SUPPLEMENTAL INFORMATION

The volume regulated anion channel LRRC8C suppresses T cell function by regulating cyclic dinucleotide transport and STING-p53 signaling

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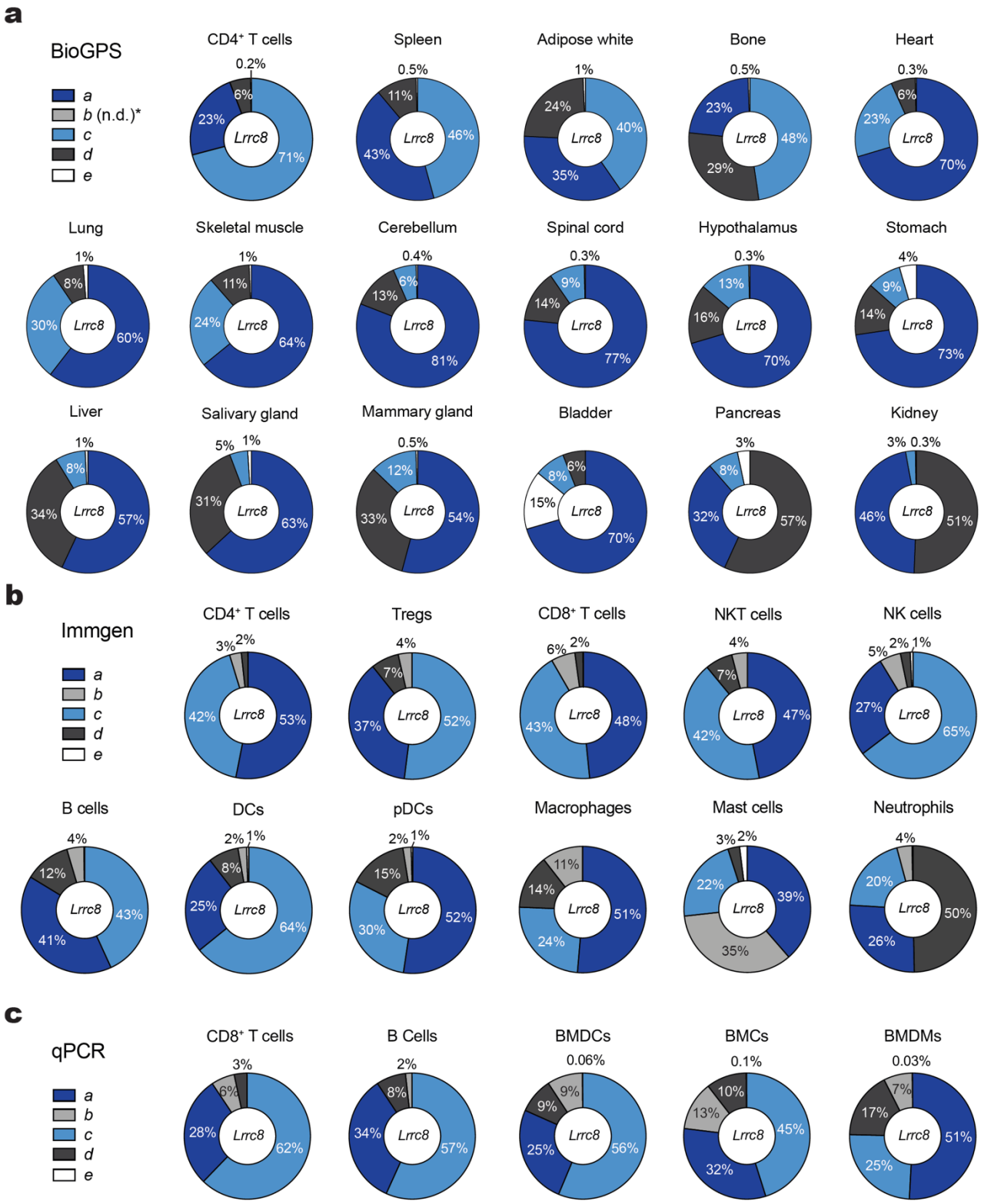
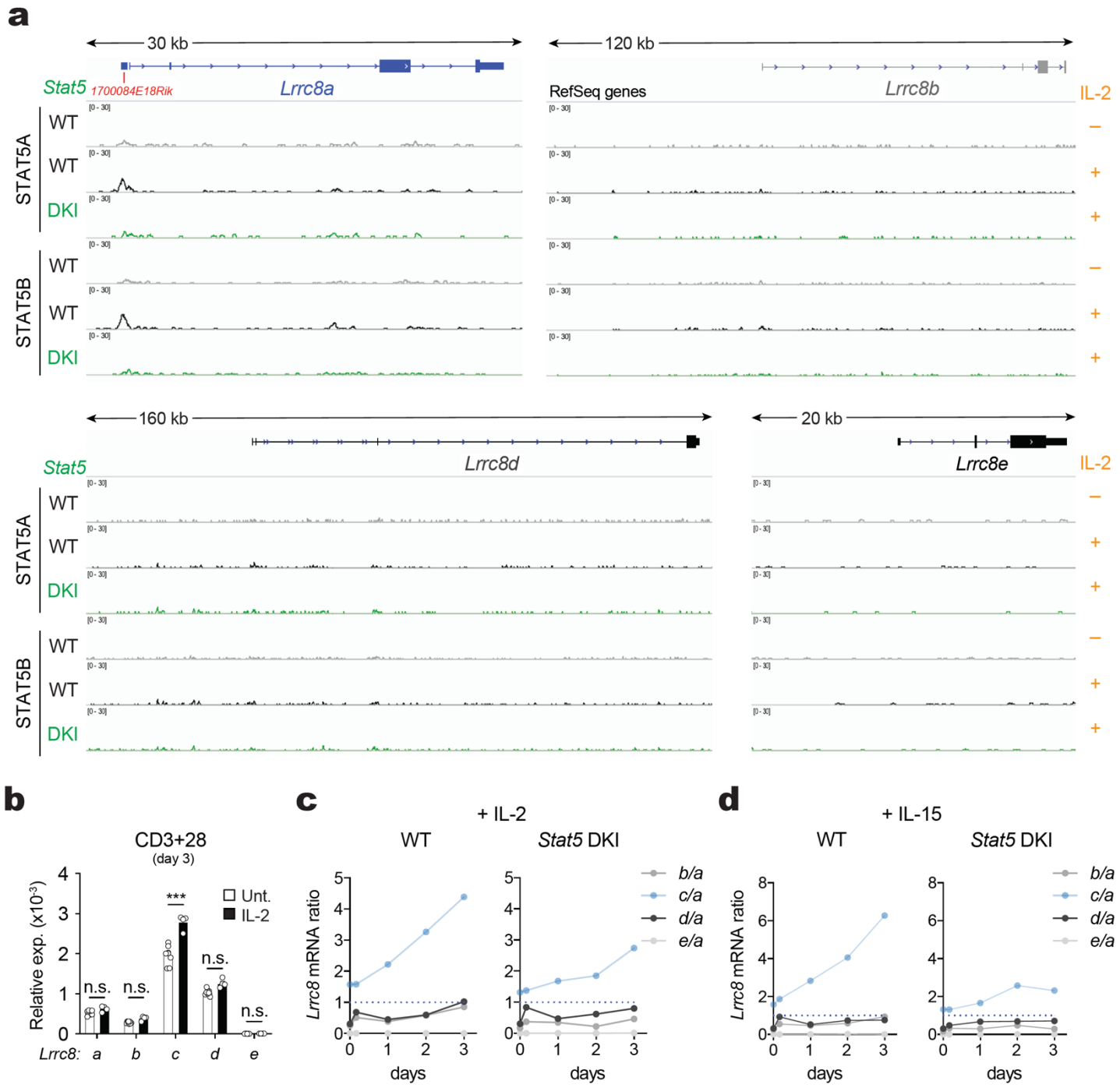
Supplemental Figure 1

(associated with Figure 1d,e)



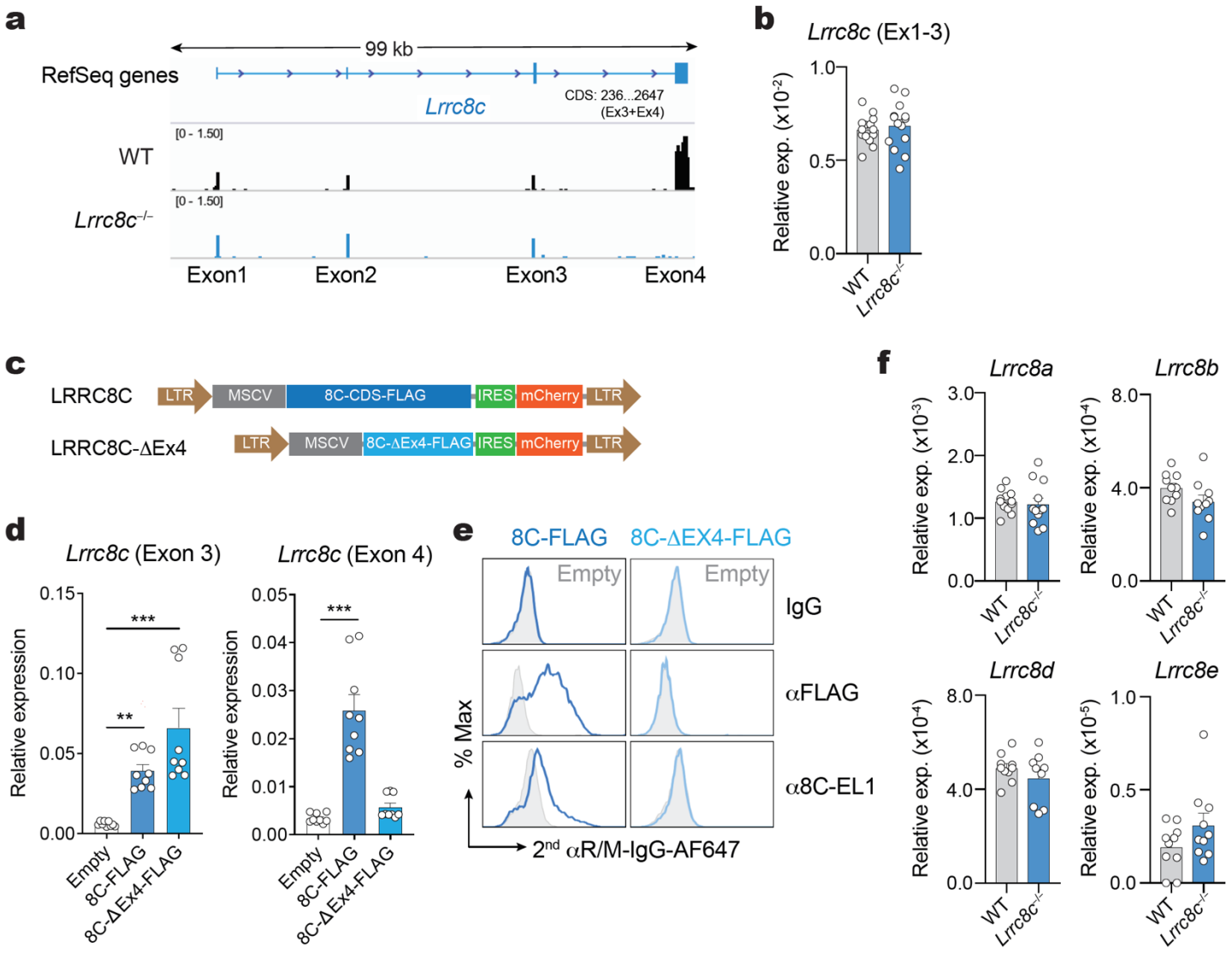
Supplemental Figure 1. Transcriptional expression of *Lrrc8* genes in different immune cells and tissues. (a-c) Pie chart showing the proportion of *Lrrc8* gene expression in murine cells from (a) BioGPS microarray gene atlas MOE340, (b) ImmGen RNA-Seq database and (c) validated by RT-qPCR. Note that *Lrrc8b* gene expression in (a) was not available from the BioGPS dataset. Data in (c) was pooled from at least 2 independent experiments and 3 WT mice.

Supplemental Figure 2
(associated with Figure 1l,m)



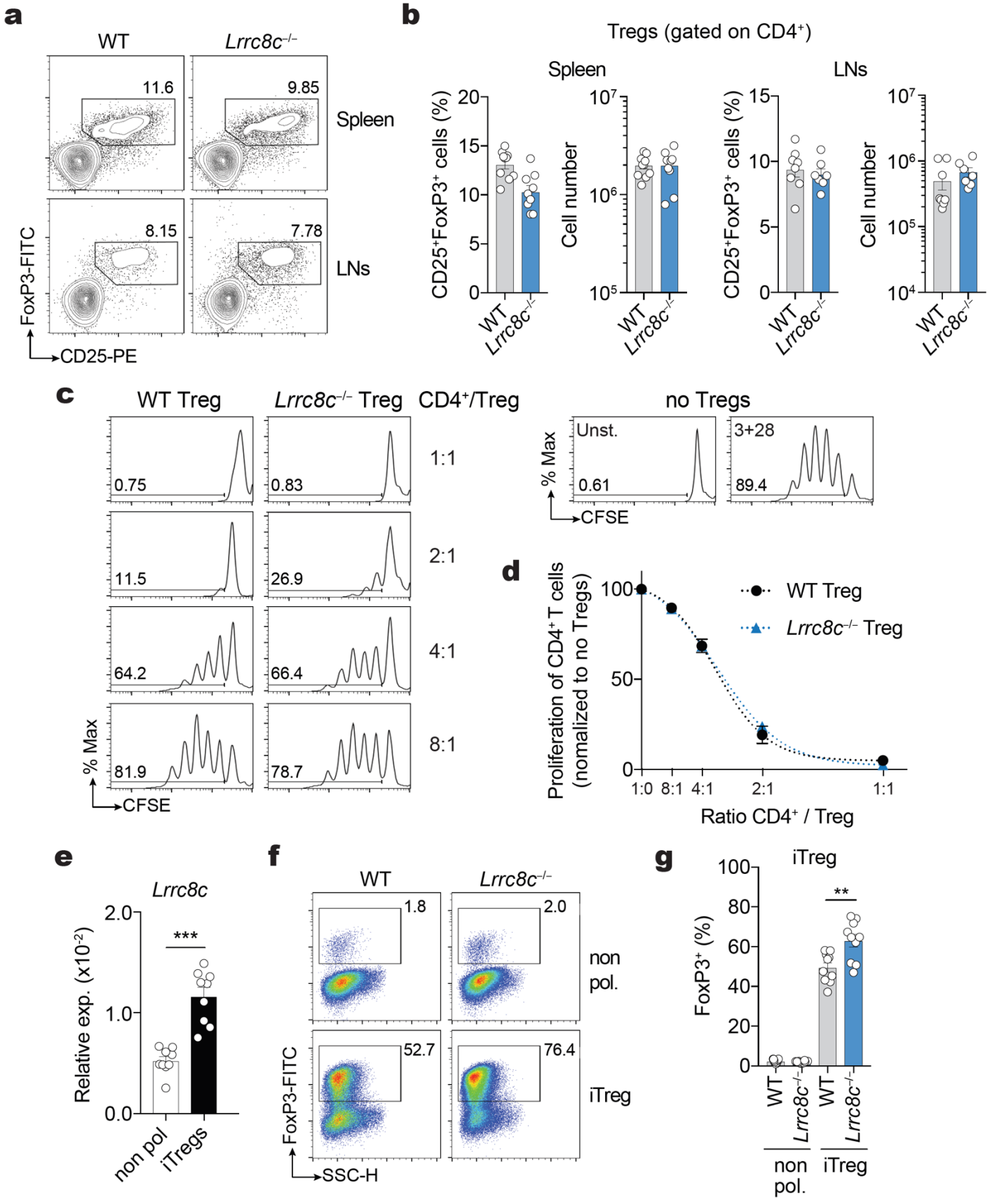
Supplemental Figure 2. *Lrrc8* genes others than *Lrrc8c* lack STAT5 binding motifs in T cells. (a) *In silico* analysis of *Lrrc8a*, *Lrrc8b*, *Lrrc8d*, and *Lrrc8e* gene loci for chromatin accessibility in activated T cells from WT and *Stat5a-Stat5b* double knock-in (DKI) mice measured by DNA binding of STAT5A and STAT5B before and after treatment with IL-2 for 1h[1]. **(b)** mRNA expression of *Lrrc8* genes from CD4$^+$ T cells activated for 3 days with anti-CD3+28 in the presence or not of 80 IU/ml IL-2 and measured by RT-qPCR. *Rlp32* mRNA was used as housekeeping control. Data are the mean ± s.e.m. from at least 4 mice per treatment, done in triplicates and pooled from 2 independent experiments. **(c,d)** mRNA expression ratio of different *Lrrc8* genes to *Lrrc8a* in mouse WT and *Stat5a-Stat5b* DKI CD8$^+$ T cells before and after re-stimulation with IL-2 (in c) or IL-15 (in d) at the indicated time points; RNA-Seq data from[1]. Statistical analysis in (b) by two-tailed, unpaired Student's *t* test. Not significant (n.s.) $P > 0.05$ and ***$P < 0.001$.

