

Table S1 174 genes

CTSE
CTSL
HSPA2
KIR3DL1
KIR3DL2
KLRC4
ERAP2
ULBP1
RAET1L
PDIA2
SLPI
CXCL2
DEFB103B
CCL1
DEFB1
DEFA6
DEFA5
PENK
LEAP2
TMSB15A
PGLYRP2
COLEC12
DEFB116
S100A14
S100A16
IFNAR1
IFNGR1
ANOS1
SPAG11B
RBP1
HJV
OBP2A
LPA
LBP
RBP4
IFNB1
R3HDML
CRABP1
OBP2B
SPAG11A
PI15
NOX1
ORM2
ORM1
IFNL2
TNFSF10
RNASEL
CHIT1
ZYG
PGC
TFR2
CST4

APOM
WNT5A
FURIN
FGF2
FGA
MPO
ROBO3
TMPRSS6
KNG1
IL17A
MASP2
MASP1
HRG
IL22
VTN
GBP2
ALB
SERPINA3
CCL16
CCR3
CCL25
CRP
TXK
BLNK
VAV3
NFATC4
EDN3
SEMA3B
SEMA3F
SEMA7A
CCR9
ROBO2
RXFP3
BDNF
BMP4
BMP6
CCK
CGB2
CHGB
CMTM6
CMTM8
CRH
CSF3
CSPG5
CTF1
FAM3B
FGF13
FGF20
FGF3
VEGFD
GDF10
GDF11
GH1

GIP
GPI
IFNK
IFNW1
IGF1
IL11
IL17D
IL37
IL36G
IL1RN
IFNL3
IL3
INHBE
INSL6
LRSAM1
MIA
NODAL
CCN3
NRTN
NUDT6
PDGFC
PRL
PRLH
AIMP1
TAC1
TG
TGFB2
THPO
TRH
UCN2
VGF
ADRB2
ANGPTL3
AVPR2
CRIM1
ESR2
ESRRG
FGFR1
GHSR
GLP2R
HTR3C
IL17RD
IL17RE
IL4R
INSR
LGR5
MC2R
MC3R
MLNR
NR0B2
NR1H2
NR1I3
NR5A2

NRP1
OPRK1
OPRL1
OXTR
PGR
PTGER3
PTGER4
RARB
RARG
RXFP1
SDC4
TNFRSF19
TNFRSF9
TRHR
PRKCG
TEC
MAP3K8
CBLC

Table S2 Immune-related gene sets

AZGP1
B2M
CALR
CANX
CD1A
CD1B
CD1C
CD1D
CD1E
CD4
CD8A
CD8B
CD74
CREB1
CTSB
CTSE
CTSL
CTSS
FCER1G
FCGRT
PDIA3
HFE
HLA-A
HLA-B
HLA-C
HLA-DMA
HLA-DMB
HLA-DOA
HLA-DOB
HLA-DPA1
HLA-DPB1
HLA-DQA1
HLA-DQA2
HLA-DQB1
HLA-DRA
HLA-DRB1
HLA-DRB3
HLA-DRB4
HLA-DRB5
HLA-E
HLA-F
HLA-G
HLA-H
MR1
HSPA1A
HSPA1B
HSPA1L
HSPA2
HSPA4
HSPA5
HSPA6
HSPA8

HSP90AA1
HSP90AB1
ICAM1
IFNA1
IFNA2
IFNA4
IFNA5
IFNA6
IFNA7
IFNA8
IFNA10
IFNA13
IFNA14
IFNA16
IFNA17
IFNA21
IFNG
KIR2DL1
KIR2DL2
KIR2DL3
KIR2DL4
KIR2DS1
KIR2DS3
KIR2DS4
KIR2DS5
KIR3DL1
KIR3DL2
KLRC1
KLRC2
KLRC3
KLRD1
LTA
CIITA
MICA
MICB
NFYA
NFYB
NFYC
LGMN
PSMB8
PSMC1
PSMC2
PSMC3
PSMC4
PSMC5
PSMC6
PSMD1
PSMD2
PSMD3
PSMD4
PSMD5
PSMD7
PSMD8

PSMD10
PSMD11
PSMD13
PSME1
PSME1
PSME2
PSME2
RELB
RFX5
RFXAP
SLC10A2
TAP1
TAP2
TAPBP
THBS1
SEM1
KLRC4
AP3B1
RFXANK
PSMD6
PSME3
PSMD14
CLEC4M
IFI30
PROCR
ADRM1
ECPAS
TRPC4AP
CD209
UBXN1
ERAP1
TAPBPL
KIR2DL5A
ERAP2
ULBP3
ULBP2
ULBP1
KIR3DL3
RAET1E
RAET1L
UBR1
RAET1G
PDIA2
HAMP
PI3
CAMP
DEFB4A
PPBP
REG3G
CXCL14
CXCL16
SLPI
CXCL8

CXCL10
CXCL9
CXCL5
CXCL11
CXCL6
CXCL1
CXCL12
CXCL13
CXCL2
PF4
XCL1
CXCL3
DEFB103B
CCL13
CCL1
DEFB1
CCL8
ELANE
DEFB103A
DEFA3
DEFA1
TMSB10
DEFA6
DEFA5
DEFA4
LCN2
LCN1
COLEC10
BPI
S100A9
S100A8
DCD
LCN6
S100A12
HTN3
LCN8
DEFA1B
CCR10
CELA1
DEFB106A
PENK
BPIFC
MMP12
BPIFB6
LEAP2
SFTPD
LCN9
BPIFB2
PTGDS
TMSB4X
PGLYRP1
ZC3HAV1
TMSB15A

S100B
S100A13
S100A6
DEFB119
DEFB107A
DEFB105A
SERPIND1
DEFB129
DEFB127
S100P
S100A7
DEFB104A
DEFB126
DEFB106B
DEFB104B
DEFB107B
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PGLYRP2
S100A10
S100A2
DEFB125
DEFB123
DEFB105B
DEFB132
BPIFB3
LCN12
PGLYRP4
S100A11
S100A5
S100A3
S100A1
DEFB128
DEFB108B
HTN1
LMBR1L
S100A7A
DEFB118
COLEC12
TMSB4Y
DEFB131A
DEFB134
DEFB130A
DEFB124
DEFB121
DEFB116
DEFB115
DEFB114
DEFB113
DEFB112
DEFB110
TMSB15B
DEFB133
S100Z

MAVS
TMSB4XP8
S100A14
LCN10
S100A16
DEFB136
DEFB135
DEFB117
DEFB110
ZC3HAV1L
S100A7L2
MBL3P
DEFB4B
BPIFB4
IFNAR1
AZU1
DEFB131B
DEFA1A3
LCN1P1
S100G
DEFA7P
DEFB130B
DEFB108F
DEFB131C
TCHHL1
TINAGL1
IFNGR1
SLC22A17
WFIKKN1
WFDC2
IL6
UMODL1
TGFB1
PF4V1
MMP9
ANOS1
TLR4
IFNG
SPAG11B
A2M
CTSL
NFKB1
APOBEC3G
FABP6
NOD2
MBL2
SFTPA1
RBP1
TLR2
SLC40A1
PLAU
IL1B
PAEP

HJV
MUC5AC
CTSS
OBP2A
PLTP
MX1
DDX58
IFNL1
IRF3
SFTPA2
LPA
LBP
RBP4
SFTPA1
NOX4
LTF
IFNB1
RBP5
FABP7
FABP5
FABP3
FABP2
FABP4
R3HDML
BPIFA3
BPIFB1
OASL
CRABP2
CRABP1
RBP7
DUOX1
OBP2B
RBP2
LCN15
CETP
FABP12
FABP9
BPIFA1
LCNL1
C8G
SPAG11A
PI15
NOX1
PMP2
APOD
ORM2
ORM1
TNF
CTSG
PRTN3
MAPK1
PML
AEN

CYBB
BPIFA2
ISG20
BCL3
ISG20L2
NOX5
NOX3
DUOX2
TLR3
TFRC
IFIH1
LRP1
TRIM5
IDO1
GDF15
NEDD4
ADIPOQ
STAT3
STAT1
IFNL2
SOCS3
SEMG1
TNFSF10
CCL20
SOCS1
RNASEL
IRF1
IL15
APOBEC3F
PLAAT4
CHIT1
IFNA1
CD40
TLR7
PPIA
HFE
ZYG
NLRX1
PGC
VEGFA
IKBKE
ISG15
DHX58
TNFAIP3
TFR2
FCN2
MUC4
F2R
ELN
IL27
MAPT
LYZ
CCL5

