

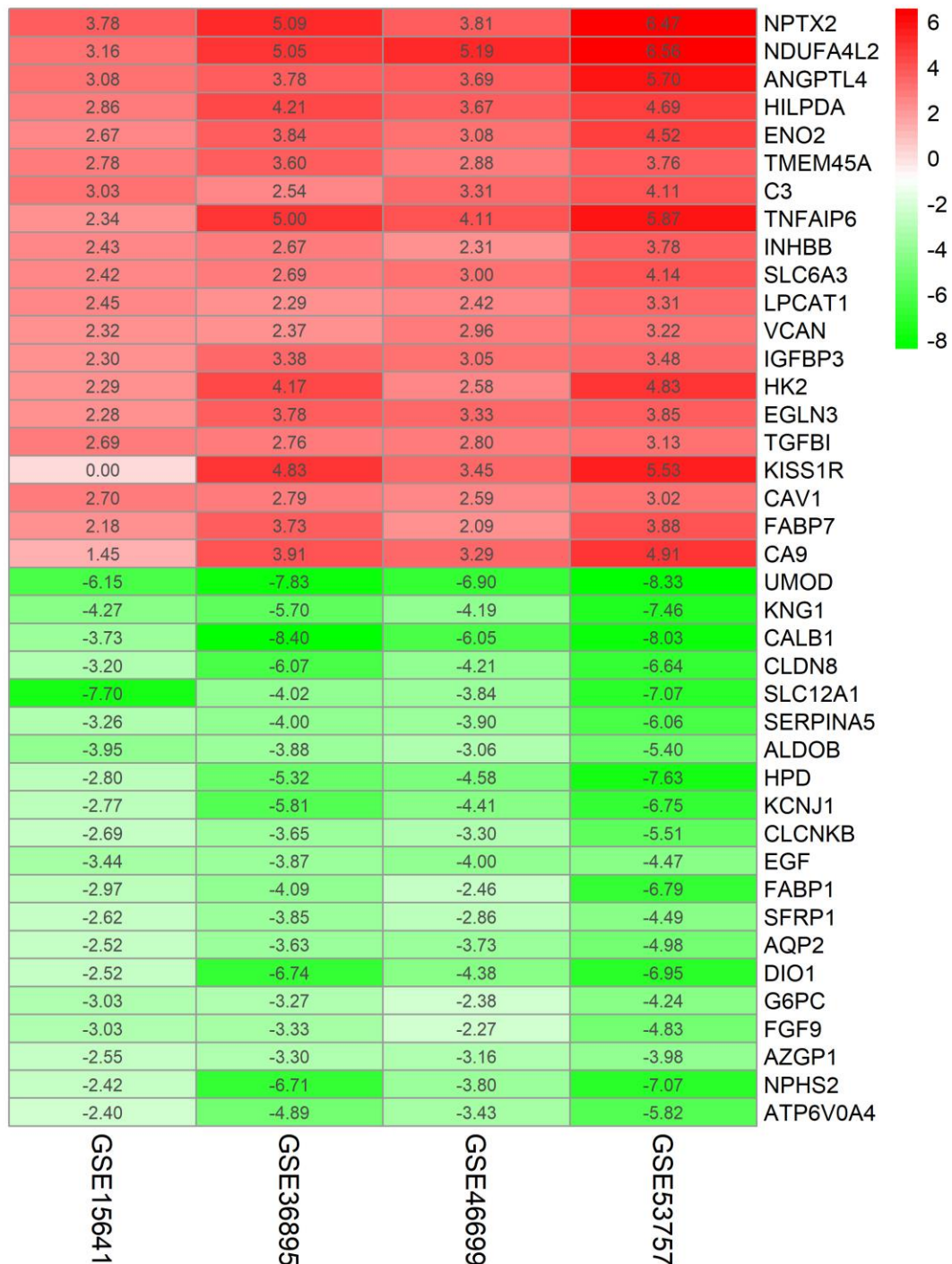
Identification of 12 immune-related lncRNAs and molecular subtypes for the clear cell renal cell carcinoma based on RNA sequencing data

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Maoshu Zhu¹, Miaoxuan Chen¹, Ying Lin¹, Yao Lin^{2*}, Jiyi Huang^{1,3*}

