

Supplementary information

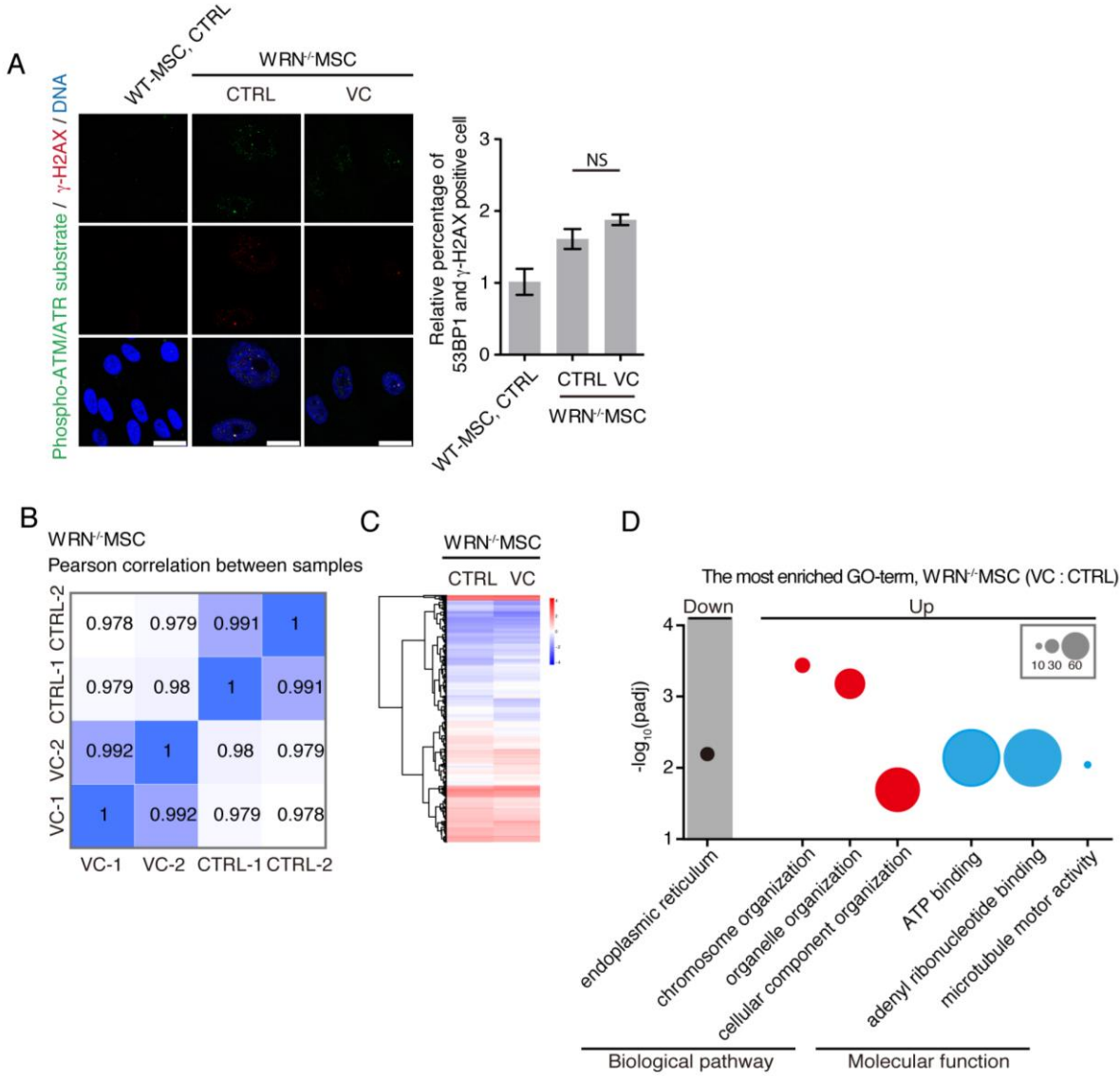


Figure S1. (A) Representative immunofluorescence staining and quantitative analysis of indicated proteins in vehicle- or VC-treated (7 days) WT MSCs and WRN^{-/-} MSCs. Scale bar, 25 μ m. (B) Heatmap showing the correlation between the biological replicates. (D) Heatmap showing significantly altered gene (P-value < 0.05, FC[VC/vehicle] < 0.5 or FC [VC/vehicle] > 2) between VC- and vehicle-treated WRN^{-/-} MSCs. FC, fold change. (E) GO analysis of the significantly alter genes (Down: down regulated genes; Up: up regulated genes) in MSCs upon VC exposure. Number of altered genes in each term was indicated by size of the bubble. NS means not significant by t test; n=3.

