032360         66.54         180         0.387         13.468           WBGene0002144         WBGene00032360         66.54         180         0.387         13.468           WBGene0002142         WBGene0003303         38.15         745         2         1 </td <td></td> <td></td> <td></td> <td></td> <td>0.113</td> <td>6.895</td>					0.113	6.895
WBGene00011932         WBGene00041901         38.81         338         1         9.2763           WBGene00021956         WBGene0003570         7.33         295         0.196         19.587           WBGene00020298         WBGene00035570         n.d.         245         8         8.633           WBGene0003655         51.18         624         0.625         10.831           WBGene0003655         WBGene00024008         59.11         266         8         9           WBGene0003563         WBGene00024668         62.74         437         1         9.4114           WBGene00017436         WBGene00032099         63.82         450         0.531         6.3726           WBGene00017436         WBGene00031037         63.82         450         0.531         3.4483           WBGene00017470         WBGene00032360         68.54         186         0.387         13.468           WBGene0002109         WBGene00032360         68.54         187         1         1           WBGene0002202         WBGene00032360         68.54         187         1         1           WBGene0002320         WBGene0003230         38.15         745         2         1           WBGene0002903	WBGene00009262	WBGene00029932	64.02	199	2	6.8952
WBGene00021356         WBGene00035270         71.33         295         0.196         19.587           WBGene0006757         WBGene00023359         n.d.         227         0.625         8.633           WBGene00021288         WBGene00025286         n.d.         245         8         8.633           WBGene00013557         WBGene00024008         59.11         266         9           WBGene0003563         WBGene00024007         59.11         286         1         9           WBGene0001743         WBGene00024068         62.74         431         9.4114           WBGene0001743         WBGene00031037         63.82         450         0.531         6.3726           WBGene0001773         WBGene00031037         63.82         457         9         6.3726           WBGene0002142         WBGene00030303         31.5         70         0.387         13.468           WBGene0002111         WBGene00030303         81.5         745         2         1           WBGene0002902         WBGene0003697         8.92         205         0.268         16.577           WBGene0002902         WBGene0003697         8.92         205         0.268         16.577           WBGene00002902	WBGene00018398	WBGene00025632	38.81	374	0.196	9.2763
WBGene00011250         WBGene00023270         71.33         293         1         19.587           WBGene00022395         n.d.         227         0.625         8.633           WBGene00025286         n.d.         245         8         8.633           WBGene0003565         WBGene00024008         51.18         664         0.625         10.831           WBGene0003565         WBGene00024008         59.11         269         0.429         10.831           WBGene0003565         WBGene00024668         62.74         437         1         9.4114           WBGene00012844         WBGene00031037         35.42         450         0.531         6.3726           WBGene0001701         WBGene00031037         35.42         468         0.387         13.468           WBGene0002110         WBGene00032360         68.54         180         0.387         13.468           WBGene00019801         WBGene00036974         38.15         775         2         1           WBGene0001980         WBGene00036974         38.15         775         2         1           WBGene0001980         WBGene00027577         66.18         414         8         10.173           WBGene0001980         WBGene0003697	WBGene00011932	WBGene00041901		338		9.2763
WBGene00006757         WBGene000232959         n.d.         227         0.625         8.633           WBGene00006715         WBGene00036253         S1.18         606         8         9           WBGene00009462         WBGene00024008         59.11         269         0.429         10.831           WBGene00009462         WBGene00024007         59.11         269         0.429         9.4114           WBGene00013653         WBGene00023668         62.74         441         0.429         9.4114           WBGene00017436         WBGene00031037         63.82         457         9         6.3726           WBGene0001743         WBGene00023260         68.54         180         0.387         13.468           WBGene00020142         WBGene00033030         38.15         770         0.387         13.468           WBGene00020142         WBGene00036047         38.15         745         2         1           WBGene0009903         WBGene00027571         66.18         414         8         10.173           WBGene0001930         WBGene00031037         73.92         205         0.268         16.577           WBGene00022456         WBGene00036043         78.92         205         0.268         16.577 </td <td>WBGene00021956</td> <td>WBGene00041901</td> <td>71.33</td> <td>295</td> <td>0.196</td> <td>19.587</td>	WBGene00021956	WBGene00041901	71.33	295	0.196	19.587
WBGene00020298         WBGene00025286         n.d.         245         8         8.633           WBGene00006716         WBGene00022006         51.18         624         0.625         10.831           WBGene00013957         WBGene00024008         59.11         269         0.429         10.831           WBGene00003563         WBGene00029668         62.74         437         1         9.4114           WBGene00012834         WBGene00031037         63.82         450         0.531         6.3726           WBGene0012834         WBGene00032360         68.54         178         2         1           WBGene0002109         WBGene00032360         68.54         178         2         1           WBGene00021142         WBGene00032360         68.54         178         2         1           WBGene0002142         WBGene00036974         38.15         770         0.387         13.468           WBGene00019903         WBGene00027571         66.18         419         0.268         10.173           WBGene00019932         WBGene00021330         78.92         205         8         9           WBGene00022456         WBGene0002333         78.92         205         8         9						
WBGene00006715         WBGene00036253         51.18         624         0.625         10.831           WBGene00013957         WBGene00024006         53.11         269         0.429         10.831           WBGene00013957         WBGene00024007         59.11         286         1         9           WBGene00013563         WBGene00028668         62.74         437         1         9.4114           WBGene00017436         WBGene00031037         63.82         450         0.531         6.3726           WBGene0001773         WBGene00023360         68.54         180         0.387         13.4483           WBGene00020142         WBGene00032360         68.54         178         2         1           WBGene00020142         WBGene00030303         38.15         770         0.387         13.468           WBGene00020142         WBGene0003774         38.15         745         2         1           WBGene00019901         WBGene0002757         66.18         419         0.268         16.577           WBGene0002328         WBGene0002303         20.39         392         5         9           WBGene0002323         WBGene00034778         80.26         5         5           WBGene0006						
WBGene00006716         WBGene00029106         51.18         606         8         9           WBGene00009462         WBGene00024007         59.11         269         0.429         10.831           WBGene00003563         WBGene00029668         62.74         441         0.429         9.4114           WBGene00017436         WBGene00031037         63.82         457         9         6.3726           WBGene0001773         WBGene00023260         68.54         180         0.387         13.4483           WBGene0002111         WBGene000332360         68.54         178         2         1           WBGene00020142         WBGene00033260         68.54         178         2         1           WBGene00020142         WBGene00033030         38.15         745         2         1           WBGene00020142         WBGene00037571         66.18         419         0.268         10.173           WBGene00019902         WBGene00029059         78.92         205         0.268         16.577           WBGene000122456         WBGene00031038         20.39         392         5         9           WBGene00022017         46.64         1342         0.868         16.577           WBGene0002202<				-	-	
WBGene00013957         WBGene00024008         59.11         269         0.429         10.831           WBGene00003565         WBGene00029668         62.74         437         1         9.4114           WBGene0001365         WBGene00031037         63.82         450         0.531         6.3726           WBGene00012834         WBGene00031037         63.82         458         0.531         3.4483           WBGene00017673         WBGene00032360         68.54         180         0.387         13.468           WBGene00020142         WBGene00032360         68.54         180         0.387         13.468           WBGene00019811         WBGene00030303         38.15         770         0.387         13.468           WBGene00019903         WBGene00027571         66.18         414         8         10.173           WBGene00019903         WBGene00031037         20.5         0.268         16.577           WBGene00019903         WBGene00031037         20.5         9.265         0.268         16.577           WBGene00019903         WBGene00031037         20.39         368         0.868         16.577           WBGene00019904         WBGene00023138         20.39         392         5         9     <				-		
WBGene00009462         WBGene00024007         59.11         286         1         9           WBGene00003563         WBGene00029668         62.74         441         0.429         9.4114           WBGene00013636         WBGene0002909         63.82         450         0.531         6.3726           WBGene00017436         WBGene00031037         63.82         457         9         6.3726           WBGene00017673         WBGene00032360         68.54         180         0.387         13.468           WBGene00020142         WBGene00032360         68.54         178         2         1           WBGene00020142         WBGene00036974         38.15         745         2         1           WBGene00019801         WBGene00027571         66.18         419         0.268         16.577           WBGene0001984         WBGene00031030         20.5         8         9         9         860ene0001983         WBGene00024017         70.348         1.296           WBGene00012245         WBGene00031038         20.39         392         5         9         9         860ene00012401         46.64         1342         0.868         11.296           WBGene00006938         WBGene00036231         76.73         <					-	-
WBGene00003563         WBGene00029668         62.74         441         0.429         9.4114           WBGene00017436         WBGene00032099         63.82         450         0.531         6.3726           WBGene00017673         WBGene00031037         63.82         457         9         6.3726           WBGene00017073         WBGene00023030         68.54         180         0.387         13.468           WBGene00020142         WBGene00032360         68.54         178         2         1           WBGene00020142         WBGene00033697         38.15         770         0.387         13.468           WBGene00019801         WBGene00036974         38.15         745         2         1           WBGene00019902         WBGene00027571         66.18         419         0.268         10.173           WBGene00019232         WBGene00031302         20.59         8         9         9           WBGene00012255         WBGene000343         78.92         205         8         9           WBGene00004930         WBGene0003444         43.72         242         1.036         14.588           WBGene00014265         WBGene000344778         69.12         611         1.036         14.588						
WBGene00003565         WBGene00029668         62.74         437         1         9.4114           WBGene00017436         WBGene00031037         63.82         450         0.531         6.3726           WBGene00017673         WBGene00031037         35.42         468         0.531         3.4483           WBGene0002109         WBGene00032360         68.54         180         0.387         13.468           WBGene00020142         WBGene00032360         68.54         178         2         1           WBGene00020142         WBGene00036974         38.15         770         0.387         13.468           WBGene00009903         WBGene00027571         66.18         419         0.268         10.173           WBGene0001984         WBGene00031037         78.92         205         8         9           WBGene00019245         WBGene00024017         78.92         205         8         11.296           WBGene00006938         WBGene0002118         46.64         1342         0.868         11.296           WBGene00006938         WBGene00034778         69.12         611         1.036         11.296           WBGene00015774         WBGene00038231         76.73         433         0.747         14.588						-
WBGene00017436WBGene0003209963.824500.5316.3726WBGene00017673WBGene0003103763.8245796.3726WBGene00019710WBGene0002434435.4266793.4483WBGene0002109WBGene0003236068.541800.38713.468WBGene00021142WBGene0003003038.157700.38713.468WBGene000290142WBGene0003697438.1574521WBGene0009902WBGene0002757166.18414810.173WBGene0001984WBGene0002757166.18414810.173WBGene0002322WBGene0003604378.922050.26816.577WBGene0002456WBGene0003130820.393680.86811.296WBGene00006938WBGene0002411746.6488055WBGene0000736WBGene0003523343.722421.03611.296WBGene0000736WBGene0003823176.734930.74714.588WBGene00014577WBGene0003823176.7343728WBGene00014578WBGene0002857148.766090.40814.889WBGene000145457.745310.4082.91083WBGene0003845WBGene0003564459.569271.2477.1603WBGene0003846WBGene0003564459.5636223WBGene0003845WBGene000364370.5514752.9108WBGene0003846 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td></t<>						
WBGene00012834WBGene0003103763.8245796.3726WBGene00017773WBGene00023103735.424680.5313.4483WBGene00020109WBGene0002326068.541800.38713.468WBGene00020142WBGene0003236068.5417821WBGene00019811WBGene0003697438.157700.38713.468WBGene00019902WBGene0002757166.18414810.173WBGene00019933WBGene000295978.922050.26816.577WBGene0001994WBGene0002905978.922050.26816.577WBGene0001994WBGene0002173720.393680.86816.577WBGene0001925WBGene000211846.6413420.86811.296WBGene00006938WBGene0002401746.6488055WBGene0000736WBGene0003477869.126111.03611.296WBGene0001573WBGene000321776.734930.74714.588WBGene0001652WBGene000323176.734930.74714.588WBGene00014113369.12600688WBGene00014269WBGene00032377443.7523623WBGene00014269WBGene000323176.734930.74714.588WBGene00014269WBGene0003257443.7523623WBGene00014269WBGene0002640343.7523623WBGene00014269 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td></td<>						
WBGene00017673         WBGene00021037         35.42         468         0.531         3.4483           WBGene00020109         WBGene00023260         68.54         180         0.387         13.468           WBGene00020142         WBGene00032360         68.54         178         2         1           WBGene00020142         WBGene00032360         68.54         178         2         1           WBGene00019801         WBGene00036974         38.15         770         0.387         13.468           WBGene00019902         WBGene00027571         66.18         414         8         10.173           WBGene00022456         WBGene00031308         20.39         368         0.868         16.577           WBGene00019232         WBGene00029118         46.64         1342         0.868         11.296           WBGene00004930         WBGene0003233         43.72         242         1.036         11.296           WBGene00004930         WBGene0003233         43.72         242         1.036         14.588           WBGene0001824         WBGene0003233         43.72         242         1.036         14.588           WBGene000284         WBGene003233         43.72         242         1.036         14.588<						
WBGene00019710         WBGene00024344         35.42         677         9         3.4483           WBGene00020109         WBGene00032360         68.54         180         0.387         13.468           WBGene00021142         WBGene00030030         38.15         770         0.387         13.468           WBGene00019801         WBGene00036974         38.15         745         2         1           WBGene00019902         WBGene00027571         66.18         414         8         10.173           WBGene00019232         WBGene00036043         78.92         205         8         9           WBGene00019245         WBGene00029059         78.92         205         8         9           WBGene00012925         WBGene00021308         20.39         368         0.868         16.577           WBGene00006938         WBGene00024017         46.64         1342         0.868         11.296           WBGene0000736         WBGene00035233         43.72         242         1.036         11.588           WBGene0000736         WBGene00038231         76.73         493         0.747         14.588           WBGene00015778         WBGene00038231         76.73         437         2         3					-	
WBGene00020109WBGene0003236068.541800.38713.468WBGene00020111WBGene0003236068.5417821WBGene00019801WBGene0003697438.157700.38713.468WBGene00009902WBGene0002757166.184190.26810.173WBGene00022456WBGene0002757166.18414810.173WBGene00022456WBGene0003604378.9220589WBGene00022456WBGene0002211846.6413420.86811.296WBGene00006938WBGene0002401746.6488055WBGene00007036WBGene0003523343.722421.03611.296WBGene00007036WBGene0003477869.126111.03614.588WBGene0001652WBGene000323176.7343728WBGene00014652WBGene000323176.7343723WBGene00014652WBGene000323176.7343723WBGene00014652WBGene000323176.7343723WBGene00014652WBGene0003257148.766090.40814.889WBGene00012718WBGene00031948.7662523WBGene00012718WBGene00031948.7662523WBGene0001404WBGene00031948.7662523WBGene0001271WBGene00031948.7662523WBGene0001454F7.745882 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td></td<>						
WBGene00009111WBGene0003030068.5417821WBGene00019012WBGene0003003038.157700.38713.468WBGene00019801WBGene0004084266.184190.26810.173WBGene00009903WBGene000295978.922050.26816.577WBGene00011984WBGene0003604378.922050.26816.577WBGene00019232WBGene0003130820.3939259WBGene00019255WBGene00013130820.3939259WBGene0001925WBGene0002401746.6413420.86811.296WBGene00004930WBGene0003477869.126111.03614.588WBGene00007954WBGene0003523343.722421.03611.296WBGene00015778WBGene0003823176.734930.74714.588WBGene000147869.126111.03614.588WBGene00014778WBGene0003823176.7343728WBGene00014770WBGene0002857148.766090.40814.889WBGene00014270WBGene0002360967.745310.4082.9108WBGene00012778WBGene0002364459.569271.2477.1603WBGene00022718WBGene0003564459.569271.2477.1603WBGene0003846WBGene000268370.551460.9811.2764WBGene0003846WBGene000268370.551460.9811.2764WBGe					-	
WBGene00020142         WBGene0003030         38.15         770         0.387         13.468           WBGene00019801         WBGene00036974         38.15         745         2         1           WBGene00009902         WBGene00027571         66.18         419         0.268         10.173           WBGene00019922         WBGene00027571         66.18         414         8         10.173           WBGene00019232         WBGene00036043         78.92         205         8         9           WBGene00019255         WBGene00031308         20.39         368         16.577           WBGene00006940         WBGene00024017         46.64         1342         0.868         11.296           WBGene00007036         WBGene00034778         69.12         611         1.036         14.588           WBGene0001652         WBGene00034778         69.12         600         6         8           WBGene00016577         WBGene00038231         76.73         437         2.84         0.747         14.588           WBGene00015778         WBGene00035774         43.75         236         2         3           WBGene00014669         WBGene00026403         43.75         236         2         3 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td></tr<>						
WBGene00019801WBGene0003697438.1574521WBGene0009902WBGene0002757166.184190.26810.173WBGene0001984WBGene0002905978.922050.26816.577WBGene00022456WBGene0003604378.9220589WBGene00019295WBGene0003130820.393680.86816.577WBGene00006938WBGene000241746.6413420.86811.296WBGene00006940WBGene0003523343.722421.03611.296WBGene00007954WBGene0003477869.126111.03614.588WBGene0001652WBGene0003823176.734930.74714.588WBGene0001655WBGene0002640343.752540.74714.889WBGene0001270WBGene0002640343.7523623WBGene0001270WBGene0002657148.7662523WBGene00012718WBGene0003564459.5636227.1603WBGene0003846WBGene0003664459.5636227.1603WBGene0001915WBGene0003664459.5636227.1603WBGene00016810WBGene0002720060.354611.2475.8279*WBGene0001685WBGene0002720060.3546525.8279WBGene0000110WBGene0002720060.3546527.1603WBGene0000110WBGene000272060.3546525.8279*<						
WBGene00009902WBGene0004084266.184190.26810.173WBGene00019903WBGene0002757166.18414810.173WBGene000232WBGene0003604378.922050.26816.577WBGene00024266WBGene0003130820.393680.86816.577WBGene00006938WBGene00024157320.393680.86811.296WBGene00006930WBGene0002401746.6413420.86811.296WBGene00006940WBGene0003523343.722421.03611.296WBGene00007036WBGene0003477869.126111.03614.588WBGene0001652WBGene0003823176.734930.74714.588WBGene0001652WBGene0003823176.7343728WBGene00014269WBGene0002640343.7523623WBGene00014270WBGene0002640343.7523623WBGene00012718WBGene0002640343.7523623WBGene00012718WBGene0002657148.7662523WBGene0001955WBGene0003564459.5636227.1603WBGene0003846WBGene0003564459.5636227.1603WBGene0001685WBGene0002723060.354611.2475.8279*WBGene0003846F9.551460.9811.2764*WBGene0003846F9.551460.9811.2764*WBGene000110 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td></td<>						
WBGene00010984WBGene0002905978.922050.26816.577WBGene0002232WBGene0003604378.9220589WBGene00022456WBGene0001157320.393680.86816.577WBGene00006938WBGene0002911846.6413420.86811.296WBGene00006930WBGene0002401746.6488055WBGene00007036WBGene0003523343.722421.03611.296WBGene00016652WBGene0003477869.126111.03614.588WBGene00016652WBGene0003823176.734930.74714.588WBGene00016652WBGene0003823176.734930.74714.889WBGene00014269WBGene0002640343.7523623WBGene00014269WBGene0002857148.766090.40814.889WBGene0001270WBGene0002360967.745310.4082.9108WBGene0001915WBGene0003564459.569271.2477.1603WBGene00003846WBGene0003564459.5636227.1603WBGene00008810WBGene0002723060.354611.2475.8279*WBGene000389370.551460.9811.2764*WBGene0003899370.551460.9811.2764WBGene00006388WBGene0003499370.551460.9811.2764WBGene00006389WBGene000354976.183220.77110.044W				419	0.268	10.173
WBGene00009232WBGene0003604378.9220589WBGene00019295WBGene0003130820.393680.86816.577WBGene0006938WBGene0002911846.6413420.86811.296WBGene00006940WBGene0002401746.6488055WBGene00007036WBGene0003523343.722421.03611.296WBGene00017036WBGene0003477869.126111.03614.588WBGene0001652WBGene0003823176.734930.74714.588WBGene00016572WBGene0003823176.7343728WBGene00014269WBGene0002640343.7523623WBGene00014270WBGene0002857148.766090.40814.889WBGene00012718WBGene0002360967.745310.4082.9108WBGene00012718WBGene0002360967.7458822.9108WBGene00012718WBGene0002364459.569271.2477.1603WBGene00013845WBGene0003564459.569271.2477.1603WBGene00003846WBGene0002723060.354611.2475.8279*WBGene0003806660.3546525.8279WBGene00006810WBGene000242370.551460.9811.2764WBGene00006110WBGene000242370.551460.9811.2764WBGene00006110WBGene0002429976.183220.77110.044	WBGene00009903	WBGene00027571	66.18	414	8	10.173
WBGene00022456WBGene0004157320.393680.86816.577WBGene00019295WBGene0002911846.6413420.86811.296WBGene00006938WBGene0002401746.6488055WBGene00004930WBGene0003648443.722421.03611.296WBGene0002082WBGene0003523343.7225465WBGene0001652WBGene0003477869.126111.03614.588WBGene0001652WBGene0003823176.734930.74714.588WBGene00015778WBGene0002640343.7523623WBGene0001404WBGene0002857148.766090.40814.889WBGene0001270WBGene000286967.745310.4082.9108WBGene0003845WBGene0003564459.569271.2477.1603WBGene0003846WBGene000386459.5636227.1603WBGene00006810WBGene000386459.5636225.8279WBGene0000110WBGene000282370.551460.9811.2764*WBGene000386459.563225.82793.8279WBGene0000110WBGene000386455.514751.2764WBGene0000110WBGene000349370.5514751.2764WBGene00006388WBGene000354976.1832186WBGene0006389WBGene000354976.1832186WBGene0006389WBGene00035	WBGene00010984	WBGene00029059	78.92	205	0.268	16.577
WBGene00019295WBGene0003130820.3939259WBGene00006938WBGene0002401746.6413420.86811.296WBGene00004930WBGene0003648443.722421.03611.296WBGene00007036WBGene0003523343.7225465WBGene00007036WBGene0003477869.126111.03614.588WBGene0001652WBGene0003823176.734930.74714.588WBGene00015778WBGene0003823176.7343728WBGene000140269WBGene0002857143.752540.74714.889WBGene0001404WBGene0002857148.766090.40814.889WBGene0001925WBGene0002360967.745310.4082.9108WBGene0003845WBGene0003564459.5636227.1603WBGene0003846WBGene000386459.5536227.1603WBGene00010685WBGene0002853370.551460.9811.2764WBGene0003845WBGene0003564459.5536225.8279WBGene0003846WBGene0002682370.551460.9811.2764WBGene0000110WBGene0002682370.5514751.2764WBGene00006388WBGene0003549976.1832186WBGene00006389WBGene0003549976.1832186WBGene0006389WBGene0003549976.1832186WBGene0006389	WBGene00009232	WBGene00036043	78.92	205	8	9
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WBGene00010685       WBGene00026823       70.55       146       0.981       1.2764         *       WBGene00034993       70.55       147       5       1.2764         WBGene0000110       WBGene00041499       54.84       557       0.981       n.d.         WBGene0000111       WBGene00029579       76.18       322       0.771       10.044         WBGene00016389       WBGene00035192       42.74       480       0.771       10.044         WBGene00022610       WBGene00023764       42.74       540       8       6         WBGene00008924       WBGene00034955       30.9       1383       0.497       2.5368	WBGene00006810	WBGene00027230	60.35	461	1.247	5.8279
*         WBGene00034993         70.55         147         5         1.2764           WBGene00000110         WBGene00041499         54.84         557         0.981         n.d.           WBGene00000111         WBGene00041499         54.84         542         5         n.d.           WBGene00006388         WBGene00029579         76.18         322         0.771         10.044           WBGene00016589         WBGene00035499         76.18         321         8         6           WBGene00022610         WBGene00023764         42.74         480         0.771         10.044           WBGene00008924         WBGene00034955         30.9         1383         0.497         2.5368	*	WBGene00038066		465	2	
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	MDGETTE 000100//	wbGette00030334	50.9	12/4	/	2.000