Supplemental Figure 3
(associated with Figure 2a,b)



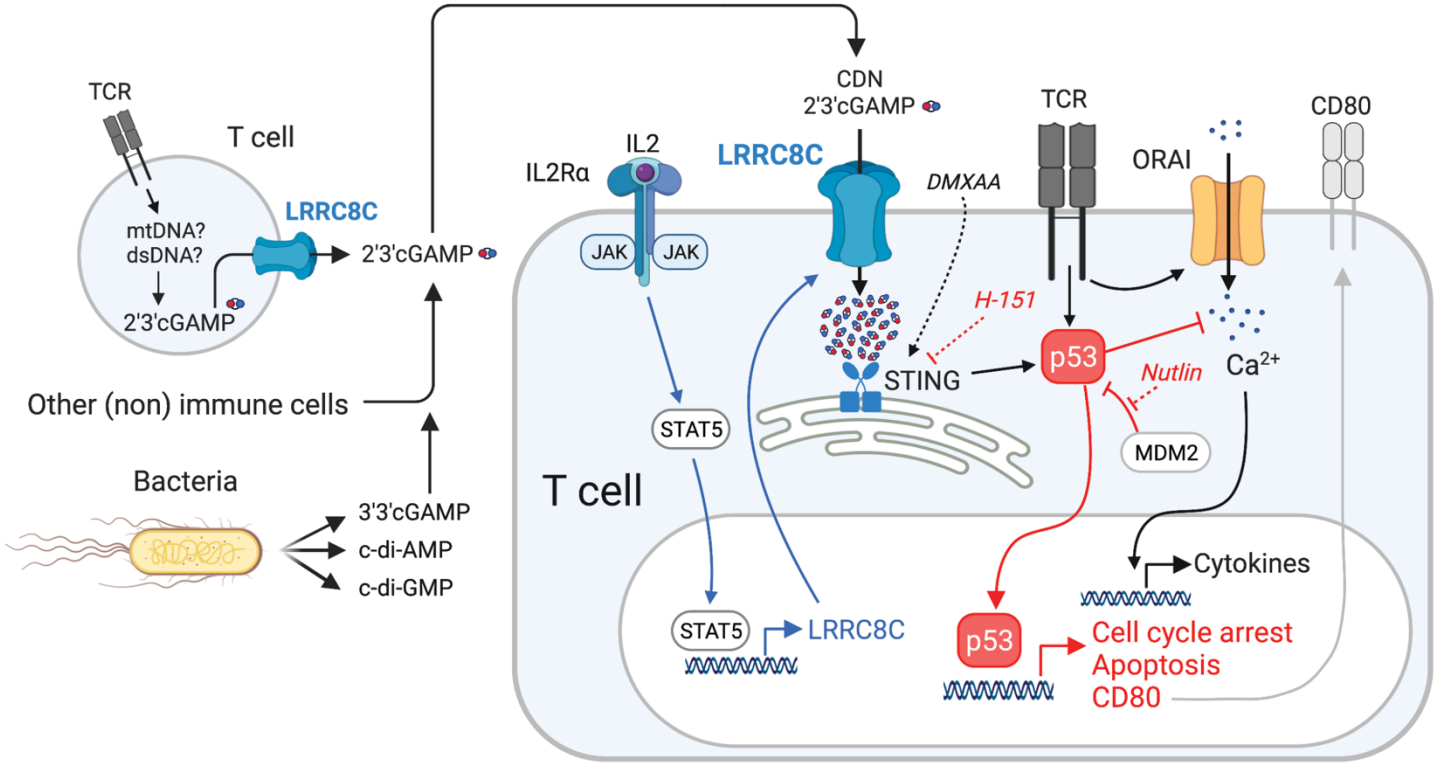
Supplemental Figure 3. *Lrrc8c*$^{-/-}$ CD4^{+} T cells lack protein expression of LRRC8C-exon3 and have no compensatory mechanism from other *Lrrc8* genes. (a) Alignment of experimental reads from RNA-Seq to the exons of the murine *Lrrc8c* gene in unstimulated WT and *Lrrc8c*$^{-/-}$ CD4^{+} T cells (representative from 3 mice per genotype). **(b)** Expression of *Lrrc8c* (exon 1-3) mRNA in unstimulated CD4^{+} T cells isolated from WT and *Lrrc8c*$^{-/-}$ mice and measured by RT-qPCR. Data are the mean ± s.e.m. of 14 mice per genotype. *Gapdh* mRNA was used as housekeeping control**. (c)** MSCV retroviral vectors encoding murine *Lrrc8c* (WT coding sequence, CDS 236-2647) and mutant *Lrrc8c*-ΔExon4 similar to *Lrrc8c*$^{-/-}$ mice. Both WT and mutant *Lrrc8c*-ΔExon4 constructs where FLAG-tagged at the C-terminus. **(d,e)** Relative mRNA (d) and protein expression (e) of LRRC8C in WT CD4^{+} T cells 3 days after transduction with retroviral vectors shown in (c)**.** In (d), mRNA expression for *Lrrc8c*-exon3 and -exon4 were measured by RT-qPCR using *Gapdh* mRNA as housekeeping control. Data are the mean ± s.e.m. of 9 independent transductions per retroviral construct, and pooled from 3 independent experiments. In (e), protein expression was measured by flow cytometry and intracellular staining with a mouse anti-FLAG antibody or by using a rabbit anti-mouse LRRC8C antibody that recognizes the epitope AVISTTPLPPPKPSPTNPATV located between 74-94 aa in the first extracellular loop of LRRC8C, and 2nd antibodies conjugated with Alexa-Fluor 647 that recognized either mouse or rabbit IgG antibodies. **(f)** Relative mRNA expression of *Lrrc8a*, *Lrrc8b*, *Lrrc8d*, and *Lrrc8e* in unstimulated CD4^{+} T cells isolated from WT and *Lrrc8c*$^{-/-}$ mice and measured by RT-qPCR. *Gapdh* mRNA was used as housekeeping control. Data are the mean ± s.e.m. of at least 9 mice per genotype. Statistical analysis in (d) by two-tailed, unpaired Student's *t* test. ***P*<0.01 and ****P*<0.001.

Supplemental Figure 4
(associated with Figure 3)



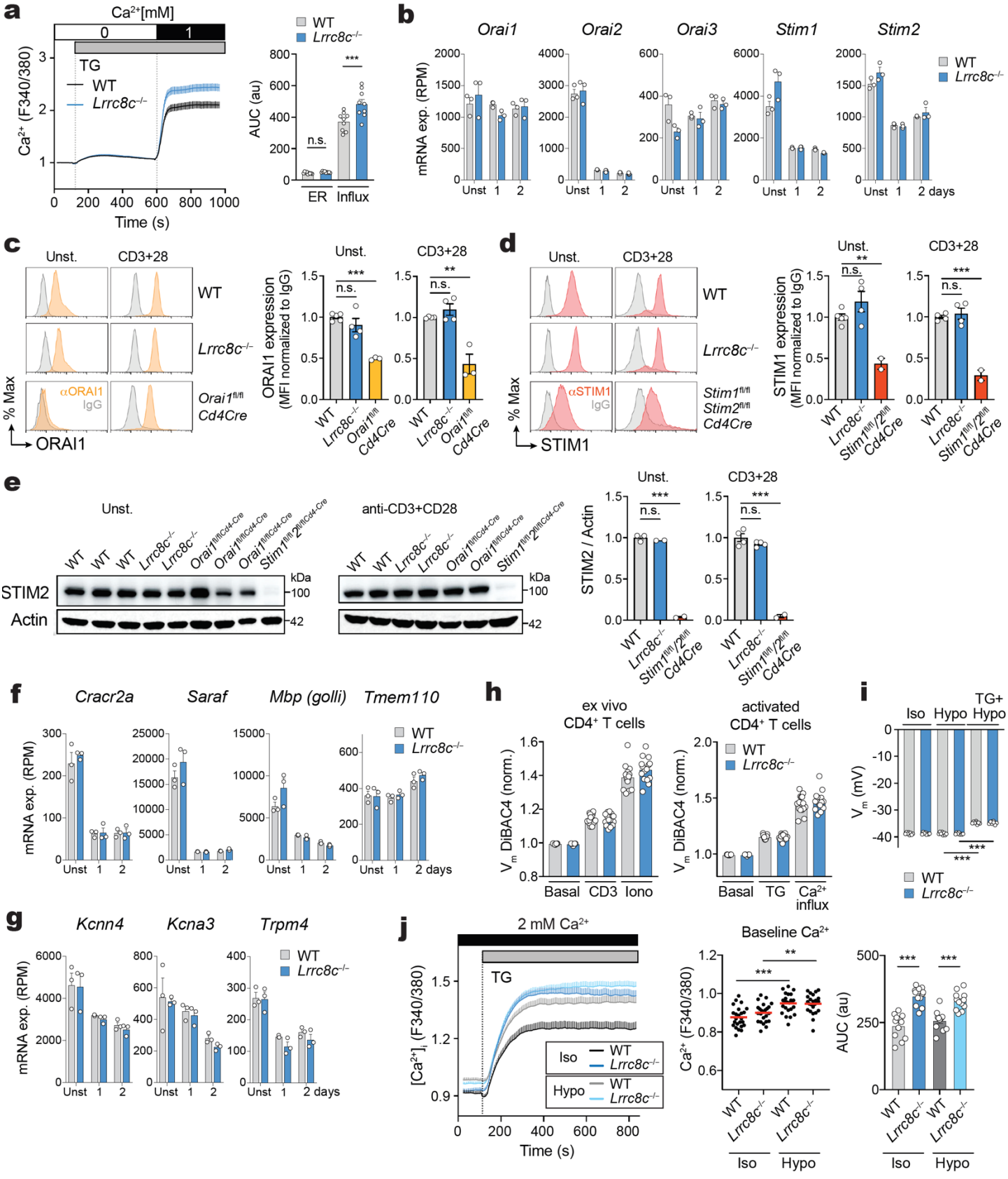
Supplemental Figure 4. *Lrrc8c*$^{-/-}$ mice show normal development and function of Treg cells but increased iTreg differentiation in vitro. (a,b) Representative flow cytometry plots (a) and quantification (b) of the proportion and total number of natural Tregs (nTregs, CD4$^+$CD25$^+$FoxP3$^+$) in the spleen and lymph nodes from WT and *Lrrc8c*$^{-/-}$ mice. Data are the mean ± s.e.m. of 10 WT and 9 *Lrrc8c*$^{-/-}$ mice (spleen), and 8 WT and 7 *Lrrc8c*$^{-/-}$ mice (LNs). **(c,d)** Treg suppression assay of CD4$^+$ T cell proliferation by WT and *Lrrc8c*$^{-/-}$ Treg cells in vitro. WT CD4$^+$ T cells from CD45.1$^+$-congenic mice were labeled with CFSE and co-cultured with WT or *Lrrc8c*$^{-/-}$ Tregs isolated from CD45.2$^+$-congenic mice at different ratios, and stimulated with anti-CD3+28 dynabeads. Representative flow cytometry plots (c) and quantification (d) of CFSE dilution by CD4$^+$ T cells after 3 days of TCR stimulation. The proliferation of WT T cells in (d) was normalized to 100% in the absence of Treg cells in the culture conditions. Data are the mean ± s.e.m. of 2 experiments using 4 mice per genotype. **(e-g)** iTreg differentiation in vitro. (e) Relative mRNA expression of *Lrrc8c* in CD4$^+$ T cells activated with anti-CD3+28 (non pol) or in vitro differentiated into iTregs for 3 days and measured by RT-qPCR. *Gapdh* mRNA was used as housekeeping control. Data are the mean ± s.e.m. of 9 mice per genotype, pooled from 3 independent experiments. (f,g) Flow cytometry analysis showing (f) the expression and (g) quantification of FoxP3 in CD4$^+$ T cells from WT and *Lrrc8c*$^{-/-}$ mice 3 days after anti-CD3+28 stimulation or in vitro differentiated into iTregs. Data are the mean ± s.e.m. of 10 mice per genotype, pooled from 4 independent experiments. Statistical analysis in (e) and (g) by two-tailed, unpaired Student's *t* test. ***P*<0.01 and ****P*<0.001.

Supplemental Figure 5



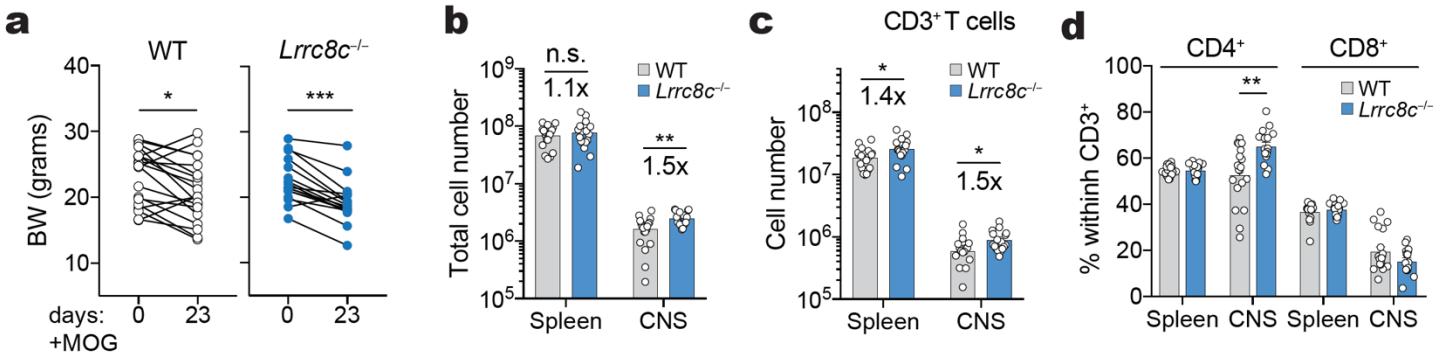
Supplemental Figure 5. LRRC8C suppresses T cell function by mediating the influx of 2'3'cGAMP, STING and p53 activation and inhibition of SOCE. LRRC8C channels located in the plasma membrane of T cells mediate the uptake of cyclic dinucleotides (CDN) including 2'3'cGAMP to activate STING. STING activation stabilizes the expression of p53 resulting in suppression of cell cycle progression and proliferation, increased apoptosis and CD80 expression. The STING-dependent activation of p53 also inhibits store-operated Ca^{2+} entry (SOCE) and therefore cytokine production. Note that LRRC8C expression in T cells is controlled by IL-2 receptor and STAT5 signaling. Abbreviations: STING, stimulator of interferon genes; VRAC, volume-regulated anion channel. Created with BioRender.com.

