TAK1 deficiency promotes liver injury and tumorigenesis via ferroptosis and macrophage cGAS-STING signalling

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Table of contents

Supplementary materials and methods

Animal treatment

Mice were maintained on either an iron-rich diet containing 2% carbonyl iron (Harlan, 2018S) or a standard diet starting at 3 weeks of age. Serum and liver samples were collected at 8 weeks of age.

Cell Isolation and Treatment

Primary mouse HSCs were isolated according to the previous study[1]. In brief, livers were perfused in situ via the portal vein with 50 ml warmed (37 °C) Hanks' balanced salt solution (Ca^{2+} and Mg^{2+} free) containing EGTA (0.5 M), followed by collagenase IV (Sigma, Saint Louis, MO, USA, 0.05% w/v, dissolved in HBSS with Ca^{2+} and Mg^{2+}). Perfused livers were dissected and teased through 70-mm nylon mesh cell strainers and centrifuged at 50 g for 3 min. The supernatant was further centrifuged at 500 g for 10 min, resuspended in Ficoll plus Percoll (1:10, GE Healthcare), and centrifuged at 1400 g for 17 min. HSCs were collected from the interface. Primary mouse HSCs were incubated with primary macrophage conditioned media (CM) for 24h.

Macrophage Polarization

To study the effects of STING inhibitors on macrophage polarization, primary liver macrophages were pretreated for 1 hour with C-176 (0.5 μM) or vehicle and then co-cultured with primary hepatocytes for 6 hours. Primary macrophages were collected for Western blot analysis and RT–qPCR.

Cell Viability Assay

Primary hepatocytes were cultured in 96-well plate, cell viability was determined using a Cell Counting Kit-8 (CCK-8) (cat# CK04, Dojindo, Japan) assay according with the manufacturer's instructions. Cells in each well were incubated with 10 μl of CCK-8 reagent. Absorbance was measured at 450 nm at different time point.

LDH Release Assay

LDH concentration of culture media was measured using the LDH Cytotoxicity Assay Kit following according with the manufacturer's instructions (cat# C0016, Beyotime, China).

Fig.S1

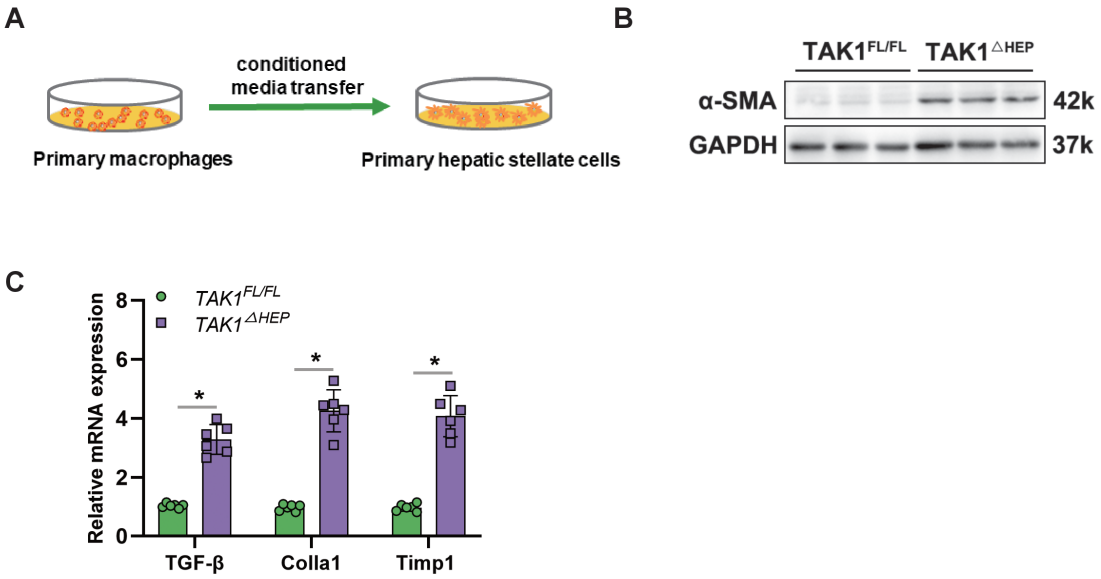

Fig.S1 Macrophages from TAK1$^{\triangle HEP}$ mice liver contributed hepatic stellate cells' activation

(A) Conditioned media of primary liver macrophage from TAK1$^{FL/FL}$ and TAK1$^{\triangle HEP}$ mice was transferred to primary hepatic stellate cells of wildtype mice for 24 hours in the presence of TGF-β1 (8 ng/mL). **(B)** α-SMA protein expression of primary HSCs. **(C)** The mRNA levels of TGF-β, Colla1, and Timp1 of primary HSCs. Data are presented as the mean ± SEM (n = 6). *$p < 0.05$ Mann–Whitney U test.

Fig. S2

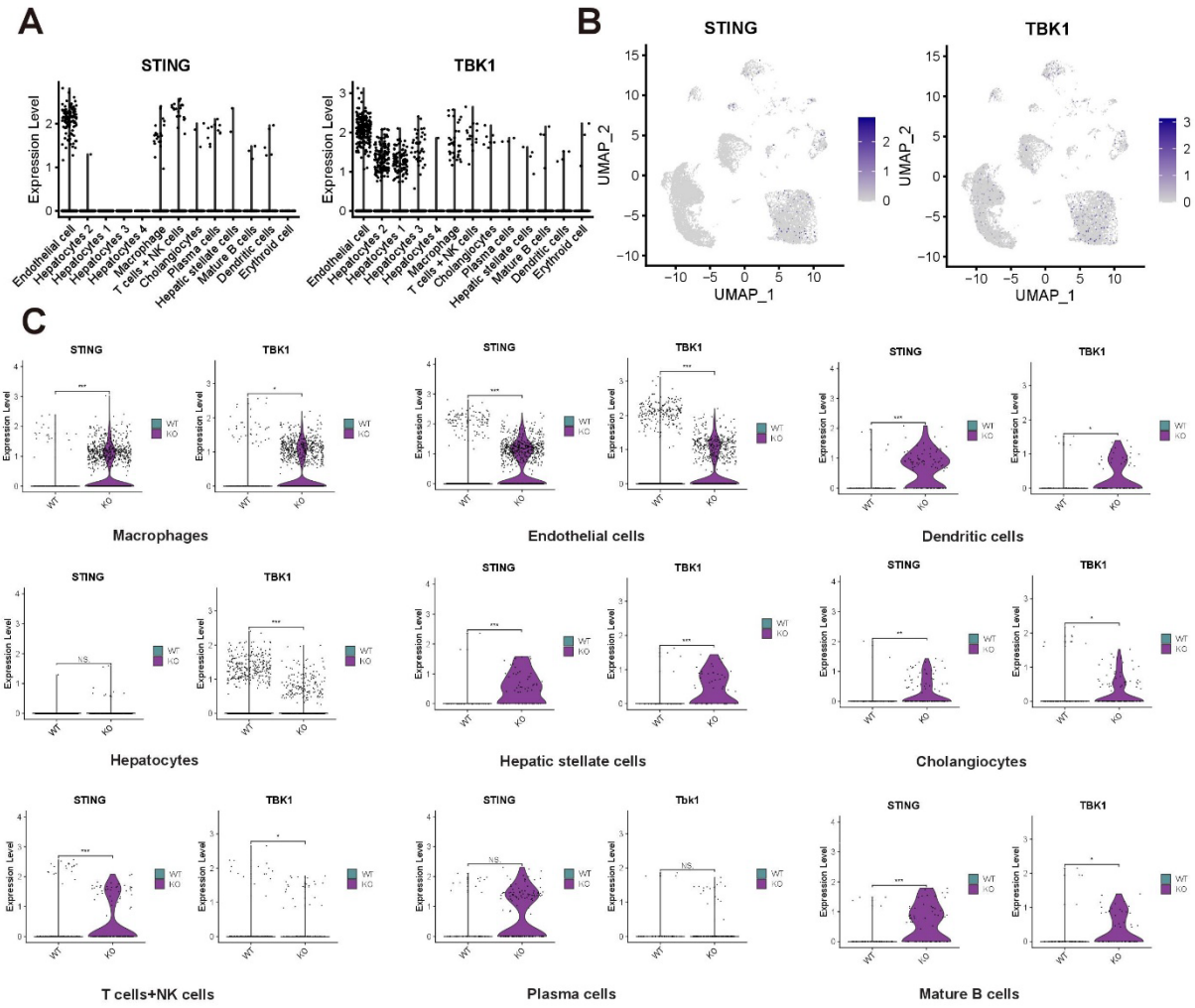

Fig. S2. STING signaling pathway related genes expression

Gene expression of all clusters were constructed using the Seurat VlnPlot & Featureplot function. Violin plots (A) and Featureplot (B) show STING and TBK1 expression across all clusters of TAK1$^{FL/FL}$ mice. (C) Violin plots of STING and TBK1 expression in macrophages of TAK1$^{FL/FL}$ and TAK1$^{\Delta HEP}$ mice. ns, not significant; * $p < 0.05$, ** $p < 0.01$, **** $p < 0.001$, Wilcoxon rank sum test. WT: TAK1$^{FL/FL}$, KO: TAK1$^{\Delta HEP}$

Fig. S3

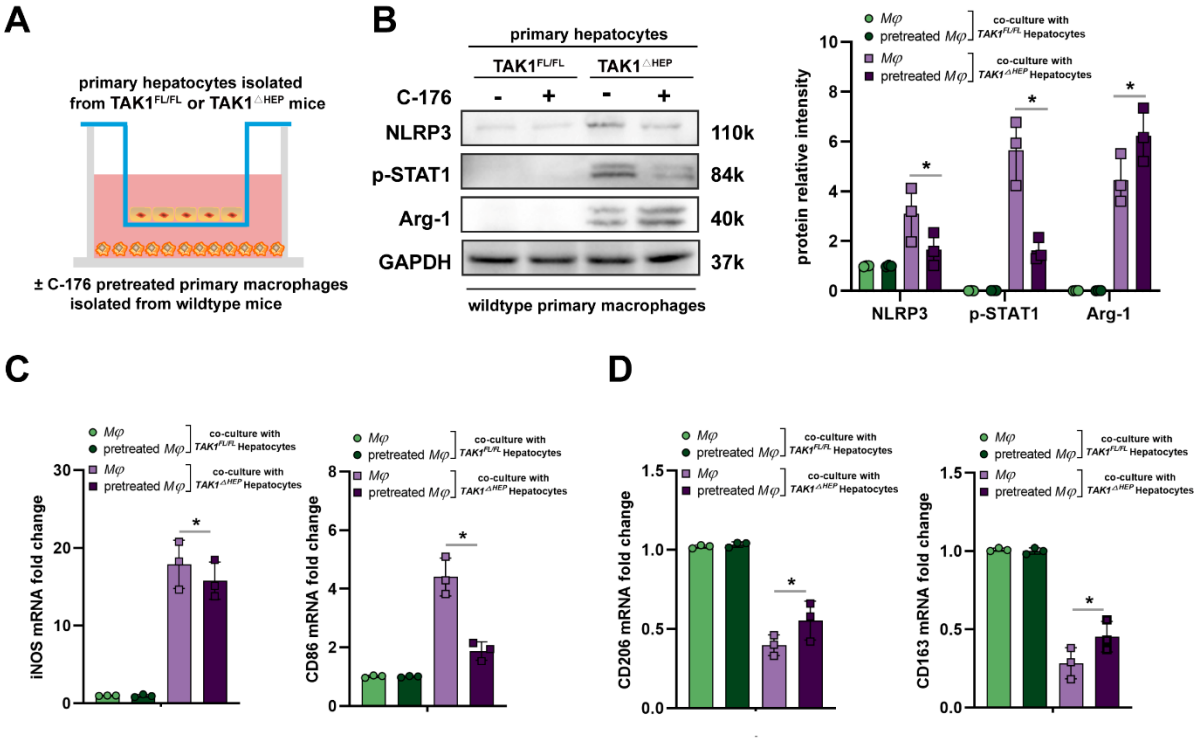

Fig. S3. C-176 impact on primary macrophage polarization.