WBGene00022717         WBGene00022775         47.31         444         0.497         16.716           WBGene00001836         WBGene00023250         49.08         478         0.23         16.716           WBGene0001836         WBGene00023243         64.08         309         0.581         16.227           WBGene00003761         66.01         153         0.581         16.227           WBGene00003761         66.01         168         7         4           WBGene00003761         62.01         168         7         4           WBGene00001754         WBGene0003761         62.01         168         7         7           WBGene00001755         WBGene0003726         45.16         1430         1.1986           WBGene0001755         WBGene0003328         54.89         372         3         3           WBGene0001754         WBGene0003325         87.54         351         0.249         19.587           WBGene0003562         WBGene0003326         51.95         30         0.709         16.4249           WBGene0003570         WBGene0003326         51.95         30         0.709         16.4249           WBGene0003562         WBGene00033702         57.79         34							
WBGene00001844         WBGene00032145         47.31         398         7         8           WBGene00001834         WBGene00032589         49.08         388         0.23         8           WBGene00004439         WBGene00028624         64.08         300         7         4           WBGene00028624         64.08         300         7         4           WBGene00030797         66.01         153         0.581         16.227           *         WBGene00040807         42.77         306         0.378         15.751           *         WBGene00040965         72.58         62         0.378         15.751           *         WBGene00023242         50.2         87.16         1432         1.1986           WBGene00016934         WBGene00023242         50.2         492         0.249         19.587           WBGene00016934         WBGene0003255         87.54         289         8         9           WBGene0000217         WBGene0003225         87.54         289         8         9           WBGene0000217         WBGene0003716         22.77         7         7           WBGene0000217         WBGene0003716         22.77         7         7      <		WBGene00022717	WBGene00027753	47.31	444	0.497	16.716
WBGene0001836         WBGene00032590         49.08         478         0.23         15.716           WBGene0002439         WBGene00028243         64.08         309         0.581         16.227           *         WBGene0002797         66.01         153         0.581         16.227           *         WBGene00037681         66.01         168         7         4           WBGene00007554         WBGene00036716         42.77         166         2         7           WBGene00003726         45.16         1432         3         1.1986           WBGene00007350         WBGene00023285         45.16         1432         3         1.1986           *         WBGene00023285         45.16         1432         3         1.1986           WBGene0003528         54.89         400         0.191         19.587           WBGene0003528         54.84         310         0.249         16.249           WBGene00003525         87.54         351         0.249         16.249           WBGene00003527         WBGene0003706         2.579         320         0.709         16.486           WBGene00003170         WBGene0003706         2.579         320         0.709         16.486							
WBGene00001315         WBGene00032589         49.08         388         0.23         8           WBGene00028624         64.08         309         0.581         16.227           *         WBGene00030797         66.01         153         0.581         16.227           *         WBGene0003767         66.01         153         0.581         16.227           *         WBGene00040807         42.77         306         0.378         15.751           *         WBGene00040805         72.58         62         0.378         15.751           *         WBGene000125898         45.16         1492         0.191         1.1986           *         WBGene00013224         45.16         1492         0.249         1.9587           *         WBGene0001634         WBGene00028696         50.2         516         8         3           WBGene0001634         WBGene00035294         51.95         900         29         9         16.249           WBGene00003517         WBGene0003709         26.79         238         0.184         16.426           WBGene0000216         WBGene0003709         26.79         238         0.184         16.426           WBGene0000217 <t< td=""><td></td><td>WBGene00006484</td><td>WBGene00032145</td><td>4/.3⊥</td><td>398</td><td>/</td><td>8</td></t<>		WBGene00006484	WBGene00032145	4/.3⊥	398	/	8
WBGene00001315         WBGene00032589         49.08         388         0.23         8           WBGene00028624         64.08         309         0.581         16.227           *         WBGene00030797         66.01         153         0.581         16.227           *         WBGene0003767         66.01         153         0.581         16.227           *         WBGene00040807         42.77         306         0.378         15.751           *         WBGene00040805         72.58         62         0.378         15.751           *         WBGene000125898         45.16         1492         0.191         1.1986           *         WBGene00013224         45.16         1492         0.249         1.9587           *         WBGene0001634         WBGene00028696         50.2         516         8         3           WBGene0001634         WBGene00035294         51.95         900         29         9         16.249           WBGene00003517         WBGene0003709         26.79         238         0.184         16.426           WBGene0000216         WBGene0003709         26.79         238         0.184         16.426           WBGene0000217 <t< td=""><td></td><td>WBGene00001834</td><td>WBGene00032590</td><td>49.08</td><td>478</td><td>0.23</td><td>16.716</td></t<>		WBGene00001834	WBGene00032590	49.08	478	0.23	16.716
WBGene00028243         64.08         309         0.581         16.227           WBGene0003767         66.01         153         0.581         16.227           WBGene00037671         66.01         153         0.581         16.227           WBGene00037671         66.01         153         0.581         16.227           WBGene00012348         WBGene0003766         7.57         7         66.01         153         0.581         15.751           WBGene00012348         WBGene0003726         42.77         166         2         7         7           WBGene0001750         WBGene0002328         54.89         400         0.191         1.1986           *         WBGene0002328         54.89         400         0.191         1.9.587           WBGene00024258         85.16         1490         0.191         1.9.587           WBGene00024255         87.54         351         0.249         16.249           WBGene0003262         WBGene003320         51.95         900         2         9           WBGene000127         WBGene003320         51.95         900         2         9           WBGene0001270         WBGene003320         51.95         900         2							
*         WBGene00024624         64.08         300         7         4           WBGene00037781         66.01         153         0.581         16.227           WBGene0007554         WBGene00037681         66.01         168         7         4           WBGene0001761         42.77         306         0.378         15.751           *         WBGene0004055         72.58         62         0.378         15.751           *         WBGene0002264         51.6         1430         0.191         1.986           *         WBGene0002242         50.2         1432         1.1986           WBGene0003524         50.2         516         8         3           WBGene0003524         51.5         933         0.79         16.249           WBGene0000216         WBGene00032245         57.54         289         8         9           WBGene0000216         WBGene0003215         51.55         900         2         9           WBGene0000217         WBGene0003216         52.88         97         0.709         16.249           WBGene0001256         WBGene0003262         51.95         900         2         7           WBGene0000217         WBGene0							
WBGene00030797         66.01         153         0.581         16.227           WBGene0003761         42.77         166         7         4           WBGene00036716         42.77         166         2.77         155.751           *         WBGene00040807         42.77         166         2.78         15.751           *         WBGene0002659         72.58         87         2         7           WBGene00007300         WBGene0002666         14.90         0.191         1.1986           WBGene00007326         45.16         1432         3         1.1986           WBGene00003528         54.89         400         0.191         1.9587           WBGene00003526         WBGene00033225         51.5         83         0.249         16.249           WBGene0000217         WBGene00032545         87.54         351         0.249         16.249           WBGene0000217         WBGene0003716         52.88         1.328         2         7           WBGene0000217         WBGene0003716         52.88         1.328         2         7           WBGene001250         WBGene0003176         52.79         422         7.47         7           WBGene001251		WBGene00004439	WBGene00028243	64.08	309	0.581	16.227
WBGene00030797         66.01         153         0.581         16.227           WBGene0003761         42.77         166         7         4           WBGene00036716         42.77         166         2.77         155.751           *         WBGene00040807         42.77         166         2.78         15.751           *         WBGene0002659         72.58         87         2         7           WBGene00007300         WBGene0002666         14.90         0.191         1.1986           WBGene00007326         45.16         1432         3         1.1986           WBGene00003528         54.89         400         0.191         1.9587           WBGene00003526         WBGene00033225         51.5         83         0.249         16.249           WBGene0000217         WBGene00032545         87.54         351         0.249         16.249           WBGene0000217         WBGene0003716         52.88         1.328         2         7           WBGene0000217         WBGene0003716         52.88         1.328         2         7           WBGene001250         WBGene0003176         52.79         422         7.47         7           WBGene001251		*	WPCopo00029624	61 08	200	7	1
*         WBGene00037681         66.01         168         7         4           WBGene00037516         WBGene00040867         42.77         306         0.378         15.751           *         WBGene00040865         72.58         62         0.378         15.751           *         WBGene00025898         45.16         1490         0.191         1.1986           *         WBGene00033226         54.16         1490         0.191         1.9587           *         WBGene00032242         50.2         1.1986         33         3           WBGene0003561         WBGene00035294         51.95         930         0.709         16.249           WBGene0000266         WBGene00035294         51.95         930         0.709         16.486           WBGene0000217         WBGene0003709         26.79         238         0.184         11.431           WBGene0000216         WBGene0003709         26.79         238         0.184         11.431           WBGene0002052         WBGene00032644         33.77         155         7         8           WBGene00012956         WBGene0003165         57.97         43         1         1.4643           WBGene00012956         WBGe						-	-
WBGene00007554         WBGene00040807         42.77         106         2         7           WBGene00040805         72.58         62         7         7           WBGene0000955         72.58         62         7         7           WBGene0000955         72.58         62         0.378         15.751           *         WBGene00037226         45.16         1432         3         3           WBGene00013328         54.89         372         3         3           WBGene0003460         WBGene00033225         57.4         289         9         3           WBGene0003551         WBGene00032524         51.55         933         0.709         16.249           WBGene0003521         WBGene0003275         S.54         351         0.249         9           WBGene0003760         WBGene0003709         26.79         238         0.709         16.486           WBGene00018901         WBGene0003709         26.79         238         0.184         11.431           WBGene0001891         WBGene0003612         34.77         55         7         8           WBGene0001296         WBGene0003612         34.77         58         14         14.31         14.31		WBGene00004438	WBGene00030797	66.01	153	0.581	16.227
WBGene00007554         WBGene00040807         42.77         106         2         7           WBGene00040805         72.58         62         7         7           WBGene0000955         72.58         62         7         7           WBGene0000955         72.58         62         0.378         15.751           *         WBGene00037226         45.16         1432         3         3           WBGene00013328         54.89         372         3         3           WBGene0003460         WBGene00033225         57.4         289         9         3           WBGene0003551         WBGene00032524         51.55         933         0.709         16.249           WBGene0003521         WBGene0003275         S.54         351         0.249         9           WBGene0003760         WBGene0003709         26.79         238         0.709         16.486           WBGene00018901         WBGene0003709         26.79         238         0.184         11.431           WBGene0001891         WBGene0003612         34.77         55         7         8           WBGene0001296         WBGene0003612         34.77         58         14         14.31         14.31		*	WPCope00027681	66 01	169	7	1
*         WBGene0001336716         42.77         166         2         7           WBGene00012348         WBGene00040965         72.58         62         0.378         15.751           *         WBGene00025898         45.16         1432         3         1.1986           *         WBGene0002242         50.2         400         0.191         1.986           WBGene0003561         WBGene0002242         50.2         492         0.249         16.249           WBGene0003552         WBGene00032255         87.54         281         0.249         16.249           WBGene0000217         WBGene0003205         51.95         930         .0.709         16.486           WBGene0000217         WBGene0003205         51.95         900         2         9           WBGene0000217         WBGene00037306         26.79         238         0.184         1.6.486           WBGene00013706         WBGene00037306         26.79         402         7         7           WBGene0001262         WBGene0003136         53.377         38         0.184         1.1.431           WBGene0001263         WBGene0003136         57.77         437         3         4           WBGene0001264							-
WBGene00012348         WBGene00040965         72.58         82         0.378         15.751           WBGene0007350         WBGene0002599         45.16         1490         0.191         1.1986           *         WBGene0002599         45.16         1432         3         1.1986           *         WBGene00026061         54.89         400         0.191         1.9.587           *         WBGene00028696         50.2         516         8         3           WBGene00003551         WBGene00028255         87.54         351         0.249         16.249           WBGene0000352         WBGene00032751         52.88         907         7009         16.486           WBGene0000216         WBGene00037909         26.79         238         0.184         11.431           WBGene00018970         WBGene00037909         26.79         402         7         7           WBGene00018970         WBGene0003612         34.77         557         R         88           WBGene0001890         WBGene0003612         34.77         508         n.d.         11.431           WBGene0001890         WBGene0003136         57.97         449         0.431         18.643           WBGene0001246 </td <td></td> <td>WBGene00007554</td> <td>WBGene00040807</td> <td>42.77</td> <td>306</td> <td>0.378</td> <td>15.751</td>		WBGene00007554	WBGene00040807	42.77	306	0.378	15.751
WBGene00012348         WBGene00040965         72.58         82         0.378         15.751           WBGene0007350         WBGene0002599         45.16         1490         0.191         1.1986           *         WBGene0002599         45.16         1432         3         1.1986           *         WBGene00026061         54.89         400         0.191         1.9.587           *         WBGene00028696         50.2         516         8         3           WBGene00003551         WBGene00028255         87.54         351         0.249         16.249           WBGene0000352         WBGene00032751         52.88         907         7009         16.486           WBGene0000216         WBGene00037909         26.79         238         0.184         11.431           WBGene00018970         WBGene00037909         26.79         402         7         7           WBGene00018970         WBGene0003612         34.77         557         R         88           WBGene0001890         WBGene0003612         34.77         508         n.d.         11.431           WBGene0001890         WBGene0003136         57.97         449         0.431         18.643           WBGene0001246 </td <td></td> <td>*</td> <td>WBGene00036716</td> <td>42 77</td> <td>166</td> <td>2</td> <td>7</td>		*	WBGene00036716	42 77	166	2	7
*         WBGene00007350         72.58         87         2         7           WBGene0007350         WBGene00025081         45.16         14320         0.191         1.1986           *         WBGene0007226         45.16         14320         0.191         1.9867           *         WBGene00022422         50.2         492         0.249         19.587           WBGene0003561         WBGene00024255         87.54         351         0.249         16.249           WBGene0000217         WBGene0003200         51.95         930         0.709         16.486           WBGene0000217         WBGene000320455         87.54         281         132.8         7           WBGene00009977         WBGene00037306         26.79         238         0.184         16.486           WBGene0001356         WBGene0003706         26.79         402         7         7           WBGene0001205         WBGene00031306         57.97         437         3         4           WBGene0001216         WBGene00031306         57.97         431         18.643           WBGene0001240         WBGene00031306         57.97         437         3         4           WBGene00012150         WBGene0003130							-
WBGene00007350         WBGene00037226         Ya.16         1490         0.191         1.1986           *         WBGene00037226         45.16         1432         3         1.1986           *         WBGene00037226         45.16         1432         3         1.986           *         WBGene00028696         50.2         492         0.249         19.587           *         WBGene0003552         WBGene0003255         87.54         351         0.249         16.249           WBGene00003561         WBGene00032294         51.95         933         0.709         16.486           WBGene00000216         WBGene00037909         25.88         907         7009         16.486           WBGene000018901         WBGene00037909         26.79         238         0.184         16.486           WBGene00012052         WBGene0003612         34.77         557         R         886           WBGene00012644         33.77         308         0.184         11.431           WBGene00012650         WBGene00031651         34.77         57         R.4           WBGene0001264         WBGene0003165         57.97         449         0.431         18.643           WBGene00012150         W		WBGene00012348	WBGene00040965	72.58	62	0.378	15.751
WBGene00007350         WBGene00037226         45.16         1490         0.191         1.1986           WBGene00037226         45.16         1432         3         1.1986           WBGene00013726         45.16         1432         3         3           WBGene00013328         54.89         372         3         3           WBGene00003561         WBGene00028696         50.2         51.6         8         3           WBGene00003561         WBGene0002255         87.54         351         0.249         16.249           WBGene0000217         WBGene00032594         51.95         933         0.709         16.486           WBGene0000216         WBGene00037909         26.79         238         0.184         16.486           WBGene00012970         WBGene00037909         26.79         402         7         7           WBGene0001262         WBGene00031264         33.77         155         7         8         14.431           WBGene0001264         WBGene0003165         7.77         7         44         464         486ene0001444         WBGene0003165         7.77         7         4           WBGene0001264         WBGene0003165         7.77         7         3 <t< td=""><td></td><td>*</td><td>WBGene00040965</td><td>72.58</td><td>87</td><td>2</td><td>7</td></t<>		*	WBGene00040965	72.58	87	2	7
*         WBGene00037226         45.16         1432         3         1.1986           WBGene0002601         54.89         400         0.191         19.587           WBGene00032324         56.2         492         0.249         19.587           WBGene0003551         WBGene00034255         87.54         351         0.249         16.249           WBGene0000217         WBGene0003202         51.95         930         .0709         16.249           WBGene0000216         WBGene00037136         52.88         1328         2         7           WBGene00008997         WBGene0003716         52.88         1328         2         7           WBGene00018997         WBGene0003706         26.79         238         0.184         11.431           WBGene00018997         WBGene0003214         33.77         308         0.184         11.431           WBGene0001262         WBGene00031306         57.97         430         18.643           WBGene0001264         WBGene00031306         57.97         437         3         4           WBGene0001266         WBGene00031306         57.97         437         3         4           WBGene0001255         WBGene00031616         57.97 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td></t<>							-
Bible Cool 17250         Bible Cool 1220         14.89         14.92         1.9.50           *         WBGene 00033328         54.89         400         0.191         9.587           WBGene 00013634         WBGene 00028425         87.54         31         0.249         16.249           WBGene 00003561         WBGene 00033225         87.54         310         0.249         16.249           WBGene 0000217         WBGene 00037136         52.88         997         0.709         16.486           WBGene 00009976         WBGene 00037909         26.79         230         0.184         16.486           WBGene 0001296         WBGene 00037909         26.79         230         0.184         11.431           WBGene 0001296         WBGene 00037906         26.79         230         0.184         11.431           WBGene 0001296         WBGene 00036912         34.77         577         n.d.         8           WBGene 0001296         WBGene 0003616         57.97         449         0.431         18.643           WBGene 00012140         WBGene 00036156         57.97         437         3         4           WBGene 00012149         WBGene 00036151         55.14         122         0.304         3.2719		WBGene0000/350	WBGene00025898	45.16	1490	0.191	1.1980
WBGene00017759         WBGene000230328         54.89         400         0.191         19.587           *         WBGene0003328         54.89         372         3         3           WBGene0003461         WBGene0002866         50.2         516         8         3           WBGene0003561         WBGene00034255         87.54         351         0.249         16.249           WBGene0000216         WBGene00035294         51.95         900         2         9           WBGene0000217         WBGene00037509         26.79         28         0.184         16.486           WBGene00018901         WBGene00037909         26.79         23         0.184         11.431           WBGene0001266         WBGene0003612         31.77         155         7         8           WBGene0001250         WBGene0003612         34.77         557         n.d.         11.431           WBGene00034158         65.14         109         0.304         3.2719           WBGene00034158         65.14         122         3         4           WBGene00034158         65.14         109         0.304         3.2719           WBGene00012149         WBGene0003612         37.41         160		*	WBGene00037226	45.16	1432	3	1,1986
*         WBGene0003328         54.89         372         3         3           WBGene00016934         WBGene00022422         50.2         492         0.249         19.587           WBGene00034255         87.54         351         0.249         16.249           WBGene00034255         87.54         351         0.249         16.249           WBGene00000217         WBGene0003529         51.95         933         0.709         16.249           WBGene00009977         WBGene00037136         52.88         1328         2         7           WBGene00018901         WBGene00037909         26.79         238         0.184         16.486           WBGene00012968         WBGene00037906         26.79         402         7         7           WBGene00012968         WBGene00036112         34.77         508         n.d.         11.431           WBGene00012968         WBGene00036120         57.97         437         3         4           WBGene0001434         WBGene00036121         45.41         120         3         471           WBGene0001450         WBGene00036158         65.14         132         9         3.771           WBGene0001450         WBGene00036159         72		MDG 00017750					
mBGene000329242         51.2         32.4         3.4         3.4           WBGene00029242         51.2         492         0.249         19.587           WBGene0003561         WBGene00034255         87.54         289         8         9           WBGene00003162         WBGene00032242         51.95         900         2         9           WBGene0000216         WBGene00035294         51.95         900         2         9           WBGene00002976         WBGene00037909         26.79         238         0.1184         16.486           WBGene0001296         WBGene00037909         26.79         402         7         7           WBGene0001296         WBGene00037906         26.79         10.184         11.431           WBGene0001296         WBGene00036912         31.77         106         n.d.         11.431           WBGene0001296         WBGene00031306         57.97         449         0.431         18.643           WBGene00012140         WBGene00031306         57.97         449         0.431         18.643           WBGene00012140         WBGene00034158         65.14         109         0.304         3.2719           WBGene00012207         WBGene00034158         6			MRGelle00020001				19.50/
WBGene00007446         WBGene00034255         S1.2         S1.6         8         3           WBGene00003561         WBGene00034255         87.54         351         0.249         16.249           WBGene0000217         WBGene00033205         51.95         933         0.709         16.249           WBGene0000217         WBGene00024751         52.88         997         0.709         16.489           WBGene00018901         WBGene00037136         52.88         1328         2         7           WBGene00018901         WBGene00037909         26.79         238         0.184         16.486           WBGene00012952         WBGene00037906         26.79         402         7         7           WBGene00012954         WBGene00036192         34.77         608         n.d.         11.431           WBGene00012956         WBGene0036121         34.77         557         n.d.         8           WBGene0001434         WBGene00036121         57.97         437         3         4           WBGene0001423         WBGene00034158         65.14         109         0.304         3.2719           WBGene0001424         WBGene00031158         65.14         109         0.263         2.376      <		*	WBGene00033328	54.89	372	3	3
WBGene00007446         WBGene00034255         S1.2         S1.6         8         3           WBGene00003561         WBGene00034255         87.54         351         0.249         16.249           WBGene0000217         WBGene00033205         51.95         933         0.709         16.249           WBGene0000217         WBGene00024751         52.88         997         0.709         16.489           WBGene00018901         WBGene00037136         52.88         1328         2         7           WBGene00018901         WBGene00037909         26.79         238         0.184         16.486           WBGene00012952         WBGene00037906         26.79         402         7         7           WBGene00012954         WBGene00036192         34.77         608         n.d.         11.431           WBGene00012956         WBGene0036121         34.77         557         n.d.         8           WBGene0001434         WBGene00036121         57.97         437         3         4           WBGene0001423         WBGene00034158         65.14         109         0.304         3.2719           WBGene0001424         WBGene00031158         65.14         109         0.263         2.376      <		WPCopo00016034	WPConc00020242	50 2	102	0 2/0	10 597
WBGene0003361         WBGene00034255         87.54         351         0.249         16.249           WBGene0000217         WBGene00031205         87.54         289         8         9           WBGene0000216         WBGene00035294         51.95         933         0.709         16.249           WBGene00009976         WBGene00037136         52.88         997         0.709         16.486           WBGene00018977         WBGene00037906         26.79         402         7         7           WBGene00012052         WBGene00031706         23.77         308         0.184         11.431           WBGene00012052         WBGene0003612         34.77         557         n.d.         8           WBGene0001256         WBGene00031306         57.97         449         0.431         18.643           WBGene0001244         WBGene00034158         65.14         122         3         4           WBGene0001244         WBGene00034158         65.14         132         9         3.2719           WBGene0001240         WBGene00034158         65.14         132         9         3.2719           WBGene0001247         WBGene00034158         65.14         132         9         3.2719							
WBGene000035262         WBGene000033202         S1.95         933         0.709         16.249           WBGene00000217         WBGene00035294         S1.95         900         2         9           WBGene00009976         WBGene00037136         S2.88         1328         2         7           WBGene00018901         WBGene00037906         26.79         402         7         7           WBGene00012952         WBGene00032644         33.77         308         0.184         11.431           WBGene00012956         WBGene00035123         34.77         508         n.d.         11.431           WBGene0001404         WBGene00036196         57.97         449         0.431         18.643           WBGene0001526         WBGene00031306         57.97         437         3         4           WBGene0001520         WBGene00034158         65.14         109         0.304         12.577           WBGene0001207         WBGene00034158         65.14         129         3.2719           WBGene00003412         WBGene0002573         37.41         150         6         1           WBGene00003412         69.25         493         0.263         12.577           WBGene00004224         WBGene		WBGene00007446	WBGene00028696	50.2	516	8	3
WBGene000035262         WBGene000033202         S1.95         933         0.709         16.249           WBGene00000217         WBGene00035294         S1.95         900         2         9           WBGene00009976         WBGene00037136         S2.88         1328         2         7           WBGene00018901         WBGene00037906         26.79         402         7         7           WBGene00012952         WBGene00032644         33.77         308         0.184         11.431           WBGene00012956         WBGene00035123         34.77         508         n.d.         11.431           WBGene0001404         WBGene00036196         57.97         449         0.431         18.643           WBGene0001526         WBGene00031306         57.97         437         3         4           WBGene0001520         WBGene00034158         65.14         109         0.304         12.577           WBGene0001207         WBGene00034158         65.14         129         3.2719           WBGene00003412         WBGene0002573         37.41         150         6         1           WBGene00003412         69.25         493         0.263         12.577           WBGene00004224         WBGene		WBGene00003561	WBCone00034255	87 54	351	0 249	16 249
WBGene0000217         WBGene00033020         51.95         933         0.709         16.249           WBGene00009977         WBGene00037905         52.88         977         0.709         16.486           WBGene00009977         WBGene00037909         26.79         238         0.184         16.486           WBGene0002052         WBGene0003706         26.79         238         0.184         11.431           WBGene00012968         WBGene00041676         33.77         155         7         8           WBGene00012968         WBGene00033016         57.97         449         0.431         18.643           WBGene00012968         WBGene00033136         57.97         477         3         4           WBGene00012968         WBGene00033166         57.97         449         0.431         18.643           WBGene00012968         WBGene00034158         65.14         122         3         4           WBGene00012149         WBGene00034158         65.14         132         9         3.2719           WBGene0001207         WBGene0002573         37.41         160         0.263         2.376           WBGene0001204         WBGene00025159         37.41         153         6         2.376							
WBGene0000216         WBGene00035294         51.95         900         2         9           WBGene00009976         WBGene00037136         52.88         997         0.709         16.486           WBGene00018901         WBGene00037136         52.88         997         0.709         16.486           WBGene00020052         WBGene00037909         26.79         238         0.184         11.431           WBGene00020052         WBGene00032644         33.77         155         7         8           WBGene00008693         WBGene00036196         57.97         449         0.431         18.643           WBGene0001256         WBGene00031306         57.97         437         3         4           WBGene00012149         WBGene00034158         65.14         109         0.304         3.2719           WBGene00012149         WBGene00023130         72.16         520         0.304         12.577           WBGene00019979         WBGene00023130         7.41         160         0.263         2.376           *         WBGene00025215         69.25         493         0.264         9.9943           WBGene00004224         WBGene0002527         82.52         148         1         1.1239      <		WBGene00003562	WBGene00034255	87.54	289	8	9
WBGene0000216         WBGene00035294         51.95         900         2         9           WBGene00009976         WBGene00037136         52.88         997         0.709         16.486           WBGene00018901         WBGene00037136         52.88         997         0.709         16.486           WBGene00020052         WBGene00037909         26.79         238         0.184         11.431           WBGene00020052         WBGene00032644         33.77         155         7         8           WBGene00008693         WBGene00036196         57.97         449         0.431         18.643           WBGene0001256         WBGene00031306         57.97         437         3         4           WBGene00012149         WBGene00034158         65.14         109         0.304         3.2719           WBGene00012149         WBGene00023130         72.16         520         0.304         12.577           WBGene00019979         WBGene00023130         7.41         160         0.263         2.376           *         WBGene00025215         69.25         493         0.264         9.9943           WBGene00004224         WBGene0002527         82.52         148         1         1.1239      <		WBGene00000217	WBGene00033020	51.95	933	0.709	16.249
WBGene00009976         WBGene00012175         52.88         997         0.709         16.486           WBGene00018901         WBGene00037106         26.79         288         0.184         116.486           WBGene00012950         WBGene00037906         26.79         402         7         7           WBGene00012956         WBGene00041676         33.77         155         7         8           WBGene0000443         WBGene0003612         34.77         608         n.d.         11.431           WBGene0000443         WBGene0003612         34.77         557         n.d.         8           WBGene00012956         WBGene00036126         57.97         437         3         4           WBGene00012149         WBGene00034158         65.14         109         0.304         3.2719           WBGene00012149         WBGene00034158         65.14         132         9         3.2719           WBGene00019207         WBGene00042591         72.16         489         9         1           WBGene00012247         WBGene00025215         69.25         493         0.263         2.376           WBGene00042257         WBGene00033192         32.04         399         0.264         5.098							
WBGene00009977         WBGene00037136         52.88         1328         2         7           WBGene00013901         WBGene00037909         26.79         238         0.184         16.486           WBGene0002052         WBGene00032644         33.77         308         0.184         11.431           WBGene00012968         WBGene00042135         34.77         557         7         8           WBGene00012956         WBGene0003196         57.97         449         0.431         18.643           WBGene00012956         WBGene00034158         65.14         109         0.304         3.2719           WBGene00012957         WBGene00034158         65.14         109         0.304         3.2719           WBGene00019207         WBGene00025309         72.16         489         9         1           WBGene00019207         WBGene00025733         37.41         153         6         2.376           WBGene00004217         WBGene0002521         69.25         493         0.264         5.098           *         WBGene00004551         72.16         489         9         1           WBGene00004224         WBGene00025527         82.52         148         0.646         18.369		WBGene00000216		51.95	900	2	9
WBGene00009977         WBGene00037136         52.88         1328         2         7           WBGene00013901         WBGene00037909         26.79         238         0.184         16.486           WBGene0002052         WBGene00032644         33.77         308         0.184         11.431           WBGene00012968         WBGene00042135         34.77         557         7         8           WBGene00012956         WBGene0003196         57.97         449         0.431         18.643           WBGene00012956         WBGene00034158         65.14         109         0.304         3.2719           WBGene00012957         WBGene00034158         65.14         109         0.304         3.2719           WBGene00019207         WBGene00025309         72.16         489         9         1           WBGene00019207         WBGene00025733         37.41         153         6         2.376           WBGene00004217         WBGene0002521         69.25         493         0.264         5.098           *         WBGene00004551         72.16         489         9         1           WBGene00004224         WBGene00025527         82.52         148         0.646         18.369		WBGene00009976	WBGene00024751	52.88	997	0.709	16.486
WBGene00018901WBGene0003790926.792380.18416.486WBGene00020052WBGene00036914WBGene000361433.773080.18411.431WBGene00012968WBGene000361234.77608n.d.11.431WBGene0001443WBGene000361234.77557n.d.8WBGene0001443WBGene000361257.9743734WBGene00012956WBGene000361257.9743734WBGene00012950WBGene0003615155.1412230.43118.643WBGene0001249WBGene0003415865.141090.3043.2719WBGene0001240WBGene0003415865.1413293.2719WBGene00019979WBGene000250172.1648991WBGene00012204WBGene000251337.411600.2632.376WBGene000042217WBGene0003314269.254930.2645.098*WBGene000455540.694910.2645.098*WBGene000455540.694910.26418.369WBGene00012426WBGene0003380530.3925841WBGene00012459WBGene0003549n.d.11.239WBGene0001249WBGene00035491.2139WBGene00012459WBGene0003549n.d.14.00.26418.369WBGene00012459WBGene0003549n.d.11.2391.239WBGene00012459WBGene0003549n.d.1.12391.239WB							
WBGene0008979         WBGene00037906         26.79         402         7         7           WBGene000252         WBGene00032644         33.77         308         0.184         11.431           WBGene0009140         WBGene00042135         34.77         608         n.d.         11.431           WBGene00012956         WBGene00036912         34.77         557         n.d.         18.643           WBGene00012956         WBGene00031306         57.97         449         0.431         18.643           WBGene00012350         WBGene00036127         45.41         223         0.431         18.643           WBGene00012149         WBGene00034158         65.14         109         0.304         3.2719           WBGene0001207         WBGene0002503         72.16         520         0.304         12.577           WBGene0001204         WBGene0002573         37.41         160         0.263         2.376           *         WBGene00025215         69.25         493         0.264         5.098           WBGene0004256         WBGene0003840         32.04         399         0.264         9.3943           WBGene00004256         WBGene0003840         30.93         184         0.646         18.369		WBGene00009977	WBGene0003/136	52.88	1328	2	/
WBGene00020052         WBGene00032644         33.77         308         0.184         11.431           WBGene00012968         WBGene00031676         33.77         155         7         8           WBGene00008693         WBGene00036912         34.77         608         n.d.         11.431           WBGene00014413         WBGene00036912         34.77         557         n.d.         8           WBGene00012956         WBGene00036196         57.97         449         0.431         18.643           WBGene00011500         WBGene00036196         57.97         437         3         4           WBGene00011490         WBGene00036217         45.41         220         3         4           WBGene00012149         WBGene00026309         72.16         620         0.304         12.577           WBGene00019979         WBGene0002573         37.41         160         0.263         2.376           *         WBGene00025215         69.25         493         0.264         5.098           *         WBGene0003192         32.04         427         3         5.098           *         WBGene0004585         40.69         41         0.264         9.3943           WBGene00004257		WBGene00018901	WBGene00037909	26.79	238	0.184	16.486
WBGene00020052         WBGene00032644         33.77         308         0.184         11.431           WBGene00012968         WBGene00031676         33.77         155         7         8           WBGene00008693         WBGene00036912         34.77         608         n.d.         11.431           WBGene00014413         WBGene00036912         34.77         557         n.d.         8           WBGene00012956         WBGene00036196         57.97         449         0.431         18.643           WBGene00011500         WBGene00036196         57.97         437         3         4           WBGene00011490         WBGene00036217         45.41         220         3         4           WBGene00012149         WBGene00026309         72.16         620         0.304         12.577           WBGene00019979         WBGene0002573         37.41         160         0.263         2.376           *         WBGene00025215         69.25         493         0.264         5.098           *         WBGene0003192         32.04         427         3         5.098           *         WBGene0004585         40.69         41         0.264         9.3943           WBGene00004257		WDCopo00008070	WDCopo00027006	26 70	402	7	7
WBGene00012968WBGene0004167633.7715578WBGene00008693WBGene0003691234.77608n.d.11.431WBGene0001443WBGene0003691234.77557n.d.8WBGene0001443WBGene0003130657.974490.43118.643WBGene0001530WBGene000368445.412230.43118.643WBGene00016700WBGene0003621745.4122034WBGene000192199WBGene0003415865.141090.3043.2719WBGene00019270WBGene0002503972.1648991WBGene00004059172.1648991WBGene000040251337.411600.26312.577WBGene00004217WBGene0002573337.411600.26312.577WBGene00004224WBGene000319232.043990.2645.098*WBGene000319232.0442735.098WBGene0004255WBGene0002552782.5214341WBGene0004256WBGene0003380530.391840.64618.369WBGene00011850WBGene00035494n.d.14.0765478WBGene0001639WBGene000354877.183550.6548WBGene0001639WBGene000354877.183550.6548WBGene0001639WBGene000354877.183550.6548WBGene0001639WBGene000354877.183550.654 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td>							-
WBGene00009140WBGene0003691234.77608n.d.11.431WBGene00008693WBGene0003691234.77557n.d.8WBGene00012956WBGene0003130657.974490.43118.643WBGene00012056WBGene0003621745.412230.43118.643WBGene00012149WBGene0003415865.141090.3043.2719WBGene00019207WBGene0002630972.165200.30412.577WBGene00019207WBGene000459137.411600.26312.577WBGene0001204WBGene0002573337.411600.2632.376WBGene000042217WBGene0003319232.043990.2645.098*WBGene0004058540.6954439.943WBGene00004257WBGene000458540.6954439.943WBGene00004257WBGene0003380630.391840.64618.369WBGene0000251782.521434112.39WBGene00004257WBGene0003380530.3925841WBGene00004257WBGene00035494n.d.11.2391.1239WBGene0001638WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.184440.65410.058WBGene0001639 <td< td=""><td></td><td>WBGene00020052</td><td>WBGene00032644</td><td>33.77</td><td>308</td><td>0.184</td><td>11.431</td></td<>		WBGene00020052	WBGene00032644	33.77	308	0.184	11.431
WBGene00009140WBGene0003691234.77608n.d.11.431WBGene00008693WBGene0003691234.77557n.d.8WBGene00012956WBGene0003130657.974490.43118.643WBGene00012056WBGene0003621745.412230.43118.643WBGene00012149WBGene0003415865.141090.3043.2719WBGene00019207WBGene0002630972.165200.30412.577WBGene00019207WBGene000459137.411600.26312.577WBGene0001204WBGene0002573337.411600.2632.376WBGene000042217WBGene0003319232.043990.2645.098*WBGene0004058540.6954439.943WBGene00004257WBGene000458540.6954439.943WBGene00004257WBGene0003380630.391840.64618.369WBGene0000251782.521434112.39WBGene00004257WBGene0003380530.3925841WBGene00004257WBGene00035494n.d.11.2391.1239WBGene0001638WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.184440.65410.058WBGene0001639 <td< td=""><td></td><td>WBGene00012968</td><td>WBGene00041676</td><td>33 77</td><td>155</td><td>7</td><td>8</td></td<>		WBGene00012968	WBGene00041676	33 77	155	7	8
WBGene00008693WBGene0003691234.77557n.d.8WBGene00012956WBGene0003130657.974490.43118.643WBGene00011530WBGene000368445.412230.43118.643WBGene00012149WBGene0003415865.141090.3043.2719WBGene00019207WBGene000230972.165200.3041.2.577WBGene00019279WBGene0002503972.165200.3041.2.577WBGene00004217WBGene0002573337.411600.2631.2.577WBGene00004224WBGene0002521569.254936.23.766*WBGene000045540.694910.2645.098WBGene00004224WBGene0002552782.5214341WBGene0004257WBGene0002552782.5214341WBGene0002429WBGene0003840530.391840.64618.369WBGene0000242WBGene00035494n.d.11.22391.2.239WBGene0001638WBGene00035497.183550.6548WBGene0001639WBGene00035497.183550.6548WBGene0001639WBGene00035487.183550.6548WBGene0001639WBGene00035487.183550.6548WBGene0001639WBGene00035487.183550.6548WBGene0001639WBGene00035487.183550.6548WBGene000055487.18355 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td>							-
WBGene00004443WBGene0003619657.974490.43118.643WBGene000122956WBGene0003868445.412230.43118.643WBGene00016700WBGene0003621745.4122034WBGene00012149WBGene0003415865.141090.3043.2719WBGene00019453WBGene0002630972.165200.30412.577WBGene00019979WBGene0004059172.1648991WBGene0001204WBGene0002573337.411600.26312.577WBGene00004217WBGene0003319269.2549362.376*WBGene0004058540.6944735.098*WBGene0004058540.6954439.3943WBGene00004257WBGene0002527782.521480.64618.369WBGene00004250WBGene000380630.391840.64618.369WBGene0000250WBGene0003549n.d.2140.2081.1239WBGene00001638WBGene0003549n.d.2140.2081.1239WBGene0001638WBGene000354877.183550.6548WBGene0001638WBGene000354877.183550.6548WBGene0001638WBGene000354877.183550.6548WBGene000164WBGene000354877.183550.6548WBGene000164WBGene000354840.085070.13418.331WBGene000164WBGene0003548 </td <td></td> <td>WBGene00009140</td> <td>WBGene00042135</td> <td>34.77</td> <td>608</td> <td>n.d.</td> <td>11.431</td>		WBGene00009140	WBGene00042135	34.77	608	n.d.	11.431
WBGene00004443WBGene0003619657.974490.43118.643WBGene000122956WBGene0003868445.412230.43118.643WBGene00016700WBGene0003621745.4122034WBGene00012149WBGene0003415865.141090.3043.2719WBGene00019453WBGene0002630972.165200.30412.577WBGene00019979WBGene0004059172.1648991WBGene0001204WBGene0002573337.411600.26312.577WBGene00004217WBGene0003319269.2549362.376*WBGene0004058540.6944735.098*WBGene0004058540.6954439.3943WBGene00004257WBGene0002527782.521480.64618.369WBGene00004250WBGene000380630.391840.64618.369WBGene0000250WBGene0003549n.d.2140.2081.1239WBGene00001638WBGene0003549n.d.2140.2081.1239WBGene0001638WBGene000354877.183550.6548WBGene0001638WBGene000354877.183550.6548WBGene0001638WBGene000354877.183550.6548WBGene0001644WBGene000354877.183550.6548WBGene0001546WBGene00035464.0685070.13418.331WBGene0001638WBGene000354		WBGene00008693	WBGene00036912	34.77	557	n.d.	8
WBGene00012956         WBGene00031306         57.97         437         3         4           WBGene00011530         WBGene00036684         45.41         223         0.431         18.643           WBGene00012149         WBGene00036217         45.41         220         3         4           WBGene00012149         WBGene00034158         65.14         109         0.304         3.2719           WBGene00019207         WBGene00026309         72.16         520         0.304         12.577           WBGene000338         WBGene00025733         37.41         160         0.263         12.577           WBGene00004217         WBGene00033192         20.43         99         0.264         5.098           *         WBGene00038480         32.04         427         3         5.098           *         WBGene0004256         WBGene00025527         82.52         143         1           WBGene0004250         WBGene00033806         30.39         184         0.646         18.369           WBGene0001459         WBGene00033806         30.39         184         0.646         18.369           WBGene0001638         WBGene00035494         n.d.         143         1         1239				E7 07			10 612
WBGene00011530WBGene0003868445.412230.43118.643WBGene00016700WBGene0003621745.4122034WBGene00012149WBGene0003415865.141090.3043.2719WBGene00019207WBGene0002630972.165200.30412.577WBGene00019979WBGene0004059137.411600.26312.577WBGene00004217WBGene0002521569.254930.2632.376*WBGene0002521569.254930.2645.098*WBGene000319232.043990.2645.098*WBGene0004257WBGene0003848032.0442735.098*WBGene0004257WBGene000458540.6954439.3943WBGene00004257WBGene0002527782.521480.64618.369WBGene0000250WBGene0003840530.3925841WBGene00011850WBGene00035494n.d.2140.2081.1239WBGene0001638WBGene000354877.183550.6548WBGene0001639WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.183550.6548WBGene0001639WBGene000354877.184440.65410.058WBGene0001639WBGene000354640.085650.13418.331WBGene0001639WBGene000354677.183550.6548WBGene000							
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WBGene00016700WBGene0003621745.4122034WBGene00012149WBGene0003415865.141090.3043.2719WBGene0001207WBGene0002630972.165200.30412.577WBGene0001207WBGene0004059172.1648991WBGene0001207WBGene0002573337.411600.26312.577WBGene00004217WBGene0002521569.2549362.376*WBGene0002521569.2549362.376*WBGene0004256WBGene0003319232.043990.2645.098*WBGene0004256WBGene000425640.69910.2649.3943WBGene00004257WBGene000458540.6954439.3943WBGene00004257WBGene000252782.521480.64618.369WBGene00004995WBGene0003380530.3925841WBGene00011850WBGene00035494n.d.18371.1239WBGene0001638WBGene0002559144.0765478WBGene0001639WBGene0002559144.0765410.058WBGene0001639WBGene000354877.183550.6548WBGene0001639WBGene000356477.183550.6548WBGene0001639WBGene000356143.064740.23811.509WBGene0001664WBGene000356470.85650.13418.331WBGene0000064WBGene00032		WBGene00011530	WBCone00038684	45 41	223	0 431	18 643
WBGene00012149         WBGene00034158         65.14         109         0.304         3.2719           WBGene00019207         WBGene00026309         72.16         520         0.304         12.577           WBGene00019207         WBGene00040591         72.16         489         9         1           WBGene00003338         WBGene00025733         37.41         160         0.263         2.577           WBGene00004217         WBGene00025215         69.25         493         0.263         2.376           *         WBGene0004224         WBGene00033192         32.04         399         0.264         5.098           *         WBGene0004255         40.69         491         0.264         9.3943           WBGene0004257         WBGene0002527         82.52         148         0.646         18.369           WBGene00004257         WBGene00033806         30.39         258         4         1           WBGene0000250         WBGene00035494         n.d.         183         7         11239           WBGene0001820         WBGene00035494         n.d.         183         7         1239           WBGene000183         WBGene0003548         77.18         444         0.654         10.058							
WBGene00009453WBGene0003415865.1413293.2719WBGene00019207WBGene0002630972.165200.30412.577WBGene00019979WBGene0004059172.1648991WBGene00001204WBGene0002573337.411600.26312.577WBGene00004217WBGene0002521569.2549362.376*WBGene0004224WBGene000319232.043990.2645.098*WBGene0004256WBGene000458540.6942735.098WBGene0004257WBGene000458540.6954439.3943WBGene0004257WBGene000252782.5214341WBGene00004250WBGene0003380630.391840.64618.369WBGene0000250WBGene00035494n.d.1143711239WBGene00011850WBGene00035494n.d.183711239WBGene0001639WBGene00035494n.d.18378WBGene0001639WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.184440.65410.058WBGene00012255WBGene000354877.184440.65410.058WBGene0001225WBGene000354143.064740.23811.509WBGene0001225WBGene000354143.064740.23811.509WBGene0001225WBGene000354143.064740.23811.509 <td< td=""><td></td><td>WBGene00016700</td><td>WBGene00036217</td><td>45.41</td><td>220</td><td>3</td><td>4</td></td<>		WBGene00016700	WBGene00036217	45.41	220	3	4
WBGene00009453WBGene0003415865.1413293.2719WBGene00019207WBGene0002630972.165200.30412.577WBGene00019979WBGene0004059172.1648991WBGene00001204WBGene0002573337.411600.26312.577WBGene00004217WBGene0002521569.2549362.376*WBGene0004224WBGene000319232.043990.2645.098*WBGene0004256WBGene000458540.6942735.098WBGene0004257WBGene000458540.6954439.3943WBGene0004257WBGene000252782.5214341WBGene00004250WBGene0003380630.391840.64618.369WBGene0000250WBGene00035494n.d.1143711239WBGene00011850WBGene00035494n.d.183711239WBGene0001639WBGene00035494n.d.18378WBGene0001639WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.184440.65410.058WBGene00012255WBGene000354877.184440.65410.058WBGene0001225WBGene000354143.064740.23811.509WBGene0001225WBGene000354143.064740.23811.509WBGene0001225WBGene000354143.064740.23811.509 <td< td=""><td></td><td>WBGene00012149</td><td>WBGene00034158</td><td>65.14</td><td>109</td><td>0.304</td><td>3.2719</td></td<>		WBGene00012149	WBGene00034158	65.14	109	0.304	3.2719
WBGene00019207WBGene0002630972.165200.30412.577WBGene0003938WBGene0004059172.1648991WBGene0001204WBGene0002573337.411600.26312.577WBGene00004217WBGene0003914269.254930.2632.376*WBGene00004224WBGene0003319232.043990.2645.098*WBGene0004256WBGene000458540.694910.2649.3943WBGene0004257WBGene000458540.694910.2649.3943WBGene00004257WBGene0000458540.6954439.3943WBGene00004250WBGene0000252782.521480.64618.369WBGene0000249WBGene0003380530.391840.64618.369WBGene0000249WBGene00035494n.d.2140.2081.1239WBGene0001638WBGene00035494n.d.18371.1239WBGene0001638WBGene000354877.183550.6548WBGene0001639WBGene000354877.183550.6548WBGene0001639WBGene000354877.183550.6548WBGene00012295WBGene000354877.183550.6548WBGene000126553.2410090.23811.509WBGene0001276WBGene000354877.183550.6548WBGene000126553.2410090.23811.509WBGene0001630WBGene00							
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WBGene00003938WBGene0004059137.411600.26312.577WBGene0001204WBGene0002573337.4115361WBGene0004217WBGene0003914269.2549362.376*WBGene0002521569.2549362.376WBGene0004224WBGene0003319232.043990.2645.098*WBGene000455540.6942735.098WBGene0004257WBGene0004058540.694210.2649.3943WBGene0000495WBGene0002552782.5214341WBGene0000499WBGene0003380630.391840.64618.369WBGene0000249WBGene0003380530.3925841WBGene00001850WBGene00035494n.d.18371.1239WBGene00001638WBGene000054877.184440.65410.058WBGene0001639WBGene000354877.183550.6548WBGene0001225WBGene000354877.183550.6548WBGene0001225WBGene000354677.183550.1548WBGene0001634WBGene000332440.085070.13418.331WBGene000164WBGene000332440.085070.13418.331WBGene0000064WBGene0003254640.085650.13418.331WBGene0000064WBGene0003254640.085650.13418.331WBGene0000064WBGene0003254640.08<		WBGene00019979	WBCone00040591	72 16	489	a	1
WBGene00001204WBGene0002573337.4115361WBGene00004217WBGene0003914269.254930.2632.376*WBGene0004224WBGene0003319232.043990.2645.098*WBGene0004256WBGene0003848032.0442735.098WBGene00004256WBGene000458540.694910.2649.3943WBGene00004257WBGene000458540.6954439.3943WBGene00004250WBGene0002552782.521480.64618.369WBGene0000250WBGene0003380630.391840.64618.369WBGene0000250WBGene00035494n.d.2140.2081.1239WBGene00001638WBGene00035494n.d.18371.1239WBGene0001638WBGene000354877.184440.65410.058WBGene0001639WBGene000354877.183550.6548WBGene00014170WBGene000356753.2410090.23811.509WBGene00014170WBGene000354677.183550.6548WBGene00015406WBGene0003536143.0642931WBGene0000963WBGene0003536143.0642931WBGene000015406WBGene0003254640.085650.13418.331WBGene000015406WBGene0003254640.085650.13418.331WBGene00005385WBGene0003254640.085650.13418.331 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
WBGene00004217         WBGene00039142         69.25         493         0.263         2.376           *         WBGene00025215         69.25         493         6         2.376           WBGene00004224         WBGene00033192         32.04         399         0.264         5.098           *         WBGene0004256         WBGene00040585         40.69         491         0.264         9.3943           WBGene00004257         WBGene00025527         82.52         148         0.646         18.369           WBGene00000250         WBGene00033806         30.39         184         0.646         18.369           WBGene0000254         WBGene00035494         n.d.         214         0.208         1.1239           WBGene00001638         WBGene00025421         44.07         654         7         8           WBGene0001639         WBGene0002541         44.07         654         7         8           WBGene0001639         WBGene0003548         77.18         355         0.654         8           WBGene0001470         WBGene0003548         77.18         355         0.654         8           WBGene0001470         WBGene00035461         43.06         474         0.238         11.509     <		WBGene00003938	WBGene00040591	37.41	160	0.263	12.577
WBGene00004217         WBGene00039142         69.25         493         0.263         2.376           *         WBGene00025215         69.25         493         6         2.376           WBGene00004224         WBGene00033192         32.04         399         0.264         5.098           *         WBGene0004256         WBGene00040585         40.69         491         0.264         9.3943           WBGene00004257         WBGene00025527         82.52         148         0.646         18.369           WBGene00000250         WBGene00033806         30.39         184         0.646         18.369           WBGene0000254         WBGene00035494         n.d.         214         0.208         1.1239           WBGene00001638         WBGene00025421         44.07         654         7         8           WBGene0001639         WBGene0002541         44.07         654         7         8           WBGene0001639         WBGene0003548         77.18         355         0.654         8           WBGene0001470         WBGene0003548         77.18         355         0.654         8           WBGene0001470         WBGene00035461         43.06         474         0.238         11.509     <		WBGene00001204	WBGene00025733	37.41	153	6	1
*         WBGene00025215         69.25         493         6         2.376           WBGene00004224         WBGene00033192         32.04         399         0.264         5.098           *         WBGene0004256         WBGene00040585         40.69         491         0.264         9.3943           WBGene00004257         WBGene00025527         82.52         148         0.646         18.369           WBGene0000250         WBGene00033805         30.39         184         0.646         18.369           WBGene0000220         WBGene00033805         30.39         258         4         1           WBGene00009622         WBGene00025421         44.07         539         0.208         1.1239           WBGene000138         WBGene0002542         44.07         539         0.208         10.058           WBGene0001638         WBGene0002542         44.07         539         0.208         10.058           WBGene00012295         WBGene00030548         77.18         344         0.654         10.058           WBGene00012295         WBGene0003548         77.18         355         0.654         8           WBGene0001470         WBGene0003546         77.18         31.509         31.509							
WBGene00004224       WBGene00033192       32.04       399       0.264       5.098         *       WBGene00038480       32.04       427       3       5.098         WBGene00004256       WBGene00040585       40.69       491       0.264       9.3943         WBGene00004257       WBGene00025527       82.52       148       0.646       18.369         WBGene0000250       WBGene00025527       82.52       143       4       1         WBGene0000249       WBGene00033806       30.39       184       0.646       18.369         WBGene0000249       WBGene00035494       n.d.       214       0.208       1.1239         WBGene0001638       WBGene0002541       44.07       539       0.208       10.058         WBGene0001639       WBGene0002541       44.07       654       7       8         WBGene0001639       WBGene0002543       77.18       444       0.654       10.058         WBGene0001639       WBGene00025657       53.24       1009       0.238       11.509         WBGene0001763       WBGene0003546       77.18       355       0.654       8         WBGene0000964       WBGene00032547       53.24       709       3       1					493	0.263	2.3/6
*         WBGene00038480         32.04         427         3         5.098           WBGene00004256         WBGene00040585         40.69         491         0.264         9.3943           WBGene00004257         WBGene00025527         82.52         148         0.646         18.369           WBGene0000250         WBGene00033806         30.39         184         0.646         18.369           WBGene0000249         WBGene00033805         30.39         184         0.646         18.369           WBGene00001250         WBGene00033805         30.39         258         4         1           WBGene00009622         WBGene00035494         n.d.         183         7         1.1239           WBGene00001638         WBGene00025421         44.07         539         0.208         10.058           WBGene0001639         WBGene0003548         77.18         444         0.654         10.058           WBGene0001639         WBGene0003548         77.18         355         0.654         8           WBGene0001639         WBGene00025657         53.24         1009         0.238         11.509           WBGene0001763         WBGene00033234         40.08         507         0.134         18.331		*	WBGene00025215	69.25	493	6	2.376
*         WBGene00038480         32.04         427         3         5.098           WBGene00004256         WBGene00040585         40.69         491         0.264         9.3943           WBGene00004257         WBGene00025527         82.52         148         0.646         18.369           WBGene0000250         WBGene00033806         30.39         184         0.646         18.369           WBGene0000249         WBGene00033805         30.39         184         0.646         18.369           WBGene00001250         WBGene00033805         30.39         258         4         1           WBGene00009622         WBGene00035494         n.d.         183         7         1.1239           WBGene00001638         WBGene00025421         44.07         539         0.208         10.058           WBGene0001639         WBGene0003548         77.18         444         0.654         10.058           WBGene0001639         WBGene0003548         77.18         355         0.654         8           WBGene0001639         WBGene00025657         53.24         1009         0.238         11.509           WBGene0001763         WBGene00033234         40.08         507         0.134         18.331		WBGene00004224	WBCone00033192	32 04	300	0 264	5 098
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WBGene00000004WBGene0002922985.2114228WBGene00008885WBGene0003637854.044851.07810.737WBGene00016044WBGene0003637854.0478128WBGene0003041WBGene0002855656.455390.4659.4187WBGene00021661WBGene0003399156.4555979.4187							
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WBGene00016044         WBGene00036378         54.04         781         2         8           WBGene00003041         WBGene00028556         56.45         539         0.465         9.4187           WBGene00021661         WBGene00033991         56.45         559         7         9.4187		WBGene00000004	WBGene00029229	85.21	142	2	8
WBGene00016044         WBGene00036378         54.04         781         2         8           WBGene00003041         WBGene00028556         56.45         539         0.465         9.4187           WBGene00021661         WBGene00033991         56.45         559         7         9.4187		WBGene00008885	WBGene00036378	54.04	485	1.078	10.737
WBGene00003041         WBGene00028556         56.45         539         0.465         9.4187           WBGene00021661         WBGene00033991         56.45         559         7         9.4187							
WBGene00021661         WBGene00033991         56.45         559         7         9.4187							
WBGene00021661         WBGene00033991         56.45         559         7         9.4187		WBGene00003041	WBGene00028556	56.45	539	0.465	9.4187
WBGeneUUU16112  WBGeneUUU25675  44.03  464  0.465  10.314							
	ļ	wBGene00016112	wBGene00025675	44.03	464	0.465	10.314

