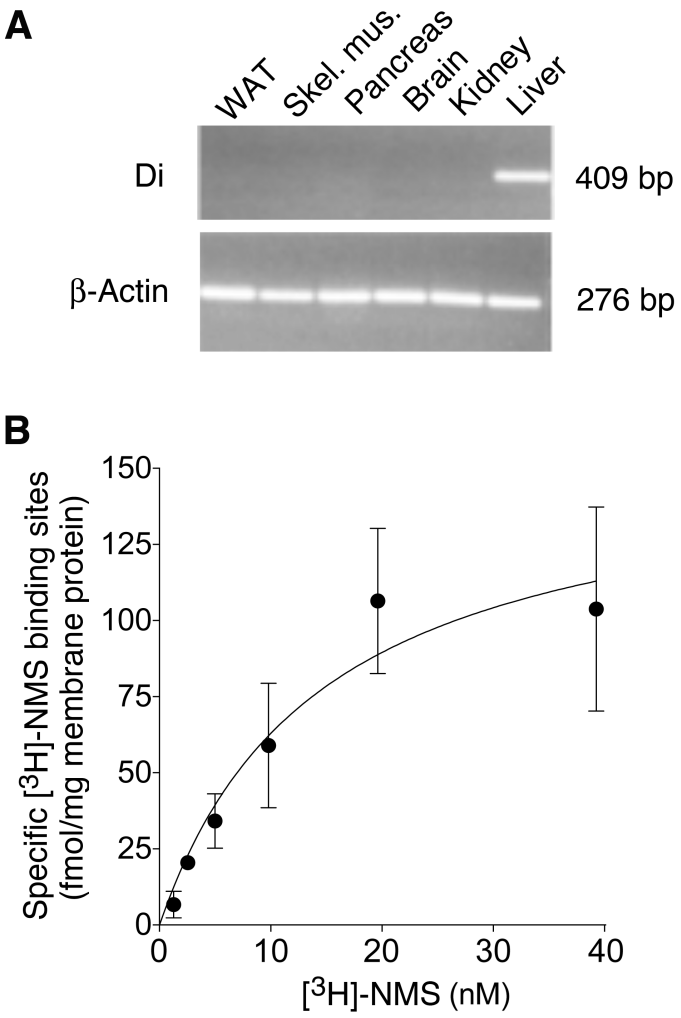
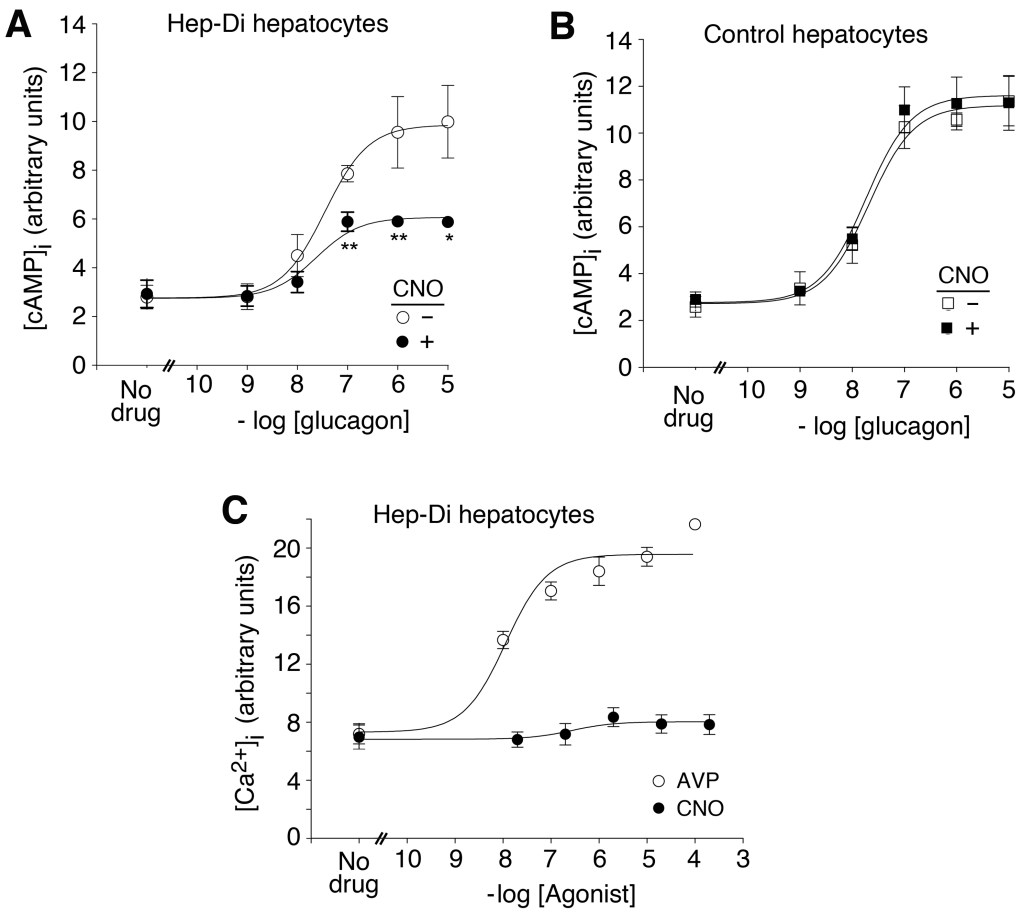
Supplemental Data

Hepatic G_i signaling regulates whole body glucose homeostasis

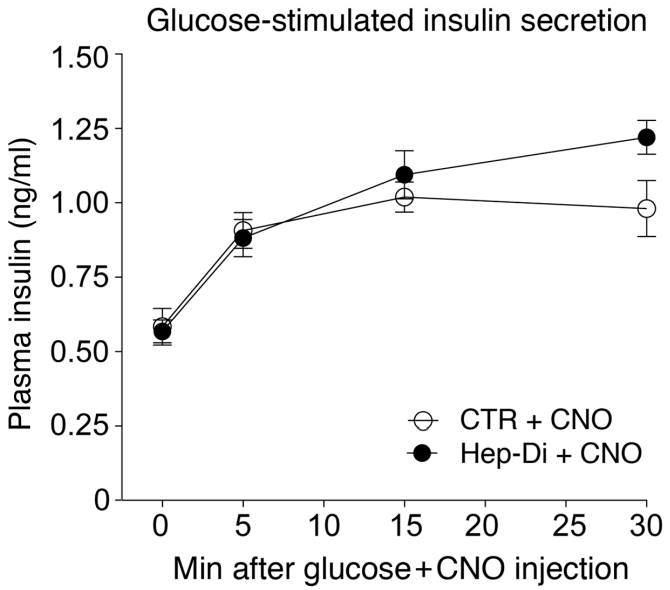
Mario Rossi, Lu Zhu, Sara M. McMillin, Sai Prasad Pydi, Shanu Jain, Lei Wang, Yinghong Cui, Regina J. Lee, Amanda H Cohen, Hideaki Kaneto, Morris J. Birnbaum, Yanling Ma, Yaron Rotman, Jie Liu, Travis J. Cyphert, Toren Finkel, Owen P. McGuinness, and Jürgen Wess



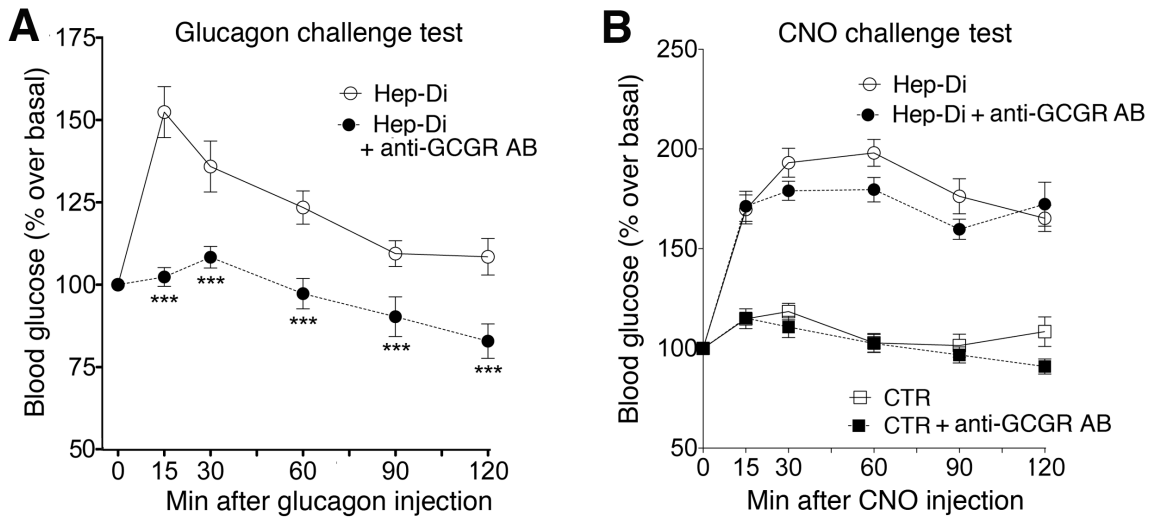
Supplemental Figure 1. Selective expression of the Di designer receptor in the liver of Hep-Di mice. (**A**) RT-PCR studies. RNA was isolated from the liver and various other tissues of Hep-Di mice and subjected to RT-PCR analysis using Di-specific primers. Note that the Di transcript was detectable only with liver RNA. WAT, white adipose tissue; Skel. mus., skeletal muscle. (**B**) [^{3}H]-NMS binding studies. To determine hepatic Di receptor densities, liver membranes from Hep-Di mice were subjected to [^{3}H]-NMS binding studies. The saturation binding curve shown is representative of three independent experiments. Livers were harvested two weeks after treatment of mice with the AAV-TBG-Di virus. Saturation binding data were analyzed using Prism 4.0 software (GraphPad Software).



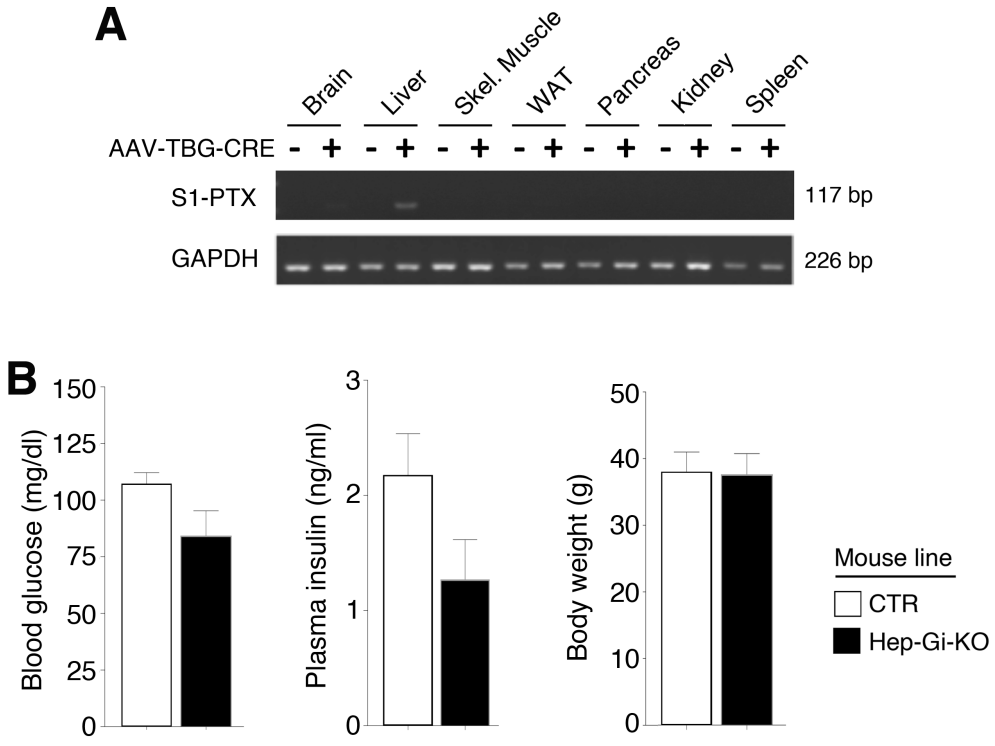
Supplemental Figure 2. Functional studies with Hep-Di and control primary hepatocytes. (**A, B**) cAMP assays. Hep-Di (A) or control (B) primary hepatocytes were treated with increasing concentrations of glucagon, either in the absence or presence of CNO (10 μM). Changes in intracellular cAMP levels were determined as described in detail under Methods. (**C**) Determination of intracellular Ca^{2+} levels ($[Ca^{2+}]_i$). Primary Hep-Di hepatocytes were incubated with increasing concentrations of CNO or arginine vasopressin (AVP), followed by the monitoring of $[Ca^{2+}]_i$ levels. Changes in $[Ca^{2+}]_i$ were determined via the use of FLIPR technology (for details, see Methods). While CNO had no effect on $[Ca^{2+}]_i$ levels, AVP caused a pronounced increase in $[Ca^{2+}]_i$ via activation of endogenous V_1 vasopressin receptors (1). Data represent means ± SEM from two to four independent experiments. *, $p<0.05$, **, $p<0.01$, as compared to the corresponding control value (two-tailed Student's t-test).



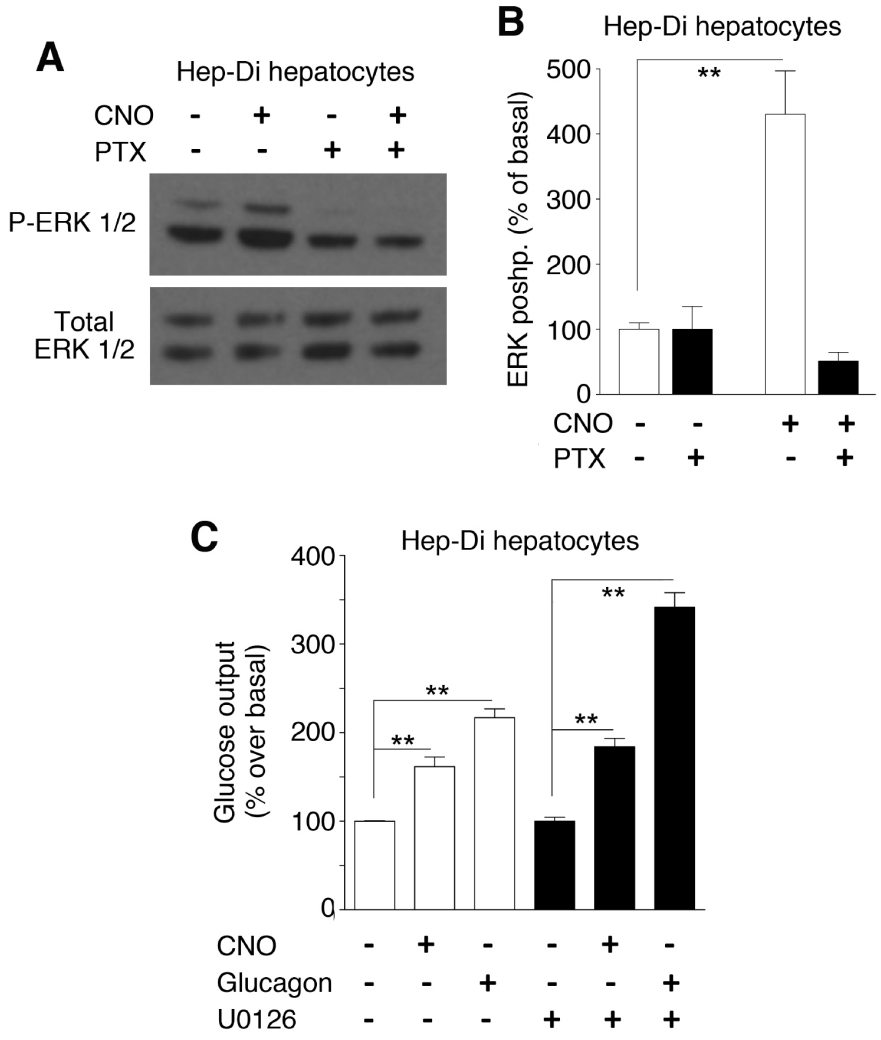
Supplemental Figure 3. CNO has no significant effect on glucose-stimulated insulin secretion (GSIS) in Hep-Di mice. Hep-Di and control mice (12-week-old males) were fasted overnight for ~12 hr and then co-injected with glucose (2 g/kg i.p.), and CNO (10 mg/kg i.p.). Blood samples were collected at the indicated time points, and plasma insulin levels were measured via ELISA. Data represent means ± SEM (5 or 6 mice per group).