LEP
CYLD
KLKB1
CST4
CSRP1
MAPK14
JUN
ITGAV
IRF5
CCR6
IL12B
TLR8
GNLY
CD81
EIF2AK2
APOM
CACYPB
NOD1
MAPK8
MAPK3
BST2
BPHL
PLA2G2A
GRN
NEWENTRY
PDGFRA
GNAI1
WNT5A
FURIN
ADAR
TYK2
NOS2
TRAF3
TPT1
TPM2
NEO1
AHNAK
TLR1
TK2
PRDX2
MX2
FGF2
FGA
TCF7L2
F2RL1
TKFC
MSR1
NFKBIZ
LMBR1
EPPIN
SRC
MPO
ELAVL1

ROBO3
SP1
SOD1
PDF
DLL4
ECD
SLC11A1
DMBT1
STING1
SKIV2L
SEMG2
LTA
DES
DCK
DAXX
TNFRSF10A
TNFRSF10B
EED
CCL4
LIMS1
LALBA
APOBEC3H
TMPRSS6
SPINK5
MARCO
BECN1
TNFSF11
KNG1
CSK
KLRK1
KCNH2
JUND
JAK1
CREB1
CLDN4
CCL28
RNASE3
RN7SL1
IRF7
IREB2
ILK
IL18
IL17A
LTB4R
APOBEC3A
MASP2
TRIM27
RELA
IL7R
IL1A
PTX3
IFNAR2
IFN1@

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DDX17
PTGS2
HTR1A
SEPTIN7
CD40LG
CD14
CD8A
CD4
MASP1
PROC
MAP2K2
MAP2K1
HRG
NDRG1
IRF9
TRIM22
LANCL1
PPP4C
HMOX1
HMGB1
HLA-B
RNASE7
ABCC4
HGF
HDAC1
IFNLR1
PLSCR1
B2M
BACH2
TANK
PIK3CG
ARRB1
RSAD2
STAB2
TBK1
PDYN
PDGFRB
PDCD1
PCSK2
PCSK1
ARG2
AQP9
FASLG
APOH
BIRC5
ANXA6
IL22
VTN
VIM
VCAM1
PRDX1

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GBP2
ALB
SLC29A3
OAS1
AGER
UNC93B1
TNFSF4
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ACTA1
ACO1
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CXCR1
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CCL14
CCL4
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CCL13
CCL18
CCL17
CCL26
CCL22
CCR3
CCL28
CCL4L1
ACKR2
CCR7
CCL27
CCR8
ACKR4
CCR10
CCL2
CCL21
CCL7
CCL5
CCL3
CCL20
CCL11
CCR5
CCL23
CCL25
CCL1
CCL3L3
CCL4L2
CXCL12
XCL1
CCL8
CCL3L1
CCR1
CCL24
XCL2

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CXCL10
CXCR4
CXCL2
CXCR6
CCR4
CXCL11
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TFAFA4
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CD40
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MMP9
LTBP1
DEFB4A
TNFSF10
IL13
IL10
IL2
PPARG
FGR
MIF
CRP
JAK2
IL1A
PTK2
PTGDR
CD86
HCK
ARRB1
GNAI1
VDR
OLR1
GRK2
TXK
RNASE2
CD79A
CD79B
LYN
SYK
BTK

BLNK
VAV3
VAV1
VAV2
RAC1
RAC2
RAC3
PPP3CA
PPP3CB
PPP3CC
CHP1
PPP3R1
PPP3R2
CHP2
NFAT5
NFATC1
NFATC2
NFATC3
NFATC4
HRAS
KRAS
NRAS
FOS
JUN
CARD11
BCL10
MALT1
CHUK
IKBKB
IKBKG
NFKB1
RELA
NFKBIA
NFKBIB
NFKBIE
CD81
CD19
CR2
PIK3R5
PIK3R1
PIK3R2
PIK3R3
PIK3CA
PIK3CB
PIK3CD
PIK3CG
AKT3
AKT1
AKT2
GSK3B
INPP5D
CD22
CD72

PTPN6
LILRB3
FCGR2B
RASGRP3
PLCG2
PRKCB
IFITM1
IGH
IGHA1
IGHA2
IGHD
IGHD1-1
IGHD1-14
IGHD1-20
IGHD1-26
IGHD1-7
IGHD2-15
IGHD2-2
IGHD2-21
IGHD2-8
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IGHD5-24
IGHD5-5
IGHD6-13
IGHD6-19
IGHD6-25
IGHD6-6
IGHD7-27
IGHE
IGHG1
IGHG2
IGHG3
IGHG4
IGHJ1
IGHJ2
IGHJ3
IGHJ4
IGHJ5
IGHJ6
IGHM
IGH
IGHV1-18
IGHV1-2

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IGHV1-3
IGHV1-45
IGHV1-46
IGHV1-58
IGHV1-69
IGHV1-8
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IGHV2-26
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IGHV3-21
IGHV3-23
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IGHV4-31
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IGHV5-51
IGHV5-10-1
IGHV6-1
IGHV7-4-1

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IGKDEL
IGKJ
IGKJ1
IGKJ2
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IGKJ4
IGKJ5
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IGKV1-16
IGKV1-17
IGKV1-27
IGKV1-33
IGKV1-37
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IGKV1D-13
IGKV1D-16
IGKV1D-17
IGKV1D-33
IGKV1D-37
IGKV1D-39
IGKV1D-42
IGKV1D-43
IGKV1D-8
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IGKV2-28
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IGKV2D-29
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IGKV2D-40
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IGKV3-15
IGKV3-20
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IGKV3D-20
IGKV3D-7
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IGKV5-2
IGKV6-21

IGKV6D-21
IGKV6D-41
IGL
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IGLC2
IGLC3
IGLC6
IGLC7
IGLJ
IGLJ1
IGLJ2
IGLJ3
IGLJ4
IGLJ5
IGLJ6
IGLJ7
IGLV@
IGLV1-36
IGLV1-40
IGLV1-44
IGLV1-47
IGLV1-50
IGLV1-51
IGLV10-54
IGLV11-55
IGLV2-11
IGLV2-14
IGLV2-18
IGLV2-23
IGLV2-33
IGLV2-8
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IGLV3-27
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IGLV4-60
IGLV4-69
IGLV5-37
IGLV5-39
IGLV5-45
IGLV5-48
IGLV5-52
IGLV6-57
IGLV7-43
IGLV7-46

IGLV8-61
IGLV9-49
C3
C5
CAMP
CCL1
CCL11
CCL13
CCL14
CCL15-CCL14
CCL15
CCL16
CCL17
CCL18
CCL19
CCL2
CCL20
CCL21
CCL22
CCL23
CCL24
CCL25
CCL26
CCL27
CCL28
CCL3
CCL3L1
CCL3P1
CCL3L3
CCL4
CCL4L2
CCL4L1
CCL5
CCL7
CCL8
CKLF
CMA1
CTSG
CX3CL1
CXCL1
CXCL10
CXCL11
CXCL12
CXCL13
CXCL14
CXCL16
CXCL17
CXCL2
CXCL3
CXCL5
CXCL6
CXCL9
CCN1

DEFA1
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DEFA5
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DEFB104A
DEFB4A
EDN1
EDN2
EDN3
FGF10
FGF2
HTN3
CXCL8
LECT2
PF4
PF4V1
PLAU
PPBP
PPBPP1
PROK2
RNASE2
SAA1
SAA2
SBDS
SEMA3A
SEMA3B
SEMA3C
SEMA3D
SEMA3E
SEMA3F
SEMA3G
SEMA4A
SEMA4B
SEMA4C
SEMA4D
SEMA4F
SEMA4G
SEMA5A
SEMA5B
SEMA6A
SEMA6B
SEMA6C
SEMA6D
SEMA7A
SLIT1
SLIT2
TNC
TYMP
XCL1
XCL2
C5AR1
ACKR2

CCR1
CCR10
CCR3
CCR4
CCR5
CCR6
CCR7
CCR8
CCR9
ACKR4
CCRL2
CMKLR1
CX3CR1
CXCR3
CXCR4
CXCR5
CXCR6
ACKR3
CYSLTR1
CYSLTR2
ACKR1
EDNRA
EDNRB
FPR1
FPR2
FPR2
GPR17
GPR32
GPR33
PTGDR2
C5AR2
CXCR1
CXCR2
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LTB4R2
PLAUR
PLXNA1
PLXNA2
PLXNA3
PLXNA4
PLXNB1
PLXNB2
PLXNB3
PLXNC1
PLXND1
PTAFR
ROBO1
ROBO2
ROBO3
RXFP3
XCR1
ADIPOQ
ADM