WBGene0000516         WBGene0003375         S78         7         8           WBGene0000516         WBGene0003375         35.24         566         2         8           WBGene0001757         WBGene00023795         52.01         586         2         1.9.277           WBGene0001101         WBGene00026051         34.83         393         0.218         19.193           WBGene0001507         WBGene0002720         75.26         287         0.149         12.798           WBGene0001506         WBGene00022972         75.26         287         0.601         14.463           WBGene0001506         WBGene00022977         34.86         312         9         5           WBGene0001506         WBGene000229977         34.36         312         9         3           WBGene0001501         WBGene00026675         41.05         1285         0.601         17.454           WBGene00016074         WBGene00036248         69.93         556         8         3           WBGene0004052         WBGene0003351         68.26         4129         0.57           WBGene0004052         WBGene0003355         68.26         4129         0.278         9.7792           WBGene0001818         WBGene000238		1				1
WBGene000017757         WBGene000220         52.01         58.24         56.6         2         8           WBGene00017757         WBGene00023795         52.01         58.6         2         1.9277           WBGene0001029         WBGene00023795         52.01         58.6         2         1.9277           WBGene00011600         WBGene00023720         75.26         28.7         0.149         12.798           WBGene00016506         WBGene00023720         75.26         28.7         0.149         12.798           WBGene00016566         WBGene00029770         74.39         297         0.601         11.463           WBGene00016506         WBGene00024977         34.39         297         0.601         11.463           WBGene0001674         WBGene00036193         41.05         1203         9         3           WBGene00016074         WBGene00036248         69.93         556         8         3           WBGene0004162         WBGene000452         WBGene000452         WBGene000442         82.16         510         0.470         0.6483           WBGene0004177         WBGene0003593         49.54         215         9         5           WBGene0004167         WBGene0003562         68.26	WBGene00016123	WBGene00034951	44.03	578	7	8
WBGene00117757         WBGene00022702         52.01         733         0.587         1.9277           WBGene00010101         WBGene00023795         52.01         586         2         1.9277           WBGene0001101         WBGene0003051         34.83         362         1         8           WBGene0001202         WBGene00023701         75.26         287         3         12.798           WBGene00014606         WBGene00029700         75.26         287         3         12.798           WBGene0001560         WBGene00029770         34.83         3299         9         5           WBGene00016010         WBGene00026875         41.05         1285         0.601         17.454           WBGene00016072         WBGene00036248         69.93         594         0.470         1.7454           WBGene0004052         WBGene0003673         49.54         255         0.221         6.59           WBGene0004052         WBGene0003673         49.54         255         0.221         6.59           WBGene00019427         WBGene0003554         48.81         429         0.278         14.074           WBGene0001842         WBGene0003555         42.64         419         9         5	WBGene00000516	WBGene00031372	35.24	441	0.587	10.314
WBGene0010101         WBGene00023795         52.01         586         2         1.9277           WBGene0001101         WBGene00031496         34.83         393         0.218         19.193           *         WBGene0002720         75.26         287         0.149         12.798           WBGene001290         75.26         287         0.149         12.798           WBGene0001290         75.26         287         0.149         11.463           WBGene0001290         V5.26         287         0.149         11.463           WBGene00012805         WBGene00029977         34.89         297         0.601         11.463           WBGene0016074         WBGene00036193         41.05         1203         9         3           WBGene0016074         WBGene00036193         41.05         1203         9         3           WBGene0004051         WBGene0003673         49.54         216         9         6.59           WBGene0004051         WBGene0003693         49.54         216         9         5           WBGene000177         WBGene00033675         49.54         216         9         5           WBGene000177         WBGene000173         49.54         216 <td< td=""><td>WBGene00000517</td><td>WBGene00036415</td><td>35.24</td><td>566</td><td>2</td><td>8</td></td<>	WBGene00000517	WBGene00036415	35.24	566	2	8
WBGene00001101         WBGene00036051         34.83         362         1         8           WBGene00031496         83.85         155         0.218         19.193           WBGene00023720         75.26         287         3         12.798           WBGene0002720         75.26         287         3         12.798           WBGene0002770         75.26         287         3         12.798           WBGene0000569         WBGene0002977         74.33         297         0.601         11.463           WBGene00003556         WBGene00026875         41.05         1225         0.601         17.454           WBGene000040510         WBGene00036248         69.93         594         0.470         17.454           WBGene00040512         WBGene0003673         49.54         255         0.221         6.59           WBGene00040512         WBGene00036973         49.54         255         0.221         6.59           WBGene00019427         WBGene000355         47.88         1429         0.278         14.074           WBGene0001335         WBGene0003355         48.24         19         5         556         5           WBGene0001335         WBGene0003355         48.24 <t< td=""><td>WBGene00017757</td><td>WBGene00042202</td><td>52.01</td><td>733</td><td>0.587</td><td>1.9277</td></t<>	WBGene00017757	WBGene00042202	52.01	733	0.587	1.9277
WBGene00001101         WBGene00031051         34.83         352         0.218         19.133           WBGene00031496         83.85         195         0.218         19.133           WBGene00016507         WBGene0002720         75.26         287         3         12.798           WBGene00015608         WBGene0002720         75.26         287         3         12.798           WBGene0000596         WBGene0002770         75.26         287         3         12.798           WBGene0000596         WBGene0002770         75.36         31.9         0.149         11.463           WBGene0000510         WBGene00026875         41.05         1203         9         3           WBGene00004051         WBGene00036248         69.93         556         8         3           WBGene0004051         WBGene00036973         49.54         255         0.221         6.59           WBGene0001677         WBGene00035547         49.54         255         0.221         6.59           WBGene00019427         WBGene0003554         48.84         129         0.278         1.7.745           WBGene000119427         WBGene0003355         5.04         313         0.311         1.0.745           WBGene00	WBGene00010029	WBGene00023795	52.01	586	2	1.9277
*         WBGene00036051         34.83         362         1         8           WBGene0001601         WBGene00023941         83.85         195         0.218         19.193           *         WBGene00023920         75.26         287         0.149         12.798           WBGene0012805         WBGene0002970         75.26         287         0.149         11.463           WBGene0012805         WBGene0002977         34.39         297         0.601         11.463           WBGene00012801         WBGene00028075         41.05         1203         9         3           WBGene00016074         WBGene00036248         69.93         556         8         3           WBGene00016074         WBGene000373         49.54         215         0.221         1.474           WBGene0001077         WBGene0003551         62.62         427         0.221         14.074           WBGene00001778         WBGene0002355         67.82         41.99         0.278         14.774           WBGene00011778         WBGene0002355         67.82         41.99         0.278         14.774           WBGene00011778         WBGene0002331         69.21         920         0.278         14.772				393	0.218	
WBGene00001102         WBGene00023920         75.26         287         12.798           WBGene00016507         WBGene00029720         75.26         287         0.149         12.798           WBGene00016507         WBGene00029720         75.26         287         3         12.798           WBGene0000596         WBGene00029770         75.26         287         3         12.798           WBGene0000596         WBGene00026977         34.39         299         5         5           WBGene00003556         WBGene00036248         69.93         544         0.601         11.463           WBGene0004055         WBGene00036248         69.93         556         8         3           WBGene0004052         WBGene0003673         49.54         255         0.221         6.59           WBGene0001427         WBGene00036973         49.54         255         0.221         14.074           WBGene00014142         WBGene0002315         F8.8         1295         5         5           WBGene0001418         WBGene0002315         5.04         13         0.311         0.311         0.388           WBGene00011477         WBGene0002315         5.04         313         0.311         0.388						
*         WBGene00023941         83.85         161         1         8           WBGene00016506         WBGene00029720         75.26         287         3.12.798           WBGene00012855         WBGene0002970         75.26         287         3.12.798           WBGene00012855         WBGene0002977         34.39         297         0.601         11.463           WBGene00012855         WBGene00026475         34.39         297         0.601         17.454           WBGene00016074         WBGene00026448         69.33         556         8         3           WBGene0004052         WBGene0004424         82.16         537         8         0.6483           WBGene0004052         WBGene0003551         68.26         410         9         5           WBGene0004142         82.16         537         8         0.6483           WBGene00041717         WBGene0003551         68.26         419         9         5           WBGene00013717         WBGene00025031         69.21         440         6         9.7792           WBGene00011178         WBGene00025031         69.21         440         6         9.7792           WBGene00021183         WBGene0003834         53.23	WPCopo00001102					-
WBGene00016507         WBGene00029720         75.26         287         0.149         12.798           WBGene00012906         WBGene00029166         34.86         319         0.149         11.463           WBGene00012815         WBGene0002977         34.86         302         3         5           WBGene0002801         WBGene0002875         41.05         1203         9         5           WBGene00016072         WBGene00026248         69.33         594         0.470         17.454           WBGene00016072         WBGene00036248         69.33         594         0.470         0.6483           WBGene00016072         WBGene00036973         49.54         216         9         6.59           WBGene00013427         WBGene0003562         68.26         427         0.221         4.074           WBGene00013472         WBGene0003562         48.26         429         5         5           WBGene0001383         WBGene00025031         69.21         44.06         9.7792           WBGene0001813         WBGene00025031         69.21         440         6         9.7792           WBGene0002183         WBGene00025031         69.21         440         6         9.7792           WBGen	*					
WBGene0001656         WBGene00029720         75.26         287         3         12.798           WBGene00012856         WBGene00035475         34.86         319         0.149         11.463           WBGene00012855         WBGene00035475         34.86         319         297         0.601         11.463           WBGene00018050         WBGene00026875         41.05         1203         9         5           WBGene00016074         WBGene00036248         69.93         556         8         3           WBGene00016072         WBGene00036248         69.93         556         8         3           WBGene00014025         WBGene00036973         49.54         216         9         6.59           WBGene0001777         WBGene0003551         68.26         417         9         5           WBGene00017178         WBGene00025031         69.21         920         0.278         14.074           WBGene00011717         WBGene00025031         69.21         920         0.278         9.7792           WBGene0001813         WBGene00025031         69.21         920         0.278         9.7792           WBGene0002264         WBGene003384         53.23         718         8         8 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td>						-
WBGene00012805         WBGene00029166         34.86         31.9         0.149         11.463           WBGene0000509         WBGene00029977         34.39         297         0.601         11.463           WBGene0002801         WBGene0002875         41.05         1285         0.601         17.454           WBGene00016072         WBGene00026475         41.05         1285         0.601         17.454           WBGene00016072         WBGene00036248         69.33         594         0.470         17.454           WBGene00004052         WBGene00036248         69.33         594         0.6483         WBGene00041422         82.16         510         0.470         0.6483           WBGene00004052         WBGene0003562         68.26         427         0.221         6.59           WBGene00019427         WBGene0003562         68.26         419         9         5           WBGene0001942         WBGene00029052         47.88         1295         6         5           WBGene0001811         WBGene0003834         53.23         719         0.278         9.7792           WBGene00020264         WBGene0003834         53.23         763         8         8         0.3888           WBGene0002265						
WBGene00012835         WBGene00035475         34.86         302         3         5           WBGene0000500         WBGene00028977         34.39         297         0.601         11.463           WBGene00002867         41.05         1285         0.601         17.454           WBGene0003956         WBGene00036248         69.93         594         0.470         17.454           WBGene0004052         WBGene00041422         82.16         530         0.6483           WBGene0004051         WBGene00041442         82.16         537         8         0.6483           WBGene00004052         WBGene00035673         49.54         216         9         5           WBGene0000177         WBGene0003551         68.26         427         0.221         14.074           WBGene0001778         WBGene00035351         69.21         920         0.278         9.7792           WBGene0001813         WBGene0002202         47.88         129         0.278         9.7792           WBGene0002177         WBGene0003384         53.23         763         8         8         0.3388           WBGene0002265         WBGene0003384         53.23         719         0.311         14.752           WBGene000						
WBGene00000510         WBGene000011856         34.39         297         0.601         11.463           WBGene00022801         WBGene000675         31.05         1228         0.601         17.454           WBGene00016074         WBGene00036248         69.93         556         8         3           WBGene0004052         WBGene00036248         69.93         556         8         3           WBGene0004052         WBGene00036248         69.93         556         8         3           WBGene0004052         WBGene00036973         49.54         216         9         6.59           WBGene00019427         WBGene00033562         68.26         427         0.221         14.074           WBGene0001813         WBGene00025031         69.21         40.0         9         5           WBGene0001813         WBGene00025031         69.21         400         6         9.7792           WBGene00020264         WBGene0002835         55.04         313         0.311         1.4.752           WBGene00020265         WBGene00028364         53.23         719         0.311         14.752           WBGene00020265         WBGene00033667         76.29         110         0.243         8.1971 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td></t<>						
WBGene0000510         WBGene00028675         41.05         1285         0.601         17.454           WBGene0003956         WBGene00036193         41.05         1203         9         3           WBGene00016072         WBGene00036248         69.93         556         8         3           WBGene0004051         WBGene00036973         49.54         255         0.221         6.59           WBGene000141442         82.16         510         0.470         0.6483           WBGene0001427         WBGene0003551         68.26         419         9         5           WBGene00011778         WBGene00025031         69.21         920         0.278         14.074           WBGene00011813         WBGene00025031         69.21         920         0.278         14.074           WBGene00011811         WBGene00025031         69.21         920         0.278         14.074           WBGene0002064         WBGene0003833         55.04         313         0.311         14.752           WBGene00020727         WBGene0003834         55.23         719         0.311         14.752           WBGene00020272         WBGene0002375         763.24         8         8         8           WBGene000221	WBGene00012835	WBGene00035475		302	3	
WBGene00022801         WBGene000365         VBGene00036193         41.05         1285         0.601         17.454           WBGene00016074         WBGene00036248         69.93         594         0.470         17.454           WBGene0004052         WBGene00036248         69.93         556         8         3           WBGene0004051         WBGene00036973         49.54         216         510         0.470         0.6483           WBGene00014142         WBGene0003551         68.26         417         0.221         14.074           WBGene0001417         WBGene00029035         47.88         1429         0.278         14.074           WBGene0001812         WBGene00029031         69.21         920         0.278         9.7792           WBGene0001811         WBGene0003834         53.23         719         0.311         0.3188           WBGene0002065         WBGene0003834         53.23         719         0.311         14.752           WBGene00021578         WBGene0003867         36.42         480         0.372         2.8893           WBGene0002265         WBGene0003834         53.23         763         8         8           WBGene0002215         WBGene0003267         36.42         4	WBGene00000509	WBGene00029977	34.39	297	0.601	11.463
WBGene00036956         WBGene00036248         69.93         594         0.470         17.454           WBGene00016072         WBGene00036248         69.93         556         8         3           WBGene0004051         WBGene00036973         49.54         255         0.221         6.59           WBGene00014025         WBGene00036973         49.54         255         0.221         6.59           WBGene00019427         WBGene0003552         68.26         419         9         5           WBGene00019427         WBGene0002022         47.88         1295         6         5           WBGene0001183         WBGene0002032         47.88         1429         0.278         14.074           WBGene0001181         WBGene0002033831         55.04         313         0.311         0.3188           WBGene0002065         WBGene00033834         53.23         719         0.311         14.752           WBGene0002215         WBGene00033667         65.09         110         0.243         14.752           WBGene0002215         WBGene00033667         65.09         110         0.243         14.752           WBGene0002215         WBGene00033667         65.09         107         5         8.971 <td>WBGene00000510</td> <td>WBGene00041856</td> <td>34.39</td> <td>299</td> <td>9</td> <td>5</td>	WBGene00000510	WBGene00041856	34.39	299	9	5
WBGene00016074         WBGene00036248         69.93         594         0.470         17.454           WBGene0004052         WBGene00041442         82.16         510         0.470         0.6483           WBGene0004051         WBGene00036973         49.54         255         0.221         6.59           WBGene00011977         WBGene0003551         68.26         419         9         5           WBGene0001812         WBGene00025031         69.21         920         0.278         14.074           WBGene0001812         WBGene00025031         69.21         920         0.278         9.7792           WBGene0002022         47.88         1295         6         5         9.7792           WBGene00020231         69.21         920         0.278         9.7792           WBGene00020264         WBGene00038834         53.23         719         0.311         14.752           WBGene0002215         WBGene00033841         78.82         170         5         8           WBGene00022459         WBGene00023567         65.27         10         0.243         8.1971           WBGene00022455         WBGene00023576         47.74         374         5         5.6259           WBGene00022555<	WBGene00022801	WBGene00026875	41.05	1285	0.601	17.454
WBGene00016072         WBGene00041442         82.16         556         8         3           WBGene0004051         WBGene00041442         82.16         510         0.470         0.6483           WBGene00004051         WBGene00036973         49.54         215         0.221         6.59           WBGene0001177         WBGene00033551         68.26         427         0.221         14.074           WBGene00011842         WBGene00029035         47.88         1429         0.278         14.074           WBGene000011578         WBGene00025031         69.21         440         6         9.7792           WBGene0002164         WBGene00033834         53.23         719         0.311         0.3888           WBGene0002065         WBGene00033834         53.23         763         8         8           WBGene0002165         WBGene00033667         65.09         100         0.243         14.752           WBGene00022459         WBGene00033667         36.42         480         0.372         2.3893           WBGene00022459         WBGene00033667         36.42         480         0.372         2.3893           WBGene00022459         WBGene0003467         47.74         245         0.372         2.3893	WBGene00003956	WBGene00036193	41.05	1203	9	3
WBGene00016072         WBGene00041442         82.16         556         8         3           WBGene0004051         WBGene00041442         82.16         510         0.470         0.6483           WBGene00004051         WBGene00036973         49.54         215         0.221         6.59           WBGene0001177         WBGene00033551         68.26         427         0.221         14.074           WBGene00011842         WBGene00029035         47.88         1429         0.278         14.074           WBGene000011578         WBGene00025031         69.21         440         6         9.7792           WBGene0002164         WBGene00033834         53.23         719         0.311         0.3888           WBGene0002065         WBGene00033834         53.23         763         8         8           WBGene0002165         WBGene00033667         65.09         100         0.243         14.752           WBGene00022459         WBGene00033667         36.42         480         0.372         2.3893           WBGene00022459         WBGene00033667         36.42         480         0.372         2.3893           WBGene00022459         WBGene0003467         47.74         245         0.372         2.3893	WBGene00016074	WBGene00036248	69.93	594	0.470	17.454
WBGene00004052         WBGene00041442         82.16         510         0.470         0.6483           WBGene00004025         WBGene00036973         49.54         255         0.221         6.59           WBGene00019427         WBGene00033551         68.26         427         0.221         14.074           WBGene00019427         WBGene00029035         47.88         1429         0.278         14.074           WBGene00001813         WBGene00025031         69.21         920         0.278         9.7792           WBGene00020727         WBGene00033831         55.04         313         0.311         0.3888           WBGene0002064         WBGene00033834         53.23         719         0.311         14.752           WBGene0002465         WBGene00033667         65.09         107         5         8.1971           WBGene00024156         WBGene00033667         65.09         107         5         2.3893           WBGene00024156         WBGene00033667         65.27         109         0.181         12.892           WBGene00021157         WBGene00023765         47.74         245         0.372         5.6259           WBGene00021242         WBGene00023765         57.74         448         0.372						
WBGene00004051         WBGene00036973         49.54         255         0.221         6.59           WBGene0001077         WBGene00035973         49.54         216         9         6.59           WBGene0001177         WBGene00035951         68.26         427         0.221         14.074           WBGene00004183         WBGene00029035         47.88         1429         0.278         14.074           WBGene00001813         WBGene00025031         69.21         920         0.278         9.7792           WBGene00001813         WBGene0003833         55.04         313         0.311         0.3888           WBGene00020265         WBGene0003834         53.23         763         8         8           WBGene0002465         WBGene00024156         78.82         170         0.243         8.1971           WBGene0002465         WBGene00024156         78.82         170         5         8           WBGene0002465         WBGene00024156         76.42         480         0.372         2.3893           WBGene00022489         WBGene00025756         65.09         107         5         8.1971           WBGene00021577         WBGene0002576         67.74         445         0.372         2.3893						-
WBGene00004025         WBGene00036973         49.54         255         0.221         6.59           WBGene00019427         WBGene00033561         68.26         427         0.221         14.074           WBGene00014183         WBGene00029023         47.88         1429         0.278         14.074           WBGene00004183         WBGene00029023         47.88         1429         0.278         14.074           WBGene00001813         WBGene00029023         47.88         1429         0.278         9.7792           WBGene00011578         WBGene00028031         69.21         440         6         9.7792           WBGene0002064         WBGene0003883         55.04         313         0.311         14.752           WBGene0002464         WBGene00033845         53.23         719         0.311         14.752           WBGene0002465         WBGene00033667         65.09         100         0.243         8.1971           WBGene00022155         WBGene00033667         65.27         169         0.312         2.3893           WBGene00022575         47.74         245         0.372         2.3893           WBGene00015177         WBGene00025765         47.74         374         5         5.6259						
WBGene0001077         WBGene00036973         49.54         216         9         6.59           WBGene00017178         WBGene00033551         68.26         427         0.221         14.074           WBGene0001178         WBGene00029035         47.88         1429         0.278         14.074           WBGene00001813         WBGene00025031         69.21         440         6         9.7792           WBGene00020727         WBGene00038831         55.04         313         0.311         0.3888           WBGene000200264         WBGene00033834         53.23         719         0.311         14.752           WBGene00004801         WBGene00033841         53.23         719         0.243         14.752           WBGene00004801         WBGene00033647         78.82         170         5         8           WBGene00022459         WBGene0002470         65.09         110         0.243         14.752           WBGene00022154         WBGene00022765         47.74         245         0.372         5.6259           WBGene00022155         WBGene00022765         47.74         374         5         5.6259           WBGene00022157         WBGene00022765         47.74         374         5         5.6259					-	
WBGene00019427         WBGene00033562         68.26         427         0.221         14.074           WBGene00011778         WBGene0002903         57         88         1429         0.278         14.074           WBGene00004182         WBGene00029022         47.88         1429         0.278         14.074           WBGene00011813         WBGene00025031         69.21         920         0.278         9.7792           WBGene00011578         WBGene00028035         55.04         258         8         0.3888           WBGene0002064         WBGene00033834         53.23         719         0.311         14.752           WBGene0004801         WBGene00033844         53.23         763         8         8           WBGene00024156         78.82         170         0.243         81.971           WBGene0002215         WBGene0003467         65.09         107         5         8.1971           WBGene0002215         WBGene00032575         47.74         245         0.372         5.6259           WBGene00012142         WBGene00025735         47.74         374         5         5.6259           WBGene0001567         WBGene00031423         65.27         201         6         8 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td></t<>						
WBGene00017178         WBGene00033551         68.26         419         9         5           WBGene00004183         WBGene00029035         47.88         1429         0.278         14.074           WBGene00001813         WBGene00025031         69.21         920         0.278         9.7792           WBGene00011578         WBGene00039835         55.04         313         0.311         0.3888           WBGene0002064         WBGene00038834         53.23         719         0.311         14.752           WBGene0002065         WBGene00033834         53.23         763         8         8           WBGene0002464         WBGene00033667         65.09         110         0.243         8.1971           WBGene0002215         WBGene00033667         65.09         100         0.243         8.1971           WBGene0002215         WBGene00022765         47.74         245         0.372         2.3893           WBGene0002215         WBGene00025735         47.74         374         5         5.6259           WBGene0001017         WBGene00031423         65.27         169         0.181         12.892           WBGene00001017         WBGene00031423         65.27         169         1.181         12.892					-	
WBGene0004183         WBGene00029035         47.88         1429         0.278         14.074           WBGene00001813         WBGene00025031         69.21         920         0.278         9.7792           WBGene00011578         WBGene00039831         55.04         313         0.311         0.3888           WBGene0002064         WBGene0003834         53.23         719         0.311         14.752           WBGene0002065         WBGene00033834         53.23         763         8         8           WBGene0002460         WBGene0003467         78.82         170         0.243         8.1971           WBGene0002489         WBGene0003467         78.82         170         0.243         8.1971           WBGene00022489         WBGene0003667         65.09         110         0.243         8.1971           WBGene00022489         WBGene00025755         47.74         245         0.372         2.3893           WBGene000112142         WBGene00025755         47.74         47         0.311         12.892           WBGene00015676         WBGene0003367         65.27         169         0.181         12.892           WBGene00015676         WBGene00034297         64.01         1219         0.181						
WBGene00004182         WBGene00029022         47.88         1295         6         5           WBGene0001813         WBGene00025031         69.21         920         0.278         9.7792           WBGene00011578         WBGene00039835         55.04         258         8         0.3818           WBGene0002064         WBGene00038834         53.23         719         0.311         14.752           WBGene0002064         WBGene00033834         53.23         763         8         8           WBGene00020460         WBGene00033641         78.82         170         0.243         8.1971           WBGene000224156         78.82         170         5         8.1971           WBGene0002215         WBGene00033667         65.09         110         0.243         8.1971           WBGene0002215         WBGene00025735         47.74         374         5         5.6259           WBGene00021142         WBGene00034297         64.01         1219         0.181         12.892           WBGene00015676         WBGene00034297         64.01         1219         6         8           WBGene0000107         WBGene00034297         64.01         1219         6         8           WBGene00001088 </td <td></td> <td></td> <td></td> <td></td> <td>-</td> <td>-</td>					-	-
WBGene00001813         WBGene00025031         69.21         920         0.278         9.7792           WBGene00011578         WBGene00039831         55.04         313         0.311         0.3888           WBGene00020727         WBGene00039835         55.04         258         8         0.3888           WBGene0002064         WBGene00033834         53.23         719         0.311         14.752           WBGene0004801         WBGene00033641         78.82         170         5         8           WBGene0002429         WBGene00033667         65.09         110         0.243         8.1971           WBGene0002215         WBGene00033667         36.42         480         0.372         2.3893           WBGene0002149         WBGene0002575         47.74         245         0.372         5.6259           WBGene00015177         WBGene0002575         47.74         245         0.372         5.6259           WBGene0000168         WBGene00031423         65.277         169         0.181         12.892           WBGene0000177         WBGene00032270         59.45         406         9         4           WBGene0001758         WBGene0003271         59.45         406         9         4 <td>WBGene00004183</td> <td></td> <td>47.88</td> <td>1429</td> <td>0.278</td> <td>14.074</td>	WBGene00004183		47.88	1429	0.278	14.074
WBGene0001811WBGene0002503169.2144069.7792WBGene0001578WBGene0003983155.043130.3110.3888WBGene0002064WBGene0003883453.237190.31114.752WBGene00004801WBGene0003383453.2376388WBGene00004802WBGene0002415678.821700.24314.752WBGene00016811WBGene0002497065.091100.2438.1971WBGene00022489WBGene0003366765.0910758WBGene000215WBGene0002676547.742450.3722.3893WBGene0001217WBGene0002573547.7437455.6259WBGene00015077WBGene0002575665.271690.18112.892WBGene000107WBGene0003429764.0112190.18112.892WBGene000107WBGene0003429764.0112190.18112.892WBGene000108WBGene0003722243.434194WBGene0001943WBGene0003257159.454650.56910.778WBGene0001943WBGene0003257159.454650.56710.7734.2335*WBGene00013268WBGene0003257159.454650.56710.454*WBGene0003257928.875270.5175.8458WBGene00013268WBGene000327928.8748389WBGene00013264WBGene00032693.074.23353.6543.52	WBGene00004182	WBGene00029022	47.88	1295	6	5
WBGene00011578         WBGene00039831         55.04         313         0.311         0.3888           WBGene00020277         WBGene00033834         53.23         719         0.311         14.752           WBGene0002065         WBGene00033834         53.23         763         8         8           WBGene0004801         WBGene00024156         78.82         170         0.243         14.752           WBGene000224190         WBGene00033667         65.09         110         0.243         8.1971           WBGene0002215         WBGene00033667         36.42         480         0.372         2.3893           WBGene00015177         WBGene00025755         47.74         245         0.372         5.6259           WBGene00015676         WBGene00025756         65.27         169         0.181         12.892           WBGene0000168         WBGene00031423         65.27         169         0.181         12.892           WBGene00001018         WBGene0003722         43.4         373         0.569         10.778           WBGene00009238         WBGene0002775         59.45         406         9         4           WBGene00016943         WBGene0002771         59.45         405         9         4	WBGene00001813	WBGene00025031	69.21	920	0.278	9.7792
WBGene00020727         WBGene00039835         55.04         258         8         0.3888           WBGene00002064         WBGene00033834         53.23         719         0.311         14.752           WBGene00004801         WBGene00033834         53.23         763         8         8           WBGene0004802         WBGene00024970         65.09         110         0.243         8.1971           WBGene00022489         WBGene00033667         36.42         480         0.372         2.3893           WBGene0002215         WBGene0002575         47.74         245         0.372         5.6259           WBGene00015177         WBGene0002575         47.74         374         5         5.6259           WBGene0001577         WBGene00024297         65.27         169         0.181         12.892           WBGene00001577         WBGene00034297         64.01         1219         6         8           WBGene0000179         WBGene00037222         43.4         373         0.569         10.778           WBGene00009238         WBGene0002770         59.45         4065         9         4           WBGene00019433         WBGene00025199         33.23         679         0.517         5.458 <td>WBGene00001811</td> <td>WBGene00025031</td> <td>69.21</td> <td>440</td> <td>6</td> <td>9.7792</td>	WBGene00001811	WBGene00025031	69.21	440	6	9.7792
WBGene00002064WBGene0003383453.237190.31114.752WBGene0002065WBGene0003383453.2376388WBGene0004801WBGene0002304178.8217058WBGene00016811WBGene0002497065.091100.2438.1971WBGene00022489WBGene0003366765.0910758.1971WBGene0002215WBGene000326736.424800.3722.3893WBGene0012142WBGene0002573547.742450.3725.6259WBGene00015177WBGene0002573547.7437455.6259WBGene00020168WBGene0003142365.2720168WBGene0000107WBGene0003429764.0112190.18112.892WBGene0001283WBGene0003722243.434194WBGene00016943WBGene000372243.434194WBGene00016943WBGene000300173.8515280.7734.2335*WBGene0003001WBGene000300273.8551.720.5175.8458*WBGene000300273.855270.5175.8458*WBGene000307528.8748389WBGene00013255WBGene0003279828.8748389WBGene00013268WBGene000327928.8748389WBGene0001609WBGene000277828.8748389WBGene0001609WBGene000277828.874	WBGene00011578	WBGene00039831	55.04	313	0.311	0.3888
WBGene00002064WBGene0003383453.237190.31114.752WBGene0002065WBGene0003383453.2376388WBGene0004801WBGene0002304178.8217058WBGene00016811WBGene0002497065.091100.2438.1971WBGene00022489WBGene0003366765.0910758.1971WBGene0002215WBGene000326736.424800.3722.3893WBGene0012142WBGene0002573547.742450.3725.6259WBGene00015177WBGene0002573547.7437455.6259WBGene00020168WBGene0003142365.2720168WBGene0000107WBGene0003429764.0112190.18112.892WBGene0001283WBGene0003722243.434194WBGene00016943WBGene000372243.434194WBGene00016943WBGene000300173.8515280.7734.2335*WBGene0003001WBGene000300273.8551.720.5175.8458*WBGene000300273.855270.5175.8458*WBGene000307528.8748389WBGene00013255WBGene0003279828.8748389WBGene00013268WBGene000327928.8748389WBGene0001609WBGene000277828.8748389WBGene0001609WBGene000277828.874	WBGene00020727	WBGene00039835	55.04	258	8	0.3888
WBGene00002065WBGene0003383453.2376388WBGene0004801WBGene0003304178.821700.24314.752WBGene00016811WBGene0002415678.8217058WBGene00022489WBGene0002367765.091100.2438.1971WBGene0002215WBGene0003366736.424800.3722.3893WBGene00015177WBGene0002257547.742450.3725.6259WBGene00015676WBGene0002357665.271690.18112.892WBGene000107WBGene0003429764.01121968WBGene0000108WBGene0003722243.434194WBGene00016943WBGene0002357159.454650.56910.778WBGene00016943WBGene000300273.8515280.7734.2335*WBGene0001693WBGene000300173.8515250.7734.2335*WBGene0001214WBGene000300273.8515250.7734.2335*WBGene00012519933.2365485.8458WBGene00013255WBGene0003307528.8748389WBGene0013255WBGene0003300173.8515250.7734.2335*WBGene0002294258.362690.45712.699WBGene00012214WBGene0003307528.8748389*WBGene0002250953.074910.26210.454*WBGene0002269					0.311	
WBGene00004801         WBGene00024156         78.82         170         0.243         14.752           WBGene000124156         78.82         170         5         8           WBGene00024970         65.09         110         0.243         8.1971           WBGene00022015         WBGene00033667         65.09         107         5         8.1971           WBGene00020490         WBGene00026765         47.74         2480         0.372         2.3893           WBGene00015177         WBGene00023575         47.74         374         5         5.6259           WBGene00015676         WBGene00023576         65.27         169         0.181         12.892           WBGene0000107         WBGene00034297         64.01         1219         6         8           WBGene000018         WBGene00037222         43.4         341         9         4           WBGene0001943         WBGene00023571         59.45         465         0.569         10.778           WBGene0001943         WBGene00023770         59.45         465         0.569         10.778           WBGene00016943         WBGene0023571         59.45         406         9         4           WBGene00016943         WBGene0025199 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>						
WBGene00004802WBGene0002415678.8217058WBGene00016811WBGene0002497065.091100.2438.1971WBGene00022489WBGene0003366736.424800.3722.3893WBGene00012142WBGene0003002836.4231652.3893WBGene00015177WBGene0002573547.7437455.6259WBGene00015177WBGene0002377665.271690.18112.892WBGene000107WBGene000237665.2720168WBGene0000107WBGene0004088464.0112190.18112.892WBGene0000108WBGene000456443.43730.56910.778WBGene0001693WBGene0002727059.454050.56910.778WBGene00016943WBGene0002357159.4540694WBGene0001609WBGene0002357159.4540694WBGene0001609WBGene0002357159.4540694WBGene0001609WBGene0002357159.4540694WBGene0001609WBGene0002357822.8875270.51712.699WBGene0001609WBGene0002798028.8748389WBGene00012284WBGene0002944258.362690.45710.454*WBGene000320953.074910.26210.454*WBGene000269041.1832523WBGene00013203WBGene000269041.18					-	-
WBGene00016811         WBGene00024970         65.09         110         0.243         8.1971           WBGene00022489         WBGene00033667         65.09         107         5         8.1971           WBGene0002215         WBGene00030627         36.42         480         0.372         2.3893           WBGene00012142         WBGene00026765         47.74         245         0.372         5.6259           WBGene00015577         WBGene00025735         47.74         374         5         5.6259           WBGene00015676         WBGene00023576         65.27         169         0.181         12.892           WBGene0000107         WBGene0004084         64.01         1219         0.181         12.892           WBGene0000107         WBGene00037222         43.4         373         0.569         10.778           WBGene00016943         WBGene00023571         59.45         406         9         4           WBGene00016943         WBGene00023571         59.45         406         9         4           WBGene0001609         WBGene00025199         33.23         679         0.517         12.699           WBGene00012214         WBGene00027980         28.87         483         8         9 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>						
WBGene00022489WBGene0003366765.0910758.1971WBGene00020215WBGene0003366736.424800.3722.3893WBGene00012142WBGene0002676547.742450.3725.6259WBGene0001577WBGene0002573547.7437455.6259WBGene00015676WBGene0002357665.271690.18112.892WBGene0000107WBGene0004088464.0112190.18112.892WBGene0000108WBGene000456443.43730.56910.778WBGene0001943WBGene0002357159.454650.56910.778WBGene00019433WBGene0002357159.4540694WBGene00016943WBGene0002519933.236790.5175.8458*WBGene0002519933.2365485.8458WBGene0001694WBGene0002519933.2365485.8458WBGene00012214WBGene0002798028.8748389WBGene00013268WBGene000269041.1832523WBGene00013255WBGene0003358041.182890.45710.454*WBGene0002691253.0749443WBGene00013917WBGene0002640639.685180.26211.391WBGene00013917WBGene0002640649.685180.26210.454*WBGene0002640639.685180.26211.491*WBGene0001301WBGene						-
WBGene00020215WBGene0003366736.424800.3722.3893WBGene00020490WBGene0002676547.742450.3725.6259WBGene00015177WBGene0002573547.7437455.6259WBGene00015676WBGene0003142365.271690.18112.892WBGene0000107WBGene0003429764.0112190.18112.892WBGene00007955WBGene0003429764.01121968WBGene00016943WBGene0003722243.434194WBGene00016943WBGene0002357159.454650.56910.778WBGene00016943WBGene0002357159.4546694WBGene00016943WBGene0002357159.4540694WBGene0001694WBGene0002727059.4540694WBGene0001694WBGene0002727059.454050.5175.8458*WBGene000300273.8515250.7734.2335WBGene0001694WBGene0002719028.875270.5175.8458*WBGene0003255WBGene000397528.875270.51712.699WBGene00013255WBGene0003220953.074910.26210.454*WBGene0003220953.074910.26210.454*WBGene0002691253.0749433WBGene0001501WBGene0002691253.0749443WBGene0001500WBGene00026912<						
WBGene00012142         WBGene00030028         36.42         316         5         2.3893           WBGene00020490         WBGene00026765         47.74         245         0.372         5.6259           WBGene00015177         WBGene00023576         65.27         169         0.181         12.892           WBGene00010767         WBGene00034237         64.01         1219         0.181         12.892           WBGene0000107         WBGene00034297         64.01         1219         6         8           WBGene00007955         WBGene00037222         43.4         341         9         4           WBGene00016943         WBGene0002770         59.45         465         0.569         10.778           WBGene00016943         WBGene00030001         73.85         1528         0.773         4.2335           *         WBGene0003001         73.85         1528         0.773         4.2335           *         WBGene0001699         WBGene0003002         73.85         1525         0.773         4.2335           *         WBGene00027980         28.87         527         0.517         5.8458           *         WBGene0003255         WBGene00032595         28.87         527         0.517						
WBGene00020490         WBGene00026765         47.74         245         0.372         5.6259           WBGene00015177         WBGene00023576         65.27         169         0.181         12.892           WBGene00020168         WBGene00031423         65.27         201         6         8           WBGene0000107         WBGene0004084         64.01         1219         0.181         12.892           WBGene0000108         WBGene00040564         43.4         373         0.569         10.778           WBGene00016943         WBGene00023571         59.45         465         0.569         10.778           WBGene0003001         WBGene00023571         59.45         406         9         4           WBGene0003001         WBGene00023571         59.45         406         9         4           WBGene0003001         WBGene00025199         33.23         679         0.517         5.8458           WBGene00012214         WBGene00027980         28.87         483         8         9           WBGene00013255         WBGene00026690         41.18         289         0.457         12.699           WBGene00013255         WBGene00026690         41.18         252         3         3 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td></tr<>						
WBGene00015177         WBGene00025735         47.74         374         5         5.6259           WBGene00015676         WBGene00023576         65.27         169         0.181         12.892           WBGene0000107         WBGene00040884         64.01         1219         0.181         12.892           WBGene0000108         WBGene00034297         64.01         1219         6         8           WBGene00009238         WBGene00037222         43.4         341         9         4           WBGene00016943         WBGene00023571         59.45         465         0.569         10.778           WBGene0003001         VBGene0003001         73.85         1528         0.773         4.2335           WBGene0003001         VBGene00025199         33.23         679         0.517         5.8458           WBGene0001225         WBGene00027980         28.87         483         8         9           WBGene00013268         WBGene00029442         58.36         269         0.457         12.699           WBGene00013255         WBGene00033580         41.18         289         0.457         10.454           *         WBGene00026690         41.18         252         3         3					-	
WBGene00015676WBGene0002357665.271690.18112.892WBGene0000168WBGene0003142365.2720168WBGene0000107WBGene0003429764.0112190.18112.892WBGene00007955WBGene0004056443.43730.56910.778WBGene00016943WBGene0002727059.454650.56910.778WBGene00016943WBGene0002357159.4540694WBGene000109433WBGene0002357159.4540694WBGene000109433WBGene0002519933.236790.5175.8458*WBGene0002519933.2365485.8458WBGene00013268WBGene0002942258.3626489WBGene00013255WBGene0003400858.3627429WBGene00013255WBGene0003358041.182890.45710.454*WBGene0003220953.074910.26210.454*WBGene0002691253.0749443WBGene0001501WBGene0002691253.0749443WBGene0001500WBGene0004106815.088810.27711.391*WBGene00016493WBGene000294633.063710.27713.631*WBGene0002646652.597310.53713.631				-		
WBGene00020168WBGene0003142365.2720168WBGene0000107WBGene0004088464.0112190.18112.892WBGene00007955WBGene0004056443.43730.56910.778WBGene00016943WBGene0002727059.454650.56910.778WBGene00019433WBGene0002357159.4540694WBGene0001609WBGene0002357159.454050.5174.2335*WBGene0001609WBGene000210173.8515280.7734.2335*WBGene0001609WBGene0002151933.236790.5175.8458WBGene000121214WBGene0002798028.875270.51712.699WBGene00013268WBGene0003400858.3627429WBGene00013255WBGene0003220953.074910.26210.454*WBGene0002669041.1832523WBGene0001501WBGene000261253.0749443WBGene0001500WBGene0004175039.685180.26211.391*WBGene0004175039.685180.227713.631*WBGene0003719515.0882598WBGene00016493WBGene0004176639.685110.27713.631*WBGene0003719515.0852598WBGene0003719515.08525984WBGene00016493WBGene0002842333.0637	WBGene00015177	WBGene00025735	47.74	374	5	
WBGene00000107WBGene0004088464.0112190.18112.892WBGene0000108WBGene0003429764.01121968WBGene00007955WBGene0003722243.43730.56910.778WBGene00016943WBGene0002727059.454650.56910.778WBGene00019433WBGene0002357159.4540694WBGene000160943WBGene000300173.8515280.7734.2335*WBGene000300173.8515250.7734.2335*WBGene0002519933.236790.5175.8458WBGene00012214WBGene0002798028.875270.51712.699WBGene00013268WBGene0003400858.3627429WBGene00013255WBGene0003358041.182890.45710.454*WBGene0002691253.074910.26210.454*WBGene0002691253.0749443WBGene0001501WBGene0004175039.685180.27711.391*WBGene0004106815.088810.27711.391*WBGene0001501WBGene000175553.0633.063710.27713.631*WBGene0001501WBGene0004175039.685180.27713.631*WBGene0003150WBGene00031505WBGene000315033.063710.27713.631*WBGene000387WBGene000316452.597310.537	WBGene00015676	WBGene00023576	65.27	169	0.181	12.892
WBGene0000108WBGene0003429764.01121968WBGene00007955WBGene0004056443.43730.56910.778WBGene00016943WBGene0002727059.454650.56910.778WBGene00019433WBGene0002357159.4540694WBGene0003001WBGene000300273.8515280.7734.2335*WBGene0002519933.236790.5175.8458*WBGene00022790028.875270.51712.699WBGene00012124WBGene0002798028.8748389WBGene0013268WBGene000244258.362690.45712.699WBGene00013255WBGene0003400858.3627429WBGene0013255WBGene000320953.074910.26210.454*WBGene0002691253.074910.26210.454*WBGene0002691253.0749443WBGene0001500WBGene0004175039.685180.27711.391*WBGene0004106815.088810.27711.391*WBGene0003719515.0852598WBGene00016493WBGene000294633.063710.27713.631*WBGene0003719515.0852598WBGene0003719515.08525984WBGene0003719515.0852598WBGene0003719515.08525	WBGene00020168	WBGene00031423	65.27	201	6	8
WBGene00007955WBGene0004056443.43730.56910.778WBGene0009238WBGene0003722243.434194WBGene00016943WBGene0002727059.454650.56910.778WBGene00019433WBGene0002357159.4540694WBGene0003001WBGene000300273.8515280.7734.2335*WBGene0002519933.236790.5175.8458*WBGene00022770028.875270.51712.699WBGene00012214WBGene0002798028.8748389WBGene0013268WBGene0002944258.362690.45712.699WBGene0013255WBGene0003400858.3627429WBGene0013255WBGene000320953.074910.26210.454*WBGene000269041.1822523WBGene0001501WBGene0002640639.685180.26211.391*WBGene0004175039.6853148WBGene0001500WBGene0004106815.088810.27711.391*WBGene0003719515.0852598WBGene00016493WBGene0002994633.063710.27713.631*WBGene0002882333.0638894WBGene0003719515.0852598WBGene0003719515.0852598WBGene0003719515.085259 <td>WBGene00000107</td> <td>WBGene00040884</td> <td>64.01</td> <td>1219</td> <td>0.181</td> <td>12.892</td>	WBGene00000107	WBGene00040884	64.01	1219	0.181	12.892
WBGene00009238WBGene0003722243.434194WBGene00016943WBGene0002727059.454650.56910.778WBGene00019433WBGene0002357159.4540694WBGene0003001WBGene000300273.8515280.7734.2335*WBGene0002519933.236790.5175.8458*WBGene00022519933.2365485.8458WBGene00012214WBGene0002798028.8748389WBGene0013268WBGene0002944258.362690.45712.699WBGene0013255WBGene0003358041.182890.45710.454*WBGene0002669041.1822523WBGene00013917WBGene0002691253.074910.26210.454*WBGene0004175039.685180.27711.391*WBGene0001500WBGene0004106815.088810.27711.391*WBGene0003719515.0852598WBGene00016493WBGene000294633.063710.27713.631*WBGene0003719515.0852598WBGene0003719515.0852598WBGene0003719515.08525984WBGene0003719515.0852598WBGene0003719515.08525984WBGene0003719515.0852598 <td>WBGene00000108</td> <td>WBGene00034297</td> <td>64.01</td> <td>1219</td> <td>6</td> <td>8</td>	WBGene00000108	WBGene00034297	64.01	1219	6	8
WBGene00016943WBGene0002727059.454650.56910.778WBGene00019433WBGene0002357159.4540694WBGene0003001WBGene0003000173.8515280.7734.2335*WBGene0002519933.236790.5175.8458*WBGene00022519933.2365485.8458WBGene0007258WBGene0002798028.875270.51712.699WBGene00013268WBGene0002944258.362690.45712.699WBGene00013255WBGene0003358041.182890.45710.454*WBGene0002669041.1822523WBGene00013917WBGene0002691253.0749443WBGene0001500WBGene0004175039.685180.26211.391*WBGene0001500WBGene0004106815.088810.27713.631*WBGene0003719515.08525988WBGene00016493WBGene000294633.063710.27713.631*WBGene000387WBGene0003719515.0852598WBGene00016493WBGene000294633.063710.27713.631*WBGene000387WBGene000316452.597310.53713.631	WBGene00007955	WBGene00040564	43.4	373	0.569	10.778
WBGene00016943WBGene0002727059.454650.56910.778WBGene00019433WBGene0002357159.4540694WBGene0003001WBGene0003000173.8515280.7734.2335*WBGene0002519933.236790.5175.8458*WBGene00022519933.2365485.8458WBGene0007258WBGene0002798028.875270.51712.699WBGene00013268WBGene0002944258.362690.45712.699WBGene00013255WBGene0003358041.182890.45710.454*WBGene0002669041.1822523WBGene00013917WBGene0002691253.0749443WBGene0001500WBGene0004175039.685180.26211.391*WBGene0001500WBGene0004106815.088810.27713.631*WBGene0003719515.08525988WBGene00016493WBGene000294633.063710.27713.631*WBGene000387WBGene0003719515.0852598WBGene00016493WBGene000294633.063710.27713.631*WBGene000387WBGene000316452.597310.53713.631	WBGene00009238	WBGene00037222	43.4	341	9	4
WBGene00019433WBGene0002357159.4540694WBGene0003001WBGene0003000173.8515280.7734.2335*WBGene000300273.8515250.7734.2335WBGene0001609WBGene0002519933.236790.5175.8458*WBGene00024248733.2365485.8458WBGene00021214WBGene0002798028.8748389WBGene0013268WBGene0002944258.362690.45712.699WBGene0013255WBGene0003400858.3627429WBGene00013255WBGene0003358041.182890.45710.454*WBGene0002669041.1832523WBGene00013917WBGene0002691253.074910.26210.454*WBGene0001500WBGene0004175039.685180.26211.391WBGene0001500WBGene0004175039.6853148WBGene0001410615.088810.27711.391**WBGene0002994633.063710.27713.631*WBGene0002882333.0638894WBGene0000387WBGene0003016452.597310.53713.631						
WBGene00003001       WBGene00030001       73.85       1528       0.773       4.2335         *       WBGene00030002       73.85       1525       0.773       4.2335         WBGene00001609       WBGene00025199       33.23       679       0.517       5.8458         *       WBGene000242487       33.23       654       8       5.8458         WBGene00012214       WBGene00027980       28.87       483       8       9         WBGene00013268       WBGene00029442       58.36       269       0.457       12.699         WBGene00013255       WBGene00034008       58.36       274       2       9         WBGene00013255       WBGene00033580       41.18       289       0.457       10.454         *       WBGene00026690       41.18       325       2       3         WBGene00013917       WBGene00026912       53.07       491       0.262       10.454         *       WBGene00026912       53.07       494       3       3         WBGene0001500       WBGene00041750       39.68       531       4       8         WBGene0001500       WBGene00041750       39.68       531       4       8         WBGene00016403 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>						
*       WBGene00030002       73.85       1525       0.773       4.2335         WBGene0001609       WBGene00025199       33.23       679       0.517       5.8458         *       WBGene00024487       33.23       654       8       5.8458         WBGene0001258       WBGene00027980       28.87       527       0.517       12.699         WBGene00013268       WBGene00029442       58.36       269       0.457       12.699         WBGene00013255       WBGene00034008       58.36       274       2       9         WBGene00015203       WBGene00026690       41.18       289       0.457       10.454         *       WBGene00026690       41.18       325       2       3         WBGene00013917       WBGene00026690       41.18       325       2       3         WBGene0001501       WBGene00026912       53.07       494       3         WBGene0001501       WBGene00041750       39.68       518       0.262       11.391         *       WBGene00041750       39.68       531       4       8         WBGene0001500       WBGene00041750       39.68       531       4       8         WBGene00016493       WBGene0002						
WBGene00001609       WBGene00025199       33.23       679       0.517       5.8458         WBGene00007258       WBGene00030975       28.87       527       0.517       12.699         WBGene00013268       WBGene00027980       28.87       483       8       9         WBGene00013255       WBGene00034008       58.36       274       2       9         WBGene00015203       WBGene00032690       41.18       289       0.457       10.454         *       WBGene00026690       41.18       325       2       3         WBGene00013917       WBGene00026690       41.18       325       2       3         WBGene0001501       WBGene000266912       53.07       491       0.262       10.454         *       WBGene000266912       53.07       494       4       3         WBGene0001500       WBGene00041750       39.68       518       0.262       11.391         *       WBGene00037195       15.08       525       9       8         WBGene00016493       WBGene00029946       33.06       371       0.277       13.631         *       WBGene000387       WBGene00030164       52.59       731       0.537       13.631						
*       WBGene00042487       33.23       654       8       5.8458         WBGene00007258       WBGene00030975       28.87       527       0.517       12.699         WBGene00013268       WBGene00029442       58.36       269       0.457       12.699         WBGene00013255       WBGene00034008       58.36       274       2       9         WBGene0013255       WBGene00033580       41.18       289       0.457       10.454         *       WBGene00026690       41.18       325       2       3         WBGene00013917       WBGene00026690       41.18       325       2       3         WBGene00013917       WBGene00026912       53.07       494       4       3         WBGene0001501       WBGene00026406       39.68       518       0.262       11.391         WBGene0001500       WBGene00041750       39.68       531       4       8         WBGene0001500       WBGene00041068       15.08       881       0.277       11.391         *       WBGene00037195       15.08       525       9       8         WBGene00016493       WBGene00028823       33.06       371       0.277       13.631         *						
WBGene00007258       WBGene00030975       28.87       527       0.517       12.699         WBGene00021214       WBGene00027980       28.87       483       8       9         WBGene00013268       WBGene00029442       58.36       269       0.457       12.699         WBGene00013255       WBGene00033580       41.18       289       0.457       10.454         *       WBGene00026690       41.18       325       2       3         WBGene00013917       WBGene00026690       41.18       325       2       3         WBGene0001501       WBGene000266912       53.07       491       0.262       10.454         *       WBGene000266912       53.07       494       4       3         WBGene00001501       WBGene00041750       39.68       518       0.262       11.391         WBGene00004106       15.08       881       0.277       11.391         *       WBGene00037195       15.08       525       9       8         WBGene00016493       WBGene00028823       33.06       371       0.277       13.631         *       WBGene000387       WBGene00030164       52.59       731       0.537       13.631						
WBGene00021214WBGene0002798028.8748389WBGene00013268WBGene0002944258.362690.45712.699WBGene00013255WBGene0003400858.3627429WBGene00015203WBGene0003358041.182890.45710.454*WBGene0002669041.1832523WBGene00013917WBGene0002691253.074910.26210.454*WBGene0002691253.0749443WBGene0001501WBGene0002640639.685180.26211.391WBGene00001500WBGene0004175039.6853148WBGene0003719515.088810.27711.391*WBGene0002994633.063710.27713.631*WBGene0002882333.0638894WBGene0000387WBGene0003016452.597310.53713.631						
WBGene00013268         WBGene00029442         58.36         269         0.457         12.699           WBGene00013255         WBGene00034008         58.36         274         2         9           WBGene00015203         WBGene00033580         41.18         289         0.457         10.454           *         WBGene00032209         53.07         491         0.262         10.454           *         WBGene00026912         53.07         491         0.262         10.454           *         WBGene00026912         53.07         494         4         3           WBGene0001501         WBGene00026406         39.68         518         0.262         11.391           WBGene00001500         WBGene00041750         39.68         531         4         8           WBGene000041068         15.08         881         0.277         11.391           *         WBGene00037195         15.08         525         9         8           WBGene00016493         WBGene00029946         33.06         371         0.277         13.631           *         WBGene000387         WBGene00030164         52.59         731         0.537         13.631						
WBGene00013255WBGene0003400858.3627429WBGene00015203WBGene0003358041.182890.45710.454*WBGene0002669041.1832523WBGene00013917WBGene0003220953.074910.26210.454*WBGene0002691253.0749443WBGene0001501WBGene0002640639.685180.26211.391WBGene00001500WBGene0004175039.6853148WBGene0004100WBGene0004106815.088810.27711.391*WBGene0003719515.0852598WBGene00016493WBGene0002882333.063710.27713.631*WBGene0003016452.597310.53713.631						
WBGene00015203         WBGene00033580         41.18         289         0.457         10.454           *         WBGene00026690         41.18         325         2         3           WBGene00013917         WBGene00032209         53.07         491         0.262         10.454           *         WBGene00026912         53.07         494         4         3           WBGene0001501         WBGene00026406         39.68         518         0.262         11.391           WBGene00001500         WBGene00041750         39.68         531         4         8           WBGene00004410         WBGene00037195         15.08         881         0.277         11.391           *         WBGene00029946         33.06         371         0.277         13.631           *         WBGene00028823         33.06         388         9         4           WBGene0000387         WBGene00030164         52.59         731         0.537         13.631	WBGene00013268	WBGene00029442		269	0.457	12.699
*       WBGene00026690       41.18       325       2       3         WBGene00013917       WBGene00032209       53.07       491       0.262       10.454         *       WBGene00026912       53.07       494       4       3         WBGene00001501       WBGene00026406       39.68       518       0.262       11.391         WBGene00001500       WBGene00041750       39.68       531       4       8         WBGene00004410       WBGene00041068       15.08       881       0.277       11.391         *       WBGene00037195       15.08       525       9       8         WBGene00016493       WBGene00028823       33.06       371       0.277       13.631         *       WBGene00030164       52.59       731       0.537       13.631	WBGene00013255	WBGene00034008	58.36	274	2	9
WBGene00013917       WBGene00032209       53.07       491       0.262       10.454         *       WBGene00026912       53.07       494       4       3         WBGene00001501       WBGene00026406       39.68       518       0.262       11.391         WBGene00001500       WBGene00041750       39.68       531       4       8         WBGene00004410       WBGene00041068       15.08       881       0.277       11.391         *       WBGene00037195       15.08       525       9       8         WBGene00016493       WBGene00028823       33.06       371       0.277       13.631         *       WBGene00030164       52.59       731       0.537       13.631	WBGene00015203	WBGene00033580	41.18	289	0.457	10.454
*         WBGene00026912         53.07         494         4         3           WBGene00001501         WBGene00026406         39.68         518         0.262         11.391           WBGene00001500         WBGene00041750         39.68         531         4         8           WBGene00004410         WBGene00041068         15.08         881         0.277         11.391           *         WBGene00037195         15.08         525         9         8           WBGene00016493         WBGene00029946         33.06         371         0.277         13.631           *         WBGene00030164         52.59         731         0.537         13.631	*	WBGene00026690	41.18	325	2	3
WBGene00001501       WBGene00026406       39.68       518       0.262       11.391         WBGene00001500       WBGene00041750       39.68       531       4       8         WBGene00004410       WBGene00041068       15.08       881       0.277       11.391         *       WBGene00029946       33.06       371       0.277       13.631         *       WBGene00028823       33.06       388       9       4         WBGene0000387       WBGene00030164       52.59       731       0.537       13.631	WBGene00013917	WBGene00032209	53.07	491	0.262	10.454
WBGene00001501WBGene0002640639.685180.26211.391WBGene00001500WBGene0004175039.6853148WBGene00004410WBGene0004106815.088810.27711.391*WBGene0003719515.0852598WBGene00016493WBGene0002994633.063710.27713.631*WBGene0002882333.0638894WBGene0003016452.597310.53713.631						
WBGene00001500         WBGene00041750         39.68         531         4         8           WBGene00004410         WBGene00041068         15.08         881         0.277         11.391           *         WBGene00037195         15.08         525         9         8           WBGene00016493         WBGene00029946         33.06         371         0.277         13.631           *         WBGene00028823         33.06         388         9         4           WBGene000030164         52.59         731         0.537         13.631	WBGene00001501					-
WBGene00004410         WBGene00041068         15.08         881         0.277         11.391           *         WBGene00037195         15.08         525         9         8           WBGene00016493         WBGene00029946         33.06         371         0.277         13.631           *         WBGene00028823         33.06         388         9         4           WBGene000030164         52.59         731         0.537         13.631						
*         WBGene00037195         15.08         525         9         8           WBGene00016493         WBGene00029946         33.06         371         0.277         13.631           *         WBGene00028823         33.06         388         9         4           WBGene0000387         WBGene00030164         52.59         731         0.537         13.631						
WBGene00016493         WBGene00029946         33.06         371         0.277         13.631           *         WBGene00028823         33.06         388         9         4           WBGene0000387         WBGene00030164         52.59         731         0.537         13.631						
*         WBGene00028823         33.06         388         9         4           WBGene0000387         WBGene00030164         52.59         731         0.537         13.631						
WBGene00000387         WBGene00030164         52.59         731         0.537         13.631						
MBGETTE 00000300   MBGETTE 000331/0   32.33   /18   2   4						
	MPGETIE00000388	MEGETTEN00321/8	52.59	110	4	Ŧ

