

Supplementary Material for

Targeting prostate cancer using intratumoral cytotypically-modified interleukin-15 immunotherapy in a syngeneic murine model

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Supplementary Methods

SDS-PAGE electrophoresis and western blot analysis

The modified IL-15 protein was analysed by SDS-PAGE using a 12% NuPAGE Bis-Tris mini gel and MES buffer (ThermoFisher). The gel was either stained with a SilverXpress Silver Staining Kit (ThermoFisher) or transferred on nitrocellulose membrane using an iBlot transfer stack (ThermoFisher) to be used for western blotting. Non-specific binding was blocked in Caseine (ThermoFisher) and IL-15 was detected using a mouse anti-IL-15 antibody (1/200, PromoCell, Heidelberg, Germany). Subsequently, a goat anti-mouse horseradish peroxidise (HRP)-conjugated secondary antibody (1/1000, Dako, Agilent Technologies, Stockport, UK) was used and signal was detected using SIGMAFAST 3,3'-Diaminobenzidine tablets (Sigma-Aldrich) according to manufacturer's instructions.

A 5-carboxyfluorescein (FAM) version of the PTL3146 peptide was created using an AnaTag 5-FAM Protein labelling Kit (Anaspec, California, USA). Subsequently, the IL-15 and the PD-L1 and CTLA-4 antibodies were modified using the FAM-labelled peptide, analysed on an agarose gel and stained with Silver Staining or visualised under UV-light.

For tumor homogenates: Tumors (~30mg) were dissociated in RIPA buffer (ThermoFisher) containing Complete Mini protease inhibitor tablets (Roche Diagnostics, Burgess Hill, UK) using a gentleMACS Dissociator (Miltenyi Biotec Ltd., Woking, UK) according to the manufacturer's instructions. Protein concentration of homogenates was determined using the BCA protein assay and samples were kept at -20 °C prior to analysis.

Equal amounts of protein (30 µg) were analysed by SDS-PAGE using 4-12% NuPAGE Bis-Tris gels and MES buffer (Thermofisher). Transfer on nitrocellulose membrane was performed as above and non-specific binding was blocked using 5% skimmed milk in TBS-T. Pdcd4 expression was detected using a rabbit polyclonal Pdcd4 antibody (1/1000, BioRad, Deeside, UK), a goat anti-rabbit HRP-conjugated secondary antibody (1/2000, Dako) and an ECL Western Blotting Detection reagent (GE Healthcare, Little Chalfont, UK). A mouse monoclonal anti-β-actin antibody (R&D, Bio-Techne Ltd, Abingdon, UK) was used to verify equal protein loading. The integrated density of the individual bands for Pdcd4 was measured and corrected using the integrated density of the individual bands for β-actin using ImageJ software.

Cell binding assay

The ability of cyto-IL-15 and cyto-abs to bind to cell membranes via the myristoylated peptide was investigated using cells that do not express or express low levels of IL-15 receptors (RBCs and naïve Jurkat cells) or PD-L1 and CTLA-4 receptors (naïve Jurkat cells).

Binding of cyto-IL-15 to RBCs: Fresh murine RBCs in 10% 0.5M EDTA solution were diluted 1/400 in wash buffer (PBS with 2% FBS). Cells were washed in wash buffer and centrifuged at 300 g for 5 min. The cell pellet was resuspended in residual buffer and incubated with 2 µg of IL-15 or cyto-IL-15 for 20 min at RT. Cells were washed with wash buffer and incubated with a mouse monoclonal anti-human IL-15 PE-conjugated antibody (Bio-technne, Abington, UK) for 45 min at 4 °C in the dark. Cells were washed, centrifuged and pellet resuspended in wash buffer. Flow cytometric analysis was performed immediately after, using a FACSCalibur flow cytometer (BD Biosciences, Berkshire, UK). All data were analysed using FlowJo software (FlowJo LLC, Oregon, USA).

Binding of cyto-IL-15 to Jurkat cells: Naïve Jurkat cells were washed in PBS and incubated with 2 µg of IL-15 or cyto-IL-15 for 20 min at RT. Cells were then washed with PBS to remove unbound or excess protein and incubated for 30 min or 24 h in RPMI complete medium at 37 °C. After 30 min or 24 h, cells were washed with wash buffer and incubated with IL-15 PE-conjugated antibody (as above) for 45 min at 4 °C in the dark. Cells were washed, centrifuged and pellet resuspended in wash buffer. Flow cytometric analysis followed as above.

Binding of cyto-PD-L1 and cyto-CTLA-4 to Jurkat cells: Naïve_Jurkat cells were washed in wash buffer and incubated with 2 µg of PD-L1, cyto-PD-L1, CTLA-4 or cyto-CTLA-4 for 20 min at RT. Cells were washed with wash buffer and incubated with a mouse monoclonal anti-rat IgG2b PE-conjugated antibody [GK1-5] (eBioscience, ThermoFisher) against PD-L1 or with a goat polyclonal anti-hamster (Armenian) IgG DyLight 649-conjugated [Poly4055] (BioLegend) against CTLA-4 for 45 min at 4°C in the dark. Cells were washed, centrifuged and the pellet resuspended in wash buffer. Flow cytometric analysis followed as above.

PBMC isolation

PBMCs were isolated from healthy donors using anonymized leukodepletion cones (Blood Transfusion Service, NHS Blood and Transplantation). Briefly, blood was diluted 1:2 in Hanks' balanced salt solution (HBSS, Sigma-Aldrich) and overlaid at a 1:1 ratio on Histopaque-1077 (Sigma-Aldrich) in 50 ml Falcon tubes. A gradient centrifugation was then performed at 450 g at RT for 30 min with no deceleration. PBMCs were then extracted from the buffy coat and washed with HBSS. Red blood cells were lysed in RBC lysis buffer (eBioscience, ThermoFisher) for 10 min at 37°C and the reaction was stopped with HBSS. PBMCs were collected, resuspended in RPMI complete medium and left to adhere in 175 cm² cell culture flasks at a 3x10⁶ cells/ml concentration, overnight. Non-adherent PBMCs were collect for further use.

Cell expansion assay

The ability of IL-15 to expand NK cells was investigated in human non-adherent PBMCs. Briefly, PBMCs were plated at a 1x10⁶ cells/ml concentration and stimulated with various concentration of IL-15, cyto-IL-15 or IL-2 (PeproTech). Cytokines were replenished after three days. After a total of six days, single-cell suspensions were washed in Stain Buffer (PBS with 1% bovine serum albumin (BSA) and 0.1% sodium azide) and stained with cell surface marker antibodies (listed in Table S1) for 45 min at 4 °C. Cells were then washed and fix in CellFix (BD Biosciences). Labelled cells were measured on the FACSCalibur flow cytometer. The gating strategy for NK and CD8 cytotoxic T cell populations is shown in Figure S4A.

CTLA-4 activity assay

To activity of cyto-CTLA-4 antibody was verified in a Jurkat cell-based assay. Briefly, 1x10⁵ cells/well were seeded in 96-well plates and activated using 2.5 µg/ml phytohemagglutinin (Sigma-Aldrich) and 2 µg/ml recombinant human B7-1/Fc chimera protein (Sino Biological, Pennsylvania, USA). Human B7-1 can bind to either human or mouse CTLA-4;¹ hence, cell activation was inhibited with 2 µg/ml recombinant mouse CTLA-4/Fc chimera protein (Sino Biological), and then reconstituted by blocking the CTLA-4/Fc protein with CTLA-4 or cyto-CTLA-4 antibodies. After 4 hours, cells were centrifuged (400 g, 5 min) and supernatants were collected. Cells activation was assessed by measuring IL-2 secretion in the supernatants using a human IL-2 ELISA (BioLegend) according to manufacturer's instructions.

PD-L1 activity assay

EL4 cells were used to verify the activity of the cyto-PD-L1 antibody, as these cells express PD-1 protein on their surface. The inhibitory effect of the PD-L1 antibody on the PD-1/PD-L1 interaction was measured. Briefly, 1x10⁵ cells were fluorescently labelled with a PE-Cy7-conjugated rat monoclonal anti-mouse PD-1 (CD279) antibody [RMP1-30] (1/200, BioLegend). 50 µg/ml recombinant mouse PD-L1/Fc chimera protein (Sino Biological) was used to interact with PD-1 on the cell surface. The PD-L1/Fc protein was blocked with PD-L1 or cyto-PD-L1 antibodies. All components were added simultaneously and incubated for 45 min at 4°C. Cells were then washed with PBS and flow cytometric analysis was performed.

Cytokine bead array assay

Tumors were dissociated in PBS containing Complete Mini protease inhibitor tablets (Roche Diagnostics) using a gentleMACS Dissociator (Miltenyi Biotec Ltd.) according to the manufacturer's instructions. Tumor lysates were kept at -80 °C prior to analysis. Levels of IFN- γ , CXCL1, TNF- α , CCL2, IL-12, CCL5, IL-1 β , CXCL10, GM-CSF, IL-10, IFN- β , IFN- α and IL-6 were measured in lysates using a LEGENDplex mouse anti-virus response panel kit (BioLegend) following the manufacturer's instructions. Data were acquired using the FACSCalibur and analysed using VigeneTech software provided with the kit. All samples were measured in technical duplicates and biological replicates ($n = 10$ or 6 depending on treatment cohort) and values were normalised to protein concentration of tumors, determined using the BCA protein assay. (IFN: interferon, TNF: tumor necrosis factor).

RNA sequencing

RNA samples were quantified using Qubit 2.0 Fluorometer (Life Technologies, California, USA) and RNA integrity was checked with 4200 Aligent TapeStation (Agilent Technologies, California, USA).

RNA sequencing library preparation used the NEBNext Ultra RNA Library Prep Kit for Illumina following manufacturer's instructions (NEB, Massachusetts, USA). Briefly, mRNAs were first enriched with Oligo(dT) beads. Enriched mRNAs were fragmented for 15 minutes at 94 °C. First strand and second strand cDNA were subsequently synthesized. cDNA fragments were end repaired and adenylated at 3'ends, and universal adapters were ligated to cDNA fragments, followed by index addition and library enrichment by PCR with limited cycles. The sequencing library was validated on the Agilent TapeStation and quantified using the Qubit 2.0 Fluorometer as well as by quantitative PCR (KAPA Biosystems, Massachusetts, USA).

The sequencing libraries were clustered on a single lane of a flowcell. After clustering, the flowcell was loaded on the Illumina HiSeq instrument according to manufacturer's instructions. The samples were sequenced using a 2x150 Paired End (PE) configuration. Image analysis and base calling were conducted by the HiSeq Control Software (HCS). Raw sequence data (.bcl files) generated from Illumina HiSeq was converted into fastq files and demultiplexed using Illumina's bcl2fastq 2.17 software. One mis-match was allowed for index sequence identification.

After investigating the quality of the raw data, sequence reads were trimmed to remove possible adapter sequences and nucleotides with poor quality using Trimmomatic v.0.36. The trimmed reads were mapped to the *Mus musculus* reference genome available on ENSEMBL using the STAR aligner v.2.5.2b. The STAR aligner uses a splice aligner that detects splice junctions and incorporates them to help align the entire read sequences. BAM files were generated as a result of this step. Unique gene hit counts were calculated by using feature Counts from the Subread package v.1.5.2. Only unique reads that fell within exon regions were counted. Since a strand-specific library preparation was performed, the reads were strand-specifically counted.

After extraction of gene hit counts, the gene hit counts table was used for downstream differential expression analysis. Using DESeq2, a comparison of gene expression between the groups of samples was performed. The Wald test was used to generate p-values and Log2 fold changes. Genes with adjusted p-values < 0.05 and absolute log2 fold changes > 1 were called as differentially expressed genes for each comparison. A gene ontology (GO) analysis was performed on the statistically significant set of genes by implementing the software GeneSCF using Fisher exact test. The mgzi GO list was used to cluster the set of genes based on their biological process and determine their statistical significance.

Splenocyte ex vivo stimulation

Spleens from treated mice were harvested at survival endpoints and kept in PBS on ice. Shortly after removal, spleens were mechanically disrupted, passed through a 40 µm cell strainer and rinsed with PBS to remove debris. Red blood cells were lysed using RBC lysis buffer for 5 min on ice and the reaction was stopped with PBS. The isolated splenocytes were kept in -80 °C until further use.

Splenocytes were thawed and stimulated with 1 µg/ml ionomycin and 20 ng/ml phorbol 12-myristate 13-acetate (PMA) (both from Sigma-Aldrich) for 5 h at 37°C. Cells were collected, washed with PBS and stained for flow cytometry analysis. The antibodies used are listed in Table S1. Labelled cells were analysed on a BD LSRII Fortessa cell analyser (BD Biosciences). The gating strategy for NK cells is shown in Figure S4B.

Supplementary Figures

PTL3146:

(N- α,ϵ bis-myristoyl lysine)SSKSPSKDDKKPGDC(S-2-pyridylthio)-acid)

Mature human IL-15 (amino acids 49-162) with C-terminus linker:

NWVNVISDLKKIEDLIQSMHIDATLYTESDVHPSCVTAMKCFLLQLQVQLESGDASIHDVTENLILAN
NSLSSNGNVNTESGCKECEELEEKNIKEFLQSFVHVQMFIINT**SRGKSLSKVPPTVQKPTTVNVPTTE**
VSPTSQKTTTHHHHHHC

Figure S1 Full sequence of the doubly myristoylated peptide PTL3146 and the mature human IL-15 with the C-terminus linker (highlighted in red).