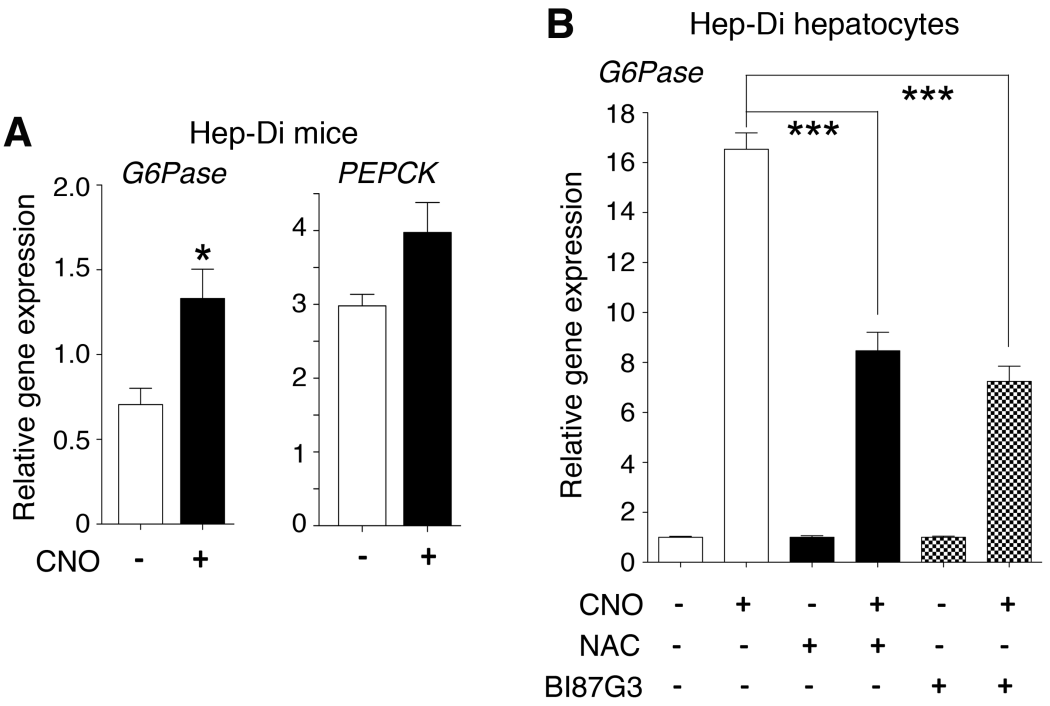
Supplemental Figure 4. In vivo studies with a glucagon receptor (GCGR) antibody. (**A**) The anti-GCGR antibody abolishes glucagon-mediated increases in Hep-Di mice. (**B**) The anti-GCGR antibody has no or only minor effects on CNO-mediated increases in blood glucose levels in Hep-Di mice. Hep-Di mice (11-week-old males) were injected with an anti-GCGR antibody (10 mg/kg i.p.; mAb7.v44; Genentech) (2) or vehicle 24 hr prior to treatment with glucagon (16 μg/kg i.p.) (A) or CNO (10 mg/kg i.p.) (B). Data are given as means ± SEM (7-10 mice per group). ***, $p<0.001$, as compared to the corresponding non-antibody-treated control group (A: two-tailed Student's t-test; B: two-way ANOVA followed by Bonferroni's post hoc test).



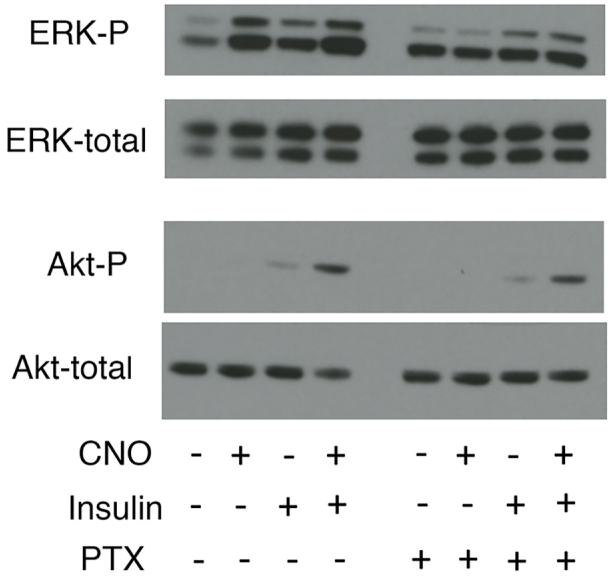
Supplemental Figure 5. Analysis of mice selectively expressing S1-PTX in the liver (hepatocytes; Hep-Gi-KO mice). (**A**) Treatment of *ROSA26*^{PTX} mice with the AAV-TBG-CRE virus leads to the liver-selective expression of PTX. RNA was isolated from the liver and various other tissues of *ROSA26*^{PTX} mice (3) treated with the AAV-TBG-CRE virus. RNA samples were then subjected to RT-PCR analysis using primers specific for the catalytic S1 subunit of PTX (S1-PTX), a known inhibitor of $G_{i/o}$ signaling. Note that the S1-PTX transcript was detectable only with liver RNA. WAT, white adipose tissue. (**B**) Blood glucose concentrations, plasma insulin levels, and body weight of Hep-Gi-KO and control mice (CTR) maintained on a HFD. Blood glucose and plasma insulin levels were measured after a ~12 hr fast. Data represent means ± SEM (6 male mice per group; age: ~14 weeks).



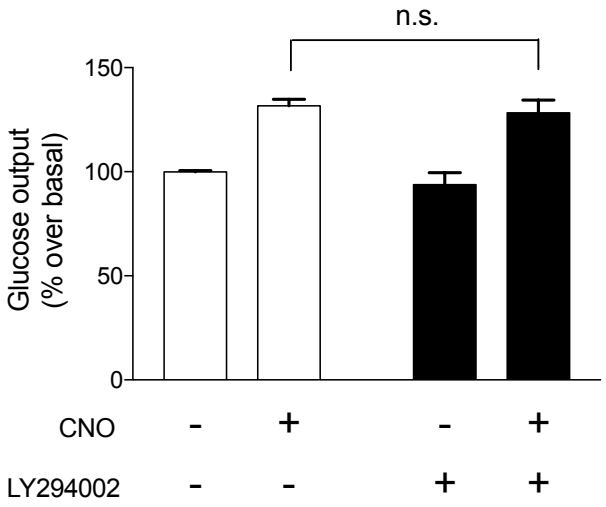
Supplemental Figure 6. CNO-stimulated ERK phosphorylation in Hep-Di hepatocytes. (**A**) CNO-stimulated ERK phosphorylation is PTX-sensitive. Western blotting studies showed that CNO (10 μM) treatment of Hep-Di hepatocytes led to a significant stimulation of ERK1/2 phosphorylation (a representative Western blot is shown). This effect was completely blocked in the presence of PTX (300 ng/ml), indicative of the involvement of G_i-type G proteins. (**B**) Quantification of Western blotting data shown in (A). Phospho-ERK1/2 expression levels were normalized by total ERK1/2 expression. (**C**) Glucose output assays with Hep-Di hepatocytes. Pretreatment of Hep-Di hepatocytes with U0126 (10 μM), a selective MEK inhibitor, had no significant effect on the ability of CNO (10 μM) or glucagon (100 nM) to stimulate glucose release from these cells. Data in (B) and (C) are means ± SEM of three independent experiments. **, $p<0.01$, ***, $p<0.001$, as compared to the corresponding control value (two-way ANOVA followed by Bonferroni's post hoc test).



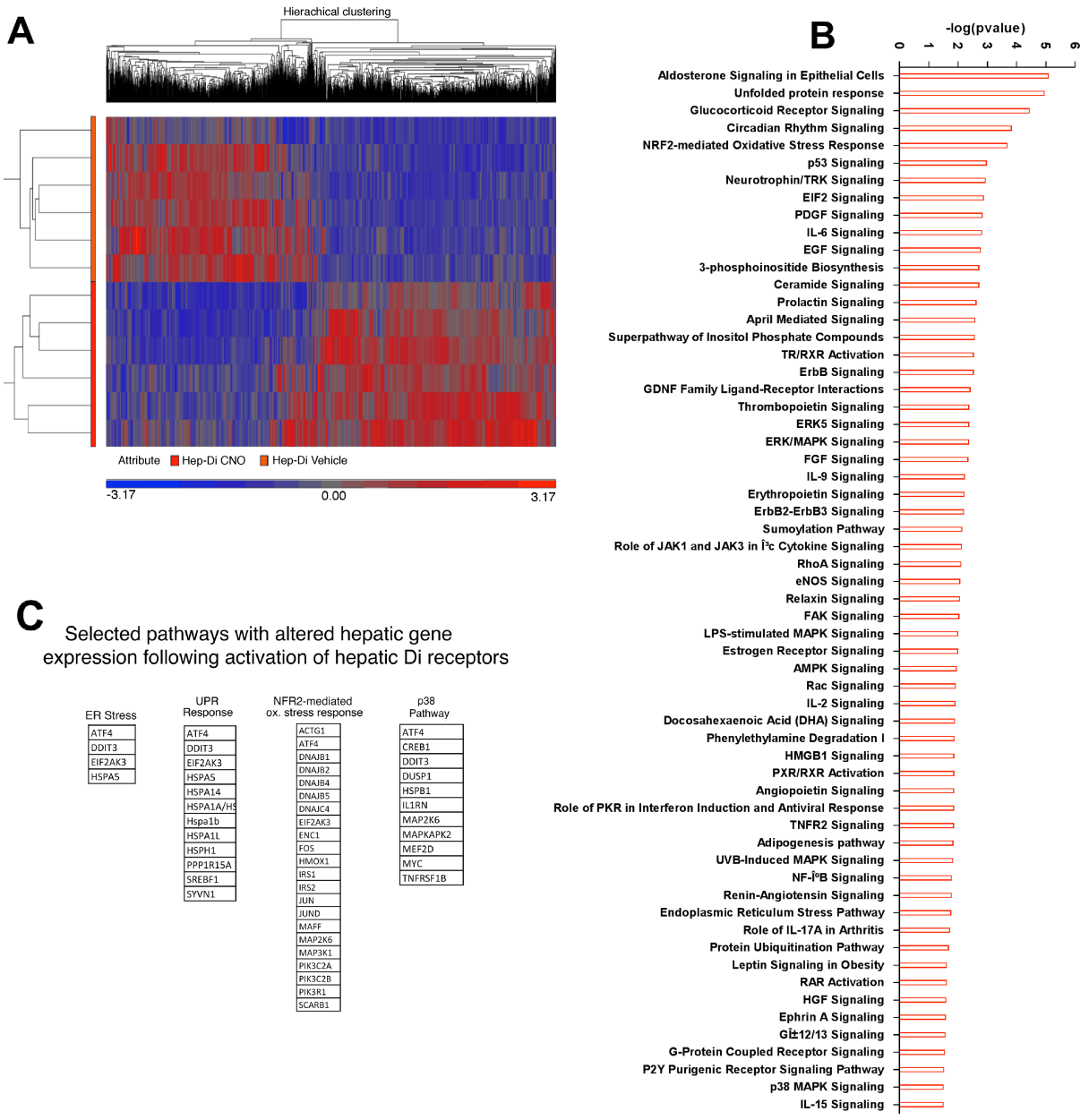
Supplemental Figure 7. Effect of hepatic Di signaling on *G6Pase* and *PEPCK* gene expression. (**A**) CNO treatment of Hep-Di mice. After an overnight fast, Hep-Di mice were injected with CNO (10 mg/kg i.p.) or saline (-), and liver samples were collected 1 hr later. *G6Pase* and *PEPCK* transcript levels were studied by qRT-PCR analysis of total liver RNA. Gene expression data were normalized relative to *β-actin* expression. (**B**) The Di-mediated increase in *G6Pase* expression is sensitive to treatment with NAC or inhibition of JNK. Primary Hep-Di hepatocytes were treated with NAC (5 mM) for 2 hr or BI87G3 (10 μM), a selective JNK inhibitor, for ~12 hr, respectively, and then stimulated with CNO (10 μM) for 3 hr. Subsequently, qRT-PCR studies were carried out with *G6Pase*-specific primers. Data are given as means ± SEM of three independent experiments (3 mice per group). *, $p<0.05$, ***, $p<0.001$, as compared to the corresponding control value (A: two-tailed Student's t-test; B: two-way ANOVA followed by Bonferroni's post hoc test).



Supplemental Figure 8. Insulin-induced ERK and Akt phosphorylation is not impaired by simultaneous activation of the Di DREADD in hep-Di hepatocytes. Isolated primary Hep-Di hepatocytes were incubated for 2 hr with glucose-free DMEM either in the presence of absence of PTX (300 ng/ml). Cells were then stimulated with 10 nM insulin and/or 10 uM CNO for 10 min with or without PTX. Subsequently, cell lysates were subjected to immunoblotting studies using the indicated antibodies. The Western blots shown are representative of three independent experiments. Importantly, co-stimulation of hep-Di hepatocytes with CNO did not reduce insulin-induced ERK and Akt phosphorylation (Akt position Ser473). In fact, insulin-stimulated Akt phosphorylation was increased in the presence of CNO.

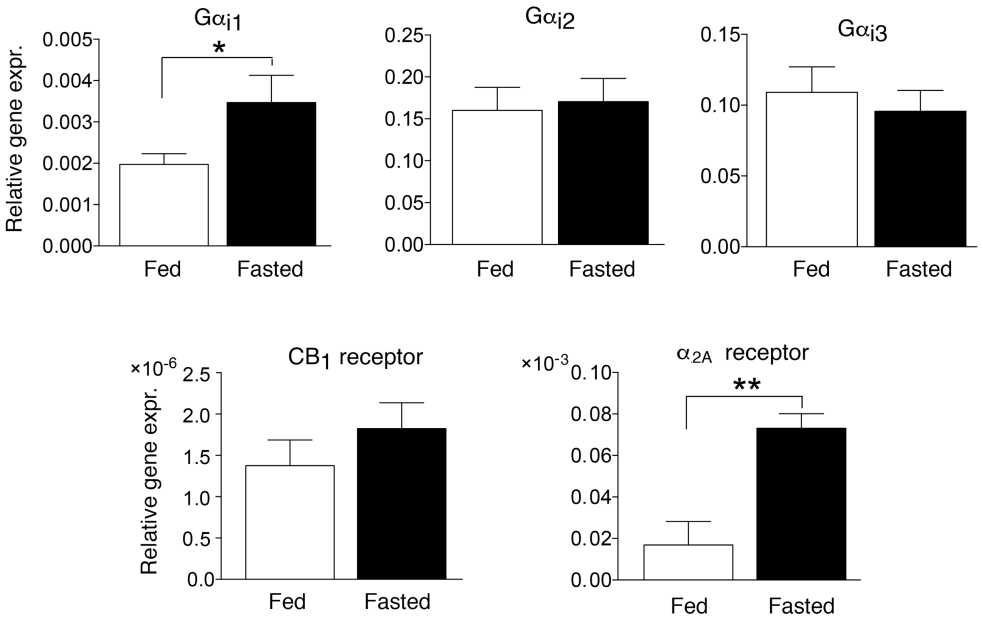


Supplemental Figure 9. A selective PI3K inhibitor has no effect on CNO-induced glucose production in Hep-Di hepatocytes. The ability of CNO (10 μM) to stimulate glucose release from primary Hep-Di hepatocytes was examined. Experiments were carried out either in the presence or absence of LY294002 (20 μM), a selective PI3K inhibitor. Data represent means ± SEM from three independent experiments. n.s., no statistically significant difference (two-way ANOVA followed by Bonferroni's post hoc test).

