

Figure 1.1

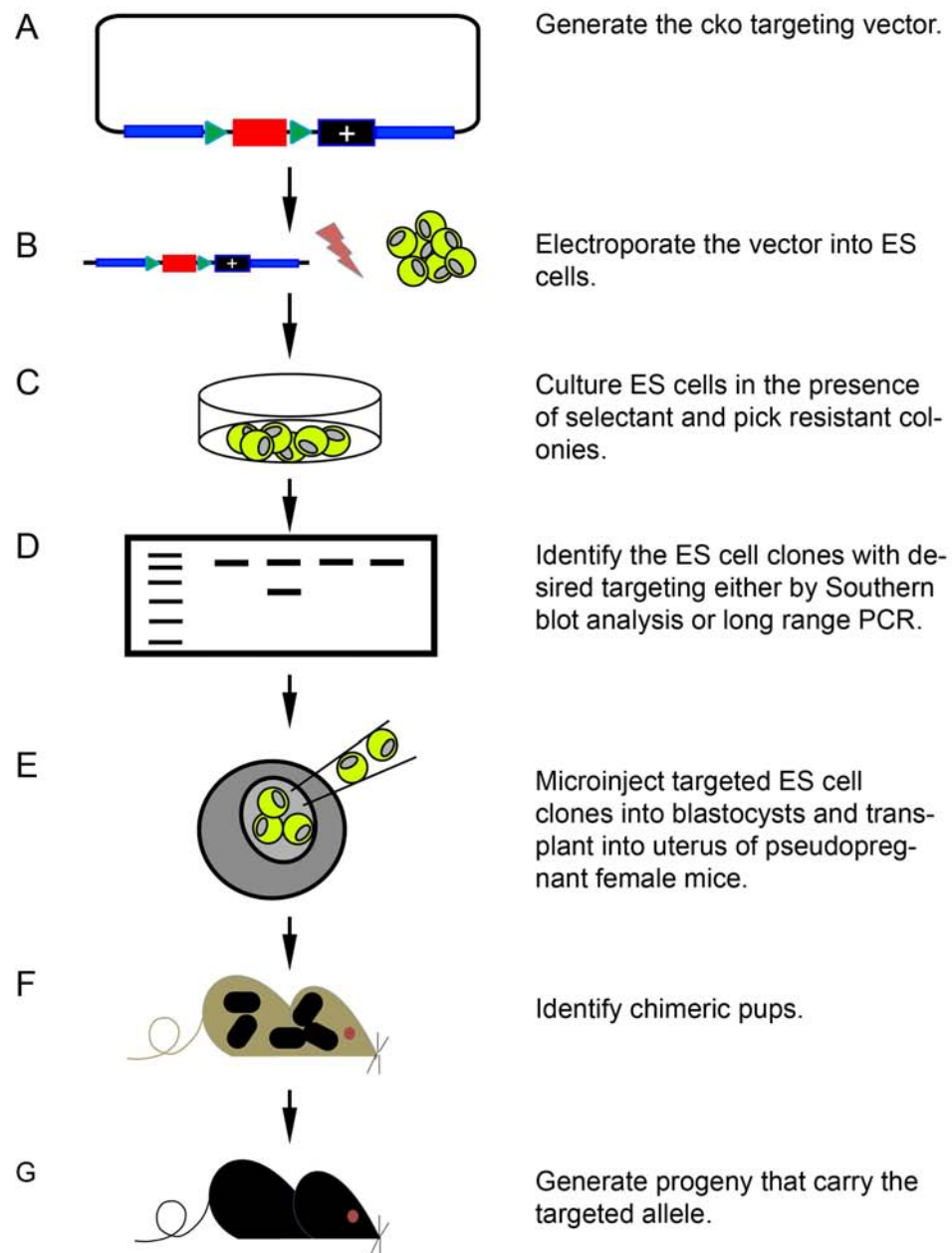


Figure 1.1 General procedure for generation of a conditional knockout mouse strain by gene targeting strategies.

(A) Generation of a targeting vector containing critical exon of targeted genes (red rectangle), two loxP site (green triangle), a positive (+) selection cassette and sequences of homology with the target locus (blue line). (B) The vector is linearized and electroporated into ES cells. (C) Correct transformants are selected for in the presence of a selectant (eg. G418 if a neomycin resistance cassette is present in the

targeting vector). (D) Correctly targeted ES cell clones are then identified and genetically characterized using long range PCR or Southern blot analysis. (E) The selected ES cell clones are then microinjected into 3.5 dpc blastocysts and transplanted into the uteri of pseudopregnant females. (F) Chimeras obtained from the microinjections are mated with wild-type mice to establish germ-line transmission of the modified allele. (G) Progeny derived from the chimeras are characterized using long range PCR or Southern blot analysis, and a mutant mouse line that carries the desired targeted allele is established.

Figure 1.2

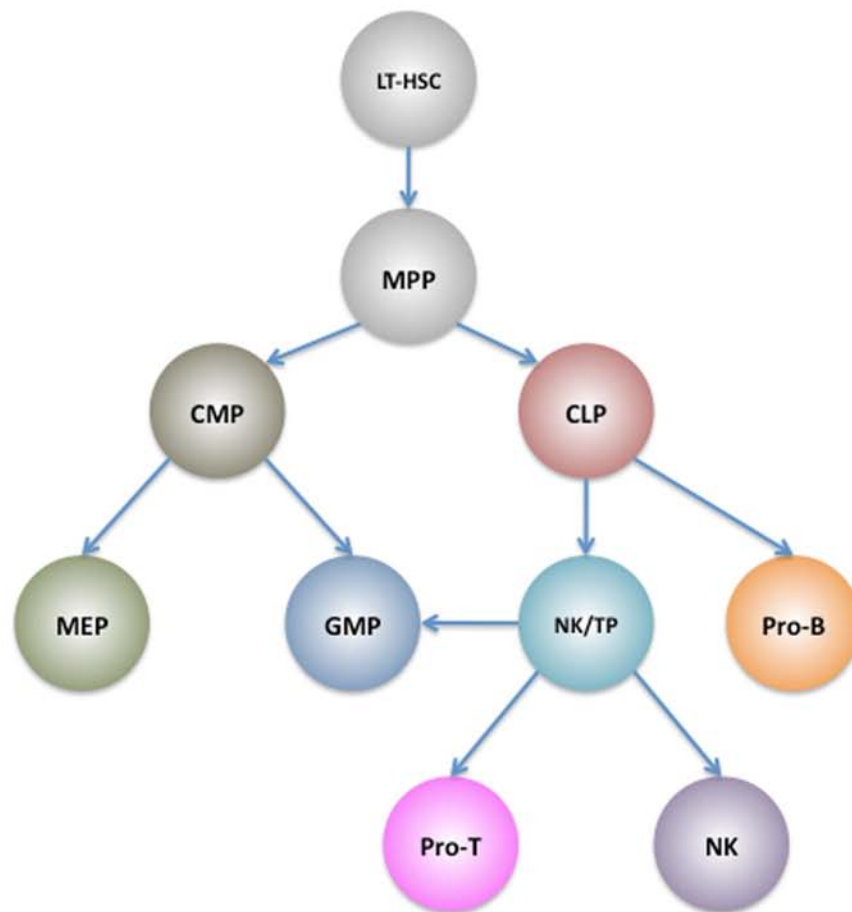


Figure 1.2 Current scheme of haematopoiesis.

LT-HSC, long-term hematopoietic stem cell; MPP, Multipotent progenitor; CMP, common myeloid progenitor; CLP, common lymphoid progenitor; MEP, megakaryocyte erythroid progenitor; GMP, granulocyte macrophage progenitor; NK/TP, NK/T progenitor, which have NK, T, and myeloid cell potentials. Pro-T and Pro-B are progenitor cells that go through several stages to eventually produce T and B cells. Arrows indicate cell differentiation.

Figure 1.3

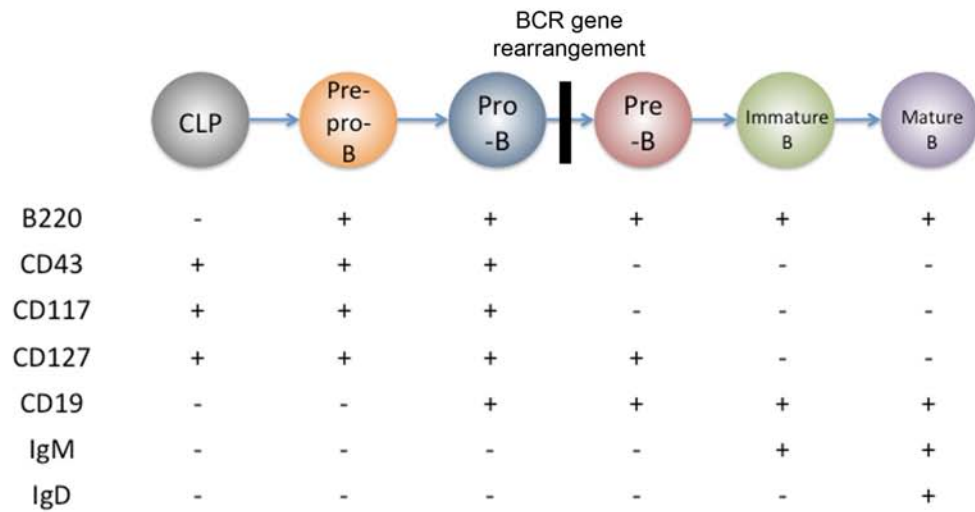


Figure 1.3 Stages in mouse bone marrow B lymphopoiesis from common lymphoid progenitors.

Diagram of B cell development from common lymphoid progenitors (CLPs) in mouse bone marrow (BM) through Pre-pro-B and Pro-B to mature B cell stages showing cell surface phenotype.

Figure 1.4

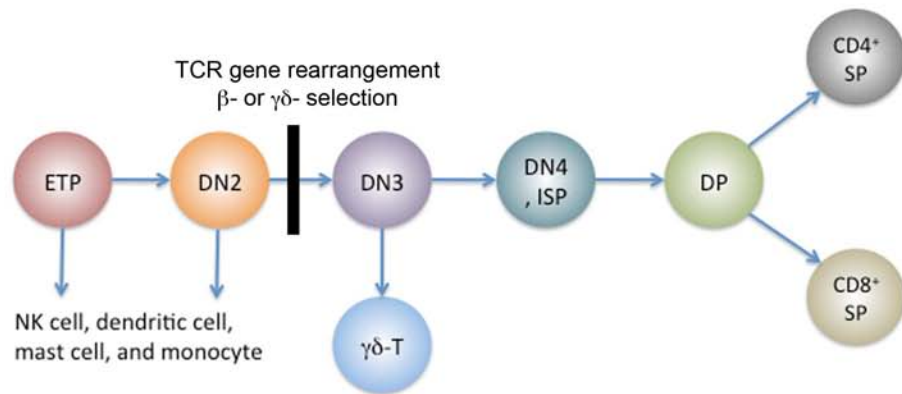


Figure 1.4 Stages in T cell development.

Early T cell precursors (ETPs) differentiate from double negative (DN) to double positive (DP) to single positive (SP) stages. Arrows indicate cell differentiation. Note that ETP and DN2 thymocytes contain non-T-cell options. β - and $\gamma\delta$ - selection occurs during the accumulation of the DN3 T cells.

Figure 3.1

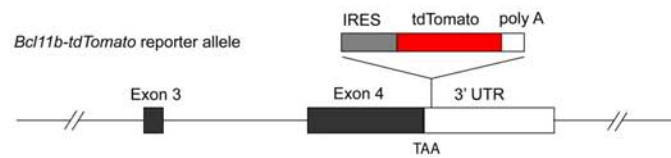


Figure 3.1 Targeting of the *IRES-tdTomato* reporter into the mouse *Bcl11b* locus.

The 3' *UTR* of *Bcl11b* locus was mutated by the introduction of an internal ribosomal entry site (*IRES*) element followed by Tandem dimer Tomato (*tdTomato*) and a polyadenylation signal (*polyA*).

Figure 3.2

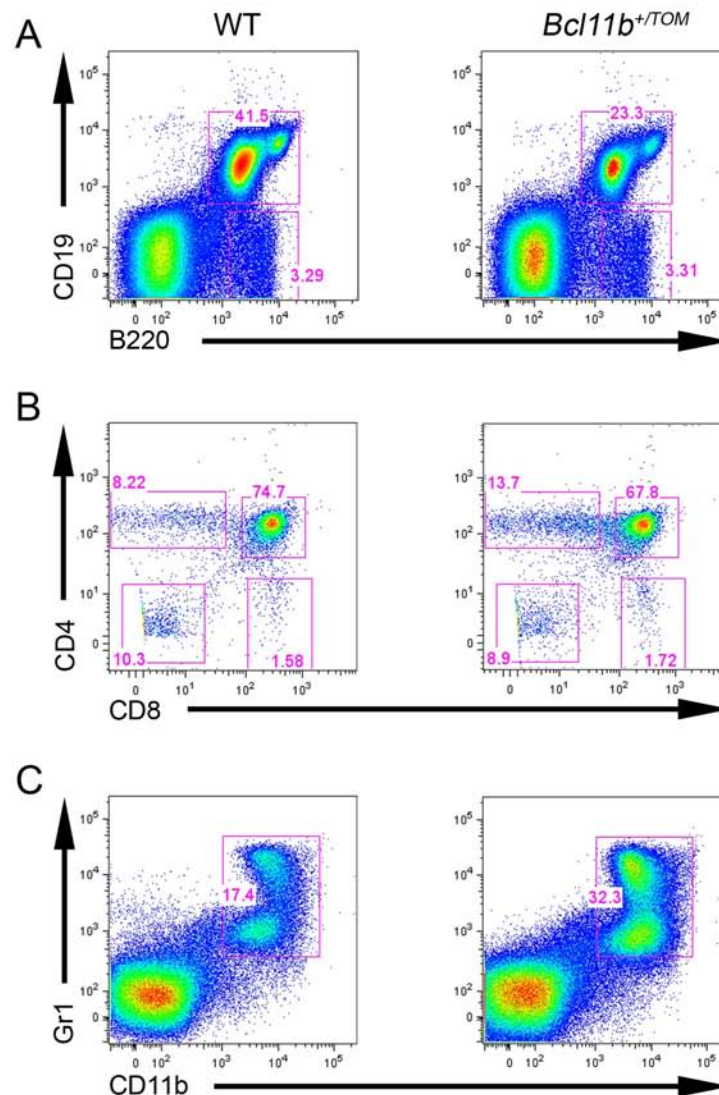


Figure 3.2 *Bcl11b*^{+/*TOM*} mice have normal haematopoiesis.

(A) Flow cytometry analysis shows the percentages of B cells that were defined as B220⁺CD19⁻ and B220⁺CD19⁺ in BM from wild type (left panel) and *Bcl11b*^{+/*TOM*} (right panel) mice. (B) Flow cytometry analysis shows the percentages of DP (CD4⁺CD8⁺), CD4 SP (CD4⁺CD8⁻), CD8 SP (CD4⁻CD8⁺) and DN (CD4⁻CD8⁻) T thymocytes from wild type (left panel) and *Bcl11b*^{+/*TOM*} (right panel) mice. (C) Flow cytometry analysis shows the percentages of myeloid cells (CD11b⁺Gr1⁺) in BM from wild type (left panel) and *Bcl11b*^{+/*TOM*} (right panel) mice. Numbers beside or in

outlined areas indicate the percentages of positive cells in each. Data are representative of two experiments.

Figure 3.3

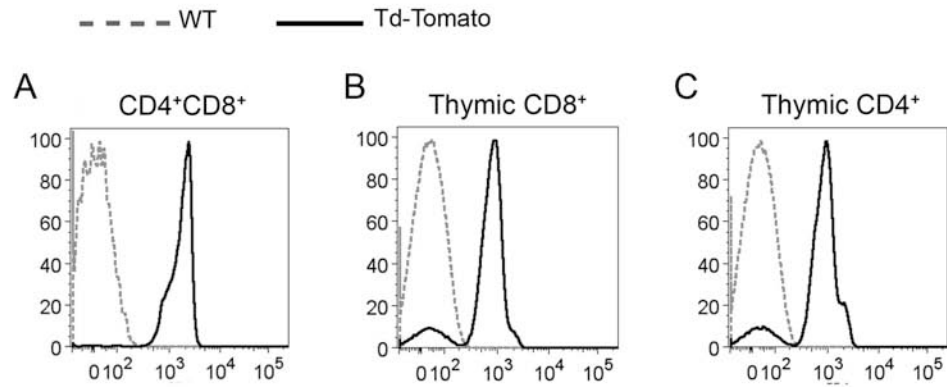


Figure 3.3 Expression of Bcl11b in thymocytes.

Flow cytometry analysis of single-cell suspensions from thymocytes of *Bcl11b*^{+/*TOM*} (solid black line) and wild type (dash grey line) mice, stained with antibodies to CD4 and CD8. (A) Bcl11b expression in CD4⁺CD8⁺ DP thymocytes, which were defined in Fig. 3.2B, was assessed indirectly with tdTomato signal. (B) Bcl11b expression in CD8⁺ thymocytes that were defined in Fig. 3.2B, was assessed indirectly with tdTomato signal. (C) Bcl11b expression in CD4⁺ thymocytes that were defined in Fig. 3.2B, was assessed indirectly with tdTomato signal. Data are representative of two experiments.

Figure 3.4

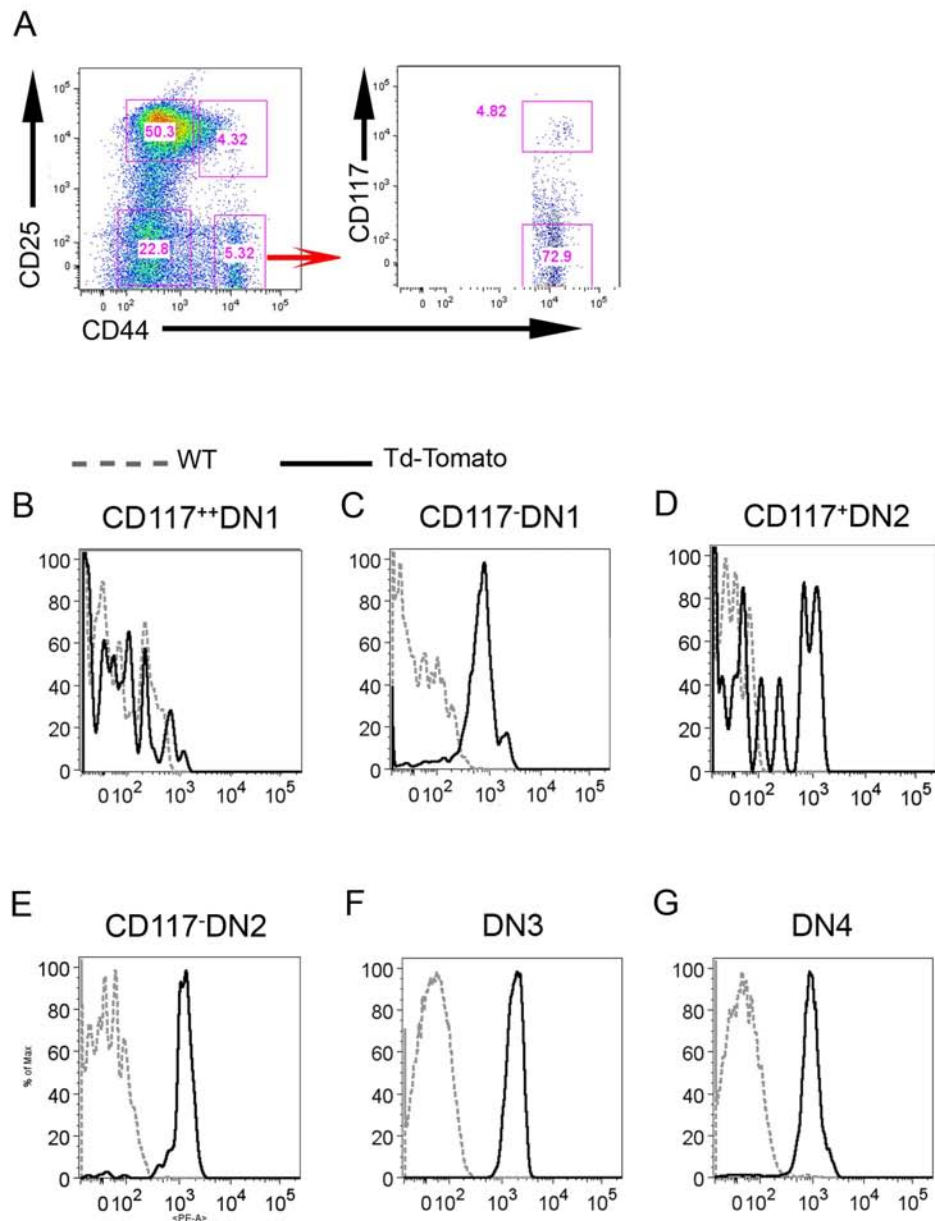


Figure 3.4 Expression of Bcl11b in subsets of DN thymocytes.

Flow cytometry analysis of single-cell suspensions from Lin⁻ thymocytes of *Bcl11b*^{+/*TOM*} (solid black line) and wild type (dash grey line) mice, stained with antibodies to Lineage cocktail, CD44, CD25 and CD117. (A) Different subsets of DN thymocytes were defined by expression of CD25, CD44 and CD117 in Lin⁻ thymocytes as follows: DN1 (CD44⁺CD25⁻), DN2 (CD44⁺CD25⁺), DN3 (CD44⁻CD25⁺) and DN4 (CD44⁻CD25⁻). The DN1 subset was further divided into two

groups by expression of CD117. Numbers beside or in outlined areas indicated the percentages of positive cells in each. (B) Bcl11b expression in CD117⁺⁺DN1 thymocytes that are defined from flow cytometry in (A) was assessed indirectly with tdTomato signal. (C) Bcl11b expression in CD117⁻DN1 thymocytes that were defined from flow cytometry in (A) was assessed indirectly with tdTomato signal. (D) Bcl11b expression in CD117⁺DN2 thymocytes that are defined from flow cytometry in (A) was assessed indirectly with tdTomato signal. (E) Bcl11b expression in CD117⁻DN2 thymocytes that are defined from flow cytometry in (A) was assessed indirectly with tdTomato signal. (F) Bcl11b expression in DN3 thymocytes that are defined from flow cytometry in (A) was assessed indirectly with tdTomato signal. (G) Bcl11b expression in DN4 thymocytes that are defined from flow cytometry in (A) was assessed indirectly with tdTomato signal. Data are representative of four experiments.

Figure 3.5

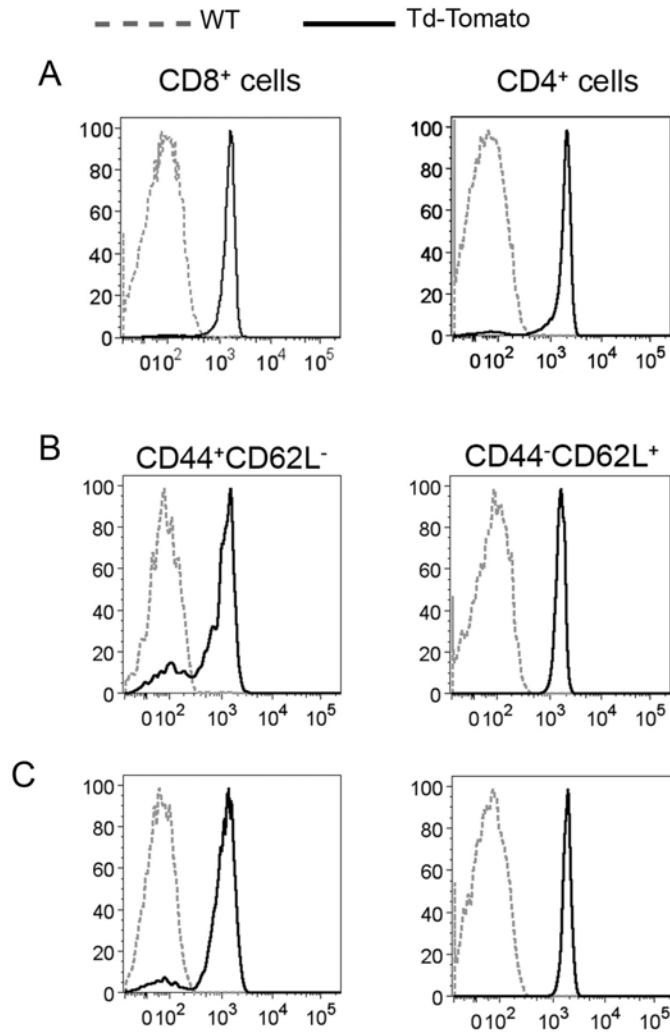


Figure 3.5 Detection of *Bcl11b* expressions in mature T cell subsets using *Bcl11b*-tdTomato knock-in reporter mice.

Flow cytometry analysis of single-cell suspensions from splenocytes of *Bcl11b*^{+/*TOM*} (solid black line) and wild type (dash grey line) mice, stained with antibodies to CD4, CD8, CD44 and CD62L. (A) *Bcl11b* expression in CD8⁺ (left panel) and CD4⁺ (right panel) splenic T cells that are defined from flow cytometry in Fig. 3.6A was assessed indirectly with tdTomato signal. (B) *Bcl11b* expression in activated (CD44⁺CD62L⁻, left panel) and naïve (CD44⁻CD62L⁺, right panel) CD8⁺ splenic T cells that are defined from flow cytometry in Fig. 3.6A (right panel) was assessed indirectly with

tdTomato signal. (C) Bcl11b expression in activated ($CD44^+CD62L^-$, left panel) and naïve ($CD44^+CD62L^+$, right panel) $CD4^+$ splenic T cells that are defined from flow cytometry in Fig. 3.6A (left panel) was assessed indirectly with tdTomato signal. Data are representative of four experiments.

Figure 3.6

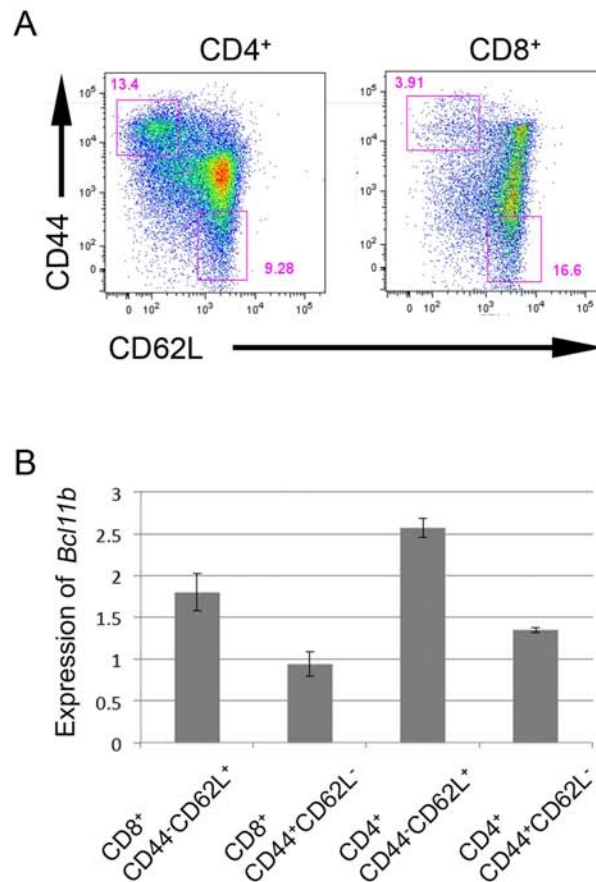


Figure 3.6 Detection of *Bcl11b* expressions in mature T cell subsets using qRT-PCR.

Flow cytometry analysis of single-cell suspensions from splenocytes of wild type mice, stained with antibodies to CD4, CD8, CD44 and CD62L. (A) Naïve (CD44⁻CD62L⁺) and activated (CD44⁺CD62L⁻) T cell subsets were defined and sorted from CD4⁺ (left panel) and CD8⁺ (right panel) splenic T cells by flow cytometry. Numbers beside or in outlined areas indicated the percentages of positive cells in each. (B) qRT-PCR was performed to measure *Bcl11b* expressions in sorted splenic naïve (CD44⁻CD62L⁺) and activated (CD44⁺CD62L⁻) T cells population. *Bcl11b* expression

was calculated relative to that in CD8⁺CD44⁺CD62L⁻ (set to 1). Bars are mean \pm SEM of 3 samples.