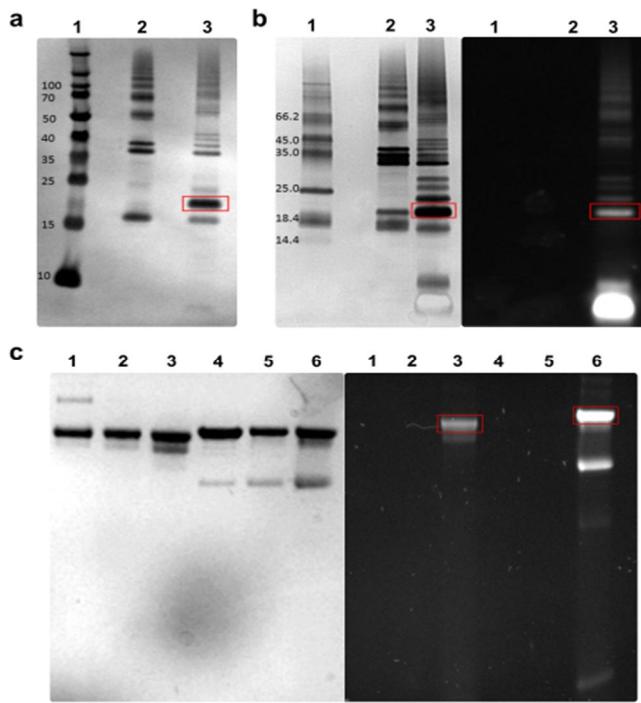


Figure S2 Cytotoxic modification of IL-15 and CTLA-4 and PD-L1 antibodies (a) Western blot indicating the cyto-IL-15 band highlighted in red (1: molecular marker, 2: IL-15, 3: cyto-IL-15). (b) Gel after Silver staining (left) and under UV light (right) indicating the presence of the PTL3146 peptide highlighted in red conjugated with IL-15 (1: molecular marker, 2: cyto-IL-15, 3: cyto-IL-15 with FAM-labelled peptide). (c) Gel after Silver staining (left) and under UV light (right) indicating the presence of the PTL3146 peptide highlighted in red conjugated with either CTLA-4 or PD-L1 antibodies (1: CTLA-4 ab, 2: cyto-CTLA-4 ab, 3: cyto-CTLA-4 ab with FAM-labelled peptide, 4: PD-L1 ab, 5: cyto-PD-L1 ab, 6: cyto-PD-L1 ab with FAM-labelled peptide).

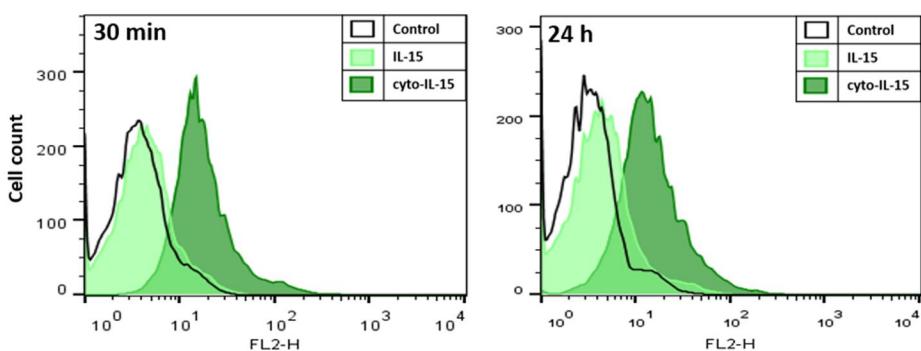


Figure S3 In vitro binding of cytotoxically-modified IL-15 over time. Cell membrane binding of IL-15 on naïve Jurkat cells 30 min (left panel) and 24 h (right panel) after incubation with IL-15 or cyto-IL-15, detected by flow cytometric analysis using fluorescent-labelled anti-IL-15 antibodies.

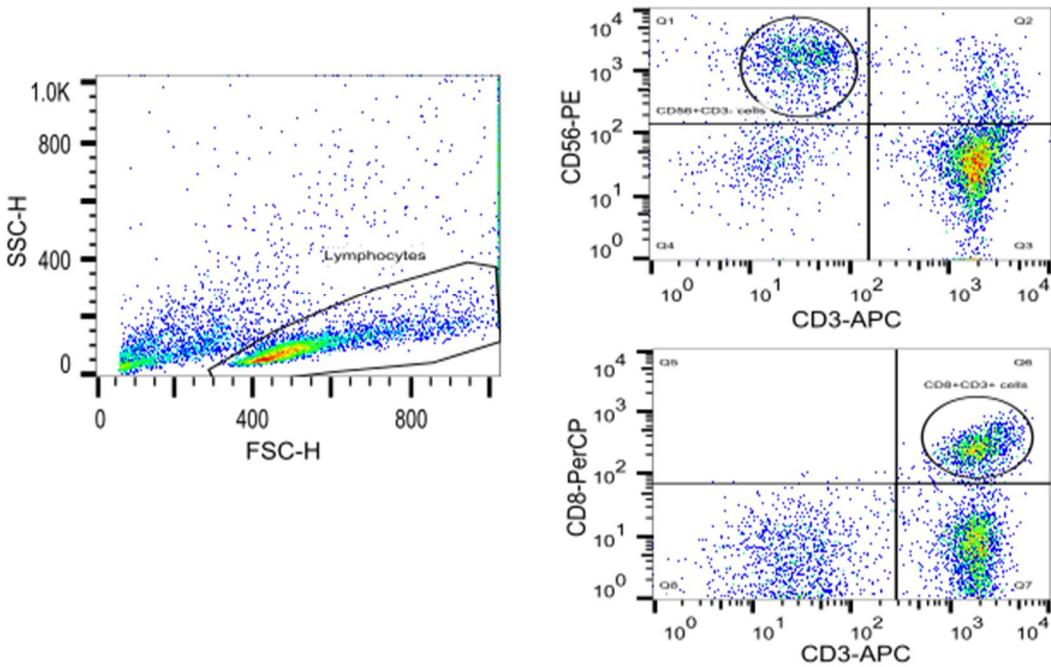
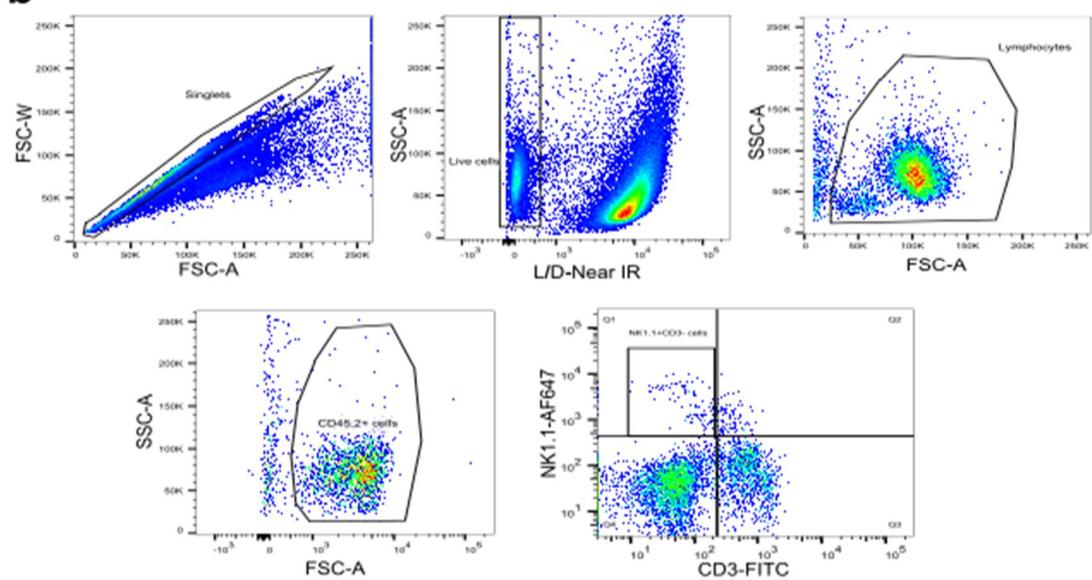
a**b**

Figure S4 Flow cytometry gating strategy. (a) Representative plots showing gating strategy used to isolate NK cells and CD8 T cells in non-adherent PBMCs, initially gating on forward and side scatter profiles and selecting CD56⁺CD3⁻ NK cells or CD8⁺CD3⁺ CD8 T cells within the lymphocyte population. (b) Representative plots showing gating strategy used to isolate NK cells in splenocytes, initially gating on singlets, then identifying live cells, selecting lymphocytes and CD45.2⁺ lymphocytes, and selecting NK1.1⁺CD3⁻ cells within the lymphocyte population.

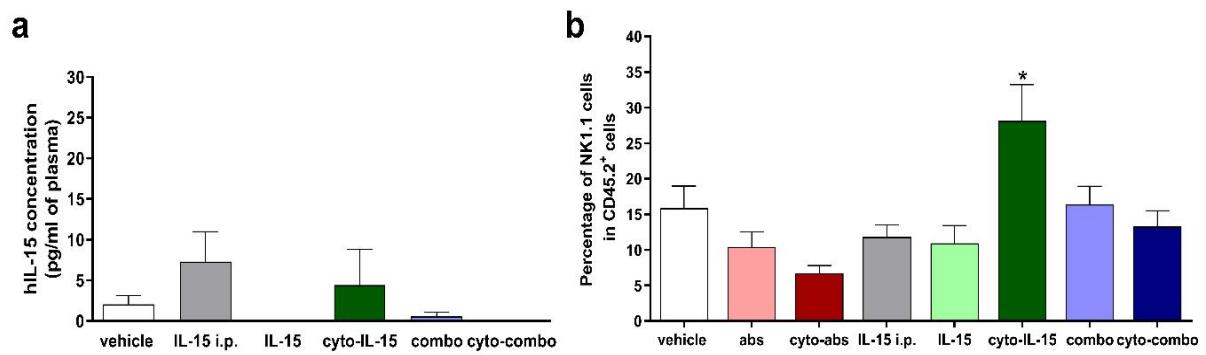


Figure S5 *Ex vivo* assessment of IL-15 in the plasma and expansion of NK cells in splenocytes.

(a) IL-15 levels in mouse plasma collected at survival endpoint from treated mice. (b) Percentage of NK cells in splenocytes isolated from spleens of treated mice collected at survival endpoints. Results are means +1 SEM from all tumors in each cohort (* $p < 0.05$, one-way ANOVA with Dunnett's multiple comparisons post-test).

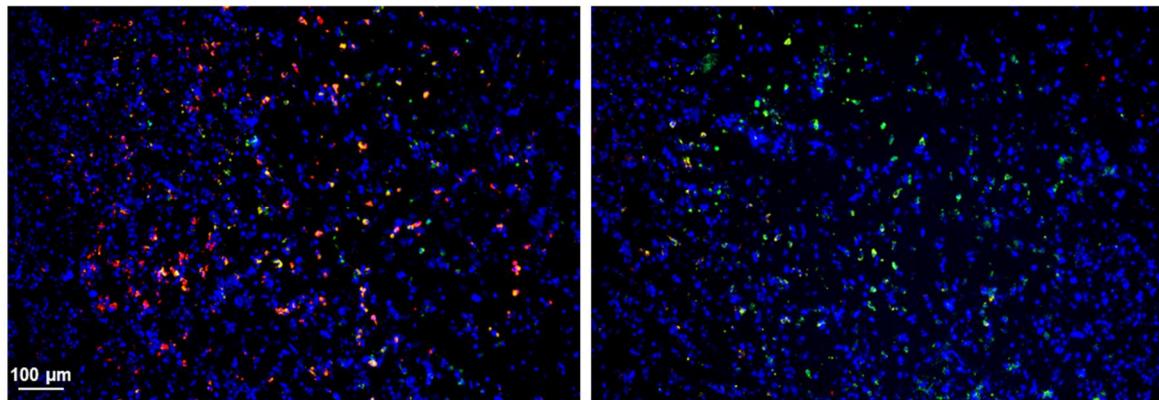


Figure S6 Histological assessment of a TRAMP-C2 prostate tumor from a mouse treated with combination of cytotypically-modified IL-15 and cytotypically-modified antibodies (anti-CTLA-4 and anti-PD-L1). RGB images of different areas from the same tumor section stained with CD3 (red) and NK1.1 (green) antibodies showing an area with mainly CD3 cells (left) and an area with mainly NK cells (right). Nuclei were stained with DAPI (blue).

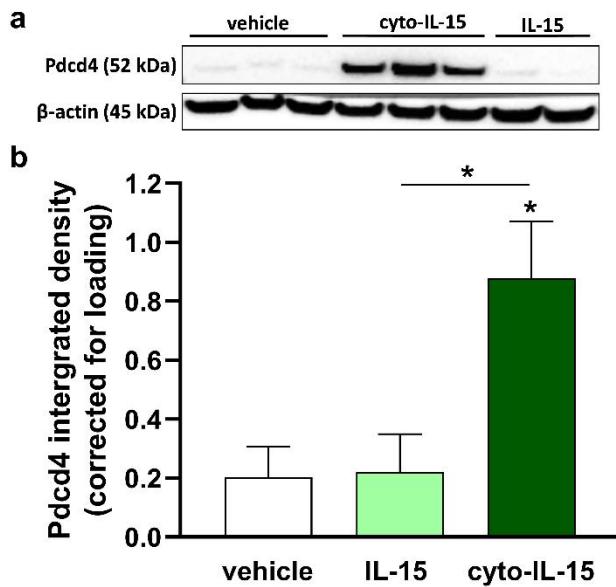


Figure S7 Pdcd4 (52 kDa) expression determined by western blot of tumor homogenates. (a)

Representative western blot showing an increase in Pdcd4 expression in tumors treated with cyto-IL-15. (b) Densitometry of western blots for Pdcd4. The integrated density of the individual bands for Pdcd4 was corrected using β-actin (45 kDa). Results are means +1 SEM from 5 tumors in each cohort (* p <0.05, one-way ANOVA with Sidak's multiple comparisons post-test).