Supplemental Figure 6
(associated with Figure 6a-c)



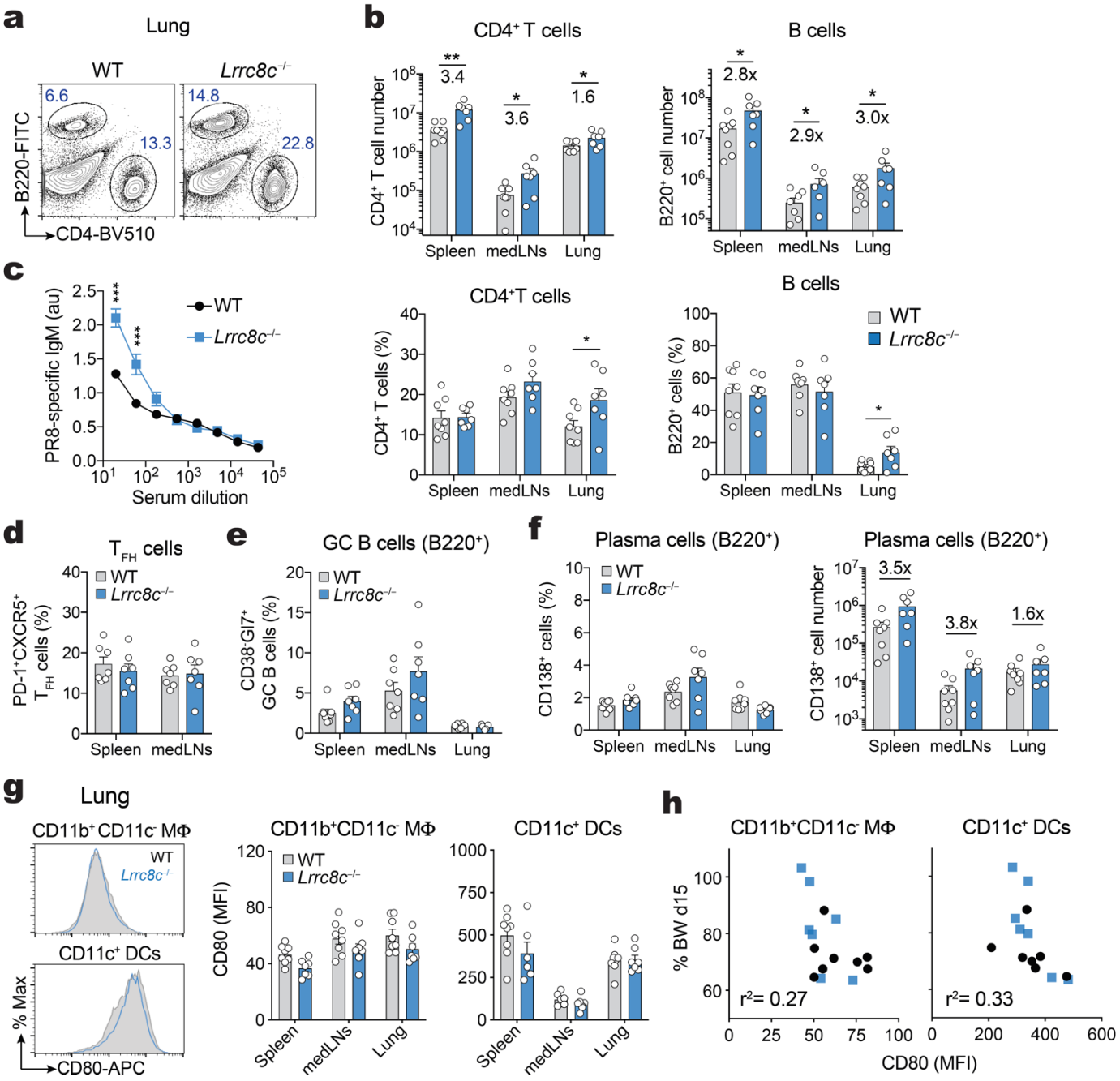
Supplemental Figure 6. Increased Ca^{2+} influx in *Lrrc8c*$^{-/-}$ T cells is not caused by increased expression of CRAC channel genes or altered membrane potential. (a) Cytosolic Ca^{2+} signaling in naïve $CD4^+$ T cells isolated from WT and *Lrrc8c*$^{-/-}$ mice. T cells loaded with Fura-2 were stimulated with thapsigargin (TG) at 120s in Ca^{2+}-free buffer to assess endoplasmic reticulum (ER)-Ca^{2+}, and Ca^{2+} influx by addition of extracellular Ca^{2+} at 600s. Averaged Ca^{2+} traces (left) and quantification of the area under the curve (AUC, right) in the regions indicated by the dotted lines (mean ± s.e.m. of 9 mice per genotype, pooled from 3 independent experiments). **(b)** mRNA expression of CRAC channel genes in WT and *Lrrc8c*$^{-/-}$ upon TCR stimulation at the indicated time points extracted from RNA-Seq data (shown data represent mean ± s.e.m., n = 3 mice/genotype and treatment). **(c,d)** Protein expression of ORAI1 (c) and STIM1 (d) in WT and *Lrrc8c*$^{-/-}$ $CD4^+$ T cells before and after 3 days of anti-CD3+28 stimulation measured by flow cytometry. Protein expression was measured by intracellular staining with rabbit polyclonal antibodies that recognize amino acids ELAEFARLQDQLDHRGD in the C-terminus of ORAI1 and DNGSIGEETDSSPGRKKFPLKIFKKPLKK in the C-terminus of STIM1. T cells from mice lacking ORAI1 (*Orai1*$^{fl/fl}$*Cd4*-Cre) and STIM1 (*Stim1*$^{fl/fl}$*Stim2*$^{fl/fl}$*Cd4*-Cre) were used as a control. Representative flow cytometry plots (left) and quantification (right) of protein expression measured as mean fluorescence intensity (MFI) after normalization to rabbit IgG control antibody. Data represent the mean ± s.e.m. of 5 WT, 4 *Lrrc8c*$^{-/-}$, 3 *Orai1*$^{fl/fl}$*Cd4*-Cre and 2 *Stim1*$^{fl/fl}$*Stim2*$^{fl/fl}$*Cd4*-Cre mice and pooled from 2 independent experiments. **(e)** Immunoblots of STIM2 in WT and *Lrrc8c*$^{-/-}$ $CD4^+$ T cells before and after 3 days of anti-CD3+28 stimulation. T cells from mice lacking STIM2 (*Stim1*$^{fl/fl}$*Stim2*$^{fl/fl}$*Cd4*-Cre) were used as a control. Actin was used as loading control. Representative blots (left) and quantification (right) of 3 WT, 2 *Lrrc8c*$^{-/-}$, and 2 *Stim1*$^{fl/fl}$*Stim2*$^{fl/fl}$*Cd4*-Cre mice for unstimulated conditions, and 4 WT, 4 *Lrrc8c*$^{-/-}$, and 2 *Stim1*$^{fl/fl}$*Stim2*$^{fl/fl}$*Cd4*-Cre mice for anti-CD3+28 stimulation, and were pooled from 2 independent experiments. **(f,g)** mRNA expression of regulators of CRAC channel function (f) and plasma membrane potential (g) in WT and *Lrrc8c*$^{-/-}$ T cells at 1-2 days after TCR stimulation. Data represent the mean ± s.e.m. of 3 mice per genotype. **(h)** Membrane potential (V_m) in WT and *Lrrc8c*$^{-/-}$ $CD4^+$ T cells measured with the V_m sensitive probe DiBAC4. V_m was measured in *ex vivo* isolated T cells (left) at baseline, upon activation of TCR by CD3-crosslinking, and during Ca^{2+} influx phase with ionomycin. In T cells stimulated with anti-CD3+28 for 3 days *in vitro* (right), V_m was measured at baseline, during store depletion with TG in Ca^{2+}-free Ringer buffer (ER-TG), and during Ca^{2+} influx phase upon the addition of extracellular Ca^{2+}. V_m measurements in WT and *Lrrc8c*$^{-/-}$ $CD4^+$ T cells were normalized to basal fluorescence of DiBAC4 from WT T cells (mean ± s.e.m. of 15 measurements from 5 mice per genotype, pooled from 2 independent experiments). **(i)** V_m in WT and *Lrrc8c*$^{-/-}$ $CD4^+$ T cells activated with CD3+28 for 2 days measured by patch-clamping. Gigaohm seals were stablished in isotonic solution in voltage-clamp configuration and cells were subjected to hypotonic buffer and stimulated with TG for at least 5 min before recording V_m (mean ± s.e.m. of 8 cells per genotype, pooled from 2 independent experiments). **(j)** Cytosolic Ca^{2+} signaling in WT and *Lrrc8c*$^{-/-}$ T cells stimulated for 3 days with anti-CD3+28. T cells loaded with Fura-2 were stimulated with thapsigargin (TG) at 120s in isotonic (~315 mOsm) or hypotonic (~215 mOsm) buffers. Averaged Ca^{2+} traces (left) and quantification of the basal Ca^{2+} signals (middle), and AUC (right) in the regions indicated by the dotted lines (mean ± s.e.m. of 12 traces from 4 mice per genotype, pooled from 2 independent experiments). Statistical analysis by two-tailed, unpaired Student's t test. Not significant (n.s.), $P > 0.05$, $^{**}P<0.01$ and $^{***}P<0.001$.

Supplemental Figure 7
(associated with Figure 7)



Supplemental Figure 7. LRRC8C deficiency exacerbates EAE. (a) Body weight (BW) of WT and *Lrrc8c*$^{-/-}$ mice before and 23 days after EAE induction with MOG_{35-55}. **(b,c)** Absolute numbers of cells (b) and $CD3^+$ T cells (c) isolated from the spleen and spinal cord (CNS) of WT and *Lrrc8c*$^{-/-}$ mice at day 23 after EAE induction and analyzed by flow cytometry. **(d)** Proportion of $CD4^+$ and $CD8^+$ T cell among $CD3^+$ T cells in the spleen and spinal cord of mice at day 23 after EAE induction and analyzed by flow cytometry. Data are the mean ± s.e.m. of 19 WT and 17 *Lrrc8c*$^{-/-}$ mice pooled from 3 independent experiments. Statistical analysis in (a) by two-tailed, paired *t* test, and in (b-d) by two-tailed, unpaired Student's *t* test. Not significant (n.s.), $P > 0.05$, $^*P<0.05$, $^{**}P<0.01$, and $^{***}P<0.001$.

Supplemental Figure 8
(associated with Figure 8)



Supplemental Figure 8. LRRC8C deficiency enhances immunity against IAV infection. (a,b) Flow cytometry analysis of CD4$^+$ T cells and B220$^+$ B cells of WT and *Lrrc8c*$^{-/-}$ mice 15 days after infection with the PR8 strain (H1N1) of influenza A virus (IAV). (a) Representative contour plots of cells in the lungs. (b) Absolute number (top) and proportion (bottom) of CD4$^+$ T cells and B220$^+$ B cells in the spleen, mediastinal lymph nodes (medLNs) and lungs. **(c)** anti-PR8 IgM antibodies in the sera of WT and *Lrrc8c*$^{-/-}$ mice at day 15 post infection (p.i.) detected by ELISA. **(d-f)** Proportion of CD4$^+$PD-1$^+$CXCR5$^+$ T_{FH} cells (d), germinal center (GC) B cells (e), and proportion and total number of plasma cells (f) in the spleen, medLNs and lung of mice 15 days p.i. with IAV. **(g)** CD80 surface expression on myeloid cells from WT and *Lrrc8c*$^{-/-}$ mice infected with IAV. Representative histograms (left) and quantification (right) of CD80 expression (MFI) at the surface of CD11b$^+$CD11c$^-$ macrophages (MΦ) and CD11c$^+$ dendritic cells (DCs) isolated from the spleen, medLNs and lungs of mice 15 days p.i. with IAV. **(h)** Correlation of body weight (BW) and CD80 expression on myeloid cells isolated from the lungs of mice 15 days after IAV infection. Data represent the mean ± s.e.m. of 8 WT and 7 *Lrrc8c*$^{-/-}$ mice pooled from 2 independent experiments. Statistical analysis by two-tailed, unpaired Student's *t* test. **P*<0.05, ***P*<0.01, and ****P*<0.001.

Supplemental Table 1. List of ion channels, transporters and regulatory proteins (ICTs). ICTs are grouped by functional category (channels, transporters, regulatory proteins, enzymes) and listed alphabetically within each category. ICT indicated in **bold** are highly expressed in $CD4^+$ T cells (compare **Fig.1b**). * The transporter category also includes ion pumps, exchangers, co-transporters and antiporters.

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Abcc8	ATP-binding cassette, sub-family C (CFTR/MRP), member 8	20927	ABCC8	6833	Channel
Abcc9	ATP-binding cassette, sub-family C (CFTR/MRP), member 9	20928	ABCC9	10060	Channel
Ano1	Anoctamin 1, Ca2+ activated chloride channel	101772	ANO1	55107	Channel
Ano10	Anoctamin 10	102566	ANO10	55129	Channel
Ano2	Anoctamin 2	243634	ANO2	57101	Channel
Ano3	Anoctamin 3	228432	ANO3	63982	Channel
Ano4	Anoctamin 4	320091	ANO4	121601	Channel
Ano5	Anoctamin 5	233246	ANO5	203859	Channel
Ano6	**Anoctamin 6**	**105722**	**ANO6**	**196527**	**Channel**
Ano7	Anoctamin 7	404545	ANO7	50636	Channel
Ano8	Anoctamin 8	382014	ANO8	57719	Channel
Ano9	**Anoctamin 9**	**71345**	**ANO9**	**338440**	**Channel**
Aqp1	Aquaporin 1	11826	AQP1	358	Channel
Aqp11	Aquaporin 11	66333	AQP11	282679	Channel
Aqp12	Aquaporin 12	208760	AQP12A | AQP12B	375318 | 653437	Channel
Aqp2	Aquaporin 2	11827	AQP2	359	Channel
Aqp3	**Aquaporin 3**	**11828**	**AQP3**	**360**	**Channel**
Aqp4	Aquaporin 4	11829	AQP4	361	Channel
Aqp5	Aquaporin 5	11830	AQP5	362	Channel
Aqp6	Aquaporin 6	11831	AQP6	363	Channel
Aqp7	Aquaporin 7	11832	AQP7	364	Channel
Aqp8	Aquaporin 8	11833	AQP8	343	Channel
Aqp9	Aquaporin 9	64008	AQP9	366	Channel
Asic1	Acid-sensing (proton-gated) ion channel 1	11419	ASIC1	41	Channel
Asic2	Acid-sensing (proton-gated) ion channel 2	11418	ASIC2	40	Channel
Asic3	Acid-sensing (proton-gated) ion channel 3	171209	ASIC3	9311	Channel
Asic4	Acid-sensing (proton-gated) ion channel family member 4	241118	ASIC4	55515	Channel
Asic5	Acid-sensing (proton-gated) ion channel family member 5	58170	ASIC5	51802	Channel
Best1	Bestrophin 1	24115	BEST1	7439	Channel
Best2	Bestrophin 2	212989	BEST2	54831	Channel
Best3	Bestrophin 3	382427	BEST3	144453	Channel
Best4ps	Bestrophin 4	230664	BEST4	266675	Channel
Bsnd	Barttin CLCNK type accessory β subunit	140475	BSND	7809	Channel
Cacna1a	Ca2+ channel, voltage-dependent, P/Q type, α 1A subunit	12286	CACNA1A	773	Channel
Cacna1b	Ca2+ channel, voltage-dependent, N type, α 1B subunit	12287	CACNA1B	774	Channel
Cacna1c	Ca2+ channel, voltage-dependent, L type, α 1C subunit	12288	CACNA1C	775	Channel
Cacna1d	Ca2+ channel, voltage-dependent, L type, α 1D subunit	12289	CACNA1D	776	Channel
Cacna1e	Ca2+ channel, voltage-dependent, R type, α 1E subunit	12290	CACNA1E	777	Channel
Cacna1f	Ca2+ channel, voltage-dependent, α 1F subunit	54652	CACNA1F	778	Channel
Cacna1g	Ca2+ channel, voltage-dependent, T type, α 1G subunit	12291	CACNA1G	8913	Channel
Cacna1h	Ca2+ channel, voltage-dependent, T type, α 1H subunit	58226	CACNA1H	8912	Channel
Cacna1i	Ca2+ channel, voltage-dependent, α 1I subunit	239556	CACNA1I	8911	Channel

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Cacna1s	Ca2+ channel, voltage-dependent, L type, α 1S subunit	12292	CACNA1S	779	Channel
Cacna2d1	Ca2+ channel, voltage-dependent, α2/δ subunit 1	12293	CACNA2D1	781	Channel
Cacna2d2	Ca2+ channel, voltage-dependent, α 2/δ subunit 2	56808	CACNA2D2	9254	Channel
Cacna2d3	Ca2+ channel, voltage-dependent, α2/δ subunit 3	12294	CACNA2D3	55799	Channel
Cacna2d4	Ca2+ channel, voltage-dependent, α 2/δ subunit 4	319734	CACNA2D4	93589	Channel
Cacnb1	Ca2+ channel, voltage-dependent, β 1 subunit	12295	CACNB1	782	Channel
Cacnb2	Ca2+ channel, voltage-dependent, β 2 subunit	12296	CACNB2	783	Channel
Cacnb3	Ca2+ channel, voltage-dependent, β 3 subunit	12297	CACNB3	784	Channel
Cacnb4	Ca2+ channel, voltage-dependent, β 4 subunit	12298	CACNB4	785	Channel
Cacng1	Ca2+ channel, voltage-dependent, γ subunit 1	12299	CACNG1	786	Channel
Cacng2	Ca2+ channel, voltage-dependent, γ subunit 2	12300	CACNG2	10369	Channel
Cacng3	Ca2+ channel, voltage-dependent, γ subunit 3	54376	CACNG3	10368	Channel
Cacng4	Ca2+ channel, voltage-dependent, γ subunit 4	54377	CACNG4	27092	Channel
Cacng5	Ca2+ channel, voltage-dependent, γ subunit 5	140723	CACNG5	27091	Channel
Cacng6	Ca2+ channel, voltage-dependent, γ subunit 6	54378	CACNG6	59285	Channel
Cacng7	Ca2+ channel, voltage-dependent, γ subunit 7	81904	CACNG7	59284	Channel
Cacng8	Ca2+ channel, voltage-dependent, γ subunit 8	81905	CACNG8	59283	Channel
Calhm1	Ca2+ homeostasis modulator 1	546729	CALHM1	255022	Channel
Calhm2	**Ca2+ homeostasis modulator family member 2**	**72691**	**CALHM2**	**51063**	**Channel**
Calhm3	Ca2+ homeostasis modulator family member 3	240669	CALHM3	119395	Channel
Calhm4	Ca2+ homeostasis modulator family member 4	270711	CALHM4	221301	Channel
Calhm5	Ca2+ homeostasis modulator family member 5	103511	CALHM5	254228	Channel
Calhm6	**Ca2+ homeostasis modulator family member 6**	**215900**	**CALHM6**	**441168**	**Channel**
Catsper1	Cation channel, sperm associated 1	225865	CATSPER1	117144	Channel
Catsper2	Cation channel, sperm associated 2	212670	CATSPER2	117155	Channel
Catsper3	Cation channel, sperm associated 3	76856	CATSPER3	347732	Channel
Catsper4	Cation channel, sperm associated 4	329954	CATSPER4	378807	Channel
Catsperb	Cation channel sperm associated auxiliary subunit β	271036	CATSPERB	79820	Channel
Catsperd	Cation channel sperm associated auxiliary subunit δ	106757	CATSPERD	257062	Channel
Catsperg1	Cation channel sperm associated auxiliary subunit γ 1	320225	CATSPERG	57828	Channel
Cct8l1	Chaperonin containing TCP1, subunit 8 (θ)-like 1	242891	CCT8L2	150160	Channel
Cftr	Cystic fibrosis transmembrane conductance regulator	12638	CFTR	1080	Channel
Chrna1	Cholinergic receptor, nicotinic, α polypeptide 1 (muscle)	11435	CHRNA1	1134	Channel
Chrna10	Cholinergic receptor, nicotinic, α polypeptide 10	504186	CHRNA10	57053	Channel
Chrna2	Cholinergic receptor, nicotinic, α polypeptide 2 (neuronal)	110902	CHRNA2	1135	Channel
Chrna3	Cholinergic receptor, nicotinic, α polypeptide 3	110834	CHRNA3	1136	Channel
Chrna4	Cholinergic receptor, nicotinic, α polypeptide 4	11438	CHRNA4	1137	Channel
Chrna5	Cholinergic receptor, nicotinic, α polypeptide 5	110835	CHRNA5	1138	Channel
Chrna6	Cholinergic receptor, nicotinic, α polypeptide 6	11440	CHRNA6	8973	Channel
Chrna7	Cholinergic receptor, nicotinic, α polypeptide 7	11441	CHRNA7	1139	Channel
Chrna9	Cholinergic receptor, nicotinic, α polypeptide 9	231252	CHRNA9	55584	Channel
Chrnb1	Cholinergic receptor, nicotinic, β polypeptide 1 (muscle)	11443	CHRNB1	1140	Channel
Chrnb2	Cholinergic receptor, nicotinic, β polypeptide 2 (neuronal)	11444	CHRNB2	1141	Channel
Chrnb3	Cholinergic receptor, nicotinic, β polypeptide 3	108043	CHRNB3	1142	Channel
Chrnb4	Cholinergic receptor, nicotinic, β polypeptide 4	108015	CHRNB4	1143	Channel
Chrnd	Cholinergic receptor, nicotinic, δ polypeptide	11447	CHRND	1144	Channel
Chrne	Cholinergic receptor, nicotinic, ε polypeptide	11448	CHRNE	1145	Channel
Chrng	Cholinergic receptor, nicotinic, γ polypeptide	11449	CHRNG	1146	Channel
Clca1	Chloride channel accessory 1	23844	CLCA1	1179	Channel