Supplementary information

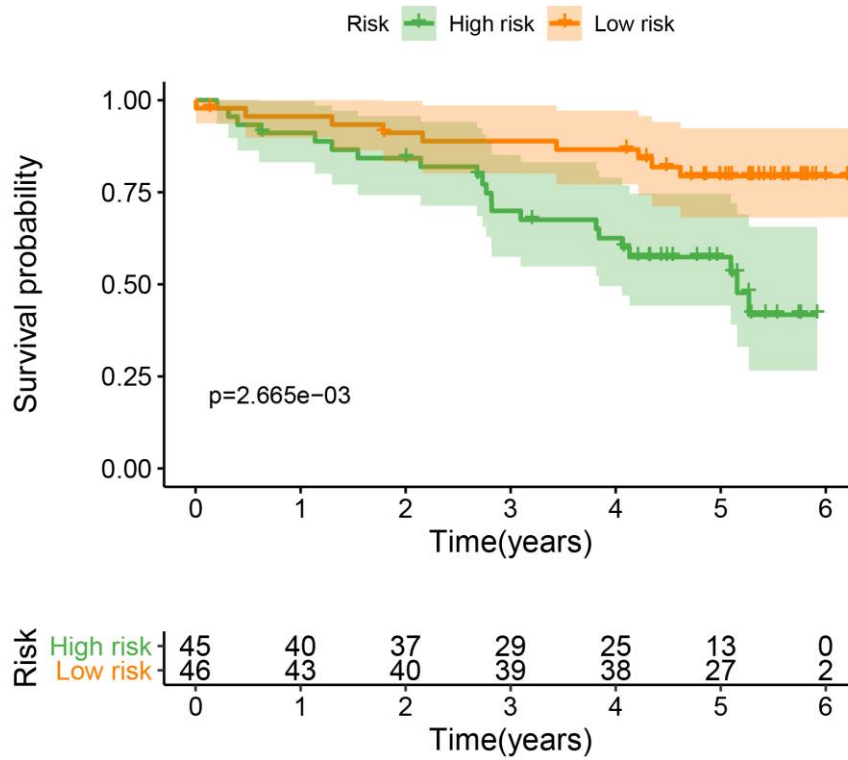
Supplementary Figure 1

A logFC heatmap for each GEO datasets (GSE46699, GSE36895, GSE15642 and GSE53757), the red label represent up-regulated while the green label represent down-regulated.