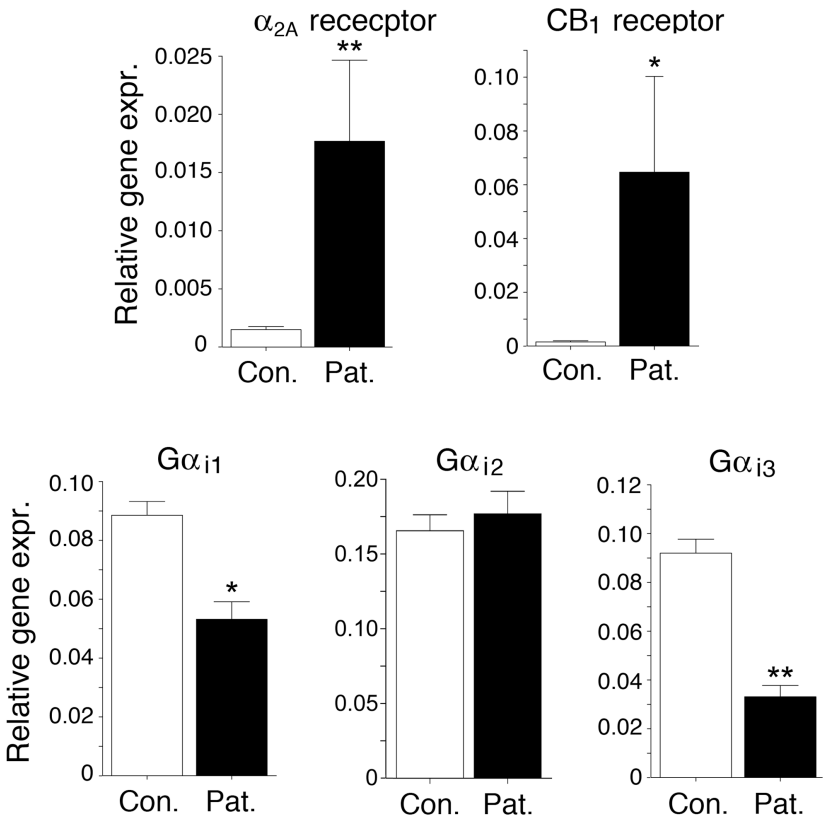


Supplemental Figure 10. Altered hepatic gene expression after CNO treatment Hep-Di mice. (A) Heat map showing hierarchical clustering of differentially expressed genes between liver from vehicle- or CNO-treated Hep-Di mice (n=6/group). Color gradation from blue to red indicates relative increase in gene expression. **(B)** Pathway enrichment analysis depicts the top 60 regulated pathways (p-value <0.05). **(C)** Selected pathways relevant to the outcome of the present study indicating differentially expressed genes. RNA was extracted from livers of 12-week-old male Hep-Di mice 30 min after i.p. injection of either vehicle (saline) or CNO (10 mg/kg) (6 mice per group). RNA quality

was assessed by the Agilent 2100 Bioanalyzer System. RNAs with RIN >9 were used to prepare transcriptome libraries using the NEBNext Ultra RNA Library Prep Kit for Illumina according to the manufacturer's protocol starting with 1 μg of total RNA per library. High throughput sequencing was done at the NIDDK Genomic Core Facility (NIH, Bethesda, MD). We obtained 25-30 M reads per library. The reads were processed using Genomatix Genome Analyzer. Differentially expressed genes were identified using EdgeR with log2 (fold change) cutoff of ± 0.58. Partek Genomics Suite software was used for hierarchical clustering and generation of graphs.



Supplemental Figure 11. Upregulation of $G\alpha_i$ and α_{2A}-adrenergic receptor transcript levels in fasted mice. Gene expression analysis of liver RNA prepared from WT mice that had free access to food (fed) or which had been fasted for 16 hr (fasted) (12-week-old males). Transcript levels for two G_i-coupled receptors (α_{2A}-adrenergic and CB_1 cannabinoid receptor) and the three $G\alpha_i$ subunits were determined via qRT-PCR. Gene expression levels are expressed relative to *β-actin* transcript levels (internal control). Data represent means ± SEM (n=10 per group). *, $p<0.05$, **, $p<0.01$ (two-tailed Student's t-test).



Supplemental Figure 12. Gene expression analysis of liver RNA prepared from NASH patients (Pat.) and healthy control subjects (Con.). Transcript levels for two G_i-coupled receptors (α_{2A}-adrenergic and CB_1 cannabinoid receptor) (top row) and the three $G\alpha_i$ subtypes (bottom row) were determined via qRT-PCR. Gene expression levels are expressed relative to *β-ACTIN* transcript levels (internal control). Data represent means ± SEM. Liver RNAs from 15 NASH patients and 5 healthy controls were analyzed. *, $p<0.05$, **, $p<0.01$, as compared to the corresponding control group (Mann-Whitney test).

Table 1. Summary of primers used for RT-PCR experiments

Gene Target	Species	Primer sequence	Amplicon (bp)	Usage
Actb (β-actin)	mouse	QuantiTect Primer (Qiagen) Cat. # QT01136772	77	qRT-PCR
Actb (β-actin)	mouse	Forward: 5' GATATCGCTGCGCTGGTCGTC Reverse: 5' ACGCAGCTCATTGTAGAAGGTGTGG	276	RT-PCR
ACTB (β-actin)	human	QuantiTect Primer (Qiagen) Cat. # QT00095431	146	qRT-PCR
CNR1 (CB_1 receptor)	human	QuantiTect Primer (Qiagen) Cat. # QT00203287	103	qRT-PCR
CNR1 (CB_1 receptor)	mouse	QuantiTect Primer (Qiagen) Cat. # QT00115395	137	qRT-PCR
ADRA2A (α_{2A} receptor)	human	QuantiTect Primer (Qiagen) Cat. # QT00211967	65	qRT-PCR
adra2a (α_{2A} receptor)	mouse	QuantiTect Primer (Qiagen) Cat. # QT00287063	60	qRT-PCR
GNAI1 ($G\alpha i_1$)	human	QuantiTect Primer (Qiagen) Cat. # QT00023555	86	qRT-PCR
gnai1 ($G\alpha i_1$)	mouse	QuantiTect Primer (Qiagen) Cat. # QT00283997	69	qRT-PCR
GNAI2 ($G\alpha i_2$)	human	QuantiTect Primer (Qiagen) Cat. # QT00013419	168	qRT-PCR
gnai2 ($G\alpha i_2$)	mouse	QuantiTect Primer (Qiagen) Cat. # QT00140469	131	qRT-PCR
GNAI3 ($G\alpha i_3$)	human	QuantiTect Primer (Qiagen) Cat. # QT00012509	109	qRT-PCR
gnai3 ($G\alpha i_3$)	mouse	QuantiTect Primer (Qiagen) Cat. # QT01062278	109	qRT-PCR
G6pase	human	QuantiTect Primer (Qiagen) Cat. # QT00031913	101	qRT-PCR
G6pase	mouse	QuantiTect Primer (Qiagen) Cat. # QT00114625	99	qRT-PCR

PEPCK	human	QuantiTect Primer (Qiagen) Cat. # QT00001197	97	qRT-PCR
Pepck	mouse	QuantiTect Primer (Qiagen) Cat. # QT00153013	93	qRT-PCR
Di (hM4Di)	_	Forward: 5' GTACCCATACGATGTTCCAGATTAC Reverse: 5' GCCCGAGCTGCCATT	64	RT-PCR
Di (hM4Di)	_	Forward: 5' GTACCCATACGATGTTCCAG Reverse: 5' GCTGATGATGAGAAGGTTC	409	RT-PCR
S1-PTX	_	Forward: 5' GGTCTATCTCGAACATCGCA Reverse: 5' GCGCCGTAGAAATTGTTGT	117	RT-PCR
Gapdh	mouse	Forward: 5' ACAGTCCATGCCATCACTGCC Reverse: 5' GCCTGCTTCACCACCTTCTTG	266	RT-PCR

Supplemental Table 2. Characteristic features of NASH patients from which liver biopsy samples were obtained

Age [years]	45±3
Male Gender [n, %]	6 (40%)
BMI [kg/m^2]	31.3±1.6
ALT (median, range) [U/L]	50 (20-282)
HOMA-IR	4.4±0.9
Insulin resistant[1] [n, %]	14 (93%)
Histological Liver Fat Score (median, range)[2]	2 (1-3)
NAFLD Activity Score (NAS) (median, range)[2]	5 (3-7)

Age, BMI, and HOMA-IR are given as means±SEM (n=15).

[1]Insulin resistance assessed by HOMA-IR>2 or abnormal oral glucose tolerance test.

[2]Scored according to (4).

BMI, body mass index; ALT, Alanine aminotransferase; HOMA-IR, Homeostasis model assessment-estimated insulin resistance; NAFLD, Nonalcoholic fatty liver disease.

Supplemental Table 3. Differential hepatic gene expression after CNO or saline (control) treatment of Hep-Di mice

RNA was extracted from livers of 12-week-old male Hep-Di mice 30 min after i.p. injection of either vehicle (saline) or CNO (10 mg/kg) (6 mice per group). For details, regarding the RNA-seq analysis, see the legend to Supplemental Figure 10.

Gene Id	Symbol	Mean log2(fold change) of reg. trans.	p-value
18124	Nr4a3	5.908	2.65E-142
74361	4931429L15Rik	5.477	1.03E-05
242646	Tctex1d4	5.061	8.92E-19
212753	Gm4779	4.965	4.87E-03
15370	Nr4a1	4.784	9.60E-82
78611	Btbd19	4.521	4.52E-19
76487	Ppp1r3g	4.299	1.85E-46
239833	Lmln	4.268	3.09E-03
83770	Tas1r2	4.086	1.63E-06
18227	Nr4a2	4.074	4.28E-42
18933	Prrx1	4.058	9.85E-03
14419	Gal	3.962	4.06E-02
272322	Arntl2	3.941	1.71E-02
442815	A230065C20Rik	3.768	1.21E-03
18218	Dusp8	3.462	1.10E-83
21930	Tnfaip6	3.405	2.14E-10
69743	Casz1	3.299	4.75E-03
12457	Ccrn4l	3.207	8.32E-28
433940	BC057022	3.196	2.43E-75
11910	Atf3	3.125	1.75E-38
76021	5830418L09Rik	3.028	2.59E-02
102747	Lrrc49	3.02	3.51E-02
17691	Sik1	3.003	3.95E-50
260423	Hist1h3f	2.929	3.07E-02
319765	Igf2bp2	2.927	2.90E-02
68815	Btbd10	2.922	3.38E-02
19207	Ptch2	2.922	2.65E-04
63873	Trpv4	2.886	9.07E-28
100504746	LOC100504746	2.818	4.52E-02
17153	Mal	2.818	4.52E-02
100044656	LOC100044656	2.771	1.02E-05
19283	Ptprz1	2.73	6.85E-04
97440	B3gnt9-ps	2.717	8.60E-03

268958	Capn11	2.698	3.76E-02
12950	Hapln1	2.695	2.35E-13
74211	1700017B05Rik	2.667	1.28E-31
231253	9130230L23Rik	2.657	8.13E-03
58864	Tssk3	2.638	1.46E-02
224813	Gm88	2.63	8.64E-04
19701	Ren1	2.617	1.68E-05
12795	Plk3	2.616	8.51E-52
54720	Rcan1	2.573	4.54E-36
11754	Aoc3	2.564	1.56E-03
18787	Serpine1	2.473	3.91E-24
434310	AY512931	2.471	4.07E-02
109934	Abr	2.47	4.11E-02
16904	Gzmm	2.383	2.52E-04
16768	Lag3	2.358	8.44E-04
14313	Fst	2.335	1.87E-27
19817	Rn7sk	2.287	5.88E-03
625424	Gm6583	2.282	8.05E-03
57754	Cend1	2.268	1.33E-08
76982	3110035E14Rik	2.252	1.27E-02
72315	Ccdc74a	2.231	9.02E-06
100340	Smpdl3b	2.191	4.22E-02
11811	Apobec2	2.188	3.66E-02
100503103	LOC100503103	2.188	3.66E-02
434232	Iqck	2.171	6.69E-05
100009600	Zglp1	2.165	6.51E-03
791271	Gm9981	2.153	1.05E-06
234129	Tpte	2.15	2.59E-17
76937	2810429I04Rik	2.119	8.57E-03
100504377	LOC100504377	2.113	1.24E-02
80885	Niacr1	2.099	1.94E-05
100504458	LOC100504458	2.076	2.39E-02
71874	2310007B03Rik	2.069	3.00E-03
11495	Adam2	2.068	5.64E-05
68797	Pdgfrl	2.054	1.74E-02
245469	Pdzd4	2.039	2.22E-06
15368	Hmox1	2.034	4.14E-27
100504392	LOC100504392	2.027	1.23E-03
171388	Bnipl	2.014	1.13E-02
74251	Ankrd9	1.986	1.65E-16
624219	Gm6484	1.976	2.56E-07
100503297	LOC100503297	1.958	6.71E-03

19275	Ptprn	1.945	5.91E-03
11567	Avil	1.942	4.12E-05
319840	A130040G06Rik	1.926	9.90E-03
65112	Pmepa1	1.913	1.26E-06
242443	Grin3a	1.906	8.50E-05
330956	Gm5122	1.887	8.97E-03
78384	2210420L05Rik	1.879	2.88E-21
384783	Irs2	1.853	1.17E-36
52040	Ppp1r10	1.832	9.65E-49
227731	Slc25a25	1.824	2.48E-11
76214	6430710M23Rik	1.816	2.38E-02
114602	Zmynd10	1.804	1.70E-03
74253	Klrg2	1.797	1.22E-05
19252	Dusp1	1.79	5.67E-19
69823	Fyttd1	1.757	3.37E-02
18578	Pde4b	1.748	3.28E-26
14569	Gdi2	1.727	1.79E-05
60345	Nrip2	1.723	2.43E-06
66626	5730403B10Rik	1.716	6.20E-08
20393	Sgk1	1.713	8.96E-15
73205	3110043O21Rik	1.712	3.17E-34
320292	Rasgef1b	1.712	1.19E-18
60599	Trp53inp1	1.681	9.09E-32
19017	Ppargc1a	1.675	5.50E-33
432530	Adcy1	1.674	5.32E-13
53868	Rab25	1.674	4.62E-02
217335	Fbf1	1.672	1.24E-21
112407	Egln3	1.669	9.74E-44
11931	Atp1b1	1.661	3.57E-21
100503645	LOC100503645	1.661	4.40E-02
552904	LOC552904	1.632	1.35E-02
73348	1700045H11Rik	1.629	3.03E-08
80733	Car15	1.627	1.01E-04
18025	Nfe2l3	1.627	1.53E-05
193034	Trpv1	1.621	5.38E-04
20387	Sftpa1	1.612	1.15E-13
19791	Rn18s	1.61	2.17E-03
330695	Ctxn1	1.607	1.33E-07
16854	Lgals3	1.606	2.95E-02
239096	Cdh24	1.597	3.39E-04
790964	LOC790964	1.593	2.22E-03
76524	Cln6	1.586	1.22E-02

227357	Espnl	1.566	3.58E-03
231327	Ppat	1.566	1.03E-100
230863	Sh2d5	1.561	1.02E-03
66550	2010109N18Rik	1.538	3.89E-03
16210	Impact	1.532	6.09E-51
243574	Kbtbd8	1.523	7.01E-17
97874	B430203I24Rik	1.519	2.63E-05
381798	4930590J08Rik	1.516	7.95E-03
60527	Fads3	1.511	1.59E-33
100504616	LOC100504616	1.506	1.03E-02
16658	Mafb	1.501	1.37E-17
233878	Sez6l2	1.496	1.56E-05
29870	Gtse1	1.491	2.84E-05
100503869	LOC100503869	1.484	5.50E-03
16476	Jun	1.482	2.09E-15
67876	Coq10b	1.481	4.28E-41
320068	E130006N16Rik	1.476	2.20E-04
74165	Fbxl22	1.475	1.55E-03
244886	AI118078	1.472	1.88E-02
12270	C4bp-ps1	1.47	2.65E-03
72313	Fryl	1.468	8.64E-03
56743	Lat2	1.463	3.40E-03
100313512	E330011M16Rik	1.462	3.60E-13
16506	Kcnd1	1.459	2.35E-03
77012	5730596P11Rik	1.454	8.52E-03
12816	Col12a1	1.449	2.72E-06
102436	Lars2	1.448	8.63E-04
76574	Mfsd2a	1.448	2.39E-20
230451	BC042782	1.443	4.49E-07
193740	Hspa1a	1.429	5.92E-06
18742	Pitx3	1.429	8.87E-06
18292	Sebox	1.422	2.59E-03
225870	Rin1	1.417	3.89E-03
665306	3930402G23Rik	1.408	5.78E-06
114565	Zfp295	1.407	3.79E-30
237940	Aoc2	1.404	3.72E-07
20482	Skil	1.402	1.21E-28
280667	Adam1b	1.392	3.74E-04
668009	Gm8923	1.39	3.24E-02
100503949	LOC100503949	1.39	3.24E-02
100504074	LOC100504074	1.39	3.24E-02
68955	Srrm4	1.384	9.99E-16