NBGene00018354         WBGene0003154         33.68         784         0.253         0.9133           NBGene0004344         WBGene00031541         33.68         784         0.253         1.0433           NBGene0004344         WBGene00031763         71.46         530         0.253         9.4085           NBGene0002041         WBGene0002570         32.13         277         0.482         1d.           NBGene0003407         WBGene00025405         45.49         278         3         3         n.d.           NBGene0003407         WBGene00025104         63.51         353         0.413         1.1.261           NBGene0002511         WBGene00025104         63.51         355         0.413         1.4609           NBGene0002511         WBGene00025104         63.51         355         0.413         1.4609           NBGene000251         WBGene00025104         63.51         359         0.754         2.8817           NBGene0002651         WBGene0002514         41.28         703         0.754         2.8927           NBGene0002640         VBGene0001754         0.402         2.9597         9.8457         0.402         2.9597           NBGene0001754         S6519         0.300         1.2016	WBGene00018008	WBGene00034705	9.39	421	0.537	8.9133
WBGene00004344         WBGene00031541         33.68         744         0.253         1.0433           WBGene00004344         WBGene00037863         71.46         530         0.253         9.4085           WBGene00020476         WBGene00037863         71.46         530         0.253         9.4085           WBGene00013024         WBGene0002577         32.13         319         3         n.d.           WBGene00031024         WBGene00025404         65.49         278         3         3           WBGene0003407         WBGene00025404         63.51         355         2         3         3           WBGene00013040         WBGene00025104         63.51         355         2         3         3         8         8.349         2         1.4609           WBGene0001315         WBGene00013514         41.28         703         2         1.4609           WBGene001228         WBGene0013739         0.428         9.8317         7         4.2682           WBGene001228         WBGene001228         0.438         9.8317         7         4.2682           WBGene0012242         9.8417         0.402         2.5957         9         2.5957           WBGene0013739         0.402						
WBGene000044569         WBGene00031539         33.66         910         7         1.0433           WBGene00004561         WBGene00037848         71.46         530         0.253         9.4085           WBGene00012766         WBGene00025077         32.13         277         0.482         11.261           WBGene00012786         WBGene0002554         54.94         278         3         3           WBGene0002501         WBGene0002505         45.49         277         0.482         11.261           WBGene0002514         G3.51         353         0.413         1.4609           WBGene0002514         G3.51         359         2         3           WBGene0001204         G3.51         359         2         3           WBGene00012315         WBGene00033164         41.28         703         0.438         6.7028           WBGene0001125         WBGene00015623         0.075         1.2682         0.075         1.2682           WBGene0001252         WBGene0001258         0.402         2.9597         0.402         2.9597           WBGene0001254         WBGene0001255         0.390         9.4457         2.9183         0.4627         2.9183           WBGene00012555         WBGene						
WBGene00002401 WBGene00002401 WBGene00012760 WBGene00012760 WBGene00012779 WBGene00013024 WBGene0002401 WBGene0002401 WBGene0002401 WBGene0002401 WBGene0002401 WBGene0002401 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00025104 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene00012928 WBGene0001255 WBGene0001264 WBGene0001258 WBGene0001258 WBGene0001258 WBGene00012875 WBGene00012875 WBGene00012875 WBGene00012875 WBGene00012875 WBGene00012875 WBGene00012420 WBGene0001226 WBGene00012420 WBGene00012420 WBGene00012420 WBGene00012420 WBGene00012420 WBGene00012420 WBGene00012420 WBGene00012420 WBGene00012420 WBGene00012420 WBGene00012420 WBGene0001244 WBGene0001244 WBGene0001244 WBGene0001244 WBGene0001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00001244 WBGene00004244 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245						
WBGene000026767 WBGene00012786 WBGene00013024         WBGene00037648 WBGene00013024         71.46 S277 S2.13 S177 WBGene0001302 WBGene0000957 WBGene0002555 WBGene00021204 WBGene00021204 WBGene00021204 WBGene00033042         71.46 S2.9 S2 S3 S3 S3 S3 S3 S3 S3 S3 S3 S3 S3 S3 S3						
WBGene00012780 WBGene0003024         WBGene00025104 WBGene00025405         32.13 45.49 45.49 WBGene0000307         39 WBGene00025405         36.42 45.49 45.49 WBGene0002040         11.261 359 2.3 WBGene0002040           WBGene00025104         63.51 63.51 359         363 0.413         1.4609 0.438           WBGene00025104         63.51 41.28         535 0.413         1.4609 0.438           WBGene00012315         WBGene00035164         41.28         703         2         1.4609 0.438           WBGene00012315         WBGene000135164         41.28         703         2         1.4609 0.438           WBGene00013154         WBGene00015523         WBGene0001552         0.438         6.7028           WBGene00010155         WBGene00015523         0.432         0.438         9.8317           WBGene0001258         WBGene000125         0.402         2.9597           WBGene0001258         0.402         2.9597           WBGene0001258         0.390         19.841           WBGene0011258         9.8457         0.905         12.016           WBGene00013739         0.462         0.390         9.8457           WBGene00013524         0.769         9.753           WBGene0001358         0.769         9.753           WBGene000121420 <t< td=""><td>WBGene00002041</td><td>WBGene00037848</td><td></td><td></td><td>7</td><td></td></t<>	WBGene00002041	WBGene00037848			7	
WBGene0003024         WBGene00025104         45.49         297         0.482         11.261           WBGene0003407         WBGene00025104         63.51         359         2         3           WBGene00025104         63.51         359         2         3         1.4609           WBGene00025104         WBGene00033942         41.28         703         0.413         1.4609           WBGene0001135         WBGene00035164         41.28         703         0.438         6.7028           WBGene00012928         WBGene0003739         41.28         703         0.438         6.7028           WBGene00012928         WBGene0001292         0.438         6.7028         0.438         6.7028           WBGene00012928         WBGene0001292         0.438         6.7028         0.438         6.7028           WBGene00012928         WBGene0001292         0.402         29597         0.402         25597           WBGene0001664         WBGene0001664         9         5         0.402         25597           WBGene0001652         S         0.390         1.8417         1.2016           *         WBGene0001664         0.390         1.9.841         2         5           WBGene0001654	WBGene00008767	WBGene00025907	32.13	277	0.482	n.d.
WBGene00003407 WBGene00003400 WBGene000025104 WBGene00025104 WBGene00025104 WBGene00012315 WBGene00012315 WBGene0000133542 WBGene0000135164 WBGene00001563 WBGene00015623 WBGene00015623 WBGene00015623 WBGene00015623 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016563 WBGene00016564 WBGene00016564 WBGene000165716 *         45.49 41.28 535 0.413 1.4609 0.438 9.8317 0.402 7 4.2682 7 7 4.2682 0.075 0.1931 7 0.075 9 5.597 0.402 9 5.5977 0.402 9 5 0.390 9 5.5977 0.402 9 5 0.390 9 5.5 0.390 9 8.6457 7 8.6519 WBGene00012538 WBGene00012538 WBGene00012538 WBGene00012538 WBGene00012538 WBGene00012538 WBGene00012538 WBGene00012538 WBGene00012538 WBGene0001254 WBGene0001254 WBGene0001254 WBGene0001254 WBGene0001254 WBGene0001254 WBGene0001254 WBGene0001254 WBGene0001254 WBGene0001254 WBGene0001226 WBGene00004244 WBGene00004245 WBGene00004244 WBGene00004244 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene00004245 WBGene0004245 WBGene000424	WBGene00012786	WBGene00042179	32.13	319		
WBGene0003408         WBGene00025104         63.51         363         0.413         11.261           WBGene00025104         WBGene00025104         63.51         359         2         3           WBGene00012315         WBGene00035164         41.28         533         0.413         1.4609           WBGene0001115         WBGene00035164         41.28         703         0.438         6.7028           WBGene0001115         WBGene0001105         0.075         0.438         6.7028           WBGene00010046         WBGene0001046         0.438         6.7028           WBGene00010258         WBGene0001046         0.075         0.1931           WBGene00015739         0.402         2557           WBGene00015642         0.390         19.841           WBGene0001578         0.390         19.841           WBGene00018738         WBGene0001875         0.905         12.016           WBGene00012914         0.769         9.7753         0.905         12.016           WBGene00012926         0.312         0.734         8.6519         0.312         0.312         1.457           WBGene00012926         0.312         0.734         8.6519         0.312         1.457           WBGene0						
WBGene00023510         WBGene00023510         WBGene00033942         41.28         535         0.413         1.4609           WBGene00012315         WBGene00035164         41.28         535         0.413         1.4609           WBGene0001135         WBGene00035164         41.28         535         0.413         1.4609           WBGene0001115         WBGene0001562         0.438         6.7028         0.438         9.8317           WBGene0001652         WBGene0001664         0.705         4.2682         0.075         0.1931           WBGene0001664         WBGene0001563         0.402         2.5597         0.402         2.5597           WBGene00016642         WBGene00016642         0.390         19.841         9         5           WBGene00016716         *         0.390         12.016         1         1           WBGene0001538         0.769         9.753         0.769         9.753         0.769         9.753           WBGene00014220         WBGene00013736         WBGene0001425         0.312         1.507         0.312         1.577           WBGene00014220         WBGene0001425         0.312         0.774         0.9746         0.312         4.577         8.6519           WBGene						
WBGene00012315         WBGene000133942         41.28         535         0.413         1.4609           WBGene00016061         WBGene0001315         WBGene0001315         1.4609           WBGene00010115         WBGene00012928         0.438         6.7028           WBGene00012402         9.8317         0.438         6.7028           WBGene00012402         9.8317         0.438         9.8317           WBGene00012402         7         4.2682         0.075         4.2682           WBGene00012649         7         0.402         2.9597           WBGene00016642         0.402         2.9597           WBGene00016642         0.402         2.9597           WBGene00016642         0.402         2.9597           WBGene00018152         7         0.402         2.9597           *         WBGene00018738         9         5           WBGene00018755         0.390         1.8417           WBGene00018755         0.905         12.016           WBGene00018214         9         7         4.6519           WBGene000122164         9         0.7753         0.734         8.6519           WBGene000122164         9         0.312         4.577         0.312						
WBGene00012315         WBGene00035164         41.28         703         2         1.4609           WBGene00010139         0.438         6.7028         0.438         6.7028           WBGene00012928         0.438         9.8317         0.075         4.2682           WBGene0001025         0.438         9.6317         0.075         4.2682           WBGene0001025         0.438         9.5317         0.075         4.2682           WBGene0001025         0.402         2.9597         0.402         2.9597           WBGene00017549         WBGene00018152         9         5         0.390         1.9.841           WBGene00018152         0.390         9.8457         2         9.8457           *         WBGene00018152         0.390         9.8457           *         WBGene00018755         0.390         1.2.016           WBGene00018152         1         1         0.905         1.2.016           WBGene00018755         WBGene00012162         0.312         4.6519         0.734         6.637           WBGene00012162         0.312         4.577         0.312         4.577         8.612           WBGene00012162         0.311         1.4083         0.311         3.768						-
WBGene000101661         0.438         6.7028           WBGene00010115         0.438         9.8317           WBGene00015623         0.075         4.2682           WBGene0001025         0.075         0.1931           WBGene0001046         7         0.1931           WBGene00017549         9         2.9597           WBGene00016749         0.402         2.9597           WBGene00012649         0.402         2.9597           WBGene0001428         9         5           WBGene00016716         0.905         12.016           *         0.905         12.016           *         0.905         12.016           *         1         1           WBGene00018738         0.905         12.016           *         0.905         12.016           *         1         1         1           WBGene00018738         0.905         12.016           *         0.905         12.016         1           *         1         1         1           WBGene00018738         0.775         8.6637           WBGene00012164         0.734         6.519           WBGene00012162         2						
WBGene00010139         1         6.7028           WBGene00012928         0.438         9.8317           WBGene00020402         7         4.2682           WBGene0001025         0.075         4.2682           WBGene0001046         7         0.1931           WBGene0001739         0.402         2.9597           WBGene00012649         0.402         2.9597           WBGene0001852         0.390         1.841           WBGene0001852         0.390         9.8457           WBGene00018738         0.905         12.016           WBGene00018738         0.905         12.016           WBGene00018755         0.905         12.016           WBGene00018755         0.769         9.7753           WBGene00012914         4         9.7753           WBGene00012926         7         8.6519           WBGene00012296         0.312         4.577           WBGene00012296         0.312         4.577           WBGene0001244         0.312         5.803           WBGene0001244         0.312         4.577           WBGene0001244         0.312         1.4083           0.311         1.4083         0.311         1.4083		MPGGIIG00033104	41.20	103		
WBGene0001115         0.438         9.8317           WBGene00015623         0.075         4.2682           WBGene00001025         0.075         0.1931           WBGene00001046         7         4.2682           WBGene00001046         7         0.1931           WBGene00001549         9         5           WBGene0001642         0.300         19.841           WBGene0001652         0.300         19.841           WBGene00016716         0.905         12.016           *         0.905         12.016           WBGene00018738         0.905         12.016           WBGene00018738         0.905         12.016           WBGene00018755         0.769         9.7753           WBGene00018755         0.734         0.9746           WBGene000121296         0.734         0.9746           WBGene000121296         0.734         0.9746           WBGene000121296         0.477         8.6519           WBGene000121296         0.311         1.4083           WBGene000121262         2         4.577           WBGene000121262         2         8           0.311         1.4083         0.3111         1.4083						
WBGene00015623         0.075         4.2682           WBGene0001025         0.075         0.1931           WBGene0001739         0.402         2.9597           WBGene0001258         9         2.9597           WBGene0001258         9         2.9597           WBGene00016642         0.390         19.841           WBGene00018152         0.390         9.8457           *         0.905         12.016           *         1         1           WBGene00018738         0.905         12.016           *         0.905         12.016           *         0.769         8.8637           WBGene00018738         0.905         12.016           *         0.769         8.8637           WBGene00018755         0.769         9.7753           WBGene0001220         7         8.6519           WBGene0001226         7         0.9746           WBGene0001226         7         8.6519           WBGene0001226         7         0.9746           WBGene0001226         2         4.577           WBGene0001262         2         8           0.477         8.9123           0.311 <t< td=""><td></td><td></td><td></td><td></td><td>0.438</td><td></td></t<>					0.438	
WBGene000102025         7         4.2682           WBGene00001025         0.075         0.1931           WBGene00013739         0.402         2.9597           WBGene00012649         9         5           WBGene00011852         0.390         19.841           WBGene00016642         0.905         12.016           WBGene00018738         0.905         12.016           WBGene00018738         0.769         8.6637           WBGene00018755         0.769         9.7753           WBGene00018755         0.769         9.7753           WBGene00018755         0.734         8.6519           WBGene00012206         0.734         8.6519           WBGene0001226         7         0.9746           WBGene0001262         2         8           WBGene0001262         2         8           0.477         15.803         7           WBGene00002162         2         8           0.477         15.803         7           WBGene00002162         2         8           0.477         15.803         7           WBGene00004245         2         8           0.477         15.803         7	WBGene00012928				1	9.8317
WBGene00001025         0.075         0.1931           WBGene00013739         0.402         2.9597           WBGene00011258         0.402         19.841           WBGene0001852         0.390         19.841           WBGene0001852         0.390         9.8457           *         0.905         12.016           *         0.905         12.016           *         0.905         12.016           *         0.769         8.6637           WBGene00018758         0.769         8.6637           WBGene00012914         4         9.7753           WBGene00012914         0.769         8.6519           WBGene00012126         0.734         0.9746           WBGene00012162         0.312         4.577           WBGene00002126         0.312         4.577           WBGene00002226         0.312         4.577           WBGene00002368         0.312         15.803           WBGene00002424         0.312         15.803           WBGene00002424         0.311         1.4083           0.477         15.803         2           0.311         3.7686         0.181           0.181         1.1253         1	WBGene00015623				0.075	4.2682
WBGene0000146         7         0.1931           WBGene00007549         0.402         2.9597           WBGene0001258         9         2.9597           WBGene00016642         0.390         19.841           WBGene00016716         0.390         9.8457           *         0.905         12.016           *         0.905         12.016           *         0.905         12.016           *         0.905         12.016           *         0.905         12.016           *         0.905         12.016           WBGene00018738         0.769         8.6637           WBGene00018755         0.769         8.6637           WBGene0001214         4         9.7753           WBGene00012126         0.734         0.574           WBGene00012126         0.734         0.574           WBGene00012126         0.312         4.577           WBGene00012424         0.312         15.803           WBGene00004245         2         8           0.477         15.803         2           0.477         15.803         2           0.311         1.4083         1.14083           1.4 </td <td>WBGene00020402</td> <td></td> <td></td> <td></td> <td>7</td> <td></td>	WBGene00020402				7	
WBGene00013739         0.402         2.9597           WBGene00020649         0.402         19.841           WBGene0001852         0.390         19.841           WBGene00016716         0.905         12.016           *         0.905         12.016           WBGene00015388         0.905         12.016           WBGene00015388         0.905         12.016           WBGene00015388         0.905         12.016           WBGene00015388         0.769         8.8637           WBGene00015364         4         9.7753           WBGene00012914         0.769         9.7753           WBGene00003366         0.734         8.6519           WBGene00003368         0.312         4.577           WBGene00003368         0.312         4.577           WBGene00004245         2         8           0.477         8.9123         0.311         3.7686           0.181         3.7686         0.181         4.1253           0.181         4.1253         0.181         4.1253           0.181         4.1253         0.181         4.1253           0.181         4.1253         0.181         4.12683           0.311						
WBGene00007549         9         2.9597           WBGene0001642         0.402         19.841           WBGene00018152         0.390         19.841           *         0.905         12.016           *         0.905         12.016           *         0.905         12.016           *         0.905         12.016           *         0.905         12.016           WBGene00018738         0.769         9.7753           WBGene00018755         0.734         8.6519           WBGene00012914         0.734         8.6519           WBGene00003368         0.312         4.577           WBGene00003368         0.312         4.577           WBGene00004245         0.312         15.803           WBGene00004245         0.312         15.803           WBGene00004245         0.312         15.803           WBGene00004245         0.311         1.4083           0.311         1.4083         0.311         3.7686           0.311         1.4083         0.311         3.7686           0.322         8         0.789         0.831           0.688         13.371         9         9						
WBGene00020649         0.402         19.841           WBGene0001642         0.390         19.841           WBGene00018152         0.390         9.8457           WBGene00016716         0.905         12.016           *         0.905         12.016           WBGene0001538         0.769         8.637           WBGene0001504         0.769         8.6637           WBGene0001575         0.769         9.7753           WBGene000121914         4         9.7753           WBGene00012162         0.734         8.6519           WBGene00012162         0.734         0.9746           WBGene00004245         2         8           0.4777         15.803         7           WBGene00004245         2         8           0.4777         15.803         7           0.311         3.7686         1.41253           0.311         3.7686         1.3371						
WBGene00011258         9         5           WBGene00018642         0.390         19.841           WBGene00018152         2         5           *         0.390         9.8457           WBGene00018738         0.905         12.016           WBGene00014220         0.769         8.6637           WBGene0001220         0.769         8.6637           WBGene00012214         4         9.7753           WBGene00012296         0.734         8.6519           WBGene00012296         0.734         0.9746           WBGene000121296         0.734         0.9746           WBGene00012296         0.7312         15.803           WBGene00012162         2         4.577           WBGene00004244         0.312         15.803           WBGene00004245         2         8           0.4777         8.9123         3.718           0.481         4.1253         1           0.181         4.1253         1           0.88         17.120         0.232           0.88         0.232         17.120           0.232         8         0.789           0.881         9         0.831           <					-	
WBGene00016642         0.390         19.841           WBGene00018152         0.390         9.8457           *         0.905         12.016           *         0.905         12.016           WBGene00015388         0.769         8.8637           WBGene00012914         0.769         9.7753           WBGene000121914         4         8.6519           WBGene000121296         0.734         0.9746           WBGene00012162         0.312         4.577           WBGene00004244         0.312         4.577           WBGene00004245         0.4777         15.803           7         8.9123         0.311         1.4083           4         1.253         1         4.1253           8         0.4777         15.803         7           7         8.9123         0.311         1.4083           4         1.4253         1         4.1253           1         4.1253         1         4.1253           1         9         9         9           0.688         17.120         2.32         8           0.739         0.631         1.5255         9						
WBGene00019980         2         5           WBGene00018152         0.390         9.8457           WBGene00016716         0.905         12.016           *         0.905         12.016           WBGene0001538         0.905         12.016           WBGene00014220         0.769         8.8637           WBGene0001855         0.769         8.753           WBGene00012914         4         9.7753           WBGene00012194         0.734         8.6519           WBGene00012296         0.734         0.9746           WBGene00012262         7         0.9746           WBGene00012162         2         4           WBGene00012262         2         8           WBGene0001244         0.312         15.803           WBGene00012425         2         8           0.4777         15.803         2           WBGene00004245         2         8           0.4777         15.803         1           WBGene00004245         8         0.4177           WBGene00004245         8         0.4177           WBGene00004245         9         9           0.688         13.3711         9					-	
*       2       9.8457         WBGene00016716       1       1         *       0.905       12.016         WBGene00015388       0.905       12.016         WBGene00014220       0.769       8.8637         WBGene00018755       0.769       9.7753         WBGene00012914       4       9.7753         WBGene00012196       0.734       8.6519         WBGene00012262       7       0.9746         WBGene000121262       2       4.577         WBGene00012162       2       4.577         WBGene00012445       0.312       15.803         WBGene00004245       2       8         0.4777       8.9123       7         0.311       1.4083       0.311       3.7686         0.181       4.1253       1       4.1253         0.181       13.371       9       9       9         0.688       13.371       9       9       0.688       17.120         0.232       17.120       0.232       8       0.789       0.831         0.789       0.6525       9       1.6525       9       1.6525						
WBGene00016716         2         0.905         12.016           *         0.905         12.016         1         1           WBGene00015388         0.905         12.016         1         1           WBGene0001504         0.769         8.8637         0.769         8.7753           WBGene00012914         4         9.7753         0.734         8.6519           WBGene0001296         0.734         0.9746         0.9746           WBGene00012162         7         0.9746         0.9746           WBGene0001226         0.312         4.577         WBGene00004245         2         8           WBGene00004245         0.312         15.803         2         8         0.4777         15.803           WBGene00004245         0.4777         8.9123         0.3111         1.4083         0.3111         3.7686           4         1.253         0.181         13.3711         9         9         9         9         9         0.6688         17.120           0.2322         8         0.739         0.831         0.789         0.831         9         0.831           0.111         1.41253         0.881         0.2322         8         0.789	WBGene00018152				0.390	9.8457
* WBGene00018738 WBGene00014220 WBGene00014220 WBGene00018755 WBGene00009514 WBGene00009514 WBGene00009514 WBGene0000368 WBGene00012162 WBGene00004244 WBGene00004245 WBGene00004245 WBGene00004245 UBGene00004245 UBGen	*				2	9.8457
WBGene00018738         0.905         12.016           WBGene00014220         0.769         8.8637           WBGene00018755         0.769         8.8637           WBGene00012914         0.734         8.6519           WBGene0001296         0.734         8.6519           WBGene00012162         7         8.6519           WBGene00004245         0.312         4.577           WBGene00004245         0.312         4.577           WBGene00004245         0.311         1.4083           WBGene00004245         0.311         1.4083           WBGene00004245         0.88         1.1203           WBGene00004245         9         8           0.311         1.4083         4           0.477         15.803         7           WBGene00004245         9         9           0.311         1.4083         4           0.477         15.803         7           WBGene00004245         9         9           0.311         1.4083         4           0.477         15.803         7           0.811         1.253         1           0.811         1.253         1           0.688 <td>WBGene00016716</td> <td></td> <td></td> <td></td> <td>0.905</td> <td>12.016</td>	WBGene00016716				0.905	12.016
WBGene00014388         1         1           WBGene00014220         0.769         8.8637           WBGene00018755         0.769         9.7753           WBGene00012914         0.734         8.6519           WBGene0001296         0.734         8.6519           WBGene00012296         0.734         8.6519           WBGene00012162         0.734         8.6519           WBGene00004244         0.312         4.577           WBGene00004245         0.312         4.577           WBGene00004245         2         8           WBGene00004245         0.311         1.4083           WBGene00004245         0.311         0.7686 <tr< td=""><td>*</td><td></td><td></td><td></td><td>1</td><td>1</td></tr<>	*				1	1
WBGene00014220         0.769         8.8637           WBGene00018755         0.769         9.7753           WBGene000012914         4         9.7753           WBGene00004135         0.734         8.6519           WBGene000012026         7         0.9746           WBGene00001226         7         0.9746           WBGene00001262         7         0.9746           WBGene00004244         0.312         4.5777           WBGene00004245         2         8           0.311         1.4083         4           1.4083         4         1.4083           4         1.4083         4           0.311         1.4083         4           0.181         4.1253         1           1.41253         1.81         13.371           9         9         0.688           0.232         17.120						
WBGene00003504         4         8.8637           WBGene00012914         0.769         9.7753           WBGene00009514         0.734         8.6519           WBGene00012026         0.734         0.9746           WBGene0001202         0.734         0.9746           WBGene00012162         2         4.577           WBGene0001245         0.312         15.803           WBGene00004244         0.312         15.803           WBGene00004245         2         8           0.477         8.9123         7           0.311         1.4083         4         1.4083           4         1.371         9         9           0.688         13.371         9         9           0.688         13.371         9         9           0.688         13.371         9         9           0.688         13.371         9         9           0.688         13.371         9         9           0.688         13.371         9         9           0.688         13.371         9         9           0.688         13.371         9         9           0.688         13.371						
WBGene 00018755         0.769         9.7753           WBGene 00009514         4         9.7753           WBGene 00004135         0.734         8.6519           WBGene 00019022         0.734         0.9746           WBGene 00012162         0.312         4.577           WBGene 00004244         0.312         15.803           WBGene 00004245         2         4           WBGene 00004245         2         8           0.4777         15.803         7         8.9123           0.311         1.4083         0.311         1.4083           0.312         15.803         7         8.9123           0.311         1.4083         0.311         3.7686           4         3.7686         4         3.7686           4         3.7686         1.41253         1           0.181         13.371         9         9           0.688         17.120         9         8           0.232         17.120         0.232         8           0.789         0.631         9         0.831           9         0.831         9         0.831           9         0.831         9         0.831						
WBGene 00012914         4         9.7753           WBGene 00004135         0.734         8.6519           WBGene 000121296         0.734         0.9746           WBGene 00012162         7         0.9746           WBGene 00004244         0.312         15.803           WBGene 00004245         2         4.577           WBGene 00004245         0.312         15.803           WBGene 00004245         2         8           0.4777         15.803         7           WBGene 00004245         2         8           0.4777         15.803         7           WBGene 00004245         2         8           0.4777         15.803         7           0.311         1.4083         4           1.4083         1.41253           0.311         1.4083           4         3.7686           0.181         4.1253           1.81         13.371           9         9           0.688         17.120           0.232         8           0.789         0.831           9         0.831           9         0.831           9         1.6525						
WBGene 00009514         0.734         8.6519           WBGene 00012196         0.734         0.9746           WBGene 00013022         0.312         4.577           WBGene 00012162         2         4.577           WBGene 00004244         0.312         15.803           WBGene 00004245         2         8           0.4777         15.803         7           WBGene 00004245         2         8           0.4777         15.803         7           WBGene 00004245         2         8           0.4777         15.803         7           8         0.477         8.9123           7         8.9123         0.311         1.4083           0.311         1.4083         0.311         3.7686           0.181         4.1253         1         4.1253           0.181         13.371         9         9           0.688         17.120         9         9           0.688         17.120         0.232         8           0.789         0.831         9         0.831           9         0.831         9         0.831           9         0.831         9         0.8						
WBGene00004135         7         8.6519           WBGene00003368         0.734         0.9746           WBGene00004244         0.312         4.577           WBGene00004245         0.312         15.803           WBGene00004245         2         8           0.4777         15.803         2           WBGene00004245         0.312         15.803           WBGene00004245         0.477         8.9123           0.4777         8.9123         0.311         1.4083           0.311         1.4083         0.311         3.7686           0.181         4.1253         1         4.1253           1         4.1253         1         4.1253           0.181         13.371         9         9           0.688         17.120         0.232         8           0.232         17.120         0.232         8           0.789         0.831         9         0.831           9         0.831         9         0.831           9         0.6525         9         1.6525						
WBGene00021296         0.734         0.9746           WBGene00003368         0.312         4.577           WBGene00004244         0.312         15.803           WBGene00004245         2         8           WBGene00004245         2         8           0.4777         15.803         2           0.4777         15.803         2           0.4777         15.803         7           0.4777         15.803         7           0.4777         8.9123         0.311           0.311         1.4083         4           0.312         3.7686         0.181           0.311         3.7686         0.181           0.181         13.371         1           1         9         0.6688         13.371           2         9         9         0.688         17.120           0.232         17.120         0.232         8         0.789         0.831           9         0.831         9         0.831         9         0.831           9         0.6525         9         1.6525         9         1.6525						
WBGene00003368 WBGene00004244 WBGene00004245 WBGene00004245 UBGene00004245 WBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene00004245 UBGene0004245 UBGene00004245 UBGene00004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene0004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBG UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004245 UBGene004 UBGene004245 UBGene004245 UBGene004 UBGene004 UBGene004245 UBGENE0	WBGene00021296				0.734	
WBGene00012162       2       4.577         WBGene00004245       0.312       15.803         WBGene00004245       2       8         0.477       15.803       7         8       0.477       8.9123         7       8       9.123         7       8.9123       0.311         1.4083       4       1.4083         0.311       1.4083       4         0.311       1.4083       1         0.311       1.4083       0.311         0.311       3.7686       0.181         0.181       13.371       9         9       9       8         0.232       17.120         9       8         0.789       0.831         9       0.831         9       0.831         9       0.831         9       0.831         9       0.831         9       1.6525         9       1.6525	WBGene00019022				7	0.9746
WBGene00004244         0.312         15.803           WBGene00004245         0.477         15.803           0.477         15.803         7           8         0.477         8.9123           7         8.9123         0.311         1.4083           4         1.4083         4         1.4083           6         0.181         3.7686         4         3.7686           0.181         4.1253         1         4.1253         1         4.1253           0.688         13.371         9         9         0.688         13.371         9         9         0.688         17.120         9         9         0.688         17.120         0.232         17.120         0.232         8         0.789         0.831         9         0.831         9         0.831         9         0.831         0.789         1.6525         9         1.6525         9         1.6525         9         1.6525         9         1.6525         9         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.6525         1.	WBGene00003368				0.312	4.577
WBGene00004245 WBGene00004245 WBGene00004245						
0.477       15.803         7       8         0.477       8.9123         7       8.9123         0.311       1.4083         4       1.4083         0.311       3.7686         4       3.7686         0.181       4.1253         1       4.1253         1       4.1253         0.181       13.371         9       9         0.688       17.120         9       8         0.232       17.120         9       0.831         9       0.831         9       0.831         9       0.831         9       0.831         9       1.6525         9       1.6525						
7       8         0.477       8.9123         7       8.9123         0.311       1.4083         4       1.4083         0.311       3.7686         4       3.7686         0.181       4.1253         1       4.1253         0.181       13.371         1       9         0.688       13.371         9       9         0.688       17.120         9       8         0.232       17.120         0.232       8         0.789       0.831         9       0.831         9       0.831         9       0.831         0.789       1.6525         9       1.6525	WBGene00004245					
0.477       8.9123         7       8.9123         0.311       1.4083         4       1.4083         0.311       3.7686         4       3.7686         0.181       4.1253         1       4.1253         0.181       13.371         1       9         0.688       17.120         9       8         0.232       17.120         0.232       8         0.789       0.831         9       0.831         9       0.831         0.789       1.6525         9       1.6525						
7       8.9123         0.311       1.4083         4       1.4083         0.311       3.7686         4       3.7686         4       3.7686         0.181       4.1253         1       4.1253         0.181       13.371         1       9         0.688       17.120         9       8         0.232       17.120         0.232       8         0.789       0.831         9       0.831         9       0.831         9       0.831         9       1.6525         9       1.6525						
0.311 1.4083 4 1.4083 0.311 3.7686 4 3.7686 0.181 4.1253 1 4.1253 0.181 13.371 1 9 0.688 13.371 9 9 0.688 17.120 9 8 0.232 17.120 0.232 8 0.789 0.831 9 0.831 9 0.831 9 0.831 9 0.831 9 0.831 9 0.831						
4       1.4083         0.311       3.7686         4       3.7686         4       3.7686         0.181       4.1253         1       4.1253         0.181       13.371         9       9         0.688       17.120         9       8         0.232       17.120         9       0.831         9       0.831         9       0.831         9       0.831         9       0.831         9       0.831         9       1.6525         9       1.6525						
4       3.7686         0.181       4.1253         1       4.1253         0.181       13.371         1       9         0.688       13.371         9       9         0.688       17.120         9       8         0.232       17.120         0.232       8         0.789       0.831         9       0.831         9       0.831         0.789       1.6525         9       1.6525						
0.181 4.1253 1 4.1253 0.181 13.371 1 9 0.688 13.371 9 9 0.688 17.120 9 8 0.232 17.120 0.232 8 0.789 0.831 9 0.831 9 0.831 0.789 1.6525 9 1.6525					0.311	3.7686
1 4.1253 0.181 13.371 1 9 0.688 13.371 9 9 0.688 17.120 9 8 0.232 17.120 0.232 8 0.789 0.831 9 0.831 9 0.831 0.789 1.6525 9 1.6525						
0.181 13.371 1 9 0.688 13.371 9 9 0.688 17.120 9 8 0.232 17.120 0.232 8 0.789 0.831 9 0.831 9 0.831 9 0.831 9 1.6525 9 1.6525						
1 9 0.688 13.371 9 9 0.688 17.120 9 8 0.232 17.120 0.232 8 0.789 0.831 9 0.831 9 0.831 0.789 1.6525 9 1.6525						
0.688 13.371 9 9 0.688 17.120 9 8 0.232 17.120 0.232 8 0.789 0.831 9 0.831 9 0.831 0.789 1.6525 9 1.6525						
9 9 0.688 17.120 9 8 0.232 17.120 0.232 8 0.789 0.831 9 0.831 9 0.831 0.789 1.6525 9 1.6525						
0.688 17.120 9 8 0.232 17.120 0.232 8 0.789 0.831 9 0.831 9 0.831 0.789 1.6525 9 1.6525						
9 8 0.232 17.120 0.232 8 0.789 0.831 9 0.831 9 0.831 0.789 1.6525 9 1.6525						
0.232 17.120 0.232 8 0.789 0.831 9 0.831 0.789 1.6525 9 1.6525						
0.232 8 0.789 0.831 9 0.831 0.789 1.6525 9 1.6525						
9 0.831 0.789 1.6525 9 1.6525						
0.789 1.6525 9 1.6525					0.789	0.831
9 1.6525						
0.591 10.796					-	
					0.591	TO./96