Supplementary table S1

Quantitative RT-PCR primers used in this study

Gene	Forward primer (5'→3')	Reverse primer (5'→3')
18S	GTAACCCGTTGAACCCCAT	CCATCCAATCGGTAGTAGCG
ASF1B	TCCGGTTCGAGATCAGCTTC	GTCGGCCTGAAAGACAAACA
BIRC5	AGGACCACCGCATCTCTACAT	AAGTCTGGCTCGTTCTCAGTG
BUB1	AAATGACCCTCTGGATGTTTGG	GCATAAACGCCCTAATTTAAGCC
CASC5	CTTCACACCGAGGACTCAAGA	TTGATGTGTAGAAGAGGCACTG
CCNA2	CGCTGGCGGTACTIONGAAGTC	GAGGAACGGTGACATGCTCAT
CCNB1	TCGCATCAAACCTCTCTGGCTA	TGAGCGACTAAACTCACCCT
CCNF	CACAAAGCATCCATATTGCACTG	TGGTCAGACATCCCTGATGAG
CDC25B	ACGCACCTATCCCTGTCTC	CTGGAAGCGTCTGATGGCAA
CDC6	ATGGCACAGTATCTGGAGGAG	TAAGCTGGACTCACTCTCGGA
CDC7	AGGGTAGATGCGGTTACTATGT	AGCGTGTTACCACAAAATCTT
CDCA5	GAGGTCCCAGCGGAAATCAG	TCTTTAAGACGATGGGCTTTCTG
CDCA7L	TTGGTCTTCGAGTAGCCTTTCA	CTCATCCCGAGAGTCATCCTC
CDCA8	GAAGGGCAGTAGTCGGGTG	TCACGGTCGAAGTCTTTCAGA
CDK1	CACCAGCGTTATATTTTGCACAG	ATCTGCCAGCTTTAACTCCCC
CDK2	TGTTTAACTACTTTGGACCCG	CCATCTCCTCTATGACTGACAGC
CDT1	CGGTGGACGAGGTTTCCAG	CTGCCGGGGTGGATTTCTT
CKS1B	TATTCGGACAAATACGACGACG	CGCCAAGATTCCCTCCATTGAGA
CKS2	TTCGACGAACACTACGAGTACC	GGACACCAAGTCTCCTCCAC
CLDN11	CGGTGTGGCTAAGTACAGGC	CGCAGTGTAGTAGAAACGGTTTT
CXCL13	GCTTGAGGTGTAGATGTGTCC	CCCACGGGGCAAGATTTGAA
DBF4	CCGGAAAGTCCTTTTACTTGGAT	AACCCTCAATTACCCACCCA
DBF4B	CCGGAAAGTCCTTTTACTTGGAT	AACCCTCAATTACCCACCCA
E2F8	ATCTGCCTTGACGAAGTGGC	GGCGTACTTATTCTCCTCCCC
ESCO2	CACTGGGACGCACCCAAAA	CACTTGCCTTGTGCAAAAAG
ESPL1	CCGCCTTGAAGGAGTTCTCTG	GGGGTAGACACTAAGTAGCCAT
GAS2L3	AGCCTGCAATTCAAGTATGGTT	TGGTCCGTGTCTGGGAGTC
GIN5	AGTTGGCCTTTGCCAGAGAG	GAAGTGGCCGAAAGAGGTCC
GMNN	GCCCTGGGGTTATTGTCCC	AGCGCCTTCTCCGTTTTTCT
GTSE1	CAGGGGACGTGAACATGGATG	ATGTCCAAAGGGTCCGAAGAA
MAD2L1	GAGAAGTCCGAAGAAACTCACG	CCGAAGCGTTGAGAGGTTCC
MIS18BP	CAGGCACACTACTCCTGTAAAA	GAGGTAGTAGCCTCTGTTAGCA
MND1	CAGTGCCGAAGAATCGGTCAT	CGAGCAGCATTTAATGGAGACA
NUSAP1	AGCCCATCAATAAGGGAGGG	ACCTGACACCCGTTTTAGCTG
ORC1	ACTACCCCAAGGCTGAAGA	AGTGCAGTTTTCGATCCAACA
PLK1	CAGTCACTCTCCGCGACAC	GAGTAGCCGAATTGCTGCTG
PLK4	AAGCTCGACACTTCATGCACC	GCATTTTCAGTTGAGTTGCCAG

POLD3	GAGTTCGTCACGGACCAAAAC	GCCAGACACCAAGTAGGTAAC
RFC3	GTGGACAAGTATCGGCCCTG	TGATGGTCCGTACACTAACAGAT
RFC5	GAAGCAGACGCCATGACTCAG	GACCGAACCGAAACCTCGT
RRM2	TGGTGAAGCGGCCTAATCC	GCAACATGAGTCGAAAGGTCCG
SKA1	CCTGAACCCGTAAGAAGCCT	TCATGTACGAAGGAACACCATTG
SMC4	CCGCTGGTCATCGGACAATTT	GCGCACATAATAGTTGGAGCCT
TOP2A	ACCATTGCAGCCTGTAAATGA	GGGCGGAGCAAATATGTTCC
TOX	TGGTTGGGTGGTCGTCAAATC	CAGACGCAATTCCTCCACAGT
TPX2	ATGGAACTGGAGGGCTTTTTC	TGTTGTCAACTGGTTTCAAAGGT
BLM	CAGACTCCGAAGGAAGTTGTATG	TTGGGGTGGTGTAAACAAATGAT
BRCA1	GCTCGTGGAAGATTTCCGGTGT	TCATCAATCACGGACGTATCATC
CHAF1A	AGCCCGTCTGCCGTTTAAG	AGAAGTACCCTGATCGTCTGAC
CHAF1B	CTGGCGTGAGAAGCAAAGA	CTGGCGTGAGAAGCAAAGA
FANCD2	AAAACGGGAGAGAGTCAGAATCA	ACGCTCACAAGACAAAAGGCA
FANCG	AATGACCGGCTCGTTCGAC	CTTGCCCTCAGGATAATGAAGTT
FANCL	AGAGCTGTATGCACTACCTCC	ATCCCAACCAAGAGTTCCTATCT
HJURP	CACAAAGCCATCAAGCATCATC	TCAGAGCAGGGTATGAAGTTCT
RAD51AP	AAGTCTGGGAGTTGTCCCCTA	ACTGCAAACAGCTACTCATTTGG
RAD54L	AGGCAGGTCCTGTGATGATGA	TCAAAGGTTTCCGAAAAGGAGAC
CENPE	GATTCTGCCATAACAAGGCTACAA	TGCCCTGGGTATAACTCCCAA
CENPA	AAGACCACTTTGAGCAGTTGCCTG	ATGCTGCCACTAATGGTGAGGCTA
CENPH	CAGCCCCAGATGCAAGACG	GTGCAGTTGAAAGTCTCATCCT
CENPN	TGAACTGACAACAATCCTGAAGG	CTTGCACGCTTTTCTCACAC
CENPW	AAGCCTCAACTTCGTCTGGAG	CACAAGCGTTTGTCTGGACT
CEP128	AATCATCCAGCGAATCAGATCAC	AGGAAGACTTCGAGTTCCCCT
CEP70	AGAACAACGAGCTAATGACTTGG	AGCCCTACTTAGTGATTATCCT
CNTRL	CAGATGAAAGCCCTTACATTGGC	CTGCCTGAGCACTGTCAATAAT
NCAPG	GAGGCTGCTGTTCGATTAAGGA	AACTGTCTTATCATCCATCGTGC
NCAPH	GTCCTCGAAGACTTTCCTCAGA	TGAAATGTCAATACTCCTGCTGG
IL1R1	ATGAAATTGATGTTTCGTCCTGT	ACCACGCAATAGTAATGTCCTG
LINC707	CACTATGAGACTGGACTGGAACA	TGGTCTGGGAGTGGTGC
LMNB1	AAGCATGAAACGCGCTTGG	AGTTTGGCATGGTAAGTCTGC
SYNE2	ACCACCCTATGGAAAGCTACT	CATCTCCCATCTGTCTGAAGGC
NDC80	GAGGACACGACAGTCACAATC	CTGGGGCCATGATGGATGC
UBE2C	TGGTCTGCCCTGTATGATGT	AAAAGCTGTGGGGTTTTTCC
UBE2L6	TGGACGAGAACGGACAGATTT	GGCTCCCTGATATTCGGTCTATT