Supplementary Tables

Table S1 List of antibodies used for flow cytometry

Experiment	Target type	Antibody name and clone	Clone	Company
PBMC expansion	Cell surface markers	PerCP/Cyanine5.5 anti-human CD8	SK1	BioLegend
		APC anti-human CD3	HIT3a	BioLegend
		PE anti-human CD56 (NCAM)	MEM-188	BioLegend
Splenocyte <i>ex vivo</i> stimulation	Cell surface markers	LIVE/DEAD Fixable Dead Cell Stain	n/a	ThermoFisher
		Pacific Blue anti-mouse CD45.2	104	BioLegend
		Alexa Flour 647 anti-mouse NK1.1	PK136	BioLegend
		FITC anti-mouse CD3	17A2	BioLegend
		PerCP/Cyanine5.5 anti-mouse CD8α	53-6.7	BioLegend

Table S2. Differentially expressed genes sorted by their adjusted p-value**(a) Vehicle versus IL-15**

Gene Name	log2 Fold Change	Adj. p-value
Peg3	2.36	0
C4b	-1.23	0
Zdhhc2	-1.55	0
H2afy2	-2.77	0
Retnla	2.97	0.01
Ptger3	-2.28	0.01
Slc5a3	-1.04	0.02
Ighv10-1	4.98	0.03

(b) Vehicle versus cyto-IL15

Gene Name	log2 Fold Change	Adj. p-value	Gene Name	log2 Fold Change	Adj. p-value
Upk3b	11.15	0	Zfhx3	-1.1	0.00449
Krt19	10.55	0	Clcf1	1.51	0.00457
Sema3e	10.54	0	Txnrd3	1.45	0.00457
Wt1	10.4	0	C330018D20Rik	1.46	0.00473
Pate1	9.75	0	Mmp2	1.99	0.00475
2310007B03Rik	9.67	0	Jagn1	1.19	0.00476
Gm48401	9.53	0	Bicc1	2.17	0.0048
Agtr2	9.37	0	Shq1	1.47	0.00483
Slc5a7	8.96	0	Sertad1	1.15	0.00483
Lce1h	8.77	0	Snta1	1.02	0.00497
Sprr2k	8.71	0	Emilin2	1.26	0.00501
Sntg1	8.7	0	Fbxo4	1.08	0.00501
Rps6ka6	8.55	0	Lrrc1	1.15	0.00504
Slc6a12	8.34	0	Mcf2l	-1.85	0.0051
Edn2	8.31	0	Vat1l	5.36	0.00512
Tmem184a	8.15	0	Ugdh	1.22	0.00515
Htr1b	8.1	0	Dusp3	1.05	0.00515
Ppl	7.96	0	Fam110c	2.25	0.0052
Gria4	7.95	0	Slc9a3r1	1.77	0.00523
Rbm20	7.81	0	Pbp2	2.12	0.00525
U90926	7.79	0	Lrrc42	1.16	0.00528
Igf2os	7.76	0	Gemin6	1.06	0.00528
Cxcl5	7.73	0	Kcnu1	3.35	0.00532
AU018091	7.7	0	Lpcat3	1.47	0.00535
Lrrc4c	7.6	0	Tnxb	2.55	0.00543
Cyp3a13	7.54	0	Chac1	1.79	0.00543
Tdrd12	7.54	0	C1s2	2.35	0.00545
Krt14	7.53	0	Dpysl3	-1.03	0.00559
Speer3	7.42	0	Phyhip	4.75	0.00563

Yap1	7.28	0	Gm6133	3.64	0.00563
Gm45494	7.09	0	Hnrnpf	1.24	0.00563
Bnc1	7.06	0	Rybp	1.17	0.00563
Olfr1033	6.83	0	Cox10	1.1	0.00563
Gabra3	6.82	0	Clic5	-2.27	0.00564
Cica3a1	6.73	0	Vegfc	-1.7	0.00565
Hif3a	6.64	0	Gas1	1.01	0.00572
Mgam	6.57	0	Nova1	1.91	0.00579
Ndn	6.56	0	Dgat2	1.85	0.0059
Smarca1	6.55	0	Lox	2.24	0.00591
Fst	6.48	0	Mkx	1.77	0.00594
Erfe	6.39	0	Tspan9	1.27	0.00609
Ppef1	6.39	0	Aebp2	1.3	0.00611
Wnt4	6.3	0	Ezr	1.17	0.00611
Bmper	6.21	0	Gm28192	-1.13	0.00611
Scel	6.19	0	Trmt6	1.02	0.00614
Gm20416	6.18	0	Sardh	1.38	0.0062
Zfp185	6.13	0	Tph1	4.37	0.00621
Krt7	6.05	0	Klf4	1.38	0.00621
Shoc2	6.04	0	Gapdh	1.33	0.00621
Chrm4	5.98	0	Tle1	1.17	0.00621
Onecut2	5.96	0	Pold2	1.03	0.00621
Krt18	5.94	0	Gm14139	4.13	0.00627
Epb41l4a	5.89	0	Dennd5b	1.38	0.00644
Tfr2	5.81	0	Rad18	1.23	0.00649
9330102E08Rik	5.77	0	Ptgs2os	2.55	0.00656
Bbip1	5.71	0	Adra2a	1.8	0.00661
Elfn1	5.66	0	Cav3	4.79	0.00665
Ptgs2	5.62	0	Arhgap6	-1.18	0.00672
Npy1r	5.55	0	C630043F03Rik	2.04	0.00677
Tmem130	5.31	0	Htr2a	-2.68	0.00678
Grb14	5.3	0	Metrnl	1.17	0.00682
Atp6v0a4	5.27	0	Cdh17	2.56	0.00685
Rasl10b	5.26	0	Maff	1.18	0.00686
Atp6v0d2	5.25	0	Tulp3	1.11	0.00686
Pabpc4l	5.03	0	Epha3	5.26	0.00687
Mmp8	4.99	0	Tet1	-2.6	0.00696
Cyp2s1	4.99	0	Gm38312	4.77	0.00697
Pdcd4	4.98	0	Zfp850	1.37	0.007
Lamc3	4.98	0	Tmem43	1.01	0.00712
Lamb3	4.97	0	Abcb4	2.34	0.00716
Crybg2	4.9	0	Cdon	1.82	0.00724
Tspan8	4.82	0	Cfap157	1.54	0.00724
Rasl11a	4.82	0	Cxcl12	1.37	0.00733

Crlf1	4.82	0	Gm35315	2.03	0.00737
Pppbp	4.8	0	Adgrd1	4.81	0.00738
Serpibn9b	4.78	0	Fat4	-1.52	0.00739
Ms4a4d	4.71	0	Necap1	1.12	0.00751
Slpi	4.67	0	Foxg1	1.01	0.00751
Pax3	4.67	0	Spocd1	5.74	0.00753
Sema4f	4.62	0	Snhg14	-1.71	0.00756
Hdx	4.61	0	Pdk4	-2.53	0.00756
Epha4	4.6	0	Slc4a8	-1.62	0.00762
Zfp575	4.57	0	Serinc2	-2.78	0.00764
Has1	4.56	0	Clic3	1.88	0.00766
Rtn4rl2	4.54	0	Cdh3	2.19	0.00769
Peg3	4.53	0	Mrps35	1.15	0.00775
Chl1	4.52	0	Tbrg4	1.05	0.00775
Cpa4	4.5	0	Lyve1	-1.92	0.00775
Rhpn2	4.48	0	Tmco3	-1.08	0.00778
C430002N11Rik	4.44	0	Hdac9	-1.22	0.00778
Cdsn	4.43	0	Gm38372	-1.03	0.00804
Tmem151a	4.4	0	Wbp11	1.12	0.00812
Tmeff2	4.37	0	Arsa	-1.15	0.00826
2200002D01Rik	4.28	0	Osmr	1.77	0.00831
Pde1a	4.22	0	Gm43031	-1.81	0.00834
Rab38	4.22	0	Dlx4os	1.84	0.00836
Crct1	4.18	0	Cyb5r1	1.1	0.00836
Angpt1	4.17	0	Basp1	1.07	0.00836
Pard6b	4.15	0	Edn1	1.81	0.0084
Baiap2l1	4.09	0	Pim1	1.02	0.00841
Akap12	4.08	0	Pcdhb19	-2	0.00841
Pappa	4.07	0	Adcy7	-1.03	0.00844
Anxa8	4	0	Mmp3	2.15	0.00847
Jph2	3.96	0	Adamts14	-1.35	0.00847
Zfp37	3.89	0	Flt4	-2.17	0.00847
Arg1	3.89	0	Ufsp1	1.39	0.00849
Cadm4	3.88	0	Spib	1.83	0.00871
Tead4	3.83	0	Ces2g	3.32	0.00887
Tinagl1	3.79	0	Stap2	-1.31	0.0089
Fgfr2	3.78	0	Pde4b	1.24	0.00892
Car12	3.78	0	Slc9b2	5.56	0.00903
Epha1	3.76	0	Cdh5	-1.44	0.00903
Nov	3.53	0	Enpp3	-1.93	0.00903
Mboat2	3.49	0	Ddc	3.54	0.00916
Ereg	3.39	0	Ackr2	-2.34	0.00929
Hspb2	3.38	0	Slc1a5	1.07	0.00935
Colec12	3.37	0	Naa50	1.04	0.00935

Adamts5	3.34	0	Rarg	1.05	0.00939
Bcam	3.3	0	Zfp12	-1.05	0.00939
Aqp5	3.3	0	Gm44274	2.35	0.00945
Gm14230	3.27	0	Inpp5a	1.02	0.00947
Esrp2	3.19	0	Drd4	3.45	0.00955
Gtpbp10	3.18	0	Lurap1l	1.41	0.00955
Lama5	3.14	0	Mcrip2	1.27	0.00955
Prr5	3.11	0	Snai1	1.12	0.00955
Slc2a3	3.09	0	Dusp1	1.1	0.00955
Slc43a1	3.09	0	Nyap2	4.91	0.00958
Ager	3.02	0	Pnpt1	1.02	0.00959
Serpinb1a	3	0	Bcr	-1.39	0.00959
Thbd	2.98	0	Fam214a	-1.45	0.00959
Cystm1	2.96	0	Rep15	-1.52	0.00959
Krt80	2.94	0	Nedd4l	1.09	0.00971
Sbsn	2.92	0	Tbx1	-3.55	0.00976
Cacna1a	2.92	0	Il17re	3.97	0.00982
Ccnd2	2.81	0	AC160966.1	3.39	0.00988
B4galt4	2.8	0	Meis2	1.21	0.0099
Fam46b	2.8	0	Gm44645	-1.83	0.00991
Cdk18	2.79	0	Cald1	1.09	0.01004
Itga2b	2.74	0	Hacd2	-1.11	0.01009
Chmp4c	2.68	0	Myo1h	1.38	0.01015
Cdh2	2.67	0	Chchd4	1.18	0.01015
Gata6	2.66	0	Gm14327	2.25	0.01019
Eno3	2.65	0	LoxI3	-1.02	0.01019
Timp3	2.65	0	Gpr19	1.53	0.01023
Gprc5a	2.6	0	Reg3g	5.01	0.01027
Prss23	2.53	0	Cica1	2.63	0.01027
Cxcl1	2.41	0	Gm10010	4.01	0.01028
Rras2	2.4	0	Nid2	1.4	0.01031
Dmd	2.35	0	Syt8	2.67	0.01039
Papss2	2.34	0	Vsig10	-1.01	0.0104
Tmem171	2.32	0	Tpi1	1.32	0.01056
Fam84b	2.3	0	Map2k3os	1.31	0.01056
Rassf7	2.23	0	Smtnl2	2.44	0.01058
Prx	2.16	0	Eps8	1.24	0.0106
Aif1l	2.14	0	Igfbp7	1.14	0.0106
Ptn	2.09	0	Klra4	1.3	0.01064
Rapgef3	2.08	0	Aen	1.15	0.01064
Dbndd2	2.08	0	Med21	1.16	0.01078
Cavin2	2.02	0	Atp10a	1.07	0.01082
Cobll1	2	0	Bcl2l13	1.11	0.01084
Bdnf	1.95	0	Fam78b	-2.23	0.01087