Figure 3.7

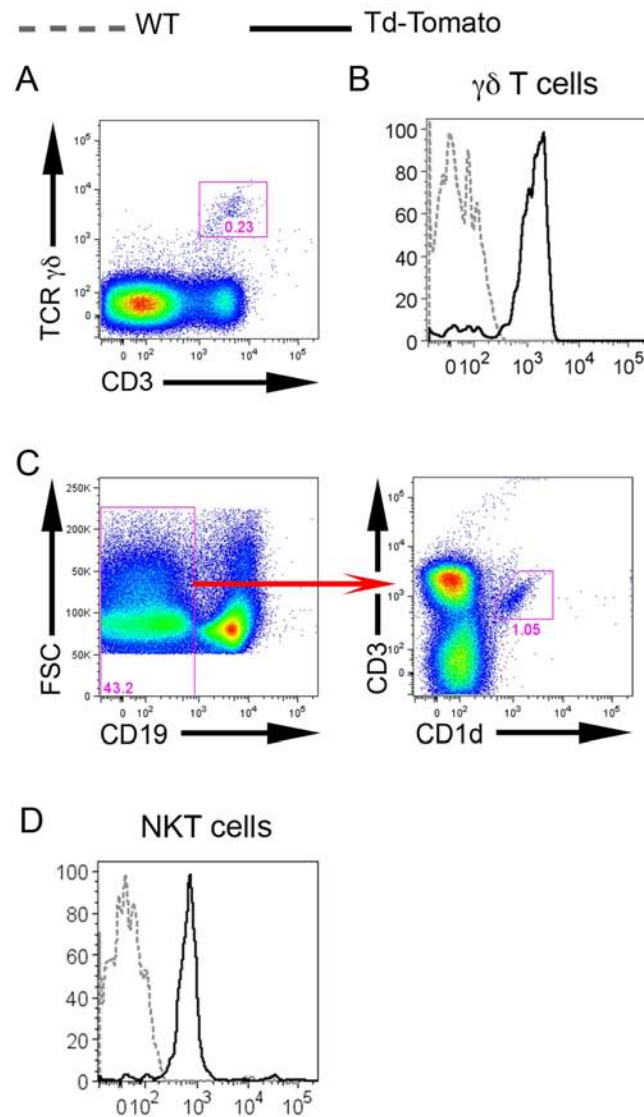


Figure 3.7 Expression of Bcl11b in $\gamma\delta$ -T cells and NKT cells.

(A) Flow cytometry analysis of single-cell suspensions from thymocytes of *Bcl11b*^{+/*TOM*} (solid black line) and wild type (dash grey line) mice, stained with antibodies to TCR $\gamma\delta$ and CD3. $\gamma\delta$ T cells were defined as TCR $\gamma\delta$ ⁺CD3⁺. Numbers beside or in outlined areas indicated the percentages of positive cells in each. (B) Bcl11b expression in $\gamma\delta$ T cells defined in (A) was assessed indirectly with tdTomato signal. (C) Flow cytometry analysis of single-cell suspensions from splenocytes of *Bcl11b*^{+/*TOM*} (solid black line) and wild type (dash grey line) mice, stained with

antibodies to CD19, CD3 and dimmer CD1d. NKT cells were defined as CD19⁻CD3⁺CD1d⁺. Numbers beside or in outlined areas indicated the percentages of positive cells in each. (D) Bcl11b expression in NKT cells defined in (C) was assessed indirectly with tdTomato signal. Data are representative of four experiments.

Figure 3.8

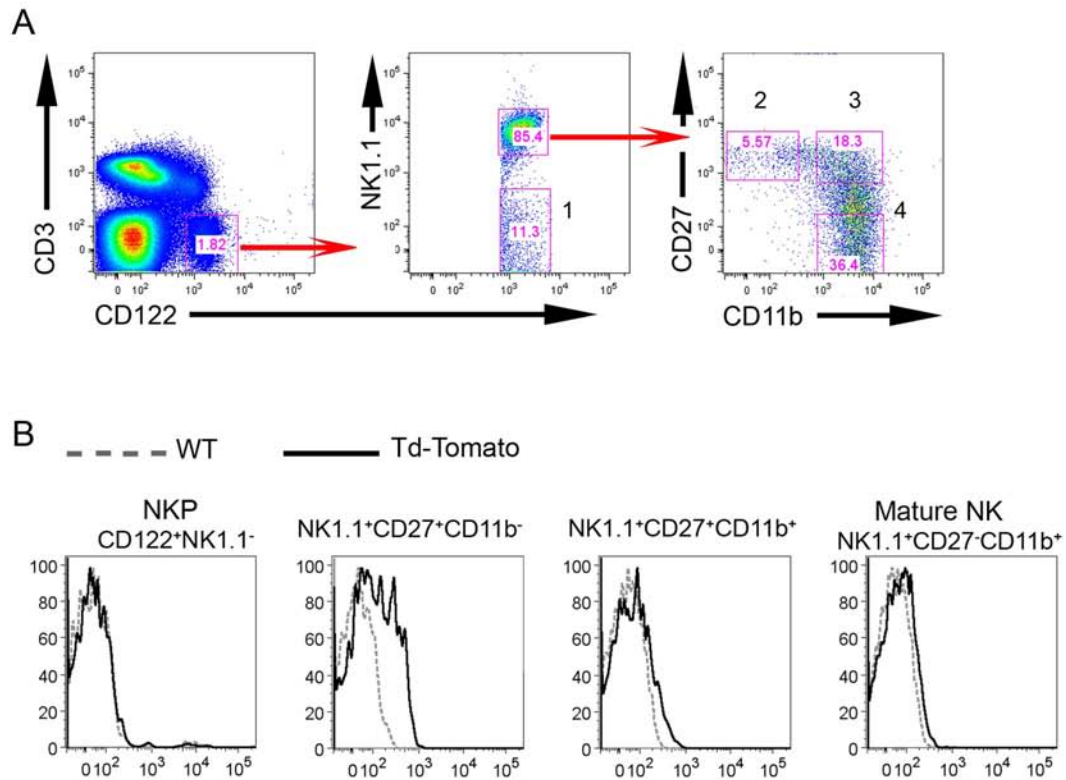


Figure 3.8 Expression of Bcl11b in NK cells.

Flow cytometry analysis of single-cell suspensions from splenocytes of *Bcl11b*^{+/*TOM*} (solid black line) and wild type (dash grey line) mice, stained with antibodies to CD3, CD122, NK1.1, CD27 and CD11b. (A) Different subsets of NK cells were defined by expression of NK1.1, CD122, CD11b and CD27. Numbers beside or in outlined areas indicated the percentages of positive cells in each. (B) Bcl11b expression in different NK cell subsets defined in (A) was assessed indirectly with tdTomato signal. Data are representative of four experiments.

Figure 3.9

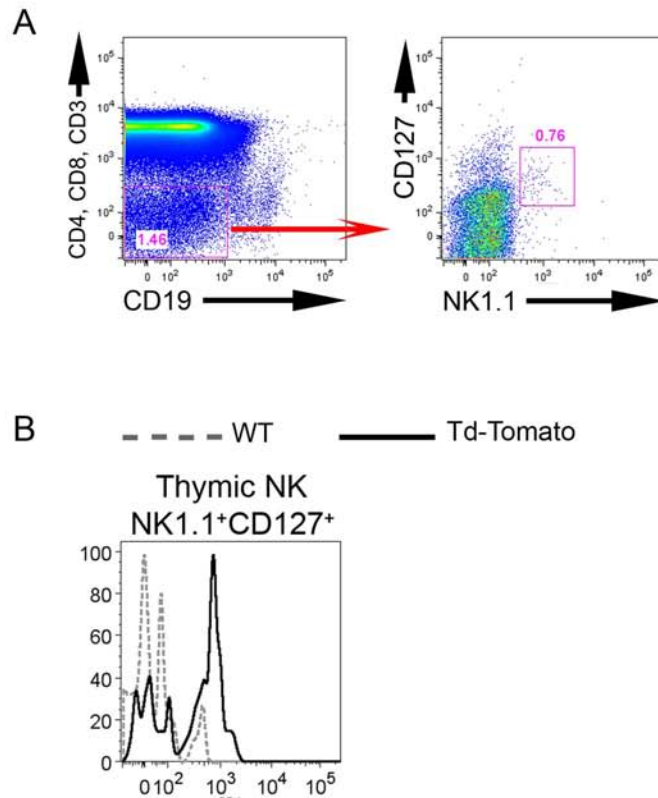


Figure 3.9 Expression of *Bcl11b* in thymic NK cells.

Flow cytometry analysis of single-cell suspensions from thymocytes of *Bcl11b*^{+/*TOM*} (solid black line) and wild type (dash grey line) mice, stained with antibodies to CD4, CD8, CD3, NK1.1, CD19 and CD127. (A) Thymic NK cells were defined as NK1.1⁺CD127⁺ thymocytes. Numbers beside or in outlined areas indicated the percentages of positive cells in each. (B) *Bcl11b* expression in thymic NK cells defined in (A) was assessed indirectly with tdTomato signal. Data are representative of four experiments.

Figure 3.10

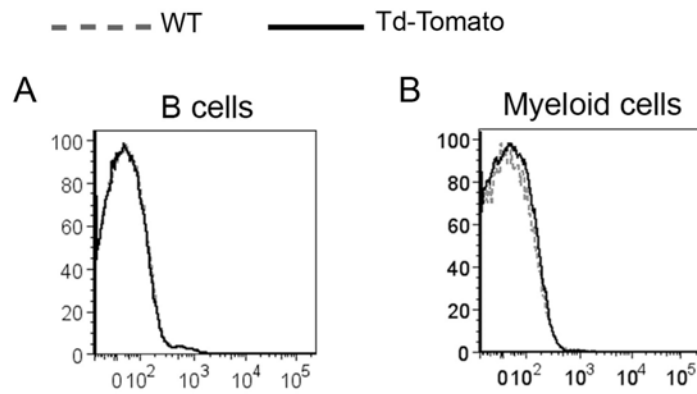


Figure 3.10 Expression of Bcl11b in B and myeloid cells.

Flow cytometry analysis of single-cell suspensions from BM of *Bcl11b*^{+/*TOM*} (solid black line) and wild type (dash grey line) mice, stained with antibodies to CD19, B220, CD11b and Gr1. (A) Bcl11b expression in B cells defined in Fig. 3.2A was assessed indirectly with tdTomato signal. (B) Bcl11b expression in myeloid cells defined in Fig. 3.2C was assessed indirectly with tdTomato signal. Data are representative of four experiments.

Figure 4.1

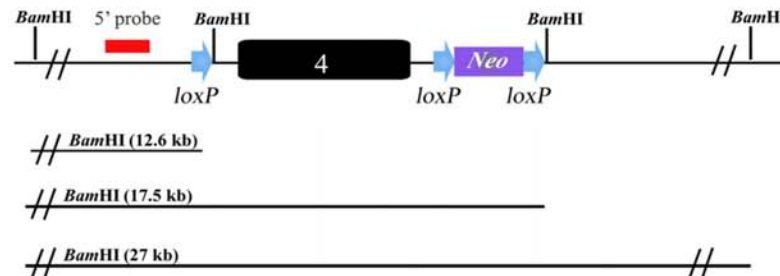


Figure 4.1 Schematic diagram of the *Bcl11b* conditional knockout allele.

Bcl11b exon 4 was flanked by *loxP* sites. Indicated DNA fragments were detected by the 5' probe in Southern blot analysis of targeted ES cells.

Figure 4.2

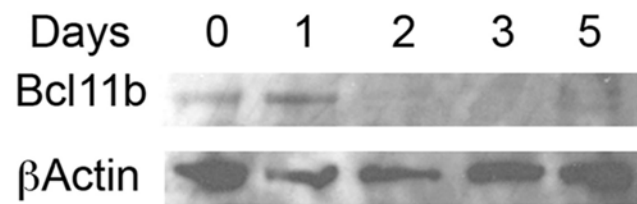


Figure 4.2 Loss of Bcl11b after OHT treatment.

Western blot analysis of Bcl11b levels from whole cell lysates of thymocytes from *flox/flox* mice at different time points after OHT treatment.

Figure 4.3

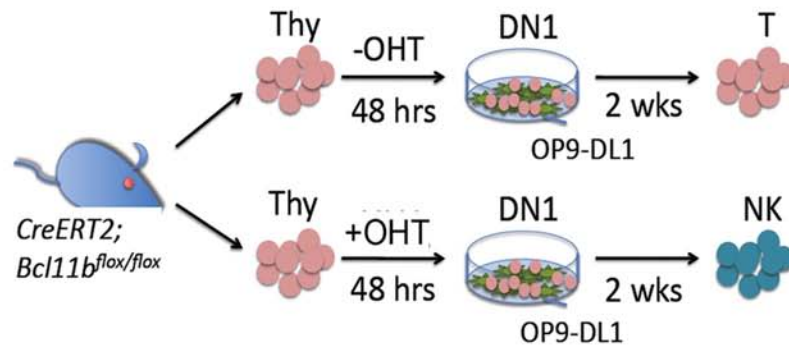


Figure 4.3 Experimental design for the analysis of *Bcl11b*-deficient DN thymocytes.

Whole thymocytes from (*flox/flox*) mice were treated with OHT (+OHT) or left untreated (-OHT) for 48 hr then sorted into the indicated subset and co-cultured with OP9-DL1 stromal cells in T cell culture condition. Two weeks later, T cells grew out from (-OHT) culture, while NK-like cells were produced from (+OHT) culture.

Figure 4.4

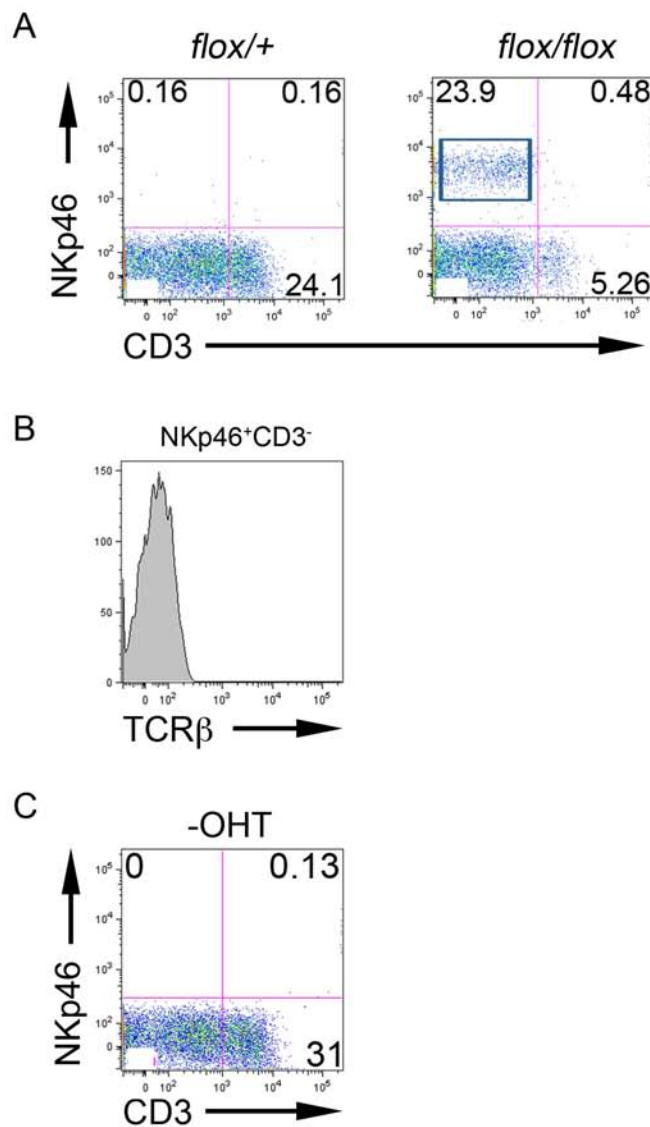


Figure 4.4 Bcl11b is essential for DN1 thymocytes to differentiate to T cells.

Thymocytes from *flox/flox* or *flox/+* control mice were treated, or not, with OHT then sorted into DN1 subsets, and co-cultured on OP9-DL1 stromal cells in T cell media.

(A) Flow cytometry profiles of cultured DN1 thymocytes from *flox/+* (left panel) and *flox/flox* (right panel) after OHT treatment in T cell culture condition without IL-2 supplement. Numbers refer to percentage of cells in the gate. Data are representative of three experiments.

(B) Flow cytometry analysis shows that NKp46⁺CD3⁻ cells

(gated in (A)) from DN1 OHT-treated *flox/flox* thymocytes did not express TCR β . Data are representative of two experiments. (C) Flow cytometry profiles of cultured DN1 thymocytes from *flox/flox* without OHT treatment in T cell culture condition. Numbers refer to percentage of cells in the gate. Data are representative of three experiments.

Figure 4.5

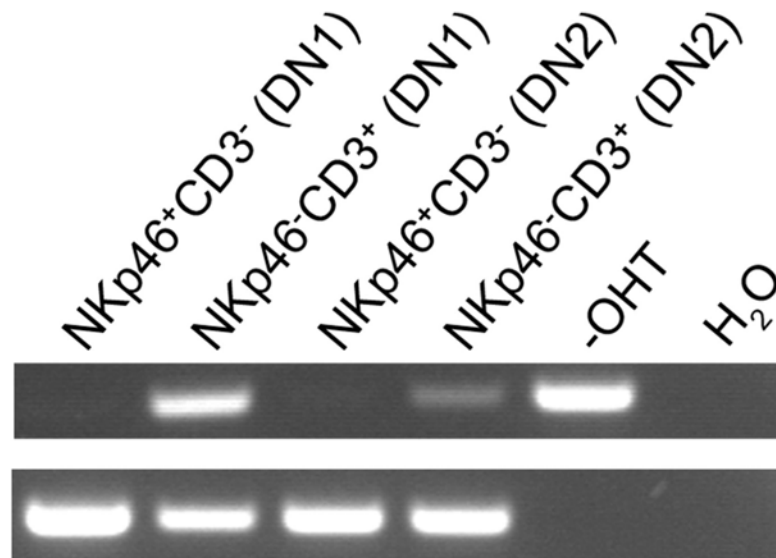


Figure 4.5 Bcl11b was deleted in NK-like cells.

Genotyping results show that homozygous *Bcl11b* deletion in NK-like cells (NKp46⁺CD3⁻) but not in T (NKp46⁻CD3⁺) cell populations from DN1 and DN2 cultures. *lox*: conditional knockout allele; *del*: deletion allele. H₂O: no DNA template control.

Figure 4.6

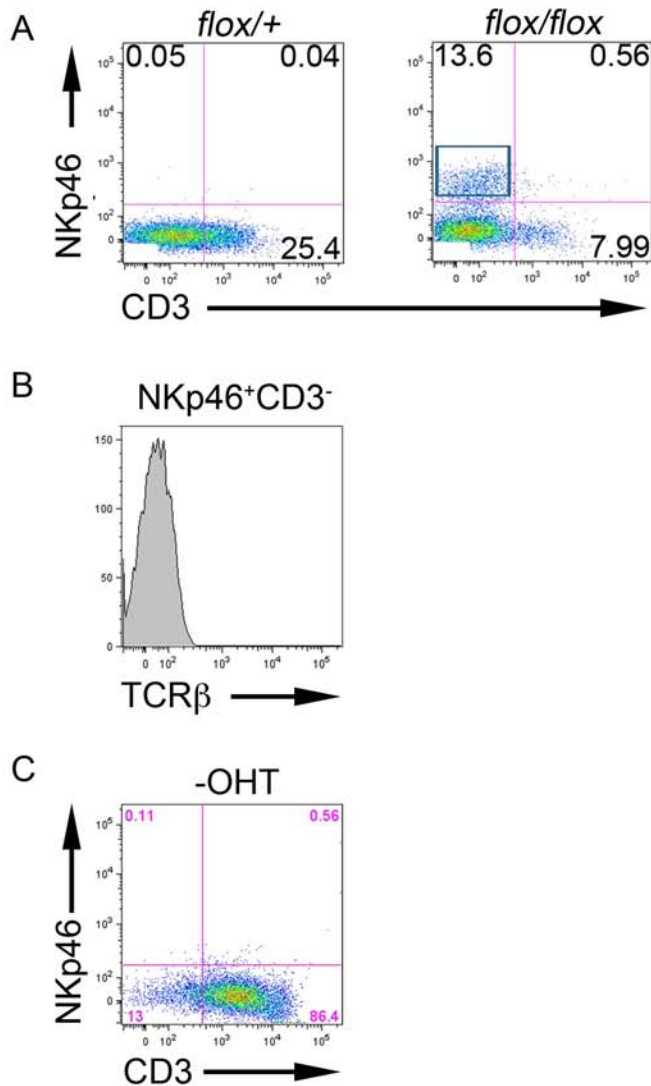


Figure 4.6 Bcl11b is essential for DN2 thymocytes to differentiate to T cells.

Thymocytes from *flox/flox* or *flox/+* control mice were treated, or not, with OHT then sorted into DN2 subsets, and co-cultured on OP9-DL1 stromal cells in T cell media.

(A) Flow cytometry profiles of cultured DN2 thymocytes from *flox/+* (left panel) and *flox/flox* (right panel) after OHT treatment in T cell culture condition without IL-2 supplement. Numbers refer to percentage of cells in the gate. Data are representative of three experiments.

(B) Flow cytometry analysis shows that NKp46⁺CD3⁻ cells

(gated in (A)) from DN2 OHT-treated *flox/flox* thymocytes did not express TCR β . Data are representative of two experiments. (C) Flow cytometry profiles of cultured DN1 thymocytes from *flox/flox* without OHT treatment in T cell culture condition. Numbers refer to percentage of cells in the gate. Data are representative of three experiments.

Figure 4.7

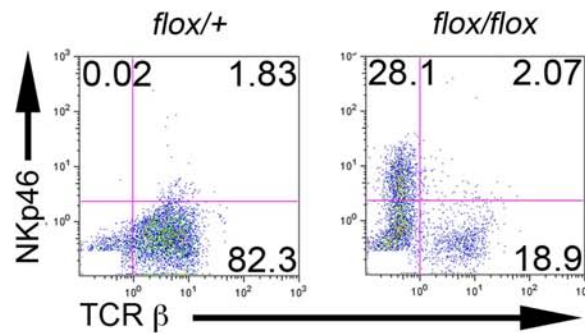


Figure 4.7 Bcl11b is essential to maintain T cell identity in committed DN3 thymocytes.

Thymocytes from *flox/flox* or *flox/+* control mice were treated, or not, with OHT then sorted into DN3 subsets, and co-cultured on OP9-DL1 stromal cells in T cell media. Flow cytometry profiles of cultured DN3 thymocytes from *flox/+* (left panel) and *flox/flox* (right panel) after OHT treatment in T cell culture condition without IL-2 supplement. Numbers refer to percentage of cells in the gate. Data are representative of three experiments.

Figure 4.8

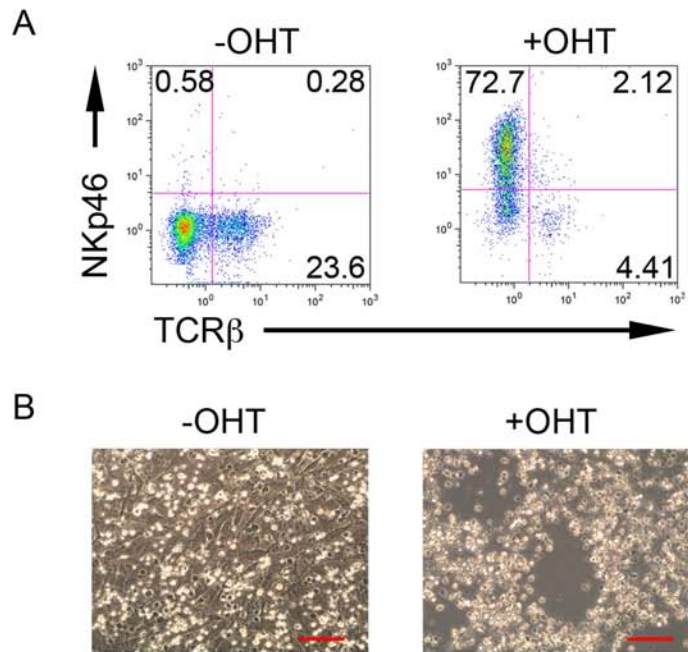


Figure 4.8 NK-like cells produced from *Bcl11b*-deficient DN3 thymocytes in T cell culture condition killed OP9-DLI stromal cells.

(A) Flow cytometry profiles of cultured *flox/flox* DN3 thymocytes (\pm OHT) supplemented with IL-2. Data are representative of three experiments. (B) Killing of OP9-DLI stromal cells by OHT-treated *flox/flox* DN3 thymocytes. Scale bar, 40 μ m.

Figure 4.9

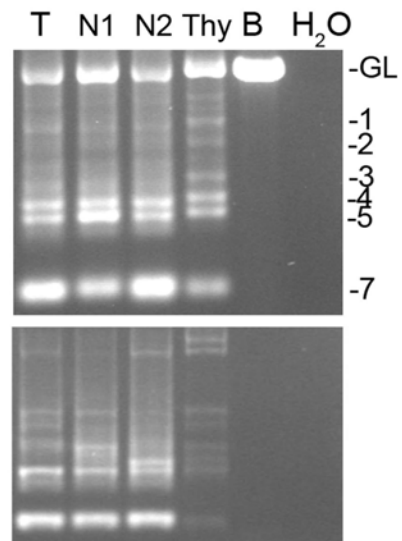


Figure 4.9 NK-like cells produced from *Bcl11b*-deficient DN3 thymocytes contain TCR DNA rearrangements.

DNA from purified NKp46⁺ cells was prepared and subjected to PCR to detect DJ (top) and V(D)J (bottom) recombination at the TCRβ locus. T, T cells growing from untreated DN3 thymocytes; N1 and N2, sorted NKp46⁺ cells growing from OHT-treated *flox/flox* DN3 thymocytes; Thy, wild-type whole thymocytes; B, B cells; and GL, germline band. H₂O: no DNA template in PCR. Numbers indicate DJ recombination products.

Figure 4.10

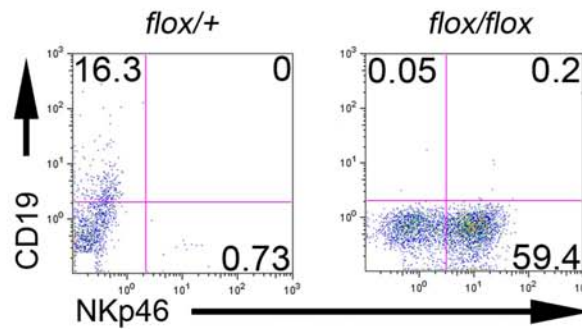


Figure 4.10 Reprogramming of *Bcl11b*-deficient DN3 thymocytes to ITNK cells in B cell culture condition.

Thymocytes from *flox/flox* or *flox/+* control mice were treated, or not, with OHT then sorted into DN3 subsets, and co-cultured on OP9 stromal cells in B cell media. Flow cytometry profiles of cultured DN3 thymocytes from *flox/+* (left panel) and *flox/flox* (right panel) after OHT treatment in B cell culture condition. Numbers refer to percentage of cells in the gate. Data are representative of three experiments.

Figure. 4.11

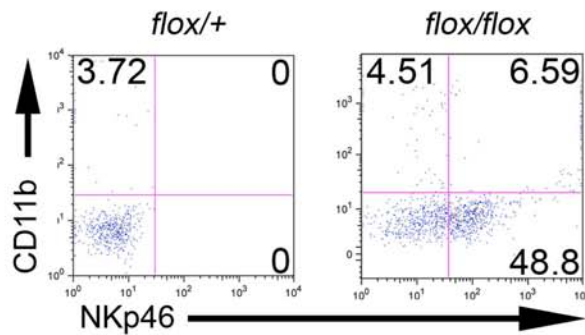


Figure 4.11 Reprogramming of *Bcl11b*-deficient DN3 thymocytes to ITNK cells in myeloid cell culture condition.

Thymocytes from *flox/flox* or *flox/+* control mice were treated, or not, with OHT then sorted into DN3 subsets, and co-cultured on OP9 stromal cells in myeloid cell media. Flow cytometry profiles of cultured DN3 thymocytes from *flox/+* (left panel) and *flox/flox* (right panel) after OHT treatment in myeloid cell culture condition. Numbers refer to percentage of cells in the gate. Data are representative of three experiments.