Supplementary table S2**List of up-regulated genes (log2FoldChange>1, pValue <0.05)**

Gene Name	log2FoldChange	pValue
TMEM119	5.187	0.00063
C6orf141	4.1753	0.019218
CENPA	3.7759	2.36E-20
CTHRC1	3.7157	4.84E-26
E2F8	3.7141	0.000273
LRRC34	3.3167	0.002348
DDX12P	3.278	0.000147
RAD54L	3.2734	1.28E-11
BRCA2	3.267	7.78E-12
TROAP	3.1501	6.59E-25
PRIM1	3.0776	0.000241
PIF1	3.0595	2.53E-07
GGT5	3.0508	9.82E-05
CKAP2L	3.0278	2.90E-34
LINC00707	3.0247	0.025785
ITPRIPL1	2.9724	0.000119
VASH2	2.9536	0.007504
CPXM1	2.9442	2.91E-31
WISP1	2.918	0.009325
ASPM	2.8923	9.45E-76
DMC1	2.877	0.049597
NEIL3	2.8757	8.86E-09
STAT5A	2.871	0.010787
KIF15	2.865	5.80E-15
TTK	2.8418	1.58E-25
PLK4	2.8356	3.88E-20
PLK1	2.8171	5.06E-58
KIF20A	2.8125	1.91E-47
NIPAL4	2.8025	0.007523
MKI67	2.7982	2.51E-105
FES	2.7959	0.00049
DEPDC1	2.7844	3.08E-36
MND1	2.7787	1.16E-05
DEPDC1B	2.7758	3.18E-12
DLGAP5	2.7716	4.91E-48
BUB1	2.7645	1.33E-45
KIF2C	2.7641	2.09E-41
UBE2C	2.7632	4.32E-45
CEP128	2.7594	7.32E-11

RP11-731J8.2	2.7355	0.026767
CDC25C	2.7174	1.64E-07
HMGB2	2.7108	1.28E-65
CDC48	2.7011	3.97E-38
SGOL1	2.6956	4.33E-07
C11orf82	2.6867	2.35E-07
ESCO2	2.6802	3.53E-08
KIF18B	2.677	1.09E-25
BUB1B	2.668	1.82E-25
KIF14	2.667	1.09E-22
FOXM1	2.6665	6.99E-53
SAPCD2	2.6655	2.49E-09
CDK1	2.6589	9.16E-39
SPC25	2.6495	7.78E-12
CLDN7	2.649	0.02624
ABI3	2.6421	6.73E-05
TOP2A	2.6418	2.99E-105
NCAPH	2.6409	1.08E-26
CDC20	2.6355	5.88E-63
RAD51AP1	2.6308	6.18E-14
PRC1	2.6307	7.08E-64
WNT7B	2.6283	0.001351
SKA3	2.6245	1.86E-20
LMNB1	2.6162	3.66E-50
GFAP	2.6108	0.032004
SPAG5	2.6081	3.16E-39
ORC1	2.607	2.59E-10
NCAPG	2.5913	6.41E-37
NEK2	2.5906	9.93E-25
CCDC152	2.5901	0.013468
CTD-2510F5.4	2.5889	1.94E-09
AC244102.1	2.5864	0.000598
OIP5	2.5854	0.003761
BIRC5	2.5783	2.41E-64
MYBL2	2.573	3.17E-40
POLQ	2.5728	8.27E-15
WDR62	2.5655	2.26E-19
MCM10	2.5534	1.79E-15
NEURL1B	2.55	2.01E-06
CBX2	2.5357	1.09E-09
HMMR	2.5315	2.10E-23
C1orf106	2.5278	0.025199
ERCC6L	2.5141	6.50E-11