(**A**) After pretreatment for 1 h with C-176 (0.5 μM) or vehicle, primary liver macrophages of wild-type mice were co-cultured with TAK1$^{FL/FL}$ and TAK1$^{\Delta HEP}$ primary hepatocytes for 6 h, Primary macrophages were harvested for western blots for **(B)** NLRP3**,** p-STAT1 and Arg-1, and **(C, D)** RT–qPCR analysis for iNOS, CD86, CD206 and CD163. Data are presented as the mean ± SEM (n = 3). * $p < 0.05$ Mann–Whitney U test. Mφ: primary liver macrophage

Fig. S4

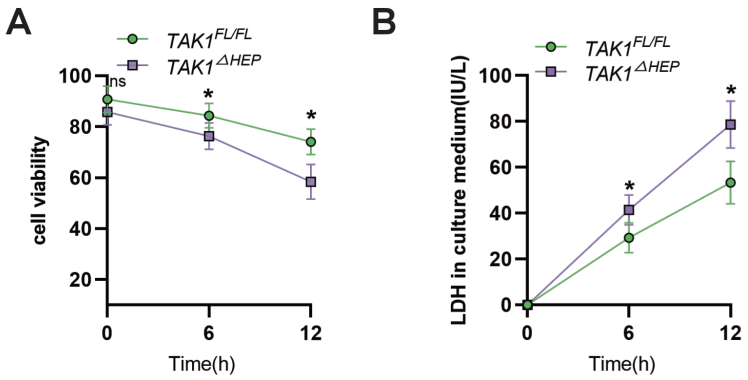

Fig.S4 Primary hepatocytes viability decreased after TAK1 deficiency.

(A) Cell viability of primary hepatocytes from $TAK1^{FL/FL}$ and $TAK1^{\triangle HEP}$ mice. **(B)** LDH level of culture media from primary hepatocytes. Data are presented as the mean ± SEM (n = 6). ns, not significant, *$p < 0.05$ Mann–Whitney U test.

Fig.S5

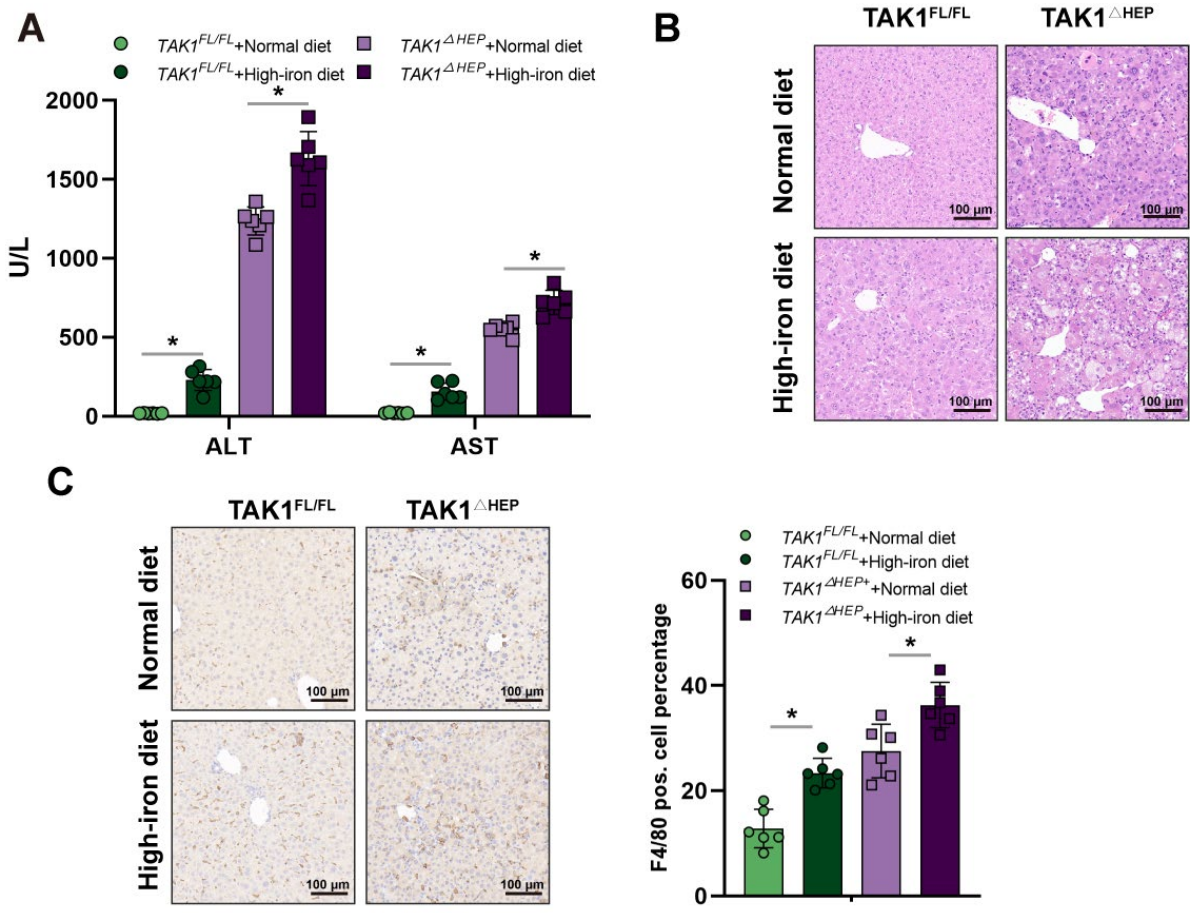

Fig.S5 High-iron diet increased liver injury and inflammation of TAK1 deficiency mice

(**A**)Serum ALT and AST levels of TAK1$^{FL/FL}$ and TAK1$^{\triangle HEP}$ mice fed with control or iron-rich diet; Data are presented as the mean ± SEM (n = 6). *$p < 0.05$ Mann–Whitney U test. (**B**) H&E and (**C**) F4/80 staining were carried out on the liver tissues of 8 weeks old TAK1$^{FL/FL}$ and TAK1$^{\triangle HEP}$ mice treated with control or iron-rich diet.

Fig. S6

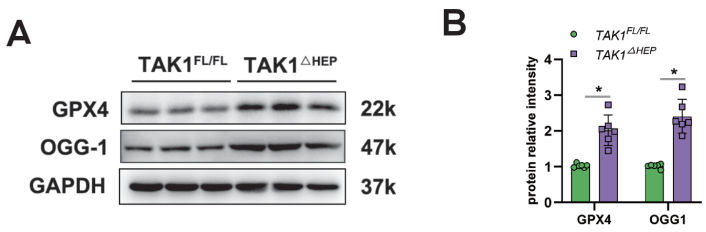

Fig.S6 Compensatory antioxidant response in TAK1 deficiency mice.

(A) Western blotting of GPX4 and OGG1 protein of TAK1FL/FL and TAK1△HEP mice liver.

(B) Quantification of GPX4 and OGG1 expression. Data are presented as the mean ± SEM (n = 6). *$p < 0.05$ Mann–Whitney U test.

Fig. S7

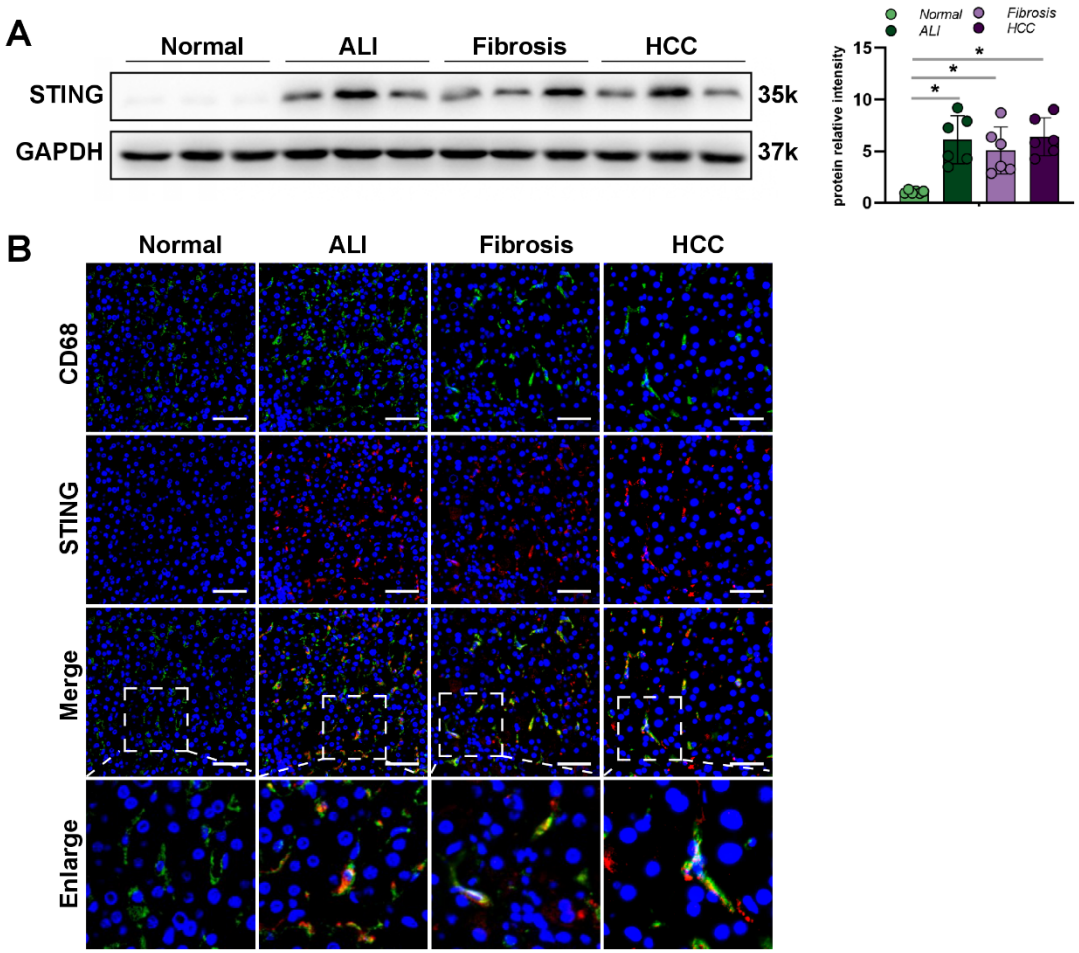

Fig. S7. Macrophage STING expression in patients with ALI, fibrosis, and HCC

Liver tissues were collected from different patients as described in Materials and Methods. (A) Western blot analysis of STING expression; Data are presented as the mean ± SEM (n = 6). * $p < 0.05$ Mann–Whitney U test. (B) Representative IF images of CD68 and STING staining (200× magnification, scale bars=100 μm).