Amotl2	1.95	0	Hoxa11	1.02	0.0109
Itga3	1.92	0	Ak5	1.73	0.01092
Trib3	1.82	0	Lpar4	1.41	0.01094
Suox	1.78	0	Ogg1	1.33	0.01094
Pim3	1.25	0	Adamts1	1.35	0.01118
Gpc4	1.13	0	Hoxb9	1.83	0.01123
Plxna1	-1	0	Shroom3	1.64	0.01124
Nlrc3	-1.35	0	B4galt5	1.08	0.01124
Ccdc141	-1.69	0	Map6	1.79	0.01128
Star	-3.25	0	Itfg2	1.3	0.01134
Vnn1	-3.48	0	Oaf	-1.04	0.01136
Prox1	-4.31	0	Lsm3	1.15	0.01146
A330076H08Rik	8.27	0.00001	Sox12	1.18	0.0115
Gm9801	7.45	0.00001	Myrf	2.1	0.01154
1700012B09Rik	7.18	0.00001	Gm45769	2.04	0.0116
Ppp2r2b	6.01	0.00001	Mttp	1.23	0.01163
Pate4	5.85	0.00001	Tatdn2	1.11	0.01163
Cnfn	5.18	0.00001	Zfp979	2.78	0.01175
Tnfsf11	4.91	0.00001	2810454H06Rik	2.24	0.01178
Klk10	4.89	0.00001	Prg4	2.02	0.01203
C79130	4.52	0.00001	Sfmbt2	-1.93	0.01203
Syt12	4.11	0.00001	Kcnt2	3.08	0.01204
Gm11627	4.02	0.00001	Eps8l1	-2.6	0.01213
Tmem45a	4.01	0.00001	Erf	1.14	0.01221
Dynap	3.67	0.00001	Mecp2	-1.11	0.01227
Smpd3	3.27	0.00001	Gm29865	2.75	0.01234
Mirt1	2.98	0.00001	Thbs1	1.89	0.01234
Frzb	2.89	0.00001	Thumpd3	1.05	0.01234
S100a7a	2.85	0.00001	Chrd	1.65	0.01236
Cxadr	2.65	0.00001	Plcxd2	1.55	0.01248
Id3	2.22	0.00001	Zfp354a	1.29	0.01251
Plaur	1.92	0.00001	Ralgps2	1.25	0.01262
Wwc1	1.92	0.00001	Socs3	1.24	0.01264
Vgll3	1.89	0.00001	C3	1.96	0.01265
Cpne8	1	0.00001	Ndnf	-1.7	0.01269
Gm43305	-1.45	0.00001	Gm38057	-1.61	0.01298
Slco4a1	-3.06	0.00001	Rspo3	2.09	0.01315
Wdr17	7.75	0.00002	Socs2	1.43	0.01315
Rorb	6.59	0.00002	Atf3	1.43	0.01315
Rassf6	4.26	0.00002	Wnt7b	-1.76	0.0132
Cd55	3.87	0.00002	Dusp5	1.19	0.01324
1500015O10Rik	3.39	0.00002	Evi2a	-1.04	0.01327
Lama2	2.96	0.00002	Arhgef40	-1.47	0.0134
Lmbr1	2.62	0.00002	Hgf	-1.54	0.0134

Gm13212	2.48	0.00002	B3gnt3	-1.71	0.0134
Serpine1	1.94	0.00002	Emilin1	-1.08	0.01352
Deptor	1.73	0.00002	Endou	2.19	0.01406
Mafk	1.58	0.00002	Fxyd1	2.06	0.01414
Cavin1	1.19	0.00002	Tsku	1.46	0.01422
Ankle1	-1.29	0.00002	Ints13	1.02	0.01422
Reln	-3.98	0.00002	Nr6a1	1.25	0.01425
Gfpt2	4.94	0.00003	Fam26e	-1.28	0.01438
A830019P07Rik	4.24	0.00003	Zfp287	-1.32	0.0145
S100a9	3.88	0.00003	Ttc38	-1.54	0.0145
Tenm3	3.09	0.00003	Slc22a15	-1.28	0.01458
Llgl2	2.73	0.00003	Asns	1.26	0.0146
Clec4d	2.29	0.00003	Scn3a	-3.88	0.01471
C1ra	1.93	0.00003	Smim20	1.2	0.01486
Igf2bp1	1.68	0.00003	D330045A20Rik	-1.36	0.01491
Gm6526	8.04	0.00004	Pxdn	-1.33	0.01492
Dact1	2.92	0.00004	Aig1	1.22	0.01493
Nr4a1	2.76	0.00004	Gucy1a2	2.97	0.01496
Fosb	2.67	0.00004	Aox3	3.82	0.01502
Sh3bp5	2.3	0.00004	Gm16701	-2.74	0.01513
Il1rn	2.13	0.00004	2810433D01Rik	1.98	0.01564
Lce1g	7.93	0.00005	Ngef	-3.23	0.01565
Gm35066	5.41	0.00005	Lrrc73	1.75	0.01581
Ocstamp	4.38	0.00005	Myl9	2.42	0.01584
Mogat2	4.15	0.00005	Ccdc91	1.19	0.01584
Nectin2	2.18	0.00005	Smim10l1	1.07	0.01584
Ybx3	1.74	0.00005	Gm16617	-2.16	0.01584
Gm11545	-4.54	0.00005	Gm10544	5.32	0.01592
Arap2	2.27	0.00006	Clstn3	4.2	0.01592
Gda	2.14	0.00006	Grik5	2.33	0.01602
Gadd45g	1.91	0.00006	Letm2	-1.09	0.01602
Plekhf1	1.63	0.00006	Ccdc174	1.03	0.01613
Insr	-1	0.00006	Stk36	-1.15	0.01613
Brinp3	7.23	0.00007	Tspan7	1.79	0.01615
Ccdc8	3.56	0.00007	Lrp6	1.12	0.01615
Arxi	3.04	0.00007	Hoxd3	-2.41	0.01615
Pdia5	1.77	0.00007	Abcg2	1.18	0.01617
Boc	1.77	0.00007	Igsf9b	-1.11	0.01617
Fkbp11	1.45	0.00007	Hdhd5	1.34	0.01622
Kcnab1	2.89	0.00008	Ly6f	3.49	0.01625
Nop2	1.88	0.00008	Plk2	1.12	0.01625
Zfp988	4.93	0.00009	AC133103.1	3.78	0.01665
Ocln	4.36	0.00009	Mcub	3.41	0.01665
Gm44275	2.41	0.00009	Flrt3	1.56	0.01665

Ptrh1	1.97	0.00009	A730017L22Rik	-1.01	0.01665
Trim44	1.73	0.00009	Pogk	-1.88	0.01674
Zdhhc2	-2.11	0.00009	Ap3m2	-1.08	0.01682
Cobl	4.6	0.0001	1810019D21Rik	2.49	0.01694
Selenbp1	2.49	0.0001	Rbm19	1.01	0.01694
Lpl	1.82	0.0001	Lyrm9	-1.29	0.01694
Lrrc75a	1.44	0.0001	Ncoa1	-1.2	0.01696
Dcstamp	4.46	0.00011	Inf2	-1.26	0.01712
Siglecg	2.6	0.00011	Capza2	1.95	0.01719
Gm48391	7.27	0.00012	Tpd52l1	2.35	0.01769
Oscar	5.46	0.00012	Coq10b	1.01	0.01769
Il33	4.75	0.00012	Rtl3	4.31	0.01779
Pla2g4a	1.28	0.00012	Ddit3	1	0.01779
Robo2	-1.32	0.00012	Usp2	1.23	0.01789
Avpi1	1.4	0.00013	Pcdhb20	-1.69	0.01789
Gdf6	4.46	0.00014	Clcn3	-1.05	0.01815
Adgrg2	3.78	0.00014	Efna3	2.27	0.01827
Slc38a4	3.36	0.00014	Bgn	-1.21	0.01829
Fads3	1.55	0.00014	Mrps25	1.01	0.01836
Mamdc2	-1.83	0.00014	5830411N06Rik	-4.35	0.01843
Efemp1	1.04	0.00015	Rpgrip1l	-1.02	0.01847
Slc6a13	8.25	0.00016	Olfml2b	-1.2	0.01851
Rufy4	5.55	0.00016	Ntf5	2.29	0.01861
Lman1l	4.89	0.00016	Sh3d19	-1.33	0.01862
Bmpr1b	3.79	0.00017	Fgfr1	-1.33	0.01862
Acot1	2.54	0.00017	Cfd	-2.98	0.01862
Cpox	1.66	0.00017	Apba2	-3.27	0.01878
F3	1.14	0.00017	AI429214	1.4	0.01905
2410012E07Rik	5.69	0.00018	Efcc1	-2.98	0.01917
9330132A10Rik	5.59	0.00018	Hotairm1	1.26	0.01929
Aff2	4.93	0.00018	Zan	2.85	0.01963
Cebpb	1.78	0.00018	Ccdc77	1.31	0.01963
Foxf1	1.16	0.00018	Foxo3	-1.13	0.01963
Tspsyl5	-1.54	0.00018	Dmtn	-1.95	0.01963
Thsd7b	6.84	0.00019	Neurl1b	-1.49	0.0208
Wnt7a	7.32	0.0002	Col27a1	-1.67	0.02086
Pltp	1.51	0.0002	Fcrlb	1.86	0.02087
Eif1a	1.47	0.0002	Slit3	3	0.02091
Nudcd1	1.03	0.0002	Patj	1.81	0.02114
Nanog	6.42	0.00022	Csgalnact2	1.05	0.02117
Nppb	5.86	0.00022	Slc25a15	1.32	0.02118
Bid	1.62	0.00022	Zfp9	1.09	0.0214
Vgf	3.15	0.00023	Zfp534	5.01	0.02146
Prdx6	1.31	0.00023	Ky	-2.29	0.02146

Arhgef16	6.01	0.00025	Lrrc32	-1.37	0.02153
2310030G06Rik	3.86	0.00025	Chrnd	5.25	0.0216
Cav2	2.56	0.00025	Fpgs	1.1	0.02171
Cyr61	2.1	0.00025	Kidins220	-1.04	0.02177
Myom2	3.87	0.00027	Stxbp2	1.18	0.02179
Akip1	1.55	0.00027	Fhl1	3.07	0.0218
9530053A07Rik	4.54	0.00028	Jade1	1.14	0.02184
Hmcn1	3.3	0.00028	Ctla2a	1.27	0.02185
Efna5	2.38	0.00028	Mnd1	1.07	0.02185
Styk1	2.38	0.00028	S100a13	-1.01	0.02185
Hist1h4i	1.76	0.00028	Lix1	3.63	0.02202
Kcnq5	3.3	0.00029	Mylk3	3.65	0.02217
Tspan6	2.49	0.00029	Particl	1.44	0.02217
Spta1	4.64	0.0003	Gm45694	-2.2	0.0222
Gm6650	4.58	0.0003	Tpsb2	2.81	0.02229
Npepl1	1.13	0.0003	Igsf9	-1.46	0.0223
Map2	2.67	0.00031	D130040H23Rik	-1.26	0.02234
Tspan4	1.66	0.00031	Fbxl13	2.38	0.0224
Folr1	6.23	0.00032	Glis2	1.21	0.02248
Il11	3.63	0.00034	Zfhx2	-1.79	0.02253
Pwwp2b	1.5	0.00034	Paqr8	-1.82	0.02266
Cacna1g	4.8	0.00035	Hpd1	2.53	0.02276
Zfp422	1.81	0.00035	Gm20744	2.36	0.02276
Dlc1	1.46	0.00036	Tspan12	1.3	0.02276
Bcat1	2.02	0.00037	Sox5	1.98	0.02284
Dpcr1	3.21	0.00038	Pcdhga5	-3.44	0.02284
F7	5.93	0.00039	Prickle2	1.57	0.02288
Tamm41	1.7	0.0004	Snrpn	-1.98	0.02298
Axin2	-1.55	0.0004	Nsg1	-2.44	0.02298
Tll5	-1.88	0.0004	Lipp	2.17	0.02303
Slc16a1	1.44	0.00041	Nr4a3	1.77	0.02309
Zfp978	5.87	0.00043	Aldh1a1	3.16	0.02312
Dlk2	2.21	0.00043	Esr2	2.84	0.02344
Cops7a	1.49	0.00044	Rbm12b1	-1.67	0.02349
Cgnl1	1.37	0.00044	Acad10	1.35	0.02354
Pde4d	1.59	0.00047	Phc1	1.06	0.02356
Apol9b	1.49	0.00047	Tmem200b	-2.68	0.02363
Tro	4.37	0.00048	Naa11	-2.7	0.02366
Dlx4	1.58	0.00048	Map9	-1.13	0.02375
Adk	1.21	0.00048	Pthlh	3.1	0.02402
Masp1	-2.31	0.00049	Mgat3	2.26	0.02404
Gpat3	1.15	0.0005	F10	2.43	0.02412
Fyb2	4.51	0.00051	Rhbd13	-2.05	0.02412
Sdc4	1.52	0.00051	Hes7	2.69	0.02414

Ildr2	3.09	0.00052	D030025P21Rik	-2.72	0.02429
Adora2b	2.27	0.00052	Btn1a1	3.05	0.0243
Cav1	1.85	0.00052	Ndufa4I2	2.06	0.02441
Phf7	1.22	0.00053	Tigar	1.42	0.02452
Fam83h	1.77	0.00055	2810001G20Rik	1.19	0.02453
Ppp1r15a	1.64	0.00055	Slc15a2	-1.27	0.02453
Fam83a	6.41	0.00056	Kcnn3	-3.17	0.02453
Car6	3.96	0.00056	Mctp1	-1.44	0.02458
Slc1a3	4.39	0.00057	Tgif2	1.3	0.02472
Epha7	2.57	0.00057	Trim43c	-2.02	0.02483
9430018G01Rik	2.18	0.00059	Rab36	-1.26	0.02489
1010001N08Rik	3.06	0.0006	2410018L13Rik	-2.95	0.02489
Pate3	5.39	0.00061	B230377A18Rik	1.93	0.02526
Gm12059	4.17	0.00061	Dus4l	1.07	0.02542
C1s1	1.56	0.00062	Nkd1	-3.09	0.02551
Thpo	3	0.00063	Ndst3	-1.96	0.0256
Strap	1.45	0.00063	3110040N11Rik	1.15	0.02591
Ddr1	1.82	0.00064	Smad6	1.91	0.02597
Olr1	4.2	0.00067	9130213A22Rik	2.04	0.02628
Gm13415	6.75	0.00069	6030419C18Rik	1.01	0.02631
Phb2	1.33	0.00069	Armcx6	-1.51	0.02631
Evi5l	-1.18	0.00071	Akr1c13	1.38	0.02636
Lrrn4	6.14	0.00072	Extl1	-1.99	0.02671
Hspa9	1.22	0.00072	Ppp1r13l	1.37	0.02675
Uba1y	8.22	0.00073	Tmem132a	-1.35	0.02684
C1rb	3.53	0.00073	Nfkbiz	1.16	0.02703
Gpr39	2.56	0.00073	Fcor	3.61	0.02706
S100a8	4.16	0.00074	Setmar	2.05	0.02723
A230057D06Rik	7.29	0.00075	Gstk1	1.62	0.0275
Dok6	6.09	0.00075	Kif5c	-1.69	0.02751
Grwd1	1.19	0.00075	Dcn	-1.46	0.02752
Ccdc136	2.75	0.00076	Pnkd	-1.13	0.0276
Ahr	1.2	0.00077	Zfp985	3.46	0.0281
Cntnap1	-1.3	0.00078	Pdzrn3	4.49	0.0283
Ccny1l	1.18	0.00079	Slc30a2	-1.74	0.02837
Mt3	7.32	0.00081	Nod1	1.35	0.02844
Olfr456	6.7	0.00081	Pank1	-1.54	0.02852
Mcc	1.63	0.00081	Fancd2	1.08	0.02898
Clmn	-2.84	0.00083	9430073C21Rik	-3.28	0.02901
Fgfbp1	5.27	0.00085	Fam120c	-1.1	0.0293
Proser2	3.01	0.00086	Nlrp1b	-1.11	0.02932
Mfap4	2.07	0.00087	4930556M19Rik	1.36	0.02943
Ccdc88c	-1.37	0.00088	Gm13230	1.17	0.0295
Fam131b	1.54	0.00089	Il27ra	-1.78	0.02961

