

## **Supporting Information**

### **Distinct T cell subsets in adipose tissue are associated with obesity**

Martha E. Haugstøyl, Martin Cornillet, Kristina Strand, Natalie Stiglund, Dan Sun, Laurence Lawrence-Archer, Iren D. Hjellestad, Ernesto Sparrelid, Christian Busch, Jøran Hjelmæsæth, Jens K. Hertel, Andrea Ponzetta, Gunnar Mellgren, Johan Fernø, Niklas K. Björkström

## **Supplementary material and methods**

### **Patient samples**

#### *Liposuction aspirates and buffy coat blood from non-obese donors*

For the proteomic screening, abdominal SAT was collected from subjects undergoing cosmetic or post weight loss liposuction (cohort 1, n=6). Buffy coat blood from anonymous donors at the Department of immunology and transfusion medicine, Haukeland University Hospital was also used in the screening and as internal controls.

#### *Bariatric surgery patients*

This study included three independent patient cohorts of obese individuals undergoing bariatric surgery at Voss Hospital (cohort 2, 3 and 4) and one cohort of obese individuals undergoing bariatric surgery at Karolinska Institutet in Stockholm (cohort 5). Cohort 2 was used for the explorative phenotyping of CD3<sup>+</sup> T cells (n=43), cohort 3 for the in-depth characterization of T cell subsets (n=6), and cohort 4 for the T cell functional characterization (n=6). Overview of available patient characteristics and biochemical measurements are listed in Table 1. Heparin blood and subcutaneous and visceral adipose tissue biopsies were obtained from all patients at the time of surgery. Samples were stored in Krebs Ringer Phosphate (KRP) buffer and sent to Haukeland University Hospital immediately after collection for further processing. Cohort 5 was used for the RNA sequencing of circulating effector memory CD8<sup>+</sup> T cells. Blood samples were taken from patients undergoing bariatric surgery at the day of surgery and one year after.

#### *Lean subjects*

Two independent groups of lean subjects were included in this study. For the characterization of T cell subsets by flow cytometry (cohort 4), matched heparin blood and visceral adipose tissue samples were collected from patients (n=6) diagnosed with intracellulapapillary mucosal neoplasm (IPMN, a premalignant pancreatic lesion found in otherwise healthy

individuals). For the transcriptional characterization of blood T cells by RNA sequencing (cohort 5), blood was collected from healthy individuals (n=5).

### **Isolation of stromal vascular cells**

Subcutaneous and visceral adipose tissue biopsies were cut in pieces with a scalpel and enzymatically digested with Collagenase Type I (Life Technologies, 0.66 mg/ml) for approximately 1 hour at 37°C. Liposuction aspirates were washed in 0.9% NaCl, diluted in KRP buffer (1:1) before enzymatically digested with Liberase (Roche, 0.078 Wunsch units/ml) for 1 hour at 37°C with shaking. The digested tissues were filtered and left to allow separation of the stromal vascular cells (SVC) from the mature adipocytes (10-20 min). The SVC was washed with phosphate-buffered saline (PBS) and centrifuged (300 x g, 5 min) before removing the supernatant. The SVC from liposuction was treated with red blood cell lysis buffer and freshly stained for the proteome screening. The SVC from tissue biopsies were cryopreserved in freezing media (FBS with 10 % DMSO) until flow cytometry experiments were performed.

### **Surface proteome screening in blood and adipose tissue**

LegendScreen™ Human PE Kit (Cat#700007, Biolegend) was applied to screen the surface of T cells for 315 proteins. Antibody barcoding was performed to enable separation of PBMC and SVF. PBMC from the healthy donors were stained with BV605 CD45 (Cat#304044) and SAT SVC from liposuction aspirates were stained with AF700 CD45 (Cat#304024). The samples were mixed and stained with a backbone panel including the following antibodies: APC-Cy7 HLA-DR (Cat#307617) and BV570 CD3 (Cat#300436) from Biolegend, BV786 CD16 (Cat#563690) and PE-CF594 CD56 (Cat# 564849) from BD Biosciences. The cells were subjected to the plates provided by the kit and the experiment was performed according to the manufacturer's protocol. The samples were acquired on the BD Fortessa instrument and the obtained data was analyzed using FlowJo v10.

## **Antibody staining and flow cytometry**

Frozen PBMC and SVF samples were thawed and stained for 29-parameter flow cytometry. In summary, the cells were stained for 25 min with the extracellular antibodies Biotin CD25 (Cat#302624), BV421 CCR7 (Cat#353208), BV510 CD123 (Cat#306022), PE CD26 (Cat# 302706) and PE-Cy7 CD127 (Cat# 351320) from Biolegend and BUV496 CD8a (Cat#564804), BUV563 CD45RA (Cat#565702), BUV615 CD49a (Cat#624297), BUV661 CD38 (Cat#612969), BUV737 CD69 (Cat#612817), BUV805 CD45 (Cat#612891), BB660 CD103 (Cat#624295), BB700 CD31 (Cat#746116), APC-Cy7 CCR5 (Cat#557755), V500 CD14 (Cat#561391), BV510 CD19 (Cat#562947), BV605 CLA (Cat# 563960), BV650 CD39 (Cat#563681), BV711 Sialyl Lewis<sup>x</sup> (Cat# 563910), BV750 CD4 (Cat# 566355), BV785 CD3 (Cat# 563800) and PE-Cy5 CD54 (Cat# 555512) from BD Biosciences, BB515 CD49e (Cat#130-110-534) from Miltenyi and PE-Cy5.5 CD28 (Cat# B24027) from Beckman Coulter. Dead Cell Marker Aqua (Cat# L34957, ThermoFisher) was used to stain dead cells. FcR Blocking Reagent (Cat# 130-059-901, Miltenyi Biotec) was added to the mix to remove potential background signals. After washing, the cells were stained for 25 min with BB630 Streptavidin (Cat# 624294, BD Biosciences) followed by washing and 1 hour fixation/permeabilization. The cells were stained for 45 minutes with an intracellular antibody mix containing the following antibodies. From BD Biosciences: BUV395 Ki67 (Cat# 564071), BB755-P Perforin (Cat# 624391, BD Horizon custom reagents), BB790-P Granzyme B (Cat# 624296, BD Horizon custom reagents). From eBioscience: eF660 Eomes (Cat# 50-4877-41), AF700 FoxP3 (Cat# 56-4776-41) and PE-Dazzle594 T-bet (Cat# 644828, Biolegend). After washing, the cells were kept in FACS buffer for immediate acquisition on the flow cytometer (BD Symphony A5) containing 5 lasers (355, 405, 488, 561 and 637 nm). Data was analyzed using Flowjo v10 (Treestar).

### **Dimension reduction analysis**

The FlowJo plugins Uniform Manifold Approximation and Projection (UMAP) and PhenoGraph were applied to visualize the single cell flow cytometry data in a high dimensional structure. To this end, CD3<sup>+</sup> T cells from blood and VAT from lean (n=6) and obese (n=6) was electronically barcoded for patient type and tissue of origin. Samples from the same patient group (“lean” or “obese”) and tissue type (blood or VAT) were concatenated and downsampled (DownSample plugin) to 26,404 events per sample for an equal number of cell input. The four files generated were concatenated to a final file that was analyzed for UMAP and Phenograph. UMAP was run using the default settings (Euclidean distance function, nearest neighbors: 15 and minimum distance: 0.5). PhenoGraph was run using the default number of nearest neighbors (K = 30). The parameter input in both analyses were the 25 phenotypic markers of interest.

### **Multifunctional T cell assay**

Frozen PBMC and SVF from SAT and VAT were thawed and rested in complete media (RPMI +10% FBS, + L-Glutamine) for 1 hour. T cells were stimulated with anti-CD3 and anti-CD28 beads (5:2 bead:cell) (Cat# 11131D, Thermo Fisher). PMA and Ionomycin (Cat# 00-4970-03, Thermo Fisher) were used as positive controls. The cells were kept at 37°C during the incubation. GolgiPlug (Brefeldin A, Cat#555029, BD Biosciences) and GolgiStop (Monesin, Cat#554724, BD Biosciences) were added after 1 hour to block the intracellular protein transport processes. The cells were then stimulated for additional 5 hours before antibody staining for flow cytometry. The staining was performed as described in the previous section with APC-Cy7 CD45 (Cat# 304014), biotin CD45RA (Cat# 304104), BV605 CD8a (Cat# 301040), PE-Cy5 CD3 (Cat# 300410), FITC IL22 (Cat# 366712), AF700 IL17 (Cat# 512318), BV650 TNF (Cat# 502938) and BV711 IFN $\gamma$  (Cat# 502540) from Biolegend and BV421 CD49e (Cat# 740077), V500 CD14 (Cat# 561391), BV510 CD19 (Cat# 562947), BV786 CD16

(Cat# 563690), PE-CF594 CD26 (Cat# 565158), PE-Cy7 CD4 (Cat# 344612), AF647 Granzyme B (Cat# 560212) and PE MIP-1 $\beta$  (Cat# 550078) from BD Biosciences. From Thermo Fisher: QD585 Streptavidin (Cat# Q10113MP), FITC IL22 (Cat# 11-7229-42) and PE-Cy5.5 CD56 (Cat# A79388, Beckman Coulter).

### **RNaseq data analysis**

RNA-seq reads were trimmed by TrimGalore 0.6.1 with '-q 30' and aligned to the human GRCh38 reference genome by HISAT 2.2.1. Reads were filtered by SAMTools 1.12 with the '-f 2 -F 4 -q 60' options to retain only uniquely mapped reads, and per gene counts were then quantified by StringTie 2.1.4. Differentially expressed genes (DEGs) between lean and obese, obese and post-surgery, as well as between lean and post-surgery samples were detected by DESeq2 1.34.0 (adjusted p-values < 0.05). Euler diagrams across DEGs of different comparisons were generated by Eulerr 6.1.1, and heatmaps were drawn by ComplexHeatmap 2.10.0 in R 4.1.1. Differentially activated pathways between obese and post-surgery samples were determined by Ingenuity Pathways Analysis (IPA) version 01-20-04, and only canonical pathways with FDR-adjusted p-values < 0.05 and absolute values of Z-scores  $\geq 2$  were retained.

## Supplementary Figure legends

**Supplementary Figure 1.** Expression of surface proteins on T cells in blood and adipose tissue. Heatmap is based on the percentage of cells expressing each surface protein, with a cut-off of minimum 20 % expression in at least one compartment.

**Supplementary Figure 2.** Expression of NK cell-specific proteins T cells. Box-and-whisker plots showing percentage of CD3<sup>+</sup> T cells expressing NKG2D, NKG2A, NKp46, Bcl2 and KIRs in PBMC, SAT and VAT from individuals with obesity (cohort 2). Line represents median and the whiskers represent the minimum and maximum value. The Wilcoxon matched-paired sign rank test was used for comparison between groups. (\*) indicates significant difference relative to blood unless otherwise specified. \*\*p<0.01, \*\*\*p<0.001.

**Supplementary Figure 3.** (A) Heatmaps showing expression patterns of differentially expressed genes (DEGs) between lean and obese (left) and obese pre- and post-bariatric surgery (right). (B) Heatmap showing 40 DEGs overlapping between lean vs. obese and obese vs. post groups.

**Supplementary Figure 4.** Relative abundance and protein expression on naïve and memory T cell subsets. (A) Pie charts showing relative abundance of naïve (CCR7<sup>+</sup>CD45RA<sup>+</sup>), central memory T (T<sub>CM</sub>, CCR7<sup>+</sup>CD45RA<sup>-</sup>) cells, effector memory T (T<sub>EM</sub>, CCR7<sup>-</sup>CD45RA<sup>-</sup>) cells and terminally differentiated T (T<sub>EMRA</sub>, CCR7<sup>-</sup>CD45RA<sup>+</sup>) cells within the CD4<sup>+</sup> and CD8<sup>+</sup> T cell population in blood and adipose tissue from individuals with obesity (n=6) and from lean subjects (n=6) (cohort 3). (B-C) Bar graphs showing protein expression on naïve and memory subsets within the (B) CD4<sup>+</sup> and (C) CD8<sup>+</sup> T cell population.

**Supplementary Figure 5.** Protein expression on Tregs in blood and adipose tissue of lean subjects (n=6) and individuals with obesity (n=6). Box-and-whisker plots showing percentage

of cells expressing the indicated proteins. Line represents median and whiskers represent min and max value.

**Supplementary Figure 6.** Representative histogram plots showing protein expression intensities on concatenated CD3<sup>+</sup> T cells from blood and subcutaneous adipose tissue (SAT) from lean subjects and individuals with obesity (cohort 3).

**Supplementary Figure 7.** UMAP plot of concatenated CD3<sup>+</sup> T cells from blood and subcutaneous adipose tissue (SAT) from lean subjects and individuals with obesity (cohort 3).

**Supplementary Figure 8.** Functional T cell assay. **(A)** Bar graphs showing CD4<sup>+</sup> and CD8<sup>+</sup> T cell protein responses in PBMC, SAT and VAT of individuals with obesity (cohort 4) for the indicated stimulations. **(B)** Expression of TNF and IFN $\gamma$  in response to anti-CD3/CD28 stimulation on CD26<sup>-</sup> and CD26<sup>+</sup> T cells (total, CD4<sup>+</sup> and CD8<sup>+</sup> T cells).

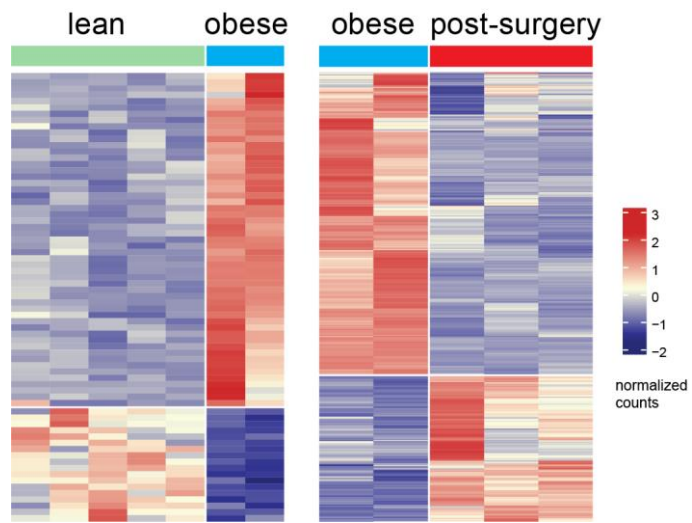
**Supplementary Figure 9.** Box-and-whisker plots showing percentages of CD26<sup>-</sup> (blue) and CD26<sup>+</sup> (red) CD4<sup>+</sup> T cells expressing the indicated proteins in blood, SAT and VAT of individuals with obesity (cohort 3). The Wilcoxon matched-paired sign rank test was used for comparison between groups. (\*) indicates significant difference between CD26<sup>-</sup> and CD26<sup>+</sup> T cells within the same compartment. \*p<0.05.