Table S1: Sequence of primers used for RT-PCR studies

Gene	Forward Primer (5'-3')	Reverse Primer (5'-3')
GAPDH	AGGTCGGTGTGAACGGATTTG	TGTAGACCATGTAGTTGAGGTCA
CD86	GGTGGCCTTTTTGACACTCTC	TGAGGTAGAGGTAGGAGGATCTT
iNOS	GTTCTCAGCCCAACAATACAAGA	GTGGACGGGTCGATGTCAC
CD163	ATGGGTGGACACAGAATGGTT	CAGGAGCGTTAGTGACAGCAG
CD206	CTCTGTTCAGCTATTGGACGC	CGGAATTTCTGGGATTCAGCTTC
IFNβ	CCTGGAGCAGCTGAATGGAA	TGGATGGCAAAGGCAGTGTAA
TNF-α	CCCTCACACTCAGATCATCTTCT	GCTACGACGTGGGCTACAG
IL-6	TAGTCCTTCCTACCCCAATTTCC	TTGGTCCTTAGCCACTCCTTC
IL-1β	GCAACTGTTCCTGAACTCAACT	ATCTTTTGGGGTCCGTCAACT
IL-10	ACAGGGAAGAAATCGATGACA	TGGGGGAGAACCTGAAGAC
NF-κB	ATGGCAGACGATGATCCCTAC	TGTTGACAGTGGTATTTCTGGTG
TIMP1	AGGTGGTCTCGTTGATTTCT	GTAAGGCCTGTAGCTGTGCC
Col1a1	TAGGCCATTGTGTATGCAGC	ACATGTTCAGCTTTGTGGACC
NRF2	TCTTGGAGTAAGTCGAGAAGTGT	GTTGAAACTGAGCGAAAAAGGC
NQO1	ATGGGAGGTGGTCGAATCTGA	GCCTTCCTTATACGCCAGAGATG
GSTP1	ATGCCACCATACACCATTGTC	GGGAGCTGCCCATACAGAC
GCLC	GGGGTGACGAGGTGGAGT	GTTGGGGTTTGTCCTCTCCC

Table S2□ Information of Patients

	Normal	ALI	Fibrosis	HCC
Number of patients	6	6	6	6
Age	42.67±9.41	43.33±15.69	50.50±12.79	49.00±10.12
Gender (male: female)	2:1	1:2	2:1	1:2
ALT(U/L)	25.21±11.31	556.94±178.59	141.57±56.12	275.27±99.08
AST(U/L)	16.17±4.12	343.54±166.50	101.00±29.08	245.95±107.30
Bilirubin(μmol/L)	13.88±5.70	204.60±45.40	28.63±7.73	288.17±109.99
Treatment	surgery	biopsy	biopsy	biopsy

Data are presented as the mean ± SD

Table S3□ DEGs of TAK1$^{\Delta HEP}$ hepatocyte cluster 7

	p_value	avg_log2FC	pct.1	pct.2	p_value adjust
Prelp	0	0.797101031	0.284	0.006	0
Slpi	0	1.858497355	0.537	0.025	0
S100a11	0	0.958553873	0.456	0.026	0
Osbpl3	0	0.845054691	0.353	0.01	0
Mfge8	0	1.414348694	0.484	0.023	0
Bicc1	0	0.790723677	0.378	0.015	0
Cd63	0	1.53332165	0.625	0.058	0
Ubd	0	1.060237398	0.431	0.011	0
Sox4	1.14E-301	1.035860402	0.303	0.009	2.42E-297
Cd14	4.83E-289	0.680249371	0.266	0.006	1.02E-284
Cybb	3.20E-280	1.214518517	0.484	0.035	6.78E-276
Tagln2	2.45E-274	1.325467013	0.55	0.049	5.20E-270
Anxa2	4.22E-273	1.13882899	0.447	0.03	8.95E-269
Spp1	9.49E-267	4.607928701	0.631	0.074	2.01E-262
Spink1	1.43E-257	1.276282901	0.409	0.026	3.02E-253
Nid1	6.70E-248	0.858957696	0.431	0.031	1.42E-243
Lcn2	4.11E-246	2.797249993	0.794	0.136	8.71E-242
Klf6	1.05E-244	1.019578201	0.481	0.041	2.22E-240
Tes	5.78E-239	0.490005671	0.269	0.01	1.23E-234
Serpina7	1.91E-235	1.800899659	0.469	0.042	4.04E-231
Rad51b	6.50E-222	0.691143361	0.291	0.014	1.38E-217
Ly6d	1.76E-216	2.179541245	0.588	0.075	3.73E-212
Atp6v0c	5.48E-213	1.30405661	0.672	0.099	1.16E-208
Casp12	9.11E-210	0.474411352	0.259	0.011	1.93E-205
Tmsb10	8.99E-209	0.727422063	0.297	0.016	1.91E-204
Serpinb6b	3.60E-204	0.73094084	0.331	0.021	7.64E-200
Cd9	1.48E-203	1.459271378	0.609	0.088	3.13E-199
Rragd	8.96E-202	0.426296742	0.266	0.013	1.90E-197
Serpinb6a	2.91E-195	0.750945891	0.378	0.031	6.16E-191
Slc25a4	4.06E-186	0.491608418	0.281	0.016	8.61E-182
Atp5mpl	5.40E-185	1.229242638	0.744	0.128	1.15E-180
Plscr1	3.27E-183	1.196865761	0.578	0.084	6.93E-179
Tgm2	1.30E-180	1.245674815	0.659	0.111	2.75E-176
Rhoc	2.56E-179	0.630814004	0.381	0.034	5.43E-175
Ifi27l2b	9.70E-178	0.693039057	0.381	0.035	2.06E-173
Gipc2	6.96E-174	0.424083999	0.259	0.015	1.48E-169
Rab5if	1.41E-173	1.044021398	0.637	0.103	2.99E-169
Scd2	1.82E-171	1.139433487	0.472	0.056	3.85E-167
Spon2	1.28E-170	0.56807136	0.35	0.03	2.71E-166
Tnfrsf12a	1.89E-164	0.499537279	0.297	0.022	4.00E-160

Anxa5	1.03E-162	2.087655464	0.784	0.204	2.19E-158
Elf3	1.93E-160	0.471903165	0.259	0.017	4.10E-156
Resf1	6.36E-159	0.544729926	0.319	0.027	1.35E-154
Tut4	2.41E-154	0.488101504	0.306	0.025	5.10E-150
Cystm1	1.60E-153	0.867547233	0.541	0.084	3.40E-149
Tax1bp3	1.61E-150	0.520600174	0.353	0.035	3.42E-146
Tut7	1.05E-148	0.625310571	0.431	0.054	2.23E-144
Stmn1	5.12E-146	0.89976965	0.347	0.036	1.08E-141
Gm30692	8.19E-144	0.501659851	0.259	0.019	1.74E-139
AC102496.1	1.11E-142	0.427597977	0.297	0.026	2.36E-138
Itih5	2.69E-139	0.658668251	0.441	0.059	5.70E-135
Slc39a4	3.35E-139	0.75034716	0.484	0.072	7.09E-135
Cstb	4.65E-137	1.712247762	0.734	0.199	9.86E-133
Lpl	1.20E-133	1.087807865	0.613	0.119	2.55E-129
Saa2	3.35E-132	2.819774034	0.628	0.133	7.11E-128
Sirpa	1.95E-131	0.395801546	0.272	0.023	4.13E-127
Cib3	1.49E-125	0.969489219	0.491	0.083	3.15E-121
Lgals1	2.79E-125	0.780574267	0.409	0.058	5.92E-121
Ciao2a	3.96E-125	0.635795775	0.434	0.064	8.39E-121
Orm2	5.08E-125	2.037785243	0.578	0.125	1.08E-120
Pgm1	1.19E-123	0.592141061	0.475	0.076	2.52E-119
Ifngr1	2.27E-123	0.492167657	0.347	0.041	4.82E-119
Col4a1	7.33E-123	0.370708213	0.25	0.021	1.55E-118
Ly6e	2.71E-121	1.57645702	0.925	0.434	5.74E-117
Tm4sf4	4.24E-121	1.986565198	0.766	0.249	9.00E-117
Tmem176b	1.32E-120	1.916099501	0.841	0.35	2.80E-116
Hpx	1.67E-120	2.020144348	0.994	0.932	3.53E-116
Depp1	1.92E-120	0.581388961	0.347	0.043	4.07E-116
Mvp	7.83E-116	0.477864708	0.328	0.04	1.66E-111
Tubb5	9.22E-116	1.156778764	0.606	0.138	1.95E-111
Ets2	6.15E-115	0.535451574	0.35	0.045	1.30E-110
H2-Q7	1.27E-114	0.835998862	0.606	0.131	2.70E-110
Ndrg1	2.41E-112	0.433813995	0.319	0.038	5.12E-108
B4galt5	2.33E-111	0.5123126	0.344	0.045	4.94E-107
Tmem176a	5.13E-111	1.562149547	0.838	0.361	1.09E-106
Ugt2b37	6.56E-110	0.544975181	0.253	0.025	1.39E-105
Alcam	3.62E-107	1.280587749	0.684	0.197	7.66E-103
Fam124a	7.92E-107	0.390158411	0.253	0.025	1.68E-102
Cxadr	2.57E-106	1.395628059	0.816	0.308	5.46E-102
Sox9	2.77E-106	0.728119153	0.422	0.07	5.86E-102
Rras	8.42E-105	0.631631107	0.444	0.078	1.78E-100
Hp	1.07E-104	1.658749015	0.994	0.93	2.26E-100
Defb1	2.00E-103	0.596038776	0.278	0.032	4.24E-99

Lmna	3.65E-102	0.616115144	0.462	0.084	7.74E-98
Wfdc2	4.26E-101	0.569744215	0.309	0.04	9.02E-97
Slc10a2	1.44E-99	0.756552639	0.55	0.121	3.06E-95
Krt8	1.50E-99	1.890329226	0.812	0.347	3.19E-95
St6gal1	3.79E-99	0.677186994	0.522	0.107	8.03E-95
Clu	2.65E-98	2.570635887	0.963	0.788	5.62E-94
Kifc3	3.48E-98	0.424097044	0.269	0.031	7.37E-94
Kcnq1ot1	1.83E-97	0.954336267	0.559	0.134	3.88E-93
Krt18	5.43E-97	1.609053952	0.812	0.326	1.15E-92
Nfe2l2	2.13E-96	0.734520277	0.537	0.118	4.52E-92
Ppl	2.42E-96	0.403712123	0.294	0.038	5.14E-92
Tpm1	1.20E-95	0.589647954	0.434	0.08	2.54E-91
Myl12a	9.57E-95	1.028615511	0.672	0.194	2.03E-90
Dynll1	1.21E-94	1.092767645	0.744	0.236	2.58E-90
Arpc1b	1.53E-94	0.518602508	0.409	0.072	3.24E-90
Jpt1	9.71E-94	0.563219571	0.366	0.06	2.06E-89
Ramac	3.41E-93	0.378547656	0.275	0.035	7.22E-89
Cp	7.06E-93	1.418220287	0.984	0.784	1.50E-88
Ecpas	2.26E-92	0.310539414	0.25	0.029	4.79E-88
Rbp1	6.23E-92	0.756935991	0.55	0.129	1.32E-87
Isg15	7.15E-92	1.479412355	0.291	0.04	1.52E-87
Mpeg1	1.92E-90	0.495605958	0.338	0.052	4.07E-86
Steap4	2.86E-90	1.211359626	0.65	0.189	6.06E-86
Gstm3	1.39E-88	1.315782535	0.444	0.093	2.95E-84
Pgd	1.92E-88	0.445622954	0.366	0.061	4.08E-84
Birc2	2.03E-88	0.547869425	0.341	0.054	4.30E-84
Ahnak	3.75E-88	0.554935127	0.353	0.058	7.95E-84
Lsr	1.15E-87	0.947246445	0.684	0.208	2.44E-83
Shisa5	8.92E-87	0.425888123	0.35	0.057	1.89E-82
Eif6	2.65E-86	0.726917138	0.619	0.164	5.61E-82
Mmp15	2.85E-86	0.366300683	0.322	0.049	6.04E-82
Fat1	4.45E-86	0.471331228	0.341	0.055	9.44E-82
Map3k1	1.14E-85	0.432660571	0.309	0.046	2.43E-81
Cldn3	3.23E-85	0.900976181	0.603	0.168	6.84E-81
Vnn1	4.94E-85	0.447584143	0.275	0.037	1.05E-80
App	8.91E-85	0.654373729	0.397	0.076	1.89E-80
Dsp	3.78E-84	0.492454451	0.397	0.074	8.01E-80
Saa1	4.32E-84	2.567253311	0.787	0.305	9.17E-80
Ablim1	1.37E-83	0.500402231	0.412	0.08	2.90E-79
Gas6	1.79E-83	0.448273942	0.269	0.037	3.80E-79
Myh9	3.56E-83	0.609146533	0.478	0.105	7.54E-79
Plpp2	6.42E-83	0.439410915	0.341	0.057	1.36E-78
Desi2	2.82E-82	0.56865687	0.566	0.139	5.97E-78