14012	Mpzl2	1.374	8.72E-03
14566	Gdf9	1.366	1.52E-02
100303735	7330403C04Rik	1.356	4.92E-06
233107	Kctd15	1.352	6.68E-20
16775	Lama4	1.343	3.91E-02
16006	Igfbp1	1.34	7.02E-06
59036	Dact1	1.332	1.48E-16
319670	Eml5	1.323	1.73E-02
234725	Zfp612	1.322	8.76E-30
213539	Bag2	1.321	2.45E-11
70460	2610306O10Rik	1.319	5.92E-03
94213	Ddx50	1.307	4.30E-02
140887	Lnx2	1.305	1.15E-37
15511	Hspa1b	1.301	2.66E-05
100503148	LOC100503148	1.295	1.58E-02
19696	Rel	1.293	3.57E-10
100503137	LOC100503137	1.288	1.61E-09
16527	Kcnk3	1.271	4.11E-02
74016	Phf19	1.27	1.53E-02
239591	Ttll8	1.269	6.88E-10
100037278	Fam129c	1.265	6.48E-03
13603	Opn3	1.265	9.07E-07
29816	Hip1r	1.263	7.81E-20
12519	Cd80	1.254	8.87E-03
21938	Tnfrsf1b	1.253	6.30E-29
56527	Mast1	1.249	1.65E-02
319803	A430090L17Rik	1.246	1.10E-02
100125339	A230020J21Rik	1.233	8.50E-03
228413	Prrg4	1.233	1.28E-04
319592	D030020J04Rik	1.232	1.11E-02
100502845	LOC100502845	1.229	1.01E-03
627110	Tubb2a-ps2	1.221	4.29E-09
100503822	LOC100503822	1.218	2.81E-03
52325	D7Ertd413e	1.216	2.42E-02
100504152	LOC100504152	1.21	2.53E-03
71275	4933437F05Rik	1.206	7.98E-03
104103	Airn	1.206	1.62E-03
12448	Ccne2	1.203	1.58E-09
22249	Unc13b	1.203	1.67E-02
20519	Slc22a3	1.202	1.93E-20
30935	Tor3a	1.201	7.06E-11
14281	Fos	1.2	1.12E-02

74197	Gtf2e1	1.198	2.12E-33
77570	3930401B19Rik	1.196	7.21E-12
18626	Per1	1.194	6.17E-28
52864	Slx4	1.188	3.58E-02
17771	Mtl5	1.183	1.71E-03
106298	Rrn3	1.177	9.34E-04
240396	Mex3c	1.171	9.97E-09
75580	Zbtb4	1.171	1.68E-03
12418	Cbx4	1.163	1.17E-21
102115	Dohh	1.162	1.64E-02
552909	LOC552909	1.162	5.42E-03
319967	9630019E01Rik	1.161	2.29E-02
70699	Nup205	1.153	3.94E-02
53892	Ppm1d	1.152	5.42E-05
73665	2210037E17Rik	1.149	1.70E-05
11426	Macf1	1.148	4.18E-02
213236	Dnd1	1.146	1.44E-04
18131	Notch3	1.146	3.29E-09
270152	Amica1	1.142	1.73E-02
22151	Tubb2a	1.142	1.55E-09
326618	Tpm4	1.138	4.97E-20
67760	Slc38a2	1.135	2.65E-10
320384	B230334L07Rik	1.125	1.57E-02
103784	Wdr92	1.125	2.34E-12
212439	AA986860	1.123	6.54E-11
72226	1700019L13Rik	1.117	1.24E-02
171567	Nme7	1.117	3.86E-18
227157	Mpp4	1.113	7.52E-03
13543	Dvl2	1.112	1.83E-02
629820	Gm7008	1.111	3.25E-12
75690	Vsig10l	1.102	5.60E-06
244421	Lonrf1	1.099	4.12E-24
67389	Fam132a	1.098	2.88E-04
67655	Ctdp1	1.096	2.81E-02
12912	Creb1	1.095	7.31E-03
404634	H2afy2	1.088	8.03E-04
15273	Hivep2	1.084	6.70E-07
71254	Naif1	1.082	3.44E-10
22256	Ung	1.076	6.20E-03
12648	Chd1	1.07	5.79E-36
22371	Vwf	1.068	3.47E-04
99681	Tchh	1.067	1.64E-03

665205	Gm14327	1.066	2.77E-04
619800	Gm6103	1.066	1.65E-04
18452	P4ha2	1.065	3.93E-03
667962	Gm8898	1.063	6.78E-14
15982	Ifrd1	1.06	7.00E-19
11538	Adnp	1.05	1.28E-02
69719	Cad	1.047	1.21E-03
13198	Ddit3	1.045	1.04E-14
100502684	LOC100502684	1.034	2.09E-02
76737	Creld2	1.032	1.27E-06
23856	Dido1	1.031	1.97E-50
17133	Maff	1.03	1.26E-04
17261	Mef2d	1.03	2.78E-35
17164	Mapkapk2	1.028	3.77E-40
320692	9430037G07Rik	1.02	3.53E-06
100019	Mdn1	1.017	5.04E-04
67143	Ikzf5	1.016	6.54E-05
22761	Zfpm1	1.015	4.94E-26
67102	D16Ertd472e	1.013	2.63E-15
71311	4933428L12Rik	1.012	4.39E-02
629777	Gm11458	1.011	1.20E-02
101631	Pwwp2b	1.006	7.31E-07
403343	130004C03	1.005	3.22E-02
12227	Btg2	1.005	4.42E-09
227634	Camsap1	0.999	7.39E-06
78287	Zfyve20	0.997	1.59E-02
12916	Crem	0.995	7.15E-25
100504538	LOC100504538	0.993	3.23E-02
280668	Adam1a	0.99	4.56E-04
100504211	LOC100504211	0.99	1.39E-02
55942	Sertad1	0.985	6.18E-11
67035	Dnajb4	0.983	9.36E-27
232566	Amn1	0.978	1.14E-03
243813	Leng9	0.977	8.38E-19
231474	Paqr3	0.976	2.27E-18
110957	D1Pas1	0.975	4.62E-03
226169	Pprc1	0.975	1.25E-19
791299	Gm10069	0.974	4.52E-02
73674	Wdr75	0.974	1.67E-02
232341	Wnk1	0.973	7.19E-03
66656	Eef1d	0.972	3.91E-02
77439	9530025L08Rik	0.97	2.45E-02

66705	Dnase1l2	0.966	1.63E-03
327987	Med13	0.965	1.19E-02
109263	Rlf	0.965	2.28E-18
216516	Ccdc157	0.964	3.09E-16
100504208	LOC100504208	0.964	1.12E-04
328580	Tubgcp6	0.963	2.34E-02
544971	Bdp1	0.962	1.62E-02
16599	Klf3	0.962	1.14E-28
12125	Bcl2l11	0.959	3.87E-06
104015	Synj1	0.959	1.79E-02
228410	Cstf3	0.953	4.79E-02
329790	A630034I12Rik	0.952	3.30E-02
100503793	LOC100503793	0.949	4.50E-02
27397	Mrpl17	0.949	6.53E-03
20845	Star	0.949	1.66E-05
230126	Shb	0.948	1.23E-11
54610	Tbc1d8	0.948	3.32E-17
70422	Ints2	0.947	1.99E-03
239510	Phf20l1	0.947	1.79E-06
100503748	LOC100503748	0.945	1.05E-05
433667	Ankrd13c	0.944	6.09E-26
231866	Zfp12	0.942	2.96E-02
14377	G6pc	0.94	2.31E-08
77504	8030488J09Rik	0.935	2.40E-06
23872	Ets2	0.934	1.06E-20
51842	D2Ertd93e	0.933	2.19E-03
104681	Slc16a6	0.932	1.54E-07
68684	1110035D15Rik	0.931	2.46E-04
68267	Slc25a22	0.931	2.16E-15
16478	Jund	0.93	2.25E-21
219132	D14Ertd668e	0.926	1.39E-02
212632	Iffo2	0.923	1.32E-04
20375	Sfpi1	0.923	1.57E-02
100503726	LOC100503726	0.92	1.64E-04
100043126	Gm4245	0.916	2.21E-05
17245	Mdm1	0.916	3.07E-02
53881	Slc5a3	0.916	1.35E-02
382686	3110053B16Rik	0.913	5.63E-05
100048447	LOC100048447	0.913	2.13E-02
73750	Whrn	0.912	3.76E-02
545490	6230416C02Rik	0.911	2.11E-04
229603	Otud7b	0.911	3.32E-07

27261	Dok3	0.91	2.62E-04
100303737	Gm11175	0.91	1.43E-17
26401	Map3k1	0.909	9.60E-03
17190	Mbd1	0.909	4.15E-17
13929	Amz2	0.908	7.14E-05
626877	Gm14405	0.908	2.02E-15
319496	6030432P03Rik	0.905	2.37E-04
100494	Zfand2a	0.904	1.80E-17
18408	Slc25a15	0.903	2.29E-15
11465	Actg1	0.902	6.36E-12
18987	Pou2f2	0.902	1.54E-02
18627	Per2	0.901	2.10E-08
207932	Urb1	0.893	8.44E-03
100504048	LOC100504048	0.892	1.90E-06
263876	Spata2	0.892	3.88E-12
433520	Gm14403	0.89	7.23E-07
29810	Bag3	0.889	1.44E-16
70028	Dopey2	0.888	1.15E-04
432628	Mfsd2b	0.888	2.76E-03
76793	Snip1	0.888	2.42E-07
77300	Raph1	0.887	4.28E-21
67263	Zswim6	0.887	3.14E-02
56218	Patz1	0.886	4.20E-02
114714	Rad51c	0.886	1.13E-02
75695	Rilpl1	0.885	4.94E-02
381066	Zfp948	0.878	1.98E-02
17318	Mid1	0.877	4.17E-02
214601	Slc10a3	0.876	9.02E-10
106369	Ypel1	0.876	1.65E-03
67945	Rpl41	0.873	3.20E-05
100039940	Gm12715	0.872	8.64E-04
100503496	LOC100503496	0.87	1.11E-04
76626	Msi2	0.87	3.21E-02
232854	Zfp418	0.867	4.00E-05
22057	Tob1	0.865	2.90E-13
75547	Akap13	0.864	1.55E-20
23991	Cib1	0.864	9.16E-03
414086	9830144P21Rik	0.862	2.50E-12
63830	Kcnq1ot1	0.86	4.76E-08
319520	Dusp4	0.858	6.54E-06
381598	2610005L07Rik	0.857	3.93E-05
384382	A430108E01Rik	0.857	3.93E-05

270210	Zfp651	0.857	2.51E-02
100504231	LOC100504231	0.856	4.43E-05
229699	Slc16a4	0.856	8.87E-03
74352	Zfp84	0.856	3.88E-04
329165	Abi2	0.854	5.67E-10
15937	Ier3	0.854	1.67E-02
69116	Ubr4	0.854	1.23E-07
18766	Pkdrej	0.853	1.28E-07
70857	4921509J17Rik	0.852	3.87E-06
216850	Kdm6b	0.852	3.01E-19
100303732	Gm14431	0.85	2.41E-12
19720	Trim27	0.849	4.66E-02
70186	Fam162a	0.848	3.56E-15
100037262	Gm12359	0.848	8.99E-03
114249	Npnt	0.848	4.11E-02
14433	Gapdh	0.847	2.20E-04
207965	Mettl21d	0.846	1.62E-02
58804	Cdc42ep5	0.845	2.51E-02
100044742	LOC100044742	0.845	3.66E-17
218832	Polr3a	0.845	8.30E-03
78032	LOC78032	0.843	4.47E-06
67131	Acbd4	0.841	3.99E-02
229055	Zbtb10	0.839	1.38E-20
320184	Lrrc58	0.838	6.33E-08
14284	Fosl2	0.837	3.13E-09
16600	Klf4	0.836	1.68E-02
23947	Mid2	0.835	2.37E-03
100503659	Dos	0.834	9.18E-08
791357	Gm9982	0.833	2.56E-02
26942	Spag1	0.832	1.70E-02
53611	Vti1a	0.832	2.99E-02
100303734	Gm9817	0.83	3.05E-04
624685	Gm6521	0.829	2.33E-02
225631	Onecut2	0.829	1.79E-12
664799	Ctcfl	0.827	4.98E-07
104831	Ptpn23	0.826	5.85E-04
235380	Dmxl2	0.825	3.01E-02
18704	Pik3c2a	0.824	2.86E-06
20442	St3gal1	0.824	6.07E-17
319693	9130221J17Rik	0.823	3.75E-03
11504	Adamts1	0.823	7.88E-10
11702	Amd1	0.823	1.20E-08

654432	Gm7334	0.822	1.12E-02
72033	Tsc22d2	0.822	2.24E-12
66875	1200016B10Rik	0.82	4.72E-03
73692	2410089E03Rik	0.819	3.65E-04
100504603	LOC100504603	0.819	9.23E-11
244666	Gm505	0.818	2.11E-02
20498	Slc12a4	0.818	8.59E-03
269587	Epb4.1	0.817	2.06E-03
21887	Tle3	0.817	1.18E-03
15586	Hyal1	0.816	1.44E-03
78713	D530017H19Rik	0.815	3.04E-05
100503353	Gm14440	0.813	1.09E-08
53376	Usp2	0.813	3.67E-03
100382	AW011738	0.812	4.14E-04
77286	Nkrf	0.812	1.53E-10
327885	C030046G05	0.811	4.51E-12
338467	Morc3	0.811	1.53E-02
209760	Tmc7	0.811	1.58E-02
217869	Eif5	0.81	1.36E-09
13999	Gm14288	0.809	1.15E-08
71760	Agxt2l1	0.808	7.09E-10
20116	Rps8	0.808	2.59E-02
100503938	LOC100503938	0.807	1.28E-08
26384	Gnpda1	0.806	9.11E-17
22196	Ube2i	0.806	2.62E-03
791402	9230104M06Rik	0.805	1.56E-02
66964	Golt1b	0.803	2.65E-06
14312	Brd2	0.801	8.37E-22
192231	Hexim1	0.801	5.96E-23
103816	AI662461	0.798	1.52E-03
14156	Fen1	0.797	4.31E-02
217038	Mrm1	0.797	5.56E-04
74375	Gcc1	0.796	2.46E-15
77264	Zfp142	0.796	4.97E-14
19157	Cyth1	0.794	1.31E-20
20515	Slc20a1	0.794	4.04E-17
403187	Opa3	0.793	1.90E-03
12569	Cdk5r1	0.791	3.38E-02
14337	Ftl2	0.791	1.37E-02
226418	Yod1	0.791	1.02E-04
68837	Foxk2	0.789	1.66E-08
107939	Pom121	0.788	3.34E-04

234724	Tat	0.787	3.06E-04
70281	2310068J16Rik	0.786	1.13E-02
70769	Nolc1	0.786	3.65E-17
225929	Patl1	0.782	6.27E-03
101214	Tra2a	0.782	2.16E-09
20020	Polr2a	0.781	1.17E-06
227522	Rpp38	0.781	2.80E-02
98952	Fam102a	0.78	7.90E-09
236904	Klhl15	0.78	4.13E-04
54446	Nfat5	0.779	5.37E-03
66663	Uba5	0.777	1.93E-06
78816	Gmip	0.776	1.01E-06
73032	Ttc9b	0.775	3.55E-02
214162	Mll1	0.773	3.08E-03
100532	Rell1	0.773	3.16E-03
230753	Thrap3	0.772	2.51E-04
22184	Zrsr2	0.771	3.18E-02
73162	Otud3	0.767	2.35E-02
17765	Mtf2	0.766	5.00E-02
18003	Nedd9	0.765	4.57E-05
319719	4732471D19Rik	0.764	7.93E-05
53321	Cntnap1	0.764	3.34E-02
212127	2810046L04Rik	0.763	1.11E-03
235047	Zfp809	0.763	4.89E-18
67848	Ddx55	0.762	3.28E-07
18700	Piga	0.762	5.97E-10
69025	1500032P08Rik	0.761	4.75E-02
226442	Zfp281	0.76	7.10E-12
11840	Arf1	0.759	1.19E-03
19647	Rbbp6	0.759	1.17E-08
13666	Eif2ak3	0.758	2.55E-02
191578	Helq	0.758	3.56E-05
381022	Mll2	0.757	1.03E-09
19041	Ppl	0.757	1.56E-03
215418	Csrnp1	0.756	1.49E-13
14428	Galr2	0.755	4.20E-02
217194	Klhl11	0.755	1.50E-05
12051	Bcl3	0.754	8.80E-06
59014	Rrs1	0.754	1.98E-13
71673	Rnf215	0.752	2.38E-05
105559	Mbnl2	0.75	9.28E-13
72129	Pex13	0.749	2.19E-03