ADM2
AGRP
AGT
AMBN
AMELX
AMH
ANGPTL5
ANGPTL7
APLN
AREG
MANF
CDNF
ARTN
AVP
AZU1
BDNF
BMP1
BMP10
BMP15
BMP2
BMP3
BMP4
BMP5
BMP6
BMP7
BMP8A
BMP8B
BTC
MYDGF
C3
C5
CALCA
CALCB
CAMP
CAT
CCK
CCL1
CCL11
CCL13
CCL14
CCL15-CCL14
CCL15
CCL16
CCL17
CCL18
CCL19
CCL2
CCL20
CCL21
CCL22
CCL23
CCL24
CCL25

CCL26
CCL27
CCL28
CCL3
CCL3L1
CCL3P1
CCL3L3
CCL4
CCL4L2
CCL4L1
CCL5
CCL7
CCL8
CD320
CD40LG
CD70
ADA2
CER1
CGA
CGB3
CGB1
CGB2
CGB5
CGB7
CGB8
CHGA
CHGB
CKLF
CLCF1
CLEC11A
CMA1
CMTM1
CMTM2
CMTM3
CMTM4
CMTM5
CMTM6
CMTM7
CMTM8
CNTF
CORT
CRH
CSF1
CSF2
CSF3
CSH1
CSH2
CSHL1
CSPG5
CTF1
CCN2
CTSG
CX3CL1

CXCL1
CXCL10
CXCL11
CXCL12
CXCL13
CXCL14
CXCL16
CXCL17
CXCL2
CXCL3
CXCL5
CXCL6
CXCL9
CCN1
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DEFA5
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DEFB104A
DEFB4A
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EDN1
EDN2
EDN3
EGF
EPGN
EPO
EREG
ESM1
FAM3B
FAM3C
FAM3D
FASLG
FGF1
FGF10
FGF11
FGF12
FGF13
FGF14
FGF16
FGF17
FGF18
FGF19
FGF2
FGF20
FGF21
FGF22
FGF23
FGF3
FGF4
FGF5

FGF6
FGF7
FGF8
FGF9
VEGFD
FIGNL2
FLT3LG
FSHB
GAL
GALP
GAST
GCG
GDF1
GDF10
GDF11
GDF15
GDF2
GDF3
GDF5
GDF6
GDF7
GDF9
GDNF
GH1
GH2
GHRH
GHRL
GIP
GKN1
GMFB
GMFG
GNRH1
GNRH2
GPHA2
GPHB5
GPI
GREM1
GREM2
GRN
GRP
GUCA2A
HAMP
HBEGF
HDGF
HDGFL3
HGF
HTN3
IAPP
IFNA1
IFNA10
IFNA13
IFNA14
IFNA16

IFNA17
IFNA2
IFNA21
IFNA4
IFNA5
IFNA6
IFNA7
IFNA8
IFNB1
IFNE
IFNG
IFNK
IFNW1
IGF1
IGF2
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IL12A
IL12B
IL13
IL15
IL16
IL17A
IL17B
IL17C
IL17D
IL17F
IL18
IL19
IL1A
IL1B
IL1F10
IL36RN
IL36A
IL37
IL36B
IL36G
IL1RN
IL2
IL20
IL21
IL22
IL23A
IL24
IL25
IL26
IL27
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IFNL3
IFNL1
IL3
IL31
IL32

IL33
IL34
IL4
IL5
IL6
IL6ST
IL7
CXCL8
IL9
INHA
INHBA
INHBB
INHBC
INHBE
INS
INS-IGF2
INSL3
INSL4
INSL5
INSL6
JAG1
JAG2
FGF7P6
FGF7P3
KITLG
KL
LACRT
LECT2
LEFTY1
LEFTY2
LEP
LHB
LIF
LRSAM1
LTA
LTB
LTBP1
LTBP2
LTBP3
LTBP4
MDK
MIA
MIF
MLN
MSTN
NAMPT
NDP
NENF
NGF
NMB
NODAL
CCN3
NPFF

NPPA
NPPB
NPPC
NPY
NRG1
NRG2
NRG3
NRG4
NRTN
NTF3
NTF4
NTS
NUDT6
OGN
OSGIN1
OSM
OSTN
OXT
ENDOU
PDGFA
PDGFB
PDGFC
PDGFD
PDGFRA
PDGFRB
PDGFRL
PDYN
PENK
PF4
PF4V1
PGF
PLAU
PMCH
PNOC
POMC
PPBP
PPBPP1
PPBPP2
PPY
PRL
PRLH
PROK1
PROK2
PSPN
PTH
PTH2
PTHLH
PTN
PYY
QRFP
RABEP1
RABEP2
REG1A

RETN
RETNLB
RLN1
RLN2
RLN3
RNASE2
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SAA1
SAA2
SBDS
SCG2
SCGB3A1
SCT
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SECTM1
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SEMA3B
SEMA3C
SEMA3D
SEMA3E
SEMA3F
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SEMA4B
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SLIT2
SLURP1
SPP1
SST
STC1
STC2
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TDGF1
TDGF1P3
TG
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TGFB2
TGFB3
THPO
TNC
TNF

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TNFSF9
TOR2A
TRH
TSHB
TSLP
TXLNA
TYMP
UCN
UCN2
UCN3
UTS2
UTS2B
VEGFA
VEGFB
VEGFC
VGF
VIP
XCL1
XCL2
ACVR1B
ACVR1C
ACVR2A
ACVR2B
ACVRL1
ADCYAP1R1
ADIPOR1
ADIPOR2
ADRB1
ADRB2
AGTR1
AGTR2
AMHR2
ANGPT1
ANGPT4
ANGPTL1
ANGPTL2
ANGPTL3
ANGPTL4
ANGPTL6
APLNR
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AVPR1A

AVPR1B
AVPR2
BMPR1A
BMPR1B
BMPR2
BRD8
C3AR1
C5AR1
CALCR
CALCRL
ACKR2
CCR1
CCR10
CCR3
CCR4
CCR5
CCR6
CCR7
CCR8
CCR9
ACKR4
CCRL2
CD40
CMKLR1
CNTFR
CRHR1
CRHR2
CRIM1
CRLF1
CRLF2
CRLF3
CSF1R
CSF2RA
CSF2RB
CSF3R
CX3CR1
CXCR3
CXCR4
CXCR5
CXCR6
ACKR3
CYSLTR1
CYSLTR2
ACKR1
EDNRA
EDNRB
EGFR
ENG
EPOR
ESR1
ESR2
ESRRA
ESRRB

ESRRG
FGFR1
FGFR2
FGFR3
FGFR4
FGFRL1
FLT1
FLT3
FLT4
FPR1
FPR2
FPR2
FSHR
GALR2
GALR3
GCGR
GHR
GHRHR
GHSR
GIPR
GLP1R
GLP2R
GNRHR
GPER1
GPR17
GPR32
GPR33
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C5AR2
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HNF4G
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HTR3B
HTR3C
HTR3D
HTR3E
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IFNAR2
IFNGR1
IFNGR2
IGF1R
IGF2R
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IL11RA
IL12RB1
IL12RB2
IL13RA1
IL13RA2
IL15RA
IL2RB
IL17RA
IL17RB

IL17RC
IL17RD
IL17RE
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IL18RAP
IL1R1
IL1R2
IL1RAP
IL1RL1
IL1RL2
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IL23R
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IL2RG
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IL3RA
IL4R
IL5RA
IL6R
IL7R
CXCR1
CXCR2
IL9R
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KDR
LEPR
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LGR5
LGR6
LHCGR
LIFR
LTB4R
LTB4R2
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MC2R
MC3R
MC4R
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MCHR2
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MPL
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MTNR1B
NGFR

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NR0B2
NR1D1
NR1D2
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NR1H3
NR1H4
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NR2F2
NR2F6
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NR3C2
NR4A1
NR4A2
NR4A3
NR5A1
NR5A2
NR6A1
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NRP2
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OPRM1
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OXTR
PGR
PGRMC2
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PLXNA2
PLXNA3
PLXNA4
PLXNB1
PLXNB2
PLXNB3
PLXNC1
PLXND1
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PPARD
PPARG
PRLHR
PRLR

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PTGDR
PTGDS
PTGER1
PTGER2
PTGER3
PTGER4
PTGFR
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PTH2R
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RARB
RARG
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ROBO2
ROBO3
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RORB
RORC
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RXFP2
RXFP3
RXRA
RXRB
RXRG
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S1PR2
SCTR
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SDC2
SDC3
SDC4
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SSTR1
SSTR2
SSTR5
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TEK
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TGFR2
TGFR3
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THRB
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TNFRSF13B
TNFRSF13C