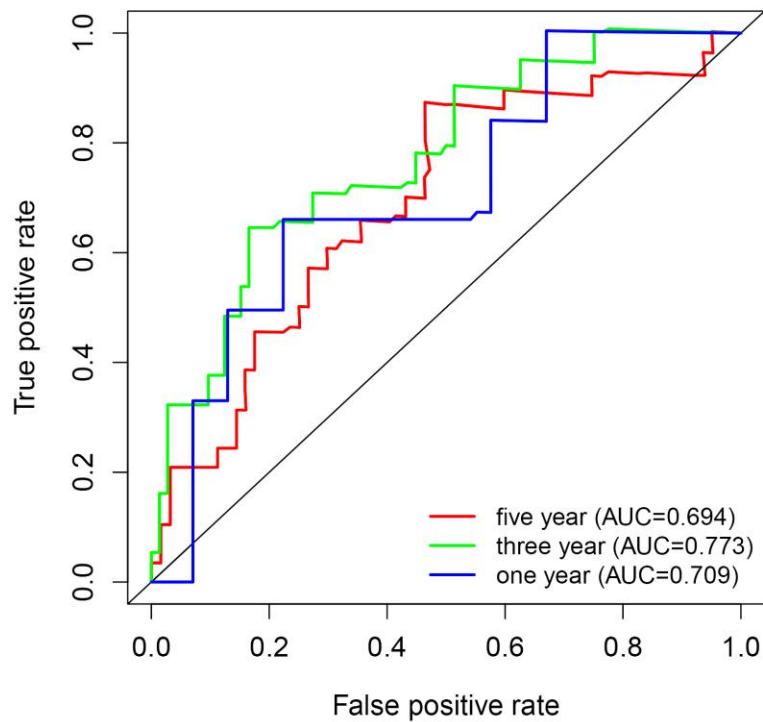
Supplementary Figure 2

KM curve survival analysis for the risk groups in the ICGC dataset



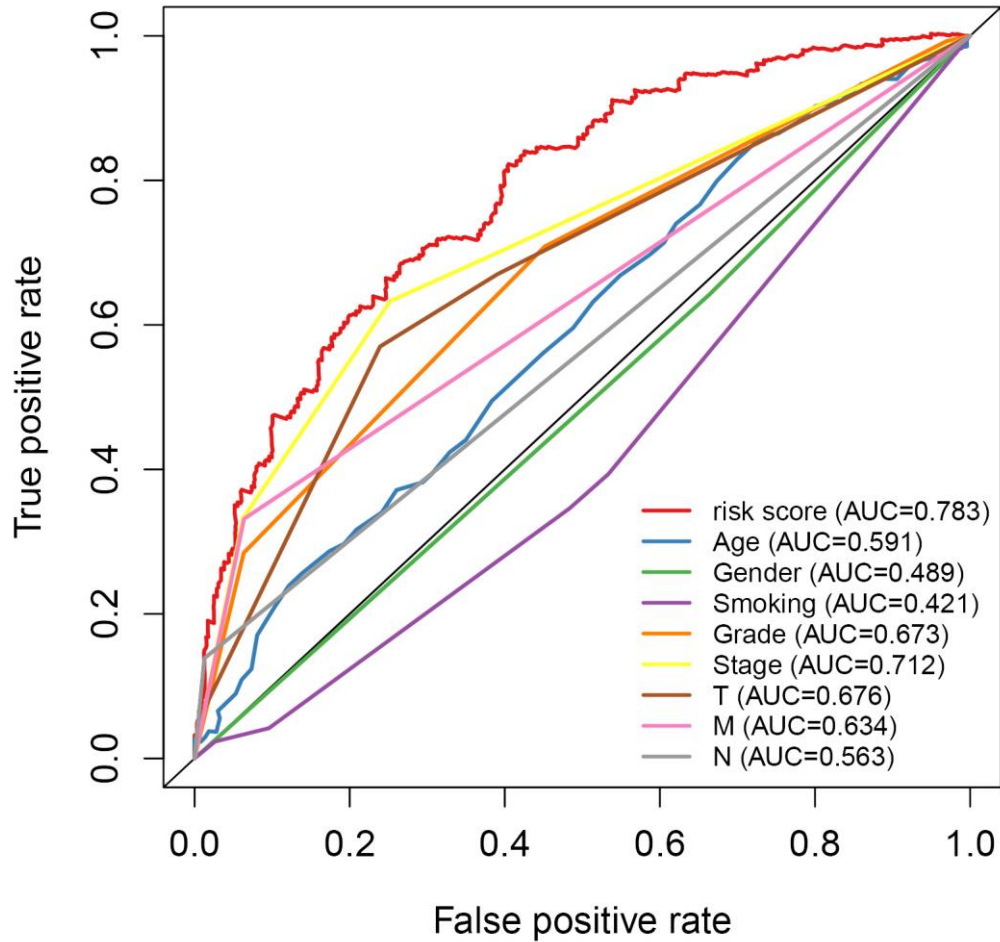
Supplementary Figure 3

Time ROC curves analysis for the 12-lncRNA signature in the ICGC dataset



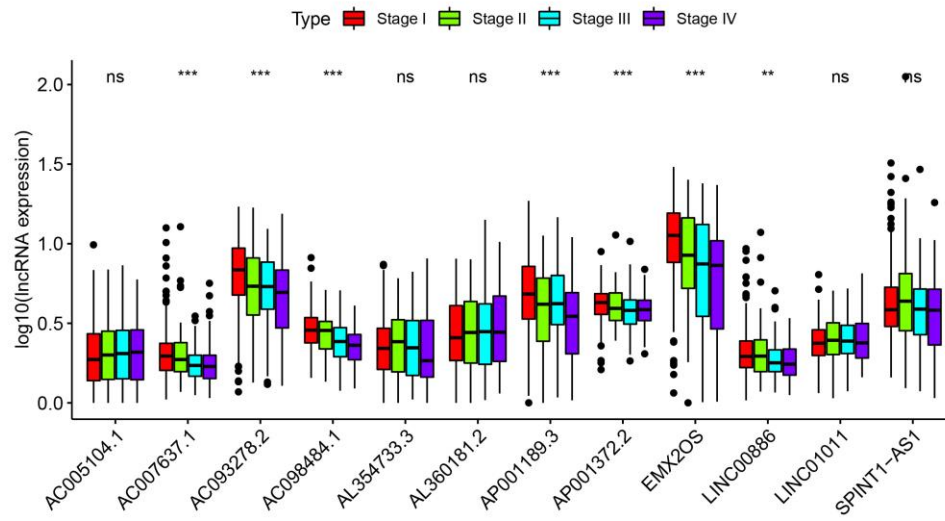
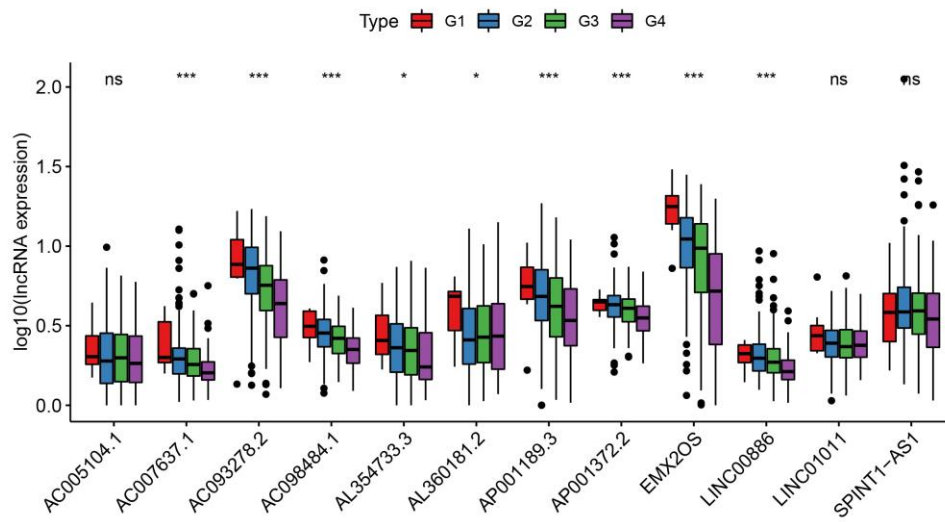
Supplementary Figure 4