Appendix Table 5.1. S. cerevisiae synthetic lethal interactions and their pairwise C. elegans orthologues

Gene 1			Gene 2	Gene 2		
SC	CE Name	CE RNAi clone	SC Name	CE Name	CE RNAi clone	
Name						
ALG6	WBGene00007435	C08B11.8	OST3	WBGene00022793	ZK686.3	Tong
ALG8	WBGene00007464	С08Н9.3	OST3	WBGene00022793	ZK686.3	Tong
ALG8	WBGene00007464	С08Н9.3	PER1	WBGene00019806	R01B10.4	Tong
ARC40	WBGene00000201	Y79H2A.6	ARC18	WBGene00000203	Y37D8A.1	Tong
ARC40	WBGene00000201	Y79H2A.6	CHS5	WBGene00022615	ZC449.5	Tong
ARC40	WBGene00000201	Y79H2A.6	GIM3	WBGene00007107	B0035.4	Tong
ARC40	WBGene00000201	Y79H2A.6	GIM4	WBGene00019220	H20J04.d	Tong
ARC40	WBGene00000201	Y79H2A.6	GLO3	WBGene00017217	F07F6.4	Tong
ARC40	WBGene00000201	Y79H2A.6	SEC22	WBGene00018853	F55A4.1	Tong
ARC40	WBGene00000201	Y79H2A.6	SPF1	WBGene00007514	C10C6.6	Tong
ARC40	WBGene00000201	Y79H2A.6	STE24	WBGene00001405	C04F12.10	Tong
ARC40	WBGene00000201	Y79H2A.6	VRP1	WBGene00020094	R144.4 & R144.8	Tong
ARC40	WBGene00000201	Y79H2A.6	YKE2	WBGene00009004	F21C3.5	Tong
ARL1	WBGene00000187	F54C9.10	COG6	WBGene00019481	К07С11.9	Tong
ARL1	WBGene00000187	F54C9.10	COG8	WBGene00011736	T12D8.9	Tong
ARL1	WBGene00000187	F54C9.10	GLO3	WBGene00017217	F07F6.4	Tong
ARL1	WBGene00000187	F54C9.10	PER1	WBGene00019806	R01B10.4	Tong
ARL1	WBGene00000187	F54C9.10	TLG2	WBGene00022534	ZC155.7	Tong
ARL1	WBGene00000187	F54C9.10	VPS29	WBGene00014234	ZK1128.8	Tong
ARL1	WBGene00000187	F54C9.10	VPS35	WBGene00006933	F59G1.3	Tong
ARL1	WBGene00000187	F54C9.10	VPS5	WBGene00004927	C05D9.1	Tong
ARL1	WBGene00000187	F54C9.10	YPT6	WBGene00009880	F49C12.11	Tong
ARL3	WBGene00021841	Y54E10B_159.i	COG6	WBGene00019481	К07С11.9	Tong
ARL3	WBGene00021841	Y54E10B_159.i	COG8	WBGene00011736	T12D8.9	Tong
ARL3	WBGene00021841	Y54E10B_159.i	GDA1	WBGene00010697	K08H10.4	Tong
ARL3	WBGene00021841	Y54E10B_159.i	GLO3	WBGene00017217	F07F6.4	Tong
arl3	WBGene00021841	Y54E10B_159.i	GYP1	WBGene00009322	F32B6.8	Tong
ARL3	WBGene00021841	Y54E10B_159.i	OST2	WBGene00000896	F57B10.10	Davierwal
ARL3	WBGene00021841	Y54E10B_159.i	TLG2	WBGene00022534	ZC155.7	Tong
ARL3	WBGene00021841	Y54E10B_159.i	TRS20	WBGene00021046	W05H7.3	Davierwal
ARL3	WBGene00021841	Y54E10B_159.i	VPS5	WBGene00004927	C05D9.1	Tong
ARL3	WBGene00021841	Y54E10B_159.i	YPT6	WBGene00009880	F49C12.11	Tong
ARP2	WBGene00000200	K07C5.1	ABD1	WBGene00006447	C25A1.3	Davierwal
ARP2	WBGene00000200	K07C5.1	CHS5	WBGene00022615	ZC449.5	Tong
ARP2	WBGene00000200	K07C5.1	CWC22	WBGene00002957	F33A8.1	Davierwal
ARP2	WBGene00000200	K07C5.1	GIM3	WBGene00007107	B0035.4	Tong
ARP2	WBGene00000200	K07C5.1	GIM4	WBGene00019220	H20J04.d	Tong
ARP2	WBGene00000200	К07С5.1	HRT1	WBGene00004320	ZK287.5	Davierwal
ARP2	WBGene00000200	К07С5.1	LAS17	WBGene00006565	Y63D3A.5	Davierwal
ARP2	WBGene00000200	K07C5.1	MAK5	WBGene00018890	F55F8.2	Davierwal
ARP2	WBGene00000200	K07C5.1	NOP14	WBGene00021660	Y48G1A_54.d	Davierwal
ARP2	WBGene00000200	K07C5.1	PAC10	WBGene00006889	T06G6.9	Tong
ARP2	WBGene00000200		PFY1	WBGene00003991	K03E6.6	Davierwal

ARP2	WBGene00000200	K07C5.1	PRP9	WBGene00011758	Т13Н5.4	Davierwala
ARP2	WBGene00000200	K07C5.1	RGD1	WBGene00001559	F45H7.2 & F45H7.3	Tonq
ARP2	WBGene00000200	K07C5.1	RVS161	WBGene00010272	F58G6.1	Tong
ARP2	WBGene00000200	K07C5.1	RVS167	WBGene00020209	T04C9.1 & ZK328.3	Tong
ARP2	WBGene00000200	K07C5.1	SPF1	WBGene00007514	C10C6.6	Tong
ARP2	WBGene00000200	K07C5.1	STE24	WBGene00001405	C04F12.10	Tong
ARP2	WBGene00000200	K07C5.1	VRP1	WBGene00020094	R144.4 & R144.8	Tong
ARP2	WBGene00000200	K07C5.1	YKE2	WBGene00009004	F21C3.5	Tong
ARP6	WBGene00007434	C08B11.6	BRE1	WBGene00007008	R05D3.4	Tong, Pan
ARP6	WBGene00007434	C08B11.6	BUD13	WBGene00011142	R08D7.1	Tong
ARP6	WBGene00007434	C08B11.6	COG6	WBGene00019481	K07C11.9	Tong
ARP6	WBGene00007434	C08B11.6	DEG1	WBGene00006473	E02H1.3	Tong
ARP6	WBGene00007434	C08B11.6	GIM3	WBGene00007107	B0035.4	Tong
ARP6	WBGene00007434	C08B11.6	GIM3 GIM4	WBGene00019220	H20J04.d	Tong
ARP6	WBGene00007434	C08B11.6	GIM4 GIM5	WBGene00019220 WBGene00020112	R151.9	Tong
ARP6	WBGene00007434	C08B11.6	GLO3	WBGene00020112 WBGene00017217	F07F6.4	Tong
ARP6	WBGene00007434	C08B11.6	HCM1	WBGene000017217 WBGene00001442	C25A1.2	Tong
ARP6	WBGene00007434	C08B11.6	LEO1	WBGene00001442 WBGene00007110	B0035.11	Tong
ARP6 ARP6	WBGene00007434	C08B11.6	PAC10	WBGene00006889	T06G6.9	Tong
ARP6	WBGene00007434	C08B11.6	PAC10 PAC2	WBGene00019503	K07H8.1	Tong
ARP6	WBGene00007434	C08B11.6	RTF1	WBGene00009103	F25B3.6	Tong
ARP6	WBGene00007434	C08B11.6	SEC22	WBGene00009103 WBGene00018853	F55A4.1	Tong
ARP6 ARP6	WBGene00007434	C08B11.6	YDL033C	WBGene000018853 WBGene00007114	B0035.16	Tong
ARP6	WBGene00007434	C08B11.6	YPT6	WBGene00009880	F49C12.11	Tong
BRE1	WBGene00007434 WBGene00007008	R05D3.4	ARC18	WBGene00009880 WBGene00000203	Y37D8A.1	Pan
	WBGene00007008	R05D3.4 R05D3.4		WBGene00000203 WBGene00010556	K04D7.1	
BRE1 BRE1	WBGene00007008	R05D3.4 R05D3.4	ASC1 CCR4	WBGene00010556 WBGene00000376	ZC518.3	Pan Pan
BRE1	WBGene00007008	R05D3.4	COG6	WBGene00019481	K07C11.9	Pan
BRE1	WBGene00007008	R05D3.4	COG8	WBGene00011736	T12D8.9	Pan
BRE1	WBGene00007008	R05D3.4	CTK1	WBGene00007135	B0285.1 & B0285.2	Pan
BRE1	WBGene00007008	R05D3.4	HTZ1	WBGene00019947	R08C7.3	Pan
BRE1	WBGene00007008	R05D3.4	LEA1	WBGene00019223	H20J04.c	Pan
BRE1	WBGene00007008	R05D3.4	LSM1	WBGene00003076	F40F8.9	Pan
BRE1	WBGene00007008	R05D3.4	MRE11	WBGene00003405	ZC302.1	Pan
BRE1	WBGene00007008	R05D3.4	NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	Pan
BRE1	WBGene00007008	R05D3.4	PEP3	WBGene00021058	W06B4.3	Pan
BRE1	WBGene00007008	R05D3.4	PEP5	WBGene00011067	R06F6.2	Pan
BRE1	WBGene00007008	R05D3.4	POL32	WBGene00011016	R04F11.3	Pan
BRE1	WBGene00007008	R05D3.4	POP2	WBGene00000369	Y56A3A.20	Pan
BRE1	WBGene00007008	R05D3.4	RAD27	WBGene00000794	Y47G6A_247.i	Pan
BRE1	WBGene00007008	R05D3.4	RAD51	WBGene00004297	Y43C5A.6	Pan
BRE1	WBGene00007008	R05D3.4	RAD54	WBGene00004298	W06D4.6	Pan
BRE1	WBGene00007008	R05D3.4	RPN10	WBGene00004466	B0205.3	Pan
BRE1	WBGene00007008	R05D3.4	SAC1	WBGene00009264	F30A10.6	Pan
BRE1	WBGene00007008	R05D3.4	SCS7	WBGene00007707	C25A1.5	Pan
BRE1	WBGene00007008	R05D3.4	SIN3	WBGene00004117	F02E9.4	Pan
BRE1	WBGene00007008	R05D3.4	SMP2	WBGene00010425	H37A05.1	Pan
BRE1	WBGene00007008	R05D3.4	SNF5	WBGene00011111	R07E5.3	Pan