KIF4A	2.5096	2.62E-28
BLM	2.5092	1.07E-06
CDKN3	2.5073	6.18E-14
KIFC1	2.501	8.84E-37
CENPF	2.4981	2.67E-83
NUSAP1	2.4956	2.77E-39
GABRB1	2.4917	0.024309
ZNF711	2.4912	5.95E-10
ARHGAP11A	2.4912	1.34E-52
FAM83D	2.4901	5.49E-25
SYNE2	2.4895	1.17E-28
DTL	2.4882	3.24E-26
PBK	2.4814	7.36E-38
RRM2	2.4798	1.94E-76
KCNJ8	2.476	0.005445
FAM64A	2.4725	1.88E-17
AURKB	2.4654	2.07E-21
TOX	2.4504	0.000814
GTSE1	2.4474	1.97E-34
PRRX2	2.4399	0.000356
CEP55	2.4397	1.96E-33
MIS18BP1	2.4376	6.96E-11
ASF1B	2.4372	4.28E-11
SKA1	2.4359	7.26E-11
CENPE	2.4311	2.38E-33
KIF11	2.4274	2.26E-43
IQGAP3	2.4117	3.14E-38
CCNA2	2.4063	1.89E-39
NUF2	2.4052	9.75E-29
GAS2L3	2.4013	1.14E-15
MYO7B	2.398	2.64E-06
HJURP	2.3884	2.84E-25
ZWINT	2.3775	2.60E-46
CASC5	2.3602	8.13E-28
TMSB15A	2.3572	1.03E-10
CIT	2.3566	4.70E-31
SHCBP1	2.3547	4.01E-34
CDCA7	2.3512	1.39E-18
NDC80	2.338	7.16E-17
SPC24	2.3306	1.32E-15
SULT1C4	2.3173	0.000398
FAM111B	2.3121	7.01E-08
FBXO5	2.3055	3.34E-17

GSDMD	2.2937	1.94E-09
CCDC15	2.2912	1.93E-05
CENPK	2.2878	1.37E-12
MAD2L1	2.2803	3.36E-33
DCHS1	2.2644	5.87E-12
PKMYT1	2.256	7.37E-15
PALM3	2.2527	0.024449
CDCA5	2.2526	8.06E-10
ARHGAP11B	2.2466	7.48E-12
TRIM6	2.2368	3.85E-06
FANCA	2.2364	1.36E-17
CENPM	2.2299	3.90E-09
WDR76	2.2172	1.06E-10
KIF20B	2.2171	2.49E-16
MYOZ3	2.2037	0.042338
AKR1C1	2.2	0.037297
MLF1IP	2.1937	4.82E-15
SLC43A3	2.1899	1.25E-05
SMC4	2.1861	4.24E-55
TPX2	2.1764	1.49E-66
CDKN2C	2.1581	4.38E-18
MELK	2.1529	6.95E-30
FAM129A	2.1474	1.74E-09
TCF19	2.1449	6.92E-30
KIAA0101	2.1437	2.80E-19
FANCI	2.1428	3.54E-30
CCNB2	2.1337	6.93E-26
GIPC3	2.1236	0.002005
EMILIN2	2.1207	8.23E-07
KIF18A	2.1193	1.37E-13
FANCD2	2.1138	6.98E-18
NPTX1	2.1114	2.21E-46
TACC3	2.108	3.25E-31
ADAMTS18	2.1021	1.16E-08
BRCA1	2.1015	1.98E-14
XRCC2	2.0972	1.16E-05
HTRA3	2.0911	0.000171
CDCA3	2.0855	5.57E-16
MTFR2	2.0754	0.002198
SLC22A3	2.075	0.017729
ANLN	2.0737	1.65E-63
CCNB1	2.0729	4.24E-55
KIF22	2.0706	3.08E-23

LPAR3	2.0687	0.036523
RP11-22B23.1	2.0665	0.002684
ANXA10	2.0646	0.000751
TRAIP	2.0631	8.69E-06
TK1	2.0578	5.24E-40
PTTG1	2.0568	2.35E-15
NLGN1	2.055	2.40E-08
BRIP1	2.0523	9.76E-17
APOBEC3B	2.0481	7.28E-05
ESPL1	2.0441	2.66E-13
CDC45	2.0364	6.70E-11
PTN	2.0351	1.08E-16
GUCY1B3	2.0167	0.001179
PLEKHG4B	2.0162	1.11E-05
CENPI	2.01	6.69E-11
MDK	2.0097	6.81E-52
REC8	2.0008	0.000695
TIFA	1.9983	0.002154
MXRA5	1.995	1.39E-51
CCDC34	1.9943	4.73E-13
BCHE	1.9802	1.26E-05
C3orf67	1.9755	0.007364
KIAA1524	1.9697	3.40E-17
RACGAP1	1.9669	6.20E-35
LIN7A	1.9658	8.26E-06
CNTRL	1.9658	1.36E-10
GSG2	1.9637	0.001148
IMPA2	1.9612	0.000244
FBXO4	1.9576	0.001474
RTKN2	1.9561	0.00016
IGF2	1.9482	1.33E-09
SPOCK3	1.9439	1.44E-05
DSCC1	1.9352	4.56E-05
CDH6	1.9332	2.46E-27
C5orf34	1.9308	0.002699
SERP2	1.93	0.006074
GNG4	1.9268	0.001729
HENMT1	1.9244	0.037474
MCM7	1.9098	5.08E-51
CLSPN	1.9089	3.37E-10
KIF24	1.9084	9.07E-05
AIM1	1.8993	0.005867
CRISPLD2	1.8988	0.000141