Figure 4.12

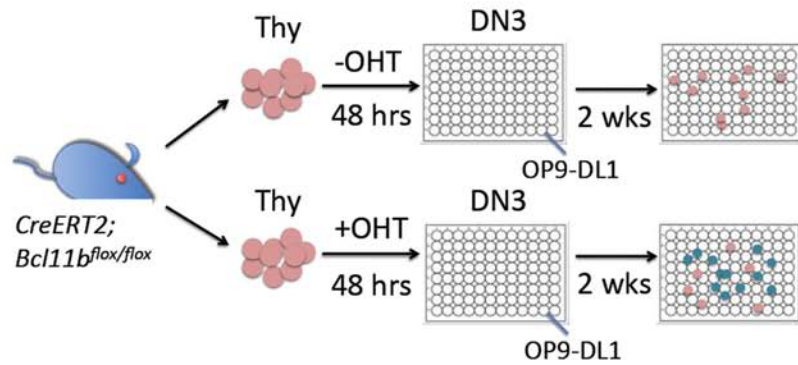


Figure 4.12 Experiment designs for single cell assay.

Experimental design for reprogramming of single DN3 thymocytes to ITNK. Whole thymocytes from *flox/flox* mice were treated with OHT (+OHT) or left untreated (-OHT) and 48-hours later single DN3 cells were sorted and seeded on OP9-DL1 stromal cells in 96-well plates for 10-14 days supplemented with IL-2.

Figure 4.13

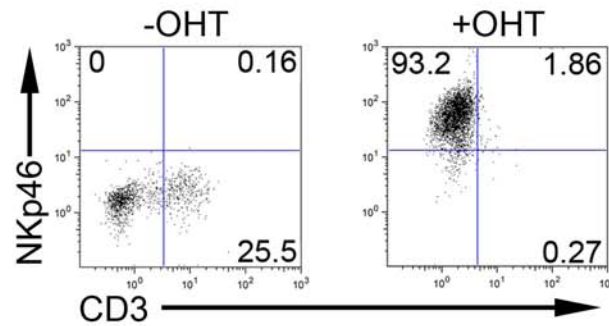


Figure 4.13 Production of ITNK cells from a single *Bcl11b*-deficient DN3 thymocytes.

Flow cytometry profiles of cells produced from a single DN3 thymocyte from *flox/flox* (right panel) treated with OHT (+OHT, right panel) or left untreated (-OHT, left panel) in T cell culture condition supplemented with IL-2. Numbers refer to percentage of cells in the gate. Data are representative of more than 200 wells.

Figure 4.14

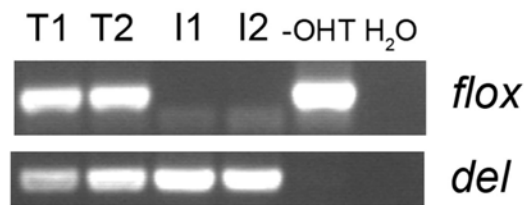


Figure 4.14 ITNK cells were produced from single *Bcl11b*-deficient DN3 thymocytes.

PCR genotyping of *Bcl11b* deletion in two representative T cell (T1 and T2) and ITNK (I1 and I2) wells. *flox*, floxed allele; *del*, deletion allele. -OHT: no OHT treatment; H₂O: no template control.

Figure 4.15

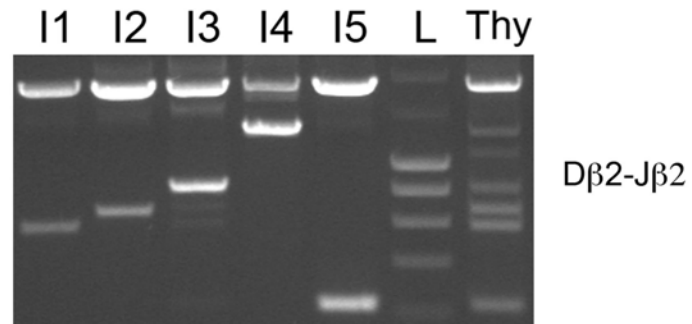


Figure 4.15 Each ITNK colony was derived from individual *Bcl11b*-deficient DN3 thymocytes.

Genotyping results show DJ recombination at the TCR β locus of five ITNK wells (I1 to I5) showing unique DJ recombination. L, DNA ladder; Thy, wild-type thymocytes.

Figure 4.16

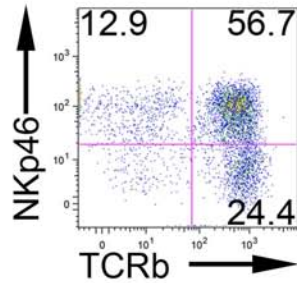


Figure 4.16 Production of ITNK cells from *Bcl11b*-deficient DP thymocytes.

Flow cytometry analysis shows that NKp46⁺TCRβ⁺ ITNK cells were reprogrammed from DP *flox/flox* thymocytes treated with OHT and cultured on OP9-DL1 in the presence of IL-2. Untreated cells died rapidly under this condition. Numbers refer to percentage of cells in the gate. Data are representative of four experiments.

Figure 4.17

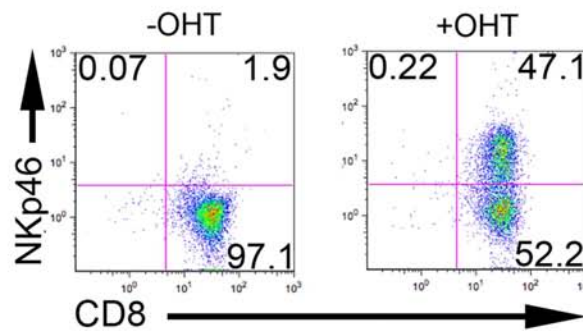


Figure 4.17 Production of ITNK cells from *Bcl11b*-deficient CD8⁺ mature T cells. Flow cytometry analysis shows that NKp46⁺CD8⁺ ITNK cells were reprogrammed from OHT-treated CD8 SP *flox/flox* splenocytes and cultured on OP9-DL1 in the presence of IL-2. Untreated cells died rapidly under this condition. Numbers refer to percentage of cells in the gate. Data are representative of four experiments.

Figure 4.18

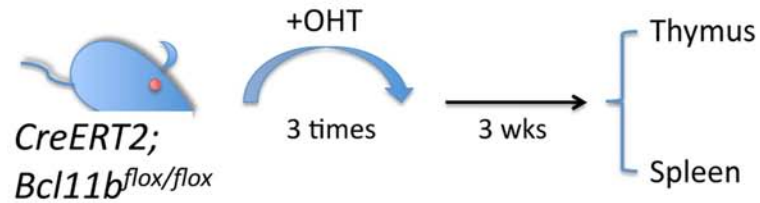


Figure 4.18 Experimental design for the analysis of *in vivo* reprogrammed ITNK cells.

flox/flox or *flox/+* mice were treated with Tamoxifen by oral gavage on three consecutive days, and the thymi and spleens were analyzed 2-3 weeks later. We observed a 5-10 fold reduction in total thymocytes and about 2-fold reduction in splenocytes in the treated *flox/flox* mice compared to treated *flox/+* control mice.

Figure 4.19

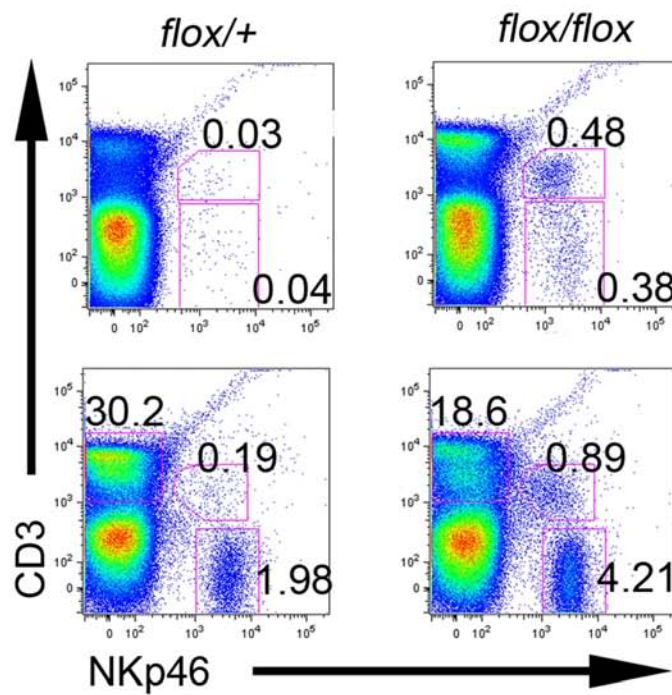


Figure 4.19 Analysis of *in vivo* reprogrammed ITNK cells in the *flox/flox* mouse. Flow cytometric analysis of thymocytes and splenocytes from OHT-treated *flox/flox* and *flox/+* mice. Numbers refer to the percentage in the lymphocyte gate. Data are representative of four mice.

Figure 4.20

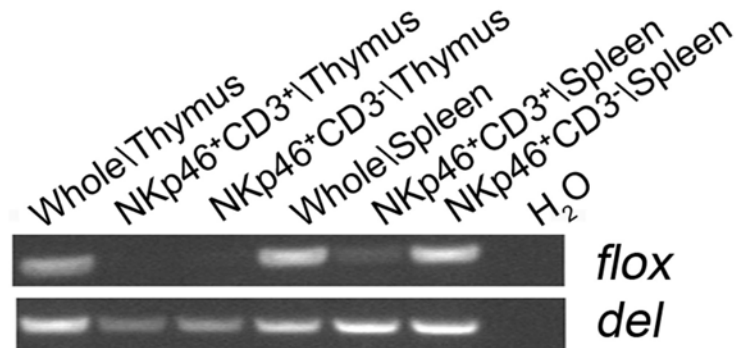


Figure 4.20 ITNK cells have *Bcl11b* deleted.

PCR results show that *Bcl11b* was deleted in ITNK (NKp46⁺CD3⁺ and NKp46⁺CD3⁻) cell populations in *flox/flox* mice. *flox*: conditional knockout allele; *del*: deletion allele. H₂O: no DNA template control. All the NKp46⁺CD3⁺ and NKp46⁺CD3⁻ cells in the thymus were ITNKs. Analyzing ITNKs in the spleen was more complicated due to the presence of many NKp46⁺ conventional NK cells. However, most of the NKp46⁺CD3⁺ cells in the spleen had *Bcl11b*-deficiency and thus were ITNKs. PCR data are representative of three experiments.

Figure 4.21

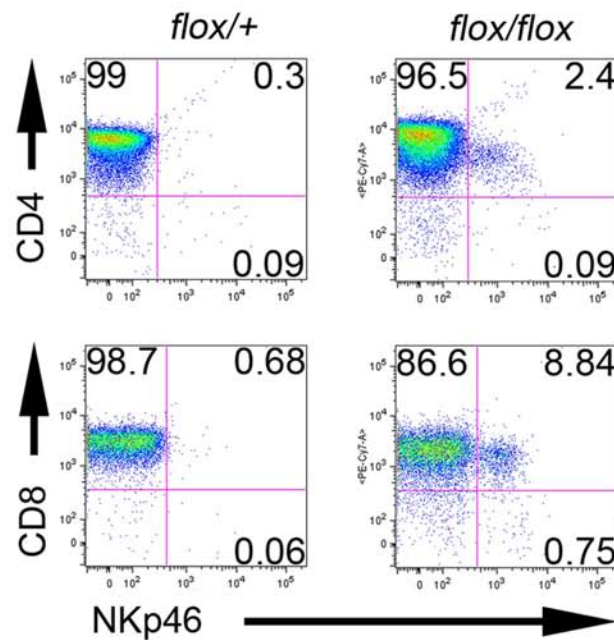


Figure 4.21 CD4 and CD8 T cells reprogram to ITNK upon loss of Bcl11b in vivo.

Flow cytometric analysis of CD4 and CD8 expression in NKp46⁺ ITNKs. Numbers refer to percentage of cells in the gate. Note that both CD4 and CD8 expression was down in ITNKs (CD4⁺NKp46⁺ or CD8⁺NKp46⁺) compared to CD4⁺NKp46⁻ or CD8⁺NKp46⁻ T cells. Numbers refer to percentage of cells in the gate. Data are representative of two mice.

Figure 4.22

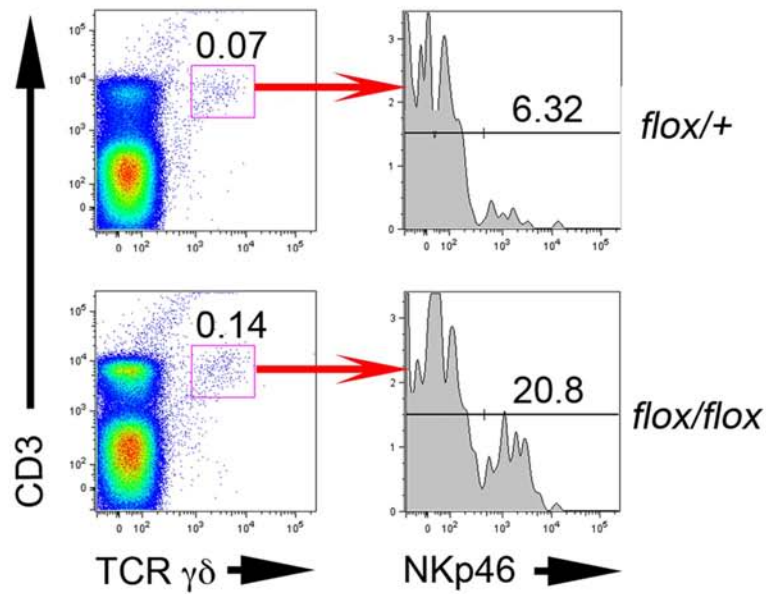


Figure 4.22 $\gamma\delta$ -T cells reprogram to ITNK cells upon loss of Bcl11b in vivo.

Flow cytometry analysis of ITNKs from thymic $\gamma\delta$ -T cells in OHT-treated *flox/flox* mice. Numbers refer to percentage of cells in the gate. Data are representative of two mice.

Figure 4.23

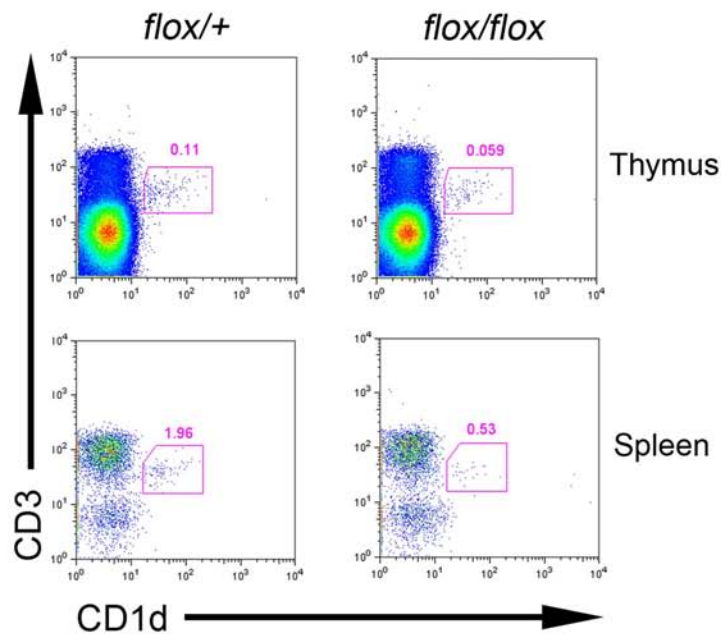


Figure 4.23 ITNKS are not NKT cells.

Flow cytometric analysis of CD1d-restricted NKT cells in thymus and spleen. Total lymphocytes and CD19⁻ splenocytes were gated in the thymus and spleen, respectively. Note the reduction of NKT cells in the OHT-treated *flox/flox* mice. Data are representative of two mice.

Figure 4.24

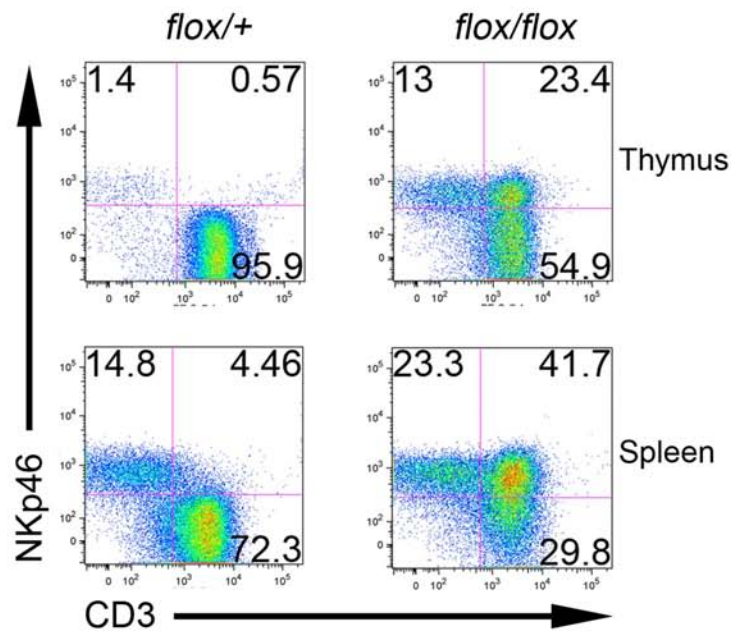


Figure 4.24 ITNK cells can be expanded in NK culture condition.

Flow cytometric analysis of cells following *ex vivo* expansion of whole thymocytes or splenocytes from OHT treated mice. Numbers refer to percentage of cells in the gate.

Data are representative of four experiments.

Figure 4.25

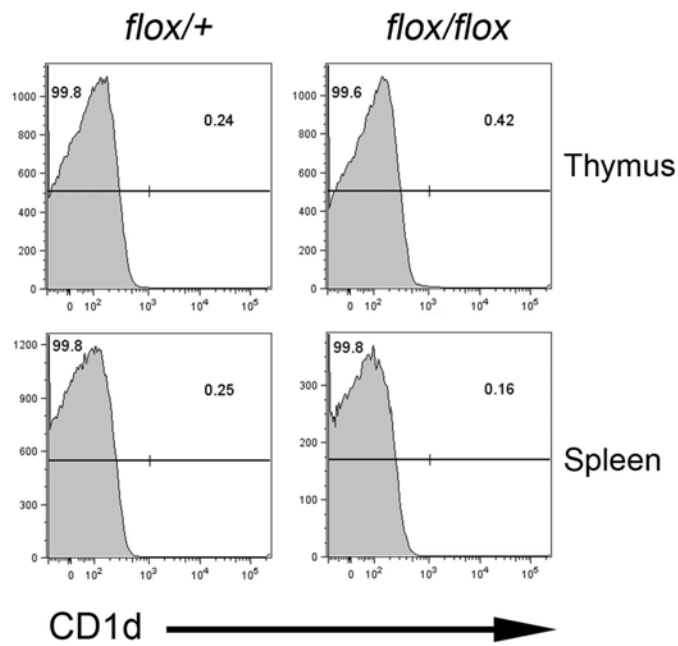


Figure 4.25 Ex vivo expanded ITNKs are not NKT cells.

Flow cytometry analysis of CD1d-restricted cells in the ex vivo expanded ITNK culture. Numbers refer to percentages in lymphocyte gate. Data are representative of four experiments.

Figure 4.26

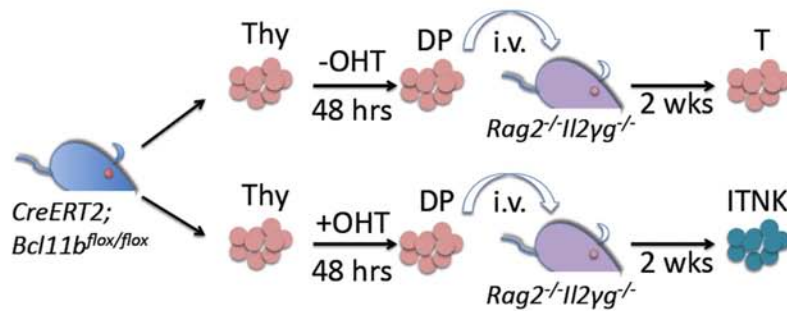


Figure 4.26 Experimental design for the analysis of in vivo reprogramming of DP thymocytes to ITNKs.

Whole thymocytes from *flox/flox* mice were treated with OHT (+OHT) or left untreated (-OHT) and 48-hours later DP cells were sorted and injected intravenously into *Rag2^{-/-}Il2γg^{-/-}* mice. Two weeks later, splenocytes, bone marrow (BM) and peripheral blood cells (PB) were analyzed by flow cytometry.

Figure 4.27

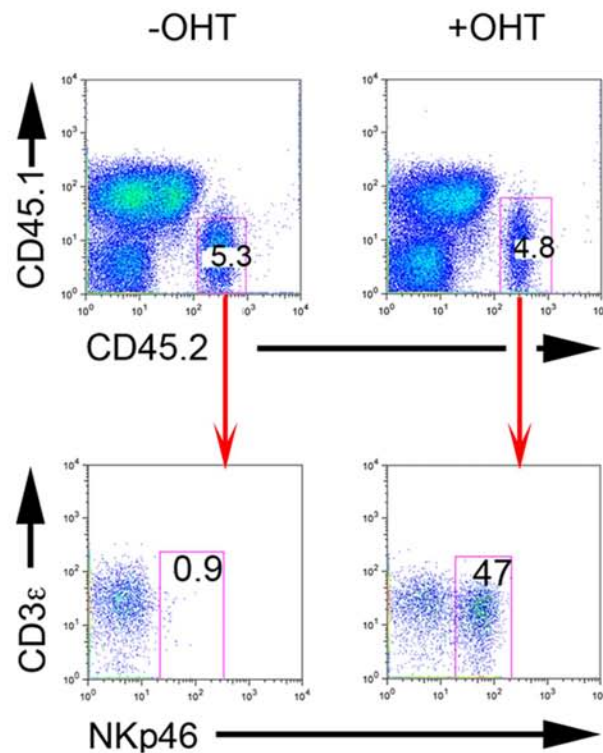


Figure 4.27 DP thymocytes reprogram to ITNKs upon loss of Bcl11b in vivo.

ITNKs production in $Rag2^{-/-}Il2\gamma^{-/-}$ recipients injected with *flox/flox* DP thymocytes.

Two weeks after injection, donor ($CD45.2^{+}$) and host ($CD45.1^{+}$) splenocytes were analyzed by flow cytometry. Numbers refer to the percentage of lymphocyte gate.

Plots are representative of 15 mice from three independent experiments.

Figure 4.28

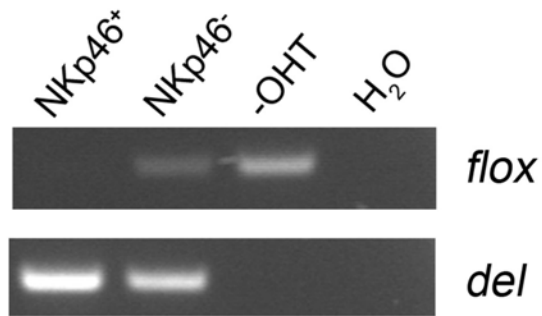


Figure 4.28 *Bcl11b* deletion in ITNKs.

PCR results show that ITNKs had complete *Bcl11b* deletion whereas donor derived NKp46⁻ cells still retained at least one copy of the *flox* allele. PCR data are representative of two individual experiments.

Figure 4.29

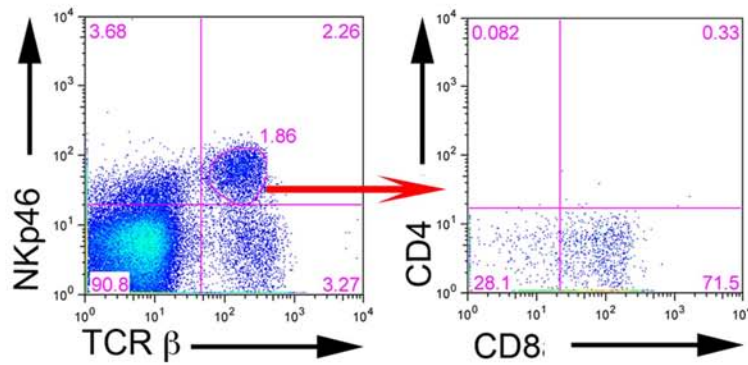


Figure 4.29 Most ITNKs in the spleen were CD8⁺.

Flow cytometry analysis shows that ITNKs derived from DP thymocytes in vivo did not express CD4 but CD8. Numbers in gates refer to percentages. Data are representative of three experiments.

Figure 4.30

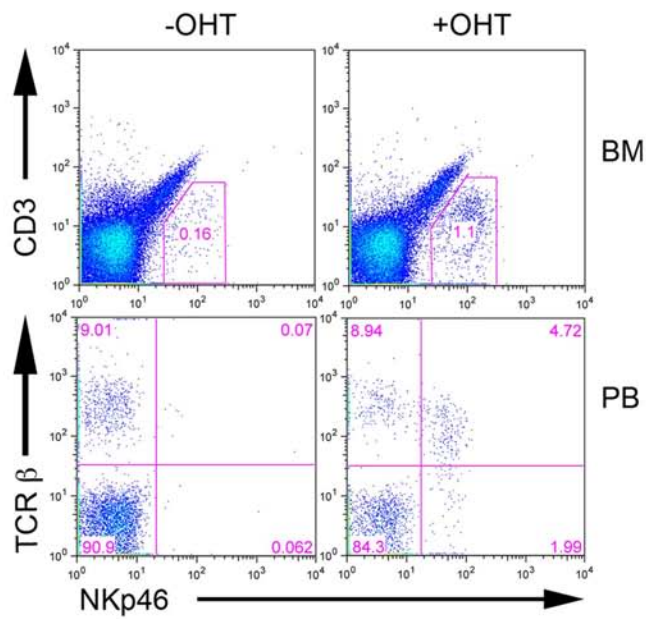


Figure 4.30 ITNKs in bone marrow and peripheral blood.

Flow cytometry analysis shows the percentages of ITNKs in bone marrow and peripheral blood. Numbers in gates refer to percentages. Data are representative of three experiments.

Figure 4.31

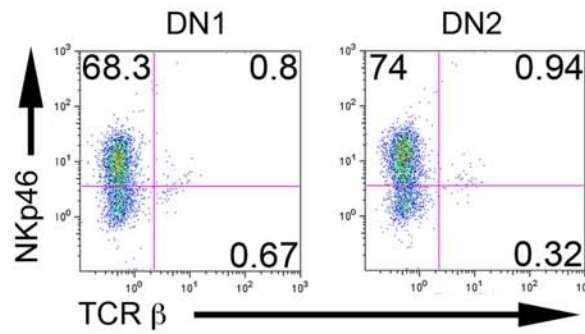


Figure 4.31 Production of NK-like cells from *Bcl11b*-deficient DN1 and DN2 thymocytes in absence of Notch signaling.

NKp46⁺TCR β ⁻ cells from OHT-treated DN1 (left panel) and DN2 (right panel) *flox/flox* thymocytes in the absence of IL-2 or IL-15 cultured on OP9 stromal cells.

Figure 4.32

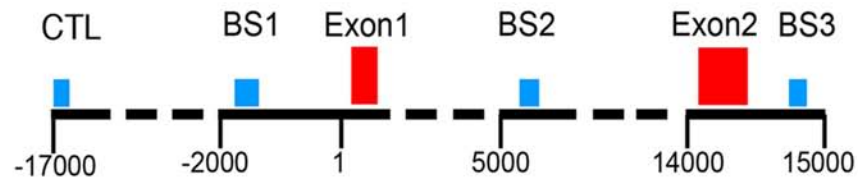


Figure 4.32 Putative CSL binding sites in *Bcl11b* locus.

Schematic of the *Bcl11b* locus showing three putative CSL binding sites (BS) and that of an irrelevant control binding site (CTL)

Figure 4.33

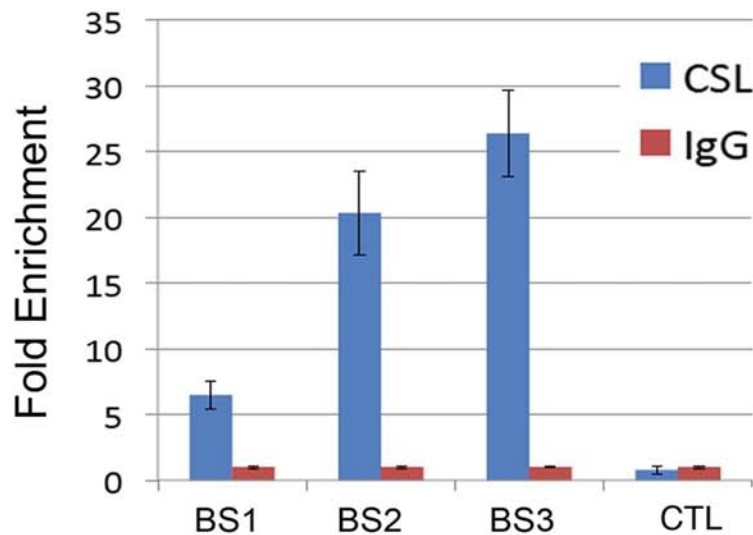


Figure 4.33 CSL directly binds to *Bcl11b* locus.