Rhou	4.06E-82	0.72440178	0.603	0.161	8.61E-78
Ahsg	4.13E-82	1.041109697	0.997	0.989	8.76E-78
Tpm4	1.32E-81	0.327956481	0.262	0.035	2.81E-77
Tns3	1.92E-79	0.31157425	0.259	0.035	4.06E-75
Nav2	3.00E-79	0.465671421	0.375	0.07	6.37E-75
Cd2ap	5.30E-79	0.760419264	0.569	0.153	1.12E-74
Samd9l	6.64E-79	0.337908707	0.275	0.04	1.41E-74
Ywhah	1.48E-78	0.781055882	0.603	0.17	3.13E-74
Pdlim1	1.68E-77	0.45404857	0.428	0.089	3.56E-73
Igtp	2.47E-77	0.561718971	0.25	0.034	5.25E-73
Mapk3	1.05E-76	0.375048456	0.3	0.048	2.23E-72
Gc	1.73E-76	0.783505512	1	0.98	3.66E-72
Colgalt1	1.25E-74	0.568586189	0.503	0.122	2.66E-70
9-Sep	2.48E-74	0.517286001	0.472	0.109	5.25E-70
Slc4a4	7.74E-74	0.813720093	0.7	0.228	1.64E-69
Itm2c	6.55E-73	0.365760372	0.297	0.049	1.39E-68
Ntrk2	2.22E-72	0.364896799	0.25	0.036	4.71E-68
Ppp4c	5.99E-72	0.414538832	0.403	0.085	1.27E-67
Atpif1	7.75E-72	0.670108478	0.556	0.153	1.64E-67
Dag1	9.63E-72	0.6661454	0.494	0.126	2.04E-67
Mgst3	5.53E-71	0.427659318	0.344	0.066	1.17E-66
Serpina10	1.02E-69	0.88672363	0.772	0.306	2.17E-65
Chmp2b	1.19E-69	0.440147156	0.444	0.102	2.52E-65
Irgm2	1.46E-68	0.458849816	0.281	0.047	3.11E-64
Tceal9	2.81E-68	0.521660635	0.403	0.091	5.96E-64
Eppk1	4.29E-68	0.37993259	0.369	0.075	9.10E-64
Hsd17b13	6.48E-68	1.440167112	0.831	0.453	1.37E-63
Rtn4	8.23E-68	1.136424149	0.694	0.268	1.74E-63
Serinc5	9.69E-68	0.367429582	0.344	0.067	2.05E-63
Rnf213	1.37E-67	0.524422182	0.359	0.075	2.90E-63
Otud7b	7.92E-67	0.273854236	0.284	0.048	1.68E-62
Nostrin	8.88E-67	0.349410233	0.319	0.06	1.88E-62
Slc6a6	1.24E-66	0.711443285	0.672	0.211	2.63E-62
Gars	1.71E-66	0.347936407	0.341	0.067	3.62E-62
C3	8.27E-66	1.20701631	0.981	0.924	1.75E-61
Myl12b	2.90E-65	0.585047272	0.562	0.162	6.14E-61
Cd47	3.17E-65	0.820428032	0.753	0.283	6.73E-61
Baiap2	3.53E-65	0.346580517	0.359	0.074	7.49E-61
Nedd4l	8.20E-65	0.529507231	0.484	0.127	1.74E-60
Mt2	1.00E-64	0.833162122	0.497	0.139	2.12E-60
Serping1	1.06E-64	0.935923034	0.931	0.591	2.25E-60
Ambp	2.51E-64	0.865833236	0.981	0.846	5.33E-60
Cyr61	1.23E-63	0.500966558	0.266	0.046	2.61E-59

Ifi47	4.20E-63	0.719673648	0.334	0.07	8.90E-59
Cadm1	6.43E-63	0.433709996	0.378	0.084	1.36E-58
Nectin2	7.12E-63	0.463743621	0.416	0.099	1.51E-58
Med21	1.27E-62	0.515657649	0.525	0.147	2.68E-58
Sqstm1	3.17E-62	0.721178955	0.647	0.218	6.73E-58
Asah1	5.31E-62	0.377648762	0.366	0.08	1.13E-57
Arhgdia	4.60E-61	0.395128969	0.409	0.097	9.76E-57
Reep5	5.90E-61	0.353824831	0.391	0.09	1.25E-56
Trf	2.80E-60	0.784457428	1	0.998	5.94E-56
Srxn1	5.07E-60	0.37435423	0.278	0.051	1.08E-55
Hacd2	5.89E-60	0.477704433	0.494	0.135	1.25E-55
Ddx39b	2.86E-59	0.367329582	0.362	0.081	6.07E-55
Anxa7	4.91E-59	0.447659838	0.531	0.151	1.04E-54
Tpr	5.36E-59	0.555177479	0.547	0.166	1.14E-54
Spint2	7.22E-59	0.636949446	0.591	0.194	1.53E-54
Tspo	1.24E-58	0.746264713	0.716	0.284	2.63E-54
Gss	1.58E-58	0.429621009	0.428	0.109	3.34E-54
Psme1	3.03E-58	0.559149166	0.622	0.204	6.42E-54
Uhrf2	3.63E-58	0.366582566	0.378	0.088	7.69E-54
Ppia	7.43E-58	0.821411847	0.978	0.845	1.58E-53
Gstm5	7.50E-58	0.369649987	0.303	0.062	1.59E-53
Frrs1	7.63E-58	0.420329855	0.419	0.106	1.62E-53
Npc2	1.07E-57	0.587791589	0.606	0.199	2.28E-53
Crip2	1.45E-57	0.569514393	0.559	0.174	3.07E-53
Ifitm3	2.01E-57	0.730474864	0.991	0.886	4.27E-53
Cd151	2.89E-57	0.305846257	0.272	0.051	6.14E-53
Sorbs2	5.33E-57	0.966195857	0.691	0.284	1.13E-52
Sqle	7.20E-57	0.475676792	0.406	0.103	1.53E-52
Idh2	9.82E-57	0.493410901	0.575	0.179	2.08E-52
Ube2v2	1.24E-56	0.606256898	0.459	0.13	2.64E-52
Tbrg1	2.15E-56	0.406972846	0.406	0.102	4.57E-52
Hspa4l	3.03E-56	0.409146065	0.362	0.085	6.43E-52
Acsl4	3.48E-56	0.592243758	0.6	0.198	7.37E-52
H2-D1	4.18E-56	0.925614942	0.875	0.486	8.85E-52
Apcs	5.06E-56	0.868227104	0.681	0.257	1.07E-51
Atp6v0e	7.34E-56	0.717217701	0.697	0.269	1.56E-51
Grn	3.19E-55	0.680386245	0.625	0.22	6.77E-51
Trp53	9.14E-55	0.25523345	0.269	0.051	1.94E-50
Fkbp1a	1.21E-54	0.605013049	0.606	0.206	2.56E-50
Cobl	1.51E-54	0.286555639	0.275	0.053	3.19E-50
Sat1	1.55E-54	0.639384738	0.641	0.229	3.28E-50
Lgmn	2.42E-54	0.380826038	0.306	0.065	5.12E-50
Rock2	6.72E-54	0.353471533	0.381	0.094	1.43E-49

Pbx1	6.89E-54	0.341015491	0.278	0.056	1.46E-49
Hspb1	1.02E-53	0.498982768	0.291	0.061	2.17E-49
Dnajc10	1.27E-53	0.270767035	0.259	0.049	2.70E-49
Atp9a	4.01E-53	0.300739391	0.291	0.06	8.49E-49
Mrps6	4.55E-53	0.255895734	0.306	0.065	9.64E-49
Ephx1	6.46E-53	0.496588389	0.528	0.162	1.37E-48
Gnb1	6.68E-53	0.485304334	0.559	0.178	1.42E-48
AW112010	1.14E-52	1.06224174	0.884	0.477	2.42E-48
Myo10	1.24E-52	0.284506801	0.309	0.067	2.63E-48
Ccl9	1.31E-52	0.770785719	0.631	0.232	2.79E-48
Akap13	1.66E-52	0.508951286	0.466	0.136	3.51E-48
Lima1	1.97E-52	0.373010718	0.359	0.087	4.18E-48
Tnfaip1	2.47E-52	0.272796761	0.3	0.064	5.25E-48
Hdac5	2.80E-52	0.274259672	0.253	0.048	5.94E-48
Fbxo6	3.05E-52	0.359202409	0.353	0.085	6.47E-48
Fkbp11	4.71E-52	0.360192541	0.372	0.093	9.98E-48
Sri	4.98E-52	0.287424751	0.419	0.109	1.06E-47
Plekha5	5.65E-52	0.282933836	0.297	0.063	1.20E-47
Acin1	6.06E-52	0.289519902	0.331	0.076	1.28E-47
Palmd	6.70E-52	0.353509302	0.353	0.085	1.42E-47
Sptan1	6.72E-52	0.330233494	0.278	0.057	1.42E-47
Adgrl2	6.81E-52	0.40287801	0.378	0.096	1.44E-47
Mup20	9.58E-52	1.346015486	1	0.987	2.03E-47
Anxa4	1.74E-51	0.372170244	0.391	0.101	3.69E-47
Adh1	2.96E-51	0.892721438	0.944	0.689	6.27E-47
Ppp1r14b	3.96E-51	0.385057816	0.409	0.11	8.40E-47
Tuba1b	4.02E-51	0.443688782	0.297	0.066	8.52E-47
Trim25	4.34E-51	0.382257342	0.403	0.106	9.19E-47
Dsc2	4.44E-51	0.355552818	0.362	0.089	9.42E-47
Snx10	4.83E-51	0.489951638	0.469	0.139	1.02E-46
Psmb10	7.28E-51	0.286677196	0.347	0.083	1.54E-46
Bax	1.23E-50	0.405303387	0.409	0.111	2.60E-46
St3gal4	1.38E-50	0.431336556	0.419	0.115	2.93E-46
Itgb5	1.85E-50	0.348369835	0.328	0.077	3.93E-46
Glmp	2.12E-50	0.262971814	0.359	0.088	4.49E-46
Pla1a	2.24E-50	0.361952145	0.378	0.097	4.74E-46
Ccnd1	2.29E-50	0.476122303	0.303	0.07	4.85E-46
Sugt1	2.36E-50	0.290821384	0.372	0.093	5.00E-46
Micu2	2.42E-50	0.262777924	0.291	0.062	5.13E-46
Rnpep	2.94E-50	0.292242475	0.284	0.06	6.24E-46
Gng12	3.44E-50	0.417327994	0.55	0.173	7.29E-46
Cxcl14	4.22E-50	0.459596263	0.294	0.065	8.95E-46
Slc35f5	4.71E-50	0.334427182	0.369	0.093	9.99E-46