TRIP13	1.8888	3.93E-19
NCAPG2	1.8834	1.03E-33
MAP2K6	1.8827	0.048776
ARTN	1.8801	0.006873
ATAD5	1.8768	2.11E-05
ZNF367	1.8684	0.000293
SCIN	1.8667	0.009993
SULT1B1	1.8648	5.05E-05
KIF23	1.8646	5.50E-19
FAM161A	1.8587	0.000174
DPYSL3	1.8536	4.24E-39
ZBED3	1.8508	0.004323
GPSM2	1.8492	3.22E-11
CDT1	1.8479	1.34E-12
DBF4	1.8477	5.75E-12
SGOL2	1.8447	1.33E-14
RP11-89K11.1	1.8415	0.046243
HNMT	1.8359	0.036813
PARP9	1.8343	5.86E-07
VILL	1.8317	0.006693
PCDH18	1.8297	2.60E-12
GINS3	1.8254	0.001028
KNTC1	1.8223	4.38E-18
CSF1R	1.8186	0.011223
CXCL5	1.8166	0.03457
EME1	1.8144	0.001744
CDCA2	1.8129	3.79E-12
RHOA	1.8	4.41E-09
TMPO	1.7977	1.08E-36
TIMELESS	1.7975	4.51E-25
PRTFDC1	1.7939	5.07E-11
TET1	1.7928	0.024265
PLA2G4A	1.7908	0.0026
HHEX	1.7869	2.44E-08
BORA	1.7864	0.010746
PKN3	1.781	1.91E-06
CENPH	1.7775	1.40E-07
RBL1	1.775	3.66E-09
PTX3	1.7744	3.05E-28
HGF	1.7697	0.016095
CENPW	1.7627	1.93E-08
IFI35	1.7619	0.006092
SAMD11	1.7606	1.94E-05

SCARA3	1.7563	9.34E-34
EZH2	1.7545	7.68E-15
MCM5	1.7513	6.31E-30
RELN	1.7512	6.32E-13
ST6GALNAC3	1.7503	0.001263
CHAF1B	1.7415	1.17E-09
SERPINB9	1.7414	0.000952
PSMC3IP	1.7411	0.000913
MTBP	1.7337	0.004591
BZRAP1	1.728	0.0046
POLE2	1.7278	0.001599
FAM111A	1.7265	1.13E-08
GMNN	1.7212	5.84E-14
MBNL3	1.7188	0.011207
DBF4B	1.7178	1.47E-08
STEAP1B	1.717	0.001518
BTN3A1	1.7023	9.03E-06
RFC3	1.7004	5.79E-11
MCM2	1.696	4.65E-19
PTGES	1.6953	2.92E-05
CDC6	1.6951	7.83E-15
CXCL6	1.6896	0.000617
CXCL1	1.679	1.79E-08
SPON2	1.6722	7.46E-06
RAD54B	1.671	0.019428
FKBP5	1.6599	4.58E-07
CCDC138	1.6553	0.003126
HELLS	1.6543	1.06E-10
STIL	1.6455	5.38E-11
POC1A	1.6369	2.15E-09
FGFR3	1.6364	0.020864
COL9A2	1.6311	7.50E-05
NR5A2	1.6305	5.76E-05
CEP152	1.6284	2.44E-05
RNASEH2A	1.6245	2.64E-15
KIAA1211	1.62	0.000509
EXO1	1.6181	1.44E-06
TGFB3	1.6169	0.003071
GPC2	1.6163	0.004367
DEK	1.6151	4.49E-37
SLFN11	1.6103	1.83E-13
TMEM194B	1.6084	0.006264
C4orf21	1.6066	0.00028

MIS18A	1.604	6.64E-07
GINS1	1.6038	9.68E-09
GINS2	1.6026	2.82E-09
H1F0	1.5956	1.25E-39
WHSC1	1.5946	3.58E-38
PPFIA2	1.5915	0.017913
CCDC18	1.5879	7.44E-05
RCOR2	1.5849	0.000548
TICRR	1.572	1.87E-05
RPL39L	1.566	1.94E-06
ATAD2	1.5652	5.23E-18
CENPN	1.5544	3.34E-08
SLC37A2	1.5527	2.12E-13
NCAPD2	1.5511	3.77E-34
ITPR3	1.551	5.29E-06
PSRC1	1.5509	1.09E-10
C18orf54	1.545	4.18E-08
C1orf112	1.5412	1.34E-05
GAL3ST4	1.5387	0.034548
CYYR1	1.5385	0.00064
ADAM33	1.5368	0.000754
TFAP4	1.5287	0.001381
SETD6	1.5277	0.001384
GNG2	1.5277	2.08E-12
EPCAM	1.5274	0.030194
PRR11	1.5227	2.75E-17
CRISPLD1	1.5205	8.10E-05
TRIM14	1.511	7.70E-10
MTMR9LP	1.51	0.021906
CHAF1A	1.5096	4.61E-16
ALPK1	1.5089	0.039611
MIR155HG	1.5072	0.043734
RP11-713C5.1	1.5069	0.043734
NYNRIN	1.5058	1.26E-16
H2AFZ	1.5023	3.76E-41
GREM2	1.4995	0.010116
ESM1	1.4993	0.000751
PHF19	1.4991	1.40E-20
CHN1	1.4991	0.000549
CORO1A	1.4972	0.005785
PARPBP	1.4944	0.000166
RP11-673C5.1	1.4925	1.58E-07
SECTM1	1.4906	0.034508