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TNFRSF1B
TNFRSF21
TNFRSF25
TNFRSF4
TNFRSF6B
TNFRSF8
TNFRSF9
TRHR
TSHR
TUBB3
VDR
VIPR1
VIPR2
XCR1
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IFNA13
IFNA14
IFNA16
IFNA17
IFNA2
IFNA21
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IFNA6
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IFNA8
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IFNG
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IL1A

IL1B
IL1F10
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IL36B
IL36G
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IL23A
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IFNL3
IFNL1
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IL6ST
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CXCL8
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TXLNA
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IL13RA2
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IL2RB
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IL17RB
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IL17RD
IL17RE
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IL1R2
IL1RAP
IL1RL1

IL1RL2
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IL21R
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IL22RA2
IL23R
IL27RA
IFNLR1
IL2RA
IL2RB
IL2RG
IL31RA
IL3RA
IL4R
IL5RA
IL6R
IL7R
CXCR1
CXCR2
IL9R
ST2
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HLA-C
HLA-E
HLA-G
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KIR3DL2
KIR2DL1
KIR2DL2
KIR2DL3
KIR2DL4
KIR2DL5A
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KLRC2
KLRC3
KLRD1
PTPN6
PTPN11
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ICAM2
ITGAL
ITGB2
PTK2B
VAV3
VAV1
VAV2
RAC1
RAC2
RAC3
PAK1
MAP2K1

MAP2K2
MAPK1
MAPK3
TNF
CSF2
IFNG
KIR2DS1
KIR2DS3
KIR2DS4
KIR2DS5
NCR2
TYROBP
LCK
FCGR3A
FCGR3B
NCR1
NCR3
FCER1G
CD247
ZAP70
SYK
LCP2
LAT
PLCG1
PLCG2
SH3BP2
PIK3CA
PIK3CB
PIK3CD
PIK3CG
PIK3R5
PIK3R1
PIK3R2
PIK3R3
FYN
SHC2
SHC4
SHC3
SHC1
GRB2
SOS1
SOS2
HRAS
KRAS
NRAS
ARAF
BRAF
RAF1
MICA
MICB
ULBP3
ULBP2
ULBP1

KLRK1
HCST
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CD244
PPP3CA
PPP3CB
PPP3CC
CHP1
PPP3R1
PPP3R2
CHP2
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NFATC3
NFATC4
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PRKCB
PRKCG
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SH2D1A
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IFNGR2
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IFNA7
IFNA8
IFNA10
IFNA13
IFNA14
IFNA16
IFNA17
IFNA21
IFNB1
IFNAR1
IFNAR2
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TNFRSF10D
TNFRSF10C
TNFRSF10B
TNFRSF10A
FASLG
FAS
GZMB
PRF1
CASP3
BID
CD3D
CD3E
CD3G

CD247
CD4
CD8A
CD8B
PTPRC
LCK
FYN
ZAP70
LCP2
LAT
ITK
TEC
NCK1
NCK2
VAV3
VAV1
VAV2
GRAP2
GRB2
PAK1
PAK2
PAK3
PAK4
PAK6
PAK5
RHOA
CDC42
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PPP3CB
PPP3CC
CHP1
PPP3R1
PPP3R2
CHP2
NFAT5
NFATC1
NFATC2
NFATC3
NFATC4
SOS1
SOS2
HRAS
KRAS
NRAS
FOS
JUN
CARD11
BCL10
MALT1
CHUK
IKBKB
IKBKG
NFKB1

RELA
NFKBIA
NFKBIB
NFKBIE
CD28
ICOS
CD40LG
PIK3R5
PIK3R1
PIK3R2
PIK3R3
PIK3CA
PIK3CB
PIK3CD
PIK3CG
AKT3
AKT1
AKT2
MAP3K8
MAP3K14
PDCD1
CTLA4
PTPN6
CBLC
CBL
CBLB
IL2
IL4
IL5
IL10
IFNG
CSF2
TNF
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PDK1
PLCG1
PRKCQ
TRAC
TRAJ1
TRAJ2
TRAJ3
TRAJ4
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TRAV8-2

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TRAV9-2
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TRAV12-2
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TRAV13-2
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TRAV22
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TRAV25
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TRAV26-2
TRAV27
TRAV29DV5
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TRAV34
TRAV35
TRAV36DV7
TRAV38-1
TRAV38-2DV8
TRAV39
TRAV40
TRAV41
TRBC1
TRBC2
TRBD1
TRBD2
TRBJ1-1
TRBJ1-2
TRBJ1-3
TRBJ1-4
TRBJ1-5
TRBJ1-6
TRBJ2-1
TRBJ2-2
TRBJ2-3
TRBJ2-4
TRBJ2-5
TRBJ2-6
TRBJ2-7

TRBV2
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TRBV4-2
TRBV4-3
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TRBV6-3
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TRGV4
TRGV3
TRGV2
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TRGJP1
TRGJP
TRGJ2
TRGJ1
TRGC2
TRGC1
TRAV6
BMP1
BMP10
BMP15
BMP2
BMP3
BMP4
BMP5
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BMP8B
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GDF15
GDF2
GDF3
GDF5
GDF6
GDF7
GDF9
GDNF
INHA
INHBA
INHBB
INHBC
INHBE
LEFTY1
LEFTY2
NODAL

TGFB1
TGFB2
TGFB3
ACVR1B
ACVR1C
ACVR2A
ACVR2B
ACVRL1
AMHR2
BMPR1A
BMPR1B
BMPR2
TGFB1
TGFB2
TGFB3
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TNFSF10
TNFSF11
TNFSF12
TNFSF13
TNFSF13B
TNFSF14
TNFSF15
TNFSF18
TNFSF4
TNFSF8
TNFSF9
TNFRSF10B
TNFRSF10C
TNFRSF10D
TNFRSF11A
TNFRSF12A
TNFRSF13B
TNFRSF13C
TNFRSF14
TNFRSF17
TNFRSF18
TNFRSF19
TNFRSF1A
TNFRSF1B
TNFRSF21
TNFRSF25
TNFRSF4
TNFRSF6B
TNFRSF8
TNFRSF9

Table S3 lncRNAs that were correlated with immune-related mRNAs in the MEbrown module

mRNA	LncRNA
AZGP1	AC004233.2
B2M	AF001548.2
CALR	AL355574.1
CANX	AC008549.1
CD1A	AC023043.3
CD1B	WAC-AS1
CD1C	AC090150.1
CD1D	CASC9
CD1E	LINC01963
CD4	PRRT3-AS1
CD8A	LINC02609
CD8B	AL035461.2
CD74	AC106820.3
CREB1	DCXR-DT
CTSB	AL023284.4
CTSE	LINC01124
CTSL	AC025171.1
CTSS	RAB11B-AS1
FCER1G	AC012313.9
FCGRT	LINC02532
PDIA3	AC007996.1
HFE	AL441992.1
HLA-A	AC104461.1
HLA-B	LINC00339
HLA-C	AC138207.5
HLA-DM	MIR4435-2HG
HLA-DMB	AC016747.1
HLA-DOA	AL391095.2
HLA-DOB	PCED1B-AS1
HLA-DPA1	LINC02428
HLA-DPB1	MIR122HG
HLA-DQA1	BACE1-AS
HLA-DQA2	AC008760.2
HLA-DQB1	AC012313.3
HLA-DRA	PRKAR1B-AS1
HLA-DRB1	LINC01595
HLA-DRB5	HNF4A-AS1
HLA-E	LINC01348
HLA-F	MAGI2-AS3
HLA-G	GIHCG
MR1	MIR210HG
HSPA1A	AC092718.3
HSPA1B	AP002807.1
HSPA1L	AC012645.1
HSPA2	AC073896.4
HSPA4	AC097639.1
HSPA5	PELATON
HSPA6	AC099850.3
HSPA8	AC002398.1

HSP90AA1 SNHG3
HSP90AB1 AC018904.1
ICAM1 AP001065.3
IFNA1 HS1BP3-IT1
IFNA2 PVT1
IFNA4 SNHG29
IFNA5 AL161668.4
IFNA6 SNHG12
IFNA8 AL354872.1
IFNA13 LINC01564
IFNA17 LAMA5-AS1
IFNA21 DBH-AS1
IFNGNRAV
KIR2DL1 AL645933.2
KIR2DL3 AC016044.1
KIR2DL4 AC114810.1
KIR3DL1 AL592494.1
KIR3DL2 AC020978.4
KLRC1 RNASEH1-AS1
KLRC2 AC015917.2
KLRC3 AC245297.3
KLRD1 LINC01485
LTA AC006504.7
CIITA AC026401.3
MICA AF124730.1
MICB AC083799.1
NFYA LINC00205
NFYB MAPKAPK5-AS1
NFYC MIR193BHG
LGMN SNHG18
PSMB8 AC022784.1
PSMC1 LINC01146
PSMC2 AC010503.4
PSMC3 AP003119.2
PSMC4 C6orf223
PSMC5 PCAT7
PSMC6 CRIM1-DT
PSMD1 AC007405.3
PSMD2 AC092171.2
PSMD3 LINC02716
PSMD4 AC083841.1
PSMD5 AL354836.1
PSMD7 VPS9D1-AS1
PSMD8 LINC00261
PSMD10 LINC01767
PSMD11 AC048341.2
PSMD13 AL035071.1
PSME1 LINC01018
PSME2 ADORA2A-AS1
RELB SNHG1
RFX5 AC115619.1
RFXAP LINC01503
SLC10A2 AC009974.1