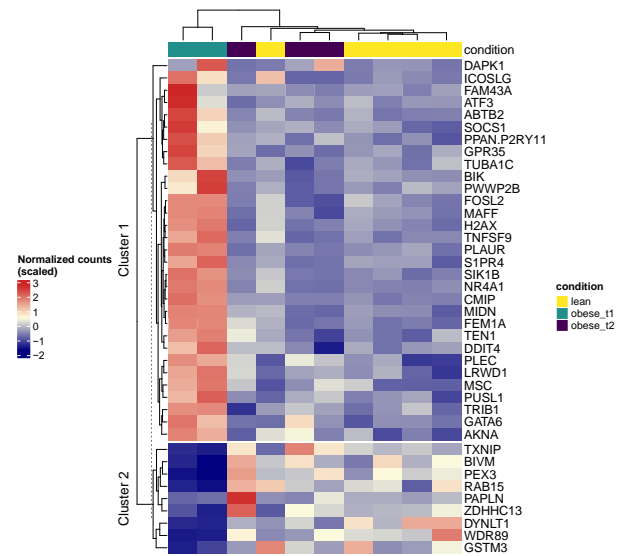


### Supplementary Figure 3

A

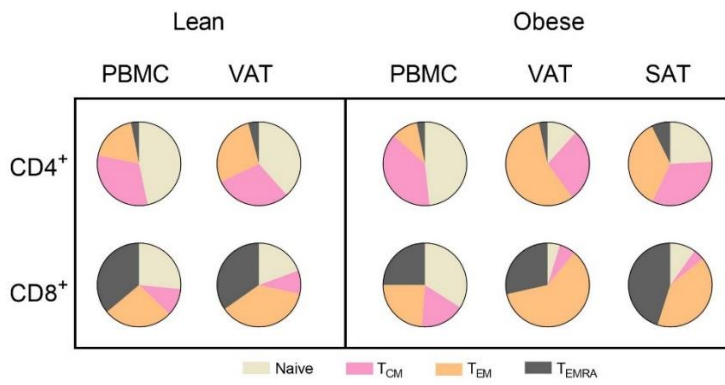


B

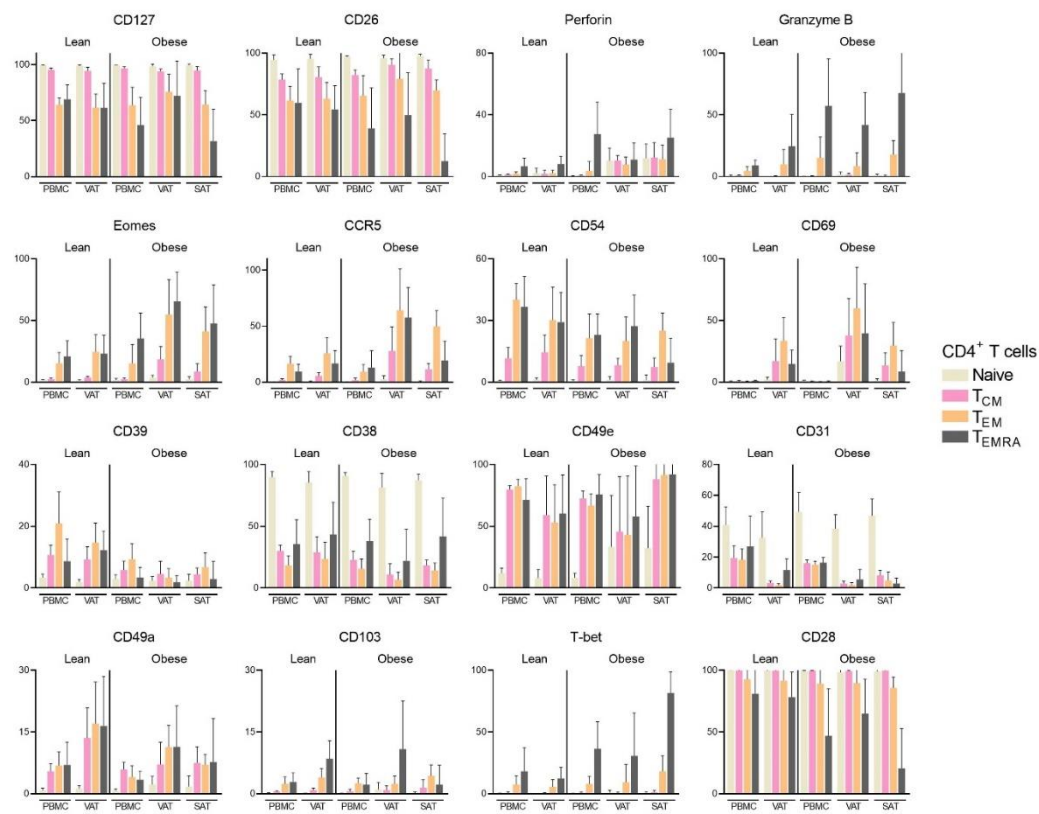


# Supplementary Figure 4

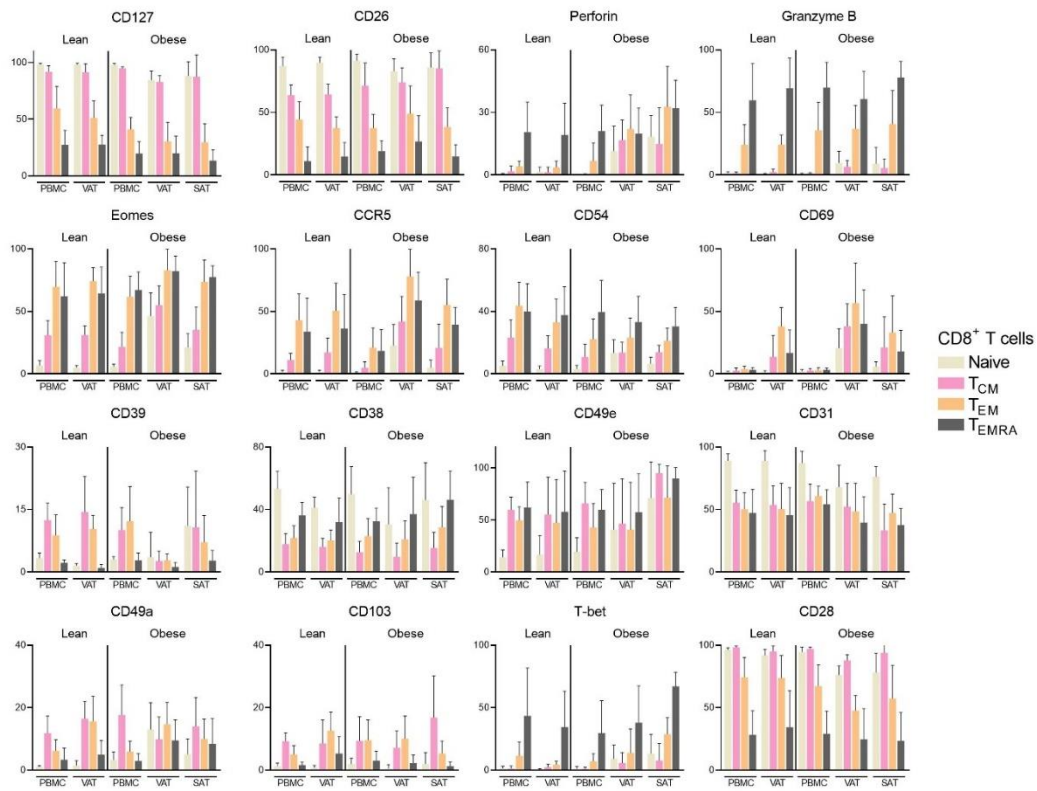
**A**



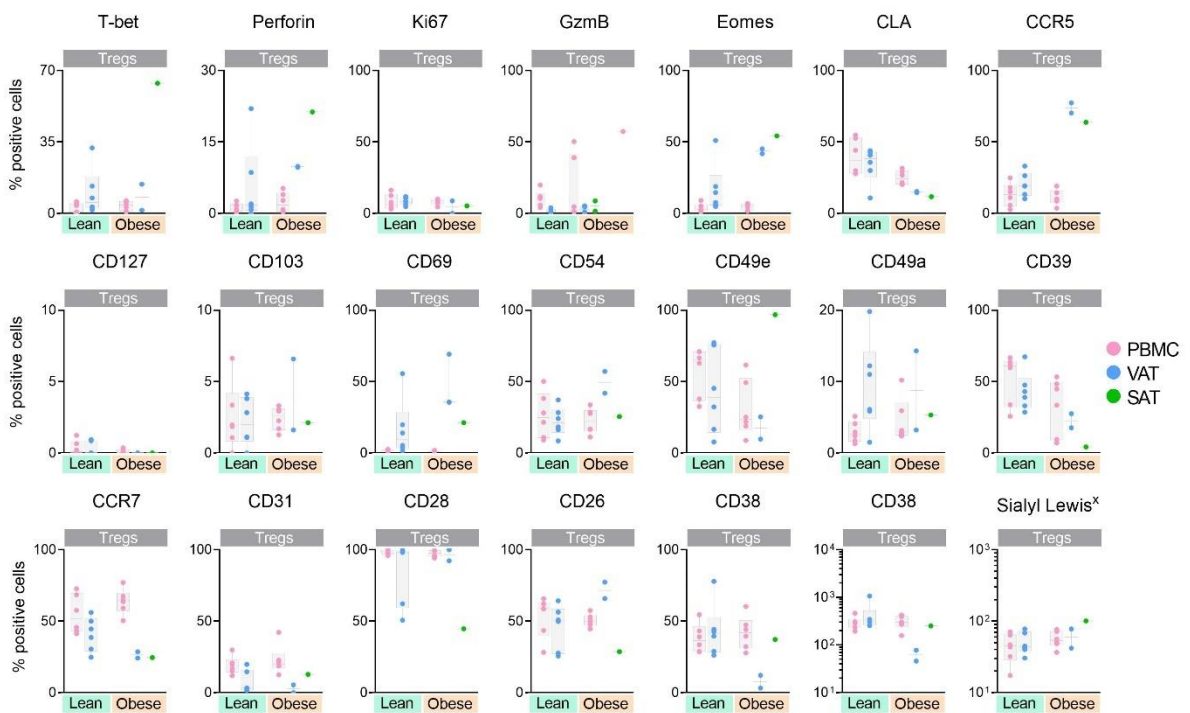
**B**



C



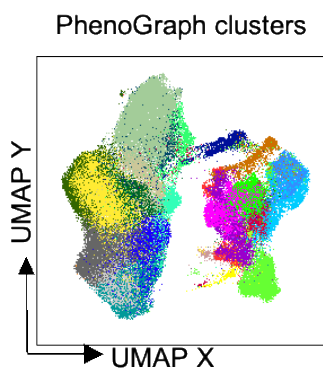
Supplementary Figure 5



## Supplementary Figure 6



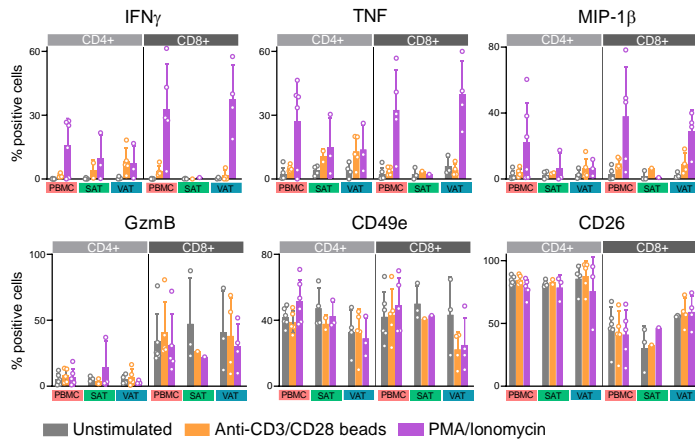
## Supplementary Figure 7



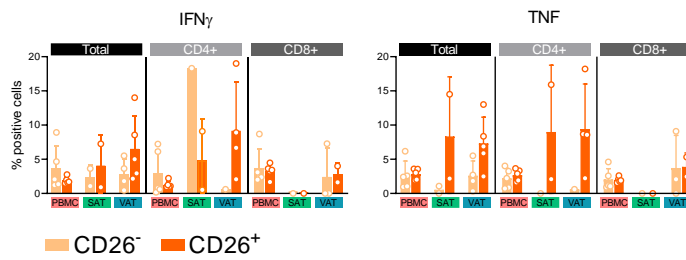
Sample Name	Subset Name	Count
concat_1_Final_Tcell.fcs	Phenograph_33FO_27	1373
concat_1_Final_Tcell.fcs	Phenograph_33FO_26	10386
concat_1_Final_Tcell.fcs	Phenograph_33FO_25	3443
concat_1_Final_Tcell.fcs	Phenograph_33FO_24	1311
concat_1_Final_Tcell.fcs	Phenograph_33FO_23	1739
concat_1_Final_Tcell.fcs	Phenograph_33FO_22	600
concat_1_Final_Tcell.fcs	Phenograph_33FO_21	1853
concat_1_Final_Tcell.fcs	Phenograph_33FO_20	3400
concat_1_Final_Tcell.fcs	Phenograph_33FO_19	1431
concat_1_Final_Tcell.fcs	Phenograph_33FO_18	1385
concat_1_Final_Tcell.fcs	Phenograph_33FO_17	3781
concat_1_Final_Tcell.fcs	Phenograph_33FO_16	2089
concat_1_Final_Tcell.fcs	Phenograph_33FO_15	1755
concat_1_Final_Tcell.fcs	Phenograph_33FO_14	146
concat_1_Final_Tcell.fcs	Phenograph_33FO_13	6194
concat_1_Final_Tcell.fcs	Phenograph_33FO_12	2351
concat_1_Final_Tcell.fcs	Phenograph_33FO_11	1317
concat_1_Final_Tcell.fcs	Phenograph_33FO_10	10168
concat_1_Final_Tcell.fcs	Phenograph_33FO_9	260
concat_1_Final_Tcell.fcs	Phenograph_33FO_8	17538
concat_1_Final_Tcell.fcs	Phenograph_33FO_7	4513
concat_1_Final_Tcell.fcs	Phenograph_33FO_6	219
concat_1_Final_Tcell.fcs	Phenograph_33FO_5	14068
concat_1_Final_Tcell.fcs	Phenograph_33FO_4	5209
concat_1_Final_Tcell.fcs	Phenograph_33FO_3	739
concat_1_Final_Tcell.fcs	Phenograph_33FO_2	2078
concat_1_Final_Tcell.fcs	Phenograph_33FO_1	6270