ANGPT2	1.4903	2.40E-06
DCLRE1B	1.4832	3.89E-06
ETV4	1.4815	1.37E-09
CKAP2	1.479	1.12E-23
CENPJ	1.4761	1.19E-08
FANCG	1.4756	1.21E-08
IL1R1	1.4733	1.17E-17
COL12A1	1.4729	1.15E-30
UBE2T	1.4649	0.000152
MATN3	1.4597	1.04E-07
ARHGAP19	1.4515	9.66E-08
WDHD1	1.4493	3.91E-10
MMS22L	1.4462	1.07E-07
DKK1	1.4452	3.68E-13
PEX5L	1.4347	0.002056
TYMS	1.4323	2.32E-08
HIRIP3	1.4277	1.73E-06
POLD3	1.4276	1.37E-08
CHEK1	1.4275	7.70E-09
C17orf53	1.4226	0.007376
SHMT1	1.4219	7.75E-05
RTTN	1.41	0.000393
SLC12A8	1.4034	0.000715
ORC6	1.3961	1.34E-07
LIN9	1.3953	0.001124
COL6A3	1.3911	3.77E-34
PSIP1	1.3904	1.67E-19
LXN	1.3883	2.25E-06
POLA1	1.3863	1.85E-11
CCNF	1.3856	3.94E-10
DHFR	1.3819	2.69E-18
RASGRF2	1.379	1.56E-05
HMGB3	1.3735	4.37E-19
FEN1	1.373	3.15E-10
GEM	1.3712	1.34E-11
DTX3L	1.3708	8.77E-06
HAS2	1.3671	0.000128
HMGB1	1.3633	1.47E-42
CPS1	1.3593	1.52E-06
BARD1	1.3563	0.000344
USP1	1.3561	2.71E-16
APOL6	1.355	0.032491
MCM3	1.3531	3.32E-20

STEAP1	1.3512	0.000206
RFC4	1.3496	0.00585
RMI2	1.3433	0.000388
DOCK10	1.3396	1.20E-13
HIC1	1.3393	3.26E-16
BTN3A3	1.3382	0.042047
ALX1	1.3381	0.010861
SOCS2	1.3355	1.10E-08
ZNF785	1.3354	0.04207
INCENP	1.3349	2.35E-15
PLSCR1	1.3317	0.000122
MCM6	1.3306	1.29E-14
PHGDH	1.3288	7.78E-12
GPC6	1.3275	0.002222
ARNTL2	1.3271	1.30E-10
CDC25B	1.3255	3.00E-22
ETV1	1.3204	5.79E-16
KISS1	1.3204	5.87E-08
STMN1	1.3202	1.85E-36
CKS2	1.3191	7.44E-15
HHIPL1	1.3186	2.01E-06
KLHL23	1.3145	0.008838
FUT4	1.3075	0.026752
VRK1	1.3031	3.05E-07
CCDC109B	1.3009	1.08E-06
FAIM	1.2988	0.00247
RPL22L1	1.291	9.95E-07
PAQR8	1.2907	0.001661
NR2C2AP	1.2892	0.015568
MAOA	1.2891	0.019472
NMI	1.287	0.026829
RAD51	1.276	0.002399
SPIN4	1.2748	0.002098
TRAF1	1.2739	0.001788
ANXA3	1.2735	2.74E-06
GINS4	1.2704	7.84E-05
TNNT1	1.2699	0.003059
PATZ1	1.2694	2.41E-06
RRM1	1.2667	3.29E-23
NOX4	1.2646	0.000271
DNA2	1.2624	0.048212
CEP70	1.2576	0.000574
TSPY26P	1.2564	2.88E-05

DUT	1.2555	2.73E-11
PDE3A	1.2546	0.005467
MCM8	1.2532	2.53E-07
BTN3A2	1.2504	0.000173
CDC7	1.2499	7.66E-06
RP11-166D19.1	1.2494	1.66E-21
AURKA	1.24	3.89E-17
COL7A1	1.2382	2.20E-17
GPX7	1.2377	0.010932
MASTL	1.2373	1.33E-05
ME3	1.2338	2.43E-05
PASK	1.2337	0.002269
PROB1	1.2332	0.00135
GABRA3	1.2321	4.24E-05
SLIT2	1.2314	5.15E-13
CDC47L	1.2311	1.06E-05
NASP	1.2301	2.09E-21
ZNF486	1.2286	0.0046
LAMA2	1.2247	0.001969
EMP2	1.2228	0.000703
CXCL12	1.2226	1.60E-28
HSPBAP1	1.2191	0.048764
DDX60	1.2139	0.014332
RNF144A	1.2127	0.000117
CLDN11	1.2124	1.63E-23
NCAPD3	1.206	7.46E-13
IGDCC4	1.2027	0.000114
SOD3	1.2027	9.95E-05
PRRT2	1.1978	0.002841
PKIA	1.1934	3.55E-09
GPR56	1.1911	1.48E-15
H2AFX	1.1906	3.08E-20
SSPN	1.1905	8.43E-07
HAUS8	1.1879	0.034965
SMC2	1.1876	1.47E-14
KIAA1841	1.1866	0.000561
MCM4	1.1824	1.69E-19
LIG1	1.1817	1.10E-09
TOPBP1	1.1794	7.91E-12
ACSS3	1.1776	0.000297
METTL4	1.1775	0.000839
C16orf59	1.1725	0.001476
NINL	1.1701	9.76E-06

COL16A1	1.1693	1.60E-09
TIPIN	1.1692	0.002637
CHTF18	1.1692	3.27E-07
TMEM48	1.1691	1.64E-10
F2RL1	1.1684	9.80E-12
RGS17	1.1668	0.002171
CDC25A	1.1648	3.75E-06
CKS1B	1.1626	2.17E-14
ALKBH2	1.1622	0.007692
EVA1C	1.156	0.016307
ZC3HAV1	1.154	2.60E-08
CENPO	1.1498	2.57E-06
ECT2	1.147	1.18E-14
DDX39A	1.1434	5.43E-17
GEN1	1.1425	3.11E-05
NRGN	1.1401	3.76E-05
SLC7A11	1.1355	2.07E-22
CYB5R2	1.1308	0.006514
LIMD2	1.1296	2.44E-10
PRDM8	1.1254	3.08E-15
CECR1	1.1253	1.59E-10
MAP3K5	1.1194	2.66E-06
PARP14	1.1168	8.40E-07
EXOSC8	1.1157	4.09E-07
BMF	1.1135	5.88E-05
DLG3	1.1117	1.95E-07
ANKRD32	1.1094	0.006468
ZNF22	1.1079	0.000443
HMG3	1.1043	0.00591
FANCE	1.1035	0.012795
ARHGAP6	1.1022	0.000513
NRAS	1.0988	5.79E-19
SV2A	1.0978	3.00E-12
KIAA1009	1.0917	0.030075
NLRC5	1.0879	0.001906
PARP12	1.0867	0.01794
CDK2	1.0866	5.64E-07
FBLN1	1.0854	2.84E-21
NRP2	1.0832	1.79E-16
ZNF184	1.0826	0.01133
SLC7A2	1.076	0.03701
ITGA10	1.0744	1.73E-08
RFC5	1.0738	0.000576