Roc curve analysis for the 12-lncRNA signature and clinical traits (Stage, Gender, Age, Grade, T, M, N and Smoking)



Supplementary Figure 5

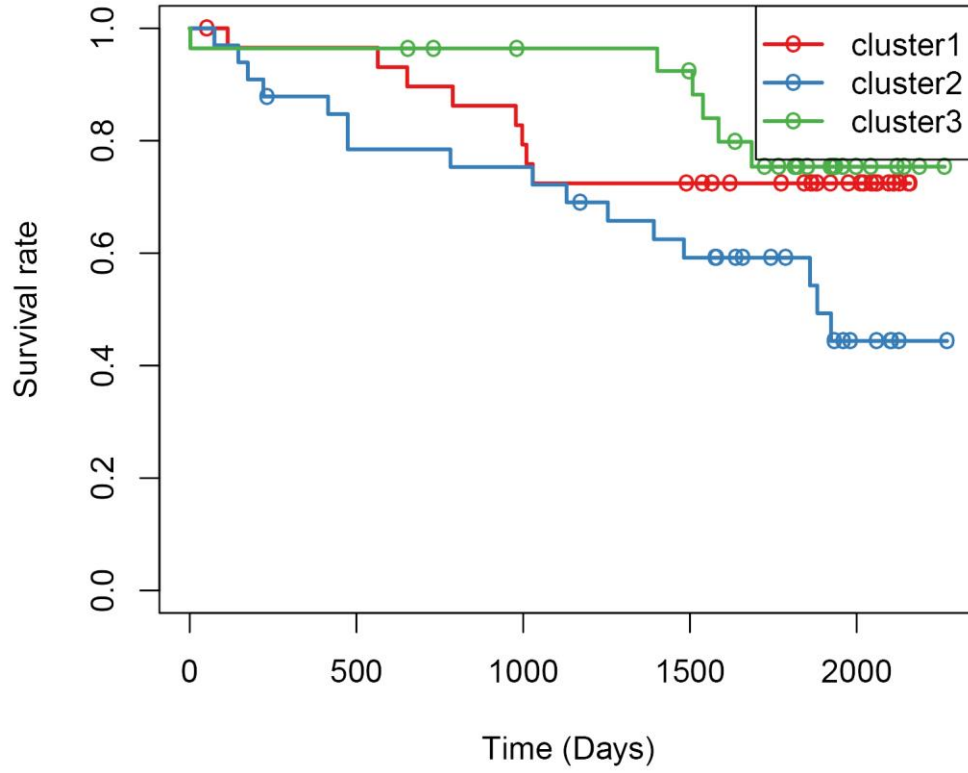
The association between 12 lncRNAs expression and clinical features. (A) Boxplots of 12 lncRNAs from AC005104.1 to SPINT1-AS1 in different pathological stages. (B) Botplots for 12 lncRNAs from AC005104.1 to SPINT1-AS1 in different grade. ns: no significant; *P < 0.05; **P < 0.01; ***P < 0.001.