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Clca2	Chloride channel accessory 2	229933	CLCA2	9635	Channel
Clca4a	Chloride channel accessory 4A	99663	CLCA4	22802	Channel
Clcc1	Chloride channel CLIC-like 1	229725	CLCC1	23155	Channel
Clcn1	Chloride channel, voltage-sensitive 1	12723	CLCN1	1180	Channel
Clcn2	Chloride channel, voltage-sensitive 2	12724	CLCN2	1181	Channel
Clcn3	**Chloride channel, voltage-sensitive 3**	**12725**	**CLCN3**	**1182**	**Channel**
Clcn4	Chloride channel, voltage-sensitive 4	12727	CLCN4	1183	Channel
Clcn5	Chloride channel, voltage-sensitive 5	12728	CLCN5	1184	Channel
Clcn6	Chloride channel, voltage-sensitive 6	26372	CLCN6	1185	Channel
Clcn7	**Chloride channel, voltage-sensitive 7**	**26373**	**CLCN7**	**1186**	**Channel**
Clcnka	Chloride channel, voltage-sensitive Ka	12733	CLCNKB	1188	Channel
Clcnkb	Chloride channel, voltage-sensitive Kb	56365	CLCNKA	1187	Channel
Clic1	**Chloride intracellular channel 1**	**114584**	**CLIC1**	**1192**	**Channel**
Clic3	Chloride intracellular channel 3	69454	CLIC3	9022	Channel
Clic4	Chloride intracellular channel 4 (mitochondrial)	29876	CLIC4	25932	Channel
Clic5	Chloride intracellular channel 5	224796	CLIC5	53405	Channel
Clic6	Chloride intracellular channel 6	209195	CLIC6	54102	Channel
Clns1a	**Chloride channel, nucleotide-sensitive, 1A**	**12729**	**CLNS1A**	**1207**	**Channel**
Cnga1	Cyclic nucleotide gated channel α 1	12788	CNGA1	1259	Channel
Cnga2	Cyclic nucleotide gated channel α 2	12789	CNGA2	1260	Channel
Cnga3	Cyclic nucleotide gated channel α 3	12790	CNGA3	1261	Channel
Cnga4	Cyclic nucleotide gated channel α 4	233649	CNGA4	1262	Channel
Cngb1	Cyclic nucleotide gated channel β 1	333329	CNGB1	1258	Channel
Cngb3	Cyclic nucleotide gated channel β 3	30952	CNGB3	54714	Channel
Cnih2	Cornichon family AMPA receptor auxiliary protein 2	12794	CNIH2	254263	Channel
Cnih3	Cornichon family AMPA receptor auxiliary protein 3	72978	CNIH3	149111	Channel
Cybb	Cytochrome b-245, β polypeptide	13058	CYBB	1536	Channel
Gabra1	γ-aminobutyric acid (GABA) A receptor, subunit α 1	14394	GABRA1	2554	Channel
Gabra2	γ-aminobutyric acid (GABA) A receptor, subunit α 2	14395	GABRA2	2555	Channel
Gabra3	γ-aminobutyric acid (GABA) A receptor, subunit α 3	14396	GABRA3	2556	Channel
Gabra4	γ-aminobutyric acid (GABA) A receptor, subunit α 4	14397	GABRA4	2557	Channel
Gabra5	γ-aminobutyric acid (GABA) A receptor, subunit α 5	110886	GABRA5	2558	Channel
Gabra6	γ-aminobutyric acid (GABA) A receptor, subunit α 6	14399	GABRA6	2559	Channel
Gabrb1	γ-aminobutyric acid (GABA) A receptor, subunit β 1	14400	GABRB1	2560	Channel
Gabrb2	γ-aminobutyric acid (GABA) A receptor, subunit β 2	14401	GABRB2	2561	Channel
Gabrb3	γ-aminobutyric acid (GABA) A receptor, subunit β 3	14402	GABRB3	2562	Channel
Gabrd	γ-aminobutyric acid (GABA) A receptor, subunit δ	14403	GABRD	2563	Channel
Gabre	γ-aminobutyric acid (GABA) A receptor, subunit ε	14404	GABRE	2564	Channel
Gabrg1	γ-aminobutyric acid (GABA) A receptor, subunit γ 1	14405	GABRG1	2565	Channel
Gabrg2	γ-aminobutyric acid (GABA) A receptor, subunit γ 2	14406	GABRG2	2566	Channel
Gabrg3	γ-aminobutyric acid (GABA) A receptor, subunit γ 3	14407	GABRG3	2567	Channel
Gabrp	γ-aminobutyric acid (GABA) A receptor, pi	216643	GABRP	2568	Channel
Gabrq	γ-aminobutyric acid (GABA) A receptor, subunit θ	57249	GABRQ	55879	Channel
Gabrr1	γ-aminobutyric acid (GABA) C receptor, subunit ρ 1	14408	GABRR1	2569	Channel
Gabrr2	γ-aminobutyric acid (GABA) C receptor, subunit ρ 2	14409	GABRR2	2570	Channel
Gabrr3	γ-aminobutyric acid (GABA) receptor, ρ 3	328699	GABRR3	200959	Channel
Gja1	Gap junction protein, α 1	14609	GJA1	2697	Channel
Gja10	Gap junction protein, α 10	14610	GJA10	84694	Channel
Gja3	Gap junction protein, α 3	14611	GJA3	2700	Channel

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Gja4	Gap junction protein, α 4	14612	GJA4	2701	Channel
Gja5	Gap junction protein, α 5	14613	GJA5	2702	Channel
Gja8	Gap junction protein, α 8	14616	GJA8	2703	Channel
Gjb1	Gap junction protein, β 1	14618	GJB1	2705	Channel
Gjb2	Gap junction protein, β 2	14619	GJB2	2706	Channel
Gjb3	Gap junction protein, β 3	14620	GJB3	2707	Channel
Gjb4	Gap junction protein, β 4	14621	GJB4	127534	Channel
Gjb5	Gap junction protein, β 5	14622	GJB5	2709	Channel
Gjb6	Gap junction protein, β 6	14623	GJB6	10804	Channel
Gjc1	Gap junction protein, γ 1	14615	GJC1	10052	Channel
Gjc2	Gap junction protein, γ 2	118454	GJC2	57165	Channel
Gjc3	Gap junction protein, γ 3	118446	GJC3	349149	Channel
Gjd2	Gap junction protein, δ 2	14617	GJD2	57369	Channel
Gjd3	Gap junction protein, δ 3	353155	GJD3	125111	Channel
Gjd4	Gap junction protein, δ 4	225152	GJD4	219770	Channel
Gje1	Gap junction protein, ε 1	76743	GJE1	100126572	Channel
Glra1	Glycine receptor, α 1 subunit	14654	GLRA1	2741	Channel
Glra2	Glycine receptor, α 2 subunit	237213	GLRA2	2742	Channel
Glra3	Glycine receptor, α 3 subunit	110304	GLRA3	8001	Channel
Glra4	Glycine receptor, α 4 subunit	14657	GLRA4	441509	Channel
Glrb	Glycine receptor, β subunit	14658	GLRB	2743	Channel
Gpr89	G protein-coupled receptor 89	67549	GPR89A | GPR89B	653519 | 51463	Channel
Gria1	Glutamate receptor, ionotropic, AMPA1 (α 1)	14799	GRIA1	2890	Channel
Gria2	Glutamate receptor, ionotropic, AMPA2 (α 2)	14800	GRIA2	2891	Channel
Gria3	Glutamate receptor, ionotropic, AMPA3 (α 3)	53623	GRIA3	2892	Channel
Gria4	Glutamate receptor, ionotropic, AMPA4 (α 4)	14802	GRIA4	2893	Channel
Grid1	Glutamate receptor, ionotropic, δ 1	14803	GRID1	2894	Channel
Grid2	Glutamate receptor, ionotropic, δ 2	14804	GRID2	2895	Channel
Grik1	Glutamate receptor, ionotropic, kainate 1	14805	GRIK1	2897	Channel
Grik2	Glutamate receptor, ionotropic, kainate 2 (β 2)	14806	GRIK2	2898	Channel
Grik3	Glutamate receptor, ionotropic, kainate 3	14807	GRIK3	2899	Channel
Grik4	Glutamate receptor, ionotropic, kainate 4	110637	GRIK4	2900	Channel
Grik5	Glutamate receptor, ionotropic, kainate 5 (γ 2)	14809	GRIK5	2901	Channel
Grin1	Glutamate receptor, ionotropic, NMDA1 (ζ 1)	14810	GRIN1	2902	Channel
Grin2a	Glutamate receptor, ionotropic, NMDA2A (ε 1)	14811	GRIN2A	2903	Channel
Grin2b	Glutamate receptor, ionotropic, NMDA2B (ε 2)	14812	GRIN2B	2904	Channel
Grin2c	Glutamate receptor, ionotropic, NMDA2C (ε 3)	14813	GRIN2C	2905	Channel
Grin2d	Glutamate receptor, ionotropic, NMDA2D (ε 4)	14814	GRIN2D	2906	Channel
Grin3a	Glutamate receptor ionotropic, NMDA3A	242443	GRIN3A	116443	Channel
Grin3b	Glutamate receptor, ionotropic, NMDA3B	170483	GRIN3B	116444	Channel
Hcn1	Hyperpolarization activated cyclic nucleotide gated K+ channel 1	15165	HCN1	348980	Channel
Hcn2	Hyperpolarization-activated, cyclic nucleotide-gated K+ 2	15166	HCN2	610	Channel
Hcn3	Hyperpolarization-activated, cyclic nucleotide-gated K+ 3	15168	HCN3	57657	Channel
Hcn4	Hyperpolarization-activated, cyclic nucleotide-gated K+ 4	330953	HCN4	10021	Channel
Htr3a	5-hydroxytryptamine (serotonin) receptor 3A	15561	HTR3A	3359	Channel
Htr3b	5-hydroxytryptamine (serotonin) receptor 3B	57014	HTR3B	9177	Channel
Hvcn1	H+ voltage-gated channel 1	74096	HVCN1	84329	Channel
Itpr1	**Inositol 1,4,5-trisphosphate receptor 1**	**16438**	**ITPR1**	**3708**	**Channel**

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Itpr2	**Inositol 1,4,5-triphosphate receptor 2**	**16439**	**ITPR2**	**3709**	**Channel**
Itpr3	**Inositol 1,4,5-triphosphate receptor 3**	**16440**	**ITPR3**	**3710**	**Channel**
Kcna1	K+ voltage-gated channel, shaker-related subfamily, member 1	16485	KCNA1	3736	Channel
Kcna10	K+ voltage-gated channel, shaker-related subfamily, member 10	242151	KCNA10	3744	Channel
Kcna2	K+ voltage-gated channel, shaker-related subfamily, member 2	16490	KCNA2	3737	Channel
Kcna3	**K+ voltage-gated channel, shaker-related subfamily, member 3**	**16491**	**KCNA3**	**3738**	**Channel**
Kcna4	K+ voltage-gated channel, shaker-related subfamily, member 4	16492	KCNA4	3739	Channel
Kcna5	K+ voltage-gated channel, shaker-related subfamily, member 5	16493	KCNA5	3741	Channel
Kcna6	K+ voltage-gated channel, shaker-related, subfamily, member 6	16494	KCNA6	3742	Channel
Kcna7	K+ voltage-gated channel, shaker-related subfamily, member 7	16495	KCNA7	3743	Channel
Kcnab1	K+ voltage-gated channel, shaker-related subfamily, β member 1	16497	KCNAB1	7881	Channel
Kcnab2	**K+ voltage-gated channel, shaker-related subfamily, β member 2**	**16498**	**KCNAB2**	**8514**	**Channel**
Kcnab3	K+ voltage-gated channel, shaker-related subfamily, β member 3	16499	KCNAB3	9196	Channel
Kcnb1	K+ voltage gated channel, Shab-related subfamily, member 1	16500	KCNB1	3745	Channel
Kcnb2	K+ voltage gated channel, Shab-related subfamily, member 2	98741	KCNB2	9312	Channel
Kcnc1	K+ voltage gated channel, Shaw-related subfamily, member 1	16502	KCNC1	3746	Channel
Kcnc2	K+ voltage gated channel, Shaw-related subfamily, member 2	268345	KCNC2	3747	Channel
Kcnc3	K+ voltage gated channel, Shaw-related subfamily, member 3	16504	KCNC3	3748	Channel
Kcnc4	K+ voltage gated channel, Shaw-related subfamily, member 4	99738	KCNC4	3749	Channel
Kcnd1	K+ voltage-gated channel, Shal-related family, member 1	16506	KCND1	3750	Channel
Kcnd2	K+ voltage-gated channel, Shal-related family, member 2	16508	KCND2	3751	Channel
Kcnd3	K+ voltage-gated channel, Shal-related family, member 3	56543	KCND3	3752	Channel
Kcne1	K+ voltage-gated channel, Isk-related subfamily, member 1	16509	KCNE1 | KCNE1B	3753 | 102723475	Channel
Kcne1l	K+ voltage-gated channel, Isk-related family, member 1-like, pseudogene	66240	KCNE5	23630	Channel
Kcne2	K+ voltage-gated channel, Isk-related subfamily, gene 2	246133	KCNE2	9992	Channel
Kcne3	K+ voltage-gated channel, Isk-related subfamily, gene 3	57442	KCNE3	10008	Channel
Kcne4	K+ voltage-gated channel, Isk-related subfamily, gene 4	57814	KCNE4	23704	Channel
Kcnf1	K+ voltage-gated channel, subfamily F, member 1	382571	KCNF1	3754	Channel
Kcng1	K+ voltage-gated channel, subfamily G, member 1	241794	KCNG1	3755	Channel
Kcng2	K+ voltage-gated channel, subfamily G, member 2	240444	KCNG2	26251	Channel
Kcng3	K+ voltage-gated channel, subfamily G, member 3	225030	KCNG3	170850	Channel
Kcng4	K+ voltage-gated channel, subfamily G, member 4	66733	KCNG4	93107	Channel
Kcnh1	K+ voltage-gated channel, subfamily H (eag-related), member 1	16510	KCNH1	3756	Channel
Kcnh2	K+ voltage-gated channel, subfamily H (eag-related), member 2	16511	KCNH2	3757	Channel
Kcnh3	K+ voltage-gated channel, subfamily H (eag-related), member 3	16512	KCNH3	23416	Channel