GNB3	1.0688	0.024009
DOCK11	1.0685	8.61E-07
ARAP3	1.0681	1.34E-11
MAPK13	1.0673	0.000121
TWIST2	1.0642	4.90E-06
NRM	1.0624	7.51E-06
RHNO1	1.0611	0.000101
SMC3	1.0569	1.95E-07
TBX3	1.0565	6.48E-06
LRRC49	1.0549	0.010856
EXOC6	1.0538	0.006693
DNMT1	1.0534	5.29E-20
PLCL2	1.0532	0.007865
PRPS2	1.0518	4.08E-05
MXD3	1.0517	0.013107
SUV39H1	1.0512	0.000903
NUP107	1.0485	1.03E-08
ITGB3BP	1.0431	0.000828
RBBP8	1.0428	6.52E-06
TNFRSF19	1.0414	2.88E-05
CC2D2A	1.0409	2.37E-07
UBE2L6	1.0395	0.000251
STON1	1.0375	0.001856
DNALI1	1.0362	0.001091
DIS3L	1.0317	1.14E-05
PRDM16	1.0305	0.00114
KIAA1755	1.0273	1.47E-06
CENPC1	1.0225	0.002848
KPNA2	1.0221	2.56E-22
HMG2	1.0221	3.09E-23
N4BP2	1.0211	0.003532
FAM213A	1.0209	4.48E-07
TRANK1	1.0209	7.30E-06
MYRF	1.02	0.000113
GLI3	1.0193	8.26E-05
FAM167A	1.0162	4.45E-07
LRRC8C	1.0161	7.91E-07
MECOM	1.0139	1.75E-05
C4orf46	1.0114	5.45E-05
PLEKHA4	1.0085	0.001264
PGBD1	1.0022	0.000606
SYT1	1.001	0.000153

Supplementary table S3**List of down-regulated gene (log2FoldChange<1, pValue<0.05)**

Gene Name	log2FoldChange	pValue
IGSF23	-4.9372	0.0019715
VAV3	-4.508	2.61E-07
MIR210HG	-4.3966	5.19E-17
PADI1	-3.6755	0.02669
AK4	-3.5099	1.04E-55
CMAHP	-3.4809	0.00080376
KCTD4	-3.441	5.95E-08
RPL17P50	-3.3941	0.0015245
MYOZ2	-2.8679	0.012532
AC003102.3	-2.7055	0.00046177
ACTC1	-2.6347	1.95E-07
DUSP27	-2.615	0.0098392
ARPP21	-2.5781	0.002286
TMEM151A	-2.5324	4.19E-05
OR52K3P	-2.4954	0.00064776
TENM2	-2.4649	0.00075121
ANKRD1	-2.435	2.22E-50
TMEM40	-2.4144	8.70E-15
KCNC3	-2.3597	0.00031899
PTPRR	-2.222	0.01417
NLRP10	-2.2216	0.0042856
RP11-267A15.1	-2.2151	0.0043405
CNNM1	-2.2109	0.032431
GDF6	-2.2106	1.01E-06
CCND2	-2.166	4.72E-36
ADM2	-2.1578	0.049101
PPFIA4	-2.1521	2.92E-05
JAG2	-2.1354	1.31E-07
GSN-AS1	-2.1354	0.011466
NFASC	-2.0921	4.56E-06
RP11-163F15.1	-2.0742	0.01179
HAPLN1	-2.0702	2.67E-83
TLL2	-2.0397	2.10E-12
EEF1A2	-2.0279	1.65E-07
ADRA2C	-2.019	0.00012355
ANGPTL4	-2.0137	9.09E-78
FBXL16	-2.0027	2.00E-13
MMP24	-1.9934	9.24E-09
IL6	-1.9838	0.0054465

USP2	-1.9649	0.045681
MFAP5	-1.9482	0.022482
GNG7	-1.8731	0.029684
PCSK1N	-1.8639	1.87E-10
HIST1H3D	-1.8224	0.033014
RGS5	-1.8191	2.22E-74
HAS3	-1.8056	5.64E-16
CRYAB	-1.7936	8.43E-31
C7orf10	-1.7784	0.0066495
CLDN1	-1.7757	1.83E-48
ARRDC4	-1.7754	6.04E-17
HK2	-1.7703	3.69E-20
CREB5	-1.7702	1.79E-16
SFTA1P	-1.7629	0.0013539
WBSCR17	-1.7546	0.0093254
RP11-420A23.1	-1.7411	0.0044909
KRTAP2-3	-1.7348	2.12E-18
ACHE	-1.7307	8.27E-05
TMEM178B	-1.7224	9.96E-05
ROR1	-1.709	3.45E-07
NPAS1	-1.6958	5.11E-09
RP11-10C24.3	-1.6934	0.00020818
NXP4	-1.6875	0.00064324
CD36	-1.6683	0.010364
P4HA1	-1.6669	2.48E-54
NRXN3	-1.6504	0.014731
CERS1	-1.6478	0.011253
MALAT1	-1.6468	1.56E-35
PTHLH	-1.6417	0.00032546
ADAMTS5	-1.6351	3.05E-08
NUDT14	-1.6283	0.016486
MAP3K7CL	-1.6256	3.99E-07
GPRIN3	-1.6198	0.046966
ASS1	-1.6164	1.91E-20
SERPINE2	-1.5984	1.19E-62
CADM2	-1.5851	0.02313
RP11-224O19.2	-1.5689	1.59E-08
SERPINB7	-1.5529	2.39E-18
CPA4	-1.5495	3.75E-58
KIT	-1.5452	0.00074946
PRPS1	-1.5448	2.08E-48
CLSTN2	-1.5324	1.83E-06
CEL2	-1.5242	0.00061714