Genomic DNA was prepared from immunoprecipitation of thymocytes, by using CSL or control immunoglobulin G (IgG) antibodies, and was amplified by using primers flanking the putative CSL or the control binding sites at the *Bcl11b* locus. Three *Bcl11b*-binding regions: Region 1, about 1.8 kb from start of the transcription; region 2, 5.4 kb downstream of exon 1; region 3, about 600 base pairs downstream of exon 2. CSL, CSL antibody; IgG, control IgG. Fold-enrichment was calculated relative to the IgG control (set to 1). Bars are means \pm SD of triplicate samples.

Figure 4.34

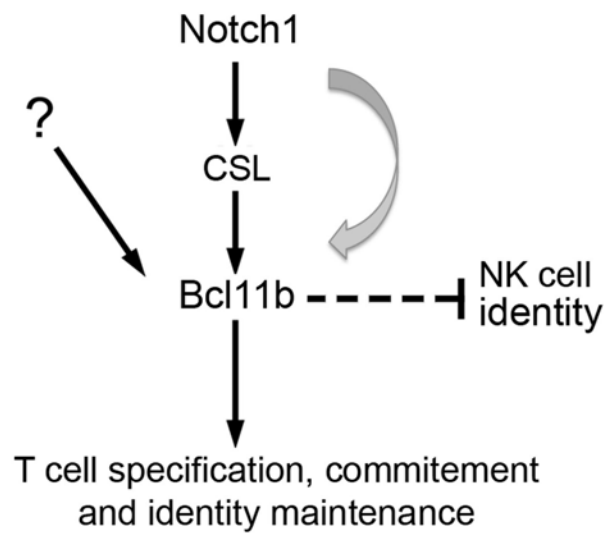


Figure 4.34 Bcl11b functions and networking in T cells.

A working model shows that Bcl11b acts downstream of Notch signaling and unknown pathways. Bcl11b promotes T cell development and maintains T cell identity and may also suppress NK cell identity.

Figure 4.35

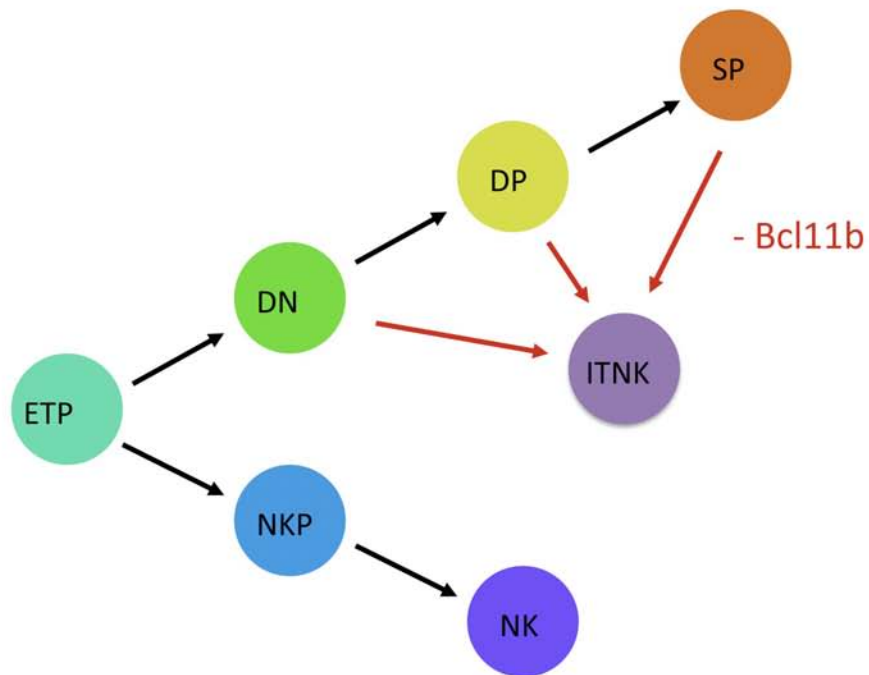


Figure 4.35 Summary of reprogram from various T cell subsets to ITNK cells. ETP, early T cell precursors; DN, double negative; DP, double positive; SP, single positive; ITNK, Induced T to natural killer cells; NKP, natural killer progenitors; NK, natural killer cells. Black arrows indicate differentiation and red arrows indicate reprogramming.

Figure 5.1

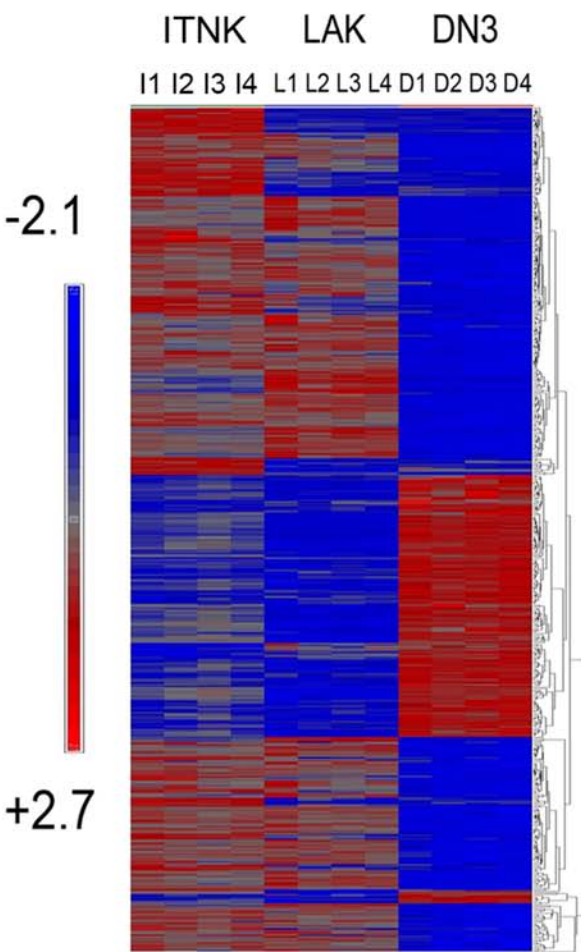


Figure 5.1 Comparison of gene expression profiles among ITNK, DN3 thymocytes and LAK.

Microarray analysis of gene expression in NKp46⁺CD3⁺ ITNK cells derived from DN3 thymocytes (columns I1 to I4), IL-2–expanded NK cells (LAK; L1 to L4) and sorted DN3 *flax/flax* thymocytes (DN3; D1 to D4) were subjected to expression. Two-way hierarchical cluster map of the array data. Column numbers (I1 to I4 for instance) refer to four independent RNA samples for each cell type, and rows represent individual transcripts. Scale indicates the log₂ value of normalized signal level.

Figure 5.2

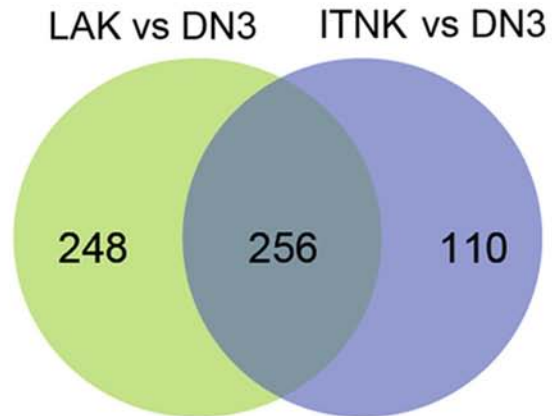


Figure 5.2 ITNKs were more similar to LAK than DN3 cells.

Venn diagram comparison of the upregulated (>2-fold) genes between LAK vs. DN3 (green) and ITNK vs. DN3 (purple) shows a significant overlapping between the two gene lists.

Figure 5.3

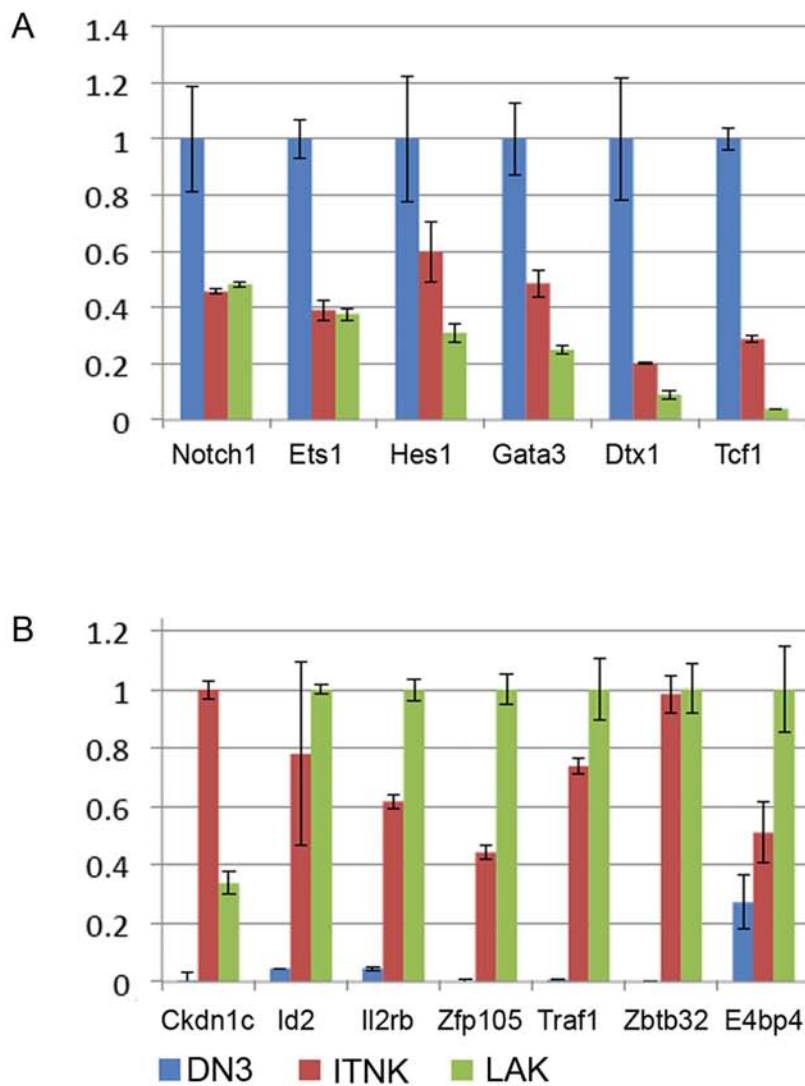


Figure 5.3 Validation of microarray analysis.

qRT-PCR was performed to validate gene expression of selected genes among ITNKs, LAKs, and DN3 cells. Bars are means \pm SD of three samples.

Figure 5.4

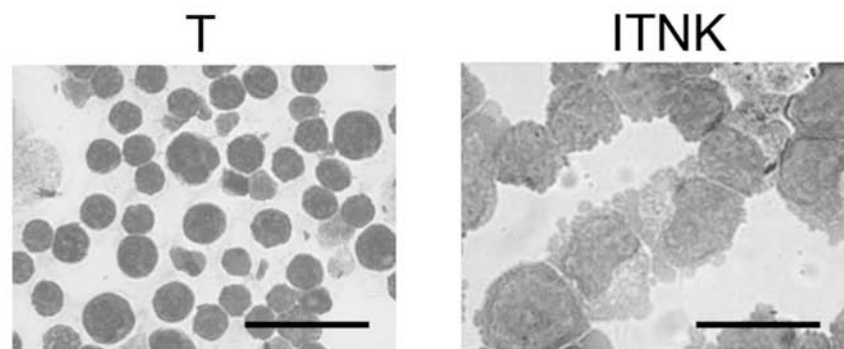


Figure 5.4 Comparison of ITNKs and T cells in morphology.

Giemsa stain of parental DN3 thymocytes (T) and ITNK cells. Scale bar, 20 μm.

Figure 5.5

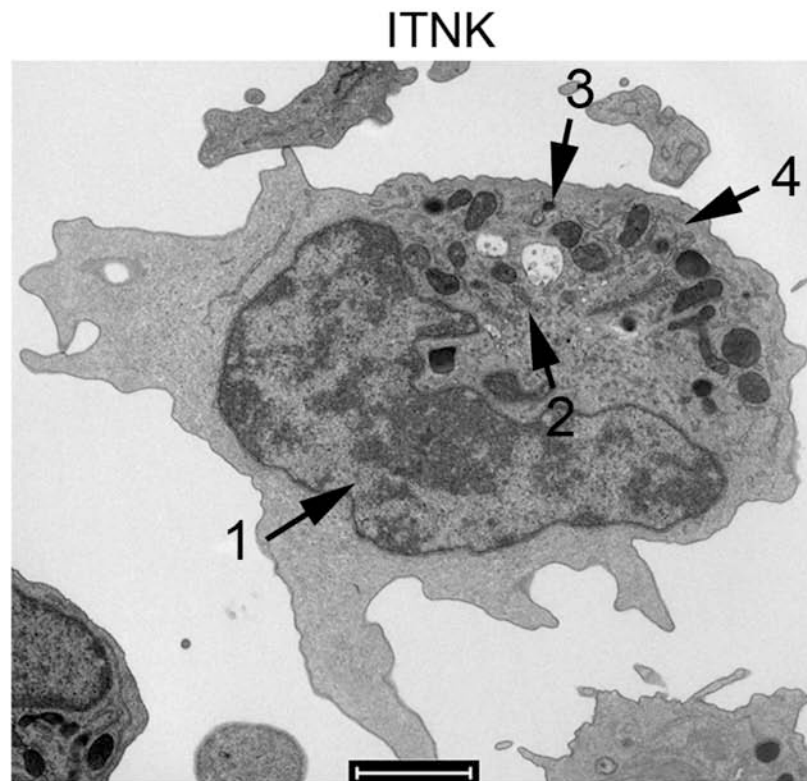


Figure 5.5 Morphology of ITNKs under electronic transmission microscopy.

Transmission electron micrograph of an ITNK cell. 1, Nucleus; 2, Golgi body; 3, granule; 4, endoplasmic reticulum. Scale bar, 2 μm .

Figure 5.6

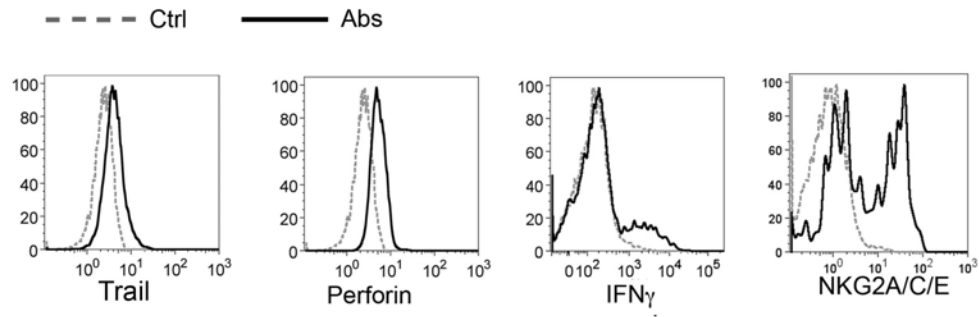


Figure 5.6 Expression of intracellular (TRAIL, perforin, IFN γ) and NK cell surface markers in ITNKs.

Flow cytometry analysis shows that ITNKs from DN3 thymocytes in vitro expressed TRAIL, perforin, IFN γ and NKG2A/C/E. Solid black lines represent experiments with antibody, while grey dash lines represent experiments with isotype control. Data are representative of three experiments.

Figure 5.7

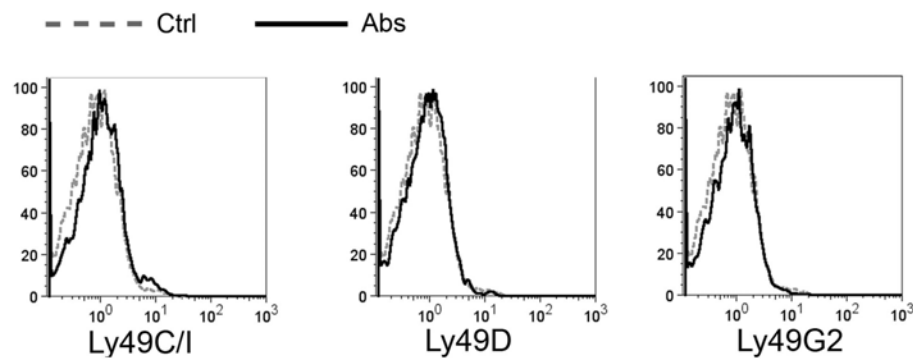


Figure 5.7 DN3-derived ITNKs did not express Ly49 family.

Flow cytometry analysis shows that ITNKs from DN3 thymocytes in vitro did not express some NK cell surface markers like Ly49C/I, Ly49D and Ly49G2. Solid black lines represent experiments with antibody, while grey dash lines represent experiments with appropriate isotype controls. Data are representative of three experiments.

Figure 5.8

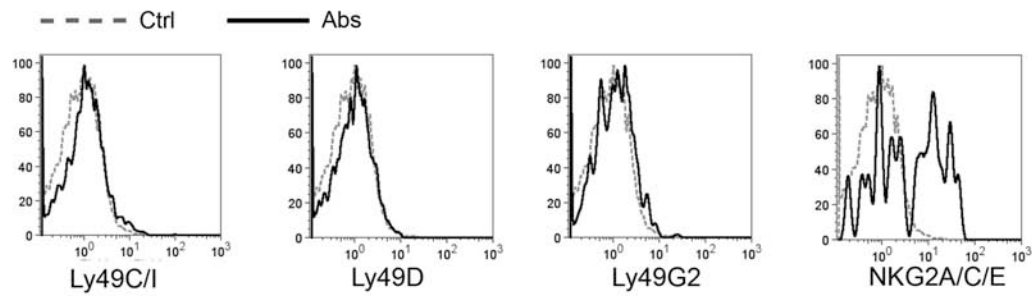


Figure 5.8 DP-derived ITNKs expressed NKG2A/C/E but not Ly49 family.

Flow cytometry analysis shows that ITNKs from DP thymocytes in vitro stained positively for NKG2A/C/E but not for Ly49C/I, Ly49D and Ly49G2. Solid black lines represent indicated antibody, while grey dash lines represent isotype control. Data are representative of three experiments.

Figure 5.9

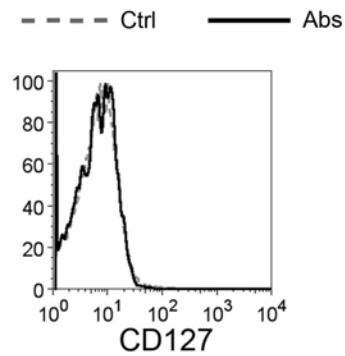


Figure 5.9 ITNKs were not thymic NK cells.

Flow cytometry analysis shows that ITNK cells did not express CD127. Solid black lines represent experiments with antibody, while grey dash lines represent experiments with isotype control. Data are representative of three experiments.

Figure 5.10

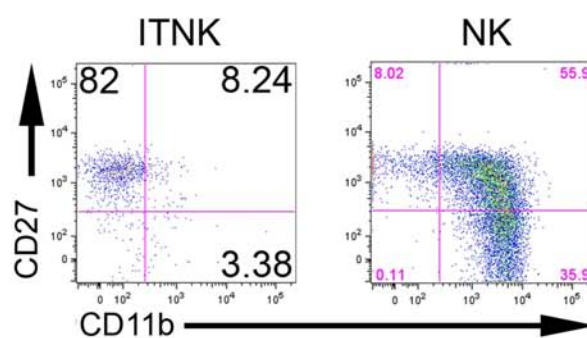


Figure 5.10 Expression of CD27 and CD11b on ITNK cells.

Flow cytometry analysis shows that ITNKs reprogrammed from DN3 thymocytes in vitro expressed CD27 but not CD11b. Numbers in gates refer to percentages. Data are representative of two experiments.

Figure 5.11

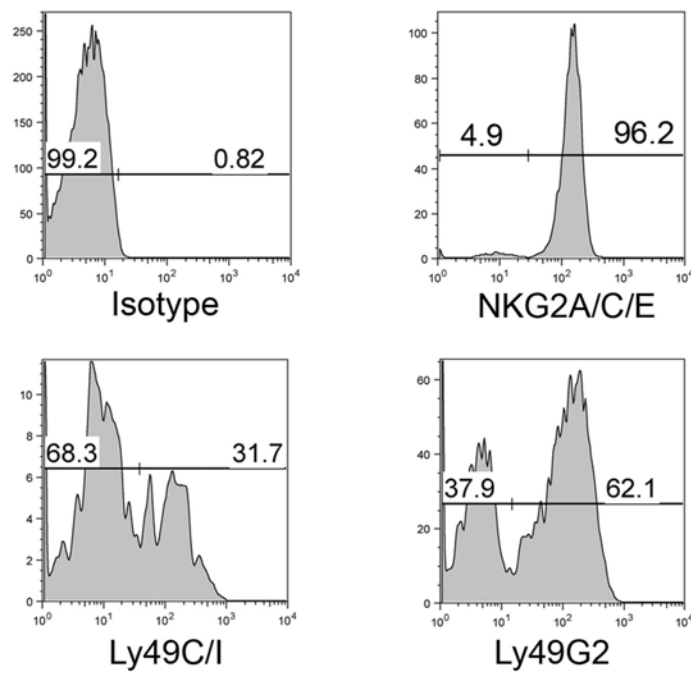


Figure 5.11 DP-derived ITNKs in vivo expressed NKG2A/C/E and Ly49 family. Flow cytometry analysis shows that ITNKs from DP thymocytes in vivo were stained positively for NKG2A/C/E, Ly49C/I, Ly49D and Ly49G2. Numbers in gates refer to percentages. Data are representative of three experiments.

Figure 5.12

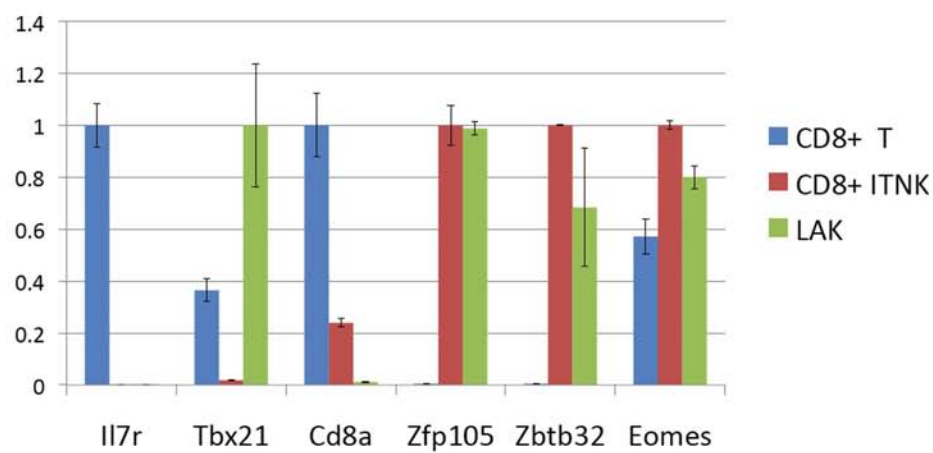


Figure 5.12 T cell associated genes decreased in ITNK cells.

qRT-PCR analysis of several key T or NK cell-associated genes in CD8⁺ T cells, CD8⁺ ITNKs and LAKs. Bars are mean \pm SEM of 3 samples. The highest expression level for each gene was chosen as 1.

Figure 5.13

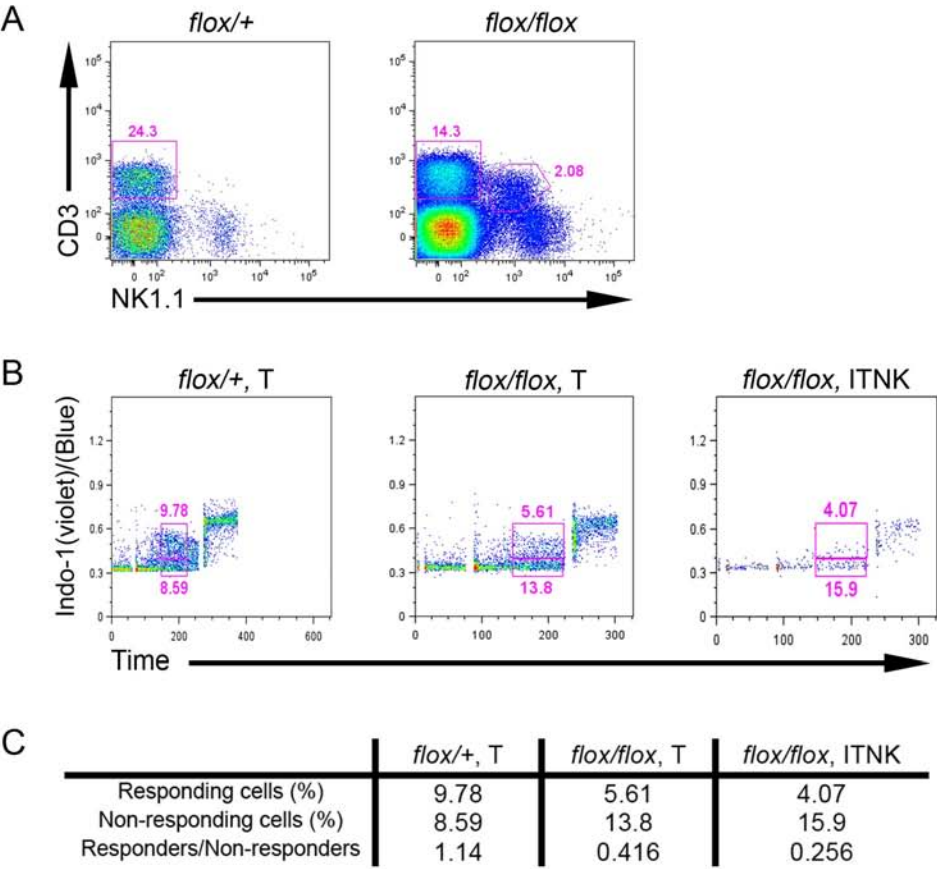


Figure 5.13 ITNK cells have compromised TCR signaling.

Splenocytes from *flox/flox* or *flox/+* mice treated with Tamoxifen were stained with NKp46, NK1.1, CD8 and CD3 to confirm expression of CD3 on ITNKs. A separate aliquot was loaded with Indo-1, stained with antibodies to NKp46, NK1.1 and CD8 and analyzed for calcium flux by flow cytometry. Top panel: Phenotype of splenocytes from *flox/flox* or *flox/+* mice indicating gated T cells (CD3⁺NKp46⁻) and ITNKs (CD3⁺NKp46⁺) cells. Numbers refer to percentages in gates of total lymphocytes. Lower panel: Calcium flux plots from the indicated cell subset. A baseline was established at the start of the assay, before acquisition was interrupted and anti-CD3 (145-2C11) was added (first arrow). CD3 was then cross-linked by

addition of anti-hamster secondary antibody (second arrow). Ionomycin was added (third arrow) as a positive control. Numbers in gates refer to responders (upper gate) and non-responders (lower gates) after addition of anti-hamster antibody. Data below calcium plots show ratio of responders to non-responders in gated area. Data are representative of two mice.

Figure 5.14

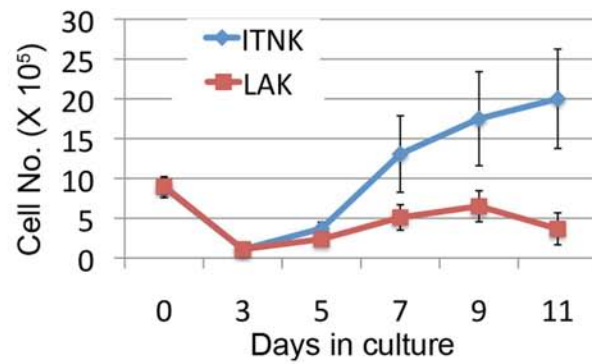


Figure 5.14 Splenocytes of the recipient mice can be expanded ex vivo.

Growth curved was drew based on numbers of viable cells that were counted at the indicated time points. Bars are means \pm SD of four samples.