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BRE1	WBGene00007008		TUF1	WBGene00007000	Y71H2_378.a	Pan
BRE1	WBGene00007008	R05D3.4	VIP1	WBGene00018508	F46F11.1	Pan
BRE1	WBGene00007008		VMA7	WBGene00006918*	ZK970.4	Pan
BRE1	WBGene00007008	R05D3.4	VPS15	WBGene00014151	ZK930.1 & ZK930.7	Pan
BRE1	WBGene00007008	R05D3.4	VPS20	WBGene00022027	Y65B4A_182.b & Y65B4A_182.c	Pan
BRE1	WBGene00007008	R05D3.4	VPS34	WBGene00006932	B0025.1	Pan
BRE1	WBGene00007008	R05D3.4	VPS36	WBGene00008919	F17C11.8	Pan
BRE1	WBGene00007008	R05D3.4	VPS45	WBGene00016643	C44C1.1 & C44C1.4	Pan
BRE1	WBGene00007008	R05D3.4	VPS9	WBGene00012644	Y39A1A.5	Pan
BRE1	WBGene00007008	R05D3.4	VRP1	WBGene00020094	R144.4 & R144.8	Pan
BRE1	WBGene00007008	R05D3.4	YAF9	WBGene00001585	M04B2.3	Pan
BRE1	WBGene00007008	R05D3.4	YJL046W	WBGene00001590	C45G3.3	Pan
CAC2	WBGene00022141	Y71G12A_202.d	CTF18	WBGene00010676	K08F4.1	Pan
CAC2	WBGene00022141	Y71G12A_202.d	ISC1	WBGene00012105	T27F6.6	Pan
CAC2	WBGene00022141	Y71G12A_202.d	MRE11	WBGene00003405	ZC302.1	Pan
CAC2	WBGene00022141	Y71G12A_202.d	POL32	WBGene00011016	R04F11.3	Pan
CAC2	WBGene00022141	Y71G12A_202.d	RAD50	WBGene00004296	T04H1.4	Pan
CCR4	WBGene00000376	ZC518.3	ARP6	WBGene00007434	C08B11.6	Pan
CCR4	WBGene00000376	ZC518.3	ATP1	WBGene00010419*	H28016.1	Pan
CCR4	WBGene00000376	ZC518.3	ATP5	WBGene00017856*	F27C1.7	Pan
CCR4	WBGene00000376	ZC518.3	CTF18	WBGene00010676	K08F4.1	Pan
CCR4	WBGene00000376	ZC518.3	CTK1	WBGene00007135	B0285.1 & B0285.2	Pan
CCR4	WBGene00000376	ZC518.3	DID4	WBGene00012903	Y46G5.m	Pan
CCR4	WBGene00000376	ZC518.3	GCS1	WBGene00010500	K02B12.7	Pan
CCR4	WBGene00000376	ZC518.3	KAR3	WBGene00002216	T09A5.2	Pan
CCR4	WBGene00000376	ZC518.3	LSM1	WBGene00003076	F40F8.9	Pan
CCR4	WBGene00000376	ZC518.3	LSM6	WBGene00003080	Y71G12A_187.b	Pan
CCR4	WBGene00000376	ZC518.3	LSM7	WBGene00003081	ZK593.7	Pan
CCR4	WBGene00000376	ZC518.3	MRE11	WBGene00003405	ZC302.1	Pan
CCR4	WBGene00000376	ZC518.3	MSY1	WBGene00006968	K08F11.4	Pan
CCR4	WBGene00000376	ZC518.3	MUS81	WBGene00016602	C43E11.2	Pan
CCR4	WBGene00000376	ZC518.3	NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	Pan
CCR4	WBGene00000376	ZC518.3	NHX1	WBGene00003733	F57C7.2	Pan
CCR4	WBGene00000376	ZC518.3	PIF1	WBGene00004028	Y18H1A_67.c & Y18H1A_67.d & Y18H1A_67.f	Pan
CCR4	WBGene00000376	ZC518.3	PIM1	WBGene00016391	C34B2.6	Pan
CCR4	WBGene00000376	ZC518.3	RAD27	WBGene00000794	Y47G6A_247.i	Pan
CCR4	WBGene00000376	ZC518.3	RAD50	WBGene00004296	T04H1.4	Pan
CCR4	WBGene00000376	ZC518.3	RAD51	WBGene00004297	Y43C5A.6	Pan
CCR4	WBGene00000376	ZC518.3	RAD54	WBGene00004298	W06D4.6	Pan
CCR4	WBGene00000376	ZC518.3	RAD6	WBGene00006701	C35B1.1	Pan
CCR4	WBGene00000376	ZC518.3	RVS161	WBGene00010272	F58G6.1	Pan
CCR4	WBGene00000376	ZC518.3	RVS167	WBGene00020209	T04C9.1 & ZK328.3	Pan
CCR4	WBGene00000376	ZC518.3	SAC1	WBGene00009264	F30A10.6	Pan
CCR4	WBGene00000376	ZC518.3	SGS1	WBGene00001865	T04A11.6	Pan
CCR4	WBGene00000376	ZC518.3	SIN3	WBGene00004117	F02E9.4	Pan
CCR4	WBGene00000376	ZC518.3	SNF8	WBGene00016167	C27F2.5	Pan
CCR4	WBGene00000376	ZC518.3	STP22	WBGene00015658	C09G12.9	Pan
CCR4	WBGene00000376		TFP1	WBGene00013025*	Y49A3A.2	Pan

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CCR4	WBGene00000376	ZC518.3	VAC14	WBGene00010565	K04G2.6	Pan
CCR4	WBGene00000376	ZC518.3	VPS20	WBGene00022027	Y65B4A_182.b & Y65B4A_182.c	Pan
CCR4	WBGene00000376	ZC518.3	VPS24	WBGene00020866	F59A6.7 & T27F7.1	Pan
CCR4	WBGene00000376	ZC518.3	VPS30	WBGene00000247	T19E7.3 & T19E7.4	Pan
CCR4	WBGene00000376	ZC518.3	VPS36	WBGene00008919	F17C11.8	Pan
CCR4	WBGene00000376	ZC518.3	VPS4	WBGene00021334	Y34D9A_152.a	Pan
CCR4	WBGene00000376	ZC518.3	VPS45	WBGene00016643	C44C1.1 & C44C1.4	Pan
CCR4	WBGene00000376	ZC518.3	YAF9	WBGene00001585	M04B2.3	Pan
CDC2	WBGene00008645	F10C2.4	CSM3	WBGene00017738	F23C8.9	Tong
CDC2	WBGene00008645	F10C2.4	POL32	WBGene00011016	R04F11.3	Tong
CDC2	WBGene00008645	F10C2.4	TRM10	WBGene00009131	F25H8.1	Tong
CDC40	WBGene00018625	F49D11.1	GPI10	WBGene00020868	T27F7.3	Davierwala
CDC40	WBGene00018625	F49D11.1	GWT1	WBGene00022447	Y110A2A_1898.d & Y110A2A_1898.e &	Davierwala
CDC40	WBGene00018625	F49D11.1	PRP16	WBGene00003389	Y110A2A_54.a	Davierwala
CDC40	WBGene00018625	F49D11.1	PSF2	WBGene00009287	K03H1.2	Davierwala
CDC40	WBGene00018625	F49D11.1	RTS2	WBGene00013128	F31C3.5	Davierwala
CDC40	WBGene00018625	F49D11.1	YGL047W	WBGene00011193	Y52B11A.9	Davierwala
CDC42	WBGene00000390	R07G3.1	CAP1	WBGene00000292	R10D12.12	Tong
CDC42	WBGene00000390	R07G3.1	CAP2	WBGene00000293	D2024.6	Tong
CDC42	WBGene00000390	R07G3.1	ELP3	WBGene00014123	M106.5	Tong
CDC42	WBGene00000390	R07G3.1	FAD1	WBGene00011271	ZK863.3	Davierwala
CDC42	WBGene00000390	R07G3.1	HRT1	WBGene00004320	R53.1	Davierwala
CDC42	WBGene00000390	R07G3.1	RPC40	WBGene00019275	ZK287.5	Davierwala
CDC42	WBGene00000390	R07G3.1	UBA4	WBGene00018357	H43I07.2	Tong
CDC42	WBGene00000390	R07G3.1	YGL211W	WBGene00017928	F42G8.6	Tong
CDC45	WBGene00009372		BUB2	WBGene00016352	F29C4.6	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	CSM3	WBGene00017738	C33F10.2	Tong
CDC45	WBGene00009372		CTF18	WBGene00010676	F23C8.9	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	DPB3	WBGene00013150	K08F4.1	Tong
CDC45	WBGene00009372		FAB1	WBGene00004089	Y53F4B.d	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	GIM4	WBGene00019220	C05E7.5 & VF11C1L.1	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	GIM1 GIM5	WBGene00020112	H20J04.d	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	HAT1	WBGene00010841	R151.9	Tong
CDC45 CDC45	WBGene00009372		HTZ1	WBGene00010841 WBGene00019947	M03C11.4	Tong
CDC45 CDC45	WBGene00009372 WBGene00009372	F34D10.2 & F34D10.3 F34D10.2 & F34D10.3	KAR3	WBGene00019947 WBGene00002216	R08C7.3	Tong
CDC45 CDC45	WBGene00009372	F34D10.2 & F34D10.3	KEM1	WBGene00002210 WBGene00012730	T09A5.2	Tong
CDC45 CDC45	WBGene00009372		LEO1	WBGene000012730 WBGene00007110	Y39G8CY39G8C.1 & Y39G8C.b.b	-
CDC45 CDC45	WBGene00009372 WBGene00009372	F34D10.2 & F34D10.3	LEOI LSM1	WBGene00007110 WBGene00003076	B0035.11	Tong
		F34D10.2 & F34D10.3				Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	MAD2	WBGene00003161	F40F8.9	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	NPR2	WBGene00018635	Y69A2A_2326.a	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	POL32	WBGene00011016	F49E8.1	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	RAD54	WBGene00004298	R04F11.3	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	RTF1	WBGene00009103	W06D4.6	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	SCS7	WBGene00007707	F25B3.6	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	SEC22	WBGene00018853	C25A1.5	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	TOP1	WBGene00006595	F55A4.1	Tong
CDC45	WBGene00009372	F34D10.2 & F34D10.3	YJR070C	WBGene00007555	M01E5.5	Tong
CHL1	WBGene00010839	M03C11.2	GIM3	WBGene00007107	C14A4.1	Tong

GTTT 1		NO 2 71 1 0	0 T 1 4 5		20025 4	-
CHL1	WBGene00010839	M03C11.2	GIM5	WBGene00020112	B0035.4	Tong
CHL1	WBGene00010839	M03C11.2	MAD2	WBGene00003161	R151.9	Tong
CHL1	WBGene00010839	M03C11.2	RAD27	WBGene00000794	Y69A2A_2326.a	Tong, Pan
CHL1	WBGene00010839	M03C11.2	YKE2	WBGene00009004	Y47G6A_247.i	Tong
CHS5	WBGene00022615	ZC449.5	ARC18	WBGene00000203	F21C3.5	Tong
CHS5	WBGene00022615	ZC449.5	ASC1	WBGene00010556	Y37D8A.1	Tong
CHS5	WBGene00022615	ZC449.5	BRE1	WBGene00007008	K04D7.1	Tong
CHS5	WBGene00022615	ZC449.5	COX11	WBGene00010437	R05D3.4	Tong
CHS5	WBGene00022615	ZC449.5	EMP24	WBGene00004766	JC8.5	Tong
CHS5	WBGene00022615	ZC449.5	FAB1	WBGene00004089	W02D7.7	Tong
CHS5	WBGene00022615	ZC449.5	HSE1	WBGene00004109	C05E7.5 & VF11C1L.1	Tong
CHS5	WBGene00022615	ZC449.5	LAT1	WBGene00009082	C34G6.7	Tong
CHS5	WBGene00022615	ZC449.5	LEA1	WBGene00019223	F23B12.5	Tong
CHS5	WBGene00022615	ZC449.5	LSM6	WBGene00003080	H20J04.c	Tong
CHS5	WBGene00022615	ZC449.5	MRE11	WBGene00003405	Y71G12A_187.b	Tong
CHS5	WBGene00022615	ZC449.5	PET8	WBGene00008364	ZC302.1	Tong
CHS5	WBGene00022615	ZC449.5	PRE9	WBGene00003924	D1046.3	Tong
CHS5	WBGene00022615	ZC449.5	RVS161	WBGene00010272	Y110A7A.f & Y110A7A.j	Tong
CHS5	WBGene00022615	ZC449.5	SEC22	WBGene00018853	F58G6.1	Tong
CHS5	WBGene00022615	ZC449.5	VPS24	WBGene00020866	F55A4.1	Tong
CHS5	WBGene00022615	ZC449.5	YDL033C	WBGene00007114	F59A6.7 & T27F7.1	Tong
CNE1	WBGene00000567	ZK632.6	PEX1	WBGene00004191	B0035.16	Tong
CNE1	WBGene00000567	ZK632.6	YNR036C	WBGene00011391	C11H1.4 & C11H1.6	Tong
CSM3	WBGene00017738	F23C8.9	BUB2	WBGene00016352	T03D8.2	Tong
CSM3	WBGene00017738	F23C8.9	CSN12	WBGene00016171	C33F10.2	Tong
CSM3	WBGene00017738	F23C8.9	DOC1	WBGene00000144	C27F2.7	Pan
CSM3	WBGene00017738	F23C8.9	GIM3	WBGene00007107	F15H10.3	Tong
CSM3	WBGene00017738	F23C8.9	GIM4	WBGene00019220	B0035.4	Tong
CSM3	WBGene00017738	F23C8.9	GIM5	WBGene00020112	H20J04.d	Tong, Pan
CSM3	WBGene00017738	F23C8.9	GUF1	WBGene00022862	R151.9	Pan
CSM3	WBGene00017738	F23C8.9	ISC1	WBGene00012105	ZK1236.1	Tong
CSM3	WBGene00017738	F23C8.9	LSM7	WBGene00003081	T27F6.6	Pan
CSM3	WBGene00017738	F23C8.9	MAK3	WBGene00015074	ZK593.7	Pan
CSM3	WBGene00017738	F23C8.9	MRE11	WBGene00003405	B0238.10	Pan
CSM3	WBGene00017738	F23C8.9	NAT1	WBGene00021754	ZC302.1	Pan
CSM3	WBGene00017738	F23C8.9	NPR2	WBGene00018635	Y50D7_162.b & Y50D7_164.a	Pan
CSM3	WBGene00017738	F23C8.9	PAC10	WBGene00006889	F49E8.1	Tong
CSM3	WBGene00017738	F23C8.9	POL32	WBGene00011016	T06G6.9	Tong, Pan
CSM3	WBGene00017738	F23C8.9	POP1	WBGene00015486	R04F11.3	Davierwala
CSM3	WBGene00017738	F23C8.9	RAD5	WBGene00010061	C05D11.9	Tong, Pan
CSM3	WBGene00017738	F23C8.9	RAD50	WBGene00004296	F54E12.2	Pan
CSM3	WBGene00017738	F23C8.9	RAD50 RAD51	WBGene00004297	T04H1.4	Pan
CSM3	WBGene00017738	F23C8.9	RAD51 RAD54	WBGene00004298	Y43C5A.6	Pan
CSM3	WBGene00017738	F23C8.9	RAD54	WBGene00006701	W06D4.6	Pan
CSM3 CSM3	WBGene00017738	F23C8.9	RPN10	WBGene00004466	C35B1.1	Pan
CSM3 CSM3	WBGene00017738	F23C8.9	VIP1	WBGene00018508	B0205.3	Pan
CSM3 CSM3	WBGene00017738	F23C8.9	VIPI YKE2	WBGene00009004	F46F11.1	Tong
	WBGene00010676		ARP6	WBGene00007434	F21C3.5	Tong
CILTO	MPGEIIE00010010	K001.4.T	AKEU	MDGGIIG0000/434	12103.3	TOUR

CTF18	WBGene00010676	K08F4.1	ASC1	WBGene00010556	C08B11.6	Pan
CTF18	WBGene00010676	K08F4.1	BUB2	WBGene00016352	K04D7.1	Pan
CTF18	WBGene00010676	K08F4.1	CHD1	WBGene00010369	C33F10.2	Pan
CTF18	WBGene00010676	K08F4.1	CHL1	WBGene00010839	H06O01.2	Tong, Pan
CTF18	WBGene00010676	K08F4.1	CSM3	WBGene00017738	M03C11.2	Tong, Pan
CTF18	WBGene00010676	K08F4.1	CTK1	WBGene00007135	F23C8.9	Pan
CTF18	WBGene00010676	K08F4.1	DPB3	WBGene00013150	B0285.1 & B0285.2	Pan
CTF18	WBGene00010676	K08F4.1	GIM3	WBGene00007107	Y53F4B.d	Tong, Pan
CTF18	WBGene00010676	K08F4.1	GIM4	WBGene00019220	B0035.4	Tong, Pan
CTF18	WBGene00010676	K08F4.1	GIM5	WBGene00020112	H20J04.d	Tong, Pan
CTF18	WBGene00010676	K08F4.1	HTZ1	WBGene00019947	R151.9	Tong, Pan
CTF18	WBGene00010676	K08F4.1	ISC1	WBGene00012105	R08C7.3	Pan
CTF18	WBGene00010676	K08F4.1	KAR3	WBGene00002216	T27F6.6	Pan
CTF18	WBGene00010676	K08F4.1	LSM1	WBGene00003076	T09A5.2	Pan
CTF18	WBGene00010676	K08F4.1	LSM7	WBGene00003081	F40F8.9	Pan
CTF18	WBGene00010676	K08F4.1	MAD2	WBGene00003161	ZK593.7	Tong, Pan
CTF18	WBGene00010676	K08F4.1	MRE11	WBGene00003405	Y69A2A_2326.a	Tong, Pan
CTF18	WBGene00010676	K08F4.1	NAT1	WBGene00021754	ZC302.1	Pan
CTF18 CTF18	WBGene00010676	K08F4.1	PAC10	WBGene00021754 WBGene00006889	Y50D7_162.b & Y50D7_164.a	Tong, Pan
CTF18 CTF18	WBGene00010676	K08F4.1	PEP5	WBGene000011067	T06G6.9	Pan
			PEP5 POL32		R06F6.2	
CTF18		K08F4.1		WBGene00011016		Tong, Pan
CTF18	WBGene00010676	K08F4.1	POP2	WBGene00000369	R04F11.3	Pan
CTF18		K08F4.1	RAD23	WBGene00013924	Y56A3A.20	Tong
CTF18	WBGene00010676	K08F4.1	RAD5	WBGene00010061	ZK20.3	Tong, Pan
CTF18	WBGene00010676	K08F4.1	RAD50	WBGene00004296	F54E12.2	Tong, Pan
CTF18	WBGene00010676	K08F4.1	RAD51	WBGene00004297	T04H1.4	Tong, Pan
CTF18		K08F4.1	RAD54	WBGene00004298	Y43C5A.6	Tong, Pan
CTF18	WBGene00010676	K08F4.1	RAD6	WBGene00006701	W06D4.6	Pan
CTF18	WBGene00010676	K08F4.1	RPN10	WBGene00004466	C35B1.1	Pan
CTF18	WBGene00010676	K08F4.1	SNF8	WBGene00016167	B0205.3	Pan
CTF18	WBGene00010676	K08F4.1	STP22	WBGene00015658	C27F2.5	Pan
CTF18	WBGene00010676	K08F4.1	UBP14	WBGene00020839	C09G12.9	Pan
CTF18	WBGene00010676	K08F4.1	VIP1	WBGene00018508	T27A3.2	Pan
CTF18	WBGene00010676	K08F4.1	VPS16	WBGene00006516	F46F11.1	Pan
CTF18	WBGene00010676	K08F4.1	VPS20	WBGene00022027	C05D11.2	Pan
CTF18	WBGene00010676	K08F4.1	VPS25	WBGene00012193	Y65B4A_182.b & Y65B4A_182.c	Pan
CTF18	WBGene00010676	K08F4.1	VPS34	WBGene00006932	W02A11.2	Pan
CTF18	WBGene00010676	K08F4.1	VPS36	WBGene00008919	B0025.1	Pan
CTF18	WBGene00010676	K08F4.1	VPS45	WBGene00016643	F17C11.8	Pan
CTF18	WBGene00010676	K08F4.1	YAF9	WBGene00001585	C44C1.1 & C44C1.4	Pan
CWH41	WBGene00008775	F13H10.4	EMP24	WBGene00004766	M04B2.3	Tong
CWH41	WBGene00008775	F13H10.4	LEA1	WBGene00019223	W02D7.7	Tong
CWH41	WBGene00008775		PER1	WBGene00019806	H20J04.c	Tong
CWH41		F13H10.4	SNF4	WBGene00013732	R01B10.4	Tong
CWH41	WBGene00008775	F13H10.4	YBR235W		Y111B2C.h	Tong
DIE2	WBGene00011987	T24D1.4	OST3	WBGene00022793	T04B8.5	Tong
DPB3	WBGene00013150	Y53F4B.d	HTZ1	WBGene00019947	ZK686.3	Pan
DYN1	WBGene00000962	T21E12.4	GIM3	WBGene00007107	R08C7.3	Tong
			51115			-0119

DYN1	WBGene00000962	T21E12.4	GIM4	WBGene00019220	B0035.4	Tong
DYN1	WBGene00000962	T21E12.4	GIM5	WBGene00020112	H20J04.d	Tong
DYN1	WBGene00000962	T21E12.4	HCM1	WBGene00001442	R151.9	Tong
DYN1	WBGene00000962	T21E12.4	KAR3	WBGene00002216	C25A1.2	Tong
DYN1	WBGene00000962	T21E12.4	PAC10	WBGene00006889	T09A5.2	Tong
DYN1	WBGene00000962	T21E12.4	YKE2	WBGene00009004	T06G6.9	Tong
DYN2	WBGene00001130	C02C6.1	GIM3	WBGene00007107	F21C3.5	Tong
DYN2	WBGene00001130	C02C6.1	GIM4	WBGene00019220	B0035.4	Tong
DYN2	WBGene00001130	C02C6.1	GIM5	WBGene00020112	H20J04.d	Tong
DYN2	WBGene00001130	C02C6.1	PAC10	WBGene00006889	R151.9	Tong
DYN2	WBGene00001130	C02C6.1	YKE2	WBGene00009004	T06G6.9	Tong
GIM3	WBGene00007107	B0035.4	BUB2	WBGene00016352	F21C3.5	Tong
GIM3	WBGene00007107	B0035.4	FAB1	WBGene00004089	C33F10.2	Tong
GIM3	WBGene00007107	B0035.4	HTZ1	WBGene00019947	C05E7.5 & VF11C1L.1	Tong
GIM3	WBGene00007107	B0035.4	NCL1	WBGene00021686	R08C7.3	Tong
GIM3	WBGene00007107	B0035.4	PAN3	WBGene00014015	Y48G8A_2614.a	Tong
GIM3	WBGene00007107	B0035.4	PER1	WBGene00019806	ZK632.7	Tong
GIM3	WBGene00007107	B0035.4	PLP1	WBGene00015482	R01B10.4	Tong
GIM3	WBGene00007107	B0035.4	STE24	WBGene00001405	C05D11.3	Tong
GIM3	WBGene00007107	B0035.4	UBA4	WBGene00018357	C04F12.10	Tong
GIM3	WBGene00007107	B0035.4	VAC14	WBGene00010565	F42G8.6	Tong
GIM3	WBGene00007107	B0035.4	VPS29	WBGene00014234	K04G2.6	Tong
GIM3	WBGene00007107	B0035.4	VRP1	WBGene00020094	ZK1128.8	Tong
GIM3	WBGene00007107	B0035.4	YBR108W	WBGene00004110	R144.4 & R144.8	Tong
GIM3	WBGene00007107	B0035.4	YGR054W	WBGene00008480	C37A2.2	Tong
GIM3	WBGene00007107	B0035.4	YTA7	WBGene00008682	E04D5.1	Tong
GIM4	WBGene00019220	H20J04.d	BUB2	WBGene00016352	F11A10.1	Tong
GIM4	WBGene00019220	H20J04.d	CAP2	WBGene00000293	C33F10.2	Tong
GIM4	WBGene00019220	H20J04.d	CHL1	WBGene00010839	M106.5	Tong
GIM4	WBGene00019220	H20J04.d	DNM1	WBGene00001093	M03C11.2	Tong
GIM4	WBGene00019220	H20J04.d	FAB1	WBGene00004089	T12E12.4	Tong
GIM4	WBGene00019220	H20J04.d	HSE1	WBGene00004109	C05E7.5 & VF11C1L.1	Tong
GIM4	WBGene00019220	H20J04.d	HTZ1	WBGene00019947	C34G6.7	Tong
GIM4	WBGene00019220	H20J04.d	ISC1	WBGene00012105	R08C7.3	Tong
GIM4	WBGene00019220	H20J04.d	MMS2	WBGene00006730	T27F6.6	Tong
GIM4	WBGene00019220	H20J04.d	NCL1	WBGene00021686	F39B2.2	Tong
GIM4	WBGene00019220	H20J04.d	PAC2	WBGene00019503	Y48G8A_2614.a	Tong
GIM4	WBGene00019220	H20J04.d	PAN3	WBGene00014015	K07H8.1	Tong
GIM4	WBGene00019220 WBGene00019220	H20J04.d	PER1	WBGene00019806	ZK632.7	Tong
GIM4	WBGene00019220	H20J04.d	STE24	WBGene00001405	R01B10.4	Tong
GIM4	WBGene00019220 WBGene00019220	H20J04.d	UBA4	WBGene00018357	C04F12.10	Tong
GIM4 GIM4	WBGene00019220 WBGene00019220	H20J04.d	VAC14	WBGene00010565	F42G8.6	Tong
GIM4 GIM4	WBGene00019220 WBGene00019220	H20J04.d	VPS29	WBGene00014234	K04G2.6	Tong
GIM4 GIM4	WBGene00019220 WBGene00019220	H20J04.d	VF529 VRP1	WBGene00014234 WBGene00020094	ZK1128.8	Tong
GIM4 GIM4	WBGene00019220 WBGene00019220	H20J04.d	VRP1 YJR129C	WBGene00020094 WBGene00011148	R144.4 & R144.8	Tong
GIM4 GIM4	WBGene00019220	H20J04.d	YTA7	WBGene000011148 WBGene00008682	R08D7.4	Tong
GIM4 GIM5	WBGene00019220 WBGene00020112	R151.9	BUB2	WBGene00016352	F11A10.1	Tong
GIM5 GIM5	WBGene00020112 WBGene00020112		CAF40	WBGene00016139	C33F10.2	Tong
CHILD	MEGENEOUOZOTIZ	NT3T•2	CUL 10	MPGGIIC00010133	0.001 10.2	10119

	WBGene00020112		CAP2	WBGene00000293	C26E6.3	Tong
	WBGene00020112	R151.9	DNM1	WBGene00001093	M106.5	Tong
GIM5	WBGene00020112	R151.9	FAB1	WBGene00004089	T12E12.4	Tong
GIM5	WBGene00020112	R151.9	HTZ1	WBGene00019947	C05E7.5 & VF11C1L.1	Tong
GIM5	WBGene00020112	R151.9	KEM1	WBGene00012730	R08C7.3	Tong
GIM5	WBGene00020112	R151.9	MAK 3	WBGene00015074	Y39G8C.Y39G8C.1 & Y39G8C.bb	Tong
GIM5	WBGene00020112	R151.9	MMS2	WBGene00006730	B0238.10	Tong
GIM5	WBGene00020112	R151.9	NCL1	WBGene00021686	F39B2.2	Tong
GIM5	WBGene00020112	R151.9	PAN3	WBGene00014015	Y48G8A_2614.a	Tong
GIM5	WBGene00020112	R151.9	PLP1	WBGene00015482	ZK632.7	Tong
GIM5	WBGene00020112	R151.9	SPF1	WBGene00007514	C05D11.3	Tong
GIM5	WBGene00020112	R151.9	STE24	WBGene00001405	C10C6.6	Tong
GIM5	WBGene00020112	R151.9	UBA4	WBGene00018357	C04F12.10	Tong
GIM5	WBGene00020112	R151.9	UGA1	WBGene00001794	F42G8.6	Tong
GIM5	WBGene00020112	R151.9	VAC14	WBGene00010565	K04D7.3	Tong
	WBGene00020112	R151.9	VPS29	WBGene00014234	K04G2.6	Tong
GIM5	WBGene00020112	R151.9	VPS35	WBGene00006933	ZK1128.8	Tong
	WBGene00020112	R151.9	VRP1	WBGene00020094	F59G1.3	Tong
GIM5	WBGene00020112	R151.9	YBR108W	WBGene00004110	R144.4 & R144.8	Tong
GIM5	WBGene00020112	R151.9	YGR054W	WBGene00008480	C37A2.2	Tong
GIM5	WBGene00020112	R151.9	YTA7	WBGene00008682	E04D5.1	Tong
	WBGene00009322	F32B6.8	ARL1	WBGene00000187	F11A10.1	Tong
	WBGene00009322	F32B6.8	COG6	WBGene00019481	F54C9.10	Tong
	WBGene00009322	F32B6.8	COG8	WBGene00011736	K07C11.9	Tong
	WBGene00009322	F32B6.8	SCS7	WBGene00007707	T12D8.9	Tong
	WBGene00009322	F32B6.8	SEC22	WBGene00018853	C25A1.5	Tong
	WBGene00009322	F32B6.8	YPT6	WBGene00009880	F55A4.1	Tong
	WBGene00002216	T09A5.2	ARP6	WBGene00007434	F49C12.11	Tong
KAR3	WBGene00002216	T09A5.2	BUB2	WBGene00016352	C08B11.6	Tong
	WBGene00002216	T09A5.2	CHL1	WBGene00010839	C33F10.2	Tong
	WBGene00002216	T09A5.2	CSM3	WBGene00017738	M03C11.2	Tong, Pan
	WBGene00002216	T09A5.2	GIM3	WBGene00007107	F23C8.9	Tong
	WBGene00002216	T09A5.2	GIM4	WBGene00019220	B0035.4	Tong
	WBGene00002216	T09A5.2	GIM5	WBGene00020112	H20J04.d	Tong
	WBGene00002216	T09A5.2	KEM1	WBGene00012730	R151.9	Tong
	WBGene00002216	T09A5.2	MAD2	WBGene00003161	Y39G8C.1 & Y39G8C.b	Tong
	WBGene00002216	T09A5.2	PAC10	WBGene00006889	Y69A2A_2326.a	Tong
	WBGene00002216	T09A5.2	PRE9	WBGene00003924	T06G6.9	Tong
	WBGene00002216	T09A5.2	RPN10	WBGene00004466	Y110A7A.f & Y110A7A.j	Tong, Pan
	WBGene00002216	T09A5.2	RRD2	WBGene00022185	B0205.3	Tong
	WBGene00002216	T09A5.2	YKE2	WBGene00009004	Y71H2_388.b & Y71H2_388.c & Y71H2_388.f	Tong
	WBGene00009204	F28C6.4	LEA1	WBGene00019223	F21C3.5	Tong
	WBGene00009204	F28C6.4	YPR045C	WBGene00017158	H20J04.c	Tong
	WBGene00007555	C14A4.1	AAH1	WBGene00015551	F01F1.1	Tong
	WBGene00007555	C14A4.1	RTF1	WBGene00009103	C06G3.5	Tong
	WBGene00003161	Y69A2A_2326.a	GIM3	WBGene00007107	F25B3.6	Tong
	WBGene00003161	Y69A2A_2326.a	GIM3 GIM4	WBGene00019220	B0035.4	Tong
	WBGene00003161	Y69A2A_2326.a	GIM4 GIM5	WBGene00020112	H20J04.d	Tong
11112		10/11211_2520.0	01110		1120001.4	10119

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MAD2	WBGene00003161	Y69A2A_2326.a	HCM1	WBGene00001442	R151.9	Tong
MAD2	WBGene00003161	Y69A2A_2326.a	HTZ1	WBGene00019947	C25A1.2	Tong
MAD2	WBGene00003161	Y69A2A_2326.a	PAC10	WBGene00006889	R08C7.3	Tong
MAD2	WBGene00003161	Y69A2A_2326.a	YKE2	WBGene00009004	T06G6.9	Tong
MRE11	WBGene00003405	ZC302.1	CTK1	WBGene00007135	F21C3.5	Pan
MRE11	WBGene00003405	ZC302.1	KEM1	WBGene00012730	B0285.1 & B0285.2	Pan
MRE11	WBGene00003405	ZC302.1	LSM1	WBGene00003076	Y39G8C.1 & Y39G8C.b	Pan
MRE11	WBGene00003405	ZC302.1	LSM6	WBGene00003080	F40F8.9	Pan
MRE11	WBGene00003405	ZC302.1	LSM7	WBGene00003081	Y71G12A_187.b	Pan
MRE11	WBGene00003405	ZC302.1	MUS81	WBGene00016602	ZK593.7	Pan
MRE11	WBGene00003405	ZC302.1	NAT1	WBGene00021754	C43E11.2	Pan
MRE11	WBGene00003405	ZC302.1	POL32	WBGene00011016	Y50D7_162.b & Y50D7_164.a	Pan
MRE11	WBGene00003405	ZC302.1	POP2	WBGene00000369	R04F11.3	Pan
MRE11	WBGene00003405	ZC302.1	RAD5	WBGene00010061	Y56A3A.20	Pan
MRE11	WBGene00003405	ZC302.1	RAD6	WBGene00006701	F54E12.2	Pan
MRE11	WBGene00003405	ZC302.1	RPN10	WBGene00004466	C35B1.1	Pan
MRE11	WBGene00003405	ZC302.1	SGS1	WBGene00001865	B0205.3	Pan
MRE11	WBGene00003405	ZC302.1	STP22	WBGene00015658	T04A11.6	Pan
MRE11	WBGene00003405	ZC302.1	VPS15	WBGene00014151	C09G12.9	Pan
MRE11	WBGene00003405	ZC302.1	VPS34	WBGene00006932	ZK930.1 & ZK930.7	Pan
MRE11	WBGene00003405	ZC302.1	YDR140W	WBGene00016341	B0025.1	Pan
MRE11	WBGene00003405	ZC302.1	YER087W	WBGene00004190	C33C12.9	Pan
MUS81	WBGene00016602	C43E11.2	POL32	WBGene00011016	T27F6.5	Pan
MUS81	WBGene00016602	C43E11.2	POP2	WBGene00000369	R04F11.3	Pan
MUS81	WBGene00016602	C43E11.2	RAD54	WBGene00004298	Y56A3A.20	Pan
MUS81	WBGene00016602	C43E11.2	RAD6	WBGene00006701	W06D4.6	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	ARC18	WBGene00000203	C35B1.1	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	ARP6	WBGene00007434	Y37D8A.1	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	BUD13	WBGene00011142	C08B11.6	Pan
NAT1	WBGene00021754		CBC2	WBGene00009141	R08D7.1	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	COX6	WBGene00012553	F26A3.2	Pan
NAT1	WBGene00021754		CRD1	WBGene00017763	Y37D8A.14	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	DOA1	WBGene00007333	F23H11.9	Pan
NAT1	WBGene00021754		DPB3	WBGene00013150	C05C10.6	Pan
NAT1 NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	FAB1	WBGene000013130 WBGene00004089	Y53F4B.d	Pan
NAT1 NAT1	WBGene00021754		GIM3	WBGene00007107	C05E7.5 & VF11C1L.1	Pan
NAT1 NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	GLO3	WBGene00007107 WBGene00017217	B0035.4	Pan
NAT1 NAT1	WBGene00021754 WBGene00021754	Y50D7 162.b & Y50D7 164.a	HTZ1	WBGene00019947	F07F6.4	Pan
NAT1 NAT1	WBGene00021754 WBGene00021754	Y50D7_162.b & Y50D7_164.a	IFM1	WBGene00009947 WBGene00009771	R08C7.3	Pan
NAT1 NAT1	WBGene00021754 WBGene00021754	Y50D7_162.b & Y50D7_164.a	IST3	WBGene00009771 WBGene00016245	F46B6.6	Pan
NAT1 NAT1	WBGene00021754 WBGene00021754	Y50D7_162.b & Y50D7_164.a	LEA1	WBGene00010245 WBGene00019223	C30B5.4	Pan
NAT1 NAT1	WBGene00021754 WBGene00021754	Y50D7 162.b & Y50D7 164.a	LEAI LSM1	WBGene00019223 WBGene00003076	H20J04.c	Pan
NAT1 NAT1	WBGene00021754 WBGene00021754	Y50D7_162.b & Y50D7_164.a	LSMI LSM6	WBGene00003078 WBGene00003080	F40F8.9	Pan
NAT1 NAT1	WBGene00021754 WBGene00021754	Y50D7_162.b & Y50D7_164.a	LSM0 LSM7	WBGene00003080 WBGene00003081	Y71G12A_187.b	Pan
	WBGene00021754 WBGene00021754		LSM/ MIP1	WBGene00003081 WBGene00013258	ZK593.7	Pan Pan
NAT1	WBGene00021754 WBGene00021754	Y50D7_162.b & Y50D7_164.a		WBGene00013258 WBGene00020993	2K593.7 Y57A10A.m	
NAT1		Y50D7_162.b & Y50D7_164.a	MRF1			Pan Pan
NAT1 NAT1	WBGene00021754 WBGene00021754	Y50D7_162.b & Y50D7_164.a	PAC10 PEP3	WBGene00006889	W03F8.3	Pan Pan
INALL	wbGeneuuu21/54	Y50D7_162.b & Y50D7_164.a	LEL2	WBGene00021058	T06G6.9	rdii

NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	PEP5	WBGene00011067	W06B4.3	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	PEX1	WBGene00004191	R06F6.2	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	PEX12	WBGene00004197	C11H1.4 & C11H1.6	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	PEX13	WBGene00004198	F08B12.2	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	PEX5	WBGene00004194	F32A5.6	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	PEX6	WBGene00004195	C34C6.6	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	PHB2	WBGene00004015	F39G3.7	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	PIM1	WBGene00016391	Т24Н7.1	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	POL32	WBGene00011016	C34B2.6	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	POP2	WBGene00000369	R04F11.3	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	PPA1	WBGene00011347*	Y56A3A.20	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	RAD27	WBGene00000794	T01H3.1	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	RAD5	WBGene00010061	Y47G6A_247.i	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	RAD50	WBGene00004296	F54E12.2	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	RAD51	WBGene00004297	T04H1.4	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	RAD54	WBGene00004298	Y43C5A.6	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	RVS161	WBGene00010272	W06D4.6	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	RVS167	WBGene00020209	F58G6.1	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	SAC1	WBGene00009264	T04C9.1 & ZK328.3	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	SCS7	WBGene00007707	F30A10.6	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	SER2	WBGene00013379	C25A1.5	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	SET2	WBGene00021515	Y62E10A.m	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	SIN3	WBGene00004117	Y41D4A_2615.a & Y41D4A_3457.b	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	SMP2	WBGene00010425	F02E9.4	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	SNF8	WBGene00016167	H37A05.1	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	STP22	WBGene00015658	C27F2.5	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	SWD1	WBGene00017683	C09G12.9	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	VMA4	WBGene00006917*	F21H12.1	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	VMA8	WBGene00010130	C17H12.14	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	VPS20	WBGene00022027	F55H2.2	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	VPS25	WBGene00012193	Y65B4A_182.b & Y65B4A_182.c	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	VPS27	WBGene00004101	W02A11.2	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	VPS36	WBGene00008919	C07G1.5	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	VPS45	WBGene00016643	F17C11.8	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	VPS9	WBGene00012644	C44C1.1 & C44C1.4	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	VRP1	WBGene00020094	Y39A1A.5	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	YAF9	WBGene00001585	R144.4 & R144.8	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	YER087W	WBGene00004190	M04B2.3	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	YGR046W	WBGene00022126	T27F6.5	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	YKE2	WBGene00009004	Y71F9B_275.b & Y71F9B_297.d	Pan
NAT1	WBGene00021754	Y50D7_162.b & Y50D7_164.a	YMR293C	WBGene00021508	F21C3.5	Pan
NIP7	WBGene00016607	C43E11.9	ABD1	WBGene00006447	Y41D4A_3192.a	Davierwala
NIP7	WBGene00016607	C43E11.9	BET3	WBGene00014222	C25A1.3	Davierwala
NIP7	WBGene00016607	C43E11.9	CDC16	WBGene00001281	ZK1098.5	Davierwala
NIP7	WBGene00016607	C43E11.9	CFT2	WBGene00017313	F10B5.6	Davierwala
NIP7	WBGene00016607	C43E11.9	CWC22	WBGene00002957	F09G2.4	Davierwala
NIP7	WBGene00016607	C43E11.9	MCD4	WBGene00021840	F33A8.1	Davierwala
NIP7	WBGene00016607	C43E11.9	MVD1	WBGene00012984	M01B12.2 & Y54E10B_159.a	Davierwala

NIP7	WBGene00016607	C43E11.9	PDS5	WBGene00001352	Y48B6A.13a	Davierwala
NIP7	WBGene00016607	C43E11.9	POL12	WBGene00001002	H38K22.1	Davierwala
NIP7	WBGene00016607	C43E11.9	PRO3	WBGene00010924	R01H10.1	Davierwala
NIP7	WBGene00016607	C43E11.9	PRP16	WBGene00003389	M153.1	Davierwala
NIP7	WBGene00016607	C43E11.9	RIM2	WBGene00011662	K03H1.2	Davierwala
NIP7	WBGene00016607	C43E11.9	RIX7	WBGene00003119	T09F3.2	Davierwala
NIP7	WBGene00016607	C43E11.9	RNA15	WBGene00000774	Y48C3A.i	Davierwala
NOP1	WBGene00001423	T01C3.7	BET3	WBGene00014222	F56A8.6	Davierwala
NOP1	WBGene00001423	T01C3.7	CWC22	WBGene00002957	ZK1098.5	Davierwala
NOP1	WBGene00001423	T01C3.7	LCP5	WBGene00003059	F33A8.1	Davierwala
NOP1	WBGene00001423	T01C3.7	MAS1	WBGene00013880	C48E7.3	Davierwala
NOP1	WBGene00001423	T01C3.7	MSS4	WBGene00004087	ZC410.2	Davierwala
NOP1	WBGene00001423	T01C3.7	PRP16	WBGene00003389	F55A12.3	Davierwala
NOP1	WBGene00001423	T01C3.7	PRP28	WBGene00017162	K03H1.2	Davierwala
NOP1	WBGene00001423	T01C3.7	RKI1	WBGene00015101	F01F1.7	Davierwala
NOP1	WBGene00001423	T01C3.7	SEC17	WBGene00017016	B0280.3	Davierwala
NOP1	WBGene00001423	T01C3.7	TAF1	WBGene00006382	D1014.3	Davierwala
NOP1	WBGene00001423	T01C3.7	UGP1	WBGene00010665	W04A8.7 & Y71A12B.a & Y71A12B.b &	Davierwala
NOP1	WBGene00001423	T01C3.7	UTP11	WBGene00007623	Y71A12B.c	Davierwala
NOP1	WBGene00001423	T01C3.7	YNR054C	WBGene00019005	K08E3.5	Davierwala
NOP1	WBGene00001423	T01C3.7	YOR287C	WBGene00020705	C16C10.2	Davierwala
PAC1	WBGene00003047	T03F6.5	CAP1	WBGene00000292	F57B10.8	Tong
PAC1	WBGene00003047	T03F6.5	FAB1	WBGene00004089	Т22Н9.1	Tong
PAC1	WBGene00003047	T03F6.5	GIM3	WBGene00007107	D2024.6	Tong
PAC1	WBGene00003047	T03F6.5	GIM4	WBGene00019220	C05E7.5 & VF11C1L.1	Tong
PAC1	WBGene00003047	T03F6.5	GIM5	WBGene00020112	B0035.4	Tong
PAC1	WBGene00003047	T03F6.5	KAR 3	WBGene00002216	H20J04.d	Tong
PAC1	WBGene00003047	T03F6.5	PAC10	WBGene00006889	R151.9	Tong
PAC1	WBGene00003047	T03F6.5	YHR168W	WBGene00010805	T09A5.2	Tong
PAC1	WBGene00003047	T03F6.5	YKE2	WBGene00009004	T06G6.9	Tong
PAC10	WBGene00006889	T06G6.9	AFG1	WBGene00016261	M01E5.2	Tong
PAC10	WBGene00006889	T06G6.9	BUB2	WBGene00016352	F21C3.5	Tong
PAC10	WBGene00006889	T06G6.9	CAF40	WBGene00016139	C30F12.2	Tong
PAC10	WBGene00006889	T06G6.9	CAP2	WBGene00000293	C33F10.2	Tong
PAC10	WBGene00006889	T06G6.9	CHL1	WBGene00010839	C26E6.3	Tong
PAC10	WBGene00006889	T06G6.9	DNM1	WBGene00001093	M106.5	Tong
PAC10	WBGene00006889	T06G6.9	FAB1	WBGene00004089	M03C11.2	Tong
PAC10	WBGene00006889	T06G6.9	HSE1	WBGene00004109	T12E12.4	Tong
PAC10	WBGene00006889	T06G6.9	HTZ1	WBGene00019947	C05E7.5 & VF11C1L.1	Tong
PAC10	WBGene00006889	T06G6.9	KEM1	WBGene00012730	C34G6.7	Tong
PAC10	WBGene00006889	T06G6.9	MAK3	WBGene00012730	R08C7.3	Tong
PAC10	WBGene00006889	T06G6.9	MMS2	WBGene00006730	Y39G8C.Y39G8C.1 & Y39G8C.bb	Tong
PAC10	WBGene00006889	T06G6.9	NCL1	WBGene00021686	B0238.10	Tong
PAC10	WBGene00006889	T06G6.9	PER1	WBGene00019806	F39B2.2	Tong
PAC10	WBGene00006889	T06G6.9	PLP1	WBGene00015482	Y48G8A_2614.a	Tong
PAC10	WBGene00006889	T06G6.9	SPF1	WBGene00007514	R01B10.4	Tong
PAC10 PAC10	WBGene00006889	T06G6.9	STE24	WBGene00001405	C05D11.3	Tong
PAC10	WBGene00006889	T06G6.9	UBA4	WBGene00018357	C10C6.6	Tong
111010		20000.2	5.5.1.1		01000.0	

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PAC10	WBGene00006889	T06G6.9	UTR4	WBGene00010286	C04F12.10	Tong
PAC10	WBGene00006889	T06G6.9	VPS29	WBGene00014234	F42G8.6	Tong
PAC10	WBGene00006889	T06G6.9	VRP1	WBGene00020094	F58H1.3	Tong
PAC10	WBGene00006889	T06G6.9	YBR108W	WBGene00004110	ZK1128.8	Tong
PAC10	WBGene00006889	T06G6.9	YGR054W	WBGene00008480	R144.4 & R144.8	Tong
PAC10	WBGene00006889	T06G6.9	YJR129C	WBGene00011148	C37A2.2	Tong
PAC2	WBGene00019503	К07Н8.1	CTF18	WBGene00010676	E04D5.1	Tong
PAC2	WBGene00019503	К07Н8.1	GIM3	WBGene00007107	R08D7.4	Tong
PAC2	WBGene00019503	К07Н8.1	GIM5	WBGene00020112	K08F4.1	Tong
PAC2	WBGene00019503	К07Н8.1	MAD2	WBGene00003161	B0035.4	Tong
PAC2	WBGene00019503	K07H8.1	PAC10	WBGene00006889	R151.9	Tong
PAC2	WBGene00019503	К07Н8.1	YKE2	WBGene00009004	Y69A2A_2326.a	Tong
POL32	WBGene00011016	R04F11.3	ARC18	WBGene00000203	T06G6.9	Tong
POL32	WBGene00011016	R04F11.3	ARP6	WBGene00007434	F21C3.5	Pan
POL32	WBGene00011016	R04F11.3	CKB2	WBGene00002196	Y37D8A.1	Pan
POL32	WBGene00011016	R04F11.3	FKH2	WBGene00003976	C08B11.6	Pan
POL32	WBGene00011016	R04F11.3	HTZ1	WBGene00019947	T01G9.6	Pan
POL32	WBGene00011016	R04F11.3	ISC1	WBGene00012105	T28H11.4	Pan
POL32	WBGene00011016	R04F11.3	LSM1	WBGene00003076	R08C7.3	Pan
POL32	WBGene00011016	R04F11.3	MSH2	WBGene00003418	T27F6.6	Pan
POL32	WBGene00011016	R04F11.3	PEP3	WBGene00021058	F40F8.9	Pan
POL32	WBGene00011016	R04F11.3	RAD27	WBGene00000794	H26D21.2	Tong, Pan
POL32	WBGene00011016	R04F11.3	RAD5	WBGene00010061	W06B4.3	Pan
POL32	WBGene00011016	R04F11.3	RAD50	WBGene00004296	Y47G6A_247.i	Tong, Pan
POL32	WBGene00011016	R04F11.3	RAD51	WBGene00004297	F54E12.2	Tong, Pan
POL32	WBGene00011016	R04F11.3	RAD54	WBGene00004298	T04H1.4	Tong, Pan
POL32	WBGene00011016	R04F11.3	RAD6	WBGene00006701	Y43C5A.6	Pan
POL32	WBGene00011016	R04F11.3	RPN10	WBGene00004466	W06D4.6	Pan
POL32	WBGene00011016	R04F11.3	RVS161	WBGene00010272	C35B1.1	Pan
POL32	WBGene00011016	R04F11.3	RVS167	WBGene00020209	B0205.3	Pan
POL32	WBGene00011016	R04F11.3	STP22	WBGene00015658	F58G6.1	Pan
POL32	WBGene00011016	R04F11.3	VIP1	WBGene00018508	T04C9.1 & ZK328.3	Pan
POL32	WBGene00011016	R04F11.3	VPS34	WBGene00006932	C09G12.9	Pan
POL32	WBGene00011016	R04F11.3	YAF9	WBGene00001585	F46F11.1	Pan
POP2	WBGene00000369	Y56A3A.20	ARP6	WBGene00007434	B0025.1	Pan
POP2	WBGene00000369	Y56A3A.20	ATP1	WBGene00010419*	M04B2.3	Pan
POP2	WBGene00000369	Y56A3A.20	ATP5	WBGene00017856*	C08B11.6	Pan
POP2	WBGene00000369	Y56A3A.20	CTK1	WBGene00007135	H28016.1	Pan
POP2	WBGene00000369	Y56A3A.20	DID4	WBGene00012903	F27C1.7	Pan
POP2	WBGene00000369	Y56A3A.20	GCS1	WBGene00010500	B0285.1 & B0285.2	Pan
POP2	WBGene00000369	Y56A3A.20	KAR3	WBGene00002216	Y46G5.m	Pan
POP2	WBGene00000369	Y56A3A.20	LSM1	WBGene00003076	K02B12.7	Pan
POP2	WBGene00000369	Y56A3A.20	LSM6	WBGene00003080	T09A5.2	Pan
POP2	WBGene00000369	Y56A3A.20	LSM7	WBGene00003081	F40F8.9	Pan
POP2	WBGene00000369	Y56A3A.20	MSY1	WBGene00006968	Y71G12A_187.b	Pan
POP2	WBGene00000369	Y56A3A.20	NHX1	WBGene00003733	ZK593.7	Pan
POP2	WBGene00000369	Y56A3A.20	PIF1	WBGene00004028	K08F11.4	Pan
POP2	WBGene00000369	Y56A3A.20	PIM1	WBGene00016391	F57C7.2	Pan

2020	TTDG	WE ( ) 23 00	D3D50			
POP2	WBGene00000369	Y56A3A.20	RAD50	WBGene00004296	Y18H1A_67.c & Y18H1A_67.d & Y18H1A_67.f	Pan
POP2	WBGene00000369	Y56A3A.20	RAD51	WBGene00004297	C34B2.6	Pan
POP2	WBGene00000369	Y56A3A.20	RAD54	WBGene00004298	T04H1.4	Pan
POP2	WBGene00000369	Y56A3A.20	RAD6	WBGene00006701	Y43C5A.6	Pan
POP2	WBGene00000369	Y56A3A.20	RVS161	WBGene00010272	W06D4.6	Pan
POP2	WBGene00000369	Y56A3A.20	RVS167	WBGene00020209	C35B1.1	Pan
POP2	WBGene00000369	Y56A3A.20	SAC1	WBGene00009264	F58G6.1	Pan
POP2	WBGene00000369	Y56A3A.20	SGS1	WBGene00001865	T04C9.1 & ZK328.3	Pan
POP2	WBGene00000369	Y56A3A.20	SIN3	WBGene00004117	F30A10.6	Pan
POP2	WBGene00000369	Y56A3A.20	SNF5	WBGene00011111	T04A11.6	Pan
POP2	WBGene00000369	Y56A3A.20	SNF8	WBGene00016167	F02E9.4	Pan
POP2	WBGene00000369	Y56A3A.20	STP22	WBGene00015658	R07E5.3	Pan
POP2	WBGene00000369	Y56A3A.20	TFP1	WBGene00013025*	C27F2.5	Pan
POP2	WBGene00000369	Y56A3A.20	VAC14	WBGene00010565	C09G12.9	Pan
POP2	WBGene00000369	Y56A3A.20	VPS20	WBGene00022027	Y49A3A.2	Pan
POP2	WBGene00000369	Y56A3A.20	VPS24	WBGene00020866	K04G2.6	Pan
POP2	WBGene00000369	Y56A3A.20	VPS30	WBGene00000247	Y65B4A_182.b & Y65B4A_182.c	Pan
POP2	WBGene00000369	Y56A3A.20	VPS36	WBGene00008919	F59A6.7 & T27F7.1	Pan
POP2	WBGene00000369	Y56A3A.20	VPS4	WBGene00021334	T19E7.3 & T19E7.4	Pan
POP2	WBGene00000369	Y56A3A.20	VPS45	WBGene00016643	F17C11.8	Pan
POP2	WBGene00000369	Y56A3A.20	YAF9	WBGene00001585	Y34D9A_152.a	Pan
PRT1	WBGene00001225	Y54E2A.11	PRO3	WBGene00010924	C44C1.1 & C44C1.4	Davierwala
RAD27	WBGene00000794	Y47G6A_247.i	ARP6	WBGene00007434	M04B2.3	Pan
RAD27	WBGene00000794	Y47G6A_247.i	CAC2	WBGene00022141	M153.1	Tong, Pan
RAD27	WBGene00000794	Y47G6A_247.i	CKB2	WBGene00002196	C08B11.6	Pan
RAD27	WBGene00000794	Y47G6A_247.i	CSM3	WBGene00017738	Y71G12A_202.d	Tong, Pan
RAD27	WBGene00000794	Y47G6A_247.i	CTF18	WBGene00010676	T01G9.6	Tong, Pan
RAD27	WBGene00000794	Y47G6A_247.i	CTK1	WBGene00007135	F23C8.9	Pan
RAD27	WBGene00000794	Y47G6A_247.i	DOA1	WBGene00007333	K08F4.1	Pan
RAD27	WBGene00000794	Y47G6A_247.i	DOC1	WBGene00000144	B0285.1 & B0285.2	Tong
RAD27	WBGene00000794	Y47G6A_247.i	GUF1	WBGene00022862	C05C10.6	Pan
RAD27	WBGene00000794	Y47G6A_247.i	HTZ1	WBGene00019947	F15H10.3	Pan
RAD27	WBGene00000794	Y47G6A_247.i	ISC1	WBGene00012105	ZK1236.1	Pan
RAD27	WBGene00000794	Y47G6A 247.i	LSM1	WBGene00003076	R08C7.3	Pan
RAD27	WBGene00000794	Y47G6A_247.i	LSM6	WBGene00003080	T27F6.6	Pan
RAD27	WBGene00000794		LSM7	WBGene00003081	F40F8.9	Pan
RAD27	WBGene00000794	 Y47G6A_247.i	MRE11	WBGene00003405	Y71G12A_187.b	Tong, Pan
RAD27	WBGene00000794		MUS81	WBGene00016602	ZK593.7	Tong, Pan
RAD27	WBGene00000794		NHX1	WBGene00003733	ZC302.1	Pan
RAD27	WBGene00000794	—	PEP3	WBGene00021058	C43E11.2	Pan
RAD27	WBGene00000794	Y47G6A_247.i	PEP5	WBGene00011067	F57C7.2	Pan
RAD27	WBGene00000794		PIF1	WBGene00004028	W06B4.3	Pan
RAD27	WBGene00000794	—	POP2	WBGene00000369	R06F6.2	Pan
RAD27	WBGene00000794	—	RAD23	WBGene00013924	Y18H1A_67.c & Y18H1A_67.d & Y18H1A_67.f	Pan
RAD27	WBGene00000794	Y47G6A 247.i	RAD5	WBGene00010061	Y56A3A.20	Pan
RAD27 RAD27	WBGene00000794	Y47G6A 247.1	RAD5 RAD50	WBGene00004296	ZK20.3	Tong, Pan
RAD27 RAD27	WBGene00000794	—	RAD50 RAD51	WBGene00004297	F54E12.2	Tong, Pan
RAD27 RAD27	WBGene00000794	—	RAD51 RAD54	WBGene00004298	T04H1.4	Tong, Pan
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RAD27	WBGene00000794	Y47G6A_247.i	RAD6	WBGene00006701	Y43C5A.6	Pan
RAD27	WBGene00000794	Y47G6A_247.i	RPN10	WBGene00004466	W06D4.6	Pan
RAD27	WBGene00000794	Y47G6A_247.i	RTF1	WBGene00009103	C35B1.1	Pan
RAD27	WBGene00000794	Y47G6A_247.i	RVS167	WBGene00020209	B0205.3	Pan
RAD27	WBGene00000794	Y47G6A_247.i	SAC1	WBGene00009264	F25B3.6	Pan
RAD27	WBGene00000794	Y47G6A_247.i	SNF8	WBGene00016167	T04C9.1 & ZK328.3	Pan
RAD27	WBGene00000794	Y47G6A_247.i	SSN8	WBGene00000506	F30A10.6	Pan
RAD27	WBGene00000794	Y47G6A_247.i	STP22	WBGene00015658	C27F2.5	Pan
RAD27	WBGene00000794	Y47G6A_247.i	UBP14	WBGene00020839	H14E04.5	Pan
RAD27	WBGene00000794	Y47G6A_247.i	VPS34	WBGene00006932	C09G12.9	Pan
RAD27	WBGene00000794	Y47G6A_247.i	VPS5	WBGene00004927	T27A3.2	Pan
RAD27	WBGene00000794	Y47G6A_247.i	YAF9	WBGene00001585	B0025.1	Pan
RAD27	WBGene00000794	Y47G6A_247.i	YTA7	WBGene00008682	C05D9.1	Pan
RAD5	WBGene00010061	F54E12.2	BRE1	WBGene00007008	M04B2.3	Pan
RAD5	WBGene00010061	F54E12.2	MUS81	WBGene00016602	F11A10.1	Pan
RAD5	WBGene00010061	F54E12.2	RAD51	WBGene00004297	R05D3.4	Pan
RAD5	WBGene00010061	F54E12.2	RAD54	WBGene00004298	C43E11.2	Pan
RAD5	WBGene00010061	F54E12.2	SGS1	WBGene00001865	Y43C5A.6	Pan
RAD50	WBGene00004296	T04H1.4	BRE1	WBGene00007008	W06D4.6	Tong, Pan
RAD50	WBGene00004296	T04H1.4	CDC45	WBGene00009372	T04A11.6	Davierwala
RAD50	WBGene00004296	T04H1.4	CDC9	WBGene00002985	R05D3.4	Davierwala
RAD50	WBGene00004296	T04H1.4	CTK1	WBGene00007135	F34D10.2 & F34D10.3	Pan
RAD50	WBGene00004296	T04H1.4	KEM1	WBGene00012730	C29A12.3	Pan
RAD50	WBGene00004296	T04H1.4	LSM1	WBGene00003076	B0285.1 & B0285.2	Pan
RAD50	WBGene00004296	T04H1.4	LSM6	WBGene00003080	Y39G8C.1 & Y39G8C.b	Pan
RAD50	WBGene00004296	T04H1.4	LSM7	WBGene00003081	F40F8.9	Pan
RAD50	WBGene00004296	T04H1.4	MUS81	WBGene00016602	Y71G12A_187.b	Pan
RAD50	WBGene00004296	T04H1.4	NPR2	WBGene00018635	ZK593.7	Tong
RAD50	WBGene00004296	T04H1.4	RAD5	WBGene00010061	C43E11.2	Tong, Pan
RAD50	WBGene00004296	T04H1.4	RAD6	WBGene00006701	F49E8.1	Pan
RAD50	WBGene00004296	T04H1.4	REV1	WBGene00014066	F54E12.2	Pan
RAD50	WBGene00004296	T04H1.4	RFC2	WBGene00004340	C35B1.1	Davierwala
RAD50	WBGene00004296	T04H1.4	RPN10	WBGene00004466	ZK675.2	Pan
RAD50	WBGene00004296	T04H1.4	STP22	WBGene00015658	F31E3.3	Pan
RAD50	WBGene00004296	T04H1.4	SWD1	WBGene00017683	B0205.3	Tong
RAD50	WBGene00004296	T04H1.4	VPS15	WBGene00014151	C09G12.9	Pan
RAD50	WBGene00004296	T04H1.4	VPS34	WBGene00006932	F21H12.1	Pan
RAD50	WBGene00004296	T04H1.4	YDR140W	WBGene00016341	ZK930.1 & ZK930.7	Pan
RAD50	WBGene00004296	T04H1.4	YER087W	WBGene00004190	B0025.1	Pan
RAD51	WBGene00004297	Y43C5A.6	CTK1	WBGene00007135	C33C12.9	Pan
RAD51	WBGene00004297	Y43C5A.6	DIA4	WBGene00005662	T27F6.5	Pan
RAD51	WBGene00004297	Y43C5A.6	LSM1	WBGene00003076	B0285.1 & B0285.2	Pan
RAD51	WBGene00004297	Y43C5A.6	LSM6	WBGene00003080	W03B1.4	Pan
RAD51	WBGene00004297	Y43C5A.6	LSM7	WBGene00003081	F40F8.9	Pan
RAD51	WBGene00004297	Y43C5A.6	RAD6	WBGene00006701	Y71G12A_187.b	Pan
RAD51	WBGene00004297	Y43C5A.6	REV1	WBGene00014066	ZK593.7	Pan
RAD51	WBGene00004297	Y43C5A.6	RPN10	WBGene00004466	C35B1.1	Pan
RAD51	WBGene00004297	Y43C5A.6	SGS1	WBGene00001865	ZK675.2	Pan
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RAD51	WBGene00004297	Y43C5A.6	STP22	WBGene00015658	B0205.3	Pan
RAD51	WBGene00004297	Y43C5A.6	VPS15	WBGene00014151	T04A11.6	Pan
RAD51	WBGene00004297	Y43C5A.6	VPS34	WBGene00006932	C09G12.9	Pan
RAD51	WBGene00004297	Y43C5A.6	YER087W	WBGene00004190	ZK930.1 & ZK930.7	Pan
RAD54	WBGene00004298	W06D4.6	CTK1	WBGene00007135	B0025.1	Pan
RAD54	WBGene00004298	W06D4.6	KEM1	WBGene00012730	T27F6.5	Pan
RAD54	WBGene00004298	W06D4.6	LSM1	WBGene00003076	B0285.1 & B0285.2	Pan
RAD54	WBGene00004298	W06D4.6	LSM6	WBGene00003080	Y39G8C.1 & Y39G8C.b	Pan
RAD54	WBGene00004298	W06D4.6	LSM7	WBGene00003081	F40F8.9	Pan
RAD54	WBGene00004298	W06D4.6	RAD6	WBGene00006701	Y71G12A_187.b	Pan
RAD54	WBGene00004298	W06D4.6	RPN10	WBGene00004466	ZK593.7	Pan
RAD54	WBGene00004298	W06D4.6	SGS1	WBGene00001865	C35B1.1	Pan
RAD54	WBGene00004298	W06D4.6	STP22	WBGene00015658	B0205.3	Pan
RAD54	WBGene00004298	W06D4.6	VPS34	WBGene00006932	T04A11.6	Pan
RAD54	WBGene00004298	W06D4.6	YDR140W	WBGene00016341	C09G12.9	Pan
RAD54	WBGene00004298	W06D4.6	YER087W	WBGene00004190	B0025.1	Pan
RAD6	WBGene00006701	C35B1.1	ARC18	WBGene00000203	C33C12.9	Pan
RAD6	WBGene00006701	C35B1.1	ARP6	WBGene00007434	T27F6.5	Pan
RAD6	WBGene00006701	C35B1.1	BUB2	WBGene00016352	Y37D8A.1	Pan
RAD6	WBGene00006701	C35B1.1	CEM1	WBGene00008667	C08B11.6	Pan
RAD6	WBGene00006701	C35B1.1	COQ6	WBGene00000766	C33F10.2	Pan
RAD6	WBGene00006701	C35B1.1	COX6	WBGene00012553	F10G8.9	Pan
RAD6	WBGene00006701	C35B1.1	CTK1	WBGene00007135	K07B1.2	Pan
RAD6	WBGene00006701	C35B1.1	DIA4	WBGene00005662	Y37D8A.14	Pan
RAD6	WBGene00006701	C35B1.1	FAB1	WBGene00004089	B0285.1 & B0285.2	Pan
RAD6	WBGene00006701	C35B1.1	FKH2	WBGene00003976	W03B1.4	Pan
RAD6	WBGene00006701	C35B1.1	GUA1	WBGene00010912	C05E7.5 & VF11C1L.1	Pan
RAD6	WBGene00006701	C35B1.1	HTZ1	WBGene00019947	T28H11.4	Pan
RAD6	WBGene00006701	C35B1.1	ISC1	WBGene00012105	M106.4	Pan
RAD6	WBGene00006701	C35B1.1	KAR3	WBGene00002216	R08C7.3	Pan
RAD6	WBGene00006701	C35B1.1	KEM1	WBGene00012730	T27F6.6	Pan
RAD6	WBGene00006701	C35B1.1	MRPL9	WBGene00016142	T09A5.2	Pan
RAD6	WBGene00006701	C35B1.1	PEP3	WBGene00021058	Y39G8C.1 & Y39G8C.b	Pan
RAD6	WBGene00006701	C35B1.1	PPA1	WBGene00011347*	C26E6.6	Pan
RAD6	WBGene00006701	C35B1.1	RAD14	WBGene00006963	W06B4.3	Pan
RAD6	WBGene00006701	C35B1.1	RAD23	WBGene00013924	T01H3.1	Pan
RAD6	WBGene00006701	C35B1.1	RVS161	WBGene00010272	K07G5.2	Pan
RAD6	WBGene00006701	C35B1.1	RVS161 RVS167	WBGene00020209	ZK20.3	Pan
RAD6	WBGene00006701	C35B1.1	SAC1	WBGene000020209 WBGene00009264	F58G6.1	Pan
RAD6	WBGene00006701	C35B1.1	SIN3	WBGene00009204 WBGene00004117	T04C9.1 & ZK328.3	Pan
RAD6	WBGene00006701	C35B1.1	SMP2	WBGene00010425	F30A10.6	Pan
RAD6	WBGene00006701	C35B1.1	SPF1	WBGene00007514	F02E9.4	Pan
RAD6 RAD6	WBGene00006701	C35B1.1 C35B1.1	UBP14	WBGene00007514 WBGene00020839	H37A05.1	Pan
RAD6	WBGene00006701	C35B1.1	VMA5	WBGene00020839 WBGene00006920*	C10C6.6	Pan
RAD6 RAD6	WBGene00006701	C35B1.1 C35B1.1	VMA5 VMA7	WBGene00006920* WBGene00006918*	T27A3.2	Pan
RAD6 RAD6	WBGene00006701	C35B1.1 C35B1.1	VMA7 VMA8	WBGene00000918* WBGene00010130	Y38F2A 5743.f	Pan
RAD6 RAD6	WBGene00006701 WBGene00006701	C35B1.1 C35B1.1	VMA8 VPS16	WBGene00010130 WBGene00006516	ZK970.4	Pan Pan
RAD6 RAD6	WBGene00006701	C35B1.1 C35B1.1	VPS16 VPS25	WBGene00012193	F55H2.2	Pan
KADU	WEGETIEUUUU0701	C33D1.1	VESZO	MPGGIIG00012193	r JJn2.2	rall

RAD6	WBGene00006701	C35B1.1	VPS36	WBGene00008919	C05D11.2	Pan
RAD6	WBGene00006701	C35B1.1	VRP1	WBGene00020094	W02A11.2	Pan
RAD6	WBGene00006701	C35B1.1	YAF9	WBGene00001585	F17C11.8	Pan
RAD6	WBGene00006701	C35B1.1	YER087W	WBGene00004190	R144.4 & R144.8	Pan
RAD6	WBGene00006701	C35B1.1	YGR257C	WBGene00007622	M04B2.3	Pan
RAD6	WBGene00006701	C35B1.1	ZUO1	WBGene00001029	T27F6.5	Pan
RFC5	WBGene00004339	C39E9.13	ALG2	WBGene00017282	C16C10.1	Davierwala
RFC5	WBGene00004339	C39E9.13	CDC27	WBGene00003132	F38A5.13	Davierwala
RFC5	WBGene00004339	C39E9.13	CDC45	WBGene00009372	F09E5.2	Davierwala
RFC5	WBGene00004339	C39E9.13	CDC9	WBGene00002985	Y110A7A.d	Davierwala
RFC5	WBGene00004339	C39E9.13	DPS1	WBGene00001094*	F34D10.2 & F34D10.3	Davierwala
RFC5	WBGene00004339	C39E9.13	MOT1	WBGene00000274	C29A12.3	Davierwala
RFC5	WBGene00004339	C39E9.13	NOP14	WBGene00021660	B0464.1	Davierwala
RFC5	WBGene00004339	C39E9.13	POL1	WBGene00012936	F15D4.1	Davierwala
RFC5	WBGene00004339	C39E9.13	RFC2	WBGene00004340	Y48G1A_54.d	Davierwala
RPN10	WBGene00004466	B0205.3	CBC2	WBGene00009141	Y47D3A.c & Y47D3A.d	Pan
RPN10	WBGene00004466	B0205.3	NHX1	WBGene00003733	F31E3.3	Pan
RPN10	WBGene00004466	B0205.3	PEP3	WBGene00021058	F26A3.2	Pan
RPN10	WBGene00004466	B0205.3	PEP5	WBGene00011067	F57C7.2	Pan
RPN10	WBGene00004466	B0205.3	RAD23	WBGene00013924	W06B4.3	Pan
RPN10	WBGene00004466	B0205.3	RAD6	WBGene00006701	R06F6.2	Pan
RPN10	WBGene00004466	B0205.3	RVS167	WBGene00020209	ZK20.3	Pan
RPN10	WBGene00004466	B0205.3	SIN3	WBGene00004117	C35B1.1	Pan
RPN10	WBGene00004466	B0205.3	SNF8	WBGene00016167	T04C9.1 & ZK328.3	Pan
RPN10	WBGene00004466	B0205.3	STP22	WBGene00015658	F02E9.4	Pan
RPN10	WBGene00004466	B0205.3	SWD1	WBGene00017683	C27F2.5	Pan
RPN10	WBGene00004466		VPS20	WBGene00022027	C09G12.9	Pan
RPN10	WBGene00004466	B0205.3	VPS25	WBGene00012193	F21H12.1	Pan
RPN10	WBGene00004466	B0205.3	VPS36	WBGene00008919	Y65B4A_182.b & Y65B4A_182.c	Pan
RPN10	WBGene00004466		VPS45	WBGene00016643	W02A11.2	Pan
RPN10	WBGene00004466	B0205.3	YDR117C	WBGene00016113	F17C11.8	Pan
RVS161	WBGene00010272		CAP1	WBGene00000292	C44C1.1 & C44C1.4	Tong
RVS161	WBGene00010272	F58G6.1	CAP2	WBGene00000293	C25H3.4	Tong
RVS161	WBGene00010272		DOA1	WBGene00007333	D2024.6	Tong
RVS161	WBGene00010272		GIM3	WBGene00007107	M106.5	Tong
RVS161	WBGene00010272		GIM4	WBGene00019220	C05C10.6	Tong
RVS161	WBGene00010272	F58G6.1	GIM5	WBGene00020112	B0035.4	Tong
RVS161	WBGene00010272		PAC10	WBGene00006889	H20J04.d	Tong
RVS161	WBGene00010272	F58G6.1	SEC22	WBGene00018853	R151.9	Tong
RVS161	WBGene00010272		SIN3	WBGene00004117	T06G6.9	Tong
RVS161	WBGene00010272	F58G6.1	SPF1	WBGene00007514	F55A4.1	Tong
RVS161	WBGene00010272	F58G6.1	YKE2	WBGene00009004	F02E9.4	Tong
RVS167	WBGene00020209	T04C9.1 & ZK328.3	CAP1	WBGene00000292	C10C6.6	Tong
RVS167	WBGene00020209	T04C9.1 & ZK328.3	CAP2	WBGene00000292	F21C3.5	Tong
RVS167 RVS167	WBGene00020209	T04C9.1 & ZK328.3	CHS5	WBGene00022615	D2024.6	Tong
RVS167 RVS167	WBGene00020209	T04C9.1 & ZK328.3	DOA1	WBGene000022013	M106.5	Tong
RVS167	WBGene00020209	T04C9.1 & ZK328.3	GIM3	WBGene00007107	ZC449.5	Tong
RVS167 RVS167	WBGene00020209	T04C9.1 & ZK328.3	GIM3 GIM4	WBGene00019220	C05C10.6	Tong
100107			51111			- 0119