A**B**

Supplementary Figure 6

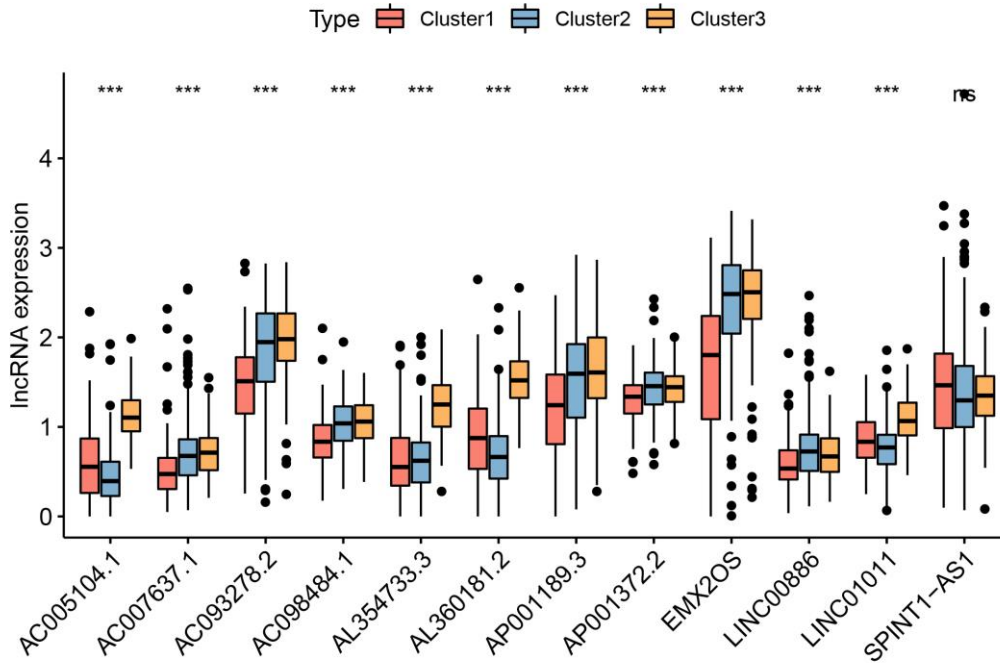
KM curves analysis for the overall survival of different subtypes in the ICGC dataset.

Survival curve (p=0.051)



Supplementary Figure 7

Estimation of the relationships between 12 lncRNAs and three subgroups



Supplementary Table 1

326 DEGs information that identified by RRA analysis

Name	Pvalue	adjPvalue	logFC
NPTX2	1.47E-15	3.18E-11	4.7863709
NDUFA4L2	2.65E-13	5.75E-09	4.9919465
ANGPTL4	6.96E-13	1.51E-08	4.0622925
HILPDA	2.36E-12	5.12E-08	3.8568892
ENO2	1.90E-11	4.12E-07	3.5284086
TMEM45A	2.72E-11	5.89E-07	3.255033
C3	3.78E-11	8.19E-07	3.2484773
TNFAIP6	4.24E-11	9.19E-07	4.3315033
INHBB	8.11E-11	1.76E-06	2.79854
SLC6A3	9.61E-11	2.08E-06	3.0634197
LPCAT1	1.78E-10	3.86E-06	2.6174957
VCAN	2.19E-10	4.76E-06	2.7164757
IGFBP3	2.19E-10	4.76E-06	3.05388
HK2	2.51E-10	5.44E-06	3.4673883
EGLN3	2.68E-10	5.80E-06	3.3108516
TGFBI	2.85E-10	6.18E-06	2.8444058
KISS1R	3.39E-10	7.35E-06	3.4525328
CAV1	4.87E-10	1.06E-05	2.7769282

FABP7	4.87E-10	1.06E-05	2.9700474
CA9	1.57E-09	3.40E-05	3.3905242
NETO2	1.81E-09	3.93E-05	2.9325383
CXCR4	2.85E-09	6.18E-05	2.5036095
C1QA	4.14E-09	8.99E-05	2.2734821
C1QB	5.50E-09	0.0001192	2.8466761
BIRC3	5.50E-09	0.0001192	2.279771
PLK2	5.50E-09	0.0001192	2.3617024
FABP5	6.38E-09	0.0001383	2.5769971
LYZ	8.01E-09	0.0001735	2.2242749
LOX	8.23E-09	0.0001784	2.770614
DDIT4	8.69E-09	0.0001884	2.1676884
NOL3	1.05E-08	0.0002266	2.0848482
APOC1	1.19E-08	0.0002573	2.4643647
AHNAK2	1.31E-08	0.000284	2.2726854
CP	1.45E-08	0.0003151	3.1804336
RGS1	1.48E-08	0.0003202	2.4821054
COL23A1	1.67E-08	0.0003622	2.6559239
CCL5	1.99E-08	0.0004308	2.0112918
CTHRC1	2.17E-08	0.0004702	2.5537755
BHLHE41	2.21E-08	0.0004801	2.828556
GZMA	2.57E-08	0.0005561	1.9674084
VWF	2.84E-08	0.0006157	2.3180794
ZNF395	2.90E-08	0.0006281	1.9513641
SPAG4	3.08E-08	0.0006667	2.8560118
TYROBP	3.20E-08	0.0006934	2.3634499
CYP2J2	3.20E-08	0.0006934	2.4626315
CCND1	3.39E-08	0.0007348	2.0313847
STC2	3.39E-08	0.0007348	1.8960054
LAPTM5	3.59E-08	0.0007782	2.151237
C10orf10	3.66E-08	0.000793	1.9924676
ADM	4.09E-08	0.0008867	1.9548955
PLOD2	4.17E-08	0.0009031	2.2480821
OLFML2B	4.98E-08	0.0010797	1.8649286
SCARB1	5.62E-08	0.0012178	1.9244853
PSMB9	6.42E-08	0.0013916	2.1166646
TLR3	8.02E-08	0.0017395	1.7345806
GAL3ST1	8.02E-08	0.0017395	1.9932018
CAV2	8.28E-08	0.0017941	1.8230404
LGALS1	9.62E-08	0.0020864	2.0593966
ITGB2	1.05E-07	0.0022781	1.8625685
DDB2	1.10E-07	0.0023788	1.8376203
DIRAS2	1.26E-07	0.0027386	2.5417737
BTN3A2	1.28E-07	0.0027767	1.7420793