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Kcnh4	K+ voltage-gated channel, subfamily H (eag-related), member 4	380728	KCNH4	23415	Channel
Kcnh5	K+ voltage-gated channel, subfamily H (eag-related), member 5	238271	KCNH5	27133	Channel
Kcnh6	K+ voltage-gated channel, subfamily H (eag-related), member 6	192775	KCNH6	81033	Channel
Kcnh7	K+ voltage-gated channel, subfamily H (eag-related), member 7	170738	KCNH7	90134	Channel
Kcnh8	K+ voltage-gated channel, subfamily H (eag-related), member 8	211468	KCNH8	131096	Channel
Kcnip1	Kv channel-interacting protein 1	70357	KCNIP1	30820	Channel
Kcnip2	Kv channel-interacting protein 2	80906	KCNIP2	30819	Channel
Kcnip3	Kv channel interacting protein 3, calsenilin	56461	KCNIP3	30818	Channel
Kcnip4	Kv channel interacting protein 4	80334	KCNIP4	80333	Channel
Kcnj1	K+ inwardly-rectifying channel, subfamily J, member 1	56379	KCNJ1	3758	Channel
Kcnj10	K+ inwardly-rectifying channel, subfamily J, member 10	16513	KCNJ10	3766	Channel
Kcnj11	K+ inwardly rectifying channel, subfamily J, member 11	16514	KCNJ11	3767	Channel
Kcnj12	K+ inwardly-rectifying channel, subfamily J, member 12	16515	KCNJ12	3768	Channel
Kcnj13	K+ inwardly-rectifying channel, subfamily J, member 13	100040591	KCNJ13	3769	Channel
Kcnj14	K+ inwardly-rectifying channel, subfamily J, member 14	211480	KCNJ14	3770	Channel
Kcnj15	K+ inwardly-rectifying channel, subfamily J, member 15	16516	KCNJ15	3772	Channel
Kcnj16	K+ inwardly-rectifying channel, subfamily J, member 16	16517	KCNJ16	3773	Channel
Kcnj2	K+ inwardly-rectifying channel, subfamily J, member 2	16518	KCNJ2	3759	Channel
Kcnj3	K+ inwardly-rectifying channel, subfamily J, member 3	16519	KCNJ3	3760	Channel
Kcnj4	K+ inwardly-rectifying channel, subfamily J, member 4	16520	KCNJ4	3761	Channel
Kcnj5	K+ inwardly-rectifying channel, subfamily J, member 5	16521	KCNJ5	3762	Channel
Kcnj6	K+ inwardly-rectifying channel, subfamily J, member 6	16522	KCNJ6	3763	Channel
Kcnj8	K+ inwardly-rectifying channel, subfamily J, member 8	16523	KCNJ8	3764	Channel
Kcnj9	K+ inwardly-rectifying channel, subfamily J, member 9	16524	KCNJ9	3765	Channel
Kcnk1	K+ channel, subfamily K, member 1	16525	KCNK1	3775	Channel
Kcnk10	K+ channel, subfamily K, member 10	72258	KCNK10	54207	Channel
Kcnk12	K+ channel, subfamily K, member 12	210741	KCNK12	56660	Channel
Kcnk13	K+ channel, subfamily K, member 13	217826	KCNK13	56659	Channel
Kcnk15	K+ channel, subfamily K, member 15	241769	KCNK15	60598	Channel
Kcnk16	K+ channel, subfamily K, member 16	74571	KCNK16	83795	Channel
Kcnk18	K+ channel, subfamily K, member 18	332396	KCNK18	338567	Channel
Kcnk2	K+ channel, subfamily K, member 2	16526	KCNK2	3776	Channel
Kcnk3	K+ channel, subfamily K, member 3	16527	KCNK3	3777	Channel
Kcnk4	K+ channel, subfamily K, member 4	16528	KCNK4	50801	Channel
Kcnk5	K+ channel, subfamily K, member 5	16529	KCNK5	8645	Channel
Kcnk6	K+ inwardly-rectifying channel, subfamily K, member 6	52150	KCNK6	9424	Channel
Kcnk7	K+ channel, subfamily K, member 7	16530	KCNK7	10089	Channel
Kcnk9	K+ channel, subfamily K, member 9	223604	KCNK9	51305	Channel
Kcnma1	K+ large conductance Ca2+-activated channel, subfamily M, α member 1	16531	KCNMA1	3778	Channel
Kcnmb1	K+ large conductance Ca2+-activated channel, subfamily M, β member 1	16533	KCNMB1	3779	Channel
Kcnmb2	K+ large conductance Ca2+-activated channel, subfamily M, β member 2	72413	KCNMB2	10242	Channel
Kcnmb3	K+ large conductance Ca2+-activated channel, subfamily M, β member 3	100502876	KCNMB3	27094	Channel

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Kcnmb4	K+ large conductance Ca2+-activated channel, subfamily M, β member 4	58802	KCNMB4	27345	Channel
Kcnn1	K+ intermediate/small conductance Ca2+-activated channel, subfamily N, member 1	84036	KCNN1	3780	Channel
Kcnn2	K+ intermediate/small conductance Ca2+-activated channel, subfamily N, member 2	140492	KCNN2	3781	Channel
Kcnn3	K+ intermediate/small conductance Ca2+-activated channel, subfamily N, member 3	140493	KCNN3	3782	Channel
Kcnn4	**K+ intermediate/small conductance Ca2+-activated channel, subfamily N, member 4**	**16534**	**KCNN4**	**3783**	**Channel**
Kcnq1	K+ voltage-gated channel, subfamily Q, member 1	16535	KCNQ1	3784	Channel
Kcnq2	K+ voltage-gated channel, subfamily Q, member 2	16536	KCNQ2	3785	Channel
Kcnq3	K+ voltage-gated channel, subfamily Q, member 3	110862	KCNQ3	3786	Channel
Kcnq4	K+ voltage-gated channel, subfamily Q, member 4	60613	KCNQ4	9132	Channel
Kcnq5	K+ voltage-gated channel, subfamily Q, member 5	226922	KCNQ5	56479	Channel
Kcns1	K+ voltage-gated channel, subfamily S, 1	16538	KCNS1	3787	Channel
Kcns2	K+ voltage-gated channel, subfamily S, 2	16539	KCNS2	3788	Channel
Kcns3	K+ voltage-gated channel, delayed-rectifier, subfamily S, member 3	238076	KCNS3	3790	Channel
Kcnt1	K+ channel, subfamily T, member 1	227632	KCNT1	57582	Channel
Kcnt2	K+ channel, subfamily T, member 2	240776	KCNT2	343450	Channel
Kcnu1	K+ channel, subfamily U, member 1	16532	KCNU1	157855	Channel
Kcnv1	K+ channel, subfamily V, member 1	67498	KCNV1	27012	Channel
Kcnv2	K+ channel, subfamily V, member 2	240595	KCNV2	169522	Channel
Kctd1	K+ channel tetramerisation domain containing 1	106931	KCTD1	284252	Channel
Kctd10	**K+ channel tetramerisation domain containing 10**	**330171**	**KCTD10**	**83892**	**Channel**
Kctd11	K+ channel tetramerisation domain containing 11	216858	KCTD11	147040	Channel
Kctd12	K+ channel tetramerisation domain containing 12	239217	KCTD12	115207	Channel
Kctd13	**K+ channel tetramerisation domain containing 13**	**233877**	**KCTD13**	**253980**	**Channel**
Kctd15	K+ channel tetramerisation domain containing 15	233107	KCTD15	79047	Channel
Kctd16	K+ channel tetramerisation domain containing 16	383348	KCTD16	57528	Channel
Kctd17	K+ channel tetramerisation domain containing 17	72844	KCTD17	79734	Channel
Kctd18	**K+ channel tetramerisation domain containing 18**	**51960**	**KCTD18**	**130535**	**Channel**
Kctd19	K+ channel tetramerisation domain containing 19	279499	KCTD19	146212	Channel
Kctd2	K+ channel tetramerisation domain containing 2	70382	KCTD2	23510	Channel
Kctd20	**K+ channel tetramerisation domain containing 20**	**66989**	**KCTD20**	**222658**	**Channel**
Kctd21	K+ channel tetramerisation domain containing 21	622320	KCTD21	283219	Channel
Kctd3	K+ channel tetramerisation domain containing 3	226823	KCTD3	51133	Channel
Kctd5	**K+ channel tetramerisation domain containing 5**	**69259**	**KCTD5**	**54442**	**Channel**
Kctd6	K+ channel tetramerisation domain containing 6	71393	KCTD6	200845	Channel
Kctd7	K+ channel tetramerisation domain containing 7	212919	KCTD7	154881	Channel
Kctd8	K+ channel tetramerisation domain containing 8	243043	KCTD8	386617	Channel
Kctd9	K+ channel tetramerisation domain containing 9	105440	KCTD9	54793	Channel
Lrrc26	Leucine rich repeat containing 26	227618	LRRC26	389816	Channel
Lrrc38	Leucine rich repeat containing 38	242735	LRRC38	126755	Channel
Lrrc52	Leucine rich repeat containing 52	240899	LRRC52	440699	Channel
Lrrc55	Leucine rich repeat containing 55	241528	LRRC55	219527	Channel
Lrrc8a	**Leucine rich repeat containing 8A VRAC subunit A**	**241296**	**LRRC8A**	**56262**	**Channel**
Lrrc8b	Leucine rich repeat containing 8 family, member B	433926	LRRC8B	23507	Channel
Lrrc8c	**Leucine rich repeat containing 8 family, member C**	**100604**	**LRRC8C**	**84230**	**Channel**
Lrrc8d	Leucine rich repeat containing 8D	231549	LRRC8D	55144	Channel

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Lrrc8e	Leucine rich repeat containing 8 family, member E	72267	LRRC8E	80131	Channel
Mcoln1	Mucolipin 1	94178	MCOLN1	57192	Channel
Mcoln2	Mucolipin 2	68279	MCOLN2	255231	Channel
Mcoln3	Mucolipin 3	171166	MCOLN3	55283	Channel
Mmd	Monocyte to macrophage differentiation-associated	67468	MMD	23531	Channel
Nalcn	Na+ leak channel, non-selective	338370	NALCN	259232	Channel
Orai1	**ORAI Ca2+ release-activated Ca2+ modulator 1**	**109305**	**ORAI1**	**84876**	**Channel**
Orai2	**ORAI Ca2+ release-activated Ca2+ modulator 2**	**269717**	**ORAI2**	**80228**	**Channel**
Orai3	ORAI Ca2+ release-activated Ca2+ modulator 3	269999	ORAI3	93129	Channel
Otop1	Otopetrin 1	21906	OTOP1	133060	Channel
Otop2	Otopetrin 2	237987	OTOP2	92736	Channel
Otop3	Otopetrin 3	69602	OTOP3	347741	Channel
P2rx1	Purinergic receptor P2X, ligand-gated ion channel, 1	18436	P2RX1	5023	Channel
P2rx2	Purinergic receptor P2X, ligand-gated ion channel, 2	231602	P2RX2	22953	Channel
P2rx3	Purinergic receptor P2X, ligand-gated ion channel, 3	228139	P2RX3	5024	Channel
P2rx4	**Purinergic receptor P2X, ligand-gated ion channel 4**	**18438**	**P2RX4**	**5025**	**Channel**
P2rx5	Purinergic receptor P2X, ligand-gated ion channel, 5	94045	P2RX5	5026	Channel
P2rx6	Purinergic receptor P2X, ligand-gated ion channel, 6	18440	P2RX6	9127	Channel
P2rx7	**Purinergic receptor P2X, ligand-gated ion channel, 7**	**18439**	**P2RX7**	**5027**	**Channel**
Pacc1	Proton activated chloride channel 1	66950	PACC1	55248	Channel
Panx1	**Pannexin 1**	**55991**	**PANX1**	**24145**	**Channel**
Panx2	Pannexin 2	406218	PANX2	56666	Channel
Panx3	Pannexin 3	208098	PANX3	116337	Channel
Piezo1	Piezo-type mechanosensitive ion channel component 1	234839	PIEZO1	9780	Channel
Piezo2	Piezo-type mechanosensitive ion channel component 2	667742	PIEZO2	63895	Channel
Pkd1	Polycystin 1, transient receptor potential channel interacting	18763	PKD1	5310	Channel
Pkd1l1	Polycystic kidney disease 1 like 1	171395	PKD1L1	168507	Channel
Pkd1l2	Polycystic kidney disease 1 like 2	76645	PKD1L2	114780	Channel
Pkd1l3	Polycystic kidney disease 1 like 3	244646	PKD1L3	342372	Channel
Pkd2	Polycystin 2, transient receptor potential cation channel	18764	PKD2	5311	Channel
Pkd2l1	Polycystic kidney disease 2-like 1	329064	PKD2L1	9033	Channel
Pkd2l2	Polycystic kidney disease 2-like 2	53871	PKD2L2	27039	Channel
Pkdrej	Polycystin (PKD) family receptor for egg jelly	18766	PKDREJ	10343	Channel
Ryr1	Ryanodine receptor 1, skeletal muscle	20190	RYR1	6261	Channel
Ryr2	Ryanodine receptor 2, cardiac	20191	RYR2	6262	Channel
Ryr3	Ryanodine receptor 3	20192	RYR3	6263	Channel
Scn10a	Na+ channel, voltage-gated, type X, α	20264	SCN10A	6336	Channel
Scn11a	Na+ channel, voltage-gated, type XI, α	24046	SCN11A	11280	Channel
Scn1a	Na+ channel, voltage-gated, type I, α	20265	SCN1A	6323	Channel
Scn1b	Na+ channel, voltage-gated, type I, β	20266	SCN1B	6324	Channel
Scn2a	Na+ channel, voltage-gated, type II, α	110876	SCN2A	6326	Channel
Scn2b	Na+ channel, voltage-gated, type II, β	72821	SCN2B	6327	Channel
Scn3a	Na+ channel, voltage-gated, type III, α	20269	SCN3A	6328	Channel
Scn3b	Na+ channel, voltage-gated, type III, β	235281	SCN3B	55800	Channel
Scn4a	Na+ channel, voltage-gated, type IV, α	110880	SCN4A	6329	Channel
Scn4b	Na+ channel, type IV, β	399548	SCN4B	6330	Channel
Scn5a	Na+ channel, voltage-gated, type V, α	20271	SCN5A	6331	Channel
Scn7a	Na+ channel, voltage-gated, type VII, α	20272	SCN7A	6332	Channel

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Scn8a	Na+ channel, voltage-gated, type VIII, α	20273	SCN8A	6334	Channel
Scn9a	Na+ channel, voltage-gated, type IX, α	20274	SCN9A	6335	Channel
Scnn1a	Na+ channel, nonvoltage-gated 1 α	20276	SCNN1A	6337	Channel
Scnn1b	Na+ channel, nonvoltage-gated 1 β	20277	SCNN1B	6338	Channel
Scnn1g	Na+ channel, nonvoltage-gated 1 γ	20278	SCNN1G	6340	Channel
Tm9sf2	**Transmembrane 9 superfamily member 2**	**68059**	**TM9SF2**	**9375**	**Channel**
Tmc1	Transmembrane channel-like gene family 1	13409	TMC1	117531	Channel
Tmc2	Transmembrane channel-like gene family 2	192140	TMC2	117532	Channel
Tmc3	Transmembrane channel-like gene family 3	233424	TMC3	342125	Channel
Tmc4	Transmembrane channel-like gene family 4	353499	TMC4	147798	Channel
Tmc5	Transmembrane channel-like gene family 5	74424	TMC5	79838	Channel
Tmc6	**Transmembrane channel-like gene family 6**	**217353**	**TMC6**	**11322**	**Channel**
Tmc7	Transmembrane channel-like gene family 7	209760	TMC7	79905	Channel
Tmc8	**Transmembrane channel-like gene family 8**	**217356**	**TMC8**	**147138**	**Channel**
Tmco1	**Transmembrane and coiled-coil domains 1**	**68944**	**TMCO1**	**54499**	**Channel**
Tmem109	**Transmembrane protein 109**	**68539**	**TMEM109**	**79073**	**Channel**
Tmem175	**Transmembrane protein 175**	**72392**	**TMEM175**	**84286**	**Channel**
Tmem37	Transmembrane protein 37	170706	TMEM37	140738	Channel
Tmem38a	**Transmembrane protein 38A**	**74166**	**TMEM38A**	**79041**	**Channel**
Tmem38b	Transmembrane protein 38B	52076	TMEM38B	55151	Channel
Tmem63a	**Transmembrane protein 63a**	**208795**	**TMEM63A**	**9725**	**Channel**
Tmem63b	**Transmembrane protein 63b**	**224807**	**TMEM63B**	**55362**	**Channel**
Tmem63c	Transmembrane protein 63c	217733	TMEM63C	57156	Channel
Tpcn1	**Two pore channel 1**	**252972**	**TPCN1**	**53373**	**Channel**
Tpcn2	**Two pore segment channel 2**	**233979**	**TPCN2**	**219931**	**Channel**
Trpa1	Transient receptor potential cation channel, subfamily A, member 1	277328	TRPA1	8989	Channel
Trpc1	Transient receptor potential cation channel, subfamily C, member 1	22063	TRPC1	7220	Channel
Trpc2	Transient receptor potential cation channel, subfamily C, member 2	22064	TRPC2	7221	Channel
Trpc3	Transient receptor potential cation channel, subfamily C, member 3	22065	TRPC3	7222	Channel
Trpc4	Transient receptor potential cation channel, subfamily C, member 4	22066	TRPC4	7223	Channel
Trpc5	Transient receptor potential cation channel, subfamily C, member 5	22067	TRPC5	7224	Channel
Trpc6	Transient receptor potential cation channel, subfamily C, member 6	22068	TRPC6	7225	Channel
Trpc7	Transient receptor potential cation channel, subfamily C, member 7	26946	TRPC7	57113	Channel
Trpm1	Transient receptor potential cation channel, subfamily M, member 1	17364	TRPM1	4308	Channel
Trpm2	Transient receptor potential cation channel, subfamily M, member 2	28240	TRPM2	7226	Channel
Trpm3	Transient receptor potential cation channel, subfamily M, member 3	226025	TRPM3	80036	Channel
Trpm4	Transient receptor potential cation channel, subfamily M, member 4	68667	TRPM4	54795	Channel
Trpm5	Transient receptor potential cation channel, subfamily M, member 5	56843	TRPM5	29850	Channel
Trpm6	Transient receptor potential cation channel, subfamily M, member 6	225997	TRPM6	140803	Channel