225743	Rnf165	0.749	4.98E-03
12455	Ccnt1	0.748	3.32E-03
76220	6530402F18Rik	0.746	3.26E-02
20893	Bhlhe40	0.746	2.12E-10
13424	Dync1h1	0.746	3.60E-05
16973	Lrp5	0.746	6.42E-03
218699	Pxk	0.746	6.34E-03
14794	Spsb2	0.745	6.22E-11
104027	Synpo	0.743	6.36E-07
98878	Ehd4	0.742	1.87E-02
195733	Grhl1	0.742	2.15E-02
74273	1700064E03Rik	0.74	1.35E-06
227624	B230208H17Rik	0.74	1.79E-10
20668	Sox13	0.74	9.22E-03
93736	Aff4	0.739	2.61E-05
270627	Taf1	0.739	6.99E-04
67886	Camsap1l1	0.738	1.72E-03
216877	Dhx33	0.738	4.12E-09
18415	Hspa4l	0.738	4.90E-13
18708	Pik3r1	0.738	3.20E-09
11988	Slc7a2	0.736	6.17E-05
216439	Agap2	0.733	4.51E-02
109674	Ampd2	0.731	2.12E-09
16404	Itga7	0.731	1.02E-03
105440	Kctd9	0.731	4.21E-02
75220	4930535I16Rik	0.73	3.26E-03
79555	BC005537	0.73	1.12E-05
14538	Gcnt2	0.729	2.92E-09
55946	Ap3m1	0.727	3.63E-06
19652	Rbm3	0.727	1.08E-05
72108	Ddhd2	0.726	5.32E-04
66967	Edem3	0.725	1.05E-05
101100	Ttll3	0.725	1.03E-02
108767	Pnrc1	0.723	1.43E-05
19243	Ptp4a1	0.723	1.07E-11
67846	Tmem39a	0.723	2.39E-02
76441	Daam2	0.721	5.86E-07
214150	Eif2c3	0.721	5.53E-03
56289	Rassf1	0.721	3.92E-11
230700	Foxj3	0.719	1.44E-02
100503512	LOC100503512	0.719	5.65E-04
100042165	BC005561	0.718	1.99E-15

14718	Got1	0.718	1.56E-04
15505	Hsph1	0.718	3.34E-08
76030	5830433I10Rik	0.717	3.37E-02
100043431	Gm4430	0.717	9.24E-04
16891	Lipg	0.717	4.63E-02
68277	2310057M21Rik	0.716	9.30E-06
15270	H2afx	0.716	1.61E-09
331392	Gm5124	0.715	7.19E-04
232334	Vgll4	0.715	7.10E-12
30877	Gnl3	0.714	5.12E-13
26556	Homer1	0.714	1.80E-03
57259	Tob2	0.713	1.63E-07
104662	Tsr1	0.713	8.01E-09
170644	Ubn1	0.712	1.71E-05
54139	Irf6	0.711	2.00E-07
442825	A230083G16Rik	0.71	8.24E-04
12282	Hyou1	0.71	4.20E-07
17769	Mthfr	0.71	2.44E-05
319801	9630033F20Rik	0.709	3.53E-08
14236	Foxn2	0.709	4.70E-03
217344	Rhbdf2	0.709	1.66E-10
100271841	Uckl1os	0.709	2.82E-02
52808	Tspyl2	0.708	1.85E-03
16911	Lmo4	0.707	1.07E-09
56692	Lamtor3	0.706	4.33E-02
75957	Mir17hg	0.706	1.12E-04
74737	Pcf11	0.706	6.03E-09
57444	Isg20	0.705	2.91E-03
223770	Brd1	0.704	4.70E-02
320391	D930017J03Rik	0.704	4.14E-02
68926	Ubap2	0.704	1.45E-02
78040	4930550L05Rik	0.702	5.48E-03
76800	Usp42	0.702	8.21E-03
68564	Nufip2	0.701	8.95E-03
71971	Zswim1	0.701	4.08E-02
104445	Cdc42ep1	0.699	1.08E-02
223650	Eppk1	0.699	2.30E-04
230738	Zc3h12a	0.699	1.17E-05
78832	2700078E11Rik	0.698	1.25E-02
329554	Gm826	0.698	3.30E-03
228545	Vps18	0.698	1.21E-05
214253	Etnk2	0.697	6.78E-09

68533	Mphosph6	0.695	1.23E-02
74718	Snx16	0.694	5.05E-05
330189	Tmem120b	0.694	1.01E-02
100041585	Amd2	0.693	1.44E-08
231999	Plekha8	0.693	1.63E-15
107513	Ssr1	0.693	7.63E-04
11611	Agxt	0.692	1.50E-10
21754	Tesk1	0.692	1.83E-03
77557	9330182L19Rik	0.691	1.76E-02
75869	Arl5b	0.691	5.06E-09
118445	Klf16	0.691	4.03E-03
320717	Pptc7	0.691	7.99E-05
75410	Wbp7	0.69	1.04E-03
14256	Flt3l	0.689	1.08E-03
74161	1300015D01Rik	0.688	4.46E-05
55935	Fnbp4	0.688	3.08E-08
230316	Megf9	0.687	1.37E-04
71711	Mus81	0.687	1.03E-02
72344	Usp36	0.687	2.15E-09
66498	Dda1	0.686	7.48E-09
26562	Ncdn	0.686	9.14E-09
29876	Clic4	0.685	2.55E-06
239528	Eif2c2	0.685	3.88E-02
16367	Irs1	0.685	3.11E-11
18451	P4ha1	0.685	5.43E-09
209446	Tcfe3	0.685	6.84E-13
76338	Rab2b	0.683	9.95E-05
227195	Ino80d	0.682	8.21E-04
67973	Mphosph10	0.682	2.81E-06
80913	Pum2	0.682	1.52E-02
211770	Trib1	0.682	1.33E-07
78818	5830407P18Rik	0.681	8.73E-03
56458	Foxo1	0.68	9.14E-09
208777	Sned1	0.68	2.47E-05
12228	Btg3	0.679	6.91E-03
192176	Flna	0.677	1.38E-02
229279	Hnrnpa3	0.677	2.24E-02
22142	Tuba1a	0.677	6.60E-04
170822	Usp33	0.677	3.44E-03
224440	Setd4	0.676	1.90E-02
97387	Strn4	0.676	1.09E-02
320800	9230112E08Rik	0.675	2.89E-04

19707	Reps1	0.675	4.64E-10
237782	Smcr8	0.675	1.35E-11
17428	Mnt	0.674	2.05E-05
22031	Traf3	0.674	9.36E-04
106200	Txndc11	0.672	9.28E-10
97112	Nmd3	0.671	1.04E-03
78246	Phf23	0.671	8.48E-03
75692	Nr2c2ap	0.67	8.35E-06
60406	Sap30	0.67	2.25E-03
442807	D630036G22Rik	0.669	2.61E-04
105734	Tigd5	0.668	2.59E-06
107999	Gtpbp6	0.667	1.73E-02
109045	6330564D18Rik	0.666	1.95E-04
67134	Nop56	0.666	1.74E-12
77805	Esco1	0.664	1.59E-02
57435	Plin4	0.664	6.70E-03
22687	Zfp259	0.664	1.21E-05
192657	Ell2	0.663	2.23E-11
217995	Heatr1	0.663	7.47E-03
108121	U2af1	0.663	1.06E-02
233057	Zfp940	0.663	2.23E-02
18640	Pfkfb2	0.662	7.52E-08
319876	Cobll1	0.661	1.47E-03
241624	Exd1	0.661	1.81E-06
101685	Spty2d1	0.661	7.19E-10
70790	Ubr5	0.661	1.31E-02
330192	Vps37b	0.661	2.79E-06
65247	Asb1	0.659	2.52E-05
54711	Plagl2	0.659	1.42E-09
56190	Rbm38	0.659	3.49E-04
74126	Syvn1	0.659	1.11E-05
101869	Unc45a	0.659	3.70E-09
70533	Btf3l4	0.658	3.78E-02
627788	Gm6788	0.658	2.12E-03
18087	Nktr	0.658	7.46E-03
271377	Zbtb11	0.657	1.04E-05
319266	A130010J15Rik	0.656	7.81E-08
11861	Arl4a	0.656	5.21E-07
215051	Bud13	0.656	7.70E-03
230848	Zbtb40	0.656	1.13E-02
77699	9030616G12Rik	0.655	3.74E-04
237459	Cdk17	0.654	3.68E-05

12952	Cry1	0.653	4.48E-05
83431	Ndel1	0.653	2.38E-02
654819	9930004E17Rik	0.652	4.14E-05
100503597	LOC100503597	0.652	2.78E-02
233789	Smg1	0.652	6.45E-03
237400	Mex3d	0.651	1.15E-03
67139	Mis12	0.649	3.40E-03
14828	Hspa5	0.648	1.33E-04
668253	Dleu2	0.647	3.38E-02
68222	Fam166a	0.647	5.46E-03
56812	Dnajb2	0.646	3.94E-07
58180	Hic2	0.646	1.53E-04
17764	Mtf1	0.646	8.14E-08
22763	Zfr	0.646	6.05E-03
217732	2310044G17Rik	0.645	1.85E-02
100504668	LOC100504668	0.644	4.52E-02
52118	Pvr	0.644	2.38E-04
11444	Chrnb2	0.643	1.08E-03
13649	Egfr	0.643	1.51E-05
213499	Fbxo42	0.642	4.06E-06
233033	Samd4b	0.642	8.58E-09
56706	Ccnl1	0.641	2.52E-02
56323	Dnajb5	0.641	2.23E-05
210146	Irgq	0.641	2.53E-04
109019	Obfc2a	0.641	1.06E-04
79264	Krit1	0.64	7.22E-05
12702	Socs3	0.64	2.20E-02
17872	Ppp1r15a	0.639	1.51E-04
20511	Slc1a2	0.639	6.05E-05
98267	Stk17b	0.639	2.66E-02
101471	Phrf1	0.638	1.26E-03
15507	Hspb1	0.637	7.84E-03
18720	Pip5k1a	0.637	4.40E-06
223773	Zbed4	0.637	6.70E-07
230125	Mcart1	0.636	3.03E-03
234797	6430548M08Rik	0.635	3.94E-02
217198	Plekhh3	0.635	2.54E-02
74192	Arpc5l	0.634	2.20E-02
11977	Atp7a	0.633	3.92E-02
56397	Morf4l2	0.633	7.67E-04
22224	Usp10	0.633	1.92E-02
22682	Zfand5	0.633	1.07E-02

68050	Akirin1	0.632	3.80E-09
12686	Elovl3	0.632	2.66E-04
18130	Ints6	0.632	6.23E-03
15519	Hsp90aa1	0.631	3.46E-06
67434	Ankrd33b	0.63	2.41E-06
228836	Dlgap4	0.63	1.15E-04
240753	Plekha6	0.63	1.03E-14
106894	Hmgxb3	0.629	6.40E-04
13205	Ddx3x	0.628	4.10E-12
20719	Serpinb6a	0.627	7.82E-03
110172	Slc35b1	0.627	8.19E-05
79560	Ublcp1	0.627	5.02E-04
14218	Sh3pxd2a	0.626	2.29E-02
78889	Wsb1	0.626	2.78E-02
667410	Gm8615	0.625	2.23E-02
81489	Dnajb1	0.624	4.57E-06
77938	Fam53b	0.624	1.61E-03
106740	LOC106740	0.624	3.68E-03
213053	Slc39a14	0.623	1.53E-05
54648	Ccdc120	0.622	3.26E-02
56209	Gde1	0.622	1.24E-10
207785	Csrnp2	0.621	3.01E-02
13446	Doc2a	0.621	8.21E-04
100503814	LOC100503814	0.621	4.81E-05
71592	Pogk	0.621	5.98E-05
227613	Tubb2c	0.621	1.08E-07
54375	Azin1	0.62	5.99E-05
235036	Ppan	0.62	8.48E-09
75985	Rab30	0.62	5.09E-03
57743	Sec61a2	0.62	4.55E-02
211948	Pde12	0.618	3.92E-12
319817	Rc3h2	0.618	5.35E-04
209815	Tbc1d25	0.618	1.23E-05
21854	Timm17a	0.618	2.99E-02
233058	Zfp420	0.618	6.32E-05
231876	Lmtk2	0.617	2.87E-04
224088	Atp13a3	0.616	2.10E-02
328162	Trmt61a	0.616	5.91E-03
225876	Kdm2a	0.615	4.59E-02
98910	Usp6nl	0.615	4.13E-08
71885	2310003H01Rik	0.614	7.69E-05
380912	Zfp395	0.613	4.97E-07

50790	Acsl4	0.612	1.59E-02
71865	Fbxo30	0.612	1.03E-11
170762	Nup155	0.612	1.35E-03
80288	Bcl9l	0.611	9.78E-07
103466	Nt5dc3	0.611	1.23E-08
244219	Zfp668	0.611	1.51E-03
66595	Aste1	0.61	2.94E-04
233651	Dchs1	0.61	2.34E-02
100502626	LOC100502626	0.609	3.56E-02
56274	Stk3	0.609	3.82E-02
73680	Zbtb8a	0.609	2.71E-03
22694	Zfp35	0.609	1.43E-02
27279	Tnfrsf12a	0.608	8.10E-06
11911	Atf4	0.607	1.03E-10
76650	Srxn1	0.607	1.01E-04
234734	Aars	0.606	1.73E-11
226551	AI848100	0.606	2.79E-02
56455	Dynll1	0.606	2.91E-03
100038443	9330195I24Rik	0.605	3.97E-04
380664	Lemd3	0.605	1.14E-04
55989	Nop58	0.605	8.84E-03
432855	Zfhx2as	0.605	1.84E-02
19326	Rab11b	0.604	9.04E-03
100503009	LOC100503009	0.603	5.07E-05
217316	Slc16a5	0.603	5.93E-03
108148	Galnt2	0.601	1.32E-02
21771	Cirh1a	0.6	1.48E-03
73545	1700094D03Rik	0.599	3.11E-03
16561	Kif1b	0.599	2.51E-03
19878	Rock2	0.599	4.71E-05
241322	Zbtb6	0.599	3.51E-04
675812	Zfp605	0.599	3.65E-02
319448	Fndc3a	0.598	1.61E-03
69863	Ttc39b	0.598	7.59E-04
329002	Zfp236	0.598	6.18E-06
57748	Jmy	0.597	8.95E-04
223775	Pim3	0.597	6.81E-05
320351	D230037D09Rik	0.596	1.41E-05
353204	Aldoart1	0.595	3.77E-06
319713	Ablim3	0.594	4.40E-04
100038565	Gm10871	0.593	1.17E-07
230734	Yrdc	0.593	1.15E-08

269966	Nup98	0.592	2.13E-02
108673	Ccdc86	0.591	3.45E-08
224250	Cldnd1	0.591	1.10E-06
19653	Rbm4	0.591	2.01E-02
627049	Zfp800	0.591	2.08E-03
234407	Glt25d1	0.59	4.06E-02
53414	Bysl	0.589	2.61E-07
67480	Cwc25	0.589	1.80E-04
12660	Chka	0.588	1.00E-02
80294	Pofut2	0.588	6.49E-07
353328	Muc6	0.587	6.36E-03
18113	Nnmt	0.587	7.26E-03
77688	9230104K21Rik	0.586	3.45E-02
319304	A730081D07Rik	0.585	2.62E-04
20333	Sec22b	0.585	1.36E-02
100503146	LOC100503146	0.584	3.11E-02
231630	Ficd	0.582	1.45E-07
16004	Igf2r	0.582	4.54E-02
237107	Gnl3l	0.581	3.22E-02
20926	Supt6h	0.581	3.26E-06
69236	2610034E01Rik	0.58	5.21E-05
15376	Foxa2	-0.581	9.15E-03
269604	Gpr157	-0.581	4.55E-02
269400	Rtel1	-0.581	1.75E-03
72180	Zfp661	-0.581	5.32E-03
72965	2900064B18Rik	-0.582	4.08E-02
74080	Nmnat3	-0.583	3.56E-03
100040608	Fancf	-0.584	1.55E-02
228730	Plk1s1	-0.584	3.10E-02
70605	Zdhhc24	-0.584	3.37E-03
105185	D130076G13Rik	-0.585	3.78E-03
67035	Dnajb4	-0.585	3.24E-02
76850	Eif2c4	-0.585	1.44E-04
100191074	Gm10374	-0.586	2.17E-02
216198	Tcp11l2	-0.587	6.38E-05
94089	Trim7	-0.587	1.21E-02
71508	Zfp935	-0.587	8.13E-05
211896	Depdc7	-0.588	8.06E-03
66358	2310004I24Rik	-0.59	7.62E-04
72281	Sh2d4a	-0.59	2.59E-02
320965	4831440E17Rik	-0.591	5.09E-03
66787	4933433P14Rik	-0.591	2.60E-06