					[	
RVS167	WBGene00020209	T04C9.1 & ZK328.3	GIM5	WBGene00020112	B0035.4	Tong
RVS167	WBGene00020209	T04C9.1 & ZK328.3	PAC10	WBGene00006889	H20J04.d	Tong
RVS167	WBGene00020209	T04C9.1 & ZK328.3	SEC22	WBGene00018853	R151.9	Tong
RVS167	WBGene00020209	T04C9.1 & ZK328.3	SIN3	WBGene00004117	T06G6.9	Tong
RVS167	WBGene00020209	T04C9.1 & ZK328.3	SPF1	WBGene00007514	F55A4.1	Tong
RVS167	WBGene00020209	T04C9.1 & ZK328.3	YKE2	WBGene00009004	F02E9.4	Tong
SEC15	WBGene00016188	C28G1.3	ALG14	WBGene00019725	C10C6.6	Davierwala
SEC15	WBGene00016188	C28G1.3	BET3	WBGene00014222	F21C3.5	Davierwala
SEC15	WBGene00016188	C28G1.3	CDS1	WBGene00016384	M02B7.4	Davierwala
SEC15	WBGene00016188	C28G1.3	ECM16	WBGene00015525	ZK1098.5	Davierwala
SEC15	WBGene00016188	C28G1.3	HRT1	WBGene00004320	C33H5.18	Davierwala
SEC15	WBGene00016188	C28G1.3	MPE1	WBGene00009477	C06E1.10	Davierwala
SEC15	WBGene00016188	C28G1.3	MRT4	WBGene00017347	ZK287.5	Davierwala
SEC15	WBGene00016188	C28G1.3	NOC2	WBGene00007413	F36F2.3	Davierwala
SEC15	WBGene00016188	C28G1.3	NOP15	WBGene00011408	F10E7.5	Davierwala
SEC15	WBGene00016188	C28G1.3	PDS5	WBGene00001352	C07E3.2	Davierwala
SEC15	WBGene00016188	C28G1.3	PFY1	WBGene00003991	T04A8.6	Davierwala
SEC15	WBGene00016188	C28G1.3	PRP16	WBGene00003389	H38K22.1	Davierwala
SEC15	WBGene00016188	C28G1.3	RPC11	WBGene00022309	K03E6.6	Davierwala
SEC15	WBGene00016188	C28G1.3	RPC40	WBGene00019275	K03H1.2	Davierwala
SEC15	WBGene00016188	C28G1.3	RPF1	WBGene00009711	Y77E11A_3443.q	Davierwala
SEC15	WBGene00016188	C28G1.3	YGL047W	WBGene00011193	H43I07.2	Davierwala
SEC15	WBGene00016188	C28G1.3	YNL313C	WBGene00020600	F44G4.1	Davierwala
SEC15	WBGene00016188	C28G1.3	ZPR1	WBGene00020999	R10D12.12	Davierwala
SEC18	WBGene00003818	H15N14.1 & ZK1014.1	HRT1	WBGene00004320	T20B12.1	Davierwala
SEC18	WBGene00003818	H15N14.1 & ZK1014.1	MRT4	WBGene00017347	W03F9.1	Davierwala
SEC18	WBGene00003818	H15N14.1 & ZK1014.1	PFY1	WBGene00003991	ZK287.5	Davierwala
SEC18	WBGene00003818	H15N14.1 & ZK1014.1	RPC40	WBGene00019275	F10E7.5	Davierwala
SEC18	WBGene00003818	H15N14.1 & ZK1014.1	RPF1	WBGene00009711	K03E6.6	Davierwala
SEC18	WBGene00003818	H15N14.1 & ZK1014.1	TFG2	WBGene00012694	H43I07.2	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	CDC45	WBGene00009372	F44G4.1	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	DRS1	WBGene00022148	Y39B6A.f	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	LAS17	WBGene00006565	F34D10.2 & F34D10.3	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	NOC2	WBGene00007413	Y71G12A_201.a & Y71G12A_203.c	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	NOG2	WBGene00003596	Y63D3A.5	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	NOP15	WBGene00011408	C07E3.2	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	NUG1	WBGene00003821	T19A6.2	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	PFY1	WBGene00003991	T04A8.6	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	RFT1	WBGene00022677	K01C8.9	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	RPF1	WBGene00009711	K03E6.6	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	THS1	WBGene00006617	ZK180.3	Davierwala
SEC7	WBGene00012386	Y6B3A.1 & Y87G2A.y	TRM5	WBGene00008263	F44G4.1	Davierwala
SET2	WBGene00021515	Y41D4A_2615.a &	ARP6	WBGene00007434	C47D12.6	Tong
SET2	WBGene00021515	Y41D4A_3457.b	BET3	WBGene00014222	C53A5.2	Davierwala
SET2	WBGene00021515	Y41D4A_2615.a &	BRE1	WBGene00007008	C08B11.6	Tong
SET2	WBGene00021515	Y41D4A 3457.b	GIM3	WBGene00007107	ZK1098.5	Tong
SET2	WBGene00021515	Y41D4A_2615.a &	GIM5	WBGene00020112	R05D3.4	Tong
SET2		Y41D4A_3457.b	HTZ1	WBGene00019947	B0035.4	Tong
2010			****		20000.1	

0.7770	MDG	W41D42 0615	1 101		5151 0	-
SET2	WBGene00021515	Y41D4A_2615.a &	LEO1	WBGene00007110	R151.9	Tong
SET2	WBGene00021515	Y41D4A_3457.b	RTF1	WBGene00009103	R08C7.3	Tong
SET2	WBGene00021515	—	SEC22	WBGene00018853	80035.11	Tong
SET2	WBGene00021515	Y41D4A_3457.b	SED5	WBGene00006373	F25B3.6	Davierwala
SET2	WBGene00021515	Y41D4A_2615.a &	SLU7	WBGene00010629	F55A4.1	Davierwala
SET2	WBGene00021515	Y41D4A_3457.b	TFG1	WBGene00015296	F55A11.2	Davierwala
SET2	WBGene00021515	Y41D4A_2615.a &	VAC14	WBGene00010565	K07C5.6	Tong
SET2	WBGene00021515	Y41D4A_3457.b	YDL033C	WBGene00007114	C01F1.1	Tong
SGS1	WBGene00001865	Y41D4A_2615.a &	CSM3	WBGene00017738	K04G2.6	Tong, Pan
SGS1	WBGene00001865	Y41D4A_3457.b	CTF18	WBGene00010676	B0035.16	Tong, Pan
SGS1	WBGene00001865	Y41D4A_2615.a &	LSM1	WBGene00003076	F23C8.9	Pan
SGS1	WBGene00001865	Y41D4A_3457.b	MUS81	WBGene00016602	K08F4.1	Tong, Pan
SGS1	WBGene00001865	Y41D4A_2615.a &	POL32	WBGene00011016	F40F8.9	Tong, Pan
SGS1	WBGene00001865	Y41D4A_3457.b	RAD27	WBGene00000794	C43E11.2	Tong, Pan
SGS1	WBGene00001865	Y41D4A_2615.a &	RAD50	WBGene00004296	R04F11.3	Tong, Pan
SGS1	WBGene00001865	Y41D4A_3457.b	SLX1	WBGene00018909	Y47G6A_247.i	Tong, Pan
SGS1	WBGene00001865	Y41D4A_2615.a &	TOP1	WBGene00006595	T04H1.4	Tong
TOP1	WBGene00006595	Y41D4A_3457.b	MRE11	WBGene00003405	F56A3.2	Tong
TOP1	WBGene00006595	Y41D4A_2615.a &	RAD50	WBGene00004296	M01E5.5	Tong
YKE2	WBGene00009004	Y41D4A_3457.b	ARP6	WBGene00007434	ZC302.1	Tong
YKE2	WBGene00009004	Y41D4A_2615.a &	BUB2	WBGene00016352	T04H1.4	Tong
YKE2	WBGene00009004	Y41D4A_3457.b	CAF40	WBGene00016139	C08B11.6	Tong
YKE2	WBGene00009004	T04A11.6	CAP2	WBGene00000293	C33F10.2	Tong
YKE2	WBGene00009004	T04A11.6	CBP3	WBGene00016442	C26E6.3	Tong
YKE2	WBGene00009004	T04A11.6	CTF18	WBGene00010676	M106.5	Tong, Pan
YKE2	WBGene00009004	T04A11.6	FAB1	WBGene00004089	C35D10.5	Tong
YKE2	WBGene00009004	T04A11.6	HAP2	WBGene00013178	K08F4.1	Tong
YKE2	WBGene00009004	T04A11.6	HTZ1	WBGene00019947	C05E7.5 & VF11C1L.1	Tong
YKE2	WBGene00009004	T04A11.6	ISC1	WBGene00012105	Y53H1A.d	Tong
YKE2	WBGene00009004	T04A11.6	KEM1	WBGene00012730	R08C7.3	Tong
YKE2	WBGene00009004	T04A11.6	MMS2	WBGene00006730	T27F6.6	Tong
YKE2	WBGene00009004	M01E5.5	NCL1	WBGene00021686	Y39G8C.1 & Y39G8C.b	Tong
YKE2	WBGene00009004	M01E5.5	PAN3	WBGene00014015	F39B2.2	Tong
YKE2	WBGene00009004	F21C3.5	PCH2	WBGene00008641	Y48G8A_2614.a	Tong
YKE2	WBGene00009004	F21C3.5	PET8	WBGene00008364	ZK632.7	Tong
YKE2	WBGene00009004	F21C3.5	PLP1	WBGene00015482	F10B5.5	Tong
YKE2	WBGene00009004	F21C3.5	SPF1	WBGene00007514	D1046.3	Tong
YKE2	WBGene00009004	F21C3.5	STE24	WBGene00001405	C05D11.3	Tong
YKE2	WBGene00009004	F21C3.5	UBA4	WBGene00018357	C10C6.6	Tong
YKE2	WBGene00009004	F21C3.5	UGA1	WBGene00001794	C04F12.10	Tong
YKE2	WBGene00009004	F21C3.5	VAC14	WBGene00010565	F42G8.6	Tong
YKE2	WBGene00009004	F21C3.5	VPS29	WBGene00014234	K04D7.3	Tong
YKE2	WBGene00009004	F21C3.5	VRP1	WBGene00020094	K04G2.6	Tong
YKE2	WBGene00009004	F21C3.5	YDL033C	WBGene00007114	ZK1128.8	Tong
YKE2	WBGene00009004	F21C3.5	YTA7	WBGene00008682	R144.4 & R144.8	Tong
		F21C3.5			B0035.16	
		F21C3.5			F11A10.1	
		F21C3.5				
L	I		1	1		1

F21C3.5	
F21C3.5	

#### Appendix Table 5.1. S. cerevisiae synthetic lethal interactions and their pairwise C. elegans orthologues

For each *S. cerevisiae* synthetic lethal gene pair ('Gene1', 'Gene 2') with both single orthologues in *C. elegans, S. cerevisiae* standard names ('SC Name'), their orthologous *C. elegans* WormBase gene names ('CE Name') & Ahringer library RNA interference (RNAi) clone gene pairs names ('CE RNAi clone') together with references for yeast synthetic lethal screens are shown. \* designates genes that resulted in first-generation larval growth arrest after RNAi & were excluded from the study for genetic interactions. Tong, Davierwala, and Pan denote yeast datasets from Tong *et al.*, 2003, Davierwala *et al.*, 2005, and Pan *et al.*, 2006, respectively.

Appendix Table 5.2. C. elegans orthologues of S. cerevisiae synthetic lethal interactions with homozygous viable loss-of-function alleles

Gene 1 ( allele)	homozygous viabl	Le loss-of-fu	inction	Gene 2 (	Gene 2 (RNAi)				
SC Name	CE Name	CE RNAi clone	CE Strain	SC Name	CE Name	CE RNAi clone			
ARC40	WBGene00000201	Y79H2A.6	tm1681	ARC18	WBGene00000203	Y37D8A.1	Tong		
ARC40	WBGene00000201	Y79H2A.6	tm1681	CHS5	WBGene00022615	ZC449.5	Tong		
ARC40	WBGene00000201	Y79H2A.6	tm1681	GIM3	WBGene00007107	B0035.4	Tong		
ARC40	WBGene00000201	Y79H2A.6	tm1681	GIM4	WBGene00019220	H20J04.d	Tong		
ARC40	WBGene00000201	Y79H2A.6	tm1681	GLO3	WBGene00017217	F07F6.4	Tong		
ARC40	WBGene00000201	Y79H2A.6	tm1681	SEC22	WBGene00018853	F55A4.1	Tong		
ARC40	WBGene00000201	Y79H2A.6	tm1681	SPF1	WBGene00007514	C10C6.6	Tong		
ARC40	WBGene00000201	Y79H2A.6	tm1681	STE24	WBGene00001405	C04F12.10	Tong		
ARC40	WBGene00000201	Y79H2A.6	tm1681	VRP1	WBGene00020094	R144.4 & R144.8	Tong		
ARC40	WBGene00000201	Y79H2A.6	tm1681	YKE2	WBGene00009004	F21C3.5	Tong		
CAF40	WBGene00016139	C26E6.3	RB1477	GIM5	WBGene00020112	R151.9	Tong		
CAF40	WBGene00016139	C26E6.3	RB1477	PAC10	WBGene00006889	T06G6.9	Tong		
CAF40	WBGene00016139	C26E6.3	RB1477	YKE2	WBGene00009004	F21C3.5	Tong		
CDC16	WBGene00001281	F10B5.6	DS88	NIP7	WBGene00016607	C43E11.9	Davierwa		
CDC16	WBGene00001281	F10B5.6	GG48	NIP7	WBGene00016607	C43E11.9	a		
CDC16	WBGene00001281	F10B5.6	HY621	NIP7	WBGene00016607	C43E11.9	Davierwa		
CDC16	WBGene00001281	F10B5.6	TJ1047	NIP7	WBGene00016607	C43E11.9	a		
CDC16	WBGene00001281	F10B5.6	TJ1049	NIP7	WBGene00016607	C43E11.9	Davierwa		
CDC16	WBGene00001281	F10B5.6	TJ1061	NIP7	WBGene00016607	C43E11.9	a		
CDC27	WBGene00003132	Y110A7A.d	DS77	RFC5	WBGene00004339	C39E9.13	Davierwa		
CDC27	WBGene00003132	Y110A7A.d	DS80	RFC5	WBGene00004339	C39E9.13	a		
CDC27	WBGene00003132	Y110A7A.d	HY604	RFC5	WBGene00004339	C39E9.13	Davierwa		
CDC42	WBGene00000390	R07G3.1	RB942	CAP1	WBGene00000292	D2024.6	a		
CDC42	WBGene00000390	R07G3.1	RB942	CAP2	WBGene00000293	M106.5	Davierwa		
CDC42	WBGene00000390	R07G3.1	RB942	ELP3	WBGene00014123	ZK863.3	a		
CDC42	WBGene00000390	R07G3.1	RB942	FAD1	WBGene00011271	R53.1	Davierwa		
CDC42	WBGene00000390	R07G3.1	RB942	HRT1	WBGene00004320	ZK287.5	a		
CDC42	WBGene00000390	R07G3.1	RB942	RPC40	WBGene00019275	H43I07.2	Davierwa		
CDC42	WBGene00000390	R07G3.1	RB942	UBA4	WBGene00018357	F42G8.6	a		
CDC42	WBGene00000390	R07G3.1	RB942	YGL211W	WBGene00017928	F29C4.6	Davierwa		
DYN1	WBGene00000962	T21E12.4	EU828	GIM3	WBGene00007107	B0035.4	a		
DYN1	WBGene00000962	T21E12.4	EU828	GIM4	WBGene00019220	H20J04.d	Tong		
DYN1	WBGene00000962	T21E12.4	EU828	GIM5	WBGene00020112	R151.9	Tong		
DYN1	WBGene00000962	T21E12.4	EU828	HCM1	WBGene00001442	C25A1.2	Tong		
DYN1	WBGene00000962	T21E12.4	EU828	KAR3	WBGene00002216	T09A5.2	Davierwa		
DYN1	WBGene00000962	T21E12.4	EU828	PAC10	WBGene00006889	T06G6.9	a		
DYN1	WBGene00000962	T21E12.4	EU828	YKE2	WBGene00009004	F21C3.5	Davierwa		
DYN2	WBGene00001130	C02C6.1	CX51	GIM3	WBGene00007107	B0035.4	a		
DYN2	WBGene00001130	C02C6.1	CX51	GIM4	WBGene00019220	H20J04.d	Davierwa		
DINZ DYN2	WBGene00001130	C02C6.1	CX51	GIM4 GIM5	WBGene00020112	R151.9	a		
DYN2	WBGene00001130		CX51	PAC10	WBGene00006889	T06G6.9	Tong		

DYN2	WBGene00001130	C02C6.1	CX51	YKE2	WBGene00009004	F21C3.5	Tong	
EMP24	WBGene00004766	W02D7.7	GS107	CHS5	WBGene00022615	ZC449.5	Tong	
EMP24	WBGene00004766	W02D7.7	GS107	CWH41	WBGene00008775	F13H10.4	Tong	
FKH2	WBGene00003976	T28H11.4	UL768	POL32	WBGene00011016	R04F11.3	Tong	
FKH2	WBGene00003976	T28H11.4	UL768	RAD6	WBGene00006701	C35B1.1	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	ARC40	WBGene00000201	Y79H2A.6	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	ARP2	WBGene00000200	K07C5.1	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	ARP6	WBGene00007434	C08B11.6	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	BUB2	WBGene00016352	C33F10.2	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	CHL1	WBGene00010839	M03C11.2	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	CSM3	WBGene00017738	F23C8.9	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	CTF18	WBGene00010676	K08F4.1	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	DYN1	WBGene00000962	T21E12.4	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	DYN2	WBGene00001130	C02C6.1	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	FAB1	WBGene00004089	C05E7.5 & VF11C1L.1	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	HTZ1	WBGene00019947	R08C7.3	Pan	
GIM3	WBGene00007107	в0035.4	VC1032	KAR3	WBGene00002216	T09A5.2	Pan	
GIM3	WBGene00007107	в0035.4	VC1032	MAD2	WBGene00003161	Y69A2A 2326.a	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	NAT1	WBGene00021754		Tong	
GIM3	WBGene00007107	в0035.4	VC1032	NCL1	WBGene00021686	Y48G8A_2614.a	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	PAC1	WBGene00003047	T03F6.5	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	PAC2	WBGene00019503	К07Н8.1	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	PAN3	WBGene00014015	ZK632.7	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	PER1	WBGene00019806	R01B10.4	Tong, P	'an
GIM3	WBGene00007107	B0035.4	VC1032	PLP1	WBGene00015482	C05D11.3	Tong	
GIM3	WBGene00007107	в0035.4	VC1032	RVS161	WBGene00010272	F58G6.1	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	RVS167	WBGene00020209	T04C9.1 & ZK328.3	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	SET2	WBGene00021515	Y41D4A_2615.a &	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	STE24	WBGene00001405	Y41D4A_3457.b	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	UBA4	WBGene00018357	C04F12.10	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	VAC14	WBGene00010565	F42G8.6	Pan	
GIM3	WBGene00007107	B0035.4	VC1032	VPS29	WBGene00014234	K04G2.6	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	VRP1	WBGene00020094	ZK1128.8	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	YBR108W	WBGene00004110	R144.4 & R144.8	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	YGR054W	WBGene00008480	C37A2.2	Tong	
GIM3	WBGene00007107	B0035.4	VC1032	YTA7	WBGene00008682	E04D5.1	Tong	
HCM1	WBGene00001442	C25A1.2	RB884	ARP6	WBGene00007434	F11A10.1	Tong	
HCM1	WBGene00001442	C25A1.2	RB884	DYN1	WBGene00000962	C08B11.6	Tong	
HCM1	WBGene00001442	C25A1.2	RB884	MAD2	WBGene00003161	T21E12.4	Tong	
HSE1	WBGene00004109	C34G6.7	RB674	CHS5	WBGene00022615	Y69A2A_2326.a	Tong	
HSE1	WBGene00004109	C34G6.7	RB674	GIM4	WBGene00019220	ZC449.5	Tong	
HSE1	WBGene00004109	C34G6.7	RB674	PAC10	WBGene00006889	H20J04.d	Tong	
MUS81	WBGene00016602	C43E11.2	tm1937	CCR4	WBGene00000376	T06G6.9	Tong	
MUS81	WBGene00016602	C43E11.2	tm1937	MRE11	WBGene00003405	ZC518.3	Tong	
MUS81	WBGene00016602	C43E11.2	tm1937	POL32	WBGene00011016	ZC302.1	Tong	
MUS81	WBGene00016602	C43E11.2	tm1937	POP2	WBGene00000369	R04F11.3	Tong	
MUS81	WBGene00016602	C43E11.2	tm1937	RAD27	WBGene00000794	Y56A3A.20	Tong	
MUS81	WBGene00016602	C43E11.2	tm1937	RAD5	WBGene00010061	Y47G6A_247.i	Tong	

MUS81	WBGene00016602	C43E11.2	tm1937	RAD50	WBGene00004296	F54E12.2	Tong
MUS81	WBGene00016602	C43E11.2	tm1937	RAD54	WBGene00004298	T04H1.4	Tong
MUS81	WBGene00016602	C43E11.2	tm1937	RAD6	WBGene00006701	W06D4.6	Tong
MUS81	WBGene00016602	C43E11.2	tm1937	SGS1	WBGene00001865	C35B1.1	Tong
NHX1	WBGene00003733	F57C7.2	RB836	CCR4	WBGene00000376	T04A11.6	Tong
NHX1	WBGene00003733	F57C7.2	RB836	POP2	WBGene00000369	ZC518.3	Tong
NHX1	WBGene00003733	F57C7.2	RB836	RAD27	WBGene00000794	Y56A3A.20	Pan
NHX1	WBGene00003733	F57C7.2	RB836	RPN10	WBGene00004466	Y47G6A_247.i	Pan
PCH2	WBGene00008641	F10B5.5	CA388	YKE2	WBGene00009004	B0205.3	Pan
PEP5	WBGene00011067	R06F6.2	RB1457	BRE1	WBGene00007008	F21C3.5	Pan
PEP5	WBGene00011067	R06F6.2	RB1457	CTF18	WBGene00010676	R05D3.4	Tong, Pan
PEP5	WBGene00011067	R06F6.2	RB1457	NAT1	WBGene00021754	K08F4.1	Pan
PEP5	WBGene00011067	R06F6.2	RB1457	RAD27	WBGene00000794	Y50D7_162.b & Y50D7_164.a	Pan
PEP5	WBGene00011067	R06F6.2	RB1457	RPN10	WBGene00004466	Y47G6A_247.i	Pan
POL12	WBGene00001002	R01H10.1	EU548	NIP7	WBGene00016607	B0205.3	Pan
POL12	WBGene00001002	R01H10.1	EU550	NIP7	WBGene00016607	C43E11.9	Tong, Pan
POL12	WBGene00001002	R01H10.1	EU879	NIP7	WBGene00016607	C43E11.9	Pan
POL12	WBGene00001002	R01H10.1	EU880	NIP7	WBGene00016607	C43E11.9	Pan
RAD14	WBGene00006963	K07G5.2	RB864	RAD6	WBGene00006701	C43E11.9	Pan
RAD6	WBGene00006701	C35B1.1	VC18	ARC18	WBGene00000203	C35B1.1	Pan
RAD6	WBGene00006701	C35B1.1	VC18	ARP6	WBGene00007434	Y37D8A.1	Tong
RAD6	WBGene00006701	C35B1.1	VC18	BUB2	WBGene00016352	C08B11.6	Pan
RAD6	WBGene00006701	C35B1.1	VC18	CCR4	WBGene00000376	C33F10.2	Pan
RAD6	WBGene00006701	C35B1.1	VC18	CEM1	WBGene00008667	ZC518.3	Pan
RAD6	WBGene00006701	C35B1.1	VC18	COQ6	WBGene00000766	F10G8.9	Pan
RAD6	WBGene00006701	C35B1.1	VC18	COX6	WBGene00012553	К07В1.2	Pan
RAD6	WBGene00006701	C35B1.1	VC18	CSM3	WBGene00017738	Y37D8A.14	Davierwal
RAD6	WBGene00006701	C35B1.1	VC18	CTF18	WBGene00010676	F23C8.9	a
RAD6	WBGene00006701	C35B1.1	VC18	CTK1	WBGene00007135	K08F4.1	Davierwal
RAD6	WBGene00006701	C35B1.1	VC18	DIA4	WBGene00005662	B0285.1 & B0285.2	a
RAD6	WBGene00006701	C35B1.1	VC18	FAB1	WBGene00004089	W03B1.4	Davierwal
RAD6	WBGene00006701	C35B1.1	VC18	FKH2	WBGene00003976	C05E7.5 & VF11C1L.1	a
RAD6	WBGene00006701	C35B1.1	VC18	GUA1	WBGene00010912	T28H11.4	Davierwal
RAD6	WBGene00006701	C35B1.1	VC18	HTZ1	WBGene00019947	M106.4	a
RAD6	WBGene00006701	C35B1.1	VC18	ISC1	WBGene00012105	R08C7.3	Pan
RAD6	WBGene00006701	C35B1.1	VC18	KAR3	WBGene00002216	T27F6.6	Pan
RAD6	WBGene00006701	C35B1.1	VC18	KEM1	WBGene00012730	T09A5.2	Pan
RAD6	WBGene00006701	C35B1.1	VC18	MRE11	WBGene00003405	Y39G8C.1 & Y39G8C.b	Pan
RAD6	WBGene00006701	C35B1.1	VC18	MRPL9	WBGene00016142	ZC302.1	Pan
RAD6	WBGene00006701	C35B1.1	VC18	MUS81	WBGene00016602	C26E6.6	Pan
RAD6	WBGene00006701	C35B1.1	VC18	PEP3	WBGene00021058	C43E11.2	Pan
RAD6	WBGene00006701	C35B1.1	VC18	POL32	WBGene00011016	W06B4.3	Pan
RAD6	WBGene00006701	C35B1.1	VC18	POP2	WBGene00000369	R04F11.3	Pan
RAD6	WBGene00006701	C35B1.1	VC18	PPA1	WBGene00011347	Y56A3A.20	Pan
RAD6	WBGene00006701	C35B1.1	VC18	RAD14	*	T01H3.1	Pan
RAD6	WBGene00006701	C35B1.1	VC18	RAD23	WBGene00006963	K07G5.2	Pan
RADO	WBGene00006701	C35B1.1	VC18	RAD25	WBGene00013924	ZK20.3	Pan
	WBGene00006701	C35B1.1	VC18	RAD50	WBGene00000794	Y47G6A_247.i	Pan

RAD6	WBGene00006701	C35B1.1	VC18	RAD51	WBGene00004296	T04H1.4	Pan
RAD6	WBGene00006701	C35B1.1	VC18	RAD54	WBGene00004297	Y43C5A.6	Pan
RAD6	WBGene00006701	C35B1.1	VC18	RPN10	WBGene00004298	W06D4.6	Pan
RAD6	WBGene00006701	C35B1.1	VC18	RVS161	WBGene00004466	B0205.3	Pan
RAD6	WBGene00006701	C35B1.1	VC18	RVS167	WBGene00010272	F58G6.1	Pan
RAD6	WBGene00006701	C35B1.1	VC18	SAC1	WBGene00020209	T04C9.1 & ZK328.3	Pan
RAD6	WBGene00006701	C35B1.1	VC18	SIN3	WBGene00009264	F30A10.6	Pan
RAD6	WBGene00006701	C35B1.1	VC18	SMP2	WBGene00004117	F02E9.4	Pan
RAD6	WBGene00006701	C35B1.1	VC18	SPF1	WBGene00010425	H37A05.1	Pan
RAD6	WBGene00006701	C35B1.1	VC18	UBP14	WBGene00007514	C10C6.6	Pan
RAD6	WBGene00006701	C35B1.1	VC18	VMA5	WBGene00020839	T27A3.2	Pan
RAD6	WBGene00006701	C35B1.1	VC18	VMA7	WBGene00006920	Y38F2A_5743.f	Pan
RAD6	WBGene00006701	C35B1.1	VC18	VMA8	*	ZK970.4	Pan
RAD6	WBGene00006701	C35B1.1	VC18	VPS16	WBGene00006918	F55H2.2	Pan
RAD6	WBGene00006701	C35B1.1	VC18	VPS25	*	C05D11.2	Pan
RAD6	WBGene00006701	C35B1.1	VC18	VPS36	WBGene00010130	W02A11.2	Pan
RAD6	WBGene00006701	C35B1.1	VC18	VRP1	WBGene00006516	F17C11.8	Pan
RAD6	WBGene00006701	C35B1.1	VC18	YAF9	WBGene00012193	R144.4 & R144.8	Pan
RAD6	WBGene00006701	C35B1.1	VC18	YER087W	WBGene00008919	M04B2.3	Pan
RAD6	WBGene00006701	C35B1.1	VC18	YGR257C	WBGene00020094	T27F6.5	Pan
RAD6	WBGene00006701	C35B1.1	VC18	ZUO1	WBGene00001585	C16C10.1	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	ARP2	WBGene00004190	F38A5.13	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	CAP1	WBGene00007622	K07C5.1	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	CAP2	WBGene00001029	D2024.6	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	CCR4	WBGene00000200	M106.5	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	CHS5	WBGene00000292	ZC518.3	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	DOA1	WBGene00000293	ZC449.5	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	GIM3	WBGene00000376	C05C10.6	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	GIM4	WBGene00022615	B0035.4	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	GIM5	WBGene00007333	H20J04.d	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	NAT1	WBGene00007107	R151.9	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	PAC10	WBGene00019220	Y50D7 162.b & Y50D7 164.a	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	POL32	WBGene00020112	 T06G6.9	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	POP2	WBGene00021754	R04F11.3	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	RAD6	WBGene00006889	Y56A3A.20	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	SEC22	WBGene00011016	C35B1.1	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	SIN3	WBGene00000369	F55A4.1	Pan
RVS161	WBGene00010272	F58G6.1	tm1060	SPF1	WBGene00006701	F02E9.4	Tong
RVS161	WBGene00010272	F58G6.1	tm1060	YKE2	WBGene00018853	C10C6.6	Tong
SGS1	WBGene00001865	T04A11.6	VC193	CCR4	WBGene00004117	F21C3.5	Tong
SGS1	WBGene00001865	T04A11.6	VC193	CSM3	WBGene00007514	ZC518.3	Pan
SGS1	WBGene00001865	T04A11.6	VC193	CTF18	WBGene00009004	F23C8.9	Tong
SGS1	WBGene00001865	T04A11.6	VC193	LSM1	WBGene00000376	K08F4.1	Tong
SGS1	WBGene00001865	T04A11.6	VC193	MRE11	WBGene00017738	F40F8.9	Tong
SGS1	WBGene00001865	T04A11.6	VC193	MUS81	WBGene00010676	ZC302.1	Tong
SGS1	WBGene00001865	T04A11.6	VC193	POL32	WBGene00003076	C43E11.2	Tong
SGS1	WBGene00001865	T04A11.6	VC193	POP2	WBGene00003405	R04F11.3	Pan
SGS1	WBGene00001865	T04A11.6	VC193	RAD27	WBGene00016602	Y56A3A.20	Tong

SGS1	WBGene00001865	T04A11.6	VC193	RAD5	WBGene00011016	Y47G6A 247.i	Pan
SGS1	WBGene00001865	T04A11.6	VC193	RAD50	WBGene00000369	F54E12.2	Pan
SGS1	WBGene00001865	T04A11.6	VC193	RAD51	WBGene00000794	T04H1.4	Pan
SGS1	WBGene00001865	T04A11.6	VC193	RAD54	WBGene00010061	Y43C5A.6	Tong
SGS1	WBGene00001865	T04A11.6	VC193	SLX1	WBGene00004296	W06D4.6	Tong
SGS1	WBGene00001865	T04A11.6	VC193	TOP1	WBGene00004297	F56A3.2	Tong
SNF5	WBGene00011111	R07E5.3	RB810	BRE1	WBGene00004298	M01E5.5	Tong
SNF5	WBGene00011111	R07E5.3	RB810	POP2	WBGene00018909	R05D3.4	Pan
UGA1	WBGene00001794	K04D7.3	RB748	GIM5	WBGene00006595	Y56A3A.20	Tong, Pan
UGA1	WBGene00001794	K04D7.3	RB748	YKE2	WBGene00007008	R151.9	Tong, Pan
UGP1	WBGene00010665	K08E3.5	MG278	NOP1	WBGene00000369	F21C3.5	Pan
VMA4	WBGene00006917	C17H12.14	RB769	NAT1	WBGene00020112	T01C3.7	Pan
					WBGene00009004	Y50D7 162.b & Y50D7 164.a	Tong, Pan
					WBGene00001423		Tong, Pan
					WBGene00021754		Pan
							Tong, Pan
							Pan
							Tong, Pan
							Pan
							Pan
							Tong, Pan
							Tong
							Pan
							Pan
							Tong
							Tong
							Davierwal
							a
							Pan

#### Appendix Table 5.2. C. elegans orthologues of S. cerevisiae synthetic lethal interactions with homozygous viable loss-of-function alleles

*C. elegans* orthologues of *S. cerevisiae* synthetic lethal interactions that were used for the study of synthetic lethal interactions by RNAi in a mutant carrying a defined genetic lesion ('CE\_Strain') are shown. For each gene pair ('Gene 1', 'Gene 2'), *S. cerevisiae* standard names ('SC Name'), *C. elegans* WormBase names ('CE Name') & Ahringer library RNA interference (RNAi) clone gene pairs names ('CE RNAi clone') together with references for yeast synthetic lethal data are listed. \* designates genes that resulted in first-generation larval growth arrest after RNAi & were not be included in the screen for synthetic lethal interactions. Tong, Davierwala, and Pan denote yeast datasets from Tong *et al.*, 2003, Davierwala *et al.*, 2006, respectively.

### Appendix Table 5.3. Overlap of literature-curated genetic interactions between S. cerevisiae, D. melanogaster, and C. elegans

Overlap S. cerevisiae and D. melanogaster

SC Name	SC Name	DM Name	DM_Name
Gene 1	Gene 2	Gene 1	Gene 2
S000002575	S00000364	FBgn0011573	FBgn0004106
S000006323	S000002314	FBgn0000405	FBgn0015625
S00000364	S000006323	FBgn0004106	FBgn0000405

Overlap C. elegans and D. melanogaster

CE Name	CE Name	DM Name	DM Name
Gene 1	Gene 2	Gene 1	Gene 2
WBGene00000090	WBGene00003965	FBgn0015279	FBgn0020386
WBGene00004297	WBGene00004985	FBgn0003479	FBgn0002716
WBGene00002335	WBGene00004214	FBgn0003205	FBgn0000382
WBGene00000453	WBGene00006870	FBgn0025360	FBgn0005558
WBGene00002299	WBGene00002335	FBgn0003731	FBgn0003205
WBGene00001163	WBGene00006868	FBgn0040324	FBgn0025936
WBGene00000554	WBGene00006527	FBgn0015614	FBgn0011826
WBGene00002299	WBGene00004947	FBgn0003731	FBgn0001965
WBGene00002299	WBGene00003043	FBgn0003731	FBgn0036844
WBGene00002694	WBGene00003196	FBgn0026181	FBgn0005536
WBGene00001648	WBGene00001678	FBgn0001122	FBgn0001104
WBGene00000478	WBGene00000857	FBgn0016797	FBgn0004009
WBGene00006957	WBGene00006958	FBgn0024273	FBgn0041781
WBGene00003024	WBGene00006796	FBgn0003339	FBgn0001235
WBGene00000443	WBGene00006796	FBgn0000611	FBgn0001235
WBGene00000406	WBGene00000870	FBgn0016131	FBgn0010315
WBGene00000870	WBGene00001061	FBgn0010315	FBgn0011763
WBGene00006745	WBGene00006746	FBgn0034013	FBgn0015774
WBGene00002694	WBGene00003372	FBgn0026181	FBgn0003514
WBGene00000870	WBGene00000871	FBgn0010315	FBgn0010382
WBGene00002335	WBGene00002363	FBgn0003205	FBgn0004177
WBGene00003196	WBGene00003776	FBgn0005536	FBgn0005634
WBGene00000962	WBGene00003047	FBgn0010349	FBgn0015754

Appendix Table 5.3. Overlap of literature-curated genetic interactions between *S. cerevisiae*, *D. melanogaster*, and *C. elegans* Pair-wise ('Gene 1, Gene 2') orthologues of *S. cerevisiae*, *D. melanogaster*, and *C. elegans* genes with reported genetic interactions are shown. *S. cerevisiae*, *D. melanogaster*, and *C. elegans* genes are listed as *Saccharomyces* Genome Database identities ('SC Name'), FlyBase gene names ('DM Name'), and WormBase gene names ('CE Name'), respectively.