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Trpm7	**Transient receptor potential cation channel, subfamily M, member 7**	**58800**	**TRPM7**	**54822**	**Channel**
Trpm8	Transient receptor potential cation channel, subfamily M, member 8	171382	TRPM8	79054	Channel
Trpv1	Transient receptor potential cation channel, subfamily V, member 1	193034	TRPV1	7442	Channel
Trpv2	**Transient receptor potential cation channel, subfamily V, member 2**	**22368**	**TRPV2**	**51393**	**Channel**
Trpv3	Transient receptor potential cation channel, subfamily V, member 3	246788	TRPV3	162514	Channel
Trpv4	Transient receptor potential cation channel, subfamily V, member 4	63873	TRPV4	59341	Channel
Trpv5	Transient receptor potential cation channel, subfamily V, member 5	194352	TRPV5	56302	Channel
Trpv6	Transient receptor potential cation channel, subfamily V, member 6	64177	TRPV6	55503	Channel
Ttyh1	Tweety family member 1	57776	TTYH1	57348	Channel
Ttyh2	Tweety family member 2	117160	TTYH2	94015	Channel
Ttyh3	Tweety family member 3	78339	TTYH3	80727	Channel
Vdac1	**Voltage-dependent anion channel 1**	**22333**	**VDAC1**	**7416**	**Channel**
Vdac2	**Voltage-dependent anion channel 2**	**22334**	**VDAC2**	**7417**	**Channel**
Vdac3	**Voltage-dependent anion channel 3**	**22335**	**VDAC3**	**7419**	**Channel**
Asna1	**ArsA arsenite transporter, ATP-binding, homolog 1 (bacterial)**	**56495**	**GET3**	**439**	**Transporter**
Atp12a	ATPase, H+/K+ transporting, nongastric, α polypeptide	192113	ATP12A	479	Transporter
Atp13a1	**ATPase type 13A1**	**170759**	**ATP13A1**	**57130**	**Transporter**
Atp13a2	**ATPase type 13A2**	**74772**	**ATP13A2**	**23400**	**Transporter**
Atp13a3	**ATPase type 13A3**	**224088**	**ATP13A3**	**79572**	**Transporter**
Atp13a4	ATPase type 13A4	224079	ATP13A4	84239	Transporter
Atp13a5	ATPase type 13A5	268878	ATP13A5	344905	Transporter
Atp1a1	**ATPase, Na+/K+ transporting, α 1 polypeptide**	**11928**	**ATP1A1**	**476**	**Transporter**
Atp1a2	ATPase, Na+/K+ transporting, α 2 polypeptide	98660	ATP1A2	477	Transporter
Atp1a3	ATPase, Na+/K+ transporting, α 3 polypeptide	232975	ATP1A3	478	Transporter
Atp1a4	ATPase, Na+/K+ transporting, α 4 polypeptide	27222	ATP1A4	480	Transporter
Atp1b1	ATPase, Na+/K+ transporting, β 1 polypeptide	11931	ATP1B1	481	Transporter
Atp1b2	ATPase, Na+/K+ transporting, β 2 polypeptide	11932	ATP1B2	482	Transporter
Atp1b3	**ATPase, Na+/K+ transporting, β 3 polypeptide**	**11933**	**ATP1B3**	**483**	**Transporter**
Atp1b4	ATPase, (Na+)/K+ transporting, β 4 polypeptide	67821	ATP1B4	23439	Transporter
Atp2a1	ATPase, Ca2+ transporting, cardiac muscle, fast twitch 1	11937	ATP2A1	487	Transporter
Atp2a2	**ATPase, Ca2+ transporting, cardiac muscle, slow twitch 2**	**11938**	**ATP2A2**	**488**	**Transporter**
Atp2a3	**ATPase, Ca2+ transporting, ubiquitous**	**53313**	**ATP2A3**	**489**	**Transporter**
Atp2b1	**ATPase, Ca2+ transporting, plasma membrane 1**	**67972**	**ATP2B1**	**490**	**Transporter**
Atp2b2	ATPase, Ca2+ transporting, plasma membrane 2	11941	ATP2B2	491	Transporter
Atp2b3	ATPase, Ca2+ transporting, plasma membrane 3	320707	ATP2B3	492	Transporter
Atp2b4	**ATPase, Ca2+ transporting, plasma membrane 4**	**381290**	**ATP2B4**	**493**	**Transporter**
Atp2c1	**ATPase, Ca2+-sequestering**	**235574**	**ATP2C1**	**27032**	**Transporter**
Atp2c2	ATPase, Ca2+ transporting, type 2C, member 2	69047	ATP2C2	9914	Transporter
Atp4a	ATPase, H+/K+ exchanging, gastric, α polypeptide	11944	ATP4A	495	Transporter
Atp4b	ATPase, H+/K+ exchanging, β polypeptide	11945	ATP4B	496	Transporter
Atp6ap1	**ATPase, H+ transporting, lysosomal accessory protein 1**	**54411**	**ATP6AP1**	**537**	**Transporter**

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Atp6ap1l	ATPase, H+ transporting, lysosomal accessory protein 1-like	435376	ATP6AP1L	92270	Transporter
Atp6ap2	**ATPase, H+ transporting, lysosomal accessory protein 2**	**70495**	**ATP6AP2**	**10159**	**Transporter**
Atp6v0a1	ATPase, H+ transporting, lysosomal V0 subunit A1	11975	ATP6V0A1	535	Transporter
Atp6v0a2	**ATPase, H+ transporting, lysosomal V0 subunit A2**	**21871**	**ATP6V0A2**	**23545**	**Transporter**
Atp6v0a4	ATPase, H+ transporting, lysosomal V0 subunit A4	140494	ATP6V0A4	50617	Transporter
Atp6v0b	**ATPase, H+ transporting, lysosomal V0 subunit B**	**114143**	**ATP6V0B**	**533**	**Transporter**
Atp6v0c	**ATPase, H+ transporting, lysosomal V0 subunit C**	**11984**	**ATP6V0C**	**527**	**Transporter**
Atp6v0d1	**ATPase, H+ transporting, lysosomal V0 subunit D1**	**11972**	**ATP6V0D1**	**9114**	**Transporter**
Atp6v0d2	ATPase, H+ transporting, lysosomal V0 subunit D2	242341	ATP6V0D2	245972	Transporter
Atp6v0e	**ATPase, H+ transporting, lysosomal V0 subunit E**	**11974**	**ATP6V0E1**	**8992**	**Transporter**
Atp6v0e2	**ATPase, H+ transporting, lysosomal V0 subunit E2**	**76252**	**ATP6V0E2**	**155066**	**Transporter**
Atp6v1a	**ATPase, H+ transporting, lysosomal V1 subunit A**	**11964**	**ATP6V1A**	**523**	**Transporter**
Atp6v1b1	ATPase, H+ transporting, lysosomal V1 subunit B1	110935	ATP6V1B1	525	Transporter
Atp6v1b2	**ATPase, H+ transporting, lysosomal V1 subunit B2**	**11966**	**ATP6V1B2**	**526**	**Transporter**
Atp6v1c1	**ATPase, H+ transporting, lysosomal V1 subunit C1**	**66335**	**ATP6V1C1**	**528**	**Transporter**
Atp6v1c2	ATPase, H+ transporting, lysosomal V1 subunit C2	68775	ATP6V1C2	245973	Transporter
Atp6v1d	**ATPase, H+ transporting, lysosomal V1 subunit D**	**73834**	**ATP6V1D**	**51382**	**Transporter**
Atp6v1e1	**ATPase, H+ transporting, lysosomal V1 subunit E1**	**11973**	**ATP6V1E1**	**529**	**Transporter**
Atp6v1e2	ATPase, H+ transporting, lysosomal V1 subunit E2	74915	ATP6V1E2	90423	Transporter
Atp6v1f	**ATPase, H+ transporting, lysosomal V1 subunit F**	**66144**	**ATP6V1F**	**9296**	**Transporter**
Atp6v1g1	**ATPase, H+ transporting, lysosomal V1 subunit G1**	**66290**	**ATP6V1G1**	**9550**	**Transporter**
Atp6v1g2	ATPase, H+ transporting, lysosomal V1 subunit G2	66237	ATP6V1G2	534	Transporter
Atp6v1g3	ATPase, H+ transporting, lysosomal V1 subunit G3	338375	ATP6V1G3	127124	Transporter
Atp6v1h	**ATPase, H+ transporting, lysosomal V1 subunit H**	**108664**	**ATP6V1H**	**51606**	**Transporter**
Atp7a	ATPase, Cu2+ transporting, α polypeptide	11977	ATP7A	538	Transporter
Atp7b	ATPase, Cu2+ transporting, β polypeptide	11979	ATP7B	540	Transporter
Cldn16	Claudin 16	114141	CLDN16	10686	Transporter
Cnnm1	Cyclin M1	83674	CNNM1	26507	Transporter
Cnnm2	Cyclin M2	94219	CNNM2	54805	Transporter
Cnnm3	**Cyclin M3**	**94218**	**CNNM3**	**26505**	**Transporter**
Cnnm4	Cyclin M4	94220	CNNM4	26504	Transporter
Cutc	**CutC copper transporter**	**66388**	**CUTC**	**51076**	**Transporter**
Letm1	**Leucine zipper-EF-hand containing transmembrane protein 1**	**56384**	**LETM1**	**3954**	**Transporter**
Magt1	**Mg2+ transporter 1**	**67075**	**MAGT1**	**84061**	**Transporter**
Mcu	**Mitochondrial Ca2+ uniporter**	**215999**	**MCU**	**90550**	**Transporter**
Mfsd5	**Major facilitator superfamily domain containing 5**	**106073**	**MFSD5**	**84975**	**Transporter**
Mfsd8	**Major facilitator superfamily domain containing 8**	**72175**	**MFSD8**	**256471**	**Transporter**
Mlc1	Megalencephalic leukoencephalopathy with subcortical cysts 1 homolog (human)	170790	MLC1	23209	Transporter
Mmgt1	**Membrane Mg2+ transporter 1**	**236792**	**MMGT1**	**93380**	**Transporter**
Mrs2	**MRS2 Mg2+ transporter**	**380836**	**MRS2**	**57380**	**Transporter**
Mtch1	**Mitochondrial carrier 1**	**56462**	**MTCH1**	**23787**	**Transporter**
Mtch2	**Mitochondrial carrier 2**	**56428**	**MTCH2**	**23788**	**Transporter**
Nipa1	Non imprinted in Prader-Willi/Angelman syndrome 1 homolog (human)	233280	NIPA1	123606	Transporter
Nipa2	**Non imprinted in Prader-Willi/Angelman syndrome 2 homolog (human)**	**93790**	**NIPA2**	**81614**	**Transporter**
Nipal1	NIPA-like domain containing 1	70701	NIPAL1	152519	Transporter
Nipal2	NIPA-like domain containing 2	223473	NIPAL2	79815	Transporter

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Nipal3	**NIPA-like domain containing 3**	**74552**	**NIPAL3**	**57185**	**Transporter**
Nipal4	NIPA-like domain containing 4	214112	NIPAL4	348938	Transporter
Rhag	Rhesus blood group-associated A glycoprotein	19743	RHAG	6005	Transporter
Rhbg	Rhesus blood group-associated B glycoprotein	58176	RHBG	57127	Transporter
Rhcg	Rhesus blood group-associated C glycoprotein	56315	RHCG	51458	Transporter
Rhd	Rh blood group, D antigen	19746	RHCE | RHD	6006 | 6007	Transporter
Sfxn1	**Sideroflexin 1**	**14057**	**SFXN1**	**94081**	**Transporter**
Sfxn2	Sideroflexin 2	94279	SFXN2	118980	Transporter
Sfxn3	**Sideroflexin 3**	**94280**	**SFXN3**	**81855**	**Transporter**
Sfxn4	Sideroflexin 4	94281	SFXN4	119559	Transporter
Sfxn5	Sideroflexin 5	94282	SFXN5	94097	Transporter
Slc10a5	Solute carrier family 10 (Na+/bile acid cotransporter family), member 5	241877	SLC10A5	347051	Transporter
Slc11a1	Solute carrier family 11 (proton-coupled divalent metal ion transporters), member 1	18173	SLC11A1	6556	Transporter
Slc11a2	**Solute carrier family 11 (proton-coupled divalent metal ion transporters), member 2**	**18174**	**SLC11A2**	**4891**	**Transporter**
Slc12a1	Solute carrier family 12, member 1	20495	SLC12A1	6557	Transporter
Slc12a2	Solute carrier family 12, member 2	20496	SLC12A2	6558	Transporter
Slc12a3	Solute carrier family 12, member 3	20497	SLC12A3	6559	Transporter
Slc12a4	Solute carrier family 12, member 4	20498	SLC12A4	6560	Transporter
Slc12a5	Solute carrier family 12, member 5	57138	SLC12A5	57468	Transporter
Slc12a6	**Solute carrier family 12, member 6**	**107723**	**SLC12A6**	**9990**	**Transporter**
Slc12a7	**Solute carrier family 12, member 7**	**20499**	**SLC12A7**	**10723**	**Transporter**
Slc12a8	Solute carrier family 12 (K+/chloride transporters), member 8	171286	SLC12A8	84561	Transporter
Slc12a9	**Solute carrier family 12 (K+/chloride transporters), member 9**	**83704**	**SLC12A9**	**56996**	**Transporter**
Slc13a1	Solute carrier family 13 (Na+/sulfate symporters), member 1	55961	SLC13A1	6561	Transporter
Slc13a2	Solute carrier family 13 (Na+-dependent dicarboxylate transporter), member 2	20500	SLC13A2	9058	Transporter
Slc13a3	Solute carrier family 13 (Na+-dependent dicarboxylate transporter), member 3	114644	SLC13A3	64849	Transporter
Slc13a4	Solute carrier family 13 (Na+/sulfate symporters), member 4	243755	SLC13A4	26266	Transporter
Slc13a5	Solute carrier family 13 (Na+-dependent citrate transporter), member 5	237831	SLC13A5	284111	Transporter
Slc17a1	Solute carrier family 17 (Na+ phosphate), member 1	20504	SLC17A1	6568	Transporter
Slc17a2	Solute carrier family 17 (Na+ phosphate), member 2	218103	SLC17A2	10246	Transporter
Slc17a3	Solute carrier family 17 (Na+ phosphate), member 3	105355	SLC17A3	10786	Transporter
Slc17a4	Solute carrier family 17 (Na+ phosphate), member 4	319848	SLC17A4	10050	Transporter
Slc1a4	Solute carrier family 1 (glutamate/neutral amino acid transporter), member 4	55963	SLC1A4	6509	Transporter
Slc20a1	**Solute carrier family 20, member 1**	**20515**	**SLC20A1**	**6574**	**Transporter**
Slc20a2	**Solute carrier family 20, member 2**	**20516**	**SLC20A2**	**6575**	**Transporter**
Slc22a23	Solute carrier family 22, member 23	73102	SLC22A23	63027	Transporter
Slc24a1	Solute carrier family 24 (Na+/K+/Ca2+ exchanger), member 1	214111	SLC24A1	9187	Transporter
Slc24a2	Solute carrier family 24 (Na+/K+/Ca2+ exchanger), member 2	76376	SLC24A2	25769	Transporter
Slc24a3	Solute carrier family 24 (Na+/K+/Ca2+ exchanger), member 3	94249	SLC24A3	57419	Transporter