## Supplementary Figure 8

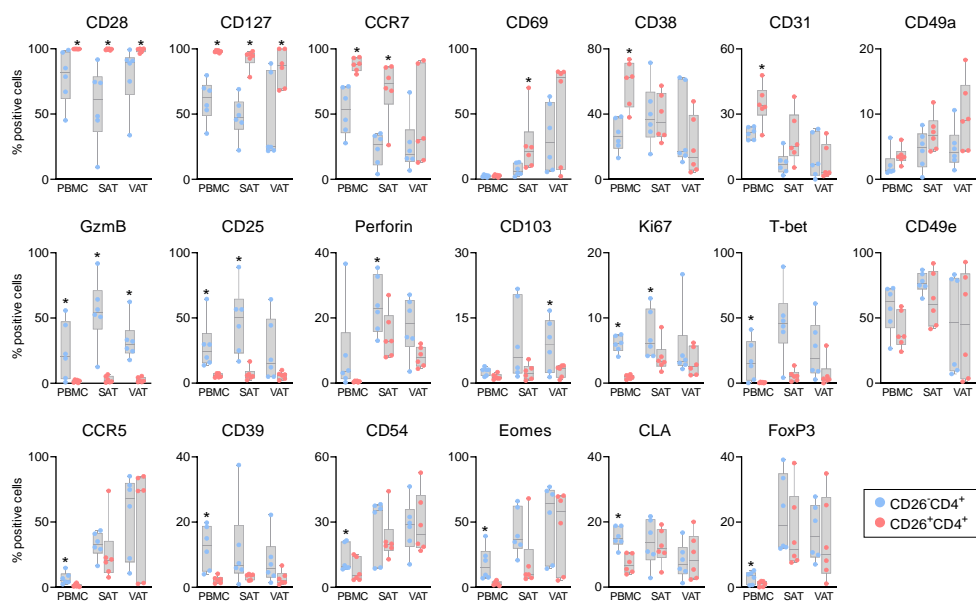
**A:**



**B:**



## Supplementary Figure 9



## Supplementary Figure 1

### T1 vs Lean

GeneID	Cluster	hgnc_symbol
ENSG00000196730	cluster1	DAPK1
ENSG00000100290	cluster1	BIK
ENSG00000171813	cluster1	PWWP2B
ENSG00000204574	cluster1	ABCF1
ENSG00000106948	cluster1	AKNA
ENSG00000141965	cluster1	FEM1A
ENSG00000185022	cluster1	MAFF
ENSG00000167470	cluster1	MIDN
ENSG00000188486	cluster1	H2AX
ENSG00000075426	cluster1	FOSL2
ENSG00000153815	cluster1	CMIP
ENSG00000122877	cluster1	EGR2
ENSG00000275993	cluster1	SIK1B
ENSG00000123358	cluster1	NR4A1
ENSG00000178860	cluster1	MSC
ENSG00000213366	cluster1	GSTM2
ENSG00000084652	cluster1	TXLNA
ENSG00000173334	cluster1	TRIB1
ENSG00000011422	cluster1	PLAUR
ENSG00000188290	cluster1	HES4
ENSG00000141448	cluster1	GATA6
ENSG00000104976	cluster1	SNAPC2
ENSG00000183655	cluster1	KLHL25
ENSG00000170271	cluster1	FAXDC2
ENSG00000169972	cluster1	PUSL1
ENSG00000125910	cluster1	S1PR4
ENSG00000184967	cluster1	NOC4L
ENSG00000262814	cluster1	MRPL12
ENSG00000171161	cluster1	ZNF672
ENSG00000178209	cluster1	PLEC
ENSG00000161036	cluster1	LRWD1
ENSG00000130810	cluster1	PPAN
ENSG00000242802	cluster1	AP5Z1
ENSG00000137801	cluster1	THBS1
ENSG00000168209	cluster1	DDIT4
ENSG00000125657	cluster1	TNFSF9
ENSG00000149823	cluster1	VPS51
ENSG00000257949	cluster1	TEN1
ENSG00000035664	cluster1	DAPK2
ENSG00000185112	cluster1	FAM43A
ENSG00000162772	cluster1	ATF3
ENSG00000138623	cluster1	SEMA7A
ENSG00000105298	cluster1	CACTIN
ENSG00000160214	cluster1	RRP1
ENSG00000243207	cluster1	PPAN-P2RY11
ENSG00000185338	cluster1	SOCS1
ENSG00000166016	cluster1	ABTB2
ENSG00000119508	cluster1	NR4A3
ENSG00000156966	cluster1	B3GNT7
ENSG00000108821	cluster1	COL1A1
ENSG00000178623	cluster1	GPR35
ENSG00000167553	cluster1	TUBA1C
ENSG00000160223	cluster1	ICOSLG
ENSG00000237440	cluster2	ZNF737
ENSG00000163599	cluster2	CTLA4
ENSG00000159882	cluster2	ZNF230
ENSG00000139998	cluster2	RAB15
ENSG00000134202	cluster2	GSTM3
ENSG00000164830	cluster2	OXR1
ENSG00000134243	cluster2	SORT1
ENSG00000169031	cluster2	COL4A3
ENSG00000134897	cluster2	BIVM
ENSG00000034693	cluster2	PEX3
ENSG00000265972	cluster2	TXNIP
ENSG00000146425	cluster2	DYNLT1
ENSG00000119977	cluster2	TCTN3
ENSG00000176624	cluster2	MEX3C
ENSG00000177054	cluster2	ZDHHC13
ENSG00000100767	cluster2	PAPLN
ENSG00000163629	cluster2	PTPN13
ENSG00000140006	cluster2	WDR89

## Supplementary Figure 1

### T1 vs T2

GeneID	Cluster	hgnc_symbol
ENSG00000174579	cluster1	MSL2
ENSG00000140455	cluster1	USP3
ENSG00000285976	cluster1	
ENSG00000163519	cluster1	TRAT1
ENSG00000164211	cluster1	STARD4
ENSG00000197121	cluster1	PGAP1
ENSG00000162772	cluster1	ATF3
ENSG00000118515	cluster1	SGK1
ENSG00000126860	cluster1	EVI2A
ENSG00000179820	cluster1	MYADM
ENSG00000149212	cluster1	SESN3
ENSG00000185112	cluster1	FAM43A
ENSG00000140564	cluster1	FURIN
ENSG00000163600	cluster1	ICOS
ENSG00000184678	cluster1	H2BC21
ENSG00000122644	cluster1	ARL4A
ENSG00000148840	cluster1	PPRC1
ENSG00000185338	cluster1	SOCS1
ENSG00000076706	cluster1	MCAM
ENSG00000095951	cluster1	HIVEP1
ENSG00000164920	cluster1	OSR2
ENSG00000154319	cluster1	FAM167A
ENSG00000181744	cluster1	DIPK2A
ENSG00000131459	cluster1	GFPT2
ENSG00000101187	cluster1	SLCO4A1
ENSG00000077150	cluster1	NFKB2
ENSG00000078804	cluster1	TP53INP2
ENSG00000107130	cluster1	NCS1
ENSG00000125089	cluster1	SH3TC1
ENSG00000124466	cluster1	LYPD3
ENSG00000126353	cluster1	CCR7
ENSG00000112486	cluster1	CCR6
ENSG00000110721	cluster1	CHKA
ENSG00000160789	cluster1	LMNA
ENSG00000120694	cluster1	HSPH1
ENSG00000134294	cluster1	SLC38A2
ENSG00000241945	cluster1	PWP2
ENSG00000221869	cluster1	CEBPD
ENSG00000196781	cluster1	TLE1
ENSG00000121152	cluster1	NCAPH
ENSG00000133639	cluster1	BTG1
ENSG00000100368	cluster1	CSF2RB
ENSG00000197061	cluster1	H4C3
ENSG00000110046	cluster1	ATG2A
ENSG00000086061	cluster1	DNAJA1
ENSG00000157954	cluster1	WIPI2
ENSG00000269858	cluster1	EGLN2



ENSG00000067064	cluster1	IDI1
ENSG00000132912	cluster1	DCTN4
ENSG00000106993	cluster1	CDC37L1
ENSG00000152700	cluster1	SAR1B
ENSG00000103168	cluster1	TAF1C
ENSG00000173762	cluster1	CD7
ENSG00000188897	cluster1	
ENSG00000168438	cluster1	CDC40
ENSG00000157540	cluster1	DYRK1A
ENSG00000155903	cluster1	RASA2
ENSG00000099337	cluster1	KCNK6
ENSG00000127418	cluster1	FGFRL1
ENSG00000129933	cluster1	MAU2
ENSG00000137166	cluster1	FOXP4
ENSG00000146676	cluster1	PURB
ENSG00000070770	cluster1	CSNK2A2
ENSG00000188636	cluster1	RTL6
ENSG00000168615	cluster1	ADAM9
ENSG00000140691	cluster1	ARMC5
ENSG00000006459	cluster1	KDM7A
ENSG00000173926	cluster1	MARCHF3
ENSG00000163607	cluster1	GTPBP8
ENSG00000166484	cluster1	MAPK7
ENSG00000116704	cluster1	SLC35D1
ENSG00000090621	cluster1	PABPC4
ENSG00000213079	cluster1	SCAF8
ENSG00000144566	cluster1	RAB5A
ENSG00000171368	cluster1	TPPP
ENSG00000166233	cluster1	ARIH1
ENSG00000145901	cluster1	TNIP1
ENSG00000101557	cluster1	USP14
ENSG00000104419	cluster1	NDRG1
ENSG00000115525	cluster1	ST3GAL5
ENSG00000099995	cluster1	SF3A1
ENSG00000172716	cluster1	SLFN11
ENSG00000167548	cluster1	KMT2D
ENSG00000081320	cluster1	STK17B
ENSG00000164040	cluster1	PGRMC2
ENSG00000104064	cluster1	GABPB1
ENSG00000108094	cluster1	CUL2
ENSG00000127948	cluster1	POR
ENSG00000006634	cluster1	DBF4
ENSG00000116604	cluster1	MEF2D
ENSG00000105321	cluster1	CCDC9
ENSG00000243207	cluster1	PPAN-P2RY11
ENSG00000125968	cluster1	ID1
ENSG00000116095	cluster1	PLEKHA3
ENSG00000102678	cluster1	FGF9
ENSG00000101199	cluster1	ARFGAP1
ENSG00000182831	cluster1	C16orf72

ENSG00000157933	cluster1	SKI
ENSG00000103966	cluster1	EHD4
ENSG00000102606	cluster1	ARHGEF7
ENSG00000163635	cluster1	ATXN7
ENSG00000088899	cluster1	LZTS3
ENSG00000188483	cluster1	IER5L
ENSG00000167325	cluster1	RRM1
ENSG00000130940	cluster1	CASZ1
ENSG00000151136	cluster1	BTBD11
ENSG00000004399	cluster1	PLXND1
ENSG00000163606	cluster1	CD200R1
ENSG00000172071	cluster1	EIF2AK3
ENSG00000008294	cluster1	SPAG9
ENSG00000169710	cluster1	FASN
ENSG00000165572	cluster1	KBTBD6
ENSG00000186174	cluster1	BCL9L
ENSG00000150990	cluster1	DHX37
ENSG00000116489	cluster1	CAPZA1
ENSG00000134987	cluster1	WDR36
ENSG00000105325	cluster1	FZR1
ENSG00000100796	cluster1	PPP4R3A
ENSG00000160223	cluster1	ICOSLG
ENSG00000108551	cluster1	RASD1
ENSG00000196150	cluster1	ZNF250
ENSG00000186866	cluster1	POFUT2
ENSG00000138670	cluster1	RASGEF1B
ENSG00000101695	cluster1	RNF125
ENSG00000104825	cluster1	NFKBIB
ENSG00000145911	cluster1	N4BP3
ENSG00000101665	cluster1	SMAD7
ENSG00000105835	cluster1	NAMPT
ENSG00000198805	cluster1	PNP
ENSG00000155380	cluster1	SLC16A1
ENSG00000160588	cluster1	MPZL3
ENSG00000135241	cluster1	PNPLA8
ENSG00000060138	cluster1	YBX3
ENSG00000198792	cluster1	TMEM184B
ENSG00000134352	cluster1	IL6ST
ENSG00000005486	cluster1	RHBDD2
ENSG00000169045	cluster1	HNRNPH1
ENSG00000179094	cluster1	PER1
ENSG00000137267	cluster1	TUBB2A
ENSG00000060558	cluster1	GNA15
ENSG00000198742	cluster1	SMURF1
ENSG00000130340	cluster1	SNX9
ENSG00000102760	cluster1	RGCC
ENSG00000178623	cluster1	GPR35
ENSG00000158158	cluster1	CNNM4
ENSG00000006652	cluster1	IFRD1
ENSG00000115762	cluster1	PLEKHB2

ENSG00000112297	cluster1	CRYBG1
ENSG00000120709	cluster1	FAM53C
ENSG00000023287	cluster1	RB1CC1
ENSG00000139505	cluster1	MTMR6
ENSG00000166825	cluster1	ANPEP
ENSG00000119508	cluster1	NR4A3
ENSG00000112182	cluster1	BACH2
ENSG00000170525	cluster1	PFKFB3
ENSG00000115902	cluster1	SLC1A4
ENSG00000183484	cluster1	GPR132
ENSG00000170442	cluster1	KRT86
ENSG00000155304	cluster1	HSPA13
ENSG00000166016	cluster1	ABTB2
ENSG00000108821	cluster1	COL1A1
ENSG00000131759	cluster1	RARA
ENSG00000069849	cluster1	ATP1B3
ENSG00000145817	cluster1	YIPF5
ENSG00000117143	cluster1	UAP1
ENSG00000166747	cluster1	AP1G1
ENSG00000105281	cluster1	SLC1A5
ENSG00000132329	cluster1	RAMP1
ENSG00000087589	cluster1	CASS4
ENSG00000109929	cluster1	SC5D
ENSG00000158747	cluster1	NBL1
ENSG00000055483	cluster1	USP36
ENSG00000005812	cluster1	FBXL3
ENSG00000131013	cluster1	PPIL4
ENSG00000076604	cluster1	TRAF4
ENSG00000197632	cluster1	SERPINB2
ENSG00000100985	cluster1	MMP9
ENSG00000129657	cluster1	SEC14L1
ENSG00000143333	cluster1	RGS16
ENSG00000162924	cluster1	REL
ENSG00000256206	cluster1	
ENSG00000130222	cluster1	GADD45G
ENSG00000139946	cluster1	PELI2
ENSG00000167553	cluster1	TUBA1C
ENSG00000125772	cluster1	GPCPD1
ENSG00000170989	cluster1	S1PR1
ENSG00000119326	cluster1	CTNNAL1
ENSG00000153922	cluster1	CHD1
ENSG00000110330	cluster1	BIRC2
ENSG00000054967	cluster1	RELT
ENSG00000172939	cluster1	OXSRI
ENSG00000140332	cluster1	TLE3
ENSG00000105329	cluster1	TGFB1
ENSG00000109606	cluster1	DHX15
ENSG00000060069	cluster1	CTDP1
ENSG00000132819	cluster1	RBM38
ENSG00000275993	cluster1	SIK1B

ENSG00000153815	cluster1	CMIP
ENSG00000099860	cluster1	GADD45B
ENSG00000175130	cluster1	MARCKSL1
ENSG00000121749	cluster1	TBC1D15
ENSG00000267740	cluster1	
ENSG00000141551	cluster1	CSNK1D
ENSG00000153234	cluster1	NR4A2
ENSG00000092820	cluster1	EZR
ENSG00000181873	cluster1	IBA57
ENSG00000072310	cluster1	SREBF1
ENSG00000167996	cluster1	FTH1
ENSG00000110713	cluster1	NUP98
ENSG00000130844	cluster1	ZNF331
ENSG00000130164	cluster1	LDLR
ENSG00000173846	cluster1	PLK3
ENSG00000141543	cluster1	EIF4A3
ENSG00000175197	cluster1	DDIT3
ENSG00000144655	cluster1	CSRNP1
ENSG00000121671	cluster1	CRY2
ENSG00000198026	cluster1	ZNF335
ENSG00000122877	cluster1	EGR2
ENSG00000166128	cluster1	RAB8B
ENSG00000139318	cluster1	DUSP6
ENSG00000162298	cluster1	SYVN1
ENSG00000188290	cluster1	HES4
ENSG00000138074	cluster1	SLC5A6
ENSG00000153201	cluster1	RANBP2
ENSG00000118985	cluster1	ELL2
ENSG00000176105	cluster1	YES1
ENSG00000167182	cluster1	SP2
ENSG00000198836	cluster1	OPA1
ENSG00000143514	cluster1	TP53BP2
ENSG00000027697	cluster1	IFNGR1
ENSG00000112312	cluster1	GMNN
ENSG00000198911	cluster1	SREBF2
ENSG00000154124	cluster1	OTULIN
ENSG00000101445	cluster1	PPP1R16B
ENSG00000124762	cluster1	CDKN1A
ENSG00000103257	cluster1	SLC7A5
ENSG00000100284	cluster1	TOM1
ENSG00000073756	cluster1	PTGS2
ENSG00000166451	cluster1	CENPN
ENSG00000104472	cluster1	CHRAC1
ENSG00000084070	cluster1	SMAP2
ENSG00000143924	cluster1	EML4
ENSG00000117000	cluster1	RLF
ENSG00000107372	cluster1	ZFAND5
ENSG00000124784	cluster1	RIOK1
ENSG00000133872	cluster1	SARAF
ENSG00000128016	cluster1	ZFP36

ENSG00000178209	cluster1	PLEC
ENSG00000153989	cluster1	NUS1
ENSG00000144580	cluster1	CNOT9
ENSG00000134970	cluster1	TMED7
ENSG00000099999	cluster1	RNF215
ENSG00000120889	cluster1	TNFRSF10B
ENSG00000164163	cluster1	ABCE1
ENSG00000168175	cluster1	MAPK1IP1L
ENSG00000187231	cluster1	SESTD1
ENSG00000167981	cluster1	ZNF597
ENSG00000031081	cluster1	ARHGAP31
ENSG00000141753	cluster1	IGFBP4
ENSG00000151287	cluster1	TEX30
ENSG00000155545	cluster1	MIER3
ENSG00000104205	cluster1	SGK3
ENSG00000213281	cluster1	NRAS
ENSG00000034677	cluster1	RNF19A
ENSG00000104660	cluster1	LEPROTL1
ENSG00000256223	cluster1	ZNF10
ENSG00000141448	cluster1	GATA6
ENSG00000106948	cluster1	AKNA
ENSG00000175040	cluster1	CHST2
ENSG00000166887	cluster1	VPS39
ENSG00000136159	cluster1	NUDT15
ENSG00000107443	cluster1	CCNJ
ENSG00000067533	cluster1	RRP15
ENSG00000213585	cluster1	VDAC1
ENSG00000086189	cluster1	DIMT1
ENSG00000156381	cluster1	ANKRD9
ENSG00000124406	cluster1	ATP8A1
ENSG00000138767	cluster1	CNOT6L
ENSG00000178184	cluster1	PARD6G
ENSG00000043591	cluster1	ADRB1
ENSG00000221968	cluster1	FADS3
ENSG00000120063	cluster1	GNA13
ENSG00000198060	cluster1	MARCHF5
ENSG00000149260	cluster1	CAPN5
ENSG00000138018	cluster1	SELENOI
ENSG00000080371	cluster1	RAB21
ENSG00000112096	cluster1	SOD2
ENSG00000170385	cluster1	SLC30A1
ENSG00000072274	cluster1	TFRC
ENSG00000144749	cluster1	LRIG1
ENSG00000154359	cluster1	LONRF1
ENSG00000160179	cluster1	ABCG1
ENSG00000113448	cluster1	PDE4D
ENSG00000127526	cluster1	SLC35E1
ENSG00000171522	cluster1	PTGER4
ENSG00000196352	cluster1	CD55
ENSG00000023902	cluster1	PLEKHO1