Syn1	3.05	0.00093	Mbp	1.14	0.02964
Ppp1r9a	1.68	0.00093	Ighg1	3.32	0.02965
Pno1	1.37	0.00093	Rnd1	1.22	0.02988
Tnfrsf22	-1.24	0.00093	2510009E07Rik	-1.38	0.02988
4921536K21Rik	2.69	0.00094	Slc16a9	-1.65	0.02988
Has2	2.7	0.00095	Tub	-3.66	0.02988
Crip1	1.24	0.00095	Ccnb2-ps	-1.9	0.02992
Gatsl2	-1.14	0.00095	Reg1	3.52	0.03003
Wdr12	1.06	0.00096	Ccne1	1.23	0.03003
Tagln	3.32	0.00098	Pvr	1.29	0.0302
4930461G14Rik	6.47	0.00099	Mturn	-1.31	0.03024
Emp1	1.34	0.00102	Rpl26-ps6	-2.14	0.03024
Ptprk	1.25	0.00102	Gper1	1.92	0.03034
Zyx	1.48	0.00103	Gm37261	-2.5	0.03071
Creb3l2	-1.01	0.00104	Pira2	1.55	0.03081
Mroh2a	-1.2	0.00105	Evpl	2.19	0.03082
Nfil3	1.71	0.00108	Gm16299	3.54	0.03093
Igf2	6.1	0.00111	Gm13986	2.62	0.03093
5330416C01Rik	-3.82	0.00113	Rgmb	-1	0.03097
Sprr2g	7.22	0.00119	Sh3rf3	1.55	0.03106
Rrs1	1.19	0.00124	Raet1d	2.68	0.03112
Fos	2.18	0.00125	Fam160a1	-1.11	0.03121
Odc1	1.06	0.00125	Mro	2.31	0.03124
Prph	3.92	0.00126	Zcchc3	1.3	0.03124
Atn1	1.65	0.00126	Hmcn2	-2.01	0.03124
AU020206	-1.13	0.00126	Atp1b1	1.82	0.03135
1700009N14Rik	7.42	0.00129	Wnk3	-1.99	0.03141
Hoxa1	1.7	0.00131	Rbak	-2.01	0.03141
Pcolce	1.19	0.00131	Adamts2	1.33	0.03149
Rassf8	1.6	0.00132	Gm12435	1.35	0.03154
Fut8	-1.14	0.00133	Brd3os	-1.01	0.03197
Rgma	-1.44	0.00133	Gm20560	3.04	0.03209
Nipal1	1.96	0.00134	Tbc1d9	-1.12	0.03271
Sema6c	-1.28	0.00134	Adam23	3.47	0.03309
Serpinb7	6.1	0.00137	9330159M07Rik	-1.05	0.03309
Phldb2	1.56	0.00137	Gm42635	2.89	0.03311
Gtpbp4	1.03	0.00137	Nectin3	1.03	0.03334
Sema3c	2.34	0.00139	Plekhh2	-1.06	0.03334
Dcun1d2	-1.02	0.00141	Rapsn	-1.38	0.03334
Gm13147	3.83	0.00143	Nlrp1c-ps	-1.61	0.03334
Clmp	-1.38	0.00144	Traf1	-1.42	0.03347
Serpinb2	9.19	0.00146	Nipsnap1	1.75	0.03359
Numbl	1.54	0.0015	Syde2	1.37	0.03361
Oplah	1.46	0.00152	C1rl	1.52	0.03377

Efnb2	-1.19	0.00152	Hbegf	1.23	0.03428
Grid2	3.49	0.00153	Oacyl	2.29	0.03443
Gm26811	-1.14	0.00153	Tbxa2r	2.13	0.03459
Cnn2	1.36	0.00154	Gpr88	2.89	0.03473
Arl14epl	6.58	0.00157	Rarres2	1.99	0.03473
Angel1	-1.31	0.00157	Rnf112	3.3	0.03484
Tppp3	1.52	0.00158	2510046G10Rik	1.87	0.03484
Rem1	1.56	0.0016	Adssl1	1.04	0.03484
Pate2	3.35	0.00163	Adgrg6	-1.02	0.03484
Ephx1	1.03	0.00163	Nynrin	-1.06	0.03494
Kcnv2	7.78	0.00167	A4galt	-1.97	0.03506
Qrfp	3.72	0.00169	Sfrp1	2.25	0.03508
Tmed8	-1.21	0.00169	Fgf18	1.91	0.03534
Tgfb3	-1.37	0.00169	Zxdb	-1.14	0.03534
Gm16183	3.61	0.00171	Gm3830	2.57	0.03539
Col11a1	2.68	0.00171	Gm15247	2.82	0.03548
Gm5535	-3.23	0.00171	Znrd1as	1.36	0.03553
Csrnp1	1.21	0.00173	Ptgfr	1.81	0.03562
Trip6	1.12	0.00173	Ccdc167	-1.04	0.03562
Slc2a5	3.43	0.00175	Greb1l	1.43	0.03585
Pygl	1.85	0.00177	Msx1	-2.24	0.03587
Dlg1	1.31	0.00177	Gm14322	1.66	0.0359
Hebp1	1.24	0.00177	Clec4b1	-1.62	0.0359
Zfp982	3.55	0.00178	D830050J10Rik	1.57	0.03617
Gm18609	4.33	0.00179	Ch25h	1.37	0.03617
Fer1l5	-1.26	0.0018	Dcp1b	-1.06	0.03632
Eno2	2.13	0.00183	Chn1	-2.05	0.0364
Mgst1	1.84	0.00183	Dtwd1	1.15	0.03648
Sil1	1.16	0.00188	Otx1	1.35	0.03661
Fez2	1.33	0.00189	Bank1	-1.13	0.03667
Angptl1	3.01	0.0019	Sobp	-3.55	0.03672
Rcor2	1.62	0.00192	Ift80	-1.01	0.03676
Crim1	1.39	0.00192	Cdc42ep3	1.21	0.03722
Eml2	1.58	0.00196	Smad7	1.21	0.03722
Sulf1	1.76	0.00197	Gm14167	2.85	0.03739
2610017A05Rik	3.59	0.002	Serpingle1	1.64	0.03743
Kras	1.38	0.002	Dchs2	-2.23	0.03743
Msln	4.6	0.00202	Gm15347	-2.27	0.03743
Mtmmr10	1.1	0.00208	Gm11793	2.01	0.0377
Taf4b	1.41	0.00213	B3galnt1	-1.29	0.0377
Tuba4a	1.06	0.00214	Samd4b	1.03	0.03771
H2afj	1.2	0.00215	Klra6	1.79	0.03785
Erc1	1.53	0.00216	Rab6b	-1.25	0.03785
Gm2694	6.61	0.00217	Slc16a10	-1.31	0.03785

Larp6	3.99	0.00217	Enkur	1.42	0.03788
Il6	3.45	0.00217	Zfp882	-1.85	0.0379
Gm5622	7.44	0.00219	Igkv13-84	-8.6	0.03826
Efhd1	-3.79	0.00219	Etfbkmt	1.57	0.03849
Thsd4	-4.52	0.00219	Man1a	-1.15	0.0386
Mycl	-2.34	0.0022	Casp3	-1.41	0.0386
Tcte2	1.89	0.00222	Fam189a1	-3.52	0.0386
Spin2c	2.91	0.00227	Hrh1	2.21	0.03866
Emg1	1.39	0.00227	Hnrnph3	-1.01	0.0389
Lrp2	2.97	0.00228	Tmem2	-1.16	0.03913
Cfp	1.38	0.00229	Mtmr11	-1.06	0.03957
Plpp3	1.28	0.00229	NA	1.51	0.03964
Fam129b	1.09	0.0023	Tnmd	4.22	0.0398
Phldb3	1.63	0.00235	Ddah1	1.03	0.0398
Cryab	1.93	0.00236	Iglon5	-1.37	0.0398
Tmem181a	1.13	0.0024	Mmrn1	-3.81	0.04002
Etf1	1.04	0.0024	Msrb2	-1.52	0.04006
Lrrn3	-3.01	0.0024	Miga1	-1.82	0.04031
Cfap100	2.45	0.00245	Aqp9	2.5	0.04036
Mbnl3	2.25	0.00245	Inpp4b	-1.15	0.04064
Peg12	1.69	0.00251	C030034L19Rik	-2.3	0.04068
Gm28370	-1.33	0.00251	Catsper2	1.15	0.04086
Hgh1	1.05	0.00254	Adamts3	1.69	0.04133
Flnc	1.58	0.00255	Acy3	1.31	0.04133
Chka	1.09	0.00257	Mb21d2	1.05	0.04133
Pkdcc	2.08	0.00258	Tmtc2	-1.56	0.04133
Akr1c14	2.54	0.00261	Gt(ROSA)26Sor	1.09	0.04143
Fbxo17	1.47	0.00262	Gm17690	-1	0.04163
Gm13293	5.17	0.00265	Sybu	2.65	0.04174
Gm7803	2.43	0.00265	Slc18b1	-1.13	0.04174
Gm19026	-3.53	0.00265	Bbs1	-1.29	0.04174
Bms1	1.21	0.00267	Foxm1	1.05	0.04206
Magohb	1.34	0.00271	Hs3st1	2.78	0.04217
Cxcr2	4.27	0.00274	Gm21814	3.11	0.04226
Gm10800	1.74	0.00274	Tsen2	1.09	0.0423
Thap12	1.03	0.00284	Mdfic	1.37	0.04231
Zbtb8b	4.1	0.00285	Syt5	-3.45	0.04231
Gm19744	3.67	0.00285	Mir186	-1.65	0.04235
Arhgef7	-1.41	0.00285	Adamtsl5	1.06	0.04244
Me3	2.8	0.00288	Efnb1	1.29	0.04254
Trem1	2.51	0.00288	Kif27	-2.55	0.04317
Sspn	1.39	0.0029	Cpa3	2.82	0.0432
Pde8b	1.31	0.0029	Slc12a8	1.86	0.0432
Fmo4	7.64	0.00291	Fam71f2	2.29	0.04329

Smyd5	1.26	0.00299	Daam2	-1.69	0.04341
Tead3	1.44	0.00303	Pianp	1.91	0.04342
Cers1	2.76	0.00314	Gm28285	1.9	0.04374
Larp1b	1.43	0.00322	Gfi1	-2.46	0.04385
Fmod	4.38	0.00323	Speg	1.02	0.04394
Notch3	2.08	0.00325	Gm2619	2.95	0.044
5930430L01Rik	-1.01	0.00325	Atp6v0e2	-1.45	0.04401
Adamts16	4.69	0.00328	Trim43a	-3.4	0.04401
Prkd1	1.71	0.00328	Matn3	3.09	0.04414
Spire1	1.23	0.00329	Slc16a13	-1.03	0.04414
Snora2b	2.15	0.0033	Rnf128	2.16	0.04417
Zfp981	2.93	0.00337	Ikzf3	-1.15	0.04417
Arhgap8	2.59	0.00337	Egfros	-1.82	0.04417
Ctf1	1.58	0.00337	Pfn2	-1.02	0.04456
Eya1	1.96	0.00338	Lrba	-1.36	0.04458
Gm37145	2.36	0.0034	9930014A18Rik	1.25	0.04477
Gm3716	2.76	0.00341	Etv1	-1.64	0.0448
Sumo3	1.34	0.00342	Il18rap	-1.37	0.04481
Uba3	1.17	0.00345	Sema7a	-1.64	0.04483
B930095G15Rik	-1.44	0.00348	Cyp46a1	-2	0.04483
Lgals7	3.24	0.0035	Tmem229b	-1.19	0.04498
1700049E17Rik2	4.91	0.00353	Fbxl19	1.02	0.0455
Mefv	1.83	0.00353	Thra	-1.02	0.0455
Erbb2	1.16	0.00353	Ptgs2os2	3.39	0.04571
Alpk1	-1.1	0.00353	Scrn3	1.05	0.04571
Thsd7a	1.53	0.00356	Nxn	1.72	0.04592
Exd1	2.94	0.00363	Pitpnm2	1.06	0.04673
Gm13292	1.84	0.00365	D7Ert443e	3.75	0.04678
Traf3	-1.21	0.00365	Cracr2a	-1.09	0.04678
Btg3	1.51	0.00368	Zfp618	2.59	0.04682
Pcsk6	-2.06	0.0037	Nrbp2	1.36	0.04682
Trim6	2.3	0.00371	Snhg15	1.09	0.04682
Rpl32	1.07	0.00371	NA	-1	0.04682
Tcof1	1.15	0.00374	Fam69b	-1.14	0.04682
Ifi205	1.3	0.00376	Gm30329	-1.5	0.04683
Tbc1d2	1.81	0.00377	Ptprm	-1.54	0.04697
Wtip	1.34	0.00377	Cma1	2.87	0.04728
Ap2a2	1.06	0.00377	Setbp1	1.54	0.04728
Gng12	1.08	0.00388	Hao1	-2.63	0.04732
Fkbp4	1.23	0.00394	Slc37a2	1.05	0.04761
E230020A03Rik	-4.44	0.00397	E130307A14Rik	-1.03	0.04781
Acp5	3.69	0.00401	2310068J16Rik	1.62	0.04788
Baalc	2.98	0.00402	Gcnt1	1.01	0.04816
Trnt1	1.36	0.00404	Irx3	-1.52	0.0487