Arl6ip5	5.39E-50	0.284533785	0.278	0.058	1.14E-45
Litaf	5.60E-50	0.569131384	0.616	0.222	1.19E-45
Gnai2	5.95E-50	0.386101809	0.45	0.129	1.26E-45
Creb3l2	1.42E-49	0.349270619	0.312	0.072	3.02E-45
Mpp1	1.49E-49	0.269361772	0.319	0.074	3.15E-45
Rhod	1.53E-49	0.267167436	0.306	0.069	3.24E-45
Mbd2	2.19E-49	0.328209585	0.45	0.127	4.64E-45
Ctnna1	2.80E-49	0.417559306	0.522	0.162	5.93E-45
Gstm1	3.21E-49	1.264601432	0.938	0.793	6.81E-45
Gpx4	3.25E-49	0.833008521	0.925	0.677	6.89E-45
Maged1	3.81E-49	0.475403022	0.491	0.151	8.08E-45
Fndc3b	5.03E-49	0.441453475	0.456	0.135	1.07E-44
Ago2	6.25E-49	0.264304619	0.272	0.057	1.32E-44
Phip	6.73E-49	0.303409841	0.334	0.08	1.43E-44
Cnih4	1.53E-48	0.380065748	0.384	0.102	3.23E-44
Mob1a	1.56E-48	0.302499995	0.378	0.097	3.31E-44
Acsl3	1.92E-48	0.263280818	0.3	0.068	4.08E-44
Calu	2.12E-48	0.464453555	0.5	0.155	4.50E-44
Tmpo	2.91E-48	0.387247242	0.375	0.099	6.17E-44
Selenoh	3.03E-48	0.370326825	0.266	0.056	6.42E-44
Ttc3	4.85E-48	0.319370297	0.275	0.06	1.03E-43
Hspa8	5.73E-48	0.829868153	0.95	0.749	1.22E-43
Lgals3bp	6.06E-48	0.364036312	0.331	0.082	1.29E-43
Pcsk9	9.88E-48	0.309783321	0.256	0.053	2.10E-43
Tubb2a	1.48E-47	0.541130765	0.644	0.243	3.14E-43
Serinc3	1.68E-47	0.690643586	0.766	0.345	3.55E-43
Gcnt2	2.03E-47	0.34596213	0.253	0.052	4.31E-43
Snrpc	2.55E-47	0.275101002	0.416	0.114	5.41E-43
Gm10073	3.72E-47	0.28731513	0.281	0.063	7.88E-43
Fgl1	4.76E-47	0.912889594	0.809	0.398	1.01E-42
Tra2a	6.21E-47	0.299892488	0.334	0.083	1.32E-42
Cdh1	1.04E-46	0.482169825	0.553	0.186	2.21E-42
Diaph1	1.31E-46	0.4153069	0.431	0.127	2.78E-42
Cdk6	1.37E-46	0.343463664	0.322	0.079	2.90E-42
Hnrnpa1	1.38E-46	0.402963349	0.425	0.123	2.92E-42
Tapbp	1.61E-46	0.452196185	0.491	0.155	3.40E-42
Map3k13	1.73E-46	0.251690152	0.256	0.054	3.67E-42
Serpinc1	1.78E-46	0.751856529	0.972	0.799	3.77E-42
P2rx4	3.13E-46	0.33818116	0.309	0.074	6.64E-42
Cr1l	3.96E-46	0.318473548	0.331	0.083	8.39E-42
Med28	4.41E-46	0.350049082	0.359	0.095	9.36E-42
Raph1	5.24E-46	0.661983825	0.666	0.269	1.11E-41
Ctsl	6.36E-46	0.779948416	0.919	0.618	1.35E-41

Nabp1	6.43E-46	0.286558499	0.256	0.054	1.36E-41
Commd2	6.53E-46	0.277427572	0.309	0.074	1.38E-41
C2	7.19E-46	0.370045975	0.478	0.146	1.52E-41
Wnk1	1.19E-45	0.483124671	0.588	0.209	2.52E-41
Mt1	1.45E-45	1.058006368	0.8	0.413	3.07E-41
Pmvk	2.59E-45	0.465221007	0.519	0.174	5.50E-41
Cct4	2.87E-45	0.447117735	0.603	0.215	6.08E-41
Ptprj	3.27E-45	0.287681329	0.316	0.077	6.94E-41
Tnfrsf1a	4.16E-45	0.285787092	0.375	0.102	8.81E-41
Tspan4	5.34E-45	0.346082833	0.388	0.109	1.13E-40
Cd36	6.33E-45	0.345601603	0.278	0.064	1.34E-40
Atp1b1	6.99E-45	0.455271002	0.453	0.141	1.48E-40
Actg1	7.90E-45	0.881000979	0.734	0.352	1.67E-40
Tstd1	9.09E-45	0.483399593	0.372	0.104	1.93E-40
Fn1	9.67E-45	0.723246662	0.966	0.766	2.05E-40
Lims1	1.06E-44	0.279108227	0.278	0.063	2.24E-40
Fdft1	1.25E-44	0.43082784	0.45	0.139	2.64E-40
Spcs1	1.30E-44	0.675626426	0.787	0.381	2.76E-40
Nfkb1	1.43E-44	0.32634042	0.253	0.055	3.02E-40
Tcim	2.38E-44	0.383301072	0.438	0.133	5.05E-40
Bag3	2.50E-44	0.334629013	0.312	0.078	5.31E-40
Cfdp1	2.51E-44	0.340248115	0.45	0.137	5.32E-40
Rpl27	3.47E-44	0.705457086	0.838	0.456	7.37E-40
Mbnl2	4.79E-44	0.397008161	0.409	0.121	1.02E-39
B2m	4.88E-44	0.566642071	1	0.949	1.04E-39
Maea	5.22E-44	0.287756964	0.275	0.063	1.11E-39
Pdcl3	7.18E-44	0.264722505	0.319	0.08	1.52E-39
Cnn3	1.77E-43	0.531220635	0.637	0.247	3.75E-39
Lrif1	2.04E-43	0.26959849	0.253	0.055	4.31E-39
Stbd1	2.38E-43	0.299927049	0.356	0.096	5.04E-39
Mdfic	2.38E-43	0.287407469	0.3	0.073	5.06E-39
Dsg2	2.49E-43	0.456190627	0.55	0.19	5.28E-39
Tmem97	2.58E-43	0.401417816	0.438	0.134	5.47E-39
Twsg1	3.00E-43	0.326278911	0.362	0.099	6.37E-39
Mat2a	3.85E-43	0.403548323	0.503	0.165	8.16E-39
Aqp8	5.21E-43	0.641740166	0.588	0.227	1.10E-38
Gm26917	5.22E-43	0.253015944	0.344	0.091	1.11E-38
Hexa	5.27E-43	0.260013746	0.284	0.068	1.12E-38
Rrp1	6.43E-43	0.282253654	0.403	0.116	1.36E-38
Bub3	6.44E-43	0.273884192	0.306	0.076	1.36E-38
Itih2	6.82E-43	0.790508707	0.853	0.525	1.45E-38
Nck1	7.32E-43	0.325135854	0.316	0.081	1.55E-38
Lrg1	7.46E-43	0.978058401	0.897	0.621	1.58E-38

Zfp950	1.10E-42	0.259178355	0.284	0.068	2.33E-38
Arf3	1.40E-42	0.315656282	0.431	0.129	2.97E-38
Mcl1	1.41E-42	0.414603649	0.534	0.184	3.00E-38
Cebpg	1.71E-42	0.365236416	0.403	0.12	3.62E-38
Vps29	2.24E-42	0.358647241	0.503	0.167	4.74E-38
Vtn	2.45E-42	0.715304958	0.972	0.833	5.20E-38
Cdc42	2.59E-42	0.610692277	0.741	0.34	5.50E-38
Vnn3	2.94E-42	0.26997184	0.281	0.067	6.24E-38
AC149090.1	3.60E-42	0.272383635	0.288	0.069	7.62E-38
Ifitm2	3.70E-42	0.686302061	0.872	0.493	7.84E-38
Nisch	3.97E-42	0.369047061	0.459	0.145	8.42E-38
Prdx4	5.61E-42	0.604173223	0.694	0.299	1.19E-37
Gnb2	5.95E-42	0.476910986	0.594	0.224	1.26E-37
Ctnnd1	8.55E-42	0.420982298	0.481	0.159	1.81E-37
Hnrnpm	9.36E-42	0.293982777	0.444	0.136	1.98E-37
Slc17a4	1.14E-41	0.299756324	0.356	0.098	2.43E-37
Psme2	1.74E-41	0.352067362	0.55	0.191	3.69E-37
Adam10	1.75E-41	0.256670817	0.3	0.075	3.71E-37
Dusp16	2.11E-41	0.329196272	0.303	0.078	4.48E-37
Tkt	2.32E-41	0.367728185	0.503	0.168	4.93E-37
G3bp2	3.13E-41	0.494932513	0.634	0.242	6.63E-37
Rnh1	4.51E-41	0.36840027	0.478	0.159	9.55E-37
Afdn	9.25E-41	0.277588759	0.35	0.097	1.96E-36
Alyref	1.02E-40	0.294897791	0.322	0.086	2.17E-36
Gsta4	1.11E-40	0.353349406	0.459	0.149	2.35E-36
Nrip1	1.24E-40	0.30779936	0.328	0.088	2.62E-36
Ube2z	1.26E-40	0.253908314	0.331	0.089	2.67E-36
Ptma	1.32E-40	0.774196475	0.938	0.708	2.79E-36
Itgb1	1.52E-40	0.428579791	0.559	0.201	3.23E-36
Csad	1.70E-40	0.787936082	0.597	0.251	3.61E-36
Myl6	2.35E-40	0.695948751	0.859	0.545	4.99E-36
Rdh11	3.53E-40	0.279702523	0.291	0.073	7.48E-36
Itgav	3.54E-40	0.364612268	0.306	0.081	7.50E-36
Cst3	4.03E-40	0.560171624	0.781	0.364	8.54E-36
H2-K1	4.04E-40	0.607820952	0.988	0.849	8.57E-36
Sptbn1	4.13E-40	0.347019098	0.391	0.118	8.76E-36
Vps28	4.39E-40	0.340804844	0.462	0.151	9.31E-36
Abhd2	4.68E-40	0.299707134	0.378	0.11	9.92E-36
Gusb	5.18E-40	0.272311977	0.269	0.065	1.10E-35
Calm2	5.38E-40	0.649522971	0.759	0.381	1.14E-35
Zbtb20	5.91E-40	0.801341601	0.922	0.654	1.25E-35
Mug2	7.31E-40	0.728763597	0.806	0.403	1.55E-35
Eef1a1	7.70E-40	0.519356787	1	0.988	1.63E-35

Chka	8.95E-40	0.605644083	0.662	0.279	1.90E-35
Cpq	9.52E-40	0.381073802	0.462	0.153	2.02E-35
Cox19	1.16E-39	0.356934531	0.45	0.147	2.45E-35
Abcb4	1.79E-39	0.517688371	0.597	0.235	3.80E-35
Hax1	1.81E-39	0.250298482	0.372	0.107	3.83E-35
Lasp1	2.31E-39	0.364157763	0.591	0.215	4.89E-35
Plin3	2.62E-39	0.250123659	0.303	0.079	5.55E-35
4930402H24Rik	3.17E-39	0.253620284	0.3	0.078	6.71E-35
Psmd8	3.20E-39	0.542534885	0.697	0.304	6.78E-35
Ermp1	3.47E-39	0.252104535	0.25	0.058	7.35E-35
Banf1	4.51E-39	0.297203786	0.391	0.118	9.57E-35
Bcap31	5.88E-39	0.466308313	0.681	0.276	1.25E-34
Nop58	8.07E-39	0.254457673	0.272	0.067	1.71E-34
H13	8.39E-39	0.447670899	0.566	0.213	1.78E-34
Nap1l1	9.17E-39	0.52610077	0.588	0.229	1.94E-34
Ik	1.00E-38	0.270249378	0.406	0.125	2.12E-34
Hsp90aa1	1.15E-38	0.812931538	0.803	0.471	2.44E-34
Slc16a1	1.34E-38	0.340788651	0.375	0.113	2.84E-34
Hnrnph1	1.36E-38	0.305316047	0.459	0.15	2.87E-34
Ifrd1	1.55E-38	0.286125249	0.269	0.066	3.29E-34
Dnajc1	1.65E-38	0.260309388	0.35	0.1	3.50E-34
Acp5	2.52E-38	0.402357653	0.5	0.177	5.34E-34
Fasn	2.84E-38	0.448090466	0.566	0.209	6.03E-34
Tuba1c	4.25E-38	0.330053745	0.362	0.109	9.01E-34
Bmpr1a	4.30E-38	0.263295559	0.291	0.075	9.12E-34
Nectin1	4.64E-38	0.312977595	0.369	0.11	9.85E-34
Chdh	4.87E-38	0.301497913	0.4	0.124	1.03E-33
Agl	5.28E-38	0.258227779	0.253	0.061	1.12E-33
Vwa5a	1.29E-37	0.304070204	0.278	0.071	2.74E-33
Hmgn1	1.52E-37	0.577941832	0.694	0.316	3.22E-33
Kdm2a	2.48E-37	0.266423008	0.369	0.11	5.25E-33
Capns1	2.82E-37	0.411284048	0.544	0.202	5.98E-33
Trip11	2.84E-37	0.262622372	0.356	0.104	6.01E-33
Krit1	3.03E-37	0.279033652	0.312	0.086	6.42E-33
Pkp2	3.12E-37	0.259109367	0.294	0.078	6.60E-33
St5	3.26E-37	0.261079052	0.328	0.093	6.90E-33
Clptm1	3.37E-37	0.308911377	0.359	0.108	7.15E-33
Hsp90ab1	3.61E-37	0.692097365	0.953	0.778	7.65E-33
Srsf7	3.81E-37	0.26847996	0.338	0.098	8.08E-33
Dmd	4.98E-37	0.251048194	0.284	0.074	1.05E-32
Cct7	6.03E-37	0.304713531	0.469	0.16	1.28E-32
Pon2	7.24E-37	0.274479061	0.456	0.151	1.54E-32
Eif3l	7.80E-37	0.33978541	0.447	0.151	1.65E-32