ENSG00000112081	cluster1	SRSF3
ENSG00000131015	cluster1	ULBP2
ENSG00000137770	cluster1	CTDSPL2
ENSG00000123989	cluster1	CHPF
ENSG00000147526	cluster1	TACC1
ENSG00000137275	cluster1	RIPK1
ENSG00000170340	cluster1	B3GNT2
ENSG00000171867	cluster1	PRNP
ENSG00000100926	cluster1	TM9SF1
ENSG00000153066	cluster1	TXNDC11
ENSG00000112149	cluster1	CD83
ENSG00000118503	cluster1	TNFAIP3
ENSG00000112972	cluster1	HMGCS1
ENSG00000108106	cluster1	UBE2S
ENSG00000069667	cluster1	RORA
ENSG00000163743	cluster1	RCHY1
ENSG00000111011	cluster1	RSRC2
ENSG00000163811	cluster1	WDR43
ENSG00000185043	cluster1	CIB1
ENSG00000141965	cluster1	FEM1A
ENSG00000059804	cluster1	SLC2A3
ENSG00000124214	cluster1	STAU1
ENSG00000154710	cluster1	RABGEF1
ENSG00000103342	cluster1	GSPT1
ENSG00000165732	cluster1	DDX21
ENSG00000108443	cluster1	RPS6KB1
ENSG00000100056	cluster1	ESS2
ENSG00000131242	cluster1	RAB11FIP4
ENSG00000006712	cluster1	PAF1
ENSG00000106346	cluster1	USP42
ENSG00000168758	cluster1	SEMA4C
ENSG00000118971	cluster1	CCND2
ENSG00000137713	cluster1	PPP2R1B
ENSG00000163961	cluster1	RNF168
ENSG00000171453	cluster1	POLR1C
ENSG00000158717	cluster1	RNF166
ENSG00000114737	cluster1	CISH
ENSG00000055044	cluster1	NOP58
ENSG00000019995	cluster1	ZRANB1
ENSG00000065135	cluster1	GNAI3
ENSG00000113013	cluster1	HSPA9
ENSG00000183508	cluster1	TENT5C
ENSG00000105656	cluster1	ELL
ENSG00000095574	cluster1	IKZF5
ENSG00000110448	cluster1	CD5
ENSG00000131669	cluster1	NINJ1
ENSG00000110906	cluster1	KCTD10
ENSG00000095380	cluster1	NANS
ENSG00000133316	cluster1	WDR74
ENSG00000105643	cluster1	ARRDC2

ENSG00000126561	cluster1	STAT5A
ENSG00000108256	cluster1	NUFIP2
ENSG00000105671	cluster1	DDX49
ENSG00000068724	cluster1	TTC7A
ENSG00000099985	cluster1	OSM
ENSG00000135926	cluster1	TMBIM1
ENSG00000161638	cluster1	ITGA5
ENSG00000165733	cluster1	BMS1
ENSG00000101654	cluster1	RNMT
ENSG00000163938	cluster1	GNL3
ENSG00000188229	cluster1	TUBB4B
ENSG00000145632	cluster1	PLK2
ENSG00000160741	cluster1	CRTC2
ENSG00000136108	cluster1	CKAP2
ENSG00000204178	cluster1	MACO1
ENSG00000117036	cluster1	ETV3
ENSG00000107742	cluster1	SPOCK2
ENSG00000163719	cluster1	MTMR14
ENSG00000161036	cluster1	LRWD1
ENSG00000130787	cluster1	HIP1R
ENSG00000119725	cluster1	ZNF410
ENSG00000117560	cluster1	FASLG
ENSG00000123136	cluster1	DDX39A
ENSG00000166226	cluster1	CCT2
ENSG00000167460	cluster1	TPM4
ENSG00000136699	cluster1	SMPD4
ENSG00000161204	cluster1	ABCF3
ENSG00000113916	cluster1	BCL6
ENSG00000146457	cluster1	WTAP
ENSG00000239857	cluster1	GET4
ENSG00000163874	cluster1	ZC3H12A
ENSG00000111424	cluster1	VDR
ENSG00000112245	cluster1	PTP4A1
ENSG00000105127	cluster1	AKAP8
ENSG00000150977	cluster1	RILPL2
ENSG00000119446	cluster1	RBM18
ENSG00000167470	cluster1	MIDN
ENSG00000076003	cluster1	MCM6
ENSG00000125633	cluster1	CCDC93
ENSG00000132376	cluster1	INPP5K
ENSG00000257949	cluster1	TEN1
ENSG00000198355	cluster1	PIM3
ENSG00000135108	cluster1	FBXO21
ENSG00000180329	cluster1	CCDC43
ENSG00000163904	cluster1	SENP2
ENSG00000103978	cluster1	TMEM87A
ENSG00000089094	cluster1	KDM2B
ENSG00000115687	cluster1	PASK
ENSG00000153207	cluster1	AHCTF1
ENSG00000184557	cluster1	SOCS3

ENSG00000169508	cluster1	GPR183
ENSG00000152270	cluster1	PDE3B
ENSG00000113580	cluster1	NR3C1
ENSG00000164849	cluster1	GPR146
ENSG00000167552	cluster1	TUBA1A
ENSG00000116106	cluster1	EPHA4
ENSG00000160683	cluster1	CXCR5
ENSG00000161835	cluster1	TAMALIN
ENSG00000111266	cluster1	DUSP16
ENSG00000023445	cluster1	BIRC3
ENSG00000176531	cluster1	PHLDB3
ENSG00000087074	cluster1	PPP1R15A
ENSG00000139514	cluster1	SLC7A1
ENSG00000185905	cluster1	C16orf54
ENSG00000116679	cluster1	IVNS1ABP
ENSG00000143507	cluster1	DUSP10
ENSG00000161921	cluster1	CXCL16
ENSG00000164951	cluster1	PDP1
ENSG00000100425	cluster1	BRD1
ENSG00000139289	cluster1	PHLDA1
ENSG00000070756	cluster1	PABPC1
ENSG00000077238	cluster1	IL4R
ENSG00000181222	cluster1	POLR2A
ENSG00000109320	cluster1	NFKB1
ENSG00000097007	cluster1	ABL1
ENSG00000094975	cluster1	SUCO
ENSG00000154764	cluster1	WNT7A
ENSG00000174738	cluster1	NR1D2
ENSG00000123908	cluster1	AGO2
ENSG00000198843	cluster1	SELENOT
ENSG00000109079	cluster1	TNFAIP1
ENSG00000168209	cluster1	DDIT4
ENSG00000272886	cluster1	DCP1A
ENSG00000090520	cluster1	DNAJB11
ENSG00000140968	cluster1	IRF8
ENSG00000173960	cluster1	UBXN2A
ENSG00000088356	cluster1	PDRG1
ENSG00000111371	cluster1	SLC38A1
ENSG00000182481	cluster1	KPNA2
ENSG00000171617	cluster1	ENC1
ENSG00000115539	cluster1	PDCL3
ENSG00000100225	cluster1	FBXO7
ENSG00000100982	cluster1	PCIF1
ENSG00000101247	cluster1	NDUFAF5
ENSG00000131408	cluster1	NR1H2
ENSG00000176170	cluster1	SPHK1
ENSG00000145675	cluster1	PIK3R1
ENSG00000144381	cluster1	HSPD1
ENSG00000011590	cluster1	ZBTB32
ENSG00000135604	cluster1	STX11



ENSG00000175166	cluster1	PSMD2
ENSG00000156875	cluster1	MFSD14A
ENSG00000055211	cluster1	GINM1
ENSG00000132153	cluster1	DHX30
ENSG00000136940	cluster1	PDCL
ENSG00000160783	cluster1	PMF1
ENSG00000160888	cluster1	IER2
ENSG00000140740	cluster1	UQCRC2
ENSG00000074319	cluster1	TSG101
ENSG00000044574	cluster1	HSPA5
ENSG00000183520	cluster1	UTP11
ENSG00000149100	cluster1	EIF3M
ENSG00000184047	cluster1	DIABLO
ENSG00000161526	cluster1	SAP30BP
ENSG00000123416	cluster1	TUBA1B
ENSG00000166579	cluster1	NDEL1
ENSG00000157734	cluster1	SNX22
ENSG00000100353	cluster1	EIF3D
ENSG00000108852	cluster1	MPP2
ENSG00000077235	cluster1	GTF3C1
ENSG00000070501	cluster1	POLB
ENSG00000151726	cluster1	ACSL1
ENSG00000028137	cluster1	TNFRSF1B
ENSG00000138166	cluster1	DUSP5
ENSG00000133794	cluster1	ARNTL
ENSG00000164169	cluster1	PRMT9
ENSG00000136146	cluster1	MED4
ENSG00000169499	cluster1	PLEKHA2
ENSG00000100243	cluster1	CYB5R3
ENSG00000082153	cluster1	BZW1
ENSG00000101082	cluster1	SLA2
ENSG00000107643	cluster1	MAPK8
ENSG00000189306	cluster1	RRP7A
ENSG00000120875	cluster1	DUSP4
ENSG00000113811	cluster1	SELENOK
ENSG00000148248	cluster1	SURF4
ENSG00000134480	cluster1	CCNH
ENSG00000109118	cluster1	PHF12
ENSG00000139112	cluster1	GABARAPL1
ENSG00000078237	cluster1	TIGAR
ENSG00000127824	cluster1	TUBA4A
ENSG00000173875	cluster1	ZNF791
ENSG00000187778	cluster1	MCRS1
ENSG00000166289	cluster1	PLEKHF1
ENSG00000161939	cluster1	RNASEK-C17orf49
ENSG00000139722	cluster1	VPS37B
ENSG00000100221	cluster1	JOSD1
ENSG00000105568	cluster1	PPP2R1A
ENSG00000172977	cluster1	KAT5
ENSG00000141030	cluster1	COPS3

ENSG00000145388	cluster1	METTL14
ENSG00000125910	cluster1	S1PR4
ENSG00000125657	cluster1	TNFSF9
ENSG00000132646	cluster1	PCNA
ENSG00000170542	cluster1	SERPINB9
ENSG00000213523	cluster1	SRA1
ENSG00000086666	cluster1	ZFAND6
ENSG00000034152	cluster1	MAP2K3
ENSG00000108588	cluster1	CCDC47
ENSG00000108826	cluster1	MRPL27
ENSG00000161547	cluster1	SRSF2
ENSG00000125084	cluster1	WNT1
ENSG00000197019	cluster1	SERTAD1
ENSG00000110172	cluster1	CHORDC1
ENSG00000090339	cluster1	ICAM1
ENSG00000138678	cluster1	GPAT3
ENSG00000175224	cluster1	ATG13
ENSG00000105447	cluster1	GRWD1
ENSG00000084463	cluster1	WBP11
ENSG00000159346	cluster1	ADIPOR1
ENSG00000117394	cluster1	SLC2A1
ENSG00000242689	cluster1	CNTF
ENSG00000119986	cluster1	AVPI1
ENSG00000070495	cluster1	JMJD6
ENSG00000115649	cluster1	CNPPD1
ENSG00000173113	cluster1	TRMT112
ENSG00000100949	cluster1	RABGGTA
ENSG00000169252	cluster1	ADRB2
ENSG00000139832	cluster1	RAB20
ENSG00000198218	cluster1	QRICH1
ENSG00000173653	cluster1	RCE1
ENSG00000066557	cluster1	LRRC40
ENSG00000124155	cluster1	PIGT
ENSG00000105193	cluster1	RPS16
ENSG00000183155	cluster1	RABIF
ENSG00000100991	cluster1	TRPC4AP
ENSG00000160460	cluster1	SPTBN4
ENSG00000230989	cluster1	HSBP1
ENSG00000116761	cluster1	CTH
ENSG00000099804	cluster1	CDC34
ENSG00000163950	cluster1	SLBP
ENSG00000101413	cluster1	RPRD1B
ENSG00000125538	cluster1	IL1B
ENSG00000114686	cluster1	MRPL3
ENSG00000105993	cluster1	DNAJB6
ENSG00000140157	cluster1	NIPA2
ENSG00000242114	cluster1	MTFP1
ENSG00000154719	cluster1	MRPL39
ENSG00000169972	cluster1	PUSL1
ENSG00000091140	cluster1	DLD

ENSG00000186480	cluster1	INSIG1
ENSG00000198369	cluster1	SPRED2
ENSG00000174574	cluster1	AKIRIN1
ENSG00000197170	cluster1	PSMD12
ENSG00000143183	cluster1	TMCO1
ENSG00000196526	cluster1	AFAP1
ENSG00000143793	cluster1	C1orf35
ENSG00000086062	cluster1	B4GALT1
ENSG00000115339	cluster1	GALNT3
ENSG00000105851	cluster1	PIK3CG
ENSG00000124198	cluster1	ARFGEF2
ENSG00000130734	cluster1	ATG4D
ENSG00000172331	cluster1	BPGM
ENSG00000152193	cluster1	OBI1
ENSG00000167550	cluster1	RHEBL1
ENSG00000085840	cluster1	ORC1
ENSG00000096080	cluster1	MRPS18A
ENSG00000100290	cluster1	BIK
ENSG00000115548	cluster1	KDM3A
ENSG00000100461	cluster1	RBM23
ENSG00000171813	cluster1	PWWP2B
ENSG00000180479	cluster1	ZNF571
ENSG00000178726	cluster1	THBD
ENSG00000149177	cluster1	PTPRJ
ENSG00000139725	cluster1	RHOF
ENSG00000178821	cluster1	TMEM52
ENSG00000100266	cluster1	PACSIN2
ENSG00000137265	cluster1	IRF4
ENSG00000176845	cluster1	METRNL
ENSG00000213413	cluster1	PVRIG
ENSG00000182173	cluster1	TSEN54
ENSG00000186575	cluster1	NF2
ENSG00000094804	cluster1	CDC6
ENSG00000157693	cluster1	TMEM268
ENSG00000006025	cluster1	OSBPL7
ENSG00000162191	cluster1	UBXN1
ENSG00000117399	cluster1	CDC20
ENSG00000172893	cluster1	DHCR7
ENSG00000144647	cluster1	POMGNT2
ENSG00000109270	cluster1	LAMTOR3
ENSG00000109321	cluster1	AREG
ENSG00000139372	cluster1	TDG
ENSG00000284512	cluster1	
ENSG00000182149	cluster1	IST1
ENSG00000196072	cluster1	BLOC1S2
ENSG00000002549	cluster1	LAP3
ENSG00000104765	cluster1	BNIP3L
ENSG00000064726	cluster1	BTBD1
ENSG00000144597	cluster1	EAF1
ENSG00000128708	cluster1	HAT1