9830144P21Rik	-1.75	0.00404	Epgn	2.48	0.04944
Apol9a	1.01	0.00408	Gprin3	2.31	0.04961
Nepro	1.1	0.00413	Peak1	-1.03	0.04961
Csdc2	2.06	0.0042	Jam2	1.32	0.04968
Steap4	1.8	0.00425	Psd3	-1.54	0.0499
Atp11a	-1.18	0.00425	Nt5e	-1.03	0.04994
Sifn4	1.48	0.00434	Igkv6-17	-4.2	0.04994
Wnt11	3.26	0.00438	Slc5a3	-1.43	0.04997

(c) IL-15 versus cyto-IL-15

Gene Name	log2 Fold Change	Adj. p-value	Gene Name	log2 Fold Change	Adj. p-value
Upk3b	11.05	0	Cd209f	3.01	0.00436
Krt19	10.79	0	Csprs	3.14	0.00442
Gm48401	10.73	0	Abi3bp	1.71	0.00444
Rps6ka6	10.68	0	Flrt3	1.68	0.00445
Gria4	10.62	0	Serpinb9	1.09	0.00446
Serpinb2	10.06	0	Gm7609	3.21	0.00453
Sprr2k	9.93	0	Mbp	1.38	0.00453
2310007B03Rik	9.91	0	Wtip	1.35	0.00453
Ppl	9.63	0	Ddr1	1.59	0.00455
Edn2	9.52	0	Ap2a2	1.08	0.0046
Cnfn	9.41	0	Reg3g	3.75	0.00462
Sema3e	9.32	0	Ddc	3.3	0.00475
Folr1	8.91	0	Gm15247	3.74	0.0048
Onecut2	8.91	0	4921536K21Rik	1.94	0.00485
Slc5a7	8.79	0	Necap1	1.19	0.00486
Zfp185	8.66	0	Garnl3	-1.09	0.00493
Nanog	8.54	0	Gucy1a1	-2.04	0.00501
Wnt7a	8.52	0	Mcm8	1.11	0.0051
A330076H08Rik	8.52	0	Vnn1	-3.02	0.00536
Igf2os	8.52	0	Wnt11	2.48	0.00541
Brinp3	8.44	0	Rrm1	1.09	0.00542
Krt14	8.28	0	Gm5622	5.83	0.00545
Pate1	8.14	0	Meis2	1.38	0.00548
Bnc1	8.11	0	Gm29865	2.99	0.00549
Gabra3	8.06	0	Fzd10	-4.18	0.0055
Lce1h	8.05	0	Cxcl1	1.64	0.00561
AU018091	7.94	0	Oas3	1.64	0.00561
Igf2	7.78	0	Ctf1	1.54	0.00567
Rbm20	7.76	0	Atat1	-1.23	0.00567
Slc6a12	7.75	0	Slc1a5	1.15	0.00584
U90926	7.72	0	Lurap1l	1.33	0.00586
Pate4	7.58	0	Runx2	-1.19	0.00586
Clca3a1	7.51	0	Trpc6	-2.58	0.00587

Erfe	7.5	0	Rapgef3os2	3.17	0.00589
Gm6650	7.43	0	Pbp2	2.53	0.00589
Htr1b	7.4	0	Clnn	-2.12	0.00589
Gm45494	7.35	0	Ick	-1.02	0.00591
Zbtb8b	7.29	0	Styk1	2.17	0.00596
Yap1	7.2	0	Atp1b1	1.97	0.00605
Cxcl5	7	0	Tcte2	1.71	0.00612
Ndn	6.87	0	Wnk3	-2.26	0.00612
Speer3	6.87	0	Htra2	1.07	0.00615
Lrrc4c	6.84	0	Clmp	-1.21	0.00616
Wnt4	6.79	0	Wbp11	1.15	0.00627
Tdrd12	6.77	0	Gdpd2	2.77	0.00628
Gm20416	6.75	0	Ephx2	3.79	0.00632
Sntg1	6.72	0	Adora2b	1.94	0.00632
Fam83a	6.59	0	Cystm1	1.92	0.00632
Bmper	6.47	0	Hebp1	1.21	0.00633
Smarca1	6.45	0	Il6	2.59	0.0064
Tmem184a	6.37	0	Matn3	3.98	0.00655
Aff2	6.25	0	Mycn	1.67	0.00655
Gm9801	6.22	0	Emg1	1.33	0.0066
Cyp3a13	6.17	0	Rragd	-2.42	0.0066
Krt18	6.17	0	Smyd5	1.21	0.00679
Fst	6.16	0	Cyp4b1	-1.92	0.00679
Krt7	6.14	0	Rspo3	2.45	0.00684
Tfr2	5.98	0	Aqp2	2.95	0.0069
Rasl10b	5.93	0	Tenm3	3.53	0.00697
C430002N11Rik	5.92	0	Serinc2	-2.2	0.00697
Hif3a	5.89	0	Zfp850	1.38	0.00703
Serpinb9b	5.87	0	Rhbdl2	-2.71	0.00706
Olfr1033	5.84	0	Rnf144a	-1.33	0.0071
Ppef1	5.83	0	Kcnu1	2.97	0.00712
Shoc2	5.82	0	Proser2	2.5	0.00712
Adgrd1	5.77	0	Pi16	1.88	0.00712
9330102E08Rik	5.73	0	Lsr	1.4	0.00715
Npy1r	5.7	0	AC160966.1	2.8	0.00724
Bbip1	5.66	0	Hnrnpf	1.24	0.00729
Slc9b2	5.65	0	Tulp3	1.08	0.00737
A830019P07Rik	5.61	0	Lrfn1	2.07	0.0074
Crct1	5.56	0	C130026I21Rik	2.1	0.00741
Gdf6	5.55	0	Klra6	2.12	0.00748
Crlf1	5.43	0	Tpi1	1.48	0.00752
Chrm4	5.39	0	Kcnq4	-1.66	0.00764
Angptl1	5.37	0	Mcub	3.76	0.00768
Epb41l4a	5.37	0	Gm7592	2.96	0.00775

Ces2g	5.35	0	Mrpl51	1.06	0.00775
Gfp2t2	5.26	0	Shq1	1.42	0.00783
Cacna1g	5.19	0	Trip6	1.05	0.00783
C79130	5.17	0	Camsap3	3.45	0.00805
Grb14	5.06	0	Gpr39	1.98	0.00805
Zfp981	5.02	0	Robo4	-1.11	0.00805
Crybg2	4.97	0	Adam22	-1.53	0.00805
Zfp575	4.96	0	Nipsnap1	1.99	0.00806
Ms4a4d	4.94	0	Slc12a5	-1.85	0.00806
Atp6v0a4	4.93	0	Clstn3	3.48	0.00812
Has1	4.88	0	Pcdhga5	-2.74	0.00812
Angpt1	4.87	0	Car2	2.63	0.00822
Pdcd4	4.87	0	Ddx56	1.04	0.00822
Larp6	4.87	0	Fam83f	1.55	0.00826
Tmeff2	4.86	0	Gatsl2	-1.1	0.00826
Epha4	4.8	0	Fbn2	4.11	0.00837
Rassf6	4.79	0	Tcof1	1.13	0.00848
Rhpn2	4.77	0	Cdh5	-1.38	0.0085
Crabp2	4.77	0	Fam129b	1.05	0.00852
Chl1	4.75	0	C1rb	2.22	0.00863
Atp6v0d2	4.65	0	Dlx4	1.35	0.00863
Slc1a3	4.58	0	Alg8	1.18	0.00863
Elfn1	4.57	0	Trmt6	1.01	0.00873
Rtn4rl2	4.55	0	Dusp5	1.23	0.00877
Cyp2s1	4.53	0	AC168977.1	2.3	0.00885
2200002D01Rik	4.51	0	Itfg2	1.36	0.00885
Rasl11a	4.5	0	Bcl2l13	1.17	0.00885
Lamb3	4.46	0	Pold2	1.12	0.0089
Gm11627	4.4	0	Pnpt1	1.04	0.0089
Pabpc4l	4.38	0	Kif5a	-2.49	0.00892
Tnfsf11	4.36	0	Pno1	1.18	0.00895
Tmem130	4.34	0	Acp6	-1.11	0.00895
Frzb	4.29	0	Thumpd3	1.1	0.00897
Cd55	4.16	0	Tspan18	-1.52	0.00897
Baiap2l1	4.14	0	Kcnq5	2.73	0.00903
Tspan8	4.11	0	Sh3bp5	1.78	0.00912
Sema4f	4.02	0	3110040N11Rik	1.32	0.00912
Lamc3	4.01	0	Sep-04	-1.15	0.00937
Zfp37	4	0	Hk2	1.59	0.00942
Mogat2	3.91	0	Slc9a3r1	1.64	0.00945
Hdx	3.91	0	Pcolce	1.31	0.0095
Rab38	3.88	0	Foxm1	1.29	0.0095
Ereg	3.8	0	Rad18	1.2	0.0095
Gpm6b	3.77	0	Cdh17	2.91	0.00958

Fmod	3.75	0	Ogg1	1.33	0.0097
Dynap	3.73	0	Heyl	-1.61	0.0097
Slit3	3.72	0	Sox7	-1.37	0.00971
Pde1a	3.71	0	Foxg1	1.05	0.00976
Syt12	3.68	0	Grik5	2.55	0.00996
Mboat2	3.66	0	Egr1	1.74	0.00996
Hspb2	3.63	0	Hoxa1	1.46	0.00996
Tinagl1	3.62	0	Fbxo17	1.25	0.00996
Nov	3.61	0	D130017N08Rik	-1.73	0.00996
Tmem151a	3.53	0	Trnt1	1.27	0.01001
Gm14230	3.51	0	Cnn2	1.1	0.01006
Aqp5	3.5	0	P3h4	1.02	0.01019
Jph2	3.41	0	Vegfc	-1.42	0.01033
Akap12	3.4	0	Chrd	1.69	0.01036
Gtpbp10	3.4	0	Plekhh2	-1.33	0.01036
Cdsn	3.37	0	Ighv10-1	-4.2	0.01042
Tnxb	3.25	0	Adora2a	-1.25	0.01047
Adamts5	3.23	0	Myo1h	1.39	0.01049
Tead4	3.23	0	Rdm1	1.26	0.01049
Itga2b	3.19	0	Prokr2	4.13	0.01054
Pappa	3.19	0	Zan	2.25	0.01059
Colec12	3.17	0	Il17re	3.07	0.01062
Thbd	3.07	0	Foxo3	-1.23	0.01062
Slc2a3	3.06	0	Cald1	1.15	0.01068
Esrp2	3.05	0	Zcwpw1	2.03	0.01087
Msln	3	0	Ccdc91	1.2	0.0109
Lama2	2.98	0	Tubb4a	-1.81	0.01091
Chmp4c	2.94	0	4930486L24Rik	1.47	0.01097
Sbsn	2.93	0	Gm10544	4.58	0.01106
S100a7a	2.91	0	Cpxm1	3.97	0.01106
Ptgfr	2.9	0	Sertad1	1.05	0.01106
Syt13	2.83	0	Ttll5	-1.22	0.01112
Gprc5a	2.77	0	Slc16a13	-1.29	0.01114
Fos	2.71	0	Svep1	1.95	0.01135
Cacna1a	2.69	0	Ddx47	1.01	0.01139
Krt80	2.69	0	Dlk2	2.25	0.0115
Hist1h2bc	2.67	0	Erbb2	1.11	0.0115
Arhgap8	2.64	0	Zfp9	1.21	0.01159
Tmem171	2.62	0	C1d	1.07	0.01159
Prr5	2.6	0	Tmed8	-1	0.01163
Ager	2.55	0	Akr1c13	1.53	0.01168
Lama5	2.52	0	E330011O21Rik	3.02	0.01177
Eno3	2.49	0	Fkbp4	1.25	0.01181
B4galt4	2.47	0	Tbc1d2	1.34	0.01184