66197	Cks2	-0.591	2.22E-06
20776	Tmie	-0.591	1.29E-02
228880	Zmynd8	-0.591	1.54E-02
69876	Thap3	-0.592	2.59E-02
408062	Zfp873	-0.593	3.88E-03
18035	Nfkbia	-0.594	6.70E-07
227099	Pms1	-0.594	1.63E-02
101113	Snx21	-0.594	7.58E-03
20787	Srebf1	-0.594	2.13E-02
214137	Arhgap29	-0.595	2.28E-07
74359	4931414P19Rik	-0.596	8.40E-03
26410	Map3k8	-0.596	1.82E-02
226352	Epb4.1l5	-0.597	1.83E-03
14885	Gtf2h4	-0.597	4.07E-02
16415	Itgb2l	-0.598	4.92E-02
382793	Mtx3	-0.601	7.21E-10
71137	Rfx4	-0.601	1.88E-03
19300	Abcd4	-0.602	1.22E-05
13803	Enc1	-0.602	8.25E-03
72194	Fbxl20	-0.602	1.06E-05
56632	Sphk2	-0.602	1.11E-05
27369	Dguok	-0.603	3.45E-03
19335	Rab23	-0.603	1.38E-05
24055	Sh3bp2	-0.603	8.72E-05
72128	2610008E11Rik	-0.604	8.55E-08
69585	Hfe2	-0.604	1.98E-10
381280	Hjurp	-0.604	1.05E-16
234214	Sorbs2	-0.604	5.49E-03
71983	Tmco6	-0.604	4.11E-02
69755	2410022M11Rik	-0.605	7.23E-03
381148	Gm1614	-0.606	3.00E-05
18803	Plcg1	-0.606	3.40E-03
75541	1700019G17Rik	-0.607	7.07E-03
235386	Agphd1	-0.607	5.13E-16
320374	7530414M10Rik	-0.608	1.83E-03
52468	Ctdsp2	-0.609	3.01E-13
19286	Pts	-0.609	3.09E-07
19364	Rad51l3	-0.609	3.85E-11
100503842	LOC100503842	-0.61	5.25E-03
234723	Txnl4b	-0.61	2.31E-02
100041734	4930522L14Rik	-0.611	3.01E-02
22033	Traf5	-0.611	1.72E-02

100637	N4bp2l1	-0.612	2.91E-03
387314	Tmtc1	-0.612	1.05E-02
380753	Atxn7l1	-0.614	6.09E-07
240174	Thada	-0.614	6.24E-04
71769	Bbs10	-0.615	1.04E-04
57431	Dnajc4	-0.615	1.14E-02
209176	Ido2	-0.615	1.45E-08
217262	Abca9	-0.616	9.24E-03
68114	Mum1	-0.618	5.53E-03
97775	D930048N14Rik	-0.62	5.08E-04
100504527	LOC100504527	-0.621	1.11E-02
224630	Bnip1	-0.622	2.51E-03
268395	Mpg	-0.622	1.77E-05
240752	Pik3c2b	-0.623	2.13E-08
230837	Asap3	-0.624	3.27E-04
320398	Lrig3	-0.625	3.29E-03
12927	Bcar1	-0.627	1.27E-05
100503860	LOC100503860	-0.627	2.47E-05
66765	4933411K16Rik	-0.628	4.47E-04
229593	Golph3l	-0.629	4.52E-04
13097	Cyp2c38	-0.631	3.37E-03
212427	A730008H23Rik	-0.632	1.46E-15
329977	Fhad1	-0.632	4.87E-02
66578	2610039C10Rik	-0.633	4.66E-02
11855	Arhgap5	-0.634	1.39E-02
67432	Hoga1	-0.634	6.19E-04
50776	Polg2	-0.634	3.42E-07
73827	1110012D08Rik	-0.635	8.28E-03
14786	Grb7	-0.635	5.35E-14
84112	Sucnr1	-0.637	1.66E-05
70484	Slc35d2	-0.638	3.27E-10
67647	4930523C07Rik	-0.639	3.00E-03
75665	Ccdc64	-0.64	1.66E-02
433281	Gm5524	-0.641	4.45E-08
71624	4833411C07Rik	-0.642	4.09E-06
246738	Dnajc28	-0.642	1.52E-11
100043461	Gm4450	-0.643	3.17E-03
218311	Zfp455	-0.643	4.54E-02
70125	2210016H18Rik	-0.644	3.08E-07
73296	Rhobtb3	-0.644	8.52E-03
64930	Tsc1	-0.645	3.06E-02
271278	BC024139	-0.647	3.94E-03

15375	Foxa1	-0.647	1.95E-09
16918	Mycl1	-0.647	4.76E-05
20778	Scarb1	-0.647	9.89E-10
105827	Amigo2	-0.651	3.18E-04
574402	Gpr17	-0.651	1.87E-07
66935	Cir1	-0.653	1.78E-02
384261	Gm5296	-0.653	1.53E-05
15482	Hspa1l	-0.653	1.45E-02
66361	Zfand1	-0.653	1.18E-03
77128	A930001N09Rik	-0.654	5.64E-10
60344	Fign	-0.654	4.09E-06
675296	LOC675296	-0.655	6.28E-03
17420	Mnat1	-0.658	2.96E-02
142980	Tlr3	-0.658	1.28E-03
67211	Armc10	-0.659	7.60E-03
18569	Pdcd4	-0.659	5.12E-15
12036	Bcat2	-0.66	2.80E-09
67155	Smarca2	-0.66	1.46E-02
319236	9230105E10Rik	-0.661	9.05E-04
108100	Baiap2	-0.661	3.95E-13
622665	Ccdc17	-0.661	4.55E-02
218294	Cdc14b	-0.662	1.84E-08
21928	Tnfaip2	-0.663	4.88E-03
15184	Hdac5	-0.664	6.14E-04
230590	Zyg11a	-0.664	3.16E-02
51800	Bok	-0.665	2.45E-04
68744	Zfp740	-0.666	2.09E-04
67554	Slc25a30	-0.667	3.02E-04
100038526	Gm10560	-0.67	9.95E-05
245695	Tceanc	-0.671	2.03E-02
93681	Zfp192	-0.671	9.28E-12
69215	Sat2	-0.672	5.60E-04
320847	D330040H18Rik	-0.674	3.19E-03
20725	Serpinb8	-0.675	2.33E-02
69820	1810059H22Rik	-0.676	1.62E-02
12696	Cirbp	-0.676	1.61E-04
320311	Rnf152	-0.676	1.01E-07
73571	1700096K18Rik	-0.678	1.84E-02
107351	Kank1	-0.678	1.39E-08
68910	Zfp467	-0.678	2.60E-04
211798	Mfsd9	-0.679	8.17E-03
240041	Zfp945	-0.679	1.21E-03

243385	Gprin3	-0.684	1.80E-04
114642	Brdt	-0.685	5.95E-03
215335	Slc36a1	-0.688	2.84E-02
71755	Dhdh	-0.689	3.43E-07
108937	Rnf169	-0.69	8.42E-14
72568	Lin9	-0.692	1.07E-02
329470	Accs	-0.693	2.76E-02
100504693	LOC100504693	-0.693	1.39E-05
74694	Tbc1d30	-0.693	1.42E-02
319990	C730014E05Rik	-0.695	6.34E-12
16596	Klf1	-0.695	2.06E-04
380718	Mks1	-0.695	1.79E-02
20359	Sema6b	-0.695	2.36E-05
212090	Tmem60	-0.696	7.03E-03
21815	Tgif1	-0.697	7.94E-10
212153	2610015P09Rik	-0.699	2.52E-02
100042371	Gm3807	-0.7	4.34E-02
234678	D230025D16Rik	-0.701	4.15E-16
67484	Eepd1	-0.701	2.04E-03
14735	Gpc4	-0.701	3.21E-13
52822	Rufy3	-0.701	1.26E-03
21331	T2	-0.701	2.07E-08
245174	Zfp937	-0.701	6.67E-03
68778	1110038D17Rik	-0.703	7.61E-20
68067	3010026O09Rik	-0.703	1.69E-03
17961	Nat2	-0.705	4.65E-14
18128	Notch1	-0.705	1.68E-04
244141	Nars2	-0.708	1.66E-02
237256	Zc3h12d	-0.708	1.47E-03
78605	6430706D22Rik	-0.709	2.10E-22
52428	Rhpn2	-0.709	1.67E-06
56699	Cdc42ep4	-0.71	8.72E-12
194126	Mtmr11	-0.71	1.68E-02
207742	Rnf43	-0.712	1.24E-03
12144	Blm	-0.713	7.85E-03
64074	Smoc2	-0.713	1.73E-02
63828	Fn3k	-0.715	7.21E-10
243382	Ppm1k	-0.716	2.68E-17
104348	Zfp120	-0.716	6.34E-05
382010	BC088983	-0.719	2.22E-05
223648	2410075B13Rik	-0.721	9.10E-04
76044	Ncapg2	-0.721	4.75E-02

26447	Poli	-0.721	5.48E-03
56318	Acpp	-0.723	9.86E-04
70266	Ccbl1	-0.723	1.08E-08
100503272	LOC100503272	-0.726	9.34E-04
12355	Nr1i3	-0.726	2.67E-08
14739	S1pr2	-0.726	1.98E-02
50768	Dlc1	-0.727	9.36E-07
232566	Amn1	-0.732	2.54E-03
230784	Sesn2	-0.732	1.47E-07
100502966	LOC100502966	-0.733	1.93E-02
66451	2610528J11Rik	-0.735	2.23E-05
67636	Lyrm5	-0.735	2.96E-04
19891	Rpa2	-0.735	1.32E-03
73815	4930404H11Rik	-0.736	2.40E-02
319572	C730027H18Rik	-0.736	3.92E-10
328330	D130037M23Rik	-0.736	5.87E-03
229473	D930015E06Rik	-0.736	2.87E-03
622175	E430024I08Rik	-0.738	4.57E-07
219094	Khnyn	-0.738	9.92E-16
57875	Angptl4	-0.74	9.47E-19
320295	C920006O11Rik	-0.74	9.43E-10
70873	4921517L17Rik	-0.741	8.33E-08
73713	Rbm20	-0.743	1.94E-04
94094	Trim34a	-0.743	1.59E-06
72421	Ttc30b	-0.743	4.99E-07
100043468	Zfp955b	-0.743	2.04E-04
227446	2310035C23Rik	-0.746	8.90E-03
252876	Gin1	-0.747	7.38E-11
50497	Hspa14	-0.747	1.97E-02
100503141	LOC100503141	-0.747	2.39E-02
100504144	LOC100504144	-0.747	4.81E-09
140742	Sesn1	-0.747	2.96E-11
330409	Cecr2	-0.75	3.21E-15
71684	Rbm43	-0.752	7.82E-04
212772	2700007P21Rik	-0.753	2.14E-03
74931	4930481A15Rik	-0.753	2.28E-05
320014	B930025P03Rik	-0.754	1.09E-03
100504663	Atg14	-0.756	6.22E-11
654822	D330041H03Rik	-0.756	9.87E-03
71564	Izumo4	-0.759	1.84E-03
72338	Wdr89	-0.76	3.97E-03
73139	Cenpv	-0.761	1.19E-05

77569	Limch1	-0.763	4.88E-02
328309	Gm9776	-0.766	1.97E-02
11905	Serpinc1	-0.768	3.99E-05
21335	Tacc3	-0.769	7.45E-03
69548	2310015A10Rik	-0.771	1.62E-04
118446	Gjc3	-0.771	6.93E-05
626359	Wdr93	-0.771	2.80E-02
269423	3110057O12Rik	-0.773	3.96E-05
70454	Cenpl	-0.773	2.98E-07
100088	Rcc1	-0.774	1.16E-05
20411	Sorbs1	-0.774	2.94E-03
20977	Syp	-0.776	5.17E-03
232560	Caprin2	-0.778	5.46E-03
76681	Trim12a	-0.779	7.55E-03
100042332	2810410L24Rik	-0.781	1.67E-04
73172	Dem1	-0.783	1.47E-02
100038701	5730424H11Rik	-0.786	5.25E-03
71846	Syce2	-0.787	2.01E-07
76877	Rab36	-0.789	3.32E-02
76835	2900052L18Rik	-0.791	7.37E-04
215705	Arrdc1	-0.791	3.15E-02
56213	Htra1	-0.793	2.74E-02
225875	Lrfn4	-0.793	1.28E-04
67168	Lpar6	-0.794	5.60E-11
72481	2610203C22Rik	-0.795	1.59E-02
66360	Bbip1	-0.795	2.13E-16
67916	Ppap2b	-0.795	1.07E-17
13122	Cyp7a1	-0.796	2.94E-03
75735	Pank1	-0.799	3.27E-05
30805	Slc22a4	-0.799	2.24E-05
235461	Fam63b	-0.8	3.97E-31
269954	Ttll13	-0.8	4.78E-02
68145	Etaa1	-0.801	1.63E-08
12190	Brca2	-0.802	2.72E-08
66961	Neat1	-0.802	3.61E-09
72401	Slc43a1	-0.804	4.10E-04
18639	Pfkfb1	-0.809	1.46E-13
58244	Stx6	-0.809	2.44E-02
320441	A130022F02Rik	-0.811	3.63E-08
628813	Gm11437	-0.811	7.57E-03
76511	2010004M13Rik	-0.812	2.55E-02
83383	Tcfap4	-0.812	9.23E-06

224703	2-Mar	-0.813	2.93E-03
21877	Tk1	-0.817	1.33E-06
100038585	F830223B06Rik	-0.818	9.68E-04
100038725	Gm9766	-0.819	3.69E-11
16181	Il1rn	-0.819	2.00E-03
68434	1010001N08Rik	-0.82	4.90E-03
71739	1200015M12Rik	-0.82	4.53E-03
263406	Plekhg3	-0.821	4.55E-20
237769	Gm12258	-0.825	1.53E-02
667597	BC023105	-0.826	1.48E-02
239122	Setdb2	-0.826	1.49E-03
78412	3110062M04Rik	-0.827	1.78E-11
78786	4833439F03Rik	-0.827	2.00E-02
74570	Zkscan1	-0.829	2.93E-19
78779	Spata2L	-0.83	4.83E-07
622208	Gm6297	-0.833	3.79E-05
209462	Hace1	-0.834	2.32E-03
231549	Lrrc8d	-0.835	2.36E-02
69710	Arap1	-0.836	5.31E-03
69809	1810046K07Rik	-0.837	3.46E-03
69129	Pex11c	-0.837	5.53E-08
78438	A930028N01Rik	-0.838	1.85E-02
240034	Zfp760	-0.838	9.46E-05
259301	Leap2	-0.839	3.37E-08
102132	E230013L22Rik	-0.842	3.48E-03
68487	Tmem140	-0.844	3.08E-12
320271	Scai	-0.849	2.52E-03
100313510	C530020B09Rik	-0.85	8.39E-06
66611	Ribc1	-0.85	2.80E-10
16906	Lmnb1	-0.854	1.10E-03
100504225	LOC100504225	-0.855	6.78E-03
24066	Spry4	-0.855	1.91E-05
67177	Cdt1	-0.858	5.21E-05
19332	Rab20	-0.859	2.38E-07
56332	Amotl2	-0.863	1.81E-14
77779	A930007I19Rik	-0.864	1.25E-04
545228	Gm5817	-0.865	4.60E-06
399101	Snhg3	-0.865	9.07E-06
320187	E230001N04Rik	-0.872	7.01E-03
108961	E2f8	-0.873	4.70E-08
223631	BC025446	-0.874	2.59E-18
73451	Zfp763	-0.874	1.36E-04