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Slc24a4	Solute carrier family 24 (Na+/K+/Ca2+ exchanger), member 4	238384	SLC24A4	123041	Transporter
Slc24a5	Solute carrier family 24, member 5	317750	SLC24A5	283652	Transporter
Slc25a14	**Solute carrier family 25 (mitochondrial carrier, brain), member 14**	**20523**	**SLC25A14**	**9016**	**Transporter**
Slc25a23	**Solute carrier family 25 (mitochondrial carrier; phosphate carrier), member 23**	**66972**	**SLC25A23**	**79085**	**Transporter**
Slc25a24	**Solute carrier family 25 (mitochondrial carrier, phosphate carrier), member 24**	**229731**	**SLC25A24**	**29957**	**Transporter**
Slc25a25	**Solute carrier family 25 (mitochondrial carrier, phosphate carrier), member 25**	**227731**	**SLC25A25**	**114789**	**Transporter**
Slc25a27	Solute carrier family 25, member 27	74011	SLC25A27	9481	Transporter
Slc25a28	**Solute carrier family 25, member 28**	**246696**	**SLC25A28**	**81894**	**Transporter**
Slc25a3	**Solute carrier family 25 (mitochondrial carrier, phosphate carrier), member 3**	**18674**	**SLC25A3**	**5250**	**Transporter**
Slc25a37	**Solute carrier family 25, member 37**	**67712**	**SLC25A37**	**51312**	**Transporter**
Slc26a1	Solute carrier family 26 (sulfate transporter), member 1	231583	SLC26A1	10861	Transporter
Slc26a10	Solute carrier family 26, member 10	216441	SLC26A10	65012	Transporter
Slc26a11	Solute carrier family 26, member 11	268512	SLC26A11	284129	Transporter
Slc26a2	**Solute carrier family 26 (sulfate transporter), member 2**	**13521**	**SLC26A2**	**1836**	**Transporter**
Slc26a3	Solute carrier family 26, member 3	13487	SLC26A3	1811	Transporter
Slc26a4	Solute carrier family 26, member 4	23985	SLC26A4	5172	Transporter
Slc26a5	Solute carrier family 26, member 5	80979	SLC26A5	375611	Transporter
Slc26a6	Solute carrier family 26, member 6	171429	SLC26A6	65010	Transporter
Slc26a7	Solute carrier family 26, member 7	208890	SLC26A7	115111	Transporter
Slc26a8	Solute carrier family 26, member 8	224661	SLC26A8	116369	Transporter
Slc26a9	Solute carrier family 26, member 9	320718	SLC26A9	115019	Transporter
Slc30a1	Solute carrier family 30 (zinc transporter), member 1	22782	SLC30A1	7779	Transporter
Slc30a10	Solute carrier family 30, member 10	226781	SLC30A10	55532	Transporter
Slc30a2	Solute carrier family 30 (zinc transporter), member 2	230810	SLC30A2	7780	Transporter
Slc30a3	Solute carrier family 30 (zinc transporter), member 3	22784	SLC30A3	7781	Transporter
Slc30a4	Solute carrier family 30 (zinc transporter), member 4	22785	SLC30A4	7782	Transporter
Slc30a5	**Solute carrier family 30 (zinc transporter), member 5**	**69048**	**SLC30A5**	**64924**	**Transporter**
Slc30a6	**Solute carrier family 30 (zinc transporter), member 6**	**210148**	**SLC30A6**	**55676**	**Transporter**
Slc30a7	**Solute carrier family 30 (zinc transporter), member 7**	**66500**	**SLC30A7**	**148867**	**Transporter**
Slc30a8	Solute carrier family 30 (zinc transporter), member 8	239436	SLC30A8	169026	Transporter
Slc30a9	**Solute carrier family 30 (zinc transporter), member 9**	**109108**	**SLC30A9**	**10463**	**Transporter**
Slc31a1	Solute carrier family 31, member 1	20529	SLC31A1	1317	Transporter
Slc31a2	Solute carrier family 31, member 2	20530	SLC31A2	1318	Transporter
Slc34a1	Solute carrier family 34 (Na+ phosphate), member 1	20505	SLC34A1	6569	Transporter
Slc34a2	Solute carrier family 34 (Na+ phosphate), member 2	20531	SLC34A2	10568	Transporter
Slc34a3	Solute carrier family 34 (Na+ phosphate), member 3	142681	SLC34A3	142680	Transporter
Slc35g1	Solute carrier family 35, member G1	240660	SLC35G1	159371	Transporter
Slc35g2	Solute carrier family 35, member G2	245020	SLC35G2	80723	Transporter
Slc35g3	Solute carrier family 35, member G3	56293	SLC35G3	146861	Transporter
Slc39a1	Solute carrier family 39 (zinc transporter), member 1	30791	SLC39A1	27173	Transporter
Slc39a10	**Solute carrier family 39 (zinc transporter), member 10**	**227059**	**SLC39A10**	**57181**	**Transporter**
Slc39a11	Solute carrier family 39 (metal ion transporter), member 11	69806	SLC39A11	201266	Transporter
Slc39a12	Solute carrier family 39 (zinc transporter), member 12	277468	SLC39A12	221074	Transporter
Slc39a13	**Solute carrier family 39 (metal ion transporter), member 13**	**68427**	**SLC39A13**	**91252**	**Transporter**

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Slc39a14	Solute carrier family 39 (zinc transporter), member 14	213053	SLC39A14	23516	Transporter
Slc39a2	Solute carrier family 39 (zinc transporter), member 2	214922	SLC39A2	29986	Transporter
Slc39a3	Solute carrier family 39 (zinc transporter), member 3	106947	SLC39A3	29985	Transporter
Slc39a4	Solute carrier family 39 (zinc transporter), member 4	72027	SLC39A4	55630	Transporter
Slc39a5	Solute carrier family 39 (metal ion transporter), member 5	72002	SLC39A5	283375	Transporter
Slc39a6	**Solute carrier family 39 (metal ion transporter), member 6**	**106957**	**SLC39A6**	**25800**	**Transporter**
Slc39a7	**Solute carrier family 39 (zinc transporter), member 7**	**14977**	**SLC39A7**	**7922**	**Transporter**
Slc39a8	Solute carrier family 39 (metal ion transporter), member 8	67547	SLC39A8	64116	Transporter
Slc39a9	**Solute carrier family 39 (zinc transporter), member 9**	**328133**	**SLC39A9**	**55334**	**Transporter**
Slc40a1	Solute carrier family 40 (iron-regulated transporter), member 1	53945	SLC40A1	30061	Transporter
Slc41a1	**Solute carrier family 41, member 1**	**98396**	**SLC41A1**	**254428**	**Transporter**
Slc41a2	Solute carrier family 41, member 2	338365	SLC41A2	84102	Transporter
Slc41a3	**Solute carrier family 41, member 3**	**71699**	**SLC41A3**	**54946**	**Transporter**
Slc4a1	Solute carrier family 4 (anion exchanger), member 1	20533	SLC4A1	6521	Transporter
Slc4a10	Solute carrier family 4, Na+ bicarbonate cotransporter-like, member 10	94229	SLC4A10	57282	Transporter
Slc4a11	Solute carrier family 4, Na+ bicarbonate transporter-like, member 11	269356	SLC4A11	83959	Transporter
Slc4a2	Solute carrier family 4 (anion exchanger), member 2	20535	SLC4A2	6522	Transporter
Slc4a3	Solute carrier family 4 (anion exchanger), member 3	20536	SLC4A3	6508	Transporter
Slc4a4	Solute carrier family 4 (anion exchanger), member 4	54403	SLC4A4	8671	Transporter
Slc4a5	Solute carrier family 4, Na+ bicarbonate cotransporter, member 5	232156	SLC4A5	57835	Transporter
Slc4a7	**Solute carrier family 4, Na+ bicarbonate cotransporter, member 7**	**218756**	**SLC4A7**	**9497**	**Transporter**
Slc4a8	Solute carrier family 4 (anion exchanger), member 8	59033	SLC4A8	9498	Transporter
Slc4a9	Solute carrier family 4, Na+ bicarbonate cotransporter, member 9	240215	SLC4A9	83697	Transporter
Slc5a11	Solute carrier family 5 (Na+/glucose cotransporter), member 11	233836	SLC5A11	115584	Transporter
Slc5a12	Solute carrier family 5 (Na+/glucose cotransporter), member 12	241612	SLC5A12	159963	Transporter
Slc5a3	**Solute carrier family 5 (inositol transporters), member 3**	**53881**	**SLC5A3**	**6526**	**Transporter**
Slc5a4a	Solute carrier family 5, member 4a	64452	SLC5A4	6527	Transporter
Slc5a5	Solute carrier family 5 (Na+ iodide symporter), member 5	114479	SLC5A5	6528	Transporter
Slc5a6	Solute carrier family 5 (Na+-dependent vitamin transporter), member 6	330064	SLC5A6	8884	Transporter
Slc5a8	Solute carrier family 5 (iodide transporter), member 8	216225	SLC5A8	160728	Transporter
Slc8a1	Solute carrier family 8 (Na+/Ca2+ exchanger), member 1	20541	SLC8A1	6546	Transporter
Slc8a2	Solute carrier family 8 (Na+/Ca2+ exchanger), member 2	110891	SLC8A2	6543	Transporter
Slc8a3	Solute carrier family 8 (Na+/Ca2+ exchanger), member 3	110893	SLC8A3	6547	Transporter
Slc8b1	Solute carrier family 8 (Na+/lithium/Ca2+ exchanger), member B1	170756	SLC8B1	80024	Transporter
Slc9a1	**Solute carrier family 9 (Na+/H+ exchanger), member 1**	**20544**	**SLC9A1**	**6548**	**Transporter**
Slc9a2	Solute carrier family 9 (Na+/H+ exchanger), member 2	226999	SLC9A2	6549	Transporter
Slc9a3	Solute carrier family 9 (Na+/H+ exchanger), member 3	105243	SLC9A3	6550	Transporter
Slc9a4	Solute carrier family 9 (Na+/H+ exchanger), member 4	110895	SLC9A4	389015	Transporter
Slc9a5	Solute carrier family 9 (Na+/H+ exchanger), member 5	277973	SLC9A5	6553	Transporter
Slc9a6	Solute carrier family 9 (Na+/H+ exchanger), member 6	236794	SLC9A6	10479	Transporter
Slc9a7	Solute carrier family 9 (Na+/H+ exchanger), member 7	236727	SLC9A7	84679	Transporter
Slc9a8	**Solute carrier family 9 (Na+/H+ exchanger), member 8**	**77031**	**SLC9A8**	**23315**	**Transporter**

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Slc9a9	**Solute carrier family 9 (Na+/H+ exchanger), member 9**	**331004**	**SLC9A9**	**285195**	**Transporter**
Slc9b1	Solute carrier family 9, subfamily B (NHA1, cation proton antiporter 1), member 1	74446	SLC9B1	150159	Transporter
Slc9b2	Solute carrier family 9, subfamily B (NHA2, cation proton antiporter 2), member 2	97086	SLC9B2	133308	Transporter
Slc9c1	Solute carrier family 9, subfamily C (Na+-transporting carboxylic acid decarboxylase), member 1	208169	SLC9C1	285335	Transporter
Svop	SV2 related protein	68666	SVOP	55530	Transporter
Tcirg1	**T cell, immune regulator 1, ATPase, H+ transporting, lysosomal V0 protein A3**	**27060**	**TCIRG1**	**10312**	**Transporter**
Tfr2	Transferrin receptor 2	50765	TFR2	7036	Transporter
Tfrc	**Transferrin receptor**	**22042**	**TFRC**	**7037**	**Transporter**
Tmco3	Transmembrane and coiled-coil domains 3	234076	TMCO3	55002	Transporter
Tmem165	**Transmembrane protein 165**	**21982**	**TMEM165**	**55858**	**Transporter**
Tusc3	**Tumor suppressor candidate 3**	**80286**	**TUSC3**	**7991**	**Transporter**
Ucp1	Uncoupling protein 1 (mitochondrial, proton carrier)	22227	UCP1	7350	Transporter
Ucp2	**Uncoupling protein 2 (mitochondrial, proton carrier)**	**22228**	**UCP2**	**7351**	**Transporter**
Ucp3	Uncoupling protein 3 (mitochondrial, proton carrier)	22229	UCP3	7352	Transporter
Wfs1	Wolframin ER transmembrane glycoprotein	22393	WFS1	7466	Transporter
Xpr1	**Xenotropic and polytropic retrovirus receptor 1**	**19775**	**XPR1**	**9213**	**Transporter**
Zdhhc13	**Zinc finger, DHHC domain containing 13**	**243983**	**ZDHHC13**	**54503**	**Transporter**
Zdhhc17	**Zinc finger, DHHC domain containing 17**	**320150**	**ZDHHC17**	**23390**	**Transporter**
Ahcyl1	**S-adenosylhomocysteine hydrolase-like 1**	**229709**	**AHCYL1**	**10768**	**ICT Regulator**
Ahcyl2	**S-adenosylhomocysteine hydrolase-like 2**	**74340**	**AHCYL2**	**23382**	**ICT Regulator**
Akap7	A kinase (PRKA) anchor protein 7	432442	AKAP7	9465	ICT Regulator
Amigo1	Adhesion molecule with Ig like domain 1	229715	AMIGO1	57463	ICT Regulator
Ank	Progressive ankylosis	11732	ANKH	56172	ICT Regulator
Ank2	Ankyrin 2, brain	109676	ANK2	287	ICT Regulator
Ank3	Ankyrin 3, epithelial	11735	ANK3	288	ICT Regulator
Anxa6	**Annexin A6**	**11749**	**ANXA6**	**309**	**ICT Regulator**
Asph	Aspartate-β-hydroxylase	65973	ASPH	444	ICT Regulator
Atox1	**Antioxidant 1 copper chaperone**	**11927**	**ATOX1**	**475**	**ICT Regulator**
Bpifa1	BPI fold containing family A, member 1	18843	BPIFA1	51297	ICT Regulator
Bspry	B-box and SPRY domain containing	192120	BSPRY	54836	ICT Regulator
Cabp1	Ca2+ binding protein 1	29867	CABP1	9478	ICT Regulator
Cabp2	Ca2+ binding protein 2	29866	CABP2	51475	ICT Regulator
Cabp4	Ca2+ binding protein 4	73660	CABP4	57010	ICT Regulator
Cabp5	Ca2+ binding protein 5	29865	CABP5	56344	ICT Regulator
Cachd1	Cache domain containing 1	320508	CACHD1	57685	ICT Regulator
Casq1	Calsequestrin 1	12372	CASQ1	844	ICT Regulator
Casq2	Calsequestrin 2	12373	CASQ2	845	ICT Regulator
Cbarp	Ca2+ channel, voltage-dependent, β subunit associated regulatory protein	100503659	CBARP	255057	ICT Regulator
Ccdc115	**Coiled-coil domain containing 115**	**69668**	**CCDC115**	**84317**	**ICT Regulator**
Cltrn	Collectrin, amino acid transport regulator	57394	CLTRN	57393	ICT Regulator
Cnksr3	Cnksr family member 3	215748	CNKSR3	154043	ICT Regulator
Commd3	**COMM domain containing 3**	**12238**	**COMMD3**	**23412**	**ICT Regulator**
Commd9	**COMM domain containing 9**	**76501**	**COMMD9**	**29099**	**ICT Regulator**
Cracr2a	**Ca2+ release activated channel regulator 2A**	**381812**	**CRACR2A**	**84766**	**ICT Regulator**
Cracr2b	Ca2+ release activated channel regulator 2B	213573	CRACR2B	283229	ICT Regulator