Ccnd2	2.46	0	Gm3716	2.52	0.01204
Rassf7	2.42	0	Trim6	1.95	0.01212
Serpinc1a	2.36	0	Gm44066	2.42	0.01217
H2afy2	2.33	0	Tbx2r	2	0.01223
Lgi2	2.31	0	Rbm12b1	-1.76	0.01223
Cebpb	2.3	0	Fam131b	1.39	0.0123
Cryab	2.3	0	Myzap	-1.58	0.0123
Cavin2	2.24	0	Itga1	-1.09	0.01244
Hist1h1c	2.16	0	Ighv5-9	-7.03	0.01253
Gadd45g	2.15	0	Clec4d	1.92	0.01257
Fam84b	2.1	0	Gpr137b	1.27	0.01262
Boc	2	0	C4b	1.34	0.01275
Pltp	1.88	0	Dennd5b	1.29	0.01276
Plekhf1	1.85	0	Sort1	-1.17	0.01278
Amotl2	1.83	0	Bcat1	1.56	0.01284
Klra4	1.83	0	Spon1	1.45	0.01284
Papss2	1.62	0	Emilin1	-1.12	0.01286
F3	1.3	0	Nova1	2.12	0.01287
Crip1	1.26	0	Ighm	-1.52	0.0129
Vwf	-1.89	0	Gpat3	1.22	0.01298
Mycl	-2.37	0	Dtwd1	1.1	0.01315
Reln	-3.4	0	Abcg2	1.25	0.01321
Prox1	-3.77	0	Dgat2	1.51	0.01334
Agtr2	10.57	0.00001	Adgrg1	-1.23	0.01338
Wt1	9.72	0.00001	Prss23os	2.04	0.01341
Gm6526	8.29	0.00001	Apba2	-2.7	0.01346
Dok6	8.21	0.00001	Calml4	1.74	0.01353
Lce1g	8.18	0.00001	Gpr88	3.8	0.01357
9330132A10Rik	7.37	0.00001	P3h3	1.01	0.01375
Mgam	7.25	0.00001	Clec3b	2.52	0.01392
Epha3	6.65	0.00001	Gm20056	2.06	0.01397
1700012B09Rik	6.12	0.00001	C630043F03Rik	1.8	0.01397
Lrrn4	5.77	0.00001	Mkx	1.8	0.01405
Veph1	4.87	0.00001	Kcnv2	4.84	0.01408
Dcstamp	4.36	0.00001	Cdkn1b	1.16	0.01413
Cpz	3.84	0.00001	Sprr1a	2.46	0.01422
Cobl	3.68	0.00001	C1s2	1.95	0.01422
Pard6b	3.65	0.00001	Mfap4	2.11	0.01428
Fgfr2	3.6	0.00001	Slfn1	1.5	0.01428
Epha1	3.36	0.00001	Prep	1.45	0.01428
Pppbp	3.27	0.00001	Bdnf	1.17	0.01428
Cfap100	3.21	0.00001	Csgalnact2	1.08	0.01428
Prg4	2.87	0.00001	Enpp1	-1.38	0.01428
Mfap5	2.72	0.00001	Zcchc3	1.42	0.0143

Dact1	2.61	0.00001	Slc16a1	1.31	0.01436
Rras2	2.33	0.00001	Ackr2	-1.86	0.01459
Fam46b	2.28	0.00001	Mpp2	1.51	0.01471
Gda	2.22	0.00001	AI429214	1.4	0.01471
Dhrs9	2.22	0.00001	A430105I19Rik	1.14	0.01471
C1ra	2.08	0.00001	Fhl5	-2.81	0.01471
Dmd	1.81	0.00001	Stat3	1.09	0.01475
Igf2bp1	1.72	0.00001	Cldn5	-1.26	0.01483
Hsd11b1	1.63	0.00001	Lrrc42	1.08	0.01484
Cavin1	1.23	0.00001	Sphk1	1.17	0.0149
Ifi27l2a	1.17	0.00001	Chac1	1.33	0.01502
Gpc4	1.01	0.00001	Gm13147	2.67	0.01505
Gm13415	7.95	0.00002	Basp1	1.05	0.01505
Arhgef16	6.24	0.00002	Wnt7b	-2.09	0.01505
Zfp988	5	0.00002	Csrnp1	1.09	0.01506
Il33	4.97	0.00002	Bhlhe40	1.42	0.01518
Ccdc8	3.24	0.00002	Phldb3	1.04	0.01518
Gucy1a2	2.85	0.00002	Myh11	-1.15	0.01518
Gm13212	2.45	0.00002	Slc4a8	-1.48	0.01518
Ptn	2.16	0.00002	Hs3st1	3.03	0.01526
Cdh2	2.13	0.00002	Htr2a	-2.36	0.01532
Eya1	2.03	0.00002	Gm30146	4.88	0.01533
Pde3b	1.71	0.00002	Gas1	1.16	0.01533
Ppp1r15a	1.58	0.00002	Gas7	1.08	0.01533
Fam83h	1.48	0.00002	Gm45769	1.84	0.01542
Ighv2-9-1	-3.35	0.00002	Scn3a	-3.46	0.01542
Fgfbp1	5.56	0.00003	Bms1	1.04	0.01581
Adm2	4.45	0.00003	Dus4l	1.18	0.01582
Rnf112	3.94	0.00003	Ikzf2	1.31	0.01607
Slc43a1	2.9	0.00003	Rasgrp3	-1.56	0.01607
Lpl	1.91	0.00003	Spsb2	1.05	0.01612
Ptrh1	1.8	0.00003	Igkv3-7	-3.57	0.01633
Oscar	5.09	0.00004	C330018D20Rik	1.68	0.01644
Hmcn1	3.18	0.00004	Dnase1l3	-1.9	0.0167
Fhl1	2.95	0.00004	Smad7	1.28	0.01676
Map2	2.67	0.00004	Fgf18	2.32	0.01705
Rarres2	2.23	0.00004	Cfap157	1.34	0.01727
Cyr61	1.9	0.00004	Brd3os	-1.03	0.01744
Mafk	1.47	0.00004	Patj	1.57	0.01787
Thsd7b	7.09	0.00005	Snai1	1.09	0.01787
9530053A07Rik	5.11	0.00005	Mro	2.27	0.01802
Wdr17	4.82	0.00005	Emilin2	1.28	0.01812
Adam23	3.57	0.00005	Med21	1.12	0.01833
9430018G01Rik	2.46	0.00005	Plekhg1	-1.13	0.01833

Lrrc75a	1.5	0.00005	Sfrp2	1.98	0.01853
Scel	4.72	0.00006	Pde8b	1.29	0.01855
Dpcr1	3.37	0.00006	Pcdhb19	-1.84	0.01873
Acp5	3.06	0.00006	Galnt17	1.33	0.01876
Bcam	2.29	0.00006	Avpi1	1.2	0.01877
Shroom3	2.09	0.00006	Edil3	3.43	0.01893
Serpding1	2.04	0.00006	Oasl1	1.5	0.01901
Ggh	1.11	0.00006	Sil1	1.04	0.01908
Fyb2	3.02	0.00007	Mamdc2	-2.21	0.01912
Cxadr	2.72	0.00007	Bean1	-1.25	0.01914
Nipal1	2.15	0.00007	Kcnn3	-2.84	0.01931
4930556M19Rik	2.01	0.00007	Clca2	-1.34	0.01935
Ly6f	4.69	0.00008	Epn3	4.19	0.01941
Ccdc136	3	0.00008	Mfap2	2.1	0.01941
Gm44275	2.82	0.00008	Usp2	1.18	0.01953
Timp3	2.25	0.00008	Mrps25	1.09	0.01968
Hist1h4i	1.75	0.00008	2610017A05Rik	2.32	0.01969
Zfp978	6.07	0.00009	Tbx2	-1.81	0.01969
Ptgs2	4.95	0.00009	Etfbkmt	1.69	0.02011
Syn1	3.62	0.00009	Spon2	2.17	0.02023
Arxi	3.1	0.00009	Crim1	1.1	0.02025
Smpd3	3.07	0.00009	Baalc	2.14	0.02029
Nr4a1	2.6	0.00009	Rybp	1.04	0.02034
Eml2	1.96	0.00009	Timp1	1.29	0.02043
Rem1	1.87	0.00009	F2rl3	-1.24	0.0205
Numbl	1.77	0.00009	Tead3	1.1	0.02064
Ybx3	1.69	0.00009	Ankrd55	1.65	0.02089
Itga3	1.64	0.00009	Fzd8	1.22	0.02092
Atf3	1.5	0.00009	Hspa9	1.03	0.02093
Ifi205	1.47	0.00009	Gstt1	-1.87	0.02095
Pla2g4a	1.3	0.00009	Plxnb1	-1.21	0.02105
Col7a1	-1.31	0.00009	Hap1	-1.51	0.02116
Prph	3.97	0.0001	Prr15	2.21	0.02123
Il11	3.71	0.0001	Adamts2	1.28	0.02129
Lipg	2.74	0.0001	C1rl	1.6	0.02136
Llgl2	2.51	0.0001	P4ha3	1.43	0.02166
Sdc4	1.66	0.0001	Ptgs2os	1.76	0.02193
Gm16299	4.59	0.00011	Gm15706	1.68	0.02199
Cma1	4.07	0.00011	2310014F06Rik	2.47	0.02211
2310030G06Rik	3.65	0.00011	Particl	1.44	0.02222
Prss23	2.02	0.00011	Cdh13	-1.11	0.02222
Tspan9	1.59	0.00011	Aox3	3.73	0.02231
Pate3	6.24	0.00012	Irf7	1.32	0.02242
Socs3	1.68	0.00012	C3	1.77	0.02243

Cops7a	1.61	0.00012	Bsn	-1.52	0.02261
Reg1	5.54	0.00013	Fcrlb	1.54	0.02281
Gata6	2.48	0.00013	Pcdh12	-1.34	0.02297
Lox	2.46	0.00015	Trim68	1.38	0.0231
Pdia5	1.55	0.00015	Smim10l1	1.03	0.0231
Dbnnd2	1.64	0.00016	Piwil2	1.67	0.02324
Cpa3	4.35	0.00017	Spire1	1.09	0.02324
Car12	3.32	0.00017	Pkdcc	1.61	0.02332
Mirt1	2.51	0.00017	Fggy	1.16	0.02332
Rapgef3	1.6	0.00017	Apol9b	1.16	0.02338
Prx	1.77	0.00018	C1qtnf9	-1.68	0.02338
Vgf	3.12	0.0002	Gsta4	-1.87	0.02338
Aif1l	1.89	0.0002	Naa50	1.01	0.02353
Tpsb2	3.77	0.00021	Emid1	-1.62	0.02365
Serpine1	1.86	0.00021	Trim71	3.77	0.02369
Sspn	1.6	0.00021	Tbx1	-2.86	0.02374
Mefv	1.91	0.00022	5730409E04Rik	1.06	0.02379
Kcnab1	2.27	0.00023	Tgif2	1.22	0.02384
SrpX	2.08	0.00023	Cyp4f17	-1.15	0.02469
Phldb2	1.71	0.00023	Fry	-1.12	0.0247
Dusp3	1.21	0.00023	Sorbs1	-1.18	0.02485
Lrrn3	-2.93	0.00023	Id3	1.49	0.02501
Siglecg	2.05	0.00024	Prss36	1.48	0.02508
Gm48391	6.55	0.00026	Myom2	2.28	0.02511
1500015O10Rik	3.53	0.00026	Gm20744	2.08	0.02543
Bmpr1b	3.26	0.00027	Mmp3	2.08	0.02554
Fosb	2.64	0.00028	Tle1	1.16	0.0257
C2	2.22	0.00028	Lrp6	1.12	0.0257
Spr2g	7.47	0.00029	2210011K15Rik	1.51	0.02617
Flt4	-2.03	0.00029	Hspb6	1.18	0.02618
4930461G14Rik	6.72	0.0003	Fez2	1.05	0.02618
Cpox	1.62	0.0003	Ccdc167	-1.09	0.02622
Fkbp11	1.56	0.0003	Unc5a	-2.36	0.02623
1700009N14Rik	7.67	0.00031	Bank1	-1.23	0.02625
Pwwp2b	1.54	0.00031	Gm35066	3.29	0.02657
Sfrp1	2.75	0.00032	Gm19744	3.16	0.02657
Wwc1	1.75	0.00032	Phc1	1.09	0.02657
Rufy4	4.37	0.00034	Fignl1	1.05	0.02657
Aldh1a1	3.68	0.00034	Gimap8	-1.03	0.02657
Pcsk5	2.83	0.00034	Zfp862-ps	-1.25	0.02657
Lmbr1	2.31	0.00035	Bcl6b	-1.42	0.02657
Car6	3.53	0.00036	Pdk4	-2.26	0.02657
Pygl	2	0.00036	Mrps35	1.06	0.02666
Gm14139	5.24	0.00038	Jagn1	1.04	0.02666

Rorb	4.6	0.00038	Igkv10-96	-2.71	0.02696
Thsd4	-4.09	0.00038	Krt8	3.57	0.02724
Tagln	3.11	0.00039	Zfp804a	4.96	0.0273
Tro	4.64	0.00041	Etfrrf1	1.21	0.0273
Atn1	1.65	0.00041	Gt(ROSA)26Sor	1.15	0.0273
1700049E17Rik2	5.62	0.00042	Duoxa1	2.23	0.02757
1010001N08Rik	3.16	0.00042	Utp14b	1.26	0.0276
Gm11545	-4.39	0.00044	A4galt	-1.98	0.02802
Thpo	2.88	0.00045	Matn4	3.06	0.02808
Mbnl3	2.8	0.00045	Hgf	-1.52	0.02808
Casd1	1.44	0.00045	Zfp986	4.75	0.02811
2410012E07Rik	5.52	0.00046	Adamts16	3.5	0.02811
Klk10	4.45	0.00047	Tm4sf19	1.81	0.02811
Pthlh	4.02	0.00048	Notch3	1.4	0.02815
Uba1y	9.91	0.00049	Cacna1h	-2.6	0.02815
Vat1l	6.17	0.00051	Txnrd3	1.27	0.02849
Olfr456	5.48	0.00051	Gm5535	-2.7	0.02864
Oplah	1.61	0.00051	Pogk	-1.79	0.02876
Sox5	2.6	0.00054	Synpr	4.35	0.0288
Arap2	2.08	0.00054	Eps8l1	-2.01	0.02902
Spib	1.88	0.00054	Larp1b	1.12	0.02913
Clic3	2.28	0.00056	Lsm3	1.09	0.02913
Bid	1.59	0.00057	Pcdhb20	-1.53	0.02913
Gpr19	1.94	0.00058	Lyve1	-1.31	0.02989
Ebf4	2.43	0.00061	Mzb1	-2.54	0.03
Selenbp1	2.21	0.00061	Rab6b	-1.28	0.03044
Smim20	1.53	0.00061	Olfml2a	-1.81	0.03082
Eps8	1.49	0.00061	Ndnf	-1.68	0.03095
Atp10a	1.33	0.00061	Rhno1	1.08	0.03111
Dusp10	1.28	0.00061	Ugdh	1.07	0.03143
Sod3	1.12	0.00061	Mannr	-1.55	0.03145
Cadm4	2.91	0.00063	Ighv1-26	-2.77	0.03145
Qrfp	2.73	0.00063	Afap1l1	-1.18	0.03162
Osmr	1.64	0.00063	Gramd2	1.51	0.03165
Illdr2	2.16	0.00065	Sox18	-1.1	0.03165
Vgll3	2.67	0.00066	Gng7	-1.34	0.03167
Cxcl12	1.67	0.00066	Prnd	-1.5	0.03177
Pate2	3.29	0.00068	Plcx2d2	1.36	0.032
Grid2	3.65	0.0007	Zfp248	1.06	0.03204
Mgst1	1.86	0.0007	Pik3c2b	-1.56	0.0322
Il17rd	-1.42	0.0007	Jag2	-1	0.03225
Spta1	3.59	0.00072	Vsig4	2.82	0.03228
Adgrg2	3.04	0.00072	Adssl1	1.09	0.03229
Gm2694	6.85	0.00073	Acot2	1.07	0.03235