Tsen34	1.03E-36	0.268505939	0.344	0.101	2.19E-32
Hikeshi	1.29E-36	0.254007199	0.359	0.107	2.73E-32
Sec11a	1.36E-36	0.432646522	0.562	0.218	2.89E-32
Ddost	2.04E-36	0.348899515	0.45	0.154	4.32E-32
Jak1	3.13E-36	0.341329016	0.537	0.197	6.64E-32
Stt3b	3.20E-36	0.362756756	0.512	0.187	6.79E-32
Nsdhl	3.28E-36	0.334915417	0.369	0.114	6.96E-32
Irf6	6.40E-36	0.286363329	0.372	0.114	1.36E-31
Thoc7	6.61E-36	0.384417412	0.569	0.215	1.40E-31
Ssrp1	7.31E-36	0.273098057	0.344	0.102	1.55E-31
Socs2	7.41E-36	0.301373244	0.269	0.071	1.57E-31
Ptprf	8.60E-36	0.452414133	0.603	0.242	1.82E-31
Tm2d3	1.15E-35	0.2734998	0.338	0.1	2.44E-31
Abracl	1.50E-35	0.259351924	0.344	0.102	3.19E-31
Sh3d19	1.54E-35	0.270017689	0.394	0.125	3.26E-31
Jkamp	1.97E-35	0.252719496	0.309	0.087	4.17E-31
Cpn1	2.00E-35	0.440802177	0.725	0.315	4.24E-31
Prg4	2.00E-35	0.300039723	0.256	0.065	4.25E-31
Psma2	2.66E-35	0.285037445	0.659	0.26	5.64E-31
C4bp	2.80E-35	0.635954782	0.956	0.713	5.94E-31
Cfl1	3.88E-35	0.417951232	0.669	0.284	8.22E-31
Eif3m	4.43E-35	0.359569545	0.578	0.223	9.39E-31
Plec	4.84E-35	0.261040885	0.284	0.077	1.03E-30
Tubb4b	8.65E-35	0.758803033	0.506	0.203	1.83E-30
C6	9.42E-35	0.463545511	0.534	0.21	2.00E-30
Drg1	1.32E-34	0.281500683	0.362	0.112	2.80E-30
Polr2k	1.41E-34	0.363465709	0.559	0.214	2.99E-30
Fubp1	1.70E-34	0.325090936	0.344	0.106	3.59E-30
Rbms1	1.79E-34	0.260907514	0.366	0.113	3.79E-30
Clint1	3.07E-34	0.30749265	0.475	0.168	6.50E-30
Psmd7	3.61E-34	0.3384749	0.519	0.193	7.66E-30
Sh3glb1	3.77E-34	0.316744758	0.566	0.215	7.98E-30
Ostf1	3.79E-34	0.281088788	0.394	0.13	8.03E-30
Zc3hav1	4.09E-34	0.281706328	0.359	0.112	8.66E-30
B4galnt1	4.37E-34	0.281948496	0.388	0.125	9.27E-30
Nedd4	4.57E-34	0.49389531	0.672	0.299	9.69E-30
Sfpq	5.45E-34	0.338977934	0.481	0.174	1.16E-29
M6pr	5.68E-34	0.28765868	0.422	0.142	1.20E-29
Itih3	5.71E-34	0.652167752	0.872	0.545	1.21E-29
Rbm5	6.37E-34	0.258056381	0.309	0.09	1.35E-29
Cct5	6.59E-34	0.339026673	0.544	0.209	1.40E-29
Tmbim4	7.25E-34	0.396160519	0.675	0.287	1.54E-29
Slc22a18	1.03E-33	0.344702838	0.406	0.138	2.18E-29

Mgam	1.05E-33	0.252289372	0.35	0.108	2.22E-29
Rnf139	1.05E-33	0.255095568	0.3	0.086	2.23E-29
Ces2e	1.13E-33	0.541615406	0.559	0.234	2.40E-29
Nipbl	1.15E-33	0.271581131	0.378	0.121	2.44E-29
Zfand3	1.33E-33	0.254936374	0.403	0.133	2.81E-29
Cct8	1.61E-33	0.27550315	0.584	0.226	3.42E-29
Htatip2	1.80E-33	0.250790712	0.344	0.106	3.82E-29
Snrpb	1.84E-33	0.338611401	0.466	0.17	3.90E-29
Ddb1	2.08E-33	0.346066682	0.519	0.197	4.41E-29
Eno1	2.08E-33	0.351145215	0.534	0.205	4.41E-29
Jun	2.53E-33	0.462263556	0.522	0.207	5.36E-29
Ubb	2.80E-33	0.457044516	0.863	0.53	5.93E-29
G3bp1	3.34E-33	0.385822281	0.441	0.158	7.09E-29
Stat1	3.94E-33	0.546735504	0.281	0.081	8.36E-29
Psap	5.13E-33	0.623494905	0.731	0.372	1.09E-28
Pglyrp2	5.44E-33	0.356611921	0.441	0.158	1.15E-28
Tsn	6.84E-33	0.330298515	0.522	0.198	1.45E-28
Jmjd1c	7.34E-33	0.27909483	0.394	0.13	1.56E-28
Ssu72	9.92E-33	0.2719336	0.528	0.198	2.10E-28
Nbeal1	1.14E-32	0.299538766	0.512	0.191	2.41E-28
Scarb1	1.25E-32	0.313427375	0.428	0.149	2.65E-28
Prdx1	1.92E-32	0.451719074	0.994	0.935	4.08E-28
Arpc3	2.16E-32	0.251829815	0.522	0.197	4.59E-28
Acaca	2.39E-32	0.284277788	0.338	0.106	5.07E-28
Itih4	2.48E-32	0.641429044	0.944	0.694	5.26E-28
Kmt2e	4.11E-32	0.274671969	0.428	0.149	8.71E-28
Hmgcs1	5.15E-32	0.832564635	0.728	0.394	1.09E-27
H2-T22	7.03E-32	0.256353531	0.431	0.151	1.49E-27
Btg2	7.19E-32	0.522430927	0.531	0.222	1.52E-27
Hnrnpc	7.64E-32	0.308759829	0.575	0.228	1.62E-27
Tmem208	7.97E-32	0.274005569	0.506	0.19	1.69E-27
Tmed9	1.29E-31	0.321727326	0.497	0.188	2.73E-27
Atxn10	1.35E-31	0.281474641	0.456	0.165	2.86E-27
Txnrd1	1.41E-31	0.44878113	0.541	0.221	3.00E-27
Rbbp7	1.58E-31	0.266147346	0.419	0.146	3.36E-27
Ptpn11	1.66E-31	0.268272501	0.341	0.108	3.52E-27
Rab11a	1.94E-31	0.397764491	0.581	0.239	4.12E-27
Mdh2	2.04E-31	0.388348299	0.747	0.346	4.33E-27
Kpnb1	2.06E-31	0.270085264	0.419	0.145	4.36E-27
Laptm4a	2.06E-31	0.513060963	0.778	0.395	4.37E-27
Hjurp	2.20E-31	0.270559777	0.306	0.093	4.66E-27
Nono	2.29E-31	0.352967741	0.509	0.198	4.85E-27
Zmpste24	2.53E-31	0.28370233	0.406	0.141	5.37E-27

Jund	2.55E-31	0.290379318	0.537	0.209	5.41E-27
Dst	3.49E-31	0.341340596	0.4	0.141	7.39E-27
Pcbp1	6.60E-31	0.521298177	0.772	0.406	1.40E-26
Fgb	6.71E-31	0.579305953	1	0.972	1.42E-26
Cfi	7.11E-31	0.55084552	0.916	0.61	1.51E-26
Tpm3	8.45E-31	0.250085793	0.378	0.128	1.79E-26
H2afz	1.00E-30	0.815709761	0.769	0.419	2.13E-26
Abca3	1.13E-30	0.262501227	0.294	0.088	2.40E-26
Dynlt3	1.23E-30	0.364230805	0.537	0.214	2.61E-26
Cct2	1.29E-30	0.306155051	0.544	0.214	2.73E-26
Rtn3	1.32E-30	0.30860054	0.522	0.203	2.79E-26
Tpp1	1.44E-30	0.349549942	0.562	0.226	3.05E-26
Gstm6	1.45E-30	0.306771881	0.506	0.194	3.07E-26
Ywhaz	1.92E-30	0.4565247	0.641	0.286	4.07E-26
Eif4ebp1	2.00E-30	0.305730502	0.497	0.191	4.24E-26
Morf4l2	2.43E-30	0.311361909	0.584	0.236	5.16E-26
Nudt4	2.48E-30	0.541539321	0.734	0.376	5.26E-26
Commd3	2.59E-30	0.324986244	0.541	0.217	5.49E-26
Capzb	3.24E-30	0.311142306	0.5	0.194	6.86E-26
Arid1a	3.44E-30	0.250196389	0.338	0.109	7.30E-26
Pla2g12b	4.12E-30	0.253577098	0.381	0.131	8.74E-26
Ctsa	4.74E-30	0.329910071	0.338	0.112	1.01E-25
Pkp4	5.65E-30	0.266928741	0.397	0.139	1.20E-25
Pabpc1	6.33E-30	0.595882585	0.803	0.461	1.34E-25
Gtf2i	7.74E-30	0.263169164	0.362	0.122	1.64E-25
Fdps	8.11E-30	0.393590096	0.572	0.241	1.72E-25
Csrp2	8.47E-30	0.270971092	0.375	0.129	1.80E-25
Larp4b	8.62E-30	0.47313324	0.706	0.339	1.83E-25
Phf3	1.02E-29	0.263839288	0.359	0.121	2.15E-25
Pros1	1.05E-29	0.266838839	0.362	0.123	2.22E-25
Snrpe	1.09E-29	0.348885346	0.644	0.276	2.31E-25
Cdkn1a	1.14E-29	0.331008912	0.475	0.181	2.41E-25
Sdc1	1.98E-29	0.392225601	0.634	0.28	4.20E-25
Cope	2.11E-29	0.250436975	0.537	0.213	4.47E-25
Rbpms	3.21E-29	0.381208529	0.572	0.242	6.81E-25
Gsta2	3.67E-29	0.267150458	0.291	0.09	7.77E-25
Csnk2b	3.99E-29	0.253780383	0.491	0.19	8.45E-25
Kng2	4.09E-29	0.464973745	0.641	0.295	8.66E-25
Dhcr24	5.19E-29	0.59171938	0.834	0.49	1.10E-24
Atp6v1e1	5.50E-29	0.306931403	0.588	0.244	1.17E-24
Hsp90b1	5.55E-29	0.580755735	0.969	0.78	1.18E-24
Cyp51	5.71E-29	0.450826547	0.525	0.221	1.21E-24
Habp2	5.91E-29	0.289508329	0.428	0.158	1.25E-24