Figure 5.15

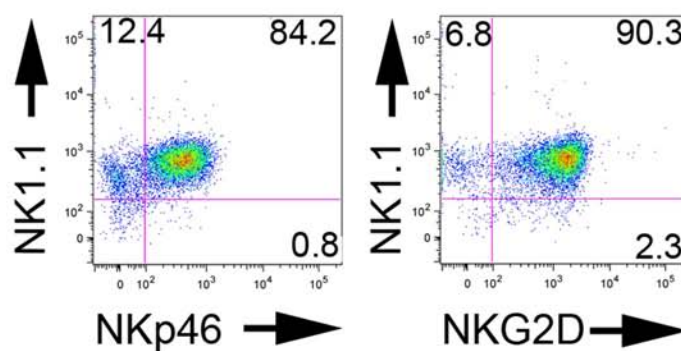


Figure 5.15 Ex vivo expansion of ITNKs.

Flow cytometry analysis shows that most cells in the culture were ITNKs because they expressed NKp46, Tcr β , NK1.1, and NKG2D. Numbers in gates refer to percentages. Data are representative of four experiments.

Figure 5.16

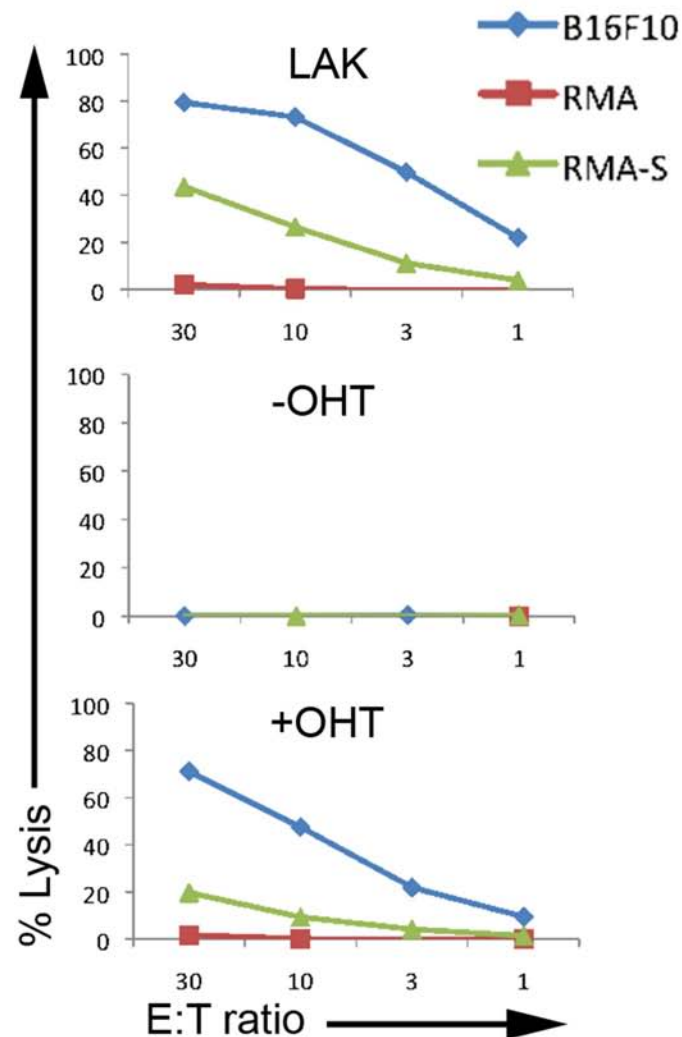


Figure 5.16 ITNK cells killed NK targets in killing assays.

The cytotoxicity of ITNKs (labeled as “+OHT”, bottom panel) and LAKs (top panel) was measured in standard ^{51}Cr -release assays with B16F10, RMA, and RMA-S tumor cell targets at the indicated effector-to-target (E:T) ratios. -OHT: *flox/flox* T cells (middle panel). Data are means of triplicate wells.

Figure 5.17

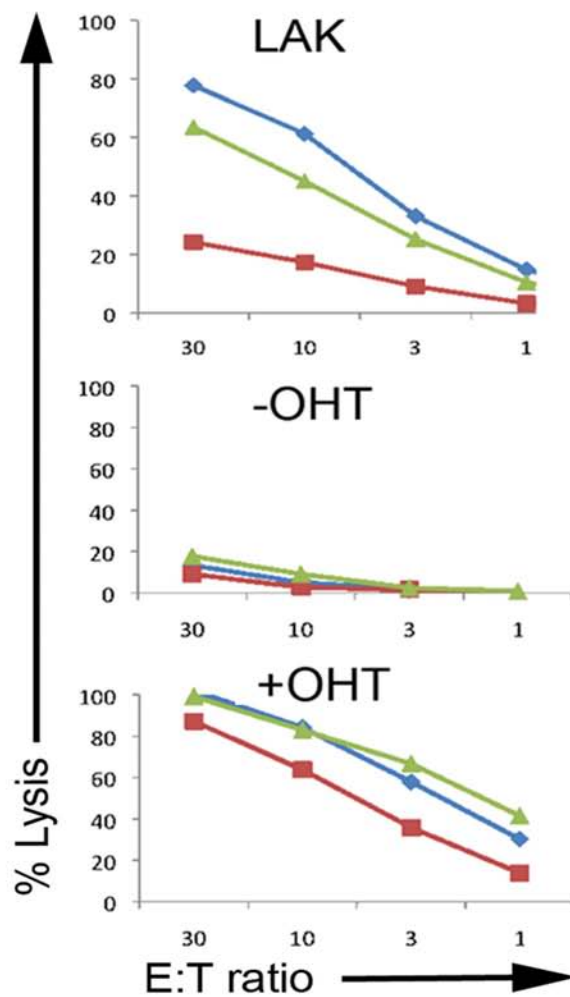


Figure 5.17 ITNK cells killed NK targets in killing assays.

The cytotoxicity of ex vivo expanded ITNKs (labeled as “+OHT”, bottom panel) and LAKs (top panel) was measured in standard ^{51}Cr -release assays with B16F10, RMA, and RMA-S tumor cell targets at the indicated effector-to-target (E:T) ratios. -OHT: *flox/flox* T cells (middle panel). Data are means of triplicate wells. Results are representative of three experiments.

Figure 5.18



Figure 5.18 Experiment design for tumour killing assays in vivo.

Rag2^{-/-}Il2rg^{-/-} recipients were transplanted with treated (+OHT) or untreated (-OHT) *flox/flox* DP thymocytes or PBS. Recipients were subsequently injected intravenously with 5×10^4 B16F10 melanoma cells. Lung tumour colonies were enumerated two weeks after tumour challenge. Experiment was performed twice.

Figure 5.19

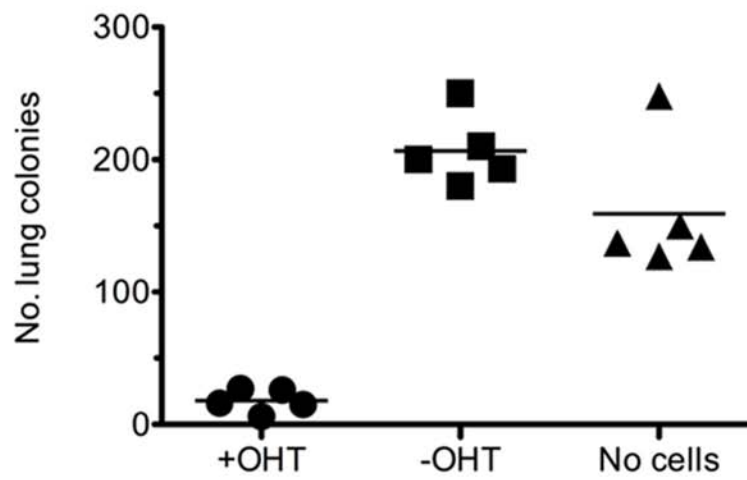


Figure 5.19 ITNKs prevented tumor metastasis.

Rag2^{-/-}*Il2rγ*^{-/-} recipients first transplanted with treated (+OHT) or untreated (-OHT) *flox/flox* DP thymocytes or phosphate-buffered saline. Recipients were subsequently injected intravenously with 50,000 B16F10 melanoma cells. Lung tumor colonies were enumerated 2 weeks after tumor challenge. Data are from individual mice, and bars represent the means.

Figure 5.20

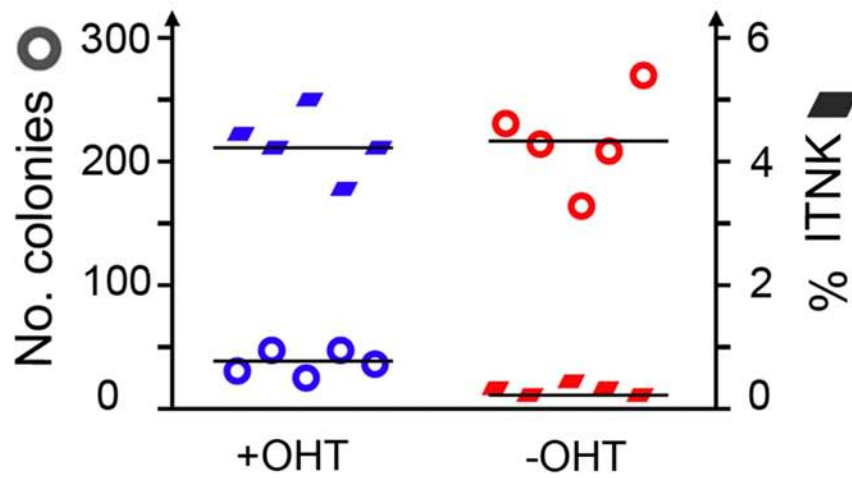


Figure 5.20 Killing ability was coordinated with numbers of ITNKs.

Plot shows inverse correlation between the percentage of ITNK cells (squares) obtained from recipient mice following *in vivo* reprogramming and tumor challenge and the number of lung colonies (circles) observed. Data are individual mice and are representative of two independent experiments, each with 5 mice per group.

Figure 6.1

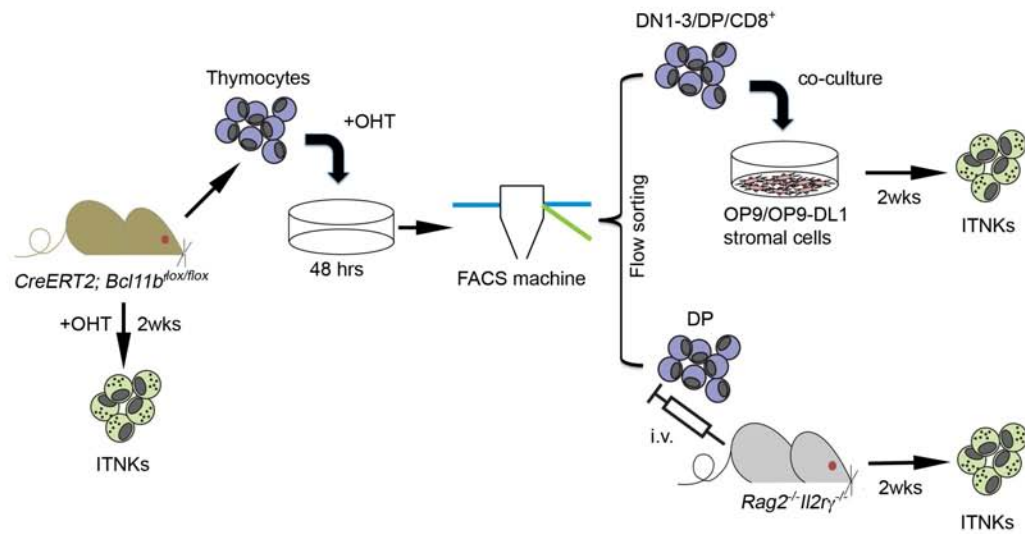


Figure 6.1 Reprogramming mouse T cells to ITNKs upon *Bcl11b* deletion (Pentao Liu, 2010).

ITNKs have been produced using three approaches. The flox/flox mice are treated with Tamoxifen to delete *Bcl11b*. ITNKs are found in peripheral blood, the spleen and thymus of the treated mice in a couple of weeks. Alternatively, *Bcl11b* are also deleted in vitro in thymocytes. Whole thymocytes from *flox/flox* mice are treated with Tamoxifen, which are then sorted into different subsets and cultured on stromal cells for ITNK production. DP thymocytes sorted from these whole thymocytes are also transferred into *Rag2^{-/-}Il2rγ^{-/-}* mice. ITNKs are detected in these recipient mice a couple of weeks after the injection.

Figure 6.2

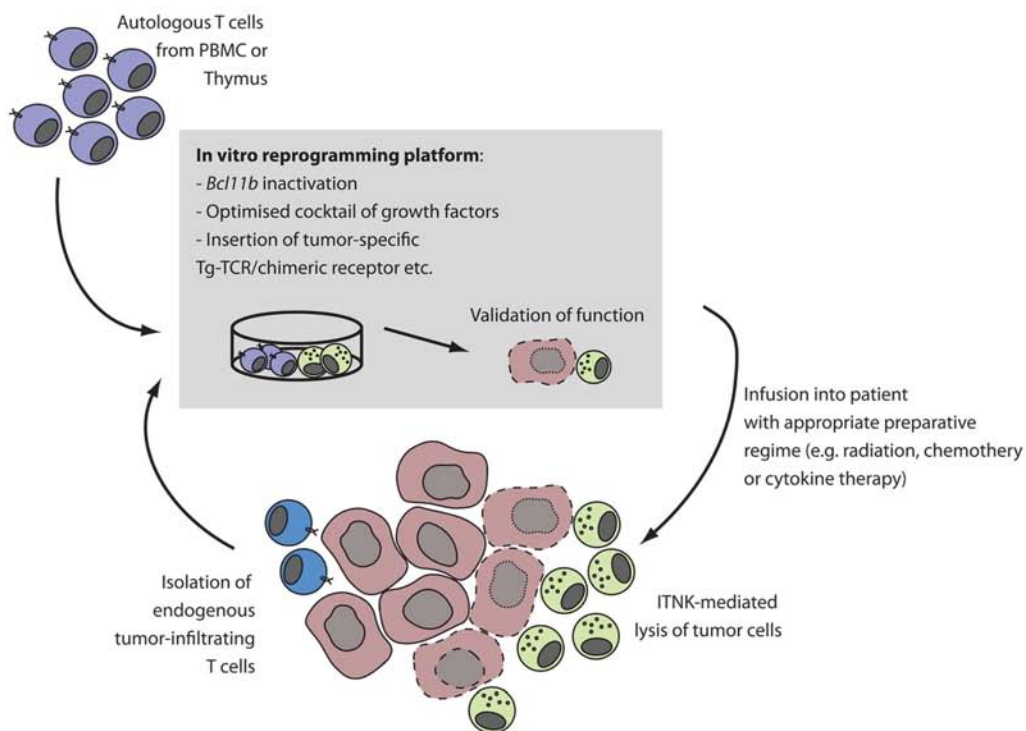


Figure 6.2 A potential platform for the production and application of human ITNKs (Pentao Liu, 2010).

Autologous T cells from PBMC or endogenous tumor-infiltrating T cells from the patient or allogeneic thymocytes are isolated and cultured in the in vitro reprogramming conditions. Several alternative approaches to modify the T cells, including *Bcl11b* inactivation, conditioning in optimized cocktails of growth factors, and insertion of tumor-specific Tg-TCR/chimeric receptors in this reprogramming platform. Then ITNKs are validated for their killing and self-tolerance capacities. Selected ITNKs are expanded and infused into patients where these ITNKs encounter and kill tumor cells. Reduction in the tumor volume by appropriate preparative regimes, including radiotherapy or chemotherapy and the co-administration of cytokine adjuncts may potentiate ITNK treatment efficacy.

Pentao Liu, P.L., Shannon Burke (2010). Critical Roles of Bcl11b in T Cell Development and Maintenance of T Cell Identity. Immunological Reviews *In press*.

Table 1. The list of primers in this study.

Genotyping primers.

Genotyping PCR primers	Primer sequences (5'-3')	Size of PCR products (bp)
Bcl11b-cko-FW	TGAGTCAATAAACCTGGGCGAC	243 (wild type); 345 (<i>flox</i>); 450 (<i>del</i>)
Bcl11b-cko-RV	GGAATCCTTGGAGTCACTTGTGC	
Bcl11b-cko-DEL	TCCTGGTAACACACAATTGC	

qRT-PCR primers.

qPCR primers	Primer sequences (5'-3')
Notch1-Fwd	CCCTTGCTCTGCCTAACGC
Notch1-Rev	GGAGTCCTGGCATCGTTGG
Ets1-Fwd	TTAGGAAAGGCTCGTTTGCTC
Ets1-Rev	CCAAAGCACAAAGCATAGTTTGC
Hes1-Fwd	CCAGCCAGTGTCAACACGA
Hes1-Rev	AATGCCGGGAGCTATCTTTCT
Gata3-Fwd	CTCGGCCATTTCGTACATGGAA
Gata3-Rev	GGATACCTCTGCACCGTAGC
Deltax1-Fwd	TGTTCAAGGCTATACACGCATCAA
Deltax1-Rev	CCACCGCCCACTTTCAAG
Tcf1-Fwd	ATGGGCGGCAACTCTTTGAT
Tcf1-Rev	CGTAGCCGGGCTGATTCAT
Cdkn1c-Fwd	CGAGGAGCAGGACGAGAATC
Cdkn1c-Rev	GAAGAAGTCGTTTCGCATTGGC
Id2-Fwd	ATGAAAGCCTTCAGTCCGGTG
Id2-Rev	AGCAGACTCATCGGGTCGT
Il2rb-Fwd	TGGAGCCTGTCCCTCTACG
Il2rb-Rev	TCCACATGCAAGAGACATTGG
Zfp105-Fwd	GGCATCCAGCCAACAAGTGTA
Zfp105-Rev	CATTTCCCTGACCCTTTTCCTCAT
Traf1-Fwd	GGAGGCATCCTTTGATGGT A
Traf1-Rev	AGGGACAGGTGGGTCTTCTT
Zbtb32-Fwd	GCTCTGAGAGAGGACTTGGGA
Zbtb32-Rev	TGCTTTATGCTTGTGTGACATCT

Tcrb rearrangement PCR primers.

PCR primers	Primer sequences (5'-3')
TCRB_D β 2-Fwd	GTAGGCACCTGTGGGGAAGAACT
TCRB_V β 2-Fwd	GGGTCACTGATACGGAGCTG
TCRB_J β 2-Rev	TGAGAGCTGTCTCCTACTATCGATT

List of primers for ChIP assay qPCR.

PCR primers	Primer sequences (5'-3')
BS1-Fwd	CCGCTACGAGGCACCCTCCTTT
BS1-Rev	AGTCTCCTTGGGAAGCACGCGCTA
BS2-Fwd	GCTTGCTTGTTTTTAATTCAGTTTATGGG
BS2-Rev	TTGAATGTCTGTGTTGGTGTGTAATCAC
BS3-Fwd	GTGAAAAAAAGGGGGTAGGCCCTC
BS3-Rev	CAGCCCAAAGTCAAAAGGCAAGATG
CTL-Fwd	G TTCCTTA ACTGAGAGTTCCTCCTCCC
CTL-Rev	TCACTCTGGGCCGGAGTCAGTT

Table 2. Changes of gene expression profiles in thymocytes at 24 and 48 hours after deletion of Bcl11b in microarray analysis.

24 hours

Column ID	Fold-Change (+OHT vs. -OHT)
HMGCS1	27.1719
FCER1G	7.97969
CYBA	6.431
LDH1	3.82439
CD52	3.81745
1300002F13R1	3.6466
ATP5G3	3.54832
UBL5	3.35851
LAPTM5	2.8707
RPA1	2.26914
LOC270037	2.16383
COX7C	2.11831
TCRB-V8.2	-2.00629
RPS14	-2.0086
BCL11B	-2.011
4932414K18R	-2.01727
AA408556	-2.03945
VIM	-2.04688
MARCKS	-2.05494
CD27	-2.07584
COX6A2	-2.10037
RNPEPL1	-2.11344
RPL8	-2.11346
RPS27	-2.14844
CDCA7	-2.15035
E430002D04R	-2.15383
HIBADH	-2.16873
TRBV1_AE000	-2.17733
PSAP	-2.20351
CSTB	-2.21395
UPP1	-2.22963
HMG2	-2.2528

48 hours

Column ID	Fold-Change (+OHT vs. -OHT)
ROG	11.7941537
FCER1G	11.6317801
UPP1	9.00046788
IFITM1	8.6938789
SCIN	8.6938789
SERPINA3G	8.51496146
XCL1	7.62110398
AQP9	7.4127045
NKG7	7.01284577
IFITM2	6.40855902
IFITM3	6.36429187
9130404D14R	5.69620078
GADD45G	5.6177795
LGALS3	5.46416103
CD160	5.31474326
KLRD1	5.27803164
VIM	4.9933222
TYROBP	4.89056111
LITAF	4.82323131
BC025206	4.78991482
AVIL	4.72397065
LMNA	4.72397065
GLRX1	4.40762046
NFIL3	4.40762046
LTA	4.1410597
CCR5	4.0278222
WBSCR5	4
P2RY14	3.91768119
1300002F13R1	3.83705648
AMICA1	3.73213197
LOC270152	3.70635225
9130211I03RI	3.6553258

TCRB-V8.2	-2.2788
HMGCS1	-2.30359
LOC382896	-2.35265
PPIA	-2.37637
LOC381808	-2.39227
TXNIP	-2.40294
MTDNA_ATP6	-2.41506
RPS17	-2.41723
LOC434197	-2.4265
UBB	-2.45105
TCRG-V4	-2.54552
A130092J06R1	-2.55682
IGH-6	-2.5636
AI481316	-2.62333
HIST1H2AG	-2.64205
G22P1	-2.74634
LOC226574	-2.74888
HIST1H2AF	-2.78505
PRKACB	-2.90749
CD8B	-3.01933
THY1	-3.11285
TBCA	-3.1281
PDLIM4	-3.15574
EMP3	-3.22525
HIST1H2AO	-3.29719
CD3E	-3.30996
RPL23	-3.38327
CD160	-3.44386
EG668668	-3.46858
CD3G	-3.49152
RPS27L	-3.63035
RPL39	-3.69839
ITGB7	-4.05052
RPS11	-4.20813

CDKN2B	3.6553258
PLCG2	3.55537072
CTSW	3.53081199
BC049975	3.50642289
LOC381140	3.36358566
LGALS1	3.34035168
MT1	3.27160823
SYTL2	3.27160823
GPR114	3.24900959
S100A1	3.24900959
2310067E08R	3.20427951
LRRK1	3.20427951
TNFRSF11B	3.18214594
IDB2	3.16016525
CCL4	3.11665832
E030006K04R	3.11665832
OSBPL3	3.11665832
LY6A	3.09512999
TNFRSF9	3.09512999
S100A6	3.07375036
1500031H04R	3.05251842
2210411K11R	3.05251842
CTNNA1	3.03143313
LOC381319	3.03143313
EMILIN2	3.01049349
1110018K11R	2.9896985
ANXA2	2.9896985
SIAT10	2.96904714
2310046K01R	2.94853843
CISH	2.92817139
1110004P15R	2.90794503
GOLPH2	2.88785839
HAVCR2	2.88785839
PLSCR1	2.88785839

MYLC2PL	-4.32543
MT-CYTB	-4.34
HIST1H2AI	-4.60413
MTDNA_ND4	-4.61459
IFITM3	-4.86541
HIST2H2AC	-4.87534
18S_RRNA_XC	-5.08974
RPL41	-5.29871
RPS17	-5.30823
RPL13	-5.33629
IFITM2	-5.49522
CD3D	-5.74896
MYLC2PL	-6.76599
RPS14	-6.99771
MTDNA_COXII	-8.38116
RPS29	-9.27924
CD3D	-9.81142
PDLIM4	-10.206
CDCA7	-12.2615
IFITM1	-12.6519
MTDNA_CYTB	-13.7646
HIST1H2AO	-35.3085
TCRB-V13	-412.694
TCRB-V13	-14894.3

SLC2A6	2.8679105
CAPG	2.84810039
LAG3	2.84810039
F2R	2.82842712
LOC269941	2.82842712
1190002C06R	2.80888975
CD9	2.78948733
S100A11	2.78948733
GCNT1	2.75108364
CDKN1A	2.73208051
KLRE1	2.73208051
GPC1	2.71320865
SERPINE2	2.69446715
LRP12	2.67585511
MLKL	2.67585511
BC024955	2.65737163
BHLHB2	2.65737163
C330008K14R	2.65737163
F2RL2	2.63901582
GLRX	2.63901582
IFNG	2.62078681
PGLYRP1	2.62078681
1110007C02R	2.60268371
BC029169	2.60268371
TRAF1	2.60268371
CDKN2A	2.58470566
DUSP6	2.58470566
LY6G5B	2.58470566
RGS1	2.5668518
MYO1F	2.54912125
HBA-A1	2.53151319
2310047C17R	2.51402675
AIM1L	2.51402675
PILRB	2.4966611

2410008K03R	2.4794154
APOB48R	2.4794154
PDGFA	2.4794154
FURIN	2.46228883
SPP1	2.46228883
ROM1	2.44528056
SH3BP2	2.44528056
PPP3CC	2.42838977
B4GALNT4	2.41161566
IER3	2.41161566
OSM	2.41161566
DAPK2	2.39495741
LOC218482	2.39495741
MAPKAPK3	2.39495741
PLP2	2.37841423
BAG3	2.36198532
OSTF1	2.36198532
SERPINB6A	2.3456699
FXVD4	2.32946717
LOC327957	2.32946717
AHNAK	2.29739671
CD69	2.28152743
HK2	2.28152743
FES	2.26576777
IL18R1	2.26576777
PPAP2C	2.26576777
SLC39A4	2.25011697
TES	2.25011697
TNF	2.25011697
HGFAC	2.23457428
CD244	2.21913894
6330414G02R	2.20381023
CD63	2.20381023
LOC383981	2.1885874

NAPSA	2.1885874
PKP3	2.1885874
EMP1	2.17346973
FOSL2	2.17346973
GLIPR1	2.17346973
NT5E	2.17346973
SLC24A3	2.17346973
2610009E16R	2.15845647
1110020C13R	2.14354693
D10BWG1379I	2.14354693
ID2	2.14354693
DOK2	2.12874036
LOC381924	2.12874036
2210008N01R	2.11403608
5330403J18RI	2.11403608
HIST1H1C	2.09943337
0610037M15R	2.08493152
7420404O03R	2.08493152
A430006M23R	2.07052985
D930046M13F	2.07052985
GNG2	2.07052985
GPR68	2.07052985
H2-Q8	2.07052985
IFI30	2.07052985
ZFP608	2.07052985
DCI	2.05622765
NFKB1	2.05622765
PIM3	2.05622765
SGK	2.05622765
CCNG1	2.04202425
CYP51	2.04202425
LOC385953	2.04202425
EGR1	2.02791896
HHEX	2.02791896

MYO1E	2.02791896
TMEM126A	2.02791896
NCF4	2.0139111
PDLIM7	2.0139111
CXCL9	2
GPR18	2
MVP	2
PRSS19	2
A130038J17R	-2.0139111
A130093I21R	-2.0139111
EPHX1	-2.0139111
NOTCH3	-2.0139111
MTF2	-2.02791896
TNFRSF7	-2.02791896
4932414K18R	-2.04202425
GFI1	-2.04202425
2410008J05R	-2.05622765
2610019F03R	-2.07052985
H2-OB	-2.07052985
SATB1	-2.07052985
TCF7	-2.07052985
2900060B14R	-2.08493152
TBXA2R	-2.08493152
NISCH	-2.09943337
LOC434197	-2.11403608
PARD6G	-2.11403608
DPP4	-2.14354693
H2-AB1	-2.14354693
LMAN2L	-2.14354693
BRD3	-2.15845647
CD27	-2.15845647
LOC386192	-2.15845647
H2-EB1	-2.17346973
NCK2	-2.17346973

RAMP1	-2.17346973
1110046J11R1	-2.1885874
AQP11	-2.23457428
SLA	-2.23457428
MARCKS	-2.25011697
IGH-6	-2.26576777
SH2D1A	-2.26576777
F730003H07R	-2.29739671
H2-T10	-2.29739671
DGKA	-2.31337637
DNTT	-2.31337637
ETS1	-2.32946717
LOC268393	-2.32946717
LOC386360	-2.32946717
TMEM108	-2.32946717
C230098O21R	-2.36198532
RNPEPL1	-2.36198532
G22P1	-2.37841423
TRBV31_X032	-2.37841423
ALDH2	-2.42838977
CDCA7	-2.46228883
NRP	-2.46228883
TXNIP	-2.46228883
SLC16A5	-2.4966611
ACAS2L	-2.51402675
FRAT2	-2.54912125
CD81	-2.63901582
PRKCB	-2.65737163
PDLIM4	-2.67585511
H2-BL	-2.71320865
PP11R	-2.73208051
ACTN1	-2.75108364
CD6	-2.75108364
CD2	-2.78948733

ST6GAL1	-2.80888975
TRBV1_AE000	-2.80888975
CD8B	-2.84810039
9430068D06R	-2.8679105
AI132321	-3.07375036
H19	-3.16016525
LY6D	-3.38698125
CTSE	-3.50642289
BCL11B	-3.58010028
LOC382896	-4.59479342
COX6A2	-6.27667278

Table 3. Comparison of gene expression profiles of ITNK, DN3 and LAK cells in microarray analysis.