TAP1AP001781.1
TAP2AC011451.1
TAPBP LINC02608
THBS1 LINC00665
SEM1 AC046143.2
KLRC4 LINC01702
AP3B1 LINC00671
RFXANK ZFAS1
PSMD6 AC009812.4
PSME3 LINC01214
PSMD14 AP006216.2
CLEC4M AP003119.3
IFI30 U91324.1
PROCR KIAA1671-AS1
ADRM1 HEIH
ECPAS SNHG32
TRPC4AP AC079949.1
CD209 AC009166.1
UBXN1 AL021707.6
ERAP1 MIR23AHG
TAPBPL AC004816.1
ERAP2 F11-AS1
ULBP3 LIVAR
ULBP2
ULBP1
KIR3DL3
RAET1E
RAET1L
UBR1
RAET1G
PDIA2
HAMP
PI3
CAMP
DEFB4A
PPBP
REG3G
CXCL14
CXCL16
SLPI
CXCL8
CXCL10
CXCL9
CXCL5
CXCL11
CXCL6
CXCL1
CXCL12
CXCL13
CXCL2
PF4
XCL1
CXCL3

DEFB103B
CCL13
CCL1
DEFB1
CCL8
ELANE
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TMSB10
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DEFA5
DEFA4
LCN2
LCN1
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BPI
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S100A8
DCD
LCN6
S100A12
HTN3
LCN8
CCR10
CELA1
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BPIFC
MMP12
BPIFB6
LEAP2
SFTPD
LCN9
BPIFB2
PTGDS
TMSB4X
PGLYRP1
ZC3HAV1
TMSB15A
S100B
S100A13
S100A6
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SERPIND1
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S100P
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PGLYRP3
PGLYRP2
S100A10
S100A2
DEFB125
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DEFB105B

DEFB132
BPIFB3
LCN12
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S100A1
DEFB108B
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LMBR1L
S100A7A
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COLEC12
TMSB4Y
DEFB131A
DEFB124
DEFB116
DEFB112
TMSB15B
DEFB133
S100Z
MAVS
S100A14
LCN10
S100A16
DEFB136
DEFB135
ZC3HAV1L
S100A7L2
BPIFB4
IFNAR1
AZU1
DEFB131B
S100G
TCHHL1
TINAGL1
IFNGR1
SLC22A17
WFIKKN1
WFDC2
IL6
UMODL1
TGFB1
PF4V1
MMP9
ANOS1
TLR4
SPAG11B
A2M
NFKB1
APOBEC3G
FABP6

NOD2
MBL2
SFTPA1
RBP1
TLR2
SLC40A1
PLAU
IL1B
PAEP
HJV
MUC5AC
OBP2A
PLTP
MX1
DDX58
IFNL1
IRF3
SFTPA2
LPA
LBP
RBP4
NOX4
LTF
IFNB1
RBP5
FABP7
FABP5
FABP3
FABP2
FABP4
R3HDML
BPIFA3
BPIFB1
OASL
CRABP2
CRABP1
RBP7
DUOX1
OBP2B
RBP2
LCN15
CETP
FABP12
FABP9
BPIFA1
LCNL1
C8G
SPAG11A
PI15
NOX1
PMP2
APOD
ORM2

ORM1
TNF
CTSG
PRTN3
MAPK1
PML
AEN
CYBB
BPIFA2
ISG20
BCL3
ISG20L2
NOX5
NOX3
DUOX2
TLR3
TFRC
IFIH1
LRP1
TRIM5
IDO1
GDF15
NEDD4
ADIPOQ
STAT3
STAT1
IFNL2
SOCS3
SEMG1
TNFSF10
CCL20
SOCS1
RNASEL
IRF1
IL15
APOBEC3F
PLAAT4
CHIT1
CD40
TLR7
PIIA
ZYG
NLRX1
PGC
VEGFA
IKBKE
ISG15
DHX58
TNFAIP3
TFR2
FCN2
MUC4
F2R

ELN
IL27
MAPT
LYZ
CCL5
LEP
CYLD
KLKB1
CST4
CSRP1
MAPK14
JUN
ITGAV
IRF5
CCR6
IL12B
TLR8
GNLY
CD81
EIF2AK2
APOM
CACYPB
NOD1
MAPK8
MAPK3
BST2
BPHL
PLA2G2A
GRN
PDGFRA
GNAI1
WNT5A
FURIN
ADAR
TYK2
NOS2
TRAF3
TPT1
TPM2
NEO1
AHNAK
TLR1
TK2
PRDX2
MX2
FGF2
FGA
TCF7L2
F2RL1
TKFC
MSR1
NFKBIZ
LMBR1

EPPIN
SRC
MPO
ELAVL1
ROBO3
SP1
SOD1
PDF
DLL4
ECD
SLC11A1
DMBT1
STING1
SKIV2L
SEMG2
DES
DCK
DAXX
TNFRSF10A
TNFRSF10B
EED
CCL4
LIMS1
LALBA
APOBEC3H
TMPRSS6
SPINK5
MARCO
BECN1
TNFSF11
KNG1
CSK
KLRK1
KCNH2
JUND
JAK1
CLDN4
CCL28
RNASE3
IRF7
IREB2
ILK
IL18
IL17A
LTB4R
APOBEC3A
MASP2
TRIM27
RELA
IL7R
IL1A
PTX3
IFNAR2

SYTL1
APOBEC3C
DDX17
PTGS2
HTR1A
SEPTIN7
CD40LG
CD14
MASP1
PROC
MAP2K2
MAP2K1
HRG
NDRG1
IRF9
TRIM22
LANCL1
PPP4C
HMOX1
HMGB1
RNASE7
ABCC4
HGF
HDAC1
IFNLR1
PLSCR1
BACH2
TANK
PIK3CG
ARRB1
RSAD2
STAB2
TBK1
PDYN
PDGFRB
PDCD1
PCSK2
PCSK1
ARG2
AQP9
FASLG
APOH
BIRC5
ANXA6
IL22
VTN
VIM
VCAM1
PRDX1
GFAP
GBP2
ALB
SLC29A3

OAS1
AGER
UNC93B1
TNFSF4
NOS1
ACTG1
ACTA1
ACO1
SERPINA3
CXCR1
CCL15
CCL14
CCL16
CCL19
CCL18
CCL17
CCL26
CCL22
CCR3
ACKR2
CCR7
CCR8
ACKR4
CCL2
CCL21
CCL7
CCL3
CCL11
CCR5
CCL23
CCL25
CCL3L3
CCL4L2
CCR1
CCL24
XCL2
CXCR4
CXCR6
CCR4
TAF5
TAF3
TAF4
TAF1
TAF2
CCL15-CCL14
PTK2B
IL4
CDH1
LTBP1
IL13
IL10
IL2
PPARG

FGR
MIF
CRP
JAK2
PTK2
PTGDR
CD86
HCK
VDR
OLR1
GRK2
TXK
RNASE2
CD79A
CD79B
LYN
SYK
BTK
BLNK
VAV3
VAV1
VAV2
RAC1
RAC2
RAC3
PPP3CA
PPP3CB
PPP3CC
CHP1
PPP3R1
PPP3R2
CHP2
NFAT5
NFATC1
NFATC2
NFATC3
NFATC4
HRAS
KRAS
NRAS
FOS
CARD11
BCL10
MALT1
CHUK
IKBKB
IKBKG
NFKBIA
NFKBIB
NFKBIE
CD19
CR2
PIK3R5

PIK3R1
PIK3R2
PIK3R3
PIK3CA
PIK3CB
PIK3CD
AKT3
AKT1
AKT2
GSK3B
INPP5D
CD22
CD72
PTPN6
LILRB3
FCGR2B
RASGRP3
PLCG2
PRKCB
IFITM1
C3
C5
CKLF
CMA1
CX3CL1
CXCL17
CCN1
EDN1
EDN2
EDN3
FGF10
LECT2
PROK2
SAA1
SAA2
SBDS
SEMA3A
SEMA3B
SEMA3C
SEMA3D
SEMA3E
SEMA3F
SEMA3G
SEMA4A
SEMA4B
SEMA4C
SEMA4D
SEMA4F
SEMA4G
SEMA5A
SEMA5B
SEMA6A
SEMA6B