Pzp	7.07E-29	0.574893315	0.919	0.664	1.50E-24
F12	8.70E-29	0.552487242	0.694	0.36	1.84E-24
Net1	9.31E-29	0.25142758	0.306	0.097	1.97E-24
Cast	1.09E-28	0.258893164	0.384	0.134	2.31E-24
Abcc3	1.22E-28	0.27771272	0.431	0.16	2.59E-24
Ssb	1.35E-28	0.252809021	0.478	0.182	2.87E-24
Eif3f	1.65E-28	0.366971952	0.591	0.259	3.50E-24
Manf	2.08E-28	0.594398609	0.787	0.441	4.42E-24
Emc7	2.22E-28	0.280576703	0.528	0.211	4.70E-24
Qk	2.30E-28	0.323252004	0.525	0.212	4.87E-24
Ifih1	2.36E-28	0.259442961	0.325	0.107	5.00E-24
Pdia6	2.89E-28	0.545583959	0.822	0.477	6.14E-24
Slc39a14	3.28E-28	0.325162076	0.553	0.229	6.94E-24
Echdc2	3.55E-28	0.281291009	0.494	0.194	7.52E-24
Tmem50a	3.58E-28	0.268153252	0.475	0.184	7.59E-24
Pbrm1	3.64E-28	0.302763373	0.531	0.213	7.72E-24
Gsk3b	4.05E-28	0.265247303	0.431	0.161	8.59E-24
Qprt	4.29E-28	0.335757118	0.603	0.261	9.09E-24
Pcyox1	5.27E-28	0.294371844	0.475	0.185	1.12E-23
Tecr	5.53E-28	0.408206485	0.681	0.32	1.17E-23
Aplp2	5.78E-28	0.512807302	0.791	0.445	1.22E-23
Ncl	6.29E-28	0.269276225	0.559	0.231	1.33E-23
Ldlr	6.37E-28	0.290312151	0.431	0.162	1.35E-23
Xbp1	6.47E-28	0.475442195	0.759	0.391	1.37E-23
Sdf2l1	1.36E-27	0.293754448	0.444	0.171	2.89E-23
Arpp19	1.53E-27	0.357064504	0.625	0.283	3.24E-23
Clptm1l	1.91E-27	0.259583853	0.431	0.162	4.05E-23
Znrf2	3.13E-27	0.268887185	0.519	0.209	6.64E-23
Srsf3	3.70E-27	0.264513913	0.494	0.196	7.84E-23
Calr	3.73E-27	0.549562635	0.966	0.778	7.90E-23
Ssbp3	3.86E-27	0.292252491	0.409	0.153	8.19E-23
Rps4x	4.54E-27	0.506948936	0.972	0.799	9.63E-23
Nampt	6.20E-27	0.269757688	0.45	0.174	1.32E-22
Pnp	6.92E-27	0.390243671	0.656	0.296	1.47E-22
Mlec	7.23E-27	0.276388607	0.416	0.158	1.53E-22
9530068E07Rik	7.29E-27	0.30387292	0.525	0.22	1.55E-22
Rarres2	8.21E-27	0.514767519	0.928	0.681	1.74E-22
C1s1	1.08E-26	0.442807487	0.803	0.431	2.28E-22
Cpne3	1.12E-26	0.352189191	0.637	0.286	2.38E-22
Psma6	1.14E-26	0.294418644	0.669	0.303	2.42E-22
Son	1.22E-26	0.335114091	0.588	0.258	2.59E-22
Atp1a1	1.24E-26	0.295356649	0.522	0.213	2.62E-22
Etfl	1.31E-26	0.280156947	0.5	0.2	2.78E-22

Irgm1	1.50E-26	0.545209523	0.312	0.109	3.19E-22
Grina	2.27E-26	0.324275102	0.478	0.195	4.81E-22
H2afy	2.99E-26	0.263729139	0.5	0.203	6.33E-22
Set	4.24E-26	0.379011493	0.669	0.317	9.00E-22
Cdk2ap2	4.63E-26	0.289519138	0.522	0.22	9.81E-22
H2-T23	4.66E-26	0.276939457	0.444	0.175	9.88E-22
Ctsb	1.22E-25	0.482520824	0.856	0.509	2.58E-21
Fabp5	1.29E-25	0.391819987	0.588	0.264	2.73E-21
Selenok	1.60E-25	0.433507766	0.741	0.399	3.39E-21
H2afv	1.70E-25	0.289746216	0.556	0.239	3.61E-21
Idi1	1.98E-25	0.420254235	0.578	0.265	4.19E-21
Nckap1	2.59E-25	0.265004215	0.456	0.182	5.49E-21
Gdf15	2.82E-25	0.333109424	0.297	0.102	5.98E-21
Eef1g	3.02E-25	0.316655071	0.656	0.304	6.40E-21
Apoa4	3.04E-25	0.485599191	0.503	0.213	6.45E-21
Atp6v0b	3.52E-25	0.3281834	0.556	0.249	7.46E-21
Bhlhe40	3.77E-25	0.292807131	0.584	0.257	8.00E-21
Psma1	3.90E-25	0.323986037	0.65	0.302	8.27E-21
Stat3	4.03E-25	0.254969112	0.438	0.172	8.54E-21
Bst2	4.13E-25	0.477623567	0.772	0.442	8.76E-21
Cbr1	5.37E-25	0.272513133	0.472	0.192	1.14E-20
Ostc	7.32E-25	0.338895903	0.603	0.279	1.55E-20
Rnf130	8.93E-25	0.273503271	0.412	0.162	1.89E-20
Rbx1	1.24E-24	0.315255474	0.637	0.3	2.63E-20
Ctsh	1.66E-24	0.415286619	0.738	0.369	3.52E-20
Klhl24	1.74E-24	0.262349082	0.522	0.222	3.68E-20
Arhgef12	2.07E-24	0.282546777	0.528	0.228	4.39E-20
F2	2.66E-24	0.466086528	0.953	0.754	5.63E-20
Apoh	2.92E-24	0.388318616	0.978	0.911	6.19E-20
Rpn1	2.92E-24	0.37822827	0.688	0.339	6.20E-20
Ctsd	3.10E-24	0.334325225	0.681	0.326	6.57E-20
Ddah1	3.67E-24	0.42403604	0.672	0.331	7.79E-20
Clta	4.25E-24	0.338209515	0.669	0.328	9.00E-20
Tcp1	4.47E-24	0.265513666	0.534	0.234	9.47E-20
Pter	8.33E-24	0.346644816	0.547	0.246	1.77E-19
Sumo2	2.34E-23	0.373648741	0.684	0.351	4.97E-19
Hpn	3.18E-23	0.395617256	0.706	0.372	6.75E-19
H3f3b	3.52E-23	0.466864178	0.912	0.675	7.47E-19
Lpgat1	3.85E-23	0.36742834	0.759	0.388	8.17E-19
Nr2f6	4.40E-23	0.26536372	0.55	0.245	9.33E-19
Hmgcr	1.14E-22	0.401085757	0.409	0.169	2.42E-18
Tmed10	2.37E-22	0.383316083	0.741	0.399	5.02E-18
Gstm2	4.28E-22	0.272534996	0.284	0.101	9.07E-18

Kif1b	5.31E-22	0.276266447	0.522	0.236	1.12E-17
Prox1	5.97E-22	0.333670415	0.556	0.263	1.27E-17
Cd81	6.31E-22	0.510842804	0.863	0.575	1.34E-17
Hnrnpu	6.47E-22	0.335897576	0.691	0.352	1.37E-17
Npm1	9.64E-22	0.456339738	0.787	0.481	2.04E-17
Ywhaq	1.03E-21	0.269809244	0.55	0.255	2.19E-17
Slc6a13	1.47E-21	0.282952281	0.572	0.266	3.12E-17
Prdx2	2.01E-21	0.377681366	0.7	0.389	4.26E-17
Lamp1	2.57E-21	0.468347948	0.919	0.687	5.45E-17
Osgin1	2.83E-21	0.286033164	0.444	0.193	5.99E-17
Rrbp1	3.01E-21	0.447205029	0.769	0.448	6.39E-17
Rpl5	5.08E-21	0.489706844	0.8	0.54	1.08E-16
Zfand5	5.53E-21	0.257161987	0.503	0.228	1.17E-16
Rpl7	6.73E-21	0.451847351	0.922	0.729	1.43E-16
Eif4a1	7.23E-21	0.394445341	0.784	0.465	1.53E-16
Arf1	8.42E-21	0.406887578	0.659	0.354	1.79E-16
Dad1	1.56E-20	0.355051585	0.756	0.418	3.30E-16
Mtdh	2.02E-20	0.268989226	0.562	0.265	4.27E-16
Dstn	3.54E-20	0.415759764	0.731	0.421	7.51E-16
Atp6v1g1	4.96E-20	0.311609552	0.706	0.383	1.05E-15
Spcs2	5.38E-20	0.37483101	0.731	0.417	1.14E-15
Pfn1	7.83E-20	0.379629393	0.853	0.557	1.66E-15
Hnrnpab	7.99E-20	0.258363865	0.581	0.279	1.69E-15
Ran	9.63E-20	0.417178169	0.703	0.39	2.04E-15
Id2	1.09E-19	0.4603996	0.725	0.415	2.31E-15
Rora	1.47E-19	0.321402556	0.634	0.33	3.12E-15
Fgg	2.01E-19	0.472831624	1	0.97	4.26E-15
Hdgf	2.25E-19	0.258855073	0.662	0.332	4.77E-15
Atxn7l3b	2.66E-19	0.304730607	0.631	0.318	5.63E-15
Pdia4	3.16E-19	0.295904926	0.644	0.322	6.70E-15
Tkfc	3.52E-19	0.286593311	0.619	0.312	7.45E-15
Sec61a1	3.66E-19	0.271617962	0.531	0.251	7.75E-15
Mrfap1	6.19E-19	0.258253225	0.691	0.361	1.31E-14
Sh3bgrl	8.73E-19	0.268484054	0.653	0.33	1.85E-14
Fads1	1.12E-18	0.302933943	0.713	0.373	2.37E-14
Btf3	1.13E-18	0.399705373	0.816	0.551	2.39E-14
H3f3a	1.48E-18	0.37639386	0.906	0.667	3.13E-14
Ndufb6	1.48E-18	0.280523086	0.75	0.407	3.14E-14
Cald1	1.57E-18	0.388713422	0.875	0.57	3.32E-14
Mbl1	2.44E-18	0.275259026	0.787	0.427	5.17E-14
Tmbim6	3.00E-18	0.392263923	0.947	0.749	6.35E-14
Tor1aip2	3.54E-18	0.284893844	0.484	0.231	7.50E-14
Hnrnpa2b1	4.38E-18	0.397314221	0.841	0.545	9.29E-14