ENSG00000131747	cluster1	TOP2A
ENSG00000284946	cluster1	
ENSG00000114013	cluster1	CD86
ENSG00000197629	cluster1	MPEG1
ENSG00000205323	cluster1	SARNP
ENSG00000081041	cluster1	CXCL2
ENSG00000165046	cluster1	LETM2
ENSG00000018280	cluster1	SLC11A1
ENSG00000187522	cluster1	HSPA14
ENSG00000124731	cluster1	TREM1
ENSG00000175606	cluster1	TMEM70
ENSG00000119414	cluster1	PPP6C
ENSG00000138757	cluster1	G3BP2
ENSG00000083937	cluster1	CHMP2B
ENSG00000123689	cluster1	GOS2
ENSG00000006007	cluster1	GDE1
ENSG00000198604	cluster1	BAZ1A
ENSG00000114416	cluster1	FXR1
ENSG00000119801	cluster1	YPEL5
ENSG00000152484	cluster1	USP12
ENSG00000153786	cluster1	ZDHHC7
ENSG00000155096	cluster1	AZIN1
ENSG00000134758	cluster1	RNF138
ENSG00000132155	cluster1	RAF1
ENSG00000150787	cluster1	PTS
ENSG00000135070	cluster1	ISCA1
ENSG00000137409	cluster1	MTCH1
ENSG00000123146	cluster1	ADGRE5
ENSG00000162650	cluster1	ATXN7L2
ENSG00000185022	cluster1	MAFF
ENSG00000177105	cluster1	RHOG
ENSG00000173848	cluster1	NET1
ENSG00000104671	cluster1	DCTN6
ENSG00000120705	cluster1	ETF1
ENSG00000118707	cluster1	TGIF2
ENSG00000134333	cluster1	LDHA
ENSG00000132326	cluster1	PER2
ENSG00000137575	cluster1	SDCBP
ENSG00000150593	cluster1	PDCD4
ENSG00000101166	cluster1	PRELID3B
ENSG00000108406	cluster1	DHX40
ENSG00000023734	cluster1	STRAP
ENSG00000119682	cluster1	AREL1
ENSG00000113384	cluster1	GOLPH3
ENSG00000177169	cluster1	ULK1
ENSG00000180008	cluster1	SOCS4
ENSG00000153561	cluster1	RMND5A
ENSG00000181826	cluster1	RELL1
ENSG00000107566	cluster1	ERLIN1
ENSG00000175110	cluster1	MRPS22

ENSG00000048162	cluster1	NOP16
ENSG00000213638	cluster1	ADAT3
ENSG00000140941	cluster1	MAP1LC3B
ENSG00000131100	cluster1	ATP6V1E1
ENSG00000255112	cluster1	CHMP1B
ENSG00000213906	cluster1	LTB4R2
ENSG00000068697	cluster1	LAPTM4A
ENSG00000124209	cluster1	RAB22A
ENSG00000134108	cluster1	ARL8B
ENSG00000106615	cluster1	RHEB
ENSG00000178974	cluster1	FBXO34
ENSG00000187840	cluster1	EIF4EBP1
ENSG00000100138	cluster1	SNU13
ENSG00000122958	cluster1	VPS26A
ENSG00000176142	cluster1	TMEM39A
ENSG00000136754	cluster1	ABI1
ENSG00000131115	cluster1	ZNF227
ENSG00000113161	cluster1	HMGCR
ENSG00000186350	cluster1	RXRA
ENSG00000128989	cluster1	ARPP19
ENSG00000008282	cluster1	SYPL1
ENSG00000150768	cluster1	DLAT
ENSG00000111596	cluster1	CNOT2
ENSG00000115875	cluster1	SRSF7
ENSG00000075415	cluster1	SLC25A3
ENSG00000135048	cluster1	CEMIP2
ENSG00000096654	cluster1	ZNF184
ENSG00000136986	cluster1	DERL1
ENSG00000101460	cluster1	MAP1LC3A
ENSG00000156502	cluster1	SUPV3L1
ENSG00000090104	cluster1	RGS1
ENSG00000155329	cluster1	ZCCHC10
ENSG00000065154	cluster1	OAT
ENSG00000103121	cluster1	CMC2
ENSG00000122862	cluster1	SRGN
ENSG00000164944	cluster1	VIRMA
ENSG00000165802	cluster1	NSMF
ENSG00000076356	cluster1	PLXNA2
ENSG00000244165	cluster1	P2RY11
ENSG00000119048	cluster1	UBE2B
ENSG00000164168	cluster1	TMEM184C
ENSG00000085872	cluster1	CHERP
ENSG00000189319	cluster1	FAM53B
ENSG00000121481	cluster1	RNF2
ENSG00000134265	cluster1	NAPG
ENSG00000146963	cluster1	LUC7L2
ENSG00000162511	cluster1	LAPTM5
ENSG00000123091	cluster1	RNF11
ENSG00000185883	cluster1	ATP6V0C
ENSG00000177666	cluster1	PNPLA2

ENSG00000163464	cluster1	CXCR1
ENSG00000145495	cluster1	MARCHF6
ENSG00000188486	cluster1	H2AX
ENSG00000198780	cluster1	FAM169A
ENSG00000274286	cluster1	ADRA2B
ENSG00000211455	cluster1	STK38L
ENSG00000173039	cluster1	RELA
ENSG00000138050	cluster1	THUMPD2
ENSG00000008405	cluster1	CRY1
ENSG00000104856	cluster1	RELB
ENSG00000100003	cluster1	SEC14L2
ENSG00000015153	cluster1	YAF2
ENSG00000059758	cluster1	CDK17
ENSG00000076067	cluster1	RBMS2
ENSG00000109917	cluster1	ZPR1
ENSG00000148841	cluster1	ITPRIP
ENSG00000158321	cluster1	AUTS2
ENSG00000100916	cluster1	BRMS1L
ENSG00000104824	cluster1	HNRNPL
ENSG00000105323	cluster1	HNRNPUL1
ENSG00000204525	cluster1	HLA-C
ENSG00000047315	cluster1	POLR2B
ENSG00000158792	cluster1	SPATA2L
ENSG00000136603	cluster1	SKIL
ENSG00000038358	cluster1	EDC4
ENSG00000036257	cluster1	CUL3
ENSG00000167508	cluster1	MVD
ENSG00000101452	cluster1	DHX35
ENSG00000182687	cluster1	GALR2
ENSG00000110514	cluster1	MADD
ENSG00000121579	cluster1	NAA50
ENSG00000188338	cluster1	SLC38A3
ENSG00000126003	cluster1	PLAGL2
ENSG00000123933	cluster1	MXD4
ENSG00000011422	cluster1	PLAUR
ENSG00000160218	cluster1	TRAPPC10
ENSG00000196843	cluster1	ARID5A
ENSG00000176853	cluster1	FAM91A1
ENSG00000155926	cluster1	SLA
ENSG00000105339	cluster1	DENND3
ENSG00000001630	cluster1	CYP51A1
ENSG00000125735	cluster1	TNFSF14
ENSG00000132334	cluster1	PTPRE
ENSG00000148331	cluster1	ASB6
ENSG00000085978	cluster1	ATG16L1
ENSG00000137801	cluster1	THBS1
ENSG00000087087	cluster1	SRRT
ENSG00000184588	cluster1	PDE4B
ENSG00000161011	cluster1	SQSTM1
ENSG00000100226	cluster1	GTPBP1

ENSG00000103522	cluster1	IL21R
ENSG00000122490	cluster1	SLC66A2
ENSG00000139636	cluster1	LMBR1L
ENSG00000095794	cluster1	CREM
ENSG00000171793	cluster1	CTPS1
ENSG00000174177	cluster1	CTU2
ENSG00000138750	cluster1	NUP54
ENSG00000100614	cluster1	PPM1A
ENSG00000101310	cluster1	SEC23B
ENSG00000103365	cluster1	GGA2
ENSG00000241484	cluster1	ARHGAP8
ENSG00000125651	cluster1	GTF2F1
ENSG00000116044	cluster1	NFE2L2
ENSG00000107937	cluster1	GTPBP4
ENSG00000134107	cluster1	BHLHE40
ENSG00000085433	cluster1	WDR47
ENSG00000100401	cluster1	RANGAP1
ENSG00000132002	cluster1	DNAJB1
ENSG00000116741	cluster1	RGS2
ENSG00000151327	cluster1	FAM177A1
ENSG00000105402	cluster1	NAPA
ENSG00000116717	cluster1	GADD45A
ENSG00000165714	cluster1	BORCS5
ENSG00000075426	cluster1	FOSL2
ENSG00000123358	cluster1	NR4A1
ENSG00000155307	cluster1	SAMSN1
ENSG00000162711	cluster1	NLRP3
ENSG00000160932	cluster1	LY6E
ENSG00000068878	cluster1	PSME4
ENSG00000069399	cluster1	BCL3
ENSG00000111897	cluster1	SERINC1
ENSG00000137656	cluster1	BUD13
ENSG00000035687	cluster1	ADSS2
ENSG00000119950	cluster1	MXI1
ENSG00000105085	cluster1	MED26
ENSG00000089902	cluster1	RCOR1
ENSG00000063978	cluster1	RNF4
ENSG00000089159	cluster1	PXN
ENSG00000141522	cluster1	ARHGDIA
ENSG00000182318	cluster1	ZSCAN22
ENSG00000196428	cluster1	TSC22D2
ENSG00000158545	cluster1	ZC3H18
ENSG00000007168	cluster1	PAFAH1B1
ENSG00000248405	cluster1	PRR5-ARHGAP8
ENSG00000145569	cluster1	OTULINL
ENSG00000101361	cluster1	NOP56
ENSG00000184922	cluster1	FMNL1
ENSG00000198380	cluster1	GFPT1
ENSG00000129083	cluster1	COPB1
ENSG00000248751	cluster1	

ENSG00000182827	cluster1	ACBD3
ENSG00000111737	cluster1	RAB35
ENSG00000138821	cluster1	SLC39A8
ENSG00000178860	cluster1	MSC
ENSG00000116016	cluster1	EPAS1
ENSG00000155252	cluster1	PI4K2A
ENSG00000153391	cluster1	INO80C
ENSG00000103274	cluster1	NUBP1
ENSG00000005007	cluster1	UPF1
ENSG00000115816	cluster1	CEBPZ
ENSG00000095261	cluster1	PSMD5
ENSG00000176095	cluster1	IP6K1
ENSG00000099797	cluster1	TECR
ENSG00000165006	cluster1	UBAP1
ENSG00000020633	cluster1	RUNX3
ENSG00000131446	cluster1	MGAT1
ENSG00000100109	cluster1	TFIP11
ENSG00000100580	cluster1	TMED8
ENSG00000196814	cluster1	MVB12B
ENSG00000072121	cluster1	ZFYVE26
ENSG00000164338	cluster1	UTP15
ENSG00000172345	cluster1	STARD5
ENSG00000152223	cluster1	EPG5
ENSG00000180901	cluster1	KCTD2
ENSG00000118965	cluster1	WDR35
ENSG00000163900	cluster1	TMEM41A
ENSG00000174652	cluster1	ZNF266
ENSG00000135821	cluster1	GLUL
ENSG00000109943	cluster1	CRTAM
ENSG00000100292	cluster1	HMOX1
ENSG00000161955	cluster1	TNFSF13
ENSG00000255274	cluster1	SMIM35
ENSG00000082515	cluster1	MRPL22
ENSG00000142444	cluster1	TIMM29
ENSG00000186364	cluster1	NUDT17
ENSG00000114354	cluster1	TFG
ENSG00000147669	cluster1	POLR2K
ENSG00000184792	cluster1	OSBP2
ENSG00000122203	cluster1	KIAA1191
ENSG00000172216	cluster1	CEBPB
ENSG00000124641	cluster1	MED20
ENSG00000172031	cluster1	EPHX4
ENSG00000030582	cluster1	GRN
ENSG00000135632	cluster1	SMYD5
ENSG00000070413	cluster1	DGCR2
ENSG00000159720	cluster1	ATP6V0D1
ENSG00000114742	cluster1	WDR48
ENSG00000213639	cluster1	PPP1CB
ENSG00000122705	cluster1	CLTA
ENSG00000181467	cluster1	RAP2B



ENSG00000171566	cluster1	PLRG1
ENSG00000138434	cluster1	ITPRID2
ENSG00000164162	cluster1	ANAPC10
ENSG00000100036	cluster1	SLC35E4
ENSG00000188725	cluster1	SMIM15
ENSG00000260916	cluster1	CCPG1
ENSG00000136867	cluster1	SLC31A2
ENSG00000125870	cluster1	SNRPB2
ENSG00000145354	cluster1	CISD2
ENSG00000173334	cluster1	TRIB1
ENSG00000198612	cluster1	COPS8
ENSG00000163788	cluster1	SNRK
ENSG00000175354	cluster1	PTPN2
ENSG00000108061	cluster1	SHOC2
ENSG00000144136	cluster1	SLC20A1
ENSG00000162642	cluster1	C1orf52
ENSG00000143294	cluster1	PRCC
ENSG00000170852	cluster1	KBTBD2
ENSG00000125304	cluster1	TM9SF2
ENSG00000123975	cluster1	CKS2
ENSG00000068912	cluster1	ERLEC1
ENSG00000189067	cluster1	LITAF
ENSG00000172115	cluster1	CYCS
ENSG00000041802	cluster1	LSG1
ENSG00000163214	cluster1	DHX57
ENSG00000165458	cluster1	INPPL1
ENSG00000176597	cluster1	B3GNT5
ENSG00000104853	cluster1	CLPTM1
ENSG00000166012	cluster1	TAF1D
ENSG00000120685	cluster1	PROSER1
ENSG00000008952	cluster1	SEC62
ENSG00000116852	cluster1	KIF21B
ENSG00000164751	cluster1	PEX2
ENSG00000145780	cluster1	FEM1C
ENSG00000138433	cluster1	CIR1
ENSG00000130479	cluster1	MAP1S
ENSG00000197933	cluster1	ZNF823
ENSG00000198522	cluster1	GPN1
ENSG00000157224	cluster1	CLDN12
ENSG00000164674	cluster1	SYTL3
ENSG00000169955	cluster1	ZNF747
ENSG00000179218	cluster1	CALR
ENSG00000121274	cluster1	TENT4B
ENSG00000134809	cluster1	TIMM10
ENSG00000185436	cluster1	IFNLR1
ENSG00000095397	cluster1	WHRN
ENSG00000118496	cluster1	FBXO30
ENSG00000163913	cluster1	IFT122
ENSG00000057704	cluster1	TMCC3
ENSG00000182095	cluster1	TNRC18

ENSG00000130766	cluster1	SESN2
ENSG00000065989	cluster1	PDE4A
ENSG00000169554	cluster1	ZEB2
ENSG00000160949	cluster1	TONSL
ENSG00000196730	cluster1	DAPK1
ENSG00000101400	cluster1	SNTA1
ENSG00000196466	cluster1	ZNF799
ENSG00000100321	cluster1	SYNGR1
ENSG00000021762	cluster1	OSBPL5
ENSG00000180739	cluster1	S1PR5
ENSG00000171970	cluster1	ZNF57
ENSG00000288534	cluster1	
ENSG00000255639	cluster1	
ENSG00000136869	cluster1	TLR4
ENSG00000090382	cluster1	LYZ
ENSG00000102870	cluster1	ZNF629
ENSG00000135114	cluster1	OASL
ENSG00000119917	cluster1	IFIT3
ENSG00000167565	cluster1	SERTAD3
ENSG00000136870	cluster1	ZNF189
ENSG00000275464	cluster1	
ENSG00000173262	cluster1	SLC2A14
ENSG00000100453	cluster1	GZMB
ENSG00000161911	cluster1	TREML1
ENSG00000259207	cluster1	ITGB3
ENSG00000124422	cluster1	USP22
ENSG00000054793	cluster1	ATP9A
ENSG00000197619	cluster1	ZNF615
ENSG00000135631	cluster1	RAB11FIP5
ENSG00000143373	cluster1	ZNF687
ENSG00000081014	cluster1	AP4E1
ENSG00000254087	cluster1	LYN
ENSG00000168566	cluster1	SNRNP48
ENSG00000161671	cluster1	EMC10
ENSG00000064703	cluster1	DDX20
ENSG00000090013	cluster1	BLVRB
ENSG00000254806	cluster1	SYS1-DBNDD2
ENSG00000115541	cluster1	HSPE1
ENSG00000099203	cluster1	TMED1
ENSG00000177963	cluster1	RIC8A
ENSG00000133119	cluster1	RFC3
ENSG00000167604	cluster1	NFKBID
ENSG00000128383	cluster1	APOBEC3A
ENSG00000107968	cluster1	MAP3K8
ENSG00000216490	cluster1	IFI30
ENSG00000171241	cluster1	SHCBP1
ENSG00000163220	cluster1	S100A9
ENSG00000170458	cluster1	CD14
ENSG00000257315	cluster1	ZBED6
ENSG00000234745	cluster1	HLA-B