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Crbn	**Cereblon**	**58799**	**CRBN**	**51185**	**ICT Regulator**
Crisp2	Cysteine-rich secretory protein 2	22024	CRISP2	7180	ICT Regulator
Dennd5a	DENN/MADD domain containing 5A	19347	DENND5A	23258	ICT Regulator
Dennd5b	DENN/MADD domain containing 5B	320560	DENND5B	160518	ICT Regulator
Dlg1	**Discs large MAGUK scaffold protein 1**	**13383**	**DLG1**	**1739**	**ICT Regulator**
Dlg4	Discs large MAGUK scaffold protein 4	13385	DLG4	1742	ICT Regulator
Dmac2l	**Distal membrane arm assembly complex 2 like**	**68055**	**DMAC2L**	**27109**	**ICT Regulator**
Dpp10	Dipeptidylpeptidase 10	269109	DPP10	57628	ICT regulator
Dpp6	Dipeptidylpeptidase 6	13483	DPP6	1804	ICT regulator
Efhb	EF hand domain family, member B	211482	EFHB	151651	ICT Regulator
Efhc1	EF-hand domain (C-terminal) containing 1	71877	EFHC1	114327	ICT Regulator
Enkur	Enkurin, TRPC channel interacting protein	71233	ENKUR	219670	ICT Regulator
Erp44	**Endoplasmic reticulum protein 44**	**76299**	**ERP44**	**23071**	**ICT Regulator**
Fxyd1	FXYD domain-containing ion transport regulator 1	56188	FXYD1	5348	ICT Regulator
Fxyd2	FXYD domain-containing ion transport regulator 2	11936	FXYD2	486	ICT Regulator
Fxyd3	FXYD domain-containing ion transport regulator 3	17178	FXYD3	5349	ICT Regulator
Fxyd4	FXYD domain-containing ion transport regulator 4	108017	FXYD4	53828	ICT Regulator
Fxyd5	**FXYD domain-containing ion transport regulator 5**	**18301**	**FXYD5**	**53827**	**ICT Regulator**
Fxyd6	FXYD domain-containing ion transport regulator 6	59095	FXYD6	53826	ICT Regulator
Fxyd7	**FXYD domain-containing ion transport regulator 7**	**57780**	**FXYD7**	**53822**	**ICT Regulator**
Gopc	**Golgi associated PDZ and coiled-coil motif containing**	**94221**	**GOPC**	**57120**	**ICT Regulator**
Gpd1l	**Glycerol-3-phosphate dehydrogenase 1-like**	**333433**	**GPD1L**	**23171**	**ICT Regulator**
Hax1	**HCLS1 associated X-1**	**23897**	**HAX1**	**10456**	**ICT Regulator**
Hpca	Hippocalcin	15444	HPCA	3208	ICT Regulator
Hrc	Histidine rich Ca2+ binding protein	15464	HRC	3270	ICT Regulator
Jph2	Junctophilin 2	59091	JPH2	57158	ICT Regulator
Jsrp1	Junctional sarcoplasmic reticulum protein 1	71912	JSRP1	126306	ICT Regulator
Kcnrg	K+ channel regulator	328424	KCNRG	283518	ICT Regulator
Lgi1	Leucine-rich repeat LGI family, member 1	56839	LGI1	9211	ICT Regulator
Lhfpl5	Lipoma HMGIC fusion partner-like 5	328789	LHFPL5	222662	ICT Regulator
Maged2	Melanoma antigen, family D, 2	80884	MAGED2	10916	ICT Regulator
Mcur1	**Mitochondrial Ca2+ uniporter regulator 1**	**76137**	**MCUR1**	**63933**	**ICT Regulator**
Micu1	**Mitochondrial Ca2+ uptake 1**	**216001**	**MICU1**	**10367**	**ICT Regulator**
Micu2	**Mitochondrial Ca2+ uptake 2**	**68514**	**MICU2**	**221154**	**ICT Regulator**
Micu3	**Mitochondrial Ca2+ uptake family, member 3**	**78506**	**MICU3**	**286097**	**ICT Regulator**
Ms4a1	Membrane-spanning 4-domains, subfamily A, member 1	12482	MS4A1	931	ICT Regulator
Mtmr6	**Myotubularin related protein 6**	**219135**	**MTMR6**	**9107**	**ICT Regulator**
Ncs1	Neuronal Ca2+ sensor 1	14299	NCS1	23413	ICT Regulator
Neto2	Neuropilin (NRP) and tolloid (TLL)-like 2	74513	NETO2	81831	ICT Regulator
Nkain1	Na+/K+ transporting ATPase interacting 1	67149	NKAIN1	79570	ICT Regulator
Nkain2	Na+/K+ transporting ATPase interacting 2	432450	NKAIN2	154215	ICT Regulator
Nkain3	Na+/K+ transporting ATPase interacting 3	269513	NKAIN3	286183	ICT Regulator
Nkain4	Na+/K+ transporting ATPase interacting 4	58237	NKAIN4	128414	ICT Regulator
Pacsin3	Protein kinase C and casein kinase substrate in neurons 3	80708	PACSIN3	29763	ICT Regulator
Pdzd3	PDZ domain containing 3	170761	PDZD3	79849	ICT Regulator
Pdzk1	PDZ domain containing 1	59020	PDZK1	5174	ICT Regulator
Pex5l	Peroxisomal biogenesis factor 5-like	58869	PEX5L	51555	ICT Regulator
Pirt	Phosphoinositide-interacting regulator of transient receptor potential channels	193003	PIRT	644139	ICT Regulator

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Pllp	Plasma membrane proteolipid	67801	PLLP	51090	ICT Regulator
Pln	Phospholamban	18821	PLN	5350	ICT Regulator
Prss8	Protease, serine 8 (prostasin)	76560	PRSS8	5652	ICT Regulator
Pxk	**PX domain containing serine/threonine kinase**	**218699**	**PXK**	**54899**	**ICT Regulator**
Rrad	**Ras-related associated with diabetes**	**56437**	**RRAD**	**6236**	**ICT Regulator**
Saraf	**Store-operated Ca2+ entry-associated regulatory factor**	**67887**	**SARAF**	**51669**	**ICT Regulator**
Sclt1	Na+ channel and clathrin linker 1	67161	SCLT1	132320	ICT Regulator
Scnm1	**Na+ channel modifier 1**	**69269**	**SCNM1**	**79005**	**ICT Regulator**
Sco1	**SCO1 cytochrome c oxidase assembly protein**	**52892**	**SCO1**	**6341**	**ICT Regulator**
Selenok	Selenoprotein K	80795	SELENOK	58515	ICT Regulator
Sestd1	SEC14 and spectrin domains 1	228071	SESTD1	91404	ICT Regulator
Slc9a3r1	**Solute carrier family 9 (Na+/H+ exchanger), member 3 regulator 1**	**26941**	**SLC9A3R1**	**9368**	**ICT Regulator**
Slc9a3r2	Solute carrier family 9 (Na+/H+ exchanger), member 3 regulator 2	65962	SLC9A3R2	9351	ICT Regulator
Sln	Sarcolipin	66402	SLN	6588	ICT Regulator
Smdt1	**Single-pass membrane protein with aspartate rich tail 1**	**69029**	**SMDT1**	**91689**	**ICT Regulator**
Sri	**Sorcin**	**109552**	**SRI**	**6717**	**ICT Regulator**
Stac	Src homology three (SH3) and cysteine rich domain	20840	STAC	6769	ICT Regulator
Stac2	SH3 and cysteine rich domain 2	217154	STAC2	342667	ICT Regulator
Stac3	SH3 and cysteine rich domain 3	237611	STAC3	246329	ICT Regulator
Stim1	**Stromal interaction molecule 1**	**20866**	**STIM1**	**6786**	**ICT Regulator**
Stim2	**Stromal interaction molecule 2**	**116873**	**STIM2**	**57620**	**ICT Regulator**
Stk39	Serine/threonine kinase 39	53416	STK39	27347	ICT Regulator
Stom	Stomatin	13830	STOM	2040	ICT Regulator
Stoml1	Stomatin-like 1	69106	STOML1	9399	ICT Regulator
Stoml2	**Stomatin-like 2**	**66592**	**STOML2**	**30968**	**ICT Regulator**
Stoml3	Stomatin (Epb7.2)-like 3	229277	STOML3	161003	ICT Regulator
Strit1	Small transmembrane regulator of ion transport 1	102637511	STRIT1	100507537	ICT Regulator
Tcaf1	TRPM8 channel-associated factor 1	77574	TCAF1	9747	ICT Regulator
Tcaf2	TRPM8 channel-associated factor 2	232748	TCAF2	285966	ICT Regulator
Tesc	Tescalcin	57816	TESC	54997	ICT Regulator
Tm9sf4	**Transmembrane 9 superfamily protein member 4**	**99237**	**TM9SF4**	**9777**	**ICT Regulator**
Tmem100	Transmembrane protein 100	67888	TMEM100	55273	ICT Regulator
Tmem150c	Transmembrane protein 150C	231503	TMEM150C	441027	ICT Regulator
Tmem199	Transmembrane protein 199	195040	TMEM199	147007	ICT Regulator
Tmem266	Transmembrane protein 266	244886	TMEM266	123591	ICT Regulator
Tmem64	Transmembrane protein 64	100201	TMEM64	169200	ICT Regulator
Trdn	Triadin	76757	TRDN	10345	ICT Regulator
Trpc4ap	**Transient receptor potential cation channel, subfamily C, member 4 associated protein**	**56407**	**TRPC4AP**	**26133**	**ICT Regulator**
Unc79	Unc-79 homolog	217843	UNC79	57578	ICT Regulator
Unc80	Unc-80, NALCN activator	329178	UNC80	285175	ICT Regulator
Uqcrb	**Ubiquinol-cytochrome c reductase binding protein**	**67530**	**UQCRB**	**7381**	**ICT Regulator**
Vstm4	V-set and transmembrane domain containing 4	320736	VSTM4	196740	ICT Regulator
Car1	Carbonic anhydrase 1	12346	CA1	759	Enzymatic
Car11	Carbonic anhydrase 11	12348	CA11	770	Enzymatic
Car12	Carbonic anhydrase 12	76459	CA12	771	Enzymatic

Mm Gene	Mm Full Name	Mm Gene ID	Hs Gene	Hs Gene ID	Functional category*
Car13	Carbonic anhydrase 13	71934	CA13	377677	Enzymatic
Car14	Carbonic anhydrase 14	23831	CA14	23632	Enzymatic
Car2	Carbonic anhydrase 2	12349	CA2	760	Enzymatic
Car3	Carbonic anhydrase 3	12350	CA3	761	Enzymatic
Car4	Carbonic anhydrase 4	12351	CA4	762	Enzymatic
Car5a	Carbonic anhydrase 5a, mitochondrial	12352	CA5A	763	Enzymatic
Car5b	**Carbonic anhydrase 5b, mitochondrial**	**56078**	**CA5B**	**11238**	**Enzymatic**
Car6	Carbonic anhydrase 6	12353	CA6	765	Enzymatic
Car7	Carbonic anhydrase 7	12354	CA7	766	Enzymatic
Car9	Carbonic anhydrase 9	230099	CA9	768	Enzymatic
Fth1	**Ferritin heavy polypeptide 1**	**14319**	**FTH1**	**2495**	**Enzymatic**
Ftl1	**Ferritin light polypeptide 1**	**14325**	**FTL**	**2512**	**Enzymatic**
Ftmt	Ferritin mitochondrial	67634	FTMT	94033	Enzymatic
Heph	Hephaestin	15203	HEPH	9843	Enzymatic
Hephl1	Hephaestin-like 1	244698	HEPHL1	341208	Enzymatic
Nox1	NADPH oxidase 1	237038	NOX1	27035	Enzymatic

Supplemental Table 2. Related to Methods. shRNAs, sgRNAs and plasmids used for deletion or overexpression of genes.

Reagent or Resource	Vector	Target sequence (for shRNA)
sgControl	pMRI-Ametrine	sg1: GAGCAGCGTCTTCGAGAGTG
sg*Sting*	pMRI-Ametrine	sg1: TATCTCGGAATCGAATGTTG sg2: GAAGGCCAAACATCCAACTG
sg*Trp53*	pMRI-Ametrine	sg1: GAAGTCACAGCACATGACGG sg2: AACAGATCGTCCATGCAGTG
sh*Lrrc8a*	pLMPd-Ametrine or mCherry	sh1: ACAGCCTCAAGAAGATGGTTAA sh2: TCCATGGACAAGAAGTCATCTA
sh*Lrrc8c*	pLMPd-Ametrine	sh1: TCCAGTTCACAGTGGACTGTAA sh2: CAGCGAGAACAAGTTAAAACAA
sh*Renilla.713*	pLMPd-Ametrine or mCherry	sh1: TAGGAATTATAATGCTTATCTA
Reagent or Resource	**Vector**	**Sequence**
MSCV-Empty vector	pMSCV-IRES-mCherry	for plasmid map compare Addgene 52114
MSCV-LRRC8C-Flag	pMSCV-IRES-mCherry	murine *Lrrc8c,* Ref Seq NM_133897.2. CDS: nt 236-2647. Source: Dharmacon, MMM1013-202767571
MSCV-LRRC8C-ΔEx4-Flag	pMSCV-IRES-mCherry	murine *Lrrc8c,* nt 236-373 from Ref Seq NM_133897.2.
MSCV-p53	pMSCV-IRES-Ametrine	murine *Trp53,* Ref Seq NM_011640.3, CDS: nt 158-1330. Source: Sino Biological, MG50534-UT

Supplemental Table 3. Related to Methods. Antibodies used for flow cytometry

Antigen	Source	Clone	Conjugation	Intracellular staining
B220	eBioscience	RA3-6B2	FITC	n/a
CD11b	BioLegend	M1/70	PE-Cy7	n/a
CD11c	BioLegend	N418	Pacific Blue	n/a
CD138	BioLegend	281-2	PE	n/a
CD25	eBioscience	PC61 .5	PE	n/a
CD279 (PD-1)	BioLegend	29F.1A12	PE-Cy7	n/a
CD3e	eBioscience	145-2C11	eFluor 450	n/a
CD38	eBioscience	90	APC	n/a
CD4	eBioscience/BioLegend	GK1.5	PE-Cy7/BV510	n/a
CD44	eBioscience/BioLegend	IM7	FITC, Pacific Blue	n/a
CD45.1	eBioscience	A20	eFluor 450	n/a
CD45.2	eBioscience	104	Per-CP Cy5.5	n/a
CD62L	BioLegend	MEL-14	Per-CP Cy5.5	n/a
CD8a	eBioscience	53-6.7	FITC, PE, APC	n/a
CD80	eBioscience	16-10A1	APC	n/a
CXCR5	eBioscience	SPRCL5	Per-CP Cy5.5	n/a
GL.7	BioLegend	GL7	AF488	n/a
MOG_{38-49} $I(A)^b$	NIH tetramer Core	---	APC	n/a
GM-CSF	BioLegend	MP1-22E9	Per-CP Cy5.5	IC staining Kit (eBioscience)
IFN-γ	eBioscience	XMG1.2	PE	IC staining Kit (eBioscience)
IL-2	eBioscience	JES6-5H4	FITC	IC staining Kit (eBioscience)
IL-17a	BioLegend	TC11-18H10.1	FITC	IC staining Kit (eBioscience)
FLAG (1^{st})	Sigma	M2	Unconjugated (mouse)	IC staining Kit (eBioscience)
Mouse IgG (2^{nd})	Thermo Fisher	Polyclonal	AF647	IC staining Kit (eBioscience)
LRRC8C	YenZym (custom-made)	custom-made rabbit polyclonal	Unconjugated (rabbit)	IC staining Kit (eBioscience)
ORAI1	YenZym	custom-made rabbit polyclonal	Unconjugated	IC staining Kit (eBioscience)
Rabbit IgG (2^{nd})	Thermo Fisher	Polyclonal	AF647	IC staining Kit (eBioscience)
STIM1	YenZym (custom-made)	custom-made rabbit polyclonal	Unconjugated	IC staining Kit (eBioscience)
TNF-α	eBioscience	MP6-XT22	APC	IC staining Kit (eBioscience)
Foxp3	eBioscience	FJK-16s	FITC	TF staining kit (eBioscience)
Ki67	eBioscience	SolA15	PE	TF staining kit (eBioscience)
p53	Cell Signaling Tech.	1C12	AF488	TF staining kit (eBioscience)

Supplemental Table 4. Related to Methods. Primers used for RT-qPCR

Gene name	Forward primer	Reverse primer
mouse *Apaf1*	AGTGGCAAGGACACAGATGG	GGCTTCCGCAGCTAACACA
mouse *Bax*	TGAAGACAGGGGCCTTTTTG	AATTCGCCGGAGACACTCG
mouse *Ccng1*	ACAACTGACTCTCAGAAACTGC	CATTATCATGGGCCGACTCAAT
mouse *Cdkn1a*	CCTGGTGATGTCCGACCTG	CCATGAGCGCATCGCAATC
Mouse *Gapdh*	AAGCTCATTTCCTGGTATGACA	CTTGCTCAGTGTCCTTGCTG
mouse *Lrrc8a*	GCTGTGTGTCCGCAAAGTAG	AGACAGGGACCAGCCTCAG
mouse *Lrrc8b*	GGTTCGCCAAGTTTTTCCCC	GTCGAAGCACTTGTGGAGGA
mouse *Lrrc8c-Exon1-3*	AACTCGGTCACCGGAATCAT	CCCCAGAGATTAATGTGGCT
mouse *Lrrc8c-Exon3*	ATTCCGGTGACCGAGTTCC	CATCCAAACACTCCGATCATCAG
mouse *Lrrc8c-Exon4*	TGCTGATGATCGGAGTGTTTG	GGTTGGTCGGTGAGGGTTT
mouse *Lrrc8d*	TGCCCGCGAAGGAAGTG	CCCACCATGGCTTCAGGATT
mouse *Lrrc8e*	GCTGCTCTGTGAACTGCTTG	CAGGCATCTAGAAGTTGGGC
mouse *Rpl32*	CCCAACATCGGTTATGGGAGCA	GATGGCCAGCTGTGCTGC
influenza PR8- M1/M2	GGACTGCAGCGTTAGACGCTT	CATCCTGTTGTATATGAGGCCCAT

References

1 Lin, J. X. *et al.* Critical Role of STAT5 transcription factor tetramerization for cytokine responses and normal immune function. *Immunity* **36**, 586-599, doi:10.1016/j.immuni.2012.02.017 (2012).