CD163	1.30E-07	0.0028152	1.7298787
CSTA	1.43E-07	0.003096	2.0815353
TAP1	1.63E-07	0.003533	1.8190601
EVI2A	1.67E-07	0.0036257	1.798937
NKG7	1.74E-07	0.0037681	2.2841049
APOLD1	1.81E-07	0.0039146	1.9802688
TIMP1	1.85E-07	0.0040147	1.9175166
ANGPT2	1.85E-07	0.0040147	2.5214989
VEGFA	1.92E-07	0.0041683	1.8761981
SCD	1.97E-07	0.0042732	1.6654676
GPR65	2.15E-07	0.0046558	1.9243817
CCL20	2.15E-07	0.0046558	2.1890913
CCL18	2.23E-07	0.0048275	1.9241498
KCNE4	2.57E-07	0.0055618	2.1913205
IL10RA	2.81E-07	0.0060959	1.6457563
SAP30	2.84E-07	0.0061653	1.5678086
MCAM	2.88E-07	0.0062353	1.8886028
PLA2G7	2.91E-07	0.0063058	1.9797028
ERV3-2	2.97E-07	0.0064487	1.7474621
FCGR1B	3.39E-07	0.0073578	1.8572043
HCLS1	3.43E-07	0.0074377	1.9091474
ACKR3	3.62E-07	0.0078468	1.8591226
GJA1	3.74E-07	0.0081003	1.7909806
CORO1A	3.74E-07	0.0081003	1.7692655
LY96	3.90E-07	0.0084477	1.8968525
FAM57A	3.94E-07	0.0085363	1.6928494
HEY1	4.10E-07	0.0088975	1.623948
PSMB8	4.28E-07	0.0092701	1.6735749
FCER1G	4.87E-07	0.0105624	1.9565
PRKCDBP	4.97E-07	0.0107726	1.7288102
IFI16	5.07E-07	0.0109859	1.8654652
C1S	5.58E-07	0.0121004	1.5066805
RNASE6	6.31E-07	0.0136734	1.652508
LHFPL2	6.73E-07	0.0145814	1.5305985
ELTD1	7.04E-07	0.0152572	1.587028
KCNK3	7.17E-07	0.0155339	1.5182363
FLT1	7.43E-07	0.0160988	1.4132457
TYMP	7.49E-07	0.0162423	1.6049008
RNASET2	7.90E-07	0.0171241	2.0379566
PNMA2	7.90E-07	0.0171241	1.6531169
ENPP3	8.63E-07	0.0187176	2.1397101
COL21A1	9.06E-07	0.0196511	1.6056756
MTCL1	9.14E-07	0.0198178	1.6452301
RRAD	9.22E-07	0.0199856	1.4394357