Elob	5.61E-18	0.275839021	0.816	0.464	1.19E-13
Entpd5	6.39E-18	0.252861764	0.484	0.228	1.36E-13
Tpi1	6.86E-18	0.30962483	0.762	0.427	1.46E-13
Dbi	7.46E-18	0.278916315	0.997	0.967	1.58E-13
Surf4	1.31E-17	0.304947801	0.609	0.318	2.77E-13
Aldh1a7	1.47E-17	0.2982854	0.669	0.355	3.11E-13
Rnf11	2.11E-17	0.2607517	0.644	0.337	4.48E-13
Trp53inp1	2.96E-17	0.367881629	0.566	0.293	6.28E-13
Agpat2	3.12E-17	0.308822209	0.8	0.472	6.62E-13
Akr1a1	3.60E-17	0.307175755	0.784	0.495	7.63E-13
Lbp	3.66E-17	0.254199332	0.431	0.2	7.76E-13
Lipa	6.22E-17	0.343216994	0.728	0.409	1.32E-12
C4b	8.68E-17	0.366525121	0.853	0.552	1.84E-12
Creg1	1.05E-16	0.453832838	0.853	0.579	2.22E-12
Ptp4a2	1.13E-16	0.281392298	0.659	0.356	2.39E-12
Rpn2	1.30E-16	0.2920571	0.581	0.296	2.75E-12
Rpsa	1.34E-16	0.351790561	0.966	0.829	2.84E-12
Sppl2a	1.49E-16	0.317183247	0.772	0.445	3.17E-12
Itm2b	1.67E-16	0.301921227	0.991	0.909	3.55E-12
Rplp0	1.87E-16	0.359705939	0.922	0.74	3.97E-12
Selenos	2.20E-16	0.285601437	0.566	0.296	4.66E-12
Ldha	2.30E-16	0.408776025	0.909	0.678	4.88E-12
Tmem59	2.52E-16	0.316849818	0.775	0.451	5.35E-12
Hspa5	2.69E-16	0.42994662	0.941	0.759	5.69E-12
Acsl5	3.04E-16	0.278855991	0.584	0.305	6.45E-12
Tbca	3.52E-16	0.32263173	0.825	0.512	7.46E-12
Bsg	4.60E-16	0.367447779	0.816	0.539	9.76E-12
Agt	4.62E-16	0.391749486	0.8	0.499	9.80E-12
Rpl15	4.79E-16	0.374290947	0.916	0.753	1.01E-11
Plin2	1.39E-15	0.280001614	0.809	0.496	2.94E-11
Ddx5	1.94E-15	0.332137278	0.856	0.567	4.11E-11
Vmp1	2.72E-15	0.273125245	0.709	0.393	5.77E-11
Ppib	6.33E-15	0.309015515	0.834	0.532	1.34E-10
Rps3	1.32E-14	0.32715143	0.878	0.659	2.80E-10
Mif	1.33E-14	0.283443331	0.838	0.542	2.82E-10
Serpinf2	1.69E-14	0.319198733	0.856	0.548	3.58E-10
Eef1b2	2.06E-14	0.328366148	0.809	0.536	4.37E-10
Hnrnpa3	2.73E-14	0.266355128	0.684	0.392	5.79E-10
Gpt2	3.25E-14	0.302098714	0.794	0.483	6.90E-10
Iigp1	4.29E-14	0.64245753	0.922	0.638	9.09E-10
Naca	7.18E-14	0.291634054	0.856	0.667	1.52E-09
Ndufc2	9.11E-14	0.279356533	0.809	0.503	1.93E-09
Aadac	1.61E-13	0.313821232	0.816	0.528	3.42E-09

Pcbp2	2.36E-13	0.296198036	0.809	0.527	4.99E-09
Rpl6	3.10E-13	0.305347556	0.881	0.694	6.58E-09
Serpind1	5.38E-13	0.252586875	0.762	0.465	1.14E-08
Canx	6.63E-13	0.287991658	0.922	0.662	1.41E-08
Rpl10a	8.70E-13	0.314822207	0.925	0.759	1.84E-08
Rack1	1.04E-12	0.295993535	0.881	0.653	2.21E-08
Neat1	1.67E-12	0.321464764	0.884	0.622	3.55E-08
Calm1	1.80E-12	0.267884005	0.812	0.539	3.82E-08
Rps27a	1.86E-12	0.2548295	0.981	0.915	3.95E-08
Dnaja1	2.78E-12	0.267444973	0.831	0.558	5.89E-08
Apom	2.93E-12	0.307378715	0.856	0.596	6.21E-08
S100a10	3.58E-12	0.301880922	0.734	0.466	7.58E-08
Sc5d	7.95E-12	0.312012581	0.809	0.543	1.69E-07
C8a	8.03E-12	0.310993159	0.881	0.61	1.70E-07
Eef2	8.27E-12	0.36620411	0.897	0.72	1.75E-07
Sult1a1	2.66E-11	0.261214993	0.672	0.425	5.64E-07
Zfp36l1	6.05E-11	0.284073079	0.841	0.589	1.28E-06
Arl6ip1	2.58E-10	0.331769333	0.769	0.488	5.47E-06
Orm1	4.07E-10	0.498447146	0.963	0.946	8.63E-06
Apof	4.15E-10	0.28293409	0.878	0.67	8.79E-06
Ces1g	1.20E-09	0.323883701	0.681	0.456	2.54E-05
Rps16	4.04E-09	0.265889953	0.953	0.863	8.55E-05
Gclc	1.71E-07	0.293582322	0.828	0.574	0.003618095

Table S4□ KEGG enrichment analysis of cluster 7's DEGs

Description	GeneRatio	BgRatio	pvalue	p.adjust	qvalue	Count
Complement and coagulation cascades	22/438	93/8912	4.59E-10	1.37E-07	9.80E-08	22
Phagosome	31/438	182/8912	9.25E-10	1.38E-07	9.88E-08	31
Ferroptosis	14/438	40/8912	2.80E-09	2.79E-07	1.99E-07	14
Protein processing in endoplasmic reticulum	28/438	172/8912	1.73E-08	1.30E-06	9.26E-07	28
Fluid shear stress and atherosclerosis	25/438	148/8912	4.85E-08	2.90E-06	2.07E-06	25
Salmonella infection	33/438	253/8912	2.34E-07	1.17E-05	8.34E-06	33
Antigen processing and presentation	18/438	90/8912	2.82E-07	1.20E-05	8.61E-06	18
Lysosome	22/438	131/8912	3.47E-07	1.30E-05	9.28E-06	22
Coronavirus disease - COVID-19	32/438	247/8912	4.19E-07	1.39E-05	9.95E-06	32
Human cytomegalovirus infection	31/438	256/8912	2.77E-06	8.27E-05	5.91E-05	31
Pertussis	15/438	77/8912	3.94E-06	0.000107	7.66E-05	15
Kaposi sarcoma-associated herpesvirus infection	27/438	224/8912	1.34E-05	0.000333	0.000238	27
Steroid biosynthesis	7/438	20/8912	2.93E-05	0.000674	0.000481	7
Adherens junction	13/438	71/8912	3.49E-05	0.000744	0.000532	13
Glutathione metabolism	13/438	72/8912	4.07E-05	0.000811	0.000579	13
Lipid and atherosclerosis	25/438	216/8912	5.54E-05	0.001035	0.00074	25
Terpenoid backbone biosynthesis	7/438	23/8912	8.14E-05	0.001432	0.001024	7
Cholesterol metabolism	10/438	49/8912	0.000108	0.001761	0.001258	10
Apoptosis	18/438	136/8912	0.000112	0.001761	0.001258	18
Platinum drug resistance	13/438	80/8912	0.000126	0.001888	0.001349	13
Metabolism of xenobiotics by cytochrome P450	12/438	73/8912	0.000204	0.002908	0.002078	12
Spliceosome	17/438	134/8912	0.000289	0.003851	0.002752	17
Toxoplasmosis	15/438	110/8912	0.000296	0.003851	0.002752	15
Hepatocellular carcinoma	20/438	174/8912	0.000334	0.00398	0.002844	20
Arrhythmogenic right ventricular cardiomyopathy	12/438	77/8912	0.000342	0.00398	0.002844	12
Thyroid cancer	8/438	37/8912	0.00035	0.00398	0.002844	8
Viral carcinogenesis	24/438	229/8912	0.000359	0.00398	0.002844	24
Human papillomavirus infection	33/438	362/8912	0.000424	0.00453	0.003237	33
Hepatitis C	19/438	165/8912	0.000457	0.004612	0.003296	19
Human T-cell leukemia virus 1 infection	25/438	247/8912	0.000463	0.004612	0.003296	25
Regulation of actin cytoskeleton	23/438	220/8912	0.000491	0.00474	0.003387	23
Tight junction	19/438	167/8912	0.000531	0.004965	0.003549	19
Leishmaniasis	11/438	70/8912	0.000557	0.00505	0.003609	11
Human immunodeficiency virus 1 infection	24/438	240/8912	0.000712	0.006258	0.004472	24
Chemical carcinogenesis - DNA adducts	12/438	84/8912	0.00077	0.006575	0.004699	12
Bacterial invasion of epithelial cells	11/438	76/8912	0.001132	0.009146	0.006537	11
Pancreatic cancer	11/438	76/8912	0.001132	0.009146	0.006537	11
Parkinson disease	25/438	264/8912	0.001222	0.009619	0.006874	25

AGE-RAGE signaling pathway in diabetic complications	13/438	101/8912	0.00128	0.009815	0.007014	13
Tuberculosis	19/438	180/8912	0.001327	0.009917	0.007088	19
Chemical carcinogenesis - receptor activation	22/438	225/8912	0.001571	0.011458	0.008189	22
Fatty acid biosynthesis	5/438	19/8912	0.001837	0.012868	0.009196	5
Proteasome	8/438	47/8912	0.001851	0.012868	0.009196	8
Epstein-Barr virus infection	22/438	231/8912	0.002196	0.014923	0.010665	22
Drug metabolism - cytochrome P450	10/438	71/8912	0.002317	0.015392	0.011	10
Neurotrophin signaling pathway	14/438	121/8912	0.002381	0.015474	0.011059	14
Proteoglycans in cancer	20/438	205/8912	0.002593	0.016495	0.011788	20
Fatty acid metabolism	9/438	62/8912	0.003072	0.019134	0.013674	9
Prion disease	24/438	268/8912	0.003192	0.019476	0.013918	24
Bile secretion	12/438	100/8912	0.003524	0.021075	0.015062	12
ECM-receptor interaction	11/438	88/8912	0.003731	0.021876	0.015634	11
Cellular senescence	18/438	184/8912	0.004046	0.023265	0.016627	18
Amyotrophic lateral sclerosis	30/438	369/8912	0.004473	0.025236	0.018035	30
Hypertrophic cardiomyopathy	11/438	91/8912	0.004837	0.026785	0.019142	11
Leukocyte transendothelial migration	13/438	118/8912	0.005131	0.027894	0.019935	13
Drug metabolism - other enzymes	11/438	92/8912	0.005259	0.028079	0.020067	11
Small cell lung cancer	11/438	93/8912	0.005709	0.029947	0.021402	11
Dilated cardiomyopathy	11/438	94/8912	0.006189	0.031798	0.022725	11
Hepatitis B	16/438	163/8912	0.006325	0.031798	0.022725	16
Chemical carcinogenesis - reactive oxygen species	20/438	222/8912	0.006381	0.031798	0.022725	20
Endometrial cancer	8/438	58/8912	0.007047	0.034544	0.024688	8
Alzheimer disease	30/438	383/8912	0.007548	0.036398	0.026013	30
Legionellosis	8/438	61/8912	0.00953	0.045229	0.032324	8
Focal adhesion	18/438	201/8912	0.009968	0.046038	0.032902	18
HIF-1 signaling pathway	12/438	114/8912	0.010008	0.046038	0.032902	12
PI3K-Akt signaling pathway	28/438	359/8912	0.010222	0.046309	0.033095	28
Viral myocarditis	10/438	88/8912	0.010814	0.048259	0.034489	10

Supplementary reference

1. Koo JH, Lee HJ, Kim W, Kim SG. Endoplasmic Reticulum Stress in Hepatic Stellate Cells Promotes Liver Fibrosis via PERK-Mediated Degradation of HNRNPA1 and Up-regulation of SMAD2. Gastroenterology. 2016 Jan;150(1):181-93 e8.