ENSG00000188404	cluster2	SELL
ENSG00000144290	cluster2	SLC4A10
ENSG00000163947	cluster2	ARHGEF3
ENSG00000099968	cluster2	BCL2L13
ENSG00000172348	cluster2	RCAN2
ENSG00000158411	cluster2	MITD1
ENSG00000072042	cluster2	RDH11
ENSG00000106479	cluster2	ZNF862
ENSG00000100034	cluster2	PPM1F
ENSG00000066294	cluster2	CD84
ENSG00000162654	cluster2	GBP4
ENSG00000139193	cluster2	CD27
ENSG00000146425	cluster2	DYNLT1
ENSG00000058668	cluster2	ATP2B4
ENSG00000146285	cluster2	SCML4
ENSG00000133574	cluster2	GIMAP4
ENSG00000065413	cluster2	ANKRD44
ENSG00000169740	cluster2	ZNF32
ENSG00000101574	cluster2	METTL4
ENSG00000181847	cluster2	TIGIT
ENSG00000161405	cluster2	IKZF3
ENSG00000133706	cluster2	LARS1
ENSG00000069329	cluster2	VPS35
ENSG00000070269	cluster2	TMEM260
ENSG00000089012	cluster2	SIRPG
ENSG00000007312	cluster2	CD79B
ENSG00000183718	cluster2	TRIM52
ENSG00000013392	cluster2	RWDD2A
ENSG00000138496	cluster2	PARP9
ENSG00000165730	cluster2	STOX1
ENSG00000082212	cluster2	ME2
ENSG00000243646	cluster2	IL10RB
ENSG00000106991	cluster2	ENG
ENSG00000074966	cluster2	TXK
ENSG00000181215	cluster2	C4orf50
ENSG00000054219	cluster2	LY75
ENSG00000120913	cluster2	PDLIM2
ENSG00000171163	cluster2	ZNF692
ENSG00000167700	cluster2	MFSD3
ENSG00000134452	cluster2	FBH1
ENSG00000162777	cluster2	DENND2D
ENSG00000151702	cluster2	FLI1
ENSG00000083454	cluster2	P2RX5
ENSG00000196510	cluster2	ANAPC7
ENSG00000205758	cluster2	CRYZL1
ENSG00000149016	cluster2	TUT1
ENSG00000111801	cluster2	BTN3A3
ENSG00000111913	cluster2	RIPOR2
ENSG00000120526	cluster2	NUDCD1
ENSG00000037757	cluster2	MRI1

ENSG00000178802	cluster2	MPI
ENSG00000213918	cluster2	DNASE1
ENSG00000108848	cluster2	LUC7L3
ENSG00000116455	cluster2	WDR77
ENSG00000171130	cluster2	ATP6V0E2
ENSG00000157978	cluster2	LDLRAP1
ENSG00000157916	cluster2	RER1
ENSG00000110031	cluster2	LPXN
ENSG00000135736	cluster2	CCDC102A
ENSG00000137752	cluster2	CASP1
ENSG00000177156	cluster2	TALDO1
ENSG00000134897	cluster2	BIVM
ENSG00000163568	cluster2	AIM2
ENSG00000092964	cluster2	DPYSL2
ENSG00000101347	cluster2	SAMHD1
ENSG00000198771	cluster2	RCSD1
ENSG00000215883	cluster2	CYB5RL
ENSG00000132530	cluster2	XAF1
ENSG00000138617	cluster2	PARP16
ENSG00000124588	cluster2	NQO2
ENSG00000204611	cluster2	ZNF616
ENSG00000082074	cluster2	FYB1
ENSG00000176422	cluster2	SPRYD4
ENSG00000174456	cluster2	C12orf76
ENSG00000104689	cluster2	TNFRSF10A
ENSG00000135272	cluster2	MDFIC
ENSG00000106785	cluster2	TRIM14
ENSG00000275074	cluster2	NUDT18
ENSG00000177054	cluster2	ZDHHC13
ENSG00000205643	cluster2	CDPF1
ENSG00000146918	cluster2	NCAPG2
ENSG00000112304	cluster2	ACOT13
ENSG00000102871	cluster2	TRADD
ENSG00000134765	cluster2	DSC1
ENSG00000133678	cluster2	TMEM254
ENSG00000196187	cluster2	TMEM63A
ENSG00000185252	cluster2	ZNF74
ENSG00000131370	cluster2	SH3BP5
ENSG00000124222	cluster2	STX16
ENSG00000174989	cluster2	FBXW8
ENSG00000140993	cluster2	TIGD7
ENSG00000152778	cluster2	IFIT5
ENSG00000139998	cluster2	RAB15
ENSG00000181192	cluster2	DHTKD1
ENSG00000132801	cluster2	ZSWIM3
ENSG00000170209	cluster2	ANKK1
ENSG00000119397	cluster2	CNTRL
ENSG00000196670	cluster2	ZFP62
ENSG00000172269	cluster2	DPAGT1
ENSG00000166135	cluster2	HIF1AN

ENSG00000135828	cluster2	RNASEL
ENSG00000140553	cluster2	UNC45A
ENSG00000067057	cluster2	PFKP
ENSG00000151065	cluster2	DCP1B
ENSG00000009790	cluster2	TRAF3IP3
ENSG00000167220	cluster2	HDHD2
ENSG00000171148	cluster2	TADA3
ENSG00000133835	cluster2	HSD17B4
ENSG00000136485	cluster2	DCAF7
ENSG00000095059	cluster2	DHPS
ENSG00000119471	cluster2	HSDL2
ENSG00000116198	cluster2	CEP104
ENSG00000159445	cluster2	THEM4
ENSG00000166272	cluster2	WBP1L
ENSG00000173208	cluster2	ABCD2
ENSG00000132256	cluster2	TRIM5
ENSG00000138375	cluster2	SMARCAL1
ENSG00000198130	cluster2	HIBCH
ENSG00000181562	cluster2	EDDM3A
ENSG00000162144	cluster2	CYB561A3
ENSG00000088888	cluster2	MAVS
ENSG00000166436	cluster2	TRIM66
ENSG00000169131	cluster2	ZNF354A
ENSG00000029639	cluster2	TFB1M
ENSG00000114026	cluster2	OGG1
ENSG00000100304	cluster2	TTLL12
ENSG00000174292	cluster2	TNK1
ENSG00000122741	cluster2	DCAF10
ENSG00000184465	cluster2	WDR27
ENSG00000174516	cluster2	PELI3
ENSG00000164530	cluster2	PI16
ENSG00000148843	cluster2	PDCD11
ENSG00000177200	cluster2	CHD9
ENSG00000185942	cluster2	NKAIN3
ENSG00000103051	cluster2	COG4
ENSG00000143970	cluster2	ASXL2
ENSG00000018699	cluster2	TTC27
ENSG00000106261	cluster2	ZKSCAN1
ENSG00000108469	cluster2	RECQL5
ENSG00000143811	cluster2	PYCR2
ENSG00000243811	cluster2	APOBEC3D
ENSG00000178096	cluster2	BOLA1
ENSG00000109814	cluster2	UGDH
ENSG00000114770	cluster2	ABCC5
ENSG00000165698	cluster2	SPACA9
ENSG00000163516	cluster2	ANKZF1
ENSG00000121621	cluster2	KIF18A
ENSG00000163157	cluster2	TMOD4
ENSG00000146802	cluster2	TMEM168
ENSG00000126091	cluster2	ST3GAL3

ENSG00000163472	cluster2	TMEM79
ENSG00000185220	cluster2	PGBD2
ENSG00000142330	cluster2	CAPN10
ENSG00000145348	cluster2	TBCK
ENSG00000099810	cluster2	MTAP
ENSG00000119711	cluster2	ALDH6A1
ENSG00000011143	cluster2	MKS1
ENSG00000184574	cluster2	LPAR5
ENSG00000112118	cluster2	MCM3
ENSG00000213380	cluster2	COG8
ENSG00000101751	cluster2	POLI
ENSG00000003400	cluster2	CASP10
ENSG00000161010	cluster2	MRNIP
ENSG00000100201	cluster2	DDX17
ENSG00000143801	cluster2	PSEN2
ENSG00000104518	cluster2	GSDMD
ENSG00000114999	cluster2	TTL
ENSG00000196458	cluster2	ZNF605
ENSG00000257390	cluster2	
ENSG00000157870	cluster2	PRXL2B
ENSG00000175782	cluster2	SLC35E3
ENSG00000135315	cluster2	CEP162
ENSG00000136636	cluster2	KCTD3
ENSG00000111732	cluster2	AICDA
ENSG00000126070	cluster2	AGO3
ENSG00000198740	cluster2	ZNF652
ENSG00000189195	cluster2	BTBD8
ENSG00000163703	cluster2	CRELD1
ENSG00000180357	cluster2	ZNF609
ENSG00000141219	cluster2	C17orf80
ENSG00000166257	cluster2	SCN3B
ENSG00000174667	cluster2	OR7D4
ENSG00000182134	cluster2	TDRKH
ENSG00000174500	cluster2	GCSAM
ENSG00000013016	cluster2	EHD3
ENSG00000235173	cluster2	HGH1
ENSG00000180336	cluster2	MEIOC
ENSG00000148143	cluster2	ZNF462
ENSG00000100767	cluster2	PAPLN
ENSG00000186812	cluster2	ZNF397
ENSG00000197557	cluster2	TTC30A
ENSG00000149292	cluster2	TTC12
ENSG00000172006	cluster2	ZNF554
ENSG00000118412	cluster2	CASP8AP2
ENSG00000165905	cluster2	LARGE2
ENSG00000116497	cluster2	S100PBP
ENSG00000175155	cluster2	YPEL2
ENSG00000167740	cluster2	CYB5D2
ENSG00000145700	cluster2	ANKRD31
ENSG00000112812	cluster2	PRSS16

ENSG00000173809	cluster2	TDRD12
ENSG00000140479	cluster2	PCSK6
ENSG00000162139	cluster2	NEU3
ENSG00000157881	cluster2	PANK4
ENSG00000125686	cluster2	MED1
ENSG00000274810	cluster2	NPHP3-ACAD11
ENSG00000148468	cluster2	FAM171A1
ENSG00000137070	cluster2	IL11RA
ENSG00000101638	cluster2	ST8SIA5
ENSG00000163482	cluster2	STK36
ENSG00000126790	cluster2	L3HYPDH
ENSG00000113522	cluster2	RAD50
ENSG00000163840	cluster2	DTX3L
ENSG00000115641	cluster2	FHL2
ENSG00000253953	cluster2	PCDHGB4
ENSG00000196284	cluster2	SUPT3H
ENSG00000111667	cluster2	USP5
ENSG00000167196	cluster2	FBXO22
ENSG00000083814	cluster2	ZNF671
ENSG00000112183	cluster2	RBM24
ENSG00000114735	cluster2	HEMK1
ENSG00000116205	cluster2	TCEANC2
ENSG00000152465	cluster2	NMT2
ENSG00000276231	cluster2	PIK3R6
ENSG00000121807	cluster2	CCR2
ENSG00000103351	cluster2	CLUAP1
ENSG00000158286	cluster2	RNF207
ENSG00000146453	cluster2	PNLDC1
ENSG00000148357	cluster2	HMCN2
ENSG00000016391	cluster2	CHDH
ENSG00000171517	cluster2	LPAR3
ENSG00000198488	cluster2	B3GNT6
ENSG00000159905	cluster2	ZNF221
ENSG00000154928	cluster2	EPHB1
ENSG00000176399	cluster2	DMRTA1
ENSG00000178826	cluster2	TMEM139
ENSG00000135960	cluster2	EDAR
ENSG00000166394	cluster2	CYB5R2
ENSG00000143257	cluster2	NR1I3
ENSG00000135476	cluster2	ESPL1
ENSG00000006534	cluster2	ALDH3B1
ENSG00000172987	cluster2	HPSE2
ENSG00000106336	cluster2	FBXO24
ENSG00000124104	cluster2	SNX21
ENSG00000233757	cluster2	
ENSG00000142675	cluster2	CNKSRI
ENSG00000203797	cluster2	DDO
ENSG00000102967	cluster2	DHODH
ENSG00000146242	cluster2	TPBG
ENSG00000167524	cluster2	RSKR

ENSG00000221926	cluster2	TRIM16
ENSG00000171872	cluster2	KLF17
ENSG00000181264	cluster2	TLCD5
ENSG00000168246	cluster2	UBTD2
ENSG00000198894	cluster2	CIPC
ENSG00000009724	cluster2	MASP2
ENSG00000256806	cluster2	C17orf100
ENSG00000136997	cluster2	MYC
ENSG00000196639	cluster2	HRH1
ENSG00000104783	cluster2	KCNN4
ENSG00000160593	cluster2	JAML
ENSG00000049089	cluster2	COL9A2
ENSG00000148814	cluster2	LRRC27
ENSG00000116991	cluster2	SIPA1L2
ENSG00000155393	cluster2	HEATR3
ENSG00000163755	cluster2	HPS3
ENSG00000035403	cluster2	VCL
ENSG00000156787	cluster2	TBC1D31
ENSG00000147471	cluster2	PLPBP
ENSG00000125703	cluster2	ATG4C
ENSG00000237651	cluster2	C2orf74
ENSG00000186409	cluster2	CCDC30
ENSG00000188822	cluster2	CNR2
ENSG00000180626	cluster2	ZNF594
ENSG00000186687	cluster2	LYRM7
ENSG00000166801	cluster2	FAM111A
ENSG00000134318	cluster2	ROCK2
ENSG00000238227	cluster2	TMEM250
ENSG00000010292	cluster2	NCAPD2
ENSG00000111671	cluster2	SPSB2
ENSG00000164306	cluster2	PRIMPOL
ENSG00000143457	cluster2	GOLPH3L
ENSG00000141161	cluster2	UNC45B
ENSG00000149308	cluster2	NPAT
ENSG00000178252	cluster2	WDR6
ENSG00000131374	cluster2	TBC1D5
ENSG00000135446	cluster2	CDK4
ENSG00000084774	cluster2	CAD
ENSG00000253729	cluster2	PRKDC
ENSG00000154743	cluster2	TSEN2
ENSG00000140575	cluster2	IQGAP1
ENSG00000149582	cluster2	TMEM25
ENSG00000100342	cluster2	APOL1
ENSG00000136100	cluster2	VPS36
ENSG00000267680	cluster2	ZNF224
ENSG00000059573	cluster2	ALDH18A1
ENSG00000138442	cluster2	WDR12
ENSG00000253352	cluster2	TUG1
ENSG00000186814	cluster2	ZSCAN30
ENSG00000159023	cluster2	EPB41



ENSG00000161551	cluster2	ZNF577
ENSG00000156521	cluster2	TYSND1
ENSG00000142230	cluster2	SAE1
ENSG00000165819	cluster2	METTL3
ENSG00000103064	cluster2	SLC7A6
ENSG00000125814	cluster2	NAPB
ENSG00000147955	cluster2	SIGMAR1
ENSG00000085719	cluster2	CPNE3
ENSG00000169871	cluster2	TRIM56
ENSG00000164062	cluster2	APEH
ENSG00000125384	cluster2	PTGER2
ENSG00000106351	cluster2	AGFG2
ENSG00000145439	cluster2	CBR4
ENSG00000196329	cluster2	GIMAP5
ENSG00000136040	cluster2	PLXNC1
ENSG00000130313	cluster2	PGLS
ENSG00000034693	cluster2	PEX3
ENSG00000112367	cluster2	FIG4
ENSG00000165275	cluster2	TRMT10B
ENSG00000128394	cluster2	APOBEC3F
ENSG00000167257	cluster2	RNF214
ENSG00000169220	cluster2	RGS14
ENSG00000162600	cluster2	OMA1
ENSG00000136631	cluster2	VPS45
ENSG00000003056	cluster2	M6PR
ENSG00000104983	cluster2	CCDC61
ENSG00000243943	cluster2	ZNF512
ENSG00000186517	cluster2	ARHGAP30
ENSG00000179583	cluster2	CIITA
ENSG00000130303	cluster2	BST2
ENSG00000124523	cluster2	SIRT5
ENSG00000168310	cluster2	IRF2
ENSG00000068784	cluster2	SRBD1
ENSG00000109854	cluster2	HTATIP2
ENSG00000163219	cluster2	ARHGAP25
ENSG00000160049	cluster2	DFFA
ENSG00000114988	cluster2	LMAN2L
ENSG00000144026	cluster2	ZNF514
ENSG00000181896	cluster2	ZNF101
ENSG00000073849	cluster2	ST6GAL1
ENSG00000178927	cluster2	CYBC1
ENSG00000159618	cluster2	ADGRG5
ENSG00000243749	cluster2	TMEM35B
ENSG00000043462	cluster2	LCP2
ENSG00000138629	cluster2	UBL7
ENSG00000243667	cluster2	DNAAF10
ENSG00000213203	cluster2	GIMAP1
ENSG00000107960	cluster2	STN1
ENSG00000157637	cluster2	SLC38A10
ENSG00000040933	cluster2	INPP4A