ITNKs vs. DN3

Column ID	p-value (iTNK vs. DN3)	Ratio (iTNK vs. DN3)	Fold-Change (iTNK vs. DN3)
FCER1G	1.61E-08	38.85427	38.8542
ROG	3.56E-09	38.51902	38.519
UPP1	1.59E-11	27.95436	27.9543
IFITM1	3.53E-06	27.42649	27.4265
XCL1	1.21E-06	25.36912	25.3691
SERPINA3G	7.75E-08	21.14876	21.1487
SCIN	1.90E-08	20.78544	20.7854
NKG7	1.76E-08	20.18204	20.182
AQP9	1.71E-07	18.25221	18.2522
KLRD1	7.30E-09	17.17812	17.1781
LGALS3	7.17E-09	15.91703	15.917
AVIL	9.13E-07	13.61854	13.6185
IFITM3	1.54E-07	13.57143	13.5714
TYROBP	1.57E-09	13.52446	13.5245
GADD45G	4.52E-08	13.52446	13.5245
CD160	3.07E-07	12.64066	12.6407
IFITM2	4.83E-06	11.27457	11.2746
CTSW	3.28E-06	9.798062	9.79809
9130404D14RIK	6.12E-09	9.67998	9.67995
LOC270152	2.41E-07	9.530163	9.53016
BC025206	1.38E-08	9.063061	9.06307
VIM	3.49E-08	8.891971	8.89195
NFIL3	2.83E-06	8.426872	8.42689
AMICA1	9.38E-08	8.267811	8.26778
LTA	1.13E-11	8.210653	8.21067
GLRX1	2.07E-06	8.027744	8.02777
LITAF	1.96E-07	7.727498	7.72749
CCR5	6.07E-09	7.323325	7.32333
LMNA	5.83E-08	7.235052	7.23503
BC049975	2.32E-08	6.98856	6.98858
P2RY14	1.44E-07	6.797496	6.79748
WBSCR5	8.76E-08	6.486767	6.48677

LAKs vs. DN3

Column ID	p-value(LAK vs. DN3)	Ratio (LAK vs. DN3)	Fold-Change (LAK vs. DN3)
GZMD	2.97E-07	79.34115	79.3413
FCER1G	8.83E-09	50.30055	50.3005
ROG	3.50E-09	38.7869	38.787
CCL4	4.38E-08	38.5859	38.5858
KLRE1	6.58E-11	35.19986	35.1999
MT1	1.56E-07	35.01744	35.0174
SPP1	2.96E-08	32.50299	32.503
AVIL	8.90E-08	30.64326	30.6433
TYROBP	1.95E-10	26.86208	26.8621
GZME	6.58E-10	26.17287	26.1729
XCL1	1.12E-06	26.12753	26.1276
ASB2	4.61E-10	25.81251	25.8125
KLRA7	9.89E-11	22.70596	22.706
PRF1	9.89E-08	22.23868	22.2387
KLRD1	4.72E-09	19.83533	19.8353
LGALS3	4.28E-09	18.79791	18.7979
GZMG	6.92E-08	18.06342	18.0634
KLRA18	6.87E-08	16.67945	16.6795
SERPINA3	1.62E-07	16.50693	16.5069
NKG7	3.26E-08	16.47835	16.4784
LTB4R1	3.28E-07	16.13924	16.1392
GADD45G	2.57E-08	16.0834	16.0834
CTSG	5.88E-06	15.94464	15.9446
CCL3	2.43E-07	15.56248	15.5625
NFIL3	3.46E-07	15.34823	15.3482
AQP9	3.11E-07	15.03237	15.0324
1300002F1	2.22E-07	14.44502	14.445
KLRA4	9.74E-08	14.24615	14.2461
LITAF	2.42E-08	13.45435	13.4543
KLRA3	5.93E-09	13.26911	13.2691
LRRK1	1.90E-09	13.22321	13.2232
KLRG1	1.44E-07	13.20031	13.2003

LAG3	8.41E-08	6.190264	6.19026
LY6A	1.40E-05	5.989781	5.98977
E030006K04RIK	6.54E-09	5.94838	5.94839
9130211I03RIK	4.39E-06	5.876684	5.87667
1300002F13RIK	7.18E-06	5.866513	5.8665
LOC381140	2.90E-07	5.84621	5.8462
GPR114	2.07E-05	5.785731	5.78573
2310067E08RIK	3.25E-07	5.725901	5.72589
CDKN2B	6.18E-06	5.686341	5.68634
IDB2	1.14E-08	5.637296	5.63728
GOLPH2	4.35E-09	5.608053	5.60805
PLCG2	2.95E-09	5.550036	5.55005
1500031H04RIK	1.83E-07	5.492634	5.49264
1110018K11RIK	7.30E-10	5.388947	5.38893
CD9	9.16E-09	5.388947	5.38893
LOC381319	6.47E-06	5.323963	5.32396
SYTL2	3.83E-10	5.250667	5.25066
SLC2A6	1.27E-07	5.223432	5.22344
OSBPL3	3.09E-11	5.187368	5.18736
2210411K11RIK	2.39E-06	5.080604	5.0806
LRRK1	1.15E-07	5.045511	5.04551
S100A6	3.80E-07	4.967438	4.96743
KLRE1	8.01E-08	4.933107	4.93312
PGLYRP1	6.39E-06	4.933107	4.93312
GLRX	6.59E-06	4.873651	4.87364
MYO1F	8.46E-09	4.839967	4.83998
LOC269941	9.61E-10	4.831595	4.8316
TRAF1	1.82E-06	4.699469	4.69948
EMILIN2	0.000282473	4.691334	4.69134
TNFRSF9	1.19E-07	4.675104	4.67511
CD52	9.20E-05	4.618746	4.61874
PLSCR1	2.75E-09	4.602759	4.60276
BHLHB2	5.80E-06	4.570969	4.57097
S100A1	8.07E-08	4.555145	4.55515
LGALS1	4.96E-07	4.5237	4.52369
2310046K01RIK	3.01E-06	4.469154	4.46915
CAPG	5.03E-09	4.453688	4.45369

EMILIN2	5.64E-06	12.83934	12.8393
1110007C0	3.19E-11	12.77278	12.7728
TNFRSF11	5.09E-06	12.77278	12.7728
LOC381140	1.29E-08	12.46664	12.4666
HAVCR2	4.62E-07	12.02112	12.0211
LOC327951	1.39E-07	12.00031	12.0003
PDGFA	2.78E-09	11.91742	11.9174
SCIN	1.18E-07	11.733	11.733
BC049975	2.96E-09	11.65196	11.652
PGLYRP1	1.73E-07	11.51147	11.5115
IFITM1	4.19E-05	11.47164	11.4716
SPEER3	4.84E-05	10.74058	10.7406
1810044J0	3.59E-09	10.68489	10.6849
CCR5	1.38E-09	10.51954	10.5195
WBSCR5	1.21E-08	10.42879	10.4288
DAF1	3.14E-07	10.33882	10.3388
2210411K1	1.18E-07	10.09102	10.091
P2RY14	3.12E-08	9.815084	9.81508
BCL2A1B	2.31E-08	9.781099	9.78112
F2R	5.12E-07	9.713547	9.71356
LOC268288	1.40E-08	9.67998	9.67995
RGS1	1.42E-06	9.546722	9.54669
2310057H1	5.56E-09	9.30172	9.30174
BHLHB2	2.26E-07	9.30172	9.30174
CTSW	4.35E-06	9.078777	9.07879
5330403J1	6.45E-09	9.063061	9.06307
SH2D1B1	3.54E-07	8.891971	8.89195
PLSCR1	1.15E-10	8.861163	8.86119
1110018K1	7.85E-11	8.693913	8.69388
ICSBP1	4.16E-07	8.589073	8.58906
SPEER1-P	0.0001	8.296483	8.29648
RGS16	6.08E-08	8.224902	8.22491
EG433016	0.000987	8.210653	8.21067
DHRS6	2.02E-06	8.196453	8.19646
2310067E0	7.56E-08	7.889858	7.88986
KLRA13	3.45E-10	7.876186	7.8762
TNFSF6	7.56E-09	7.700779	7.70076

C330008K14RIK	4.31E-07	4.430601	4.43059
TNFRSF11B	0.000351472	4.384773	4.38477
CCL4	8.44E-05	4.362031	4.36203
SIAT10	6.50E-06	4.339411	4.33941
HBA-A1	1.28E-06	4.301982	4.30198
ROM1	1.73E-08	4.272263	4.27226
1190002C06RIK	2.57E-07	4.198876	4.19887
F2R	2.39E-05	4.184346	4.18434
RGS1	5.76E-05	4.184346	4.18434
CD69	2.26E-05	4.177092	4.17709
CISH	1.63E-06	4.15543	4.15544
DAPK2	9.71E-09	4.133888	4.13389
SH3BP2	3.58E-08	4.098226	4.09823
GCNT1	2.49E-08	4.069921	4.06992
HAVCR2	5.18E-05	4.062877	4.06287
DUSP6	3.27E-09	4.041808	4.04181
CTNNA1	4.08E-08	3.993068	3.99307
BC024955	6.91E-10	3.917682	3.91768
ITGB7	0.000152314	3.917682	3.91768
MLKL	7.92E-08	3.877156	3.87716
SERPINE2	2.49E-05	3.870448	3.87045
LY6G5B	7.00E-06	3.863749	3.86375
PPP3CC	5.92E-09	3.850374	3.85038
LOC218482	1.61E-08	3.837063	3.83706
A430006M23RIK	3.38E-06	3.777676	3.77768
2410008K03RIK	3.43E-08	3.732137	3.73213
FURIN	1.27E-06	3.732137	3.73213
F2RL2	9.14E-05	3.732137	3.73213
GPR18	2.97E-06	3.712779	3.71278
HGFAC	7.05E-05	3.706353	3.70635
S100A10	4.21E-06	3.693526	3.69353
APOB48R	4.85E-06	3.680747	3.68075
OSM	1.62E-05	3.680747	3.68075
AIM1L	2.96E-06	3.674377	3.67438
IL18R1	3.56E-07	3.661662	3.66167
NT5E	2.59E-08	3.655331	3.65533
IFNG	3.30E-06	3.636377	3.63637

CCL5	0.000148	7.387052	7.38706
E030006KC	2.60E-09	7.235052	7.23503
CAR2	7.88E-11	6.904313	6.90432
SERPINE2	1.33E-06	6.904313	6.90432
IER3	7.22E-06	6.844768	6.84476
TNFRSF9	1.74E-08	6.832888	6.83291
SIAT10	6.93E-07	6.797496	6.79748
GLRX1	4.58E-06	6.646064	6.64606
DAPK2	7.72E-10	6.611614	6.6116
F2RL2	5.36E-06	6.554583	6.55456
IFITM3	2.68E-06	6.464333	6.46433
MLKL	5.34E-09	6.309387	6.30939
SYTL2	1.70E-10	6.147491	6.1475
TMEM119	0.000651	6.136852	6.13686
2810025M1	1.47E-08	6.041894	6.04189
SEPN1	8.40E-07	6.041894	6.04189
TCRD-V1	7.87E-09	6.010555	6.01056
OSBPL3	1.46E-11	5.989781	5.98977
APOB48R	3.32E-07	5.989781	5.98977
CD52	2.73E-05	5.979395	5.9794
MYO1F	2.88E-09	5.938101	5.93809
SH3BP2	4.75E-09	5.897061	5.89708
RASD2	1.15E-06	5.856344	5.85634
LOC26994	3.60E-10	5.805819	5.80582
IFITM2	6.30E-05	5.805819	5.80582
GPR87	1.21E-06	5.775706	5.77572
LOC27015	2.10E-06	5.745773	5.74577
HIST1H1C	2.95E-05	5.715984	5.71598
AA467197	3.72E-05	5.706069	5.70608
KLRA1	3.83E-07	5.637296	5.63728
IDB2	1.24E-08	5.550036	5.55005
LY6A	2.01E-05	5.540442	5.54044
FCGR3	2.61E-07	5.511707	5.51171
GVIN1	3.28E-05	5.511707	5.51171
A430038C1	2.04E-08	5.426407	5.42642
ID2	4.68E-09	5.379612	5.3796
S100A1	3.25E-08	5.379612	5.3796

H2-Q8	0.000127421	3.63008	3.63008
FXYD4	1.04E-07	3.617513	3.61752
PILRB	3.51E-05	3.592535	3.59253
PLP2	3.87E-08	3.580098	3.5801
MT1	0.000577989	3.580098	3.5801
DOK2	7.55E-08	3.567708	3.56771
0610037M15RIK	7.75E-06	3.549221	3.54922
2310047C17RIK	4.43E-05	3.549221	3.54922
S100A11	2.00E-07	3.530812	3.53081
FES	1.98E-08	3.518599	3.5186
BC029169	3.49E-07	3.500347	3.50035
TNF	5.66E-10	3.482197	3.4822
LRP12	7.21E-05	3.482197	3.4822
IER3	0.000215344	3.476169	3.47617
NAPSA	2.95E-05	3.47015	3.47015
ANXA2	3.41E-06	3.434266	3.43426
PRSS19	1.77E-05	3.428321	3.42832
OSTF1	5.84E-09	3.38112	3.38112
GVIN1	0.000422456	3.36942	3.36942
1110007C02RIK	2.44E-08	3.340348	3.34035
MAPKAPK3	1.77E-07	3.311532	3.31153
CD244	7.87E-08	3.277281	3.27728
F630022B06RIK	4.89E-06	3.271609	3.27161
ID2	1.03E-07	3.265946	3.26594
GPR68	6.05E-06	3.265946	3.26594
GLIPR1	4.48E-07	3.260292	3.26029
PDGFA	1.76E-06	3.254647	3.25464
PKP3	1.71E-08	3.254647	3.25464
D10BWG1379E	5.49E-08	3.254647	3.25464
SLC39A4	4.73E-08	3.215403	3.2154
TES	1.92E-07	3.182149	3.18215
EGR1	0.0012963	3.182149	3.18215
1110004P15RIK	5.91E-05	3.17664	3.17664
B4GALNT4	4.86E-07	3.149229	3.14923
CDKN1A	0.000553492	3.149229	3.14923
D2ERTD217E	7.91E-08	3.079083	3.07908
NCF4	5.37E-06	3.073755	3.07375

CAPG	1.77E-09	5.370281	5.37029
PPP3CC	8.68E-10	5.333191	5.33319
1500031H0	2.19E-07	5.305546	5.30554
PLCG2	3.91E-09	5.259781	5.25977
NCF4	1.99E-07	5.241585	5.24157
AI115600	1.22E-09	5.142604	5.14261
DUSP6	8.20E-10	5.115953	5.11594
SERPINB6	9.97E-06	5.098243	5.09824
BCL2A1D	1.37E-08	4.899055	4.89904
UPP1	1.21E-08	4.856774	4.85678
PIM3	1.14E-06	4.856774	4.85678
AMICA1	1.15E-06	4.848367	4.84837
SLC2A3	4.16E-06	4.814891	4.81488
5031436OC	2.13E-06	4.773338	4.77334
CD160	1.84E-05	4.73216	4.73216
A430084PC	2.72E-07	4.691334	4.69134
GOLPH2	1.25E-08	4.618746	4.61874
CD244	8.49E-09	4.618746	4.61874
DMWD	1.23E-06	4.578901	4.5789
AHNAK	1.67E-08	4.570969	4.57097
TRAF1	2.12E-06	4.570969	4.57097
TES	1.82E-08	4.555145	4.55515
CDKN2B	1.88E-05	4.555145	4.55515
1110004P1	6.74E-06	4.555145	4.55515
SRGAP2	1.33E-08	4.508038	4.50804
SULF2	3.60E-09	4.469154	4.46915
HHEX	1.23E-08	4.384773	4.38477
LAG3	5.75E-07	4.301982	4.30198
ALDOA	1.30E-05	4.220745	4.22075
AI850995	5.34E-08	4.213436	4.21344
PTER	3.14E-06	4.206152	4.20615
LOC21848	9.08E-09	4.198876	4.19887
1190002C0	2.68E-07	4.169864	4.16986
CTNNA1	3.18E-08	4.15543	4.15544
CDKN1A	0.000117	4.141061	4.14106
2310016C1	9.43E-06	4.12674	4.12673
A530050EC	2.79E-07	4.08405	4.08405

LOC381924	1.33E-06	3.047229	3.04723
1700025G04RIK	2.02E-06	3.041955	3.04196
AA467197	0.00100238	3.036689	3.03669
SGK	5.37E-08	3.020947	3.02095
BC021614	5.58E-05	3.015718	3.01571
LOC385953	1.27E-10	3.005277	3.00528
CDKN2A	8.87E-06	2.989698	2.9897
2610009E16RIK	2.28E-05	2.953651	2.95365
HIST1H1C	0.00103646	2.928172	2.92817
DCI	1.02E-08	2.912989	2.91299
NFKB1	1.21E-07	2.902909	2.90291
TPST2	2.16E-06	2.902909	2.90291
TRF	2.76E-06	2.897887	2.89788
HK2	3.64E-06	2.887861	2.88786
PDZK1	5.44E-10	2.882858	2.88286
GNG2	6.86E-09	2.872886	2.87288
S100A4	8.62E-08	2.848102	2.8481
ZFP608	8.21E-08	2.838248	2.83825
2210008N01RIK	6.64E-08	2.833335	2.83333
SH3BGR13	4.55E-05	2.82843	2.82843
MYO1G	2.01E-06	2.823527	2.82353
1110019C08RIK	1.34E-05	2.81864	2.81864
S100A13	8.29E-05	2.81864	2.81864
PPAP2C	3.95E-06	2.813763	2.81376
MYO1E	7.25E-08	2.808886	2.80889
IFI30	1.07E-06	2.799168	2.79917
LTB4R1	0.000868775	2.784654	2.78466
TMEM126A	3.48E-08	2.775026	2.77502
1110020C13RIK	7.24E-08	2.775026	2.77502
CD7	7.40E-06	2.775026	2.77502
4933439K08RIK	1.06E-08	2.751085	2.75108
E030003N15RIK	2.16E-05	2.732084	2.73208
CCL5	0.0117888	2.732084	2.73208
7420404O03RIK	1.10E-05	2.722629	2.72263
4930486L24RIK	1.95E-06	2.717916	2.71791
BC022224	9.36E-07	2.713211	2.71321
5330403J18RIK	5.98E-06	2.708508	2.70851

LMNA	1.14E-06	4.062877	4.06287
GLIPR1	1.07E-07	4.034812	4.03481
9830144J01	4.06E-09	4.020844	4.02085
PPAP2C	3.54E-07	3.958624	3.95863
SAT1	1.91E-05	3.958624	3.95863
SLC2A1	5.83E-05	3.958624	3.95863
HAK	4.36E-08	3.938093	3.9381
SCL00031E	6.01E-07	3.917682	3.91768
2310046K01	7.02E-06	3.863749	3.86375
RHOF	3.34E-07	3.843715	3.84371
LOC21239E	4.55E-08	3.823785	3.82378
CD69	3.83E-05	3.810554	3.81055
B230343A11	1.49E-08	3.803959	3.80395
BC022224	7.94E-08	3.777676	3.77768
KLRB1C	9.87E-09	3.745094	3.74509
MYO1E	8.79E-09	3.719214	3.71922
KLRA33	3.61E-06	3.693526	3.69353
WDFY1	5.95E-08	3.680747	3.68075
GCNT1	5.12E-08	3.642682	3.64268
C80638	3.80E-05	3.642682	3.64268
HGFAC	7.89E-05	3.636377	3.63637
RASL12	4.28E-07	3.611256	3.61125
GNG2	1.28E-09	3.580098	3.5801
SH2D2A	1.04E-06	3.567708	3.56771
GPR141	1.94E-05	3.567708	3.56771
DCI	2.41E-09	3.518599	3.5186
GLRX	4.20E-05	3.518599	3.5186
LOC38569E	9.48E-07	3.512506	3.5125
CD72	8.84E-05	3.488246	3.48824
EGR1	0.000779	3.488246	3.48824
2210008N01	1.43E-08	3.458149	3.45815
ADORA2B	6.64E-07	3.446184	3.44618
KLRA10	4.19E-08	3.434266	3.43426
S100A11	2.42E-07	3.434266	3.43426
F730045P11	3.27E-05	3.434266	3.43426
PILRB	4.70E-05	3.428321	3.42832
LGALS1	2.90E-06	3.404638	3.40463

FXYD5	4.01E-06	2.703821	2.70382
A430038C16RIK	2.01E-06	2.699143	2.69914
GPC1	0.00472373	2.675857	2.67586
AHNAK	7.45E-07	2.666596	2.6666
EMP1	0.000268268	2.666596	2.6666
CX3CR1	3.25E-09	2.661982	2.66198
2810032E02RIK	4.29E-07	2.661982	2.66198
LOC327957	0.000272484	2.657369	2.65737
FCGR3	3.00E-05	2.625333	2.62533
CLNK	1.01E-08	2.620785	2.62079
HVCN1	0.000222656	2.620785	2.62079
BSCL2	5.79E-06	2.616246	2.61625
LGALS3BP	6.49E-06	2.616246	2.61625
CYP51	7.38E-07	2.607195	2.6072
PIM3	6.98E-05	2.593677	2.59368
BC038881	7.63E-09	2.584707	2.58471
LOC383981	0.00132323	2.584707	2.58471
PDLIM7	5.33E-07	2.580232	2.58023
SLC24A3	6.09E-05	2.580232	2.58023
HHEX	5.95E-07	2.575766	2.57576
D930046M13RIK	1.74E-05	2.575766	2.57576
BC087945	7.68E-07	2.571302	2.5713
9830144J08RIK	1.24E-07	2.566854	2.56685
DP1	1.29E-06	2.566854	2.56685
E130012A19RIK	1.31E-05	2.562407	2.56241
4631423F02RIK	7.66E-05	2.540302	2.5403
4930555L03RIK	4.40E-08	2.535902	2.5359
FOSL2	6.92E-06	2.535902	2.5359
ZFP296	2.68E-09	2.518384	2.51839
F730045P10RIK	0.000293728	2.518384	2.51839
PEA15	5.59E-08	2.509675	2.50967
ITGAE	0.000534865	2.50533	2.50533
A530050E01RIK	1.01E-05	2.50533	2.50533
SCL0001419.1_32	1.67E-07	2.500994	2.50099
SPP1	0.00129868	2.496661	2.49666
ASB2	2.54E-05	2.492336	2.49234
CCNG1	4.25E-05	2.492336	2.49234

S100A10	7.33E-06	3.392855	3.39286
NQO2	4.88E-08	3.386983	3.38698
CD9	1.56E-07	3.38112	3.38112
PLP2	5.92E-08	3.36942	3.36942
SLC39A4	3.49E-08	3.351948	3.35195
7420404OC	2.40E-06	3.334567	3.33457
NEDD9	3.25E-07	3.311532	3.31153
BSPRY	1.11E-06	3.288662	3.28866
STX11	2.41E-06	3.288662	3.28866
NFKBIZ	5.41E-07	3.277281	3.27728
ADAM8	1.09E-06	3.277281	3.27728
PPP1R3B	1.39E-06	3.277281	3.27728
SEC61B	1.17E-10	3.265946	3.26594
S100A6	4.92E-06	3.265946	3.26594
ANXA2	4.93E-06	3.254647	3.25464
HK2	1.70E-06	3.193195	3.19319
PDLIM7	9.37E-08	3.187668	3.18766
TRIO	4.54E-07	3.17664	3.17664
ENO1	2.54E-07	3.160167	3.16017
LOC38398	0.000359	3.154694	3.15469
N4WBP5-P	5.19E-09	3.149229	3.14923
LOC32870	2.98E-07	3.143784	3.14378
HIC1	5.07E-06	3.116663	3.11666
AOAH	2.89E-09	3.111262	3.11126
1110020C1	2.86E-08	3.111262	3.11126
MAPKAPK	2.85E-07	3.105879	3.10588
FTL1	8.72E-06	3.095132	3.09513
BC046404	6.62E-07	3.079083	3.07908
E030003N1	8.70E-06	3.079083	3.07908
VIM	1.02E-05	3.068426	3.06843
CISH	1.19E-05	3.068426	3.06843
C230043G	1.82E-07	3.052522	3.05252
GPR97	4.15E-06	3.041955	3.04196
LASP1	1.17E-07	3.036689	3.03669
9930117H0	6.85E-06	3.036689	3.03669
CASP1	0.000297	3.000075	3.00008
D10ERTD4	3.40E-07	2.979356	2.97935

TUBA6	1.47E-06	2.483713	2.48372
SDF2L1	7.56E-05	2.483713	2.48372
RHOF	9.16E-06	2.479415	2.47942
1110030J09RIK	2.72E-10	2.458023	2.45803
EGR3	0.00128127	2.458023	2.45803
CXCR3	5.82E-05	2.453771	2.45377
ALDOA	0.000483723	2.449521	2.44952
GCNT2	3.22E-08	2.445281	2.44528
MVP	4.37E-07	2.445281	2.44528
C130027E04RIK	5.53E-07	2.445281	2.44528
SEC61B	1.47E-09	2.436819	2.43682
E430036I04RIK	2.87E-07	2.432599	2.4326
AI481100	9.30E-05	2.424184	2.42419
CD63	0.000436295	2.419989	2.41999
DEGS	4.85E-07	2.415797	2.4158
LOC385699	1.78E-05	2.415797	2.4158
EG331493	3.45E-06	2.415797	2.4158
A930008A22RIK	6.04E-07	2.411614	2.41162
4930504E06RIK	0.000436715	2.411614	2.41162
LOC212399	1.73E-06	2.40744	2.40744
AI850995	3.62E-06	2.40744	2.40744
CTGF	0.000743838	2.40744	2.40744
KIRL2	3.13E-06	2.394957	2.39496
1700017I11RIK	6.32E-08	2.390812	2.39081
2310037P21RIK	2.51E-06	2.386669	2.38667
UAP1L1	3.29E-06	2.382541	2.38254
D14ERTD449E	0.000867516	2.382541	2.38254
BC023892	4.42E-09	2.378415	2.37841
AA175286	0.000409847	2.361983	2.36199
PPIB	5.05E-09	2.357896	2.3579
GPR34	1.68E-07	2.357896	2.3579
IRAK2	7.34E-05	2.357896	2.3579
SH2D1B1	0.000605208	2.353811	2.35381
HSD11B1	6.66E-05	2.353811	2.35381
LOC328703	3.58E-06	2.34974	2.34974
BC004728	5.49E-07	2.34974	2.34974
LOC215405	4.47E-05	2.34974	2.34974

TBC1D2B	7.23E-09	2.974199	2.9742
1700129I1E	2.83E-05	2.963903	2.96391
NDFIP1	1.87E-07	2.958772	2.95878
5730469M1	9.16E-05	2.958772	2.95878
JUNB	0.000169	2.958772	2.95878
PGK1	2.49E-06	2.953651	2.95365
LOC24067	1.77E-07	2.948539	2.94854
BSCL2	2.21E-06	2.943436	2.94343
IFNG	1.45E-05	2.938333	2.93834
S100A13	6.20E-05	2.933248	2.93325
CHN2	1.49E-07	2.928172	2.92817
CST7	1.31E-07	2.923105	2.9231
POLD4	1.30E-05	2.912989	2.91299
BC087945	2.69E-07	2.907949	2.90794
4631423F0	2.76E-05	2.892866	2.89287
2310061N2	0.002866	2.872886	2.87288
GIPC2	3.20E-05	2.862942	2.86295
AA175286	9.62E-05	2.848102	2.8481
TUBA6	4.58E-07	2.838248	2.83825
KLRB1D	7.14E-11	2.833335	2.83333
HRMT1L1	2.71E-07	2.833335	2.83333
TMEM126A	2.96E-08	2.82843	2.82843
TRF	3.44E-06	2.81864	2.81864
LOC38318	2.82E-08	2.813763	2.81376
AW536289	4.33E-07	2.813763	2.81376
CCNG1	1.58E-05	2.813763	2.81376
HAAO	5.90E-06	2.799168	2.79917
6720467C0	2.29E-11	2.794326	2.79433
SLC24A3	3.28E-05	2.789486	2.78949
PSTPIP1	5.32E-06	2.775026	2.77502
TBX21	4.36E-06	2.765426	2.76542
PRDX5	7.28E-05	2.765426	2.76542
EGR3	0.000564	2.760631	2.76063
TFF1	0.008643	2.760631	2.76063
E130012A1	7.32E-06	2.746317	2.74632
BCAP29	8.13E-06	2.746317	2.74632
IRAK2	2.06E-05	2.741566	2.74157