PTPRC	9.30E-07	0.0201544	1.4629682
SERPINE1	9.30E-07	0.0201544	1.4269578
PPP1R3C	9.30E-07	0.0201544	1.677792
FN1	9.77E-07	0.02119	1.7793841
CLEC2B	1.01E-06	0.0219022	1.5317692
EHD2	1.04E-06	0.022448	1.7242947
PCDH17	1.07E-06	0.0231916	1.6124668
VIM	1.10E-06	0.0237612	1.6384554
TRIB3	1.11E-06	0.0241468	1.8808469
KCNJ2	1.23E-06	0.0265597	1.7366367
CD70	1.28E-06	0.0278318	2.0567245
APOL1	1.30E-06	0.0282658	1.625524
RARRES2	1.39E-06	0.0300528	1.3879668
PYCARD	1.40E-06	0.030282	1.5895982
MS4A4A	1.42E-06	0.0307443	1.470912
DOC2A	1.45E-06	0.0314477	1.9833602
CHST15	1.46E-06	0.0316848	1.4663128
CXCL9	1.46E-06	0.0316848	1.7894825
COL6A2	1.53E-06	0.0331358	1.374133
ARL4C	1.54E-06	0.0333824	1.4111872
GZMB	1.60E-06	0.034636	1.9062136
LIPA	1.60E-06	0.034636	1.3966345
HCK	1.63E-06	0.035405	1.5470738
ITGA5	1.65E-06	0.0356641	1.5065179
TMCC1	1.69E-06	0.0367149	1.351145
ISG20	1.77E-06	0.0383345	1.6383164
ST8SIA4	1.78E-06	0.0386095	2.0824638
SERPINH1	1.82E-06	0.0394435	1.2929034
PRC1	1.93E-06	0.0417337	1.5385943
HLX	1.99E-06	0.0432148	1.4210671
COL1A2	2.04E-06	0.0441221	1.5866644
PECAM1	2.08E-06	0.0450437	1.3548869
ALOX5	2.09E-06	0.0453541	1.3737956
THEMIS2	2.12E-06	0.0459797	1.4483692
SLC2A3	2.21E-06	0.0478952	1.6811192
GMFG	2.25E-06	0.0488751	1.3596574
CD36	2.29E-06	0.0495367	1.7969086
SCG5	2.30E-06	0.04987	1.7758852
HLA-DMA	2.30E-06	0.04987	1.5056682
UMOD	2.90E-16	6.28E-12	-7.302804
KNG1	7.42E-14	1.61E-09	-5.404098
CALB1	3.76E-13	8.14E-09	-6.554177
CLDN8	2.15E-11	4.66E-07	-5.030439
SLC12A1	5.64E-11	1.22E-06	-5.658348

SERPINA5	6.19E-11	1.34E-06	-4.30207
ALDOB	8.84E-11	1.92E-06	-4.070806
HPD	1.66E-10	3.59E-06	-5.082931
KCNJ1	2.19E-10	4.76E-06	-4.935449
CLCNKB	2.68E-10	5.80E-06	-3.786769
EGF	3.65E-10	7.91E-06	-3.942262
FABP1	4.10E-10	8.90E-06	-4.07696
SFRP1	4.10E-10	8.90E-06	-3.456481
AQP2	7.05E-10	1.53E-05	-3.717898
DIO1	8.04E-10	1.74E-05	-5.144958
G6PC	9.45E-10	2.05E-05	-3.230212
FGF9	1.04E-09	2.25E-05	-3.362799
AZGP1	1.24E-09	2.69E-05	-3.247542
NPHS2	1.24E-09	2.69E-05	-4.998929
ATP6V0A4	1.41E-09	3.07E-05	-4.135511
TYRP1	1.48E-09	3.20E-05	-3.740351
SLC22A6	1.60E-09	3.48E-05	-3.507035
XPNPEP2	1.81E-09	3.93E-05	-4.047793
ALB	1.88E-09	4.09E-05	-3.460995
PCP4	1.96E-09	4.25E-05	-3.330601
HRG	2.04E-09	4.42E-05	-3.310422
DPEP1	2.12E-09	4.59E-05	-3.760058
PCK1	2.29E-09	4.96E-05	-3.756705
MAL	2.56E-09	5.54E-05	-3.692542
TSPAN8	2.85E-09	6.18E-05	-3.562915
ACSF2	3.76E-09	8.14E-05	-3.191834
TMEM213	4.31E-09	9.34E-05	-3.920067
HSD11B2	4.42E-09	9.58E-05	-3.581927
SOSTDC1	4.56E-09	9.90E-05	-3.21646
CYP4F3	4.71E-09	0.0001021	-3.428473
S100A2	5.33E-09	0.0001156	-3.495117
HAO2	5.50E-09	0.0001192	-2.910431
ABAT	6.20E-09	0.0001343	-2.887205
SLC12A3	7.16E-09	0.0001552	-3.254631
SLC13A1	7.79E-09	0.0001688	-3.152569
FXYP4	9.15E-09	0.0001984	-3.903004
DUSP9	1.16E-08	0.0002509	-2.894959
ALDH6A1	1.41E-08	0.0003054	-2.885324
SLC13A3	1.44E-08	0.0003127	-3.054985
DEFB1	1.58E-08	0.0003436	-3.405082
ASS1	1.90E-08	0.0004121	-2.758804
ESRRG	2.21E-08	0.0004801	-2.926568
TFAP2B	2.26E-08	0.0004904	-2.674896
TMEM52B	2.45E-08	0.0005315	-3.947865