22691	Zscan2	-0.874	1.15E-03
66333	Aqp11	-0.876	7.25E-08
215351	Senp6	-0.878	4.54E-02
231670	Fbxo21	-0.879	1.09E-09
53412	Ppp1r3c	-0.881	5.97E-03
72230	Zfp558	-0.881	8.45E-03
99458	BB166591	-0.883	4.92E-06
66638	5730458M16Rik	-0.884	3.27E-12
17857	Mx1	-0.884	1.46E-02
12615	Cenpa	-0.885	1.66E-03
14191	Fgr	-0.886	3.76E-03
20239	Atxn2	-0.888	7.94E-05
70489	5730405O15Rik	-0.889	1.38E-03
100503888	LOC100503888	-0.89	1.41E-03
445007	Nup85	-0.893	1.06E-02
407790	Ndufa4l2	-0.894	3.18E-02
228913	Zfp217	-0.896	8.74E-04
68781	1110055C04Rik	-0.897	1.97E-08
103268	Cep57l1	-0.898	5.19E-04
319791	9430011C21Rik	-0.9	3.77E-02
14451	Gas1	-0.9	2.23E-06
320933	D230017M19Rik	-0.901	1.17E-04
67261	2900005J15Rik	-0.903	4.74E-06
20301	Ccl27a	-0.903	5.25E-03
12193	Zfp36l2	-0.906	4.69E-15
67099	Mettl21a	-0.907	1.26E-02
75216	4930534B04Rik	-0.909	4.58E-02
104943	Fam110c	-0.909	3.49E-04
69430	1700048O20Rik	-0.91	1.37E-02
235493	BC031353	-0.911	9.17E-23
231724	Rad9b	-0.911	1.12E-02
319915	A830049F12Rik	-0.913	1.10E-02
107372	C030016D13Rik	-0.914	2.09E-02
52609	Cbx7	-0.915	5.19E-03
16362	Irf1	-0.916	6.67E-08
76306	1110021L09Rik	-0.917	1.19E-05
170770	Bbc3	-0.917	5.99E-07
100504127	LOC100504127	-0.917	1.56E-05
100503876	LOC100503876	-0.918	1.47E-02
76432	2310001H17Rik	-0.919	5.48E-09
54126	Arhgef7	-0.919	2.01E-02
94176	Dock2	-0.919	4.21E-02

56198	Heyl	-0.919	1.81E-02
219131	Phf11	-0.919	2.11E-02
22756	Zfp94	-0.923	2.13E-02
72290	Lsm11	-0.929	4.54E-02
214547	She	-0.93	1.92E-04
15980	Ifngr2	-0.933	1.46E-02
100502960	LOC100502960	-0.935	5.48E-11
171543	Bmf	-0.936	5.78E-04
319667	B930094L07Rik	-0.937	1.00E-11
223332	Ranbp3l	-0.937	3.00E-02
217166	Nr1d1	-0.94	9.25E-06
97268	C230066G23Rik	-0.941	3.34E-02
12053	Bcl6	-0.947	2.55E-02
18821	Pln	-0.947	9.39E-03
330602	Gm5115	-0.948	2.58E-08
237436	Gas2l3	-0.953	3.98E-04
100504549	LOC100504549	-0.953	1.26E-03
78808	Stxbp5	-0.954	4.98E-02
232879	Zbtb45	-0.961	4.38E-18
22698	Zfp39	-0.961	4.16E-11
78792	4930432F04Rik	-0.965	2.83E-02
241274	Pnpla7	-0.967	8.11E-04
214642	A430107O13Rik	-0.969	2.63E-04
170460	Stard5	-0.97	4.70E-16
70050	2600014K08Rik	-0.971	2.32E-06
623474	Rad54b	-0.971	3.80E-02
75424	Zfp820	-0.971	4.51E-02
232984	B3gnt8	-0.974	2.24E-02
18201	Nsmaf	-0.975	1.89E-02
75836	4930556N08Rik	-0.978	8.32E-03
100504305	LOC100504305	-0.991	8.72E-03
360013	Myo18a	-0.991	3.05E-04
107003	A330093E20Rik	-0.995	1.00E-21
238330	6430527G18Rik	-0.998	4.52E-12
319977	A530079E22Rik	-0.998	3.54E-03
66568	Rwdd3	-0.998	2.76E-09
14528	Gch1	-1	3.77E-07
319982	5930430L01Rik	-1.005	1.51E-09
72287	Plekhf1	-1.005	5.74E-11
641376	Tomm40l	-1.005	3.84E-11
72137	Wdsub1	-1.017	4.52E-02
268319	BC025920	-1.018	5.33E-03

71970	2410018M08Rik	-1.02	1.46E-06
16168	Il15	-1.022	3.15E-02
117591	Slc2a9	-1.026	7.10E-11
100040307	Gm2703	-1.027	3.34E-02
70012	Ccdc21	-1.028	3.75E-22
73644	2210039B01Rik	-1.03	2.13E-05
93694	Clec2d	-1.031	6.22E-31
70456	Brp44	-1.035	2.17E-07
320377	9330175E14Rik	-1.037	3.80E-07
75729	4933432B09Rik	-1.04	1.48E-02
242662	Rims3	-1.041	2.36E-02
70713	Gpr137c	-1.043	2.19E-03
21386	Tbx3	-1.043	5.15E-05
77622	Apex2	-1.045	2.16E-02
170756	Slc24a6	-1.048	5.19E-23
56220	Zfp386	-1.052	3.34E-03
225994	BC016495	-1.056	1.08E-07
100503178	LOC100503178	-1.056	9.81E-14
66302	Fam82b	-1.061	8.92E-16
67206	2810013P06Rik	-1.069	2.67E-15
330938	Dixdc1	-1.07	1.81E-15
75654	1700003O08Rik	-1.073	2.50E-04
70289	2510016D11Rik	-1.075	3.31E-03
54343	Atf7ip	-1.078	1.03E-12
56248	Ak3	-1.085	2.53E-04
23856	Dido1	-1.085	6.31E-38
402734	C730036E19Rik	-1.09	1.78E-04
21685	Tef	-1.09	1.67E-04
319271	A130072N09Rik	-1.093	1.94E-02
242484	D630039A03Rik	-1.098	1.46E-11
245038	Dclk3	-1.099	4.65E-08
27883	D16H22S680E	-1.101	4.00E-13
18260	Ocln	-1.107	1.06E-30
269023	Zfp608	-1.119	7.26E-05
320323	A930038B10Rik	-1.121	3.13E-09
637079	Gm16486	-1.122	8.42E-04
23957	Nr0b2	-1.129	1.03E-09
100502950	LOC100502950	-1.132	1.37E-08
50780	Rgs3	-1.132	5.47E-03
69857	1810053B23Rik	-1.134	3.58E-12
224019	Tmem191c	-1.14	1.00E-02
239691	AU021092	-1.142	7.72E-03

100503351	LOC100503351	-1.145	2.83E-03
20509	Slc19a1	-1.146	6.91E-20
15024	H2-T10	-1.148	4.84E-03
69034	4930579G22Rik	-1.151	1.31E-03
17869	Myc	-1.152	8.07E-06
67219	Med18	-1.153	2.59E-06
14738	Gpr12	-1.154	4.98E-03
100503381	LOC100503381	-1.156	1.63E-02
100041434	Gm3336	-1.16	2.24E-08
70448	2610204G22Rik	-1.161	4.26E-02
100329140	4930550G17Rik	-1.161	4.74E-02
104871	Spata7	-1.162	2.31E-03
105442	B130052P14Rik	-1.163	6.71E-09
52670	Cpsf4l	-1.168	1.33E-24
16169	Il15ra	-1.169	2.66E-34
21748	Terc	-1.169	3.10E-04
320430	C230073G13Rik	-1.172	5.22E-07
17684	Cited2	-1.177	5.71E-20
100042125	Gm15535	-1.177	1.22E-04
13706	Cela2a	-1.179	3.62E-02
58909	Fam13a	-1.179	1.58E-07
67861	Akr1b10	-1.18	4.58E-03
75842	4930556H04Rik	-1.185	1.23E-02
621080	AI429214	-1.186	1.59E-02
12124	Bik	-1.197	2.62E-11
320937	E430014L09Rik	-1.199	2.76E-09
21684	Tectb	-1.202	4.17E-02
66443	Tnfaip8l1	-1.212	1.76E-08
218215	Rnf144b	-1.215	2.89E-43
434246	Trim72	-1.217	1.86E-02
78892	Crispld2	-1.218	1.83E-02
78421	9530046B11Rik	-1.223	4.08E-02
319614	D830015G05Rik	-1.227	1.51E-07
64291	Osbpl1a	-1.228	1.31E-11
14467	Gbas	-1.23	2.26E-05
103135	Pan2	-1.233	4.97E-02
21664	Phlda1	-1.233	1.58E-06
71524	8430432A02Rik	-1.235	6.18E-03
18712	Pim1	-1.235	6.72E-08
627860	Cyp2d37-ps	-1.238	2.09E-25
77866	E130102H24Rik	-1.24	3.13E-17
13867	Erbb3	-1.24	1.98E-51

434234	2610020H08Rik	-1.241	2.49E-02
18407	Orm3	-1.243	2.45E-02
71972	Dnmbp	-1.246	1.51E-42
230806	Aim1l	-1.248	1.36E-02
217039	Ggnbp2	-1.248	3.12E-02
100038525	Gm10804	-1.249	2.15E-02
77252	9430038I01Rik	-1.257	3.22E-11
100503593	LOC100503593	-1.26	2.83E-02
78751	Zc3h6	-1.264	2.04E-05
12350	Car3	-1.269	3.43E-02
320621	D830044D21Rik	-1.274	7.64E-03
27273	Pdk4	-1.284	1.58E-02
77393	9530006C21Rik	-1.292	5.26E-04
628705	Gm6907	-1.296	7.44E-07
100503880	LOC100503880	-1.301	5.53E-03
67731	Fbxo32	-1.311	8.94E-11
100502920	LOC100502920	-1.318	1.55E-03
319846	A130086G11Rik	-1.321	9.90E-03
110855	Pde6c	-1.326	2.40E-02
15494	Hsd3b3	-1.332	7.47E-09
237877	Atad5	-1.333	1.70E-02
277250	Kdm3b	-1.359	1.88E-02
74181	2310024H09Rik	-1.372	5.90E-09
66209	1110054O05Rik	-1.376	2.91E-02
634650	Gbp11	-1.384	8.69E-05
100503307	LOC100503307	-1.385	3.32E-09
14825	Cxcl1	-1.388	1.15E-05
68497	1110018G07Rik	-1.396	2.73E-04
14803	Grid1	-1.396	3.49E-02
11799	Birc5	-1.418	1.03E-09
320036	D030041H20Rik	-1.418	6.85E-03
18550	Furin	-1.419	1.21E-08
399591	Tmsb15l	-1.421	3.53E-02
100502851	LOC100502851	-1.422	2.55E-02
14161	Fga	-1.429	9.85E-25
56338	Txnip	-1.429	2.19E-12
328365	Zmiz1	-1.435	6.45E-07
18519	Kat2b	-1.436	4.08E-02
320238	A830054O07Rik	-1.438	2.63E-02
320172	E230016M11Rik	-1.448	5.38E-03
70807	Arrdc2	-1.451	6.36E-12
65970	Lima1	-1.452	6.23E-09

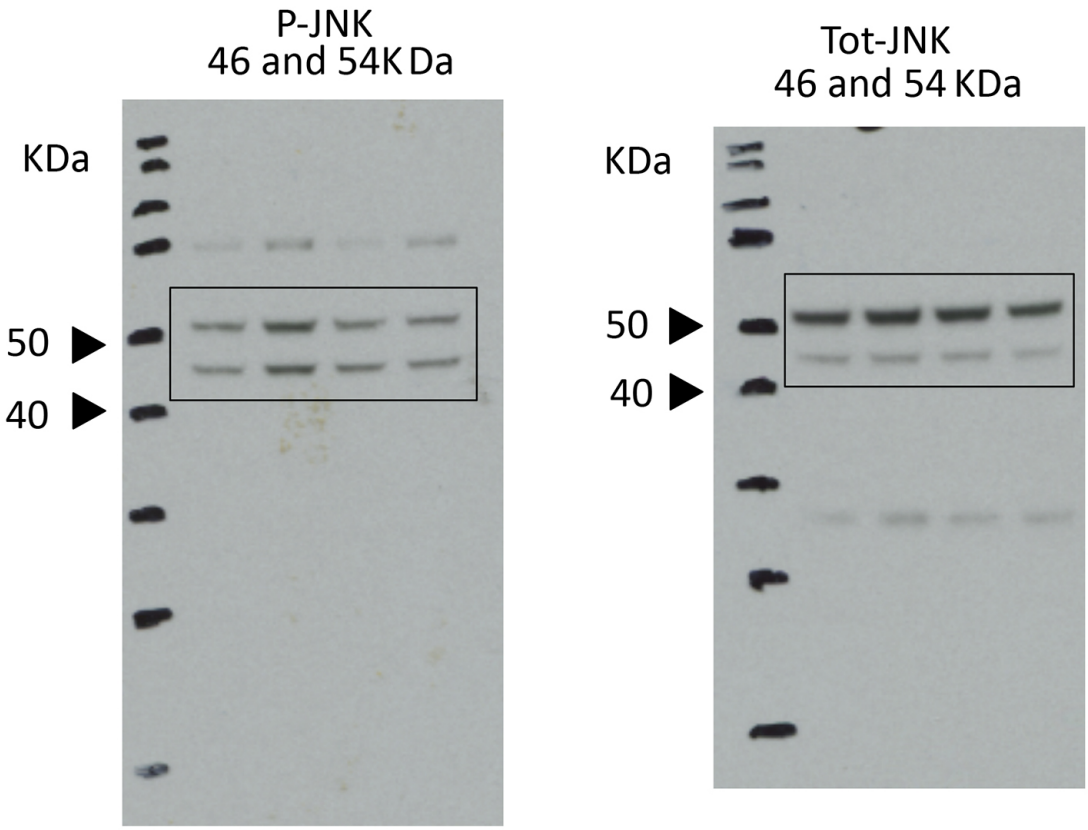
218850	D14Abb1e	-1.455	1.48E-09
791283	Gm9978	-1.463	4.43E-04
100043697	Gm9959	-1.479	4.51E-02
70485	5730409N24Rik	-1.48	3.10E-02
100038427	Gm10652	-1.494	1.98E-05
320879	B230217O12Rik	-1.532	4.81E-23
627280	Vmn1r90	-1.537	4.56E-09
100038498	Gm10447	-1.543	8.38E-06
18824	Plp2	-1.543	3.81E-02
78286	Nav2	-1.551	9.98E-04
16543	Mdfic	-1.558	1.54E-03
228775	Trib3	-1.58	6.43E-40
667754	Ces2d-ps	-1.583	2.26E-02
320099	BC106179	-1.592	6.86E-03
330361	AW146020	-1.612	3.04E-03
26399	Map2k6	-1.633	9.22E-07
76500	Ip6k2	-1.638	3.97E-41
18004	Nek1	-1.656	8.93E-03
80981	Arl4d	-1.664	2.49E-12
71982	Snx10	-1.67	1.95E-06
71096	Sntg1	-1.671	4.76E-02
666457	G370120E05Rik	-1.68	1.92E-04
16184	Il2ra	-1.71	1.57E-03
116904	Alpk3	-1.716	1.89E-02
69065	Chac1	-1.718	8.08E-05
77115	6030451C04Rik	-1.725	9.66E-08
574437	Xlr3b	-1.73	2.70E-02
74238	Mterfd3	-1.734	4.44E-02
16597	Klf12	-1.749	1.67E-02
53961	9530053J19Rik	-1.77	1.06E-14
17686	Msh3	-1.772	3.17E-02
56226	Espn	-1.787	4.01E-02
320751	D830014E11Rik	-1.789	1.84E-04
15567	Slc6a4	-1.791	3.38E-02
54422	Barhl1	-1.794	1.09E-02
403347	F830014O18Rik	-1.819	1.33E-07
18109	Mycn	-1.833	2.27E-12
18119	Nodal	-1.857	1.08E-09
100502820	LOC100502820	-1.91	6.60E-04
100047123	LOC100047123	-1.913	5.54E-12
15220	Foxq1	-1.934	1.96E-05
20583	Snai2	-1.973	1.45E-23