ENSG00000090861	cluster2	AARS1
ENSG00000124587	cluster2	PEX6
ENSG00000133561	cluster2	GIMAP6
ENSG00000166326	cluster2	TRIM44
ENSG00000144852	cluster2	NR1I2
ENSG00000140006	cluster2	WDR89
ENSG00000122224	cluster2	LY9
ENSG00000171944	cluster2	OR52A5
ENSG00000137700	cluster2	SLC37A4
ENSG00000095370	cluster2	SH2D3C
ENSG00000111679	cluster2	PTPN6
ENSG00000138380	cluster2	CARF
ENSG00000125846	cluster2	ZNF133
ENSG00000164241	cluster2	C5orf63
ENSG00000197077	cluster2	KIAA1671
ENSG00000127952	cluster2	STYXL1
ENSG00000138172	cluster2	CALHM2
ENSG00000265590	cluster2	CFAP298-TCP10L
ENSG00000128923	cluster2	MINDY2
ENSG00000100271	cluster2	TTLL1
ENSG00000204842	cluster2	ATXN2
ENSG00000166821	cluster2	PEX11A
ENSG00000171843	cluster2	MLLT3
ENSG00000167094	cluster2	TTC16
ENSG00000185379	cluster2	RAD51D
ENSG00000149346	cluster2	SLX4IP
ENSG00000185518	cluster2	SV2B
ENSG00000156958	cluster2	GALK2
ENSG00000128487	cluster2	SPECC1
ENSG00000178537	cluster2	SLC25A20
ENSG00000134539	cluster2	KLRD1
ENSG00000122223	cluster2	CD244
ENSG00000164088	cluster2	PPM1M
ENSG00000156738	cluster2	MS4A1
ENSG00000000938	cluster2	FGR
ENSG00000168229	cluster2	PTGDR
ENSG00000149311	cluster2	ATM
ENSG00000162739	cluster2	SLAMF6
ENSG00000164483	cluster2	SAMD3
ENSG00000186470	cluster2	BTN3A2
ENSG00000116791	cluster2	CRYZ
ENSG00000165609	cluster2	NUDT5
ENSG00000014919	cluster2	COX15
ENSG00000105483	cluster2	CARD8
ENSG00000140836	cluster2	ZFHX3
ENSG00000117281	cluster2	CD160
ENSG00000265972	cluster2	TXNIP
ENSG00000103653	cluster2	CSK
ENSG00000175899	cluster2	A2M
ENSG00000147905	cluster2	ZCCHC7

ENSG00000156990	cluster2	RPU3D3
ENSG00000113845	cluster2	TIMMDC1
ENSG00000119929	cluster2	CUTC
ENSG00000156973	cluster2	PDE6D
ENSG00000100442	cluster2	FKBP3
ENSG00000117676	cluster2	RPS6KA1
ENSG00000151743	cluster2	AMN1
ENSG00000107201	cluster2	DDX58
ENSG00000236287	cluster2	ZBED5
ENSG00000102738	cluster2	MRPS31
ENSG00000172086	cluster2	KRCC1
ENSG00000139187	cluster2	KLRG1
ENSG00000143110	cluster2	C1orf162
ENSG00000244509	cluster2	APOBEC3C
ENSG00000026751	cluster2	SLAMF7
ENSG00000128340	cluster2	RAC2
ENSG00000172794	cluster2	RAB37
ENSG00000089127	cluster2	OAS1
ENSG00000198937	cluster2	CCDC167
ENSG00000160856	cluster2	FCRL3
ENSG00000177409	cluster2	SAMD9L
ENSG00000197057	cluster2	DTHD1
ENSG00000169359	cluster2	SLC33A1
ENSG00000175567	cluster2	UCP2
ENSG00000134202	cluster2	GSTM3
ENSG00000176049	cluster2	JAKMIP2
ENSG00000254505	cluster2	CHMP4A
ENSG00000075292	cluster2	ZNF638
ENSG00000139437	cluster2	TCHP
ENSG00000160050	cluster2	CCDC28B
ENSG00000188321	cluster2	ZNF559
ENSG00000119640	cluster2	ACYP1
ENSG00000101224	cluster2	CDC25B
ENSG00000174600	cluster2	CMKLR1
ENSG00000145723	cluster2	GIN1
ENSG00000181036	cluster2	FCRL6
ENSG00000171596	cluster2	NMUR1
ENSG00000227191	cluster2	TRGC2
ENSG00000104886	cluster2	PLEKHJ1
ENSG00000213809	cluster2	KLRK1
ENSG00000185697	cluster2	MYBL1
ENSG00000048028	cluster2	USP28
ENSG00000197548	cluster2	ATG7
ENSG00000141469	cluster2	SLC14A1
ENSG00000177225	cluster2	GATD1
ENSG00000211695	cluster2	TRGV9
ENSG00000171570	cluster2	RAB4B-EGLN2
ENSG00000178386	cluster2	ZNF223
ENSG00000111885	cluster2	MAN1A1
ENSG00000204179	cluster2	PTPN20

ENSG00000144118	cluster2	RALB
ENSG00000076351	cluster2	SLC46A1
ENSG00000162543	cluster2	UBXN10
ENSG00000114346	cluster2	ECT2
ENSG00000126822	cluster2	PLEKHG3
ENSG00000235750	cluster2	KIAA0040

Supplementary Figure 2

Pathway	pvalue	p.adjust	zScore	logQ	cond	Molecules
Ceramide Signaling	1E-11	5,75E-09	-3.273	8,24033216	obesity	CNKSRI1,CYCS,DIABLO,MAPK8,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6,PPP2R1A,PPP2R1B,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,S1PR1,S1PR3,S1PR4,S1PR5,SMPD4,SPHK1,TNFRSF1B
IL-6 Signaling	2,1878E-09	1,7971E-07	-2.449	6,7454302	obesity	A2M,CD14,CEBPB,COL1A1,CSNK2A2,CXCL8,IL1B,IL6ST,MAP2K3,MAPK8,NFKB1,NFKB2,NFKBID,NRAS,PIK3CG,PIK3R1,PIK3R6,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,SOC3,S1PR3,TNFRSF1B
Autophagy	2,1878E-09	1,7971E-07	-3.569	6,7454302	obesity	ARL8B,ATG13,ATG16L1,ATG2A,ATG7,ATM,DAPK1,DDIT3,EIF2AK3,EPG5,GABARAPL1,GNAI3,KATS,MAP1LC3A,MAP1LC3B,MAPK8,MYC,NFKB1,NFKB2,PIK2A,PIK3CG,PIK3R1,PIK3R6,PPP2R1A,PPP2R1B,RAF1,RALB,RB1CC1,RIK1,SLC1A5,SLC7A5,SQSTM1,TGFB1,TLR4,TNFRSF1B,ULK1,VP539,WIPI2
HMGB1 Signaling	5,2481E-09	3,7721E-07	-3.962	6,42342214	obesity	CNTF,CXCL8,FASLG,HAT1,ICAM1,IFNGR1,IL1B,LIF,MAP2K3,MAPK8,NFKB1,NFKB2,NRAS,OSM,PIK3CG,PIK3R1,PIK3R6,RA C2,RALB,RAP2B,RASD1,REL,RELA,RELB,RHOF,RHOG,TGFB1,TLR4,TNFRSF1B,TNFSF13,TNFSF14,TNFSF9
Tumor Microenvironment Pathway	3,02E-08	1,3357E-06	-3.651	5,87427551	obesity	COL1A1,CXCL8,FASLG,FGF9,HLA-B,HLA-C,ICAM1,IL1B,ITGA5,ITGB3,MMP9,MYC,NFKB1,NFKB2,NRAS,OSM,PIK3CG,PIK3R1,PIK3R6,PTGS2,RAF1,RALB,RAP2B,RAS D1,REL,RELA,RELB,SLC16A1,SLC14A4,SLC2A1,SLC2A3,TGFB1
Unfolded protein response	6,6069E-08	2,5327E-06	-3.873	5,59642341	obesity	CALR,CEBPB,CEBPD,CEBPZ,DDIT3,DNAJA1,DNAJB1,DNAJB11,DNAJB6,EIF2AK3,HSPA14,HSPA5,HSPA9,HSPH1,INSIG1,MAPK8,NFE2L2,PPP1R15A,SREBF1,SREBF2,SYVN1
PDF Signaling	4,6774E-07	1,3447E-05	-2.138	4,87136215	obesity	FASLG,NFKB1,NFKB2,NFKBID,NFKBID,NRAS,PIK3CG,PIK3R1,PIK3R6,PNPLA2,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,RO CK2,SOD2
LPS-stimulated MAPK Signaling	5,6234E-07	1,4698E-05	-2.5	4,83275484	obesity	CD14,MAP2K3,MAPK8,NFKB1,NFKB2,NFKBID,NRAS,PIK3CG,PIK3R1,PIK3R6,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,TLR4
Senescence Pathway	6,6069E-07	1,6198E-05	-2.466	4,7905434	obesity	ANAPC10,ANAPC7,ASXL2,ATF3,ATM,BHLHE40,CAPN10,CAPN5,CCND2,CDC25B,CDK4,CDKN1A,CEBPB,CXCL8,DLAT,DL D,EIF4EBP1,FZR1,GADD45A,GADD45B,GADD45G,MAP2K3,MAPK7,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6,PPP2R1A,PP P2R1B,RAD50,RAF1,RALB,RAP2B,RASD1,RNF2,SMAD7,SOD2,SQSTM1,TGFB1
NF-κB Activation by Viruses	6,7608E-07	1,6198E-05	-2.84	4,7905434	obesity	CXCR5,ITGB3,NFKB1,NFKB2,NFKBID,NRAS,PIK3CG,PIK3R1,PIK3R6,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,RIK1 1
Cardiac Hypertrophy Signaling (Enhanced)	1,0233E-06	2,1014E-05	-4.808	4,67749019	obesity	ADRA2B,ADRB1,ADRB2,CNTF,CSF2RB,CXCL8,CXCR1,EDN1,EIF4EBP1,FASLG,FGF9,FGFRL1,GDE1,GNA13,GNA15,GNAI3,IF NLR1,IL10RB,IL11RA,IL1B,IL21R,IL4R,IL6ST,ITGA5,ITGB3,LIF,MAP2K3,MAP3K8,MAPK7,MAPK8,MEF2D,MYC,NFKB1,NFKB 2,NRAS,OSM,PDE3B,PDE4A,PDE4B,PDE4D,PDE6D,PIK3CG,PIK3R1,PIK3R6,PNPLA8,PTGS2,RAF1,RALB,RAP2B,RASD1,REL, RELA,RELB,ROCK2,RPS6KB1,TGFB1,TNFRSF13,TNFSF14,TNFSF9,WNT1,WNT7A
TREM1 Signaling	2,6303E-06	4,4218E-05	-2.84	4,3544002	obesity	CASP1,CD83,CD86,CITA,CXCL8,ICAM1,IL1B,ITGA5,NFKB1,NFKB2,NLRP3,REL,RELA,RELB,STAT5A,TLR4,TREM1
NGF Signaling	2,6915E-06	4,4218E-05	-2.668	4,3544002	obesity	MAP3K8,MAPK7,MAPK8,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,RHOG,RO CK2,RPS6KA1,RPS6KB1,SMPD4,TRAF4
IL-8 Signaling	3,7154E-06	5,7739E-05	-3.272	4,23853388	obesity	CCND2,CXCL8,CXCR1,EIF4EBP1,GNA13,GNA15,GNAI3,HMOX1,ICAM1,IQGAP1,ITGB3,MAPK8,MMP9,NFKB1,NFKBID,NRA S,PIK3CG,PIK3R1,PIK3R6,PLD4,PTGS2,RAC2,RAF1,RALB,RAP2B,RASD1,REL,RHOF,RHOG,ROCK2,RPS6KB1
Coronavirus Pathogenesis Pathway	5,1286E-06	7,1926E-05	-2.646	4,14311601	obesity	ABL1,ADAM9,BST2,CASP1,CCR2,CDK4,CXCL8,DDIT3,DDX58,EIF2AK3,FASLG,FURIN,IL1B,MAPK8,MAVS,NFKB1,NFKB2,NF KBI1,NFKBID,NLRP3,NUP98,OAS1,PTGS2,REL,RELA,RELB,RIK1,RPS16,SIGMAR1,TGFB1
MIF-mediated Glucocorticoid Regulation	5,4954E-06	7,5197E-05	-2.333	4,12380061	obesity	CD14,NFKB1,NFKB2,NFKBID,NFKBID,NR3C1,PTGS2,REL,RELA,RELB,TLR4
LXR/RXR Activation	1,4454E-05	0,00016623	2,324	3,77930216	post-surgery	ABCG1,APOL1,CD14,CYP51A1,FASN,HMGCR,IL1B,LDLR,LV2,MMP9,NFKB1,NFKB2,NR1H2,PTGS2,REL,RELA,RELB,RXRα,SR EBF1,TLR4,TNFRSF1B
Lymphotoxin β Receptor Signaling	1,8197E-05	0,00020122	-2.121	3,6963355	obesity	BIRC2,CYCS,DIABLO,NFKB1,NFKB2,NFKBID,PIK3CG,PIK3R1,PIK3R6,RELA,RELB,TNFSF14,TRAF4
HER-2 Signaling in Breast Cancer	1,8197E-05	0,00020122	-2.646	3,6963355	obesity	AHCTF1,AREG,CDK4,CDKN1A,COX15,FGR,ITGB3,LYN,MYC,NFKB1,NFKB2,NFKBID,NRAS,NUP54,NUP98,PAR6G, PIK3CG,PIK3R1,PIK3R6,PTGS2,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,RHEB,RPS6KB1,YES1
PPAR Signaling	2,0417E-05	0,00021741	2,5	3,66272592	post-surgery	IL1B,MED1,NFKB1,NFKB2,NFKBID,NRAS,PTGS2,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,RXRα,SRRA1,STAT5A,TN FRSF1B
ERK5 Signaling	3,02E-05	0,00031008	-2.138	3,50852018	obesity	FOSL1,GNA13,IL6ST,LIF,MAP3K8,MAPK7,MEF2D,MYC,NRAS,RALB,RAP2B,RASD1,RPS6KA1,RPS6KB1,SGK1
Regulation Of The Epithelial Mesenchymal Transition By Growth Factors Pathway	3,7154E-05	0,00035605	-4.082	3,44848341	obesity	FASLG,FGF9,FGFRL1,MAP2K3,MAPK8,MMP9,NFKB1,NFKB2,NRAS,PAR6G,PIK3CG,PIK3R1,PIK3R6,RAF1,RALB,RAP2B,RA SD1,REL,RELA,RELB,SMURF1,TGFB1,TNFRSF1B,TNFSF13,TNFSF14,TNFSF9,ZEB2
MIF Regulation of Innate Immunity	4,5709E-05	0,00042391	-3	3,37272384	obesity	CD14,MAPK8,NFKB1,NFKB2,NFKBID,NFKBID,PTGS2,REL,RELA,RELB,TLR4
PI3K Signaling in B Lymphocytes	4,7863E-05	0,00043002	-3,5	3,36651213	obesity	ABL1,ATF3,CD79B,IL4R,LYN,NFKB1,NFKB2,NFKBID,NFKBID,NRAS,PIK3CG,PIK3R1,PLEKHA2,PLEKHA3,RAF1,RALB,RAP2B, RASD1,REL,RELA,RELB,TLR4
Hepatic Fibrosis Signaling Pathway	7,5858E-05	0,00063215	-2.897	3,19918125	obesity	CEBPB,COL1A1,CSNK1D,CXCL8,EDN1,ETH1,GLI1,GNAI3,ICAM1,IL1B,ITGA5,ITGB3,MAP2K3,MAPK8,MYC,NFKB1,NFKB2,N FKBI1,NFKBID,NRAS,PDCD4,PIK3CG,PIK3R1,PIK3R6,RAC2,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,RHOF,RHOG,RIK1,R OCK2,RPS6KB1,SMAD7,SOD2,TFRC,TGFB1,TLR4,TNFRSF1B,TRADD,WNT1,WNT7A
Cholecystokinin/Gastrin-mediated Signaling	9,3325E-05	0,0007351	-3.153	3,13365502	obesity	CREM,EPHA4,GNA13,IL1B,MAP2K3,MAPK7,MAPK8,MEF2D,NRAS,PTGS2,PXN,RAC2,RAF1,RALB,RAP2B,RASD1,RHOF,RH OG,ROCK2
Crosstalk between Dendritic Cells and Natural Killer Cells	0,00010233	0,0007742	-2.111	3,11114575	obesity	CCR7,CD83,CD86,CSF2RB,FASLG,HLA-B,HLA-C,KLR4-KLRK1/KLRK1,IL1B,NFKB1,NFKB2,REL,RELA,RELB,TLR4,TNFRSF1B
NRF2-mediated Oxidative Stress Response	0,00010233	0,0007742	-3.153	3,11114575	obesity	CD3CA,CUL3,DNAJA1,DNAJB1,DNAJB11,DNAJB6,EIF2AK3,ENC1,FOSL1,ETH1,GSTM3,HMOX1,MAFF,MAP2K3,MAPK7, MAPK8,NFE2L2,NQO2,NRAS,PIK3CG,PIK3R1,PIK3R6,PMF1/PMF1-BGLAP,RAF1,RALB,RAP2B,RASD1,SOD2,SQSTM1,USP14
4-1BB Signaling in T Lymphocytes	0,00013804	0,00095629	-2.236	3,01941025	obesity	MAPK8,NFKB1,NFKB2,NFKBID,REL,RELA,RELB,TNFSF9
Role of MAPK Signaling in Promoting the Pathogenesis of Influenza	0,00014454	0,00098944	-2.357	3,00461144	obesity	ATPVOC,ATPV0D1,ATPV0E2,ATPV1E1,MAP2K3,MAPK8,NFKB1,NFKB2,NFKBID,NRAS,PNPLA8,PTGS2,RABGE F1,RAF1,RALB,RAP2B,RASD1
IL-17 Signaling	0,00015849	0,00104749	-4,2	2,97985141	obesity	CEBPB,CNTF,CXCL8,FASLG,IL1B,LIF,MAP2K3,MAPK8,MMP9,NFKB1,NRAS,OSM,PIK3CG,PIK3R1,PIK3R6,PTGS2,RALB,RAP2 B,RASD1,RELA,SGS16,TGFB1,TNFSF13,TNFSF14,TNFSF9
PDGF Signaling	0,00018197	0,00116259	-2.138	2,93457466	obesity	ABL1,CSNK2A2,INPP5K,INPP1,MAPK8,MYC,NRAS,PIK3CG,PIK3R1,PIK3R6,RAF1,RALB,RAP2B,RASD1,SPHK1
Neuroinflammation Signaling Pathway	0,00020893	0,00130581	-3.889	2,88411998	obesity	BIRC2,BIRC3,CASP1,CD200R1,CD86,CNTF,CXCL8,FASLG,GLUL,HLA-B,HLA-C,HMOX1,ICAM1,IFNGR1,IL1B,MAPK7,MAPK8,MMP9,NFE2L2,NFKB1,NFKB2,NLRP3,PIK3CG,PIK3R1,PIK3R6,PSEN2,PTGS 2,RAC2,REL,RELA,RELB,RIK1,SOD2,TGFB1,TLR4,WNT1
Production of Nitric Oxide and Reactive Oxygen Species in Macrophages	0,00022387	0,00136943	-2,4	2,86346001	obesity	APOL1,IFNGR1,IRF8,LV2,MAP3K8,MAPK8,NFKB1,NFKB2,NFKBID,NFKBID,PIK3CG,PIK3R1,PIK3R6,PPP1B,PPP2R1A,PPP2R 1B,PTPN6,RAC2,REL,RELA,RELB,RHOF,RHOG,TLR4,TNFRSF1B
Apelin Endothelial Signaling Pathway	0,00031623	0,00185542	-3	2,73155823	obesity	GNA13,GNA15,GNAI3,ICAM1,MAPK8,MEF2D,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6,RAF1,RALB,RAP2B,RASD1,REL, RELA,RELB,RPS6KB1
RANK Signaling in Osteoclasts	0,00034674	0,00195464	-2,714	2,70893233	obesity	BIRC2,BIRC3,MAP3K8,MAPK8,NFKB1,NFKB2,NFKBID,NFKBID,PIK3CG,PIK3R1,PIK3R6,RAF1,REL,RELA,RELB
Pulmonary Fibrosis Idiopathic Signaling Pathway	0,00035481	0,00196171	-3,55	2,70736549	obesity	AREG,COL1A1,COL9A2,EDN1,EIF4EBP1,FGF9,FGFRL1,GLI1,GNA13,IL11RA,IL1B,IL6ST,MAP2K3,MAPK8,MMP9,NFKB1,NF KB2,NRAS,PIK3CG,PIK3R1,PIK3R6,POLR2A,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,ROCK2,RPS6KA1,RPS6KB1,TGFB1,T HBS1,WNT1,WNT7A
Glioma Invasiveness Signaling	0,00038905	0,00211039	-2,111	2,67563802	obesity	ITGB3,MMP9,NRAS,PIK3CG,PIK3R1,PIK3R6,PLAUR,RAC2,RALB,RAP2B,RASD1,RHOF,RHOG
Antioxidant Action of Vitamin C	0,00038905	0,00211039	3,317	2,67563802	post-surgery	CSF2RB,HMOX1,MAPK8,NFKB1,NFKB2,NFKBID,PLD4,PNPLA8,REL,RELA,RELB,SELENOT,SLC2A1,SLC2A14,SLC2A3, STAT5A
iNOS Signaling	0,00041687	0,00224019	-2,828	2,64971593	obesity	CD14,IFNGR1,NFKB1,NFKB2,NFKBID,NFKBID,REL,RELA,RELB,TLR4
Pancreatic Adenocarcinoma Signaling	0,00057544	0,0028772	-3,207	2,54103	obesity	ABL1,CDK4,CDKN1A,HMOX1,MAPK8,MMP9,NFKB1,NFKB2,PIK3CG,PIK3R1,PIK3R6,PLD4,PTGS2,RAF1,REL,RELA,RELB,TGF B1
RAC Signaling	0,00064565	0,00320044	-2,138	2,49479014	obesity	IQGAP1,ITGA5,ITGB3,MAPK8,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6,RAC2,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB, RPS6KB1
Colorectal Cancer Metastasis Signaling	0,00102329	0,00459682	-2,985	2,33754212	obesity	GNA13,GNA15,GNAI3,IFNGR1,IL6ST,MAPK8,MMP9,MYC,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6,PTGER2,PTGER4,P TGS2,RAC2,RALB,RAP2B,RASD1,REL,RELA,RELB,RHOF,RHOG,TGFB1,TLR4,WNT1,WNT7A
Superpathway of Cholesterol Biosynthesis	0,00138038	0,00601304	-2,646	2,22090609	obesity	CYP51A1,DHCR7,HMGCR,HMGCS1,IDI1,MVD,SC5D
Wound Healing Signaling Pathway	0,00141254	0,00610684	-3,402	2,2141838	obesity	CEBPB,CNTF,COL1A1,COL9A2,CXCL8,FASLG,IFNGR1,IL1B,LIF,MAP2K3,MAPK8,MMP9,NFKB1,NFKB2,NFKBID,NFKBID,NRA S,OSM,RAF1,RALB,RAP2B,RASD1,TGFB1,TNFRSF1B,TNFSF13,TNFSF14,TNFSF9,TRADD
Adrenomedullin signaling pathway	0,00213796	0,00847813	-2,524	2,07170016	obesity	CEBPB,CSK,CTH,GNA15,IL1B,CNNM4,MAP2K3,MAPK7,MAPK8,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6,RAF1,RALB,RA P2B,RASD1,REL,RELA,RELB,RXRα
Role of MAPK Signaling in Inhibiting the Pathogenesis of Influenza	0,00213796	0,00847813	-2,309	2,07170016	obesity	CXCL8,IL1B,MAP2K3,MAPK8,NFKB1,NFKB2,NFKBID,PNPLA8,PTGS2,RAF1,TLR4
Osteoarthritis Pathway	0,00229087	0,00902225	-2,357	2,04468501	obesity	CASP1,CASP10,CEBPB,CXCL8,DDIT4,EPAS1,GLI1,IL1B,ITGA5,ITGB3,MMP9,NAMPT,NFKB1,NFKB2,PTGS2,REL,RELA,RELB, S100A9,S1PR3,SLC39A8,SMAD7,SPHK1,TGFB1,TLR4,TNFRSF1B