SEMA6C
SEMA6D
SEMA7A
SLIT1
SLIT2
TNC
TYMP
C5AR1
CCR9
CCRL2
CMKLR1
CX3CR1
CXCR3
CXCR5
ACKR3
CYSLTR1
CYSLTR2
ACKR1
EDNRA
EDNRB
FPR1
FPR2
GPR17
GPR32
GPR33
PTGDR2
C5AR2
CXCR2
LTB4R2
PLAUR
PLXNA1
PLXNA2
PLXNA3
PLXNA4
PLXNB1
PLXNB2
PLXNB3
PLXNC1
PLXND1
PTAFR
ROBO1
ROBO2
RXFP3
XCR1
ADM
ADM2
AGRP
AGT
AMBN
AMELX
AMH
ANGPTL5
ANGPTL7

APLN
AREG
MANF
CDNF
ARTN
AVP
BDNF
BMP1
BMP10
BMP15
BMP2
BMP3
BMP4
BMP5
BMP6
BMP7
BMP8A
BMP8B
BTC
MYDGF
CALCA
CALCB
CAT
CCK
CD320
CD70
ADA2
CER1
CGA
CGB3
CGB2
CGB5
CGB7
CGB8
CHGA
CHGB
CLCF1
CLEC11A
CMTM1
CMTM2
CMTM3
CMTM4
CMTM5
CMTM6
CMTM7
CMTM8
CNTF
CORT
CRH
CSF1
CSF2
CSF3
CSH1

CSH2
CSHL1
CSPG5
CTF1
CCN2
DKK1
EBI3
EGF
EPGN
EPO
EREG
ESM1
FAM3B
FAM3C
FAM3D
FGF1
FGF11
FGF12
FGF13
FGF14
FGF16
FGF17
FGF18
FGF19
FGF20
FGF21
FGF22
FGF23
FGF3
FGF4
FGF5
FGF6
FGF7
FGF8
FGF9
VEGFD
FIGNL2
FLT3LG
FSHB
GAL
GALP
GAST
GCG
GDF10
GDF11
GDF2
GDF3
GDF5
GDF6
GDF7
GDF9
GDNF
GH1

GH2
GHRH
GHRL
GIP
GKN1
GMFB
GMFG
GNRH1
GNRH2
GPHA2
GPHB5
GPI
GREM1
GREM2
GRP
GUCA2A
HBEGF
HDGF
HDGFL3
IAPP
IFNE
IFNK
IFNW1
IGF1
IGF2
IL11
IL12A
IL16
IL17B
IL17C
IL17D
IL17F
IL19
IL1F10
IL36RN
IL36A
IL37
IL36B
IL36G
IL1RN
IL20
IL21
IL23A
IL24
IL25
IL26
IFNL3
IL3
IL31
IL32
IL33
IL34
IL5

IL6ST
IL7
IL9
INHA
INHBA
INHBB
INHBC
INHBE
INS
INS-IGF2
INSL3
INSL4
INSL5
INSL6
JAG1
JAG2
KITLG
KL
LACRT
LEFTY1
LEFTY2
LHB
LIF
LRSAM1
LTB
LTBP2
LTBP3
LTBP4
MDK
MIA
MLN
MSTN
NAMPT
NDP
NENF
NGF
NMB
NODAL
CCN3
NPPA
NPPB
NPPC
NPY
NRG1
NRG2
NRG3
NRG4
NRTN
NTF3
NTF4
NTS
NUDT6
OGN

OSGIN1
OSM
OSTN
OXT
ENDOU
PDGFA
PDGFB
PDGFC
PDGFD
PDGFRL
PGF
PMCH
PNOC
POMC
PPY
PRL
PRLH
PROK1
PSPN
PTH
PTH2
PTHLH
PTN
PYY
QRFP
RABEP1
RABEP2
REG1A
RETN
RETNLB
RLN1
RLN2
RLN3
SCG2
SCGB3A1
SCT
AIMP1
SECTM1
SLURP1
SPP1
SST
STC1
STC2
TAC1
TDGF1
TG
TGFA
TGFB2
TGFB3
THPO
TNFRSF11B
TNFSF12
TNFSF13

TNFSF13B
TNFSF14
TNFSF15
TNFSF18
TNFSF8
TNFSF9
TOR2A
TRH
TSHB
TSLP
TXLNA
UCN
UCN2
UCN3
UTS2
UTS2B
VEGFB
VEGFC
VGF
VIP
ACVR1B
ACVR1C
ACVR2A
ACVR2B
ACVRL1
ADCYAP1R1
ADIPOR1
ADIPOR2
ADRB1
ADRB2
AGTR1
AGTR2
AMHR2
ANGPT1
ANGPT4
ANGPTL1
ANGPTL2
ANGPTL3
ANGPTL4
ANGPTL6
APLNR
AR
AVPR1A
AVPR1B
AVPR2
BMPR1A
BMPR1B
BMPR2
BRD8
C3AR1
CALCR
CALCRL
CNTFR

CRHR1
CRHR2
CRIM1
CRLF1
CRLF2
CRLF3
CSF1R
CSF2RA
CSF2RB
CSF3R
EGFR
ENG
EPOR
ESR1
ESR2
ESRRA
ESRRB
ESRRG
FGFR1
FGFR2
FGFR3
FGFR4
FGFRL1
FLT1
FLT3
FLT4
FSHR
GALR2
GALR3
GCGR
GHR
GHRHR
GHSR
GIPR
GLP1R
GLP2R
GNRHR
GPER1
HNF4A
HNF4G
HTR3A
HTR3B
HTR3C
HTR3D
HTR3E
IFNGR2
IGF1R
IGF2R
IL10RA
IL10RB
IL11RA
IL12RB1
IL12RB2

IL13RA1
IL13RA2
IL15RA
IL2RB
IL17RA
IL17RB
IL17RC
IL17RD
IL17RE
IL18R1
IL18RAP
IL1R1
IL1R2
IL1RAP
IL1RL1
IL1RL2
IL20RA
IL20RB
IL21R
IL22RA1
IL22RA2
IL23R
IL27RA
IL2RA
IL2RG
IL31RA
IL3RA
IL4R
IL5RA
IL6R
IL9R
INSR
KDR
LEPR
LGR4
LGR5
LGR6
LHCGR
LIFR
LTBR
MC1R
MC2R
MC3R
MC4R
MCHR1
MCHR2
MET
MLNR
MPL
MTNR1A
MTNR1B
NGFR
NMBR

NPR1
NPR3
NR0B1
NR0B2
NR1D1
NR1D2
NR1H2
NR1H3
NR1H4
NR1I2
NR1I3
NR2C1
NR2C2
NR2E1
NR2E3
NR2F1
NR2F2
NR2F6
NR3C1
NR3C2
NR4A1
NR4A2
NR4A3
NR5A1
NR5A2
NR6A1
NRP1
NRP2
OGFR
OPRD1
OPRK1
OPRL1
OPRM1
OSMR
OXTR
PGR
PGRMC2
PPARA
PPARD
PRLHR
PRLR
PTGER1
PTGER2
PTGER3
PTGER4
PTGFR
PTH1R
PTH2R
RARA
RARB
RARG
RORA
RORB

RORC
RXFP1
RXFP2
RXRA
RXRB
RXRG
S1PR1
S1PR2
SCTR
SDC1
SDC2
SDC3
SDC4
SORT1
SSTR1
SSTR2
SSTR5
TACR1
TEK
TGFB1
TGFB2
TGFB3
THRA
THRB
TIE1
TNFRSF10C
TNFRSF10D
TNFRSF11A
TNFRSF12A
TNFRSF13B
TNFRSF13C
TNFRSF14
TNFRSF17
TNFRSF18
TNFRSF19
TNFRSF1A
TNFRSF1B
TNFRSF21
TNFRSF25
TNFRSF4
TNFRSF8
TNFRSF9
TRHR
TSHR
TUBB3
VIPR1
VIPR2
PTPN11
ICAM2
ITGAL
ITGB2
PAK1
NCR2

TYROBP
LCK
FCGR3A
FCGR3B
NCR1
NCR3
CD247
ZAP70
LCP2
LAT
PLCG1
SH3BP2
FYN
SHC2
SHC4
SHC3
SHC1
GRB2
SOS1
SOS2
ARAF
BRAF
RAF1
HCST
CD48
CD244
PRKCA
PRKCG
SH2D1B
SH2D1A
FAS
GZMB
PRF1
CASP3
BID
CD3D
CD3E
CD3G
PTPRC
ITK
TEC
NCK1
NCK2
GRAP2
PAK2
PAK3
PAK4
PAK6
PAK5
RHOA
CDC42
CD28
ICOS