RAB3D	1.16E-05	2.337552	2.33755
SULT2B1	0.000164735	2.337552	2.33755
EVI2A	2.55E-07	2.33351	2.33351
TSPO	2.22E-06	2.33351	2.33351
TNFRSF18	2.31E-05	2.33351	2.33351
EG630499	0.000147665	2.329466	2.32947
SERPINB6A	0.00133703	2.325435	2.32543
SYPL	6.57E-07	2.321408	2.32141
8030402P03RIK	0.000483123	2.321408	2.32141
HAAO	3.04E-05	2.31739	2.31739
NRGN	5.54E-05	2.313374	2.31338
TAF9B	1.33E-06	2.309373	2.30937
9930117H01RIK	6.56E-05	2.309373	2.30937
GBP2	0.000466109	2.309373	2.30937
AW212394	7.13E-06	2.305375	2.30537
KIT	0.000138895	2.301379	2.30138
A630086H07RIK	3.07E-05	2.297398	2.2974
ANK	1.14E-07	2.29342	2.29342
BATF	6.24E-06	2.29342	2.29342
TIAM1	1.13E-07	2.289451	2.28945
TCRD-V1	6.14E-06	2.285484	2.28548
ARL6IP5	2.09E-07	2.285484	2.28548
EHD4	3.43E-05	2.285484	2.28548
N4WBP5-PENDING	9.39E-08	2.281527	2.28153
B3GNT8	1.44E-07	2.281527	2.28153
BLR1	8.56E-06	2.281527	2.28153
NDFIP1	2.11E-06	2.261845	2.26184
PRDX4	1.09E-05	2.261845	2.26184
SNAG1	4.20E-07	2.250119	2.25012
B4GALNT2	0.000956597	2.250119	2.25012
TRPM6	9.96E-08	2.238448	2.23845
CXCL9	0.00820156	2.230704	2.23071
0610009O03RIK	8.23E-09	2.222988	2.22299
PRR7	1.26E-06	2.207632	2.20763
A630077B13RIK	3.14E-05	2.207632	2.20763
SLC19A2	4.63E-05	2.207632	2.20763
2810440J20RIK	7.67E-07	2.192381	2.19238

2310016C0	0.000898	2.741566	2.74157
E430036I04	9.77E-08	2.736817	2.73682
FES	1.41E-07	2.732084	2.73208
C330023F1	1.27E-07	2.717916	2.71791
FKBP11	0.000164	2.713211	2.71321
GP49A	8.69E-07	2.708508	2.70851
FHL2	3.43E-08	2.703821	2.70382
PRMT2	5.08E-07	2.694466	2.69447
3300005D0	5.96E-05	2.685148	2.68514
RPS6KA1	5.06E-08	2.666596	2.6666
GPD2	2.77E-08	2.661982	2.66198
SNAG1	8.24E-08	2.661982	2.66198
CLN3	2.04E-05	2.652773	2.65277
TMPIT	4.29E-07	2.648179	2.64818
1810011E0	4.07E-06	2.648179	2.64818
BIN1	6.15E-08	2.643593	2.64359
PEA15	3.62E-08	2.629883	2.62989
SDF2L1	4.71E-05	2.629883	2.62989
LOC383095	3.70E-05	2.629883	2.62989
4930486L2	2.78E-06	2.607195	2.6072
CAMK2N1	2.06E-06	2.602682	2.60268
IFI30	2.03E-06	2.598179	2.59818
4930513E2	0.000993	2.593677	2.59368
0610037M1	7.56E-05	2.589191	2.58919
PFKP	1.61E-05	2.584707	2.58471
A630024B1	2.56E-06	2.580232	2.58023
SPIN2	4.24E-07	2.575766	2.57576
MMD	1.33E-06	2.575766	2.57576
MGC18837	1.51E-06	2.562407	2.56241
C130027EC	3.69E-07	2.553541	2.55354
IL18R1	5.54E-06	2.553541	2.55354
GALGT1	1.55E-05	2.553541	2.55354
STK39	3.36E-08	2.549122	2.54912
OBFC2A	8.44E-06	2.549122	2.54912
D930046M1	1.92E-05	2.544711	2.54471
ALDOC	0.001341	2.544711	2.54471
IL2RB	4.01E-07	2.540302	2.5403

MED10	3.04E-06	2.192381	2.19238
COMT	8.15E-09	2.188586	2.18859
PLTP	6.19E-07	2.188586	2.18859
2310010I15RIK	1.21E-08	2.181016	2.18102
0610039P13RIK	0.000646447	2.181016	2.18102
VPS29	1.09E-07	2.17724	2.17724
AI847670	1.60E-06	2.165951	2.16595
ASAH1	3.80E-08	2.1622	2.1622
B830021E24RIK	1.42E-05	2.1622	2.1622
SRGAP2	4.27E-06	2.158457	2.15846
IQGAP2	0.000141764	2.158457	2.15846
LASP1	2.73E-06	2.154717	2.15472
CORO1C	7.53E-07	2.150991	2.15099
H2-Q6	3.02E-06	2.150991	2.15099
9130604K18RIK	4.57E-06	2.147264	2.14726
FNBP1	2.88E-08	2.143549	2.14355
TMPIT	3.47E-06	2.139834	2.13984
H2-Q7	5.84E-05	2.136131	2.13613
0610007H07RIK	2.48E-06	2.132433	2.13243
CCND2	3.28E-06	2.125055	2.12505
SERTAD1	0.000141861	2.121377	2.12138
RAB19	7.99E-06	2.114035	2.11404
BAG3	0.00480518	2.110377	2.11038
VTI1B	1.30E-05	2.106722	2.10672
CAPN2	2.23E-06	2.103076	2.10307
2310057H16RIK	6.11E-05	2.099433	2.09943
STX11	0.000109261	2.095799	2.0958
FTL1	0.00023523	2.095799	2.0958
ARF6	3.80E-07	2.092168	2.09217
2900026A02RIK	2.85E-07	2.088546	2.08855
CSTB	3.81E-05	2.088546	2.08855
LOC383189	5.48E-07	2.084932	2.08493
CCL3	0.00511685	2.084932	2.08493
GLIPR2	6.01E-05	2.084932	2.08493
C330023F11RIK	1.81E-06	2.081321	2.08132
SIRT3	2.69E-06	2.081321	2.08132
CAPNS1	3.44E-08	2.077719	2.07772

LOC381319	0.000587	2.531511	2.53151
BAG3	0.001254	2.531511	2.53151
DOK2	1.17E-06	2.522755	2.52275
UGCG	8.13E-05	2.522755	2.52275
ARRDC4	0.000487	2.518384	2.51839
ATF4	0.002253	2.518384	2.51839
IL12RB1	6.73E-07	2.514028	2.51403
9130211I03	0.000664	2.514028	2.51403
1810061M1	7.55E-08	2.50533	2.50533
KLRA21	1.66E-06	2.500994	2.50099
MVP	3.59E-07	2.496661	2.49666
CYBA	1.03E-06	2.492336	2.49234
BATF	2.83E-06	2.492336	2.49234
NENF	1.16E-05	2.492336	2.49234
TNFSF13	2.10E-08	2.48802	2.48802
EHD4	1.57E-05	2.48802	2.48802
CSDA	3.96E-08	2.479415	2.47942
CRELD2	1.86E-05	2.475125	2.47512
LOC238943	2.92E-06	2.470838	2.47084
1110019C0	3.97E-05	2.470838	2.47084
OSTF1	8.10E-08	2.46656	2.46656
2510048K0	4.28E-07	2.46656	2.46656
1700025GC	1.15E-05	2.46229	2.46229
PADI2	1.20E-08	2.458023	2.45803
A530060OC	9.89E-07	2.458023	2.45803
FXVD5	9.20E-06	2.458023	2.45803
MYO1G	6.72E-06	2.453771	2.45377
ECH1	1.99E-05	2.453771	2.45377
GABARAPI	5.14E-09	2.445281	2.44528
AI847670	4.70E-07	2.441049	2.44105
PPIB	3.62E-09	2.436819	2.43682
FOSL2	1.02E-05	2.428393	2.42839
BC023892	3.65E-09	2.424184	2.42419
STX7	1.05E-06	2.424184	2.42419
NUCB1	1.57E-05	2.424184	2.42419
KLF7	1.89E-05	2.424184	2.42419
TAF9B	8.39E-07	2.419989	2.41999

RBMS1	1.72E-07	2.077719	2.07772
1110008P14RIK	2.41E-07	2.077719	2.07772
MINA	1.96E-08	2.074121	2.07412
CCDC132	2.24E-06	2.074121	2.07412
LOC234582	1.09E-06	2.066944	2.06695
KCTD10	9.73E-05	2.066944	2.06695
LOC240672	5.49E-06	2.05623	2.05623
A230057G18RIK	9.28E-07	2.05623	2.05623
ELOVL1	3.81E-06	2.05623	2.05623
STX7	5.97E-06	2.052667	2.05267
BC017612	5.16E-06	2.052667	2.05267
ZBTB32	3.61E-05	2.052667	2.05267
H47	3.72E-06	2.049113	2.04911
TNFRSF22	7.52E-05	2.049113	2.04911
AI115600	1.65E-06	2.045567	2.04557
MYL6	1.28E-07	2.045567	2.04557
H2-GS17	0.000428176	2.042025	2.04202
CAPZB	5.20E-07	2.038491	2.03849
SC4MOL	3.38E-06	2.038491	2.03849
FHL2	6.33E-07	2.034961	2.03496
3010031K01RIK	4.37E-08	2.034961	2.03496
A330042I21RIK	1.18E-06	2.034961	2.03496
D15MGI27	2.70E-05	2.034961	2.03496
RAB4A	4.71E-08	2.024406	2.02441
DCXR	0.000151877	2.024406	2.02441
AIM1	0.000114024	2.024406	2.02441
SEMA4A	7.97E-05	2.017402	2.0174
XBP1	0.000154152	2.017402	2.0174
LOC383099	0.000417017	2.013912	2.01391
JUNB	0.00325781	2.013912	2.01391
HRMT1L1	7.88E-06	2.010426	2.01042
GPR97	0.000165473	2.010426	2.01042
COTL1	0.000539041	2.010426	2.01042
2310061N23RIK	0.025362	2.006944	2.00694
9130227C08RIK	4.47E-06	2.00347	2.00347
AI840980	0.000521047	2.00347	2.00347
DYRK3	0.000241993	2.00347	2.00347

LOC38168	4.83E-07	2.419989	2.41999
LOC38640	0.004194	2.419989	2.41999
H47	6.51E-07	2.415797	2.4158
GPR34	1.34E-07	2.411614	2.41162
1110006I15	1.08E-07	2.40744	2.40744
MYL6	2.17E-08	2.403274	2.40327
SOAT2	1.66E-05	2.403274	2.40327
HIP1	1.04E-10	2.399111	2.39911
DEGS	5.19E-07	2.399111	2.39911
2810032E0	1.12E-06	2.399111	2.39911
SH3BGRL3	0.000169	2.399111	2.39911
DTR	4.75E-06	2.386669	2.38667
SLK	1.18E-08	2.382541	2.38254
EOMES	8.89E-07	2.378415	2.37841
GMDS	2.61E-06	2.378415	2.37841
DCXR	3.22E-05	2.370185	2.37019
H2-Q8	0.002068	2.370185	2.37019
HIP-1	1.62E-10	2.36608	2.36608
DAB2IP	5.55E-08	2.36608	2.36608
KLRK1	3.04E-08	2.36608	2.36608
OLFM1	7.39E-08	2.361983	2.36199
CABLES1	2.23E-06	2.361983	2.36199
AI840980	0.000111	2.361983	2.36199
BC024955	4.20E-08	2.357896	2.3579
MINA	4.70E-09	2.357896	2.3579
A530090PC	6.45E-06	2.357896	2.3579
NRGN	4.73E-05	2.353811	2.35381
ZFP52	0.000839	2.353811	2.35381
TSPO	2.07E-06	2.34974	2.34974
TDRD7	2.88E-06	2.345672	2.34567
TMEM38B	6.08E-08	2.341608	2.34161
SAMSN1	1.16E-06	2.341608	2.34161
IAN4	0.000116	2.341608	2.34161
IMPA2	0.000465	2.337552	2.33755
2310056P0	0.000375	2.337552	2.33755
ETFB	8.23E-07	2.33351	2.33351
GZMK	0.000515	2.321408	2.32141

CASP1	0.00573828	2.00347	2.00347
TRBV11_AE000663_T	0.000105474	0.5	-2
C920004C08RIK	0.0113298	0.5	-2
A930023F05RIK	1.93E-06	0.499134	-2.00347
PLEKHG2	1.52E-05	0.499134	-2.00347
ABHD8	7.47E-05	0.499134	-2.00347
3110013H01RIK	0.00068445	0.499134	-2.00347
E030007N04RIK	3.23E-07	0.496547	-2.01391
PRKCD	1.24E-06	0.495688	-2.0174
9130430L19RIK	1.04E-05	0.494829	-2.0209
6030443O07RIK	1.78E-05	0.494829	-2.0209
A130062D16RIK	1.86E-06	0.493971	-2.02441
5930416I19RIK	2.26E-06	0.493971	-2.02441
FYB	9.40E-06	0.493971	-2.02441
AA408556	0.000447224	0.49141	-2.03496
TRBV31_X03277_T_C	0.00870127	0.49141	-2.03496
A130038J17RIK	8.99E-05	0.490559	-2.03849
AJ237586	1.68E-05	0.490559	-2.03849
ZFP260	3.69E-06	0.490559	-2.03849
0710008K08RIK	9.80E-06	0.489711	-2.04202
ANP32E	0.000183335	0.485486	-2.05979
4921518A06RIK	8.35E-06	0.484644	-2.06337
4933421G18RIK	1.04E-05	0.484644	-2.06337
3110018A08RIK	0.00338526	0.484644	-2.06337
C730009F21RIK	1.18E-07	0.483805	-2.06695
OLFML3	1.61E-05	0.482132	-2.07412
A330103N21RIK	9.39E-05	0.481297	-2.07772
H2-T9	0.000542267	0.481297	-2.07772
LOC386360	0.00269607	0.481297	-2.07772
ILVBL	4.13E-05	0.478801	-2.08855
SBK	5.91E-07	0.477973	-2.09217
6330403M23RIK	6.88E-08	0.47632	-2.09943
C230075L19RIK	4.42E-07	0.475495	-2.10307
MSH6	0.00037102	0.475495	-2.10307
CXCL12	0.00745872	0.475495	-2.10307
BC035291	1.11E-05	0.474672	-2.10672
MMP2	0.000824671	0.473848	-2.11038

5730438N1	1.67E-05	2.31739	2.31739
LOC215678	4.32E-05	2.313374	2.31338
LOC269358	1.94E-05	2.309373	2.30937
STK32C	4.69E-07	2.305375	2.30537
SLAMF7	1.11E-06	2.305375	2.30537
ABCB1B	1.12E-06	2.301379	2.30138
4930539E0	3.24E-05	2.301379	2.30138
CLNK	3.67E-08	2.297398	2.2974
TEX9	1.16E-06	2.297398	2.2974
LOC218617	6.06E-08	2.29342	2.29342
PALD	8.48E-07	2.29342	2.29342
GPR114	0.004116	2.29342	2.29342
GOLGA7	1.77E-06	2.289451	2.28945
GPR160	5.41E-06	2.289451	2.28945
KIT	0.000146	2.289451	2.28945
SQSTM1	0.000722	2.289451	2.28945
KLRA16	3.18E-07	2.285484	2.28548
ZBTB32	1.19E-05	2.285484	2.28548
1110030J08	5.87E-10	2.281527	2.28153
CYP51	2.62E-06	2.281527	2.28153
3110054C0	1.87E-06	2.281527	2.28153
C730026J1	4.19E-05	2.269699	2.2697
SERTAD1	7.39E-05	2.269699	2.2697
2310004N1	8.08E-05	2.269699	2.2697
VEGFC	1.79E-07	2.265765	2.26577
LOC114601	7.89E-06	2.265765	2.26577
A930008A2	1.15E-06	2.261845	2.26184
GFOD1	6.22E-07	2.261845	2.26184
STK2	7.89E-09	2.250119	2.25012
BC036961	4.29E-06	2.250119	2.25012
1810006K2	4.62E-06	2.250119	2.25012
2310047C1	0.001134	2.250119	2.25012
CAI	2.16E-07	2.238448	2.23845
CAPNS1	1.49E-08	2.234572	2.23457
RPL36	3.70E-05	2.234572	2.23457
2310043N1	7.41E-05	2.230704	2.23071
SYPL	1.01E-06	2.226844	2.22684

GM525	0.000141229	0.473028	-2.11404	GZMN	0.002202	2.226844	2.22684
STK4	2.73E-05	0.47221	-2.1177	COMT	6.85E-09	2.222988	2.22299
A130093I21RIK	7.45E-05	0.471391	-2.12138	SCL000416	1.60E-08	2.222988	2.22299
A230013K13RIK	3.45E-06	0.471391	-2.12138	LOC382121	0.000239	2.222988	2.22299
0610041G09RIK	0.00831324	0.471391	-2.12138	2610009E1	0.000239	2.21914	2.21914
TRIM28	3.45E-05	0.470577	-2.12505	GPC1	0.01453	2.21914	2.21914
B230342M21RIK	7.67E-06	0.468949	-2.13243	ASAH1	2.95E-08	2.21146	2.21146
1190002H23RIK	5.23E-05	0.464902	-2.15099	HADH2	7.87E-06	2.21146	2.21146
TSPAN32	9.87E-06	0.462492	-2.1622	XDH	1.37E-06	2.207632	2.20763
2610019F03RIK	3.67E-05	0.462492	-2.1622	DP1	5.63E-06	2.203808	2.20381
H2-OB	1.61E-05	0.461691	-2.16595	TGFBR2	3.17E-07	2.199993	2.19999
4732481H14RIK	1.72E-05	0.460891	-2.16971	SC4MOL	1.44E-06	2.199993	2.19999
COL5A1	0.00288136	0.460891	-2.16971	XAB1	1.99E-06	2.199993	2.19999
LDH2	8.49E-05	0.459297	-2.17724	PTPN8	3.84E-06	2.192381	2.19238
6720418B01RIK	7.62E-06	0.458501	-2.18102	DIP3B	3.01E-06	2.184799	2.1848
6430510M02RIK	1.62E-06	0.458501	-2.18102	VTI1B	8.79E-06	2.184799	2.1848
TNFRSF7	0.000102955	0.458501	-2.18102	STK17B	1.46E-05	2.184799	2.1848
CRYL1	8.89E-07	0.458501	-2.18102	GNS	0.000893	2.184799	2.1848
B230345P09RIK	5.94E-05	0.458501	-2.18102	MTMR9	0.001715	2.184799	2.1848
CTLA4	0.000629703	0.456915	-2.18859	ALAD	2.13E-08	2.181016	2.18102
RGL2	2.61E-06	0.455334	-2.19619	ARPC1B	3.71E-07	2.181016	2.18102
1810015C11RIK	3.91E-09	0.452974	-2.20763	2600010E0	1.17E-05	2.181016	2.18102
F730003H07RIK	0.00244488	0.452974	-2.20763	LOC23736	1.67E-05	2.158457	2.15846
CD97	0.000238915	0.45219	-2.21146	MPP6	2.77E-06	2.154717	2.15472
LLGL1	1.90E-06	0.450625	-2.21914	PDCD1LG2	8.02E-06	2.154717	2.15472
LOX	0.000702165	0.450625	-2.21914	SERPINB6	2.58E-05	2.154717	2.15472
PDXP	3.27E-05	0.449845	-2.22299	CAPN2	1.74E-06	2.150991	2.15099
TRIB2	4.12E-06	0.449067	-2.22684	ELOVL1	2.29E-06	2.150991	2.15099
2210008I11RIK	0.000393721	0.449067	-2.22684	RAB3D	2.65E-05	2.150991	2.15099
H2-AB1	0.00426068	0.449067	-2.22684	HINT2	0.00035	2.147264	2.14726
SLC29A1	8.67E-06	0.448288	-2.23071	FIGF	4.55E-05	2.143549	2.14355
ITPR2	5.30E-06	0.446738	-2.23845	OSM	0.000888	2.143549	2.14355
TPST1	9.65E-06	0.445965	-2.24233	ACATE3	1.20E-06	2.139834	2.13984
RPS6KL1	9.39E-07	0.442884	-2.25793	5430427O1	3.35E-06	2.139834	2.13984
RIL-PENDING	1.64E-06	0.441351	-2.26577	EG630499	0.000337	2.128742	2.12874
TTC3	8.83E-09	0.439825	-2.27363	KLK1B11	0.003666	2.128742	2.12874
MAPK1	2.50E-07	0.439063	-2.27758	FNBP1	3.25E-08	2.121377	2.12138

H2-EB1	0.00320736	0.438302	-2.28153
CD3D	0.000186864	0.435275	-2.2974
TRBV8_AE000663_T_	0.000766092	0.435275	-2.2974
PPP1R1C	6.89E-07	0.434522	-2.30138
PITPNM2	5.21E-07	0.432268	-2.31338
2210419D22RIK	1.12E-07	0.43152	-2.31739
RAPGEF3	1.11E-07	0.430773	-2.32141
SATB1	5.66E-06	0.427057	-2.34161
C530015C18	9.54E-09	0.426317	-2.34567
5830496L11RIK	1.02E-06	0.424843	-2.35381
BCL7A	3.37E-07	0.424843	-2.35381
GLDC	0.000448781	0.424106	-2.3579
CD27	0.000101099	0.423372	-2.36199
A830080H07RIK	1.99E-05	0.423372	-2.36199
ART4	9.75E-06	0.42264	-2.36608
SCL000121.1_106	6.92E-06	0.41972	-2.38254
4932414K18RIK	2.36E-06	0.418994	-2.38667
ACVR2B	4.27E-08	0.417544	-2.39496
AI481316	4.04E-07	0.417544	-2.39496
POU6F1	8.86E-07	0.417544	-2.39496
NCK2	0.000270785	0.412509	-2.42419
1110046J11RIK	5.70E-05	0.411083	-2.4326
ETS2	1.91E-06	0.408243	-2.44952
FBP1	0.00205479	0.408243	-2.44952
TPCN1	3.56E-08	0.407536	-2.45377
TBXA2R	3.11E-06	0.405423	-2.46656
5430417L22RIK	5.18E-07	0.404021	-2.47512
PPARGC1B	1.79E-07	0.404021	-2.47512
TCF7	1.40E-05	0.398459	-2.50967
DNTT	0.00027177	0.397768	-2.51403
LOC386545	0.00608272	0.394337	-2.5359
SOX4	1.85E-07	0.390258	-2.56241
GPR83	1.40E-05	0.388908	-2.5713
HIBADH	2.18E-08	0.387562	-2.58023
IGH-6	2.87E-05	0.386221	-2.58919
LOC381739	1.61E-06	0.382889	-2.61172
DAP3	2.30E-08	0.380904	-2.62533

SRI	2.09E-08	2.121377	2.12138
2610529H0	2.11E-07	2.121377	2.12138
ANXA5	0.000191	2.121377	2.12138
RPIA	2.24E-08	2.114035	2.11404
LCP1	1.15E-05	2.114035	2.11404
LOC233525	3.13E-05	2.110377	2.11038
UGALT2	1.37E-05	2.106722	2.10672
ANXA3	0.005884	2.103076	2.10307
JAM4	2.28E-07	2.099433	2.09943
CHST12	6.51E-07	2.099433	2.09943
SCL000125	3.97E-05	2.099433	2.09943
PYGL	9.38E-05	2.099433	2.09943
MREG	1.19E-07	2.095799	2.0958
1810003N2	2.62E-06	2.095799	2.0958
HRC	0.000101	2.095799	2.0958
DDIT4	0.010118	2.092168	2.09217
FBXO4	2.51E-07	2.084932	2.08493
2010007E0	5.45E-06	2.084932	2.08493
ZFP296	2.06E-08	2.081321	2.08132
0610039D0	7.86E-07	2.081321	2.08132
COTL1	0.000383	2.081321	2.08132
KLRI1	1.30E-08	2.077719	2.07772
UBL4	2.81E-07	2.077719	2.07772
ARHGAP15	3.33E-07	2.077719	2.07772
SNX9	1.75E-07	2.074121	2.07412
PFN1	3.03E-07	2.074121	2.07412
9130227C0	2.98E-06	2.074121	2.07412
DAP	2.54E-05	2.074121	2.07412
9030611O1	7.73E-05	2.074121	2.07412
D8ERTD35	0.000214	2.074121	2.07412
2900026A0	3.15E-07	2.070531	2.07053
M6PR	1.54E-06	2.070531	2.07053
MRPS6	1.82E-05	2.070531	2.07053
0610009OC	1.91E-08	2.066944	2.06695
CAPZB	4.50E-07	2.063366	2.06337
ARRB2	1.28E-06	2.063366	2.06337
A430093BC	4.59E-07	2.059796	2.05979

DGKA	8.26E-05	0.378929	-2.63902
SNAI3	4.51E-07	0.376964	-2.65277
SLC5A9	2.33E-05	0.376964	-2.65277
2410008J06RIK	1.24E-06	0.376312	-2.65737
NAV1	2.19E-06	0.376312	-2.65737
HDAC7A	2.22E-06	0.376312	-2.65737
A130092J06RIK	6.62E-06	0.37566	-2.66198
SLA	2.73E-05	0.373065	-2.6805
MTF2	2.39E-06	0.371131	-2.69447
C230098O21RIK	6.12E-05	0.370488	-2.69914
GFI1	2.05E-06	0.368567	-2.71321
EPHX1	2.39E-08	0.36793	-2.71791
BRD3	2.92E-06	0.36793	-2.71791
AQP11	4.62E-07	0.364755	-2.74157
IL17RB	2.04E-07	0.362236	-2.76063
RAMP1	0.000135079	0.361609	-2.76542
NISCH	3.31E-07	0.361609	-2.76542
BGN	0.0025721	0.360982	-2.77022
TXNIP	0.000742272	0.359733	-2.77984
COL6A1	0.00166573	0.35911	-2.78466
CCL9	0.000264226	0.356013	-2.80889
DPP4	1.63E-06	0.354167	-2.82353
MLL	1.54E-07	0.35233	-2.83825
C3	0.0001376	0.350503	-2.85304
MARCKS	4.55E-06	0.349896	-2.85799
TRBV1_AE000663_T_	0.00160689	0.348083	-2.87288
3830612M24	2.00E-06	0.344482	-2.90291
PP11R	0.000186213	0.344482	-2.90291
2510015F01RIK	0.000255295	0.342696	-2.91804
PARD6G	1.26E-07	0.327598	-3.05252
NOTCH3	3.24E-06	0.327598	-3.05252
H2-T10	0.000761011	0.327598	-3.05252
LMAN2L	1.87E-07	0.327031	-3.05781
DTX1	2.93E-07	0.324772	-3.07908
TMEM108	2.25E-05	0.32421	-3.08442
ETS1	5.90E-07	0.322529	-3.1005
SH2D1A	2.22E-06	0.320856	-3.11666