AC012360.6	-1.5134	0.0069626
KNDC1	-1.5082	0.019596
TXNIP	-1.5037	4.15E-36
LDB3	-1.489	0.023131
IL1RAPL1	-1.488	0.0012248
ZNF219	-1.4826	3.98E-05
UNC13A	-1.481	4.02E-06
SERINC2	-1.4789	7.33E-05
TUFT1	-1.4752	2.44E-20
LINC00607	-1.4651	0.045607
SLC1A1	-1.4649	5.11E-11
AL450307.1	-1.4615	1.06E-21
RNF128	-1.4606	0.00015359
JPH2	-1.4396	0.034027
CTD-2021J15.2	-1.4337	1.18E-06
MMP15	-1.4327	5.79E-07
TMEM59L	-1.4305	4.04E-08
PNMA2	-1.4123	0.00025725
HIST1H4H	-1.4111	0.0014852
GJA5	-1.4111	0.044556
GALNT3	-1.4047	1.33E-05
RIMS2	-1.3983	0.0021928
LRRN1	-1.3552	1.23E-14
FAM212B	-1.354	3.48E-09
GPR1	-1.3204	0.0024225
ALS2CL	-1.3191	2.11E-05
ADAMTS1	-1.3184	5.93E-31
FRMPD3	-1.3168	0.022385
HIST1H2BC	-1.3145	8.58E-06
RP11-879F14.2	-1.3051	3.50E-08
TTC18	-1.2912	0.041733
HBEGF	-1.2869	1.98E-23
SLC35F3	-1.2843	0.025309
STYK1	-1.2792	0.0027173
FAM83H	-1.275	0.00050909
BTG2	-1.2746	1.43E-12
SIRPA	-1.2727	4.18E-31
SERPINE1	-1.268	3.36E-45
RASSF7	-1.2648	6.61E-07
GRIA3	-1.2587	0.00027143
KCTD20	-1.2566	4.32E-35
LMCD1	-1.2508	1.14E-08
L1CAM	-1.2491	8.07E-21

FAM115C	-1.237	0.0034585
MAMDC2	-1.2346	1.43E-31
NRG1	-1.2245	1.16E-16
MOK	-1.2156	1.98E-26
ULBP2	-1.2038	1.87E-07
PCDH10	-1.2018	1.39E-12
HIST1H1C	-1.2013	7.90E-08
CLCA2	-1.2002	2.06E-06
HIST2H2BE	-1.1997	4.16E-14
MAP3K9	-1.1993	0.037285
HIST1H2BK	-1.1983	9.79E-09
DUSP8	-1.1954	5.11E-05
PVR	-1.1914	3.82E-30
COL11A1	-1.1877	9.36E-15
KCNK6	-1.17	2.96E-09
SYNGR2	-1.1609	3.82E-15
SELPLG	-1.1412	0.0002368
IGFBP7	-1.1399	2.52E-09
THBS1	-1.1345	1.15E-30
IRGQ	-1.1341	3.08E-14
RP11-758N13.1	-1.1302	0.042299
LIPG	-1.1285	5.76E-05
HIST1H2AC	-1.1272	1.00E-16
SCD5	-1.1248	1.85E-21
ABAT	-1.1218	1.97E-07
TGFB2	-1.1186	9.96E-26
EBI3	-1.1182	0.0086495
BNIP3	-1.1162	2.07E-06
CCDC113	-1.1155	0.041998
P4HA2	-1.1144	5.09E-26
DPP4	-1.1076	1.31E-14
PDK1	-1.0985	8.42E-10
GAMT	-1.0953	4.01E-11
IGFBP3	-1.0931	1.46E-22
EXTL1	-1.092	2.01E-15
KRT18	-1.0869	1.42E-14
KLHL13	-1.0861	0.033833
PLAT	-1.0797	3.11E-23
MN1	-1.0788	1.09E-05
LIMS2	-1.0741	0.00014619
PROSER2	-1.0732	0.015086
RP11-366L20.2	-1.07	0.0012336
CST1	-1.0687	0.0022287

SORT1	-1.062	3.38E-17
PTPRB	-1.0596	0.00012654
NF2	-1.0569	2.15E-21
RP11-54A9.1	-1.0549	0.0070751
DYSF	-1.0537	7.34E-11
FAM198B	-1.0537	0.0011757
HS3ST1	-1.0521	0.0017177
NDRG1	-1.0505	8.65E-15
CDK15	-1.0487	0.038765
FADS3	-1.0427	5.52E-12
DNASE1L1	-1.0309	6.04E-05
TTC3P1	-1.0277	0.00089101
RCAN1	-1.024	2.39E-22
FBXO2	-1.021	6.29E-07
EFHD1	-1.0196	0.00061536
RAB3A	-1.0144	0.0099778
GPR155	-1.0143	1.68E-05
QPCTL	-1.0076	9.48E-09
SVEP1	-1.0054	4.90E-06
EDN1	-1.0008	1.69E-09