MAP3K8
MAP3K14
CTLA4
CBLC
CBL
CBLB
CDK4
RASGRP1
PDK1
PRKCQ

Table S4 Immune-related mRNAs (22 genes) and lncRNAs (36 genes) associated with prognosis

mRNA	lncRNA
KIR3DL2	CASC9
RAET1L	AL023284.4
DEFB1	AC025171.1
PGLYRP2	RAB11B-AS1
ANOS1	AC012313.9
OBP2A	AC138207.5
IFNB1	AC016747.1
NOX1	BACE1-AS
TMPRSS6	LINC01595
IL17A	HNF4A-AS1
MASP2	MIR210HG
SERPINA3	AC099850.3
VAV3	SNHG3
GDF10	AC018904.1
AIMP1	AP001065.3
IL17RD	SNHG12
MC3R	AL354872.1
OXTR	LAMA5-AS1
PTGER4	NRAV
RXFP1	AL645933.2
MAP3K8	AC020978.4
CBLC	AC015917.2
	AC245297.3
	LINC01485
	AC026401.3
	AC083799.1
	MAPKAPK5-AS1
	C6orf223
	AC092171.2
	AC083841.1
	LINC01018
	SNHG1
	LINC01503
	LINC00665
	AC009166.1
	AC004816.1

Table S5 727 HBV-HCC genes that were co-expressed with AC099850.3

MTF2
NCAPG
EPB41L2
DNMT3A
INTS13
SMARCC2
DROSHA
CAND1
SMARCC1
DHX15
FRG1HP
DENND5A
UBE2N
VTA1
MORF4L2
ITGB3BP
RBM12
RECQL
THOC1
EXTL2
TNPO3
DCAF7
ZDHHC20
SMARCD1
NEK2
TAF3
PBK
TUBA1C
LARP4B
MOB1A
STRN4
ADNP2
ZCCHC8
SLC37A3
PPP1R12A
SRRM2
SENPI
RAD18
NEMP1
CBX1
ILF3
PLAGL2
KATNA1
RCC1
TEFM
NKTR
RACGAP1
IQGAP1
MAP4K5
EHMT1
EML4
IFT52

TRRAP
BRD1
GTF3C2
HDAC2
ATF7IP
CNOT6
FAM83D
DKC1
TOP2A
CNOT9
RHOT1
NUP98
HNRNPL
EIF4G3
ASF1B
GPR107
DSN1
C1orf109
NUP85
EXOSC10
CDC42
DCTN1
CCDC93
ADNP
RALGAPB
ANKRD11
MLLT10
CDC6
MBD6
CCT5
SCAF11
FANCG
CAPRIN1
RFC5
CENPF
PURB
INCENP
FNBP1
TUT4
YBX1P10
CDK12
TUBG1
U2SURP
LIMK1
MAML1
CDC45
TASOR2
TPX2
FAM122B
PNPT1
KIF2A
CSTF2
NUP188

CBFA2T2
LIG1
ANKRD52
ANKIB1
GIT1
DVL3
RAI1
EP300
NDC80
SELENON
CENPH
RPA1
ACTL6A
CSTF2T
AMD1
FEN1
ZMYM3
ERI1
SMC1A
CDK2
RAD1
USP39
ZNF211
COMMD2
LMNB2
TIA1
RCC2
SPATS2
PLXNA1
MTREX
PDCD10
PRPF38A
BTBD10
RAP1B
LSM12P1
PIK3C3
ZBTB40
GNL3L
SEPTIN2
APOC1
TMEM168
SP1
SART3
PLK1
EIF4G2
MBD1
PGS1
SF1
PAPSS1
STAG1
DNAJC14
ANKRD27
NASP

DVL2
KMT2A
PBRM1
SMC3
CSRNP2
HS2ST1
ZBTB2
MGME1
RBM25
UBAP2
RFC3
ASXL1
XRCC5
FRG1BP
COPB2
LEMD3
CAD
ZWINT
KDM5C
FAM111B
ATXN2L
HPS3
RBBP8
PSRC1
BICD2
CEBPZ
HAUS2
OXSR1
HSF2
KLHL42
RRM2
AGBL5
MTA2
DHX9
ATN1
TAF4
SLC30A6
GPN1
NDC1
DIP2B
ELMO2
NCAPG2
NAA50
DNAJC13
MED13L
ZFR
NCAPD2
KMT5B
UIMC1
HNRNPK
C17orf80
TGFBRAP1
PSMD5

PATL1
FBXO42
QSER1
ZFP64
TASOR
PRIM1
TSC1
CCNT1
SMCHD1
CDC20
HSPA13
CDK19
MCM6
MCM7
TTI1
SNRNP200
KIF4A
ZBED5
TACC3
DDX23
DDX55
PLCB3
SRSF1
GPATCH8
CIAO1
DHX35
POLD1
ARID1B
CUL3
CREBZF
SBNO1
TUG1
USP48
PXN
PNISR
NAA25
ZNF639
SMC6
HNRNPH1
SPTY2D1
MKI67
CPSF7
TRIM32
ANAPC5
WNK1
FBNP4
GAPVD1
ZNF84
MED14
E2F6
PPAT
YWHAQ
REV1

NPEPPS
XPOT
SRSF11
HNRNPH3
PROSER1
MAP4K3
USP14
HJURP
SMC4
MYBL2
ARMC8
PHRF1
PDCL
ACIN1
SRRM1
NKIRAS2
TDG
ABL1
BCOR
KIF2C
TEX10
LSG1
PCLAF
THOC2
QTRT2
TM9SF4
ICE1
KBTBD4
POFUT2
COPS7B
ARL13B
SWAP70
PPM1D
LRRC59
NUP205
NRAS
RFC4
PHACTR4
KANSL2
CCNA2
KDM1A
SUV39H2
POLA1
PRDM4
AL139287.1
PRR14L
TAF6
CSE1L
VRK2
TAOK1
KIF11
FAM168A
TAF1B

CPSF6
HNRNPLL
ZNF142
TBP
POLR2B
MYO19
HMGXB4
CCDC88A
NCOA5
UBTF
NSD3
EZH2
EFTUD2
RBM39
ANKRD13C
WDR82
HLTF
STX7
ZBTB24
DENND6A
WSB1
FAM193A
CREB1
STMN1
ZNF776
ZDHC17
DR1
PARG
DTL
LLGL1
CLDND1
TOPBP1
RERE
GNB1
ANLN
GTF3C3
RBM33
CDCA5
NCBP2
NSD2
UBE2O
RAVER1
CDCA4
DIDO1
PCBP2P2
SCAF8
KPNA2
RBMX
SRP72
R3HDM1
FIP1L1
GNAI3
XPO1

ZRANB2
SMC2
MELK
GCN1
TCERG1
PRPF38B
U2AF2
SFR1
TRAK1
FOXM1
AURKA
NUFIP2
DLGAP4
TYMS
DPF2
CCT2
SPINDOC
CAMSAP1
FIG4
HMMR
NUP160
TROAP
SMURF2
ECT2
ANKLE2
SFPQ
RIC8A
SRRT
CHD6
SPTLC1
EPS15L1
STK36
NCOA6
NUP155
ZNF548
ZNF207
DDX17
M6PR
GOPC
MTMR1
KRAS
BTBD3
PDCD7
LRCH3
FAM104A
CDKN3
USP28
PHF6
NBEAL2
CENPU
LENG8
MARK2
TRIM37

KHSRP
LSM12
TCF19
ZNF37A
USP3
CSNK1D
CCNB2
NCAPH
EYA3
EDC4
KBTBD2
RNF41
CNOT2
TIMELESS
GMPS
UTP20
PRKCI
CNNM4
PRPF3
ETAA1
CRKL
NUSAP1
BAZ1B
PPIL4
MIDEAS
RBM6
CUL4B
SKP2
DCAF16
NT5C2
USP13
CDCA7L
ROCK1
FBXO11
NEPRO
ATAD2
CDK1
SPTAN1
MFN1
DCK
SLC5A3
VHL
PHF12
WDCP
DNMT1
GOLGA2
BRAP
CKAP2
CDCA8
CPSF3
WDR45B
GTF2H1
MSH6