NIBAN	3.10E-05	2.059796	2.05979
2610036L1	0.001476	2.059796	2.05979
DHRS7	1.18E-08	2.05623	2.05623
LOC24162	3.38E-06	2.052667	2.05267
COX7A1	0.0006	2.052667	2.05267
RBMS1	2.03E-07	2.049113	2.04911
CDKN2A	0.000238	2.049113	2.04911
BB220380	1.50E-07	2.038491	2.03849
CMKBR2	3.22E-06	2.038491	2.03849
AW212394	2.59E-05	2.038491	2.03849
1110030C2	0.00017	2.034961	2.03496
SCL003196	8.06E-06	2.031434	2.03144
LCN4	0.003078	2.031434	2.03144
KDELR2	1.28E-06	2.02792	2.02792
CD59A	0.00082	2.024406	2.02441
CAPN5	0.001239	2.017402	2.0174
ZFP608	2.50E-06	2.013912	2.01391
SLC2A6	0.000147	2.013912	2.01391
CORO1C	1.61E-06	2.013912	2.01391
GNPDA1	7.70E-07	2.013912	2.01391
CARD4	8.05E-06	2.010426	2.01042
9-Sep	2.79E-06	2.006944	2.00694
2410012H2	8.81E-07	2.00347	2.00347
SKAP2	1.02E-06	2.00347	2.00347
IAN3	0.004387	2.00347	2.00347
TPI1	0.000372	2.00347	2.00347
9130422GC	8.52E-08	2	2
2810004N2	1.13E-06	2	2
B4GALNT2	0.002623	2	2
DNMT3B	1.05E-06	0.5	-2
SCL000548	2.96E-06	0.5	-2
LYT-2	2.32E-05	0.5	-2
LBR	1.18E-05	0.499134	-2.00347
6330406L2	5.22E-05	0.499134	-2.00347
MIER1	1.68E-08	0.498271	-2.00694
1810020D1	2.21E-07	0.498271	-2.00694
SLC9A9	4.02E-05	0.498271	-2.00694

9626100_15	0.00161165	0.314253	-3.18215
CD8B	3.35E-05	0.313166	-3.19319
ACAS2L	7.23E-06	0.309927	-3.22657
LOC434197	1.33E-06	0.30566	-3.27161
9626100_224	0.00113435	0.305131	-3.27728
FRAT2	2.01E-06	0.302499	-3.3058
NRP	8.11E-07	0.299889	-3.33457
G22P1	8.46E-08	0.296273	-3.37526
RNPEPL1	4.01E-09	0.29576	-3.38112
9626958_317	0.00188407	0.293718	-3.40463
H19	0.000268847	0.283221	-3.53081
ACTN1	2.58E-07	0.278838	-3.58631
SLC16A5	3.62E-09	0.275476	-3.63008
CD2	1.50E-06	0.275	-3.63637
PRKCB	2.18E-07	0.272155	-3.67438
ST6GAL1	7.38E-08	0.268874	-3.71922
PRELP	1.65E-05	0.268408	-3.72567
CDCA7	4.57E-05	0.267944	-3.73213
PDLIM4	4.93E-06	0.267016	-3.74509
CD6	1.61E-09	0.264713	-3.77768
ALDH2	7.40E-07	0.248704	-4.02085
CD81	6.28E-06	0.247414	-4.04181
9430068D06RIK	3.23E-10	0.239816	-4.16986
H2-BL	9.51E-06	0.232854	-4.29453
AI132321	1.19E-06	0.208772	-4.78991
LY6D	2.50E-08	0.184924	-5.40764
COX6A2	0.000397718	0.15822	-6.32033
BCL11B	1.64E-08	0.150205	-6.65759
LOC382896	6.81E-09	0.112267	-8.90737

TCRG-V5	0.001068	0.498271	-2.00694
BC035295	8.94E-08	0.497409	-2.01042
LOC386192	0.004528	0.497409	-2.01042
ARHGEF11	2.19E-08	0.496547	-2.01391
B230114J0	6.30E-07	0.496547	-2.01391
ARID1A	2.03E-06	0.496547	-2.01391
C030002B1	3.75E-05	0.496547	-2.01391
E430013K1	3.08E-06	0.495688	-2.0174
A130022AC	4.53E-06	0.495688	-2.0174
LOC269407	5.58E-06	0.495688	-2.0174
2700007B1	3.11E-05	0.495688	-2.0174
DDAH1	0.000139	0.495688	-2.0174
HP	0.001812	0.495688	-2.0174
DNCHC1	5.02E-06	0.494829	-2.0209
SPEC1	1.46E-05	0.493971	-2.02441
KCNH3	5.03E-08	0.492262	-2.03144
LRMP	3.72E-06	0.492262	-2.03144
CAMK4	5.35E-08	0.49141	-2.03496
1110001P0	2.50E-06	0.49141	-2.03496
COL15A1	7.73E-05	0.490559	-2.03849
E130307M1	3.42E-05	0.489711	-2.04202
NFE2	3.74E-05	0.489711	-2.04202
ASB13	4.76E-07	0.48717	-2.05267
XLR4A	0.000619	0.48717	-2.05267
LOC382021	0.001199	0.48717	-2.05267
3110018A0	0.003534	0.48717	-2.05267
BC020108	0.00042	0.486327	-2.05623
SOX9	0.001197	0.486327	-2.05623
CD5	2.42E-06	0.485486	-2.05979
ZFP96	2.60E-05	0.485486	-2.05979
AKAP8L	8.62E-07	0.484644	-2.06337
5530400P0	1.11E-06	0.483805	-2.06695
A430107D2	2.94E-06	0.483805	-2.06695
0610012D1	7.81E-08	0.482968	-2.07053
GALNT2	5.48E-07	0.482968	-2.07053
EPPB9	2.51E-05	0.482968	-2.07053
NSG2	8.56E-08	0.482132	-2.07412

DUSP10	4.51E-08	0.481297	-2.07772
9430080K1	3.61E-08	0.481297	-2.07772
RNASEN	2.84E-06	0.481297	-2.07772
GAS6	0.000311	0.481297	-2.07772
1810015C1	7.75E-09	0.480464	-2.08132
SLITL2	0.00045	0.480464	-2.08132
LOC386330	0.00292	0.480464	-2.08132
FKBP9	0.000505	0.479632	-2.08493
ZFPN1A1	8.59E-07	0.478801	-2.08855
DDX6	3.03E-07	0.477973	-2.09217
BACH1	1.88E-06	0.477973	-2.09217
TNNT1	0.000227	0.477973	-2.09217
BLK	2.09E-08	0.477145	-2.0958
MSCP	3.61E-07	0.477145	-2.0958
2900060B1	0.018802	0.477145	-2.0958
CNN3	2.16E-06	0.475495	-2.10307
REEP1	3.13E-08	0.474672	-2.10672
SDH1	4.36E-08	0.473028	-2.11404
PPARGC1E	9.21E-07	0.473028	-2.11404
TLK1	5.15E-07	0.473028	-2.11404
A630097D0	3.46E-05	0.47221	-2.1177
3110078MC	8.46E-07	0.471391	-2.12138
1110015K0	2.05E-06	0.470577	-2.12505
EXT1	5.14E-06	0.468949	-2.13243
FBLN2	1.48E-07	0.468136	-2.13613
1810018P1	4.02E-05	0.466516	-2.14355
DCAMKL2	1.02E-06	0.46571	-2.14726
PPT1	1.66E-06	0.46571	-2.14726
2810036L1	3.90E-05	0.46571	-2.14726
H2-EB1	0.004956	0.464902	-2.15099
2810470K0	6.54E-06	0.464097	-2.15472
RAG1	2.91E-05	0.463293	-2.15846
2610020H1	1.83E-07	0.462492	-2.1622
D10UCLA1	4.00E-05	0.461691	-2.16595
1110003A1	7.74E-07	0.460891	-2.16971
KCTD2	2.52E-05	0.460891	-2.16971
G630024G0	3.72E-08	0.459297	-2.17724

1700026B2	3.84E-06	0.458501	-2.18102
FAS	7.68E-09	0.457708	-2.1848
4933424M2	1.76E-07	0.457708	-2.1848
4921518A0	4.47E-06	0.457708	-2.1848
IGTP	0.001511	0.457708	-2.1848
9430068D0	6.51E-08	0.456915	-2.18859
A930005H1	1.37E-07	0.456915	-2.18859
ABCA3	2.04E-07	0.455334	-2.19619
5330403D1	3.86E-07	0.455334	-2.19619
4631427C1	9.36E-07	0.455334	-2.19619
TRIM28	2.42E-05	0.454548	-2.19999
CERK	1.15E-05	0.454548	-2.19999
CRYL1	7.94E-07	0.45376	-2.20381
IL7R	1.25E-08	0.452974	-2.20763
IHPK1	4.52E-07	0.452974	-2.20763
RENB	1.68E-08	0.45219	-2.21146
TPST1	1.05E-05	0.449845	-2.22299
9430029L2	9.20E-09	0.448288	-2.23071
5730593F1	3.51E-06	0.448288	-2.23071
C530015C	1.57E-08	0.446738	-2.23845
HMG	0.000104	0.446738	-2.23845
TRAF4	8.39E-08	0.445965	-2.24233
AXIN2	2.23E-09	0.445192	-2.24622
BCL7A	5.46E-07	0.445192	-2.24622
A630082K2	7.65E-08	0.444421	-2.25012
TNRC6C	1.44E-07	0.444421	-2.25012
PCOLCE	0.00026	0.443652	-2.25402
PRICKLE1	6.89E-07	0.442884	-2.25793
BCL6	1.24E-05	0.442884	-2.25793
COL2A1	3.25E-05	0.442118	-2.26184
MRPL14	5.42E-07	0.441351	-2.26577
ZFP148	8.82E-07	0.440587	-2.2697
CNOT2	1.44E-07	0.439825	-2.27363
C230075L1	1.84E-07	0.439063	-2.27758
2700083E1	2.52E-07	0.439063	-2.27758
CCND1	1.92E-05	0.438302	-2.28153
CUTL1	8.66E-08	0.437545	-2.28548

AI467606	5.41E-07	0.43603	-2.29342
GMFG	7.47E-05	0.43603	-2.29342
GLDC	0.000565	0.43603	-2.29342
CNP1	1.01E-07	0.435275	-2.2974
RBM38	2.02E-08	0.434522	-2.30138
BC039093	2.61E-06	0.434522	-2.30138
6.33E+19	2.02E-05	0.434522	-2.30138
SCARA3	5.87E-05	0.434522	-2.30138
FKBP5	3.81E-07	0.43377	-2.30537
BC063749	1.34E-09	0.433019	-2.30937
LOC22613	0.000315	0.433019	-2.30937
AFF1	5.19E-07	0.432268	-2.31338
COL4A1	3.11E-05	0.430028	-2.32543
COL6A3	0.001678	0.430028	-2.32543
VAMP4	4.17E-07	0.429282	-2.32947
NUP210	0.0001	0.428539	-2.33351
ADCY6	1.78E-07	0.427798	-2.33755
UHRF1	0.000152	0.427798	-2.33755
PTPRS	3.83E-07	0.427057	-2.34161
LBH	5.98E-05	0.426317	-2.34567
SCML4	1.21E-07	0.425579	-2.34974
1700095N2	2.00E-07	0.425579	-2.34974
5930416I1	4.45E-07	0.425579	-2.34974
SEMA4B	1.98E-06	0.425579	-2.34974
SCA2	6.05E-07	0.424843	-2.35381
5830431A1	2.60E-06	0.424843	-2.35381
MSH6	0.000132	0.424843	-2.35381
TTC3	5.71E-09	0.421907	-2.37019
KCTD1	1.30E-06	0.421907	-2.37019
BC028975	1.19E-08	0.421177	-2.3743
GPSM1	2.16E-06	0.421177	-2.3743
ERICH1	3.26E-08	0.420449	-2.37841
GATA3	6.03E-07	0.420449	-2.37841
TTYH3	4.09E-06	0.420449	-2.37841
H2-OB	6.36E-06	0.420449	-2.37841
BHLHB9	1.72E-05	0.420449	-2.37841
AW046396	0.001335	0.420449	-2.37841

4632417D2	5.33E-07	0.417544	-2.39496
PDLIM1	8.32E-07	0.417544	-2.39496
1810010N1	1.37E-06	0.416821	-2.39911
CHRNA9	1.78E-09	0.4161	-2.40327
GSTM2	0.0004	0.415379	-2.40744
SCL000121	6.07E-06	0.413942	-2.4158
MNS1	0.000532	0.413942	-2.4158
GABABRB1	3.45E-05	0.412509	-2.42419
ANP32E	3.77E-05	0.411083	-2.4326
SMARCD2	6.84E-06	0.404021	-2.47512
CASP6	6.84E-07	0.40332	-2.47942
LTAP	3.13E-08	0.400535	-2.49666
EFEMP2	8.18E-05	0.399842	-2.50099
4932408F1	3.03E-07	0.398459	-2.50967
CD1D1	9.54E-07	0.398459	-2.50967
SH2D1A	1.27E-05	0.398459	-2.50967
ADRB2	1.53E-08	0.397768	-2.51403
6330403E0	2.81E-07	0.397079	-2.51839
C230082I2	1.32E-09	0.396393	-2.52275
FBXL12	3.35E-06	0.395021	-2.53151
SMO	3.82E-09	0.394337	-2.5359
6720469N1	1.55E-07	0.393654	-2.5403
ZFPN1A2	1.20E-07	0.392972	-2.54471
PHF2	2.68E-07	0.392972	-2.54471
LIP1	8.34E-07	0.392972	-2.54471
IFNGR1	1.21E-07	0.392292	-2.54912
SPATA13	1.64E-07	0.391613	-2.55354
NEDD4L	4.00E-09	0.390935	-2.55797
SLA	4.00E-05	0.390935	-2.55797
ARHGEF18	2.56E-05	0.390935	-2.55797
RASGRP1	7.85E-08	0.390258	-2.56241
NOTCH1	2.02E-08	0.388235	-2.57576
2900016B0	6.34E-09	0.387562	-2.58023
PITPNM2	1.79E-07	0.386891	-2.58471
SMAD3	2.00E-06	0.385553	-2.59368
CHDH	1.11E-07	0.383553	-2.6072
C920011N1	5.34E-06	0.383553	-2.6072

NISCH	5.43E-07	0.382889	-2.61172
2310007GC	1.06E-06	0.382889	-2.61172
SIT1	3.76E-09	0.382226	-2.61625
SLC29A3	7.22E-07	0.380904	-2.62533
AEBP1	0.000162	0.380904	-2.62533
C730009F2	9.48E-09	0.379586	-2.63445
PLEKHG2	9.65E-07	0.379586	-2.63445
MBP	2.65E-08	0.378273	-2.64359
D8ERTD32	9.64E-06	0.378273	-2.64359
VPS54	4.16E-08	0.377618	-2.64818
MLL	2.80E-07	0.377618	-2.64818
LOC386144	4.21E-05	0.377618	-2.64818
LOC386360	0.000404	0.377618	-2.64818
BACH2	0.000136	0.376964	-2.65277
BDH	2.28E-10	0.375009	-2.6666
KLHL6	2.22E-08	0.375009	-2.6666
DAP3	1.93E-08	0.373712	-2.67586
TCRB-V8.2	8.04E-08	0.373712	-2.67586
A130062D1	1.07E-07	0.373712	-2.67586
SSBP3	1.03E-07	0.373712	-2.67586
MAPK1	5.13E-08	0.37242	-2.68514
FRMD6	3.31E-08	0.371775	-2.6898
TNFRSF13	6.85E-08	0.371775	-2.6898
MMP2	0.000109	0.371775	-2.6898
ECM1	1.84E-07	0.371131	-2.69447
CUL7	2.80E-07	0.366021	-2.73208
NOTCH3	7.70E-06	0.366021	-2.73208
D930015EC	2.19E-07	0.365388	-2.73682
A430106G7	1.00E-06	0.364755	-2.74157
5830468F0	5.09E-06	0.364124	-2.74632
HIBADH	1.23E-08	0.363494	-2.75108
TMEM9	4.73E-07	0.362236	-2.76063
TSPAN32	8.74E-07	0.35663	-2.80403
H2-T9	4.22E-05	0.35663	-2.80403
ESM1	0.001321	0.356013	-2.80889
ALOX5AP	1.28E-07	0.355396	-2.81376
RFX2	1.13E-06	0.355396	-2.81376

2610019F0	3.33E-06	0.354781	-2.81864
WHRN	4.89E-07	0.353553	-2.82843
5830496L1	1.90E-07	0.352942	-2.83333
GSTP1	7.09E-07	0.352942	-2.83333
3100002J2	3.91E-07	0.35233	-2.83825
YPEL3	0.000133	0.351111	-2.8481
A130092J0	3.76E-06	0.350503	-2.85304
IGSF3	5.35E-07	0.34929	-2.86295
HDAC7A	1.07E-06	0.344482	-2.90291
IDB3	1.63E-07	0.343886	-2.90794
OLFML3	6.69E-07	0.34329	-2.91299
6430510MC	1.07E-07	0.342696	-2.91804
TRBV13-1_	1.50E-05	0.34151	-2.92817
CD97	2.26E-05	0.33974	-2.94343
MTF2	1.12E-06	0.337977	-2.95878
PLA2G12A	1.72E-08	0.336225	-2.9742
D15WSU75	2.04E-06	0.336225	-2.9742
ETHE1	1.66E-08	0.334482	-2.9897
HIVEP3	3.41E-09	0.333903	-2.99488
CYB5	3.77E-08	0.333903	-2.99488
CTSE	0.149884	0.333324	-3.00008
ZFP219	2.26E-07	0.329877	-3.03143
ABHD8	1.69E-06	0.329877	-3.03143
4732481H1	8.63E-07	0.329306	-3.03669
PRNP	3.14E-05	0.328735	-3.04196
A630038E1	0.000216	0.328735	-3.04196
A930013B1	8.09E-08	0.325336	-3.07375
ETS1	5.90E-07	0.322529	-3.1005
LOC385086	0.001044	0.322529	-3.1005
RNPEPL1	7.60E-09	0.32197	-3.10588
KLF13	6.51E-07	0.321413	-3.11126
KCNN4	1.98E-06	0.320856	-3.11666
NIPSNAP1	1.39E-06	0.320856	-3.11666
C920004C6	0.000563	0.320856	-3.11666
TRBV7_AE	6.95E-05	0.319746	-3.12748
SLC43A1	3.64E-08	0.316439	-3.16017
STK4	7.89E-07	0.315891	-3.16565

WISP2	1.27E-05	0.312624	-3.19873
ACTN2	3.36E-07	0.310465	-3.22098
EPB4.1L4B	4.42E-07	0.310465	-3.22098
RNF144	2.74E-09	0.308855	-3.23777
SCL000184	1.73E-05	0.307786	-3.24901
ART4	6.83E-07	0.306191	-3.26594
18S_RRNA	0.00445	0.299889	-3.33457
A330103N2	1.65E-06	0.29937	-3.34035
TPCN1	2.60E-09	0.298851	-3.34615
AJ237586	1.97E-07	0.298334	-3.35195
BC026370	6.26E-09	0.29576	-3.38112
EPHX1	4.14E-09	0.295248	-3.38698
COL5A1	0.000124	0.293718	-3.40463
SNN	1.47E-08	0.292701	-3.41645
BCL9L	1.00E-08	0.292194	-3.42238
0710008K0	9.65E-08	0.291688	-3.42832
F730003HC	0.00011	0.289674	-3.45216
AI504432	2.49E-08	0.287175	-3.4822
OACT1	9.74E-09	0.286678	-3.48824
A130093I2	1.16E-06	0.285191	-3.50642
RGS10	2.26E-05	0.284698	-3.5125
1110046J11	3.46E-06	0.284204	-3.5186
E2F2	2.29E-06	0.278355	-3.59253
BRD3	3.58E-07	0.277873	-3.59876
AA408556	4.12E-06	0.272627	-3.66802
SATB1	1.49E-07	0.270744	-3.69353
ILVBL	3.59E-07	0.270744	-3.69353
TIAM1	1.97E-09	0.268874	-3.71922
POU6F1	2.59E-08	0.268874	-3.71922
MAGED1	1.17E-05	0.268874	-3.71922
1810055GC	1.69E-09	0.266554	-3.75158
0710001E1	6.72E-10	0.264713	-3.77768
LMAN2L	4.14E-08	0.264713	-3.77768
SLC29A1	1.20E-07	0.264255	-3.78423
3830612M2	2.98E-07	0.263797	-3.79079
H2-T10	0.000217	0.263797	-3.79079
CXCR4	4.41E-08	0.26334	-3.79737

RIL-PENDI	2.35E-08	0.262429	-3.81055
SERPINH1	3.41E-05	0.262429	-3.81055
PALM	2.59E-09	0.261975	-3.81716
CXCL12	0.000158	0.261069	-3.83041
5430417L2	1.68E-08	0.260616	-3.83706
TRIB2	4.82E-08	0.260165	-3.84371
ETS2	5.78E-08	0.260165	-3.84371
ALDH2	9.48E-07	0.258816	-3.86375
HMGN1	3.20E-05	0.257028	-3.89062
TRP53INP	4.08E-08	0.255696	-3.9109
ITPR2	5.70E-08	0.25393	-3.9381
TCRB	8.36E-06	0.25349	-3.94493
A930023F0	4.58E-09	0.247843	-4.03481
SLC5A9	1.20E-06	0.246986	-4.04882
ICAM2	2.53E-07	0.246558	-4.05584
H2-DMA	1.25E-05	0.246558	-4.05584
4932414K1	3.75E-08	0.244431	-4.09113
TAP2	9.85E-09	0.243585	-4.10534
TRBV12-2_	3.25E-05	0.243585	-4.10534
PRELP	8.99E-06	0.242323	-4.12673
TRBV12-1_	1.47E-06	0.241066	-4.14824
LOX	8.44E-06	0.240232	-4.16264
1500004A0	1.03E-07	0.239816	-4.16986
6720418B0	4.27E-08	0.238572	-4.1916
4930572J0	4.75E-07	0.236925	-4.22075
SCL00010	7.57E-06	0.236925	-4.22075
PSAP	4.23E-08	0.236105	-4.2354
ASS1	5.82E-08	0.235696	-4.24275
PARD6G	1.30E-08	0.235288	-4.25011
1500009L1	9.73E-07	0.232451	-4.30198
GM2A	2.89E-06	0.231246	-4.3244
LAT	5.46E-08	0.230846	-4.3319
C3	9.90E-06	0.230846	-4.3319
PPAP2B	1.69E-05	0.230446	-4.33941
CTLA4	5.06E-06	0.230446	-4.33941
FBP1	5.98E-05	0.228458	-4.37717
B3BP	1.28E-10	0.224533	-4.45369

PRKCB	6.59E-08	0.224533	-4.45369
PPP1R1C	3.85E-09	0.220676	-4.53154
RAPGEF3	6.21E-10	0.219532	-4.55515
BAMBI-PS'	7.87E-08	0.219151	-4.56306
1700012H1	5.26E-09	0.218393	-4.5789
ACVR2B	3.12E-10	0.218015	-4.58684
18S_RRNA	0.000603	0.215386	-4.64282
SERPINF1	1.43E-05	0.214642	-4.65893
NAV1	4.40E-08	0.21427	-4.66701
TBXA2R	3.11E-08	0.213528	-4.68322
SCL000113	1.63E-05	0.20733	-4.82323
SOX4	1.93E-09	0.205541	-4.8652
E430021E2	3.57E-07	0.204476	-4.89056
LOC381736	2.02E-08	0.203063	-4.92458
CD6	3.02E-10	0.200963	-4.97605
H2-OA	1.09E-07	0.198884	-5.02805
LOC384370	7.41E-06	0.197853	-5.05426
ZDHHC8	3.73E-09	0.19751	-5.06303
AI481316	1.75E-09	0.196827	-5.0806
H2-BL	3.80E-06	0.196146	-5.09824
AA407270	7.17E-09	0.195467	-5.11594
ITGAE	6.39E-06	0.195129	-5.12482
GPR83	1.37E-07	0.194791	-5.1337
SBK	4.54E-10	0.18783	-5.32396
RPS6KL1	1.75E-09	0.187505	-5.33319
TCF7	8.08E-08	0.183965	-5.43583
NRP	4.24E-08	0.183646	-5.44526
DNAJC6	3.58E-11	0.182694	-5.47364
SCL000105	3.66E-09	0.182694	-5.47364
SCL000113	1.31E-06	0.179245	-5.57897
IL17RB	1.94E-09	0.178006	-5.61778
ACAS2L	2.63E-07	0.17647	-5.66667
AKR1C12	8.40E-09	0.176165	-5.67649
COL6A1	3.56E-05	0.174645	-5.72589
SOCS3	3.74E-08	0.172839	-5.78573
LDH2	1.01E-07	0.172839	-5.78573
DGKA	6.54E-07	0.172839	-5.78573

GM525	1.28E-07	0.17254	-5.79577
TIMP2	2.00E-08	0.172241	-5.80582
AQP11	3.40E-09	0.170459	-5.8665
TRBV6_AE	5.66E-08	0.166951	-5.98977
TNFRSF7	9.20E-08	0.161544	-6.19026
CD2	7.22E-08	0.15932	-6.27667
DTX1	3.94E-09	0.158769	-6.29846
AI875142	2.49E-07	0.157127	-6.36429
IGFBP4	1.57E-08	0.155771	-6.41967
SH3KBP1	2.13E-10	0.154964	-6.45313
2510015F0	3.11E-06	0.153627	-6.50929
TRBV11_AI	2.50E-08	0.151511	-6.60016
SLC16A5	1.12E-10	0.148651	-6.72717
TUBB2B	4.82E-08	0.148137	-6.75053
DNTT	7.39E-07	0.14534	-6.88044
SYTL1	6.70E-08	0.143091	-6.98858
2410008J0	2.59E-09	0.137262	-7.28536
0610041GC	9.40E-06	0.137024	-7.29799
2210408F1	2.70E-08	0.135138	-7.39987
LOC38654	2.77E-05	0.131215	-7.6211
TRBV31_X	4.97E-06	0.129184	-7.74089
TCRB-V8.3	1.15E-08	0.128292	-7.79473
KLF2	3.06E-06	0.125434	-7.97232
TCRB-V13	5.74E-08	0.124352	-8.0417
A130038J1	8.77E-09	0.117848	-8.4855
LOC38173	1.87E-09	0.117237	-8.52973
G22P1	5.44E-10	0.115823	-8.63383
CD27	4.55E-08	0.113834	-8.78474
TMEM108	8.61E-08	0.112656	-8.87656
ACTN1	2.20E-09	0.110913	-9.01608
ST6GAL1	6.69E-10	0.106579	-9.38268
9626100_1	1.11E-05	0.103485	-9.66319
9626100_2	8.13E-06	0.10118	-9.88335
C030046M	1.45E-12	0.101005	-9.90049
SELL	6.85E-09	0.099442	-10.0561
COX6A2	7.37E-05	0.098755	-10.1261
FRAT2	6.49E-09	0.098414	-10.1612

LY6D	1.48E-09	0.097903	-10.2142
9130430L1	2.71E-10	0.092782	-10.7779
CDCA7	3.37E-07	0.092142	-10.8528
LOC382896	3.09E-09	0.091506	-10.9283
CD8B	7.37E-08	0.089934	-11.1193
E430002DC	2.09E-10	0.089312	-11.1967
TRGV2_M1	2.57E-11	0.08657	-11.5514
PP11R	2.12E-07	0.086419	-11.5715
CD81	4.58E-08	0.083187	-12.0211
IGH-6	8.08E-09	0.082899	-12.0629
AI132321	2.09E-08	0.082042	-12.1889
9626958_3	8.03E-06	0.077214	-12.9511
TRBV8_AE	9.31E-08	0.076947	-12.996
MGST2	3.44E-09	0.074197	-13.4777
RAMP1	5.23E-08	0.072043	-13.8806
NCK2	3.02E-08	0.068631	-14.5707
MARCKS	1.18E-09	0.065721	-15.2158
DPP4	2.19E-10	0.056426	-17.7224
TRBV1_AE	6.96E-07	0.056036	-17.8456
H19	3.39E-07	0.055745	-17.9387
TCRG-V4	3.97E-09	0.051296	-19.4946
1190002H2	4.58E-10	0.050241	-19.9042
BCL11B	2.77E-10	0.049549	-20.182
CD3G	8.20E-11	0.046472	-21.5184
BGN	3.71E-07	0.039692	-25.1939
CD3D	1.53E-09	0.034976	-28.5912
CD3E	7.19E-10	0.031907	-31.3414
LOC434197	5.40E-11	0.02356	-42.4443
MYLC2PL	8.10E-10	0.017039	-58.6883
PDLIM4	8.76E-11	0.009786	-102.182

Table 4. Comparison of cell surface receptor repertoires of ITNKs and LAKs.

Cell Type	Ly49C/I	Ly49D	Ly49G2	NK1.1	NKp46	NKG2A/C/E	NKG2D	CD3
DN3-reprogrammed ITNK (in vitro)	-	-	-	+	+	+	-	-
DP-reprogrammed ITNK (in vitro)	-	-	-	+	+	+	ND	+
DP-reprogrammed ITNK (in vivo)	+	-	+	+	+	+	+	low
LAK	+	+	+	+	+	+	+	-

Note: N.D., not determined. +, present; -, absent; low, low levels.