100041677	Gm13157	-1.981	4.27E-02
54667	Atp8b2	-1.989	2.49E-02
56734	Tulp2	-1.996	4.27E-07
100303645	LOC100303645	-2.001	2.21E-42
100040938	Gm3052	-2.008	6.88E-06
20459	Ptk6	-2.008	3.56E-03
100038559	Gm10673	-2.031	3.06E-10
100043899	R3hdml	-2.057	1.02E-08
94071	Clec2h	-2.094	6.75E-08
21646	Tcte2	-2.16	1.38E-03
399628	C130089O13Rik	-2.168	5.20E-03
241589	D430041D05Rik	-2.317	1.61E-02
71816	Rnf180	-2.377	2.39E-02
100038649	Gm10690	-2.38	2.86E-04
11488	Adam11	-2.452	1.54E-02
20497	Slc12a3	-2.474	2.68E-02
100503347	LOC100503347	-2.488	1.95E-22
621603	Aldh3b2	-2.495	2.70E-03
18791	Plat	-2.566	4.87E-02
100503072	LOC100503072	-2.746	5.33E-22
11749	Anxa6	-2.816	1.61E-02
667742	Fam38b	-2.835	1.02E-02
546648	Klhdc7b	-2.889	6.81E-05
791369	Gm9889	-2.912	4.52E-02
381810	Lpar5	-3.023	3.89E-02
434794	Xlr4a	-3.295	1.16E-05
52492	D18Ertd232e	-3.331	1.48E-05
207854	Fmr1nb	-3.363	8.50E-03
69442	1700023H06Rik	-3.459	4.02E-09
666182	Gm7967	-3.611	1.62E-02
100505357	LOC100505357	-3.785	3.91E-04
100505359	LOC100505359	-3.788	3.17E-04
74547	9030622M22Rik	-3.927	3.91E-05
100502888	LOC100502888	-3.999	1.71E-02
213393	8430408G22Rik	-4.041	3.37E-61
105171	Arrdc3	-4.098	2.71E-34
27083	Xlr4b	-4.175	2.72E-04
19734	Rgs16	-6.334	1.71E-44

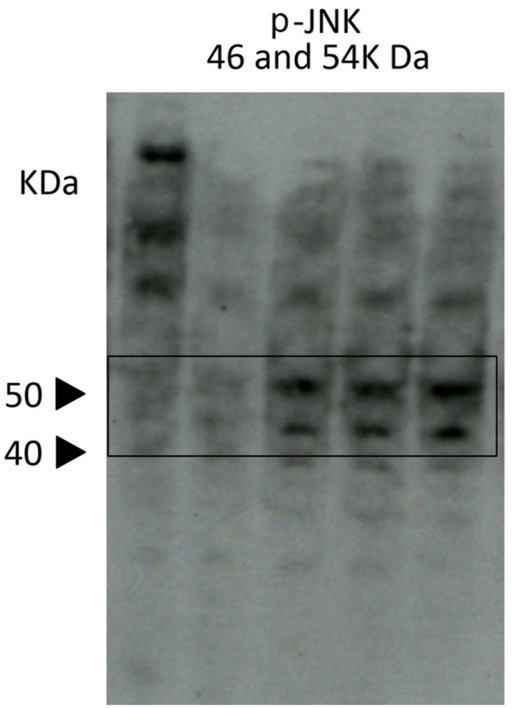
Supplemental References

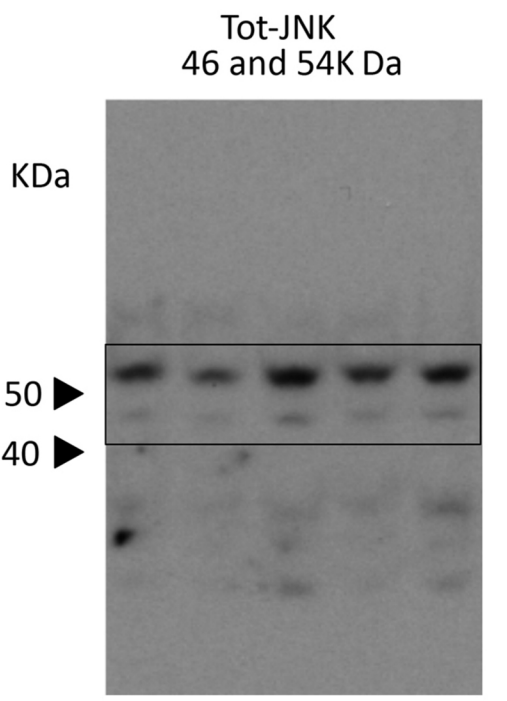
1. Li JH, Jain S, McMillin SM, Cui Y, Gautam D, Sakamoto W, Lu H, Jou W, McGuinness OP, Gavrilova O, et al. A novel experimental strategy to assess the metabolic effects of selective activation of a G(q)-coupled receptor in hepatocytes in vivo. *Endocrinology.* 2013;154(10):3539-51.
2. Mukund S, Shang Y, Clarke HJ, Madjidi A, Corn JE, Kates L, Kolumam G, Chiang V, Luis E, Murray J, et al. Inhibitory mechanism of an allosteric antibody targeting the glucagon receptor. *J Biol Chem.* 2013;288(50):36168-78.
3. Regard JB, Kataoka H, Cano DA, Camerer E, Yin L, Zheng YW, Scanlan TS, Hebrok M, and Coughlin SR. Probing cell type-specific functions of Gi in vivo identifies GPCR regulators of insulin secretion. *J Clin Invest.* 2007;117(12):4034-43.
4. Kleiner DE, Brunt EM, Van Natta M, Behling C, Contos MJ, Cummings OW, Ferrell LD, Liu YC, Torbenson MS, Unalp-Arida A, et al. Design and validation of a histological scoring system for nonalcoholic fatty liver disease. *Hepatology.* 2005;41(6):1313-21.

Uncropped gels for Figure 3B



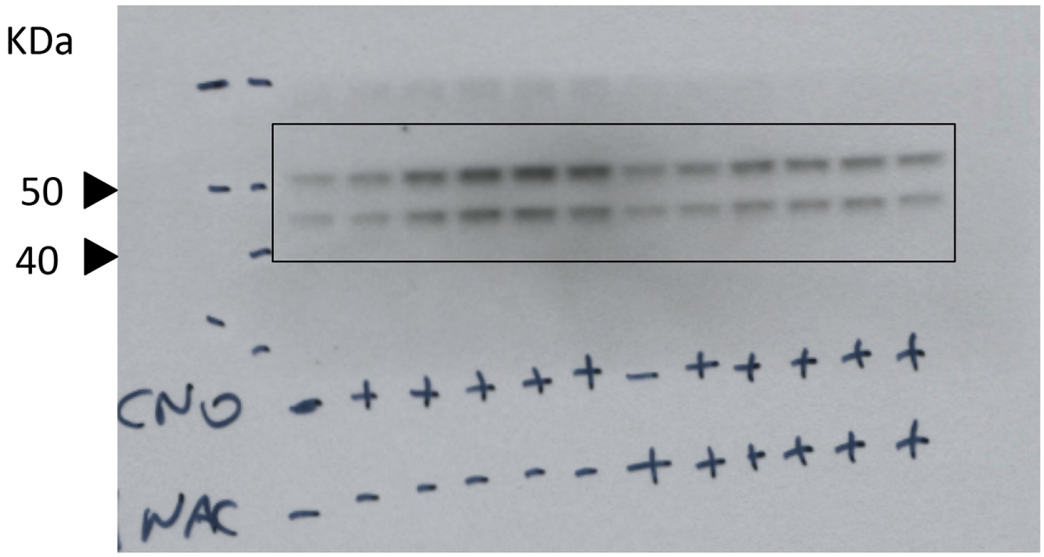
Uncropped gels for Figure 3D



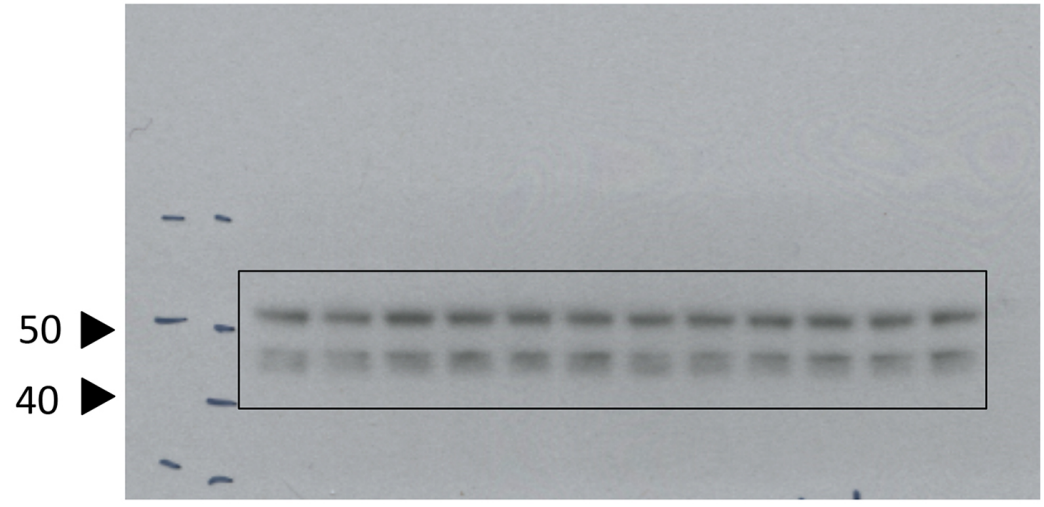


Uncropped gels for Figure 4B

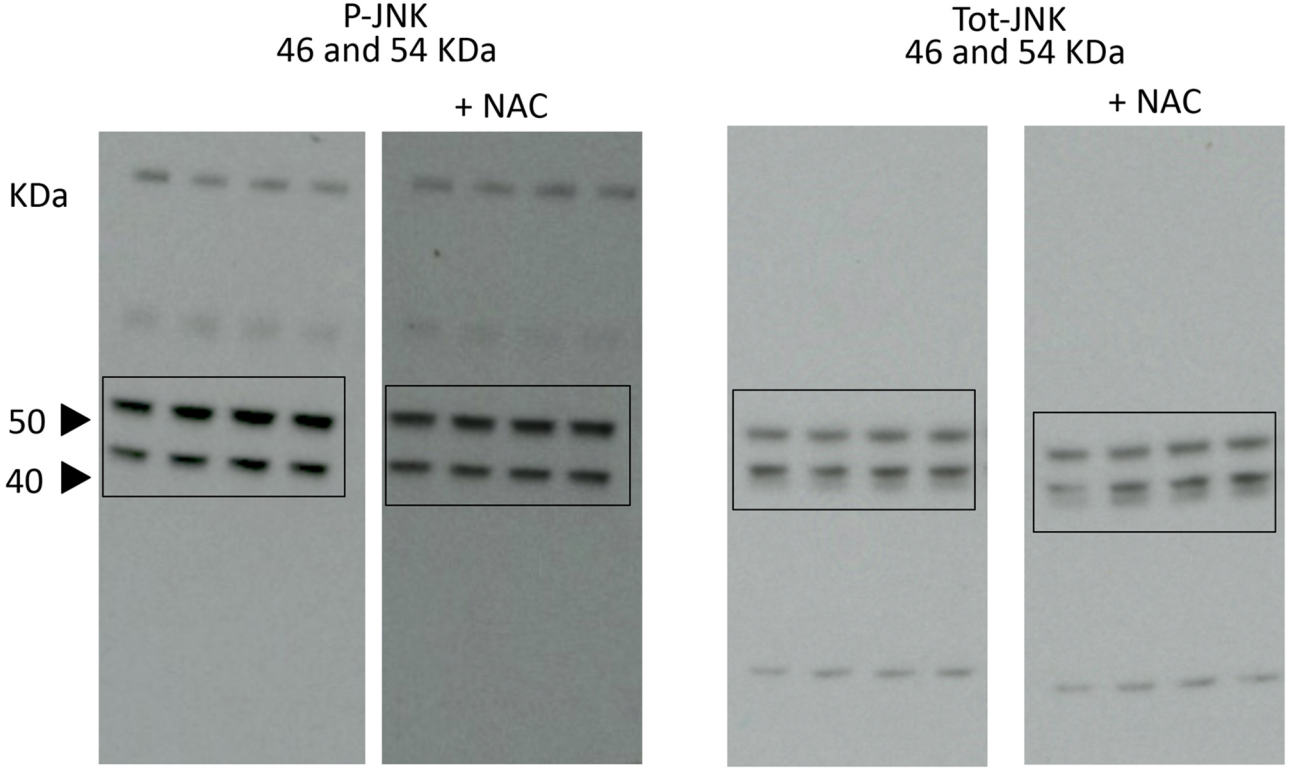
P-JNK
46 and 54 KDa



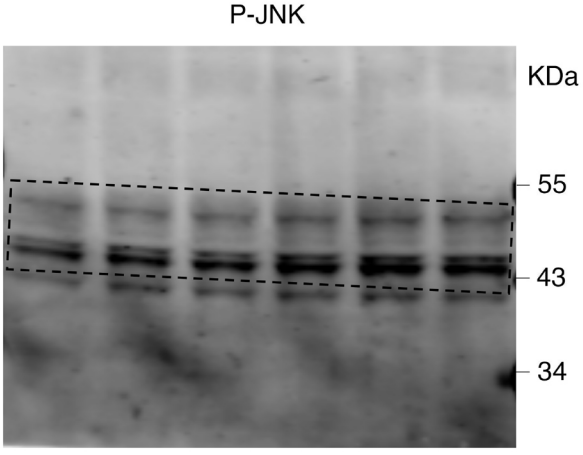
Tot-JNK
46 and 54 KDa

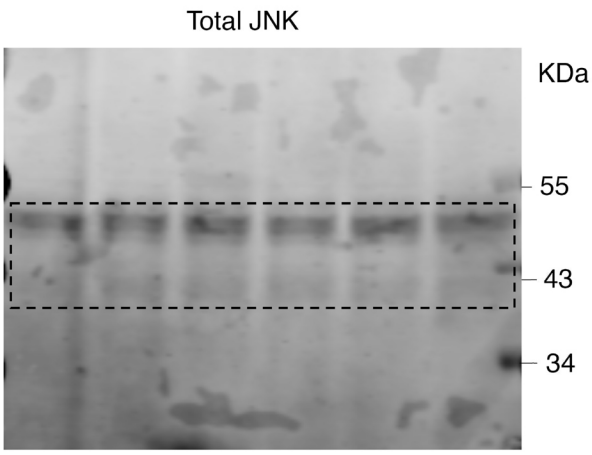


Uncropped gels for Figure 5E

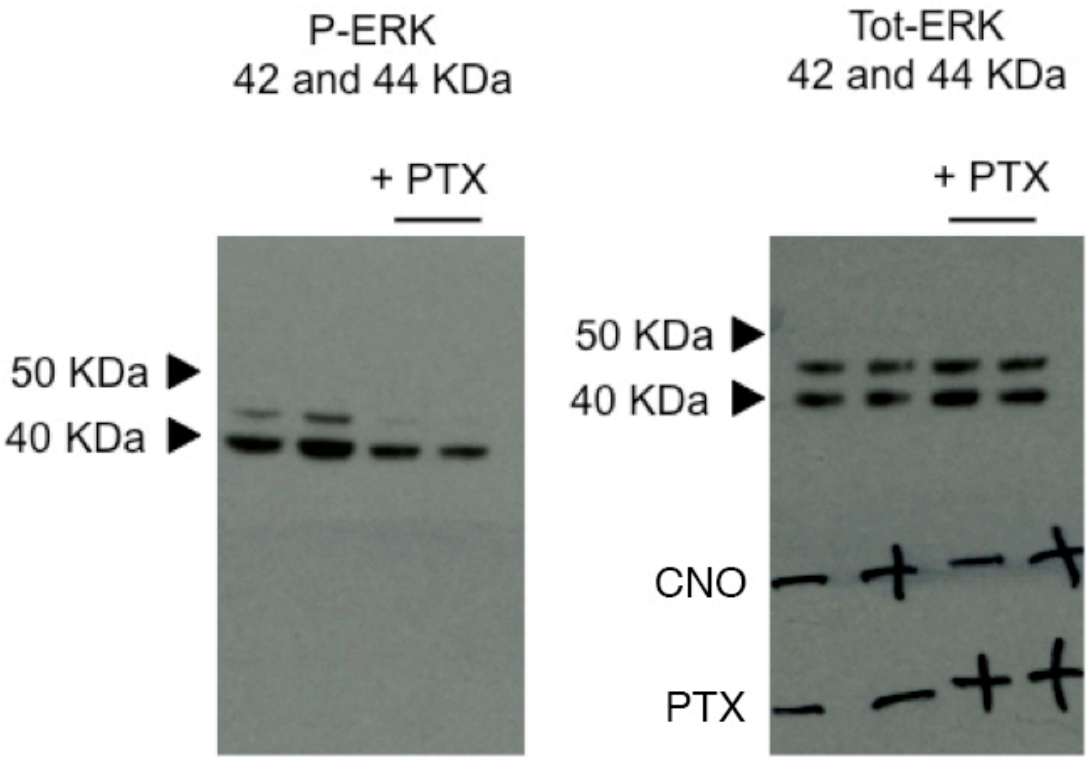


Uncropped gels for Figure 6B





Uncropped gels for Supplemental Figure 6A



Uncropped gels for Supplemental Figure 8