Ppp2r2b	6.7	0.00073	Camk2n2	-1.11	0.03255
Naaladl2	3.87	0.00073	Cd209g	3.08	0.03258
Tspan6	2.08	0.00073	Zfp950	-1.29	0.03258
Gcnt1	1.37	0.00073	Gm8941	-1.87	0.03259
Reep1	-1.84	0.00073	Map2k3os	1.42	0.03264
Smtnl2	2.97	0.00074	Scrn3	1.12	0.03264
Emp1	1.51	0.00076	Tmem2	-1.09	0.03264
Cobll1	1.41	0.00076	Tshz3	-2.16	0.03267
Nppb	4.89	0.00077	Slc18b1	-1.13	0.03268
Drd4	4.87	0.00084	Cacng7	-1.12	0.03274
AC133103.1	4.89	0.00086	Slc37a2	1.17	0.03281
Plaur	1.48	0.00086	Gm21814	2.8	0.03294
Tppp3	1.39	0.00086	Neb1	-2.3	0.03302
Fbln2	1.88	0.00088	Pax3	2.41	0.03328
Gm2619	3.53	0.00089	Sumo3	1.24	0.03328
Pcsk6	-2.18	0.00091	Sema6c	-1.31	0.03328
Fmo4	7.88	0.00092	BC030867	1.09	0.0333
Dpep1	2.24	0.00096	Syt8	2.64	0.03362
Odc1	1.04	0.00097	Pxdn	-1.23	0.03365
Arl14epl	5.94	0.00099	Gm6377	1.16	0.03374
Smad6	2.31	0.001	Foxp1	1.25	0.0342
Ccdc141	-1.78	0.00101	Rtl1	2.62	0.03453
Wisp2	1.91	0.00102	Dmtn	-1.75	0.03461
Akip1	1.41	0.00102	Gm16701	-2.59	0.03462
Vcan	1.28	0.00103	Zfp979	2.38	0.03482
Gm15675	4.49	0.00104	Runx1t1	-1.03	0.03487
Mcpt4	3.92	0.00104	Csf3	1.82	0.03498
Pdzrn3	4.4	0.00107	Hpd1	2.06	0.03514
Tnmd	5.17	0.00108	Igkv5-43	-2.86	0.03514
Gm18609	4.13	0.00108	Sec14l2	-1.43	0.03539
Cdk18	2.47	0.00108	Fbxl12os	-1.22	0.0354
Rgs4	-2.29	0.00108	Ttpa	3.94	0.03541
Nectin2	1.79	0.00109	Sh3tc2	1.5	0.03541
Trim44	1.69	0.00112	Gm14410	1.27	0.03541
A230057D06Rik	6.57	0.00113	Ptp4a3	-1.13	0.03541
Slc6a13	5.04	0.00114	Gm19705	1.11	0.03544
Slc38a4	2.67	0.00115	Vamp5	1.23	0.03547
Zyx	1.43	0.00115	Dll4	-1.01	0.03556
Efna5	2.21	0.00117	Med13l	1.03	0.03583
Trib3	1.39	0.00117	Bcr	-1.11	0.036
Cav1	1.82	0.00118	Sh3rf3	1.52	0.03611
Spin2c	2.9	0.00119	Ptgis	1.45	0.03613
Gm14327	2.37	0.00119	Caprin2	1.12	0.0363
Rassf8	1.63	0.00119	Krba1	1.05	0.03636

Suox	1.62	0.00119	Nod1	1.36	0.03659
Deptor	1.47	0.00119	Peg3	2.18	0.03663
Sema3b	1.26	0.00119	Stxbp6	1.66	0.03663
Tnfrsf22	-1.27	0.00119	Il17rc	1.06	0.03663
Tmem200b	-3	0.0012	Pvr	1.28	0.0367
Fam78b	-2.16	0.00121	Fibin	2.34	0.0368
Ccl9	1.6	0.00122	Nxn	1.58	0.03728
Lman1l	3.43	0.00123	Gm17690	-1.04	0.03742
Metrnl	1.37	0.00124	Igkv6-15	-1.99	0.03751
Gm10010	5.82	0.0013	Zswim7	1.05	0.03753
Igssf9b	-1.41	0.00131	Rtn4rl1	1.73	0.03776
Akr1c14	2.61	0.00132	Pcdhb15	1.52	0.03776
Nop2	1.65	0.00132	Snhg15	1.15	0.03776
Tspan4	1.54	0.00136	Vstm4	-1.36	0.03776
Aff3	-2.62	0.00137	Paqr8	-1.71	0.03776
Pde4d	1.42	0.0014	Cyp1b1	1.64	0.03782
Has2	2.6	0.00144	B3gnt3	-1.47	0.03782
Tmem43	1.2	0.00144	Trpc3	-2.27	0.03788
Setmar	2.7	0.00145	Me3	1.92	0.03796
Cfp	1.49	0.00147	Extl1	-1.9	0.03796
Adra2a	1.43	0.00154	Fgf7	1.07	0.03797
Gucy1b1	-1.88	0.00154	Mpp6	1.21	0.03813
Cav2	2.28	0.00156	Col27a1	-1.61	0.03827
Nnmt	1.33	0.00156	Pank1	-1.46	0.03871
Ttn	-2.56	0.00156	Glis2	1.06	0.03902
Olr1	3.6	0.00159	Hdhd5	1.19	0.03916
Ocstamp	3.08	0.00159	Gas2	1.2	0.03929
Gm43305	-1.17	0.00159	Pcbp3	-1.99	0.03929
Nfil3	1.61	0.00161	Sparcl1	-1.26	0.03938
Tph1	5.38	0.00164	Gm20560	2.53	0.03939
Foxf1	1.11	0.00166	Robo2	-1.14	0.03939
Tspyl5	-1.52	0.00167	Ccr3	3.24	0.03949
Srgap1	-1.62	0.00167	Col18a1	-1.04	0.03953
Cebpd	1.14	0.00169	Tmem143	1.12	0.03968
Prdx6	1.18	0.00178	Tsen2	1.13	0.03981
Kcnj8	-1.33	0.00178	Capza2	1.77	0.03983
Had2	-1.21	0.00179	Ppp1r13l	1.19	0.03983
Aebp1	1.52	0.0018	Ric8b	-1.02	0.03983
Gfi1	-2.15	0.00183	Gcnt4	-2.81	0.03983
Lpcat3	1.58	0.00186	Slc25a23	-1.44	0.03991
Cpa4	3.5	0.0019	Foxa2	2.58	0.04008
Trpm8	3.84	0.00191	Slc9a4	1.76	0.04008
Col12a1	2.47	0.00191	Samd4b	1.05	0.04012
Pdzd2	-1.44	0.00191	4930430E12Rik	1.86	0.04023

5830411N06Rik	-3.93	0.00193	Cabp1	-1.57	0.04024
Serpинb6b	1.08	0.00206	Egflam	-2.2	0.04049
Adamts1	1.32	0.00207	Tbx3os1	-3.2	0.04069
Ptgs2os2	3.81	0.0021	Gm15609	-2.19	0.04077
Magohb	1.4	0.0021	Nrcam	3.81	0.04096
Ocln	3.53	0.00215	Scn7a	2.09	0.04111
Isg20	1.25	0.00215	Ppp1r9a	1.38	0.04111
Ezr	1.24	0.00216	Hbegf	1.17	0.04111
Ccbe1	-2.89	0.00216	Nectin3	1	0.04111
Eno2	2.11	0.00219	Slc14a1	-1.14	0.04111
Dcbld1	-1.28	0.00219	Ncoa1	-1.15	0.04111
Mcc	1.53	0.00228	Gm27042	-1.43	0.04111
Dlg1	1.32	0.00229	Tet1	-2.2	0.04111
Phyhip	5.31	0.0024	2500004C02Rik	1.32	0.04122
Slpi	3.06	0.00243	Gm13986	2.23	0.04126
Nyap2	5.78	0.00248	Mapkapk3	1.15	0.04162
Mt3	5.71	0.00248	Thbs1	1.58	0.04168
Esr2	3.43	0.00248	Iglon5	-1.33	0.04168
Eif1a	1.3	0.00248	Ighv1-61	-6.27	0.0418
Dlc1	1.31	0.00249	2810410L24Rik	-1.22	0.04181
Cyb5r1	1.23	0.00249	Ndst3	-1.97	0.04197
Gm13293	5.09	0.0025	Ddx60	1.18	0.04225
Gm35315	2.23	0.00255	Mamld1	-1.38	0.04225
Ccdc77	1.64	0.00256	Col5a3	-1.55	0.04252
Erc1	1.52	0.00256	Erbb3	1.15	0.04262
Gapdh	1.47	0.00256	Gm18009	2.53	0.04271
Nedd4l	1.2	0.00258	Ptprm	-1.53	0.04277
Igkv5-39	-3.84	0.00258	Ngef	-2.88	0.04289
Vash1	-1.44	0.00262	Daam2	-1.44	0.043
Nfkbiz	1.39	0.00267	Otx1	1.3	0.04302
Lcmt2	1.13	0.00267	Fgd5	-1.15	0.04309
Gm26651	3.46	0.00269	Zfhx2	-1.5	0.04338
Fln	1.6	0.00271	Zfp287	-1.13	0.04359
Loxl1	-1.05	0.00271	Zfp985	2.93	0.04362
Mtmr10	1.07	0.00274	Ccdc65	3.8	0.04375
Fancd2	1.44	0.00277	Syngr3	1.74	0.04375
Pear1	-1.4	0.00279	Grem2	3.15	0.04458
Mmp8	3	0.00283	Zfp618	2.65	0.04458
Pipp3	1.27	0.00289	Tspan13	-1	0.04461
Meox2	-1.47	0.00292	Hykk	-1.3	0.04464
Uba3	1.2	0.00297	Mturn	-1.39	0.04464
Tamm41	1.49	0.00302	Smim3	1.16	0.04487
Snta1	1.09	0.00307	Usp54	-1.4	0.04487
Serpинb7	4.78	0.00308	Gm13230	1.37	0.04495

Nr4a3	1.97	0.00309	AA986860	1	0.04496
Clcf1	1.42	0.00309	Zfp518b	1.19	0.045
Map6	1.64	0.00311	Gm37145	1.52	0.04525
C1s1	1.55	0.00317	Gpr171	1.44	0.04546
Axin2	-1.43	0.00332	Gm42547	1.13	0.04555
Rtl3	5.58	0.00338	Slco4a1	-2.44	0.04564
Gm12059	3.57	0.00338	D7Ertd443e	4	0.04576
Dnmt3l	3.24	0.00338	Cftr	3.58	0.04581
Tsku	1.58	0.00341	Misp	2.22	0.04604
Zfp354a	1.4	0.00341	Stra6	-3.7	0.04604
Zfp422	1.64	0.00343	Gprin1	-1.88	0.04716
Kcnt2	3.32	0.00346	9830144P21Rik	-1.76	0.04725
Btg3	1.46	0.00349	B130055M24Rik	1.27	0.04737
Abcc9	-1.53	0.00349	AI839979	1.26	0.04768
Cdh3	1.54	0.00357	Zfp992	1.14	0.04768
Kras	1.33	0.00363	Rab15	-2.84	0.04772
Enpp3	-1.72	0.00363	Usp18	1.22	0.04773
Podn	2.88	0.00369	Raet1d	2.68	0.04784
Exd1	2.65	0.0037	6530402F18Rik	-1.16	0.04809
Strap	1.33	0.0037	Tekt2	-1.34	0.04834
Abcb4	2.5	0.00375	Erc2	-1.5	0.04834
Lrrc32	-1.54	0.0038	Lix1	2.88	0.04878
Snora2b	1.97	0.00388	Nrxn1	3.03	0.04885
Igf1	-1.38	0.00402	H2-M2	-2.07	0.04889
Phb2	1.22	0.00405	Stap2	-1.29	0.04891
Zfp534	6.7	0.00406	9130213A22Rik	2.15	0.04917
Ntf5	2.5	0.00409	Chchd4	1.08	0.04917
Aebp2	1.35	0.00409	Rhbdl3	-1.76	0.04961
Higd1b	-2.49	0.00427	Cap2	-2.25	0.04961
Adgrg3	-1.6	0.00434	Gm6133	2.44	0.04972
Rgs5	-1.76	0.00434			

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