LMNB1
DHX57
CENPQ
ZNF131
NONO
UBAP2L
STRN
NEDD1
SMARCD1
TBCCD1
ZMYM4
RBM5
NUP43
ZNF335
PIAS3
NCBP1
DDX31
XPO7
BCLAF1
HCFC1
KHDRBS1
NAA40
HAUS6
ZMIZ1
MTMR2
GTPBP4
KIFC1
NUF2
ARIH2
SRSF10
PFAS
TRA2B
MASTL
STAM
TTF1
PHF20
MAPRE1
ZSWIM1
MED23
HNRNPR
SF3B1
SP3
STK4
ORC2
TUBA1B
DNAJC9
DBR1
ZNF697
DCAF1
MAP3K4
NCAPD3
TRAM2
NCDN

PRPF8
NDRG3
TMX3
KMT2D
SFSWAP
PTBP1
CDC27
SPEN
SETD5
YTHDF2
AQR
CAPZA1
TRIM44
CASP2
KIF20A
POLR3F
PRR12
DGCR8
FOKK1
SRSF7
GNL2
RRM1
PCNP
PIP4K2B
PPP1R8
GPD2
DYRK2
SYNCRIP
SET
DHX36
RBM14
PMS1
BRPF1
PPP1CC
PTPN23
SLMAP
SCMH1
HEATR6
SSRP1
MED12
UPF3B
CTDSPL2
ZWILCH
NUP107
TSR1
USP15
KANSL3
STK24
COPB1
CUL2
SETD2
PTBP3
CCNYL1

YEATS2
MAU2
PRMT3
CWC22
SAP130
MCM2
C1orf52
MSH2
DCLRE1B
NOL10
PIGS
MTA3
SRCAP
TMPO
MAPKAPK5
BAZ2A
GMEB1
SMPD4
ARID1A
HP1BP3
USP1
ZNF384
MRPL3
ATF7
PRPF39
RLF
OIP5
TRIO
SFMBT1
C1orf174
FANCL
ATP2C1
RAPGEF1
ZC3H14
SPAG5
LAMA5
KCTD9
KANSL1
TMEM39A
CNOT3
ELK1
KRR1
IGHMBP2
SUPT20H
MAST2
HNRNPU
MCM4
PRIM2
TBL1XR1
CEP85
TMEM201
HSPA14
CAP1

PRC1
FUBP1
SUGP2
DSG2
FKBP15
ARHGAP1
RPAP3
ZUP1
SPATS2L
CEP95
BIRC5
PRRC2A
DYNC1LI2
RYK
MDC1
NPAT
FOKK2
DMTF1
KDM3B
VGLL4
UNK
MCM3
RALGDS
RNF34
RNMT
GINS1
CDC42SE1
ATXN7L3
RBBP4
ZNF143
WASF1
USP24
CRLF3
MFSD14B
CHML
FBH1
BRF2
FARP2
TOP1
RFWD3
IARS1
GTF3C4
MYLIP
HUWE1
SUZ12
MAP3K7
WEE1
EDC3
ZNF182
WBP11
CDK16
DNM1L
FOXJ3

AURKB
BCL9L
COIL
KPNB1
ARL6IP6
ASAP1
CALU
ADAM17
KHDC4
AZI2
PTPN1
UBXN7
CCNB1
AGO1
CKAP5
NUP62
PPHLN1
PDS5A
MTPAP
SPIN1
SUPT7L
ZBED4
RAB35
C2CD5
KNSTRN
NDOR1
SRSF2
CORO1C
POLE3
VEZF1
EXOC1
IPO7
PJA1
NIPBL
SOCS5
IQCB1
ZNF329
PPP6R1

Table S6 clinical data for HBV-HCC patients

Id	futime	fustat	Age		Gender	Grade		Stage T		M	N	
TCGA-BC-A10W-01A	91	1	50	1	3	NA	T4	MX	NX			
TCGA-DD-A3A3-01A	535	1	45	1	2	1	T1	M0	N0			
TCGA-DD-A1EI-01A	183	0	46	1	2	1	T1	M0	N0			
TCGA-UB-A7ME-01A		486	0	51	1	2	1	T1	MX	NX		
TCGA-O8-A75V-01A	538	0	54	1	2	1	T1	MX	NX			
TCGA-G3-A25Z-01A	655	0	58	1	2	1	T1	M0	N0			
TCGA-G3-A3CK-01A	585	0	61	1	2	1	T1	M0	N0			
TCGA-K7-A6G5-01A	512	0	66	1	2	1	T1	MX	N0			
TCGA-RC-A7S9-01A	640	0	47	0	3	1	T1	M0	N0			
TCGA-G3-A25Y-01A	452	1	52	0	3	1	T1	M0	N0			
TCGA-G3-A25U-01A	1636	0	63	0	3	1	T1	M0	N0			
TCGA-DD-A11A-01A	79	0	67	1	3	1	T1	M0	N0			
TCGA-CC-A7IG-01A	299	1	47	1	2	2	T2	M0	N0			
TCGA-QA-A7B7-01A	94	0	48	1	2	2	T2	MX	NX			
TCGA-CC-5258-01A	129	1	48	1	2	2	T2	M0	N0			
TCGA-G3-A3CJ-01A	594	0	52	1	2	2	T2	M0	N0			
TCGA-RC-A7SB-01A	588	0	53	1	2	2	T2	M0	N0			
TCGA-DD-A1EA-01A	2415	0	68	1	2	2	T2	M0	N0			
TCGA-ED-A7XP-01A	400	0	53	0	3	2	T2	M0	N0			
TCGA-DD-A1EL-01A	415	1	23	1	3	2	T2	M0	N0			
TCGA-DD-A4NQ-01A		373	1	60	1	3	2	T2	M0	N0		
TCGA-G3-A25X-01A	1779	0	73	1	3	2	T2	M0	N0			
TCGA-DD-A1EH-01A	1495	0	23	1	3	3	T3	M0	N0			
TCGA-CC-5263-01A	129	1	35	1	1	3	T3	M0	N0			
TCGA-CC-A3MB-01A		315	1	36	1	1	3	T3	M0	N0		
TCGA-CC-A7IL-01A	278	1	61	1	1	3	T3	M0	N0			
TCGA-ED-A7XO-01A	427	0	29	1	2	3	T3a	M0	N0			
TCGA-CC-A5UD-01A	304	1	45	1	2	3	T3	M0	N0			
TCGA-G3-A3CH-01A	780	0	53	1	2	3	T3a	M0	N0			
TCGA-CC-A3MC-01A		363	0	54	1	2	3	T3	M0	N0		
TCGA-UB-A7MF-01A	214	1	56	1	2	3	T3a	MX	NX			
TCGA-CC-5264-01A	102	1	71	1	2	3	T3	M0	N0			
TCGA-CC-A3M9-01A	300	1	45	1	3	3	T3	M0	N0			
TCGA-CC-A1HT-01A	101	1	50	1	3	3	T3	M0	N0			
TCGA-CC-A7II-01A	399	0	54	1	3	3	T3	M0	N0			
TCGA-UB-A7MC-01A		500	0	59	1	3	3	T3a	MX	N0		
TCGA-CC-A7IK-01A	262	1	59	1	3	3	T3	M0	N0			
TCGA-CC-A5UC-01A	347	1	63	1	3	3	T3	M0	N0			
TCGA-DD-A116-01A	1622	1	68	1	3	3	T3	M0	N0			
TCGA-CC-A5UE-01A	272	1	48	1	2	3	T4	M0	N0			
TCGA-CC-5262-01A	103	1	67	1	1	3	T4	M0	N0			
TCGA-CC-5259-01A	250	0	60	0	2	3	T4	M0	N0			
TCGA-BW-A5NP-01A	0	0	26	0	3	4	T2	M1	N0			
TCGA-DD-A119-01A	223	1	40	1	3	4	T3a	M1	N0			

Table S7. RT-qPCR primer sequences (human)

	Forward Primer (5'-3')
AC099850.3	F: 5'-CTGGAGTGGCAGTGTTGCAATC-3' R: 5'-GGTGACGCACACCTGTAGTCC-3'
CD276	F: 5'-GCTGTCTGTCTGTCTCATTGC-3' R: 5'-ATTTCTTGTCCATCATCTTCTTTGC-3'
GAPDH	F: 5'-CTCCTCCTGTTCGACAGTCAGC-3' R: 5'-CCCAATACGACCAAATCCGTT-3'

Note: F: Forward; R: Reverse.

Table S8. Western blot test of primary antibody manufacturer information

Antibody Name	Antibody Item Number	Concentration	Manufacturer
Anti-CD276	ab219648	1: 1000	Abcam
Anti-E-cadherin	ab40772	1: 1000	Abcam
Anti-N-cadherin	ab76011	1: 5000	Abcam
Anti-Vimentin	ab92547	1: 1000	Abcam
Anti-Ki67	ab92742	1: 5000	Abcam
Anti-PCNA	ab92552	1: 1000	Abcam