Sphingosine-1-phosphate Signaling	0,00234423	0,0091696	-3,357	2,03764949	obesity	CASP1,CASP10,GNA13,GNAI3,PIK3CG,PIK3R1,PIK3R6,RAC2,RHOF,RHOG,S1PR1,S1PR3, <b>S1PR4</b> ,S1PR5,SMPD4,SPHK1
Thrombin Signaling	0,00245471	0,00947287	-2,357	2,02351842	obesity	ARHGFE3,ARHGFE7, <b>GATA6</b> ,GNA13,GNA15,GNAI3,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6,PPP1CB,RAC2,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,RHOF,RHOG,ROCK2,RPS6KB1
B Cell Activating Factor Signaling	0,00380189	0,01278415	-2	1,89332827	obesity	MAPK8,NFKB1,NFKB2,NFKBIB,NFKBID,REL,RELA,RELB
Hypoxia Signaling in the Cardiovascular System	0,0057544	0,01808076	-2,236	1,74278325	obesity	ATM,CDC34,CSNK1D,EDN1,HIF1AN,LDDA,NFKBIB,NFKBID,UBE2B,UBE2E2,UBE2S
Phagosome Formation	0,00707946	0,0213125	-2,889	1,67136552	obesity	ADGRE5,ADGRG5,ADRA2B,ADRB1,ADRB2,AP1G1,CCR2,CCR6,CCR7,CD14,CMKLR1,CNR2,CXCR1,DRD3,F2RL1,FGR,GALR2,GPR132,GPR146,GPR183, <b>GPR35</b> ,HMOX1,HRH1,ITGA5,ITGB3,LPAR3,LPAR5,LTBR42,LYN,MAP2K3,MAPK7,NMUR1,NRAS,P2RY11,PIK3CG,PIK3R1,PIK3R6,PLD4,PNPLA8,PTAFR,PTGDR,PTGER4,RAC2,RAF1,RALB,RAP2B,RASD1,ROCK2,RPS6KB1,S1PR1,S1PR3, <b>S1PR4</b> ,S1PR5,SPHK1,SSTR3,TLR4,YES1
Endoplasmic Reticulum Stress Pathway	0,00724436	0,02169535	-2,236	1,66363338	obesity	CALR,DDIT3,EIF2AK3,HSPA5,MAPK8
Mevalonate Pathway I	0,00812831	0,02360493	-2	1,62699735	obesity	HMGCR,HMGCS1,IDI1,MVD
Cardiac Hypertrophy Signaling	0,00812831	0,02360493	-2,711	1,62699735	obesity	ADRA2B,ADRB1,ADRB2,ADSS2,GNA13,GNA15,GNAI3,MAP2K3,MAP3K8,MAPK8,MEF2D,NRAS,PIK3CG,PIK3R1,PIK3R6,RAC2,RAF1,RALB,RAP2B,RASD1,RHOF,RHOG,ROCK2,RPS6KA1,RPS6KB1,TGFB1
Pulmonary Healing Signaling Pathway	0,00912011	0,02583282	-2,4	1,58782819	obesity	BMP4,FGR,LYN,MAPK8,MMMP9,MYC,NFKB1,NFKB2,NRAS,RAF1,RALB,RAP2B,RASD1,STAT5A,TGFB1,THBS1,TLR4,TNFRSF1B,WNT1,WNT7A,YES1
MSP-RON Signaling In Cancer Cells Pathway	0,01047129	0,02880856	-2,138	1,54047844	obesity	CSF2RB,MYC,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6, <b>PLAUR</b> ,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB
ERBB Signaling	0,01096478	0,02988033	-2,111	1,52461461	obesity	AREG,MAP2K3,MAPK8,NRAS,PIK3CG,PIK3R1,PIK3R6,RAF1,RALB,RAP2B,RASD1,RPS6KB1
IL-1 Signaling	0,0128825	0,03429368	-2,646	1,46478591	obesity	GNA13,GNA15,GNAI3,MAP2K3,MAPK8,NFKB1,NFKB2,NFKBIB,NFKBID,REL,RELA,RELB
CXCR4 Signaling	0,01380384	0,03607823	-2,324	1,44275484	obesity	GNA13,GNA15,GNAI3,LYN,MAPK8,NRAS,PIK3CG,PIK3R1,PIK3R6,PNX,RAC2,RAF1,RALB,RAP2B,RASD1,RHOF,RHOG,ROCK2
Insulin Secretion Signaling Pathway	0,01412538	0,03642193	-2,353	1,43863702	obesity	AGO2,AGO3,CRTC2,DLAT,DLDD,EIF2AK3,EIF4A3,EIF4EBP1,FGR,FURIN,GNA15,LYN,NAPA,NAPB,NAPG,PABPC1,PIK3CG,PIK3R1,PIK3R6,RPS6KB1,SLC2A1,SLC2A14,SLC2A3,STAT5A,STX16,YES1
Pyridoxal 5'-phosphate Salvage Pathway	0,01737801	0,04363474	-2,333	1,36016764	obesity	CDK4,CSNK1D, <b>DAPK1</b> ,DYRK1A,MAP2K3,MAP3K8,MAPK7,MAPK8,SGK1
Coronavirus Replication Pathway	0,01737801	0,04363474	-2,646	1,36016764	obesity	COPB1,TUBA1A,TUBA1B, <b>TUBA1C</b> ,TUBA4A,TUBB2A,TUBB4B
ILK Signaling	0,01862087	0,04595279	-2	1,33768808	obesity	ITGB3,MAPK8,MMMP9,MYC,NFKB1,NFKB2,PIK3CG,PIK3R1,PIK3R6,PPP2R1A,PPP2R1B,PTGS2,PNX,RAC2,REL,RELA,RELB,RHOF,RHOG,VCL
Integrin Signaling	0,01862087	0,04595279	-2,065	1,33768808	obesity	ABL1,ARHGFE7,CAPN10,CAPN5,ITGA5,ITGB3,MAPK8,NRAS,PIK3CG,PIK3R1,PIK3R6,PPP1CB,PNX,RAC2,RAF1,RALB,RAP2B,RASD1,RHOF,RHOG,VCL
Oxytocin Signaling Pathway	0,02041738	0,04912131	-3,53	1,30873006	obesity	ATP2B4,CAMKK1,CTH,CXCL8,GNA13,GNAI3,MAPK7,MAPK8,NFE2L2,NFKB1,NFKB2,NRAS,PIK3CG,PIK3R1,PIK3R6,PNPLA2,PPP1CB,PTGS2,RAF1,RALB,RAP2B,RASD1,REL,RELA,RELB,ROCK2
Superpathway of Geranylgeranyldiphosphate Biosynthesis I (via Mevalonate)	0,02041738	0,04912131	-2	1,30873006	obesity	HMGCR,HMGCS1,IDI1,MVD
Ephrin Receptor Signaling	0,02137962	0,04997269	-2	1,30126726	obesity	ABI1,ABL1,EPHA4,EPHB1,GNA13,GNA15,GNAI3,ITGA5,ITGB3,NRAS,PIK3CG,PNX,RAC2,RAF1,RALB,RAP2B,RASD1,ROCK2,SDCBP,SH2D3C