DDC	2.51E-08	0.0005447	-2.414098
CYP4A11	2.57E-08	0.0005561	-2.513541
TUBB2B	3.08E-08	0.0006667	-2.530529
TCF21	3.14E-08	0.0006799	-2.496969
OGDHL	3.32E-08	0.0007208	-2.846837
AFM	4.24E-08	0.0009182	-3.60049
C7	4.72E-08	0.0010242	-2.750164
DCXR	4.98E-08	0.0010797	-2.585558
PLG	4.98E-08	0.0010797	-3.084024
PTH1R	5.25E-08	0.0011374	-2.973055
FAM151A	5.64E-08	0.001222	-3.310906
EFHD1	6.01E-08	0.0013025	-2.640471
SLC22A8	6.16E-08	0.0013365	-4.189292
LRRC19	6.42E-08	0.0013916	-2.532659
GLYAT	6.63E-08	0.0014377	-2.245246
FBP1	7.07E-08	0.0015336	-2.527832
PVALB	7.78E-08	0.0016862	-3.421883
PPP1R1A	9.48E-08	0.0020557	-2.412781
ATP6V1B1	9.77E-08	0.0021175	-2.401014
TOX3	9.91E-08	0.0021489	-2.266402
PCK2	1.23E-07	0.0026636	-2.338826
SCNN1G	1.59E-07	0.0034421	-2.743564
ALDH4A1	1.63E-07	0.003533	-2.364461
SORD	1.85E-07	0.0040147	-1.985296
IL17RB	1.88E-07	0.0040654	-2.02656
SLC34A1	1.90E-07	0.0041166	-2.611352
FTCD	1.97E-07	0.0042732	-1.89992
SLC5A12	1.97E-07	0.0042732	-2.366611
SLC7A9	2.00E-07	0.0043264	-2.008003
MT1F	2.07E-07	0.0044888	-2.189513
SLC27A2	2.07E-07	0.0044888	-2.08448
PEPD	2.28E-07	0.0049445	-2.03111
ATP6V1G3	2.33E-07	0.0050591	-3.239567
RALYL	2.47E-07	0.0053507	-3.660475
ACPP	2.51E-07	0.005434	-2.995437
CLIC5	2.51E-07	0.005434	-2.166733
AGMAT	2.57E-07	0.0055618	-2.172175
SOST	2.61E-07	0.0056533	-3.099937
LINC00645	2.75E-07	0.0059671	-3.193299
PLCL1	2.78E-07	0.0060272	-2.319684
MME	2.78E-07	0.0060272	-2.086422
CYP17A1	2.88E-07	0.0062353	-2.238106
SLC47A2	3.06E-07	0.0066291	-2.8782
FMO1	3.32E-07	0.0072	-2.055695

FAM169A	3.43E-07	0.0074377	-2.197552
PRODH2	3.43E-07	0.0074377	-2.270279
LPPR1	3.47E-07	0.0075182	-2.772715
DPYS	3.54E-07	0.0076812	-2.167162
UPP2	3.56E-07	0.0077111	-2.794842
AOX1	3.78E-07	0.0081861	-1.885688
GSTM3	3.98E-07	0.0086255	-2.163723
GATA3	3.98E-07	0.0086255	-2.330078
CTXN3	4.11E-07	0.0089047	-3.200629
PIPOX	4.15E-07	0.0089896	-2.78988
DCN	4.23E-07	0.0091759	-1.966154
KL	4.59E-07	0.0099502	-2.187749
CHL1	4.68E-07	0.0101513	-2.12606
CORO2B	5.17E-07	0.0112024	-1.781482
TMPRSS2	5.32E-07	0.011533	-2.242153
EPCAM	5.64E-07	0.0122163	-2.471577
CDH16	5.74E-07	0.0124507	-2.207442
CWH43	5.74E-07	0.0124507	-2.263498
KLK1	5.80E-07	0.0125691	-1.9413
MT1H	6.19E-07	0.013422	-2.070257
GGT6	6.35E-07	0.0137602	-2.706129
BHMT	6.66E-07	0.014449	-1.994456
MPPED2	6.85E-07	0.014849	-1.847225
HSPA2	7.10E-07	0.0153951	-2.19101
HS6ST2	7.15E-07	0.0155008	-2.950906
CAPN3	7.17E-07	0.0155339	-1.878915
HADH	7.23E-07	0.0156737	-1.913352
KCNJ15	7.36E-07	0.0159561	-1.960405
DAO	7.36E-07	0.0159561	-2.496216
MT1G	7.49E-07	0.0162423	-2.068359
GRB14	7.63E-07	0.0165324	-2.122586
SLC4A1	7.69E-07	0.0166788	-2.34437
HEPACAM2	7.72E-07	0.0167392	-3.24158
SLC44A4	8.04E-07	0.0174258	-1.810502
HMGCS2	8.39E-07	0.0181976	-1.951932
ANK2	8.61E-07	0.0186728	-1.772605
ERBB4	9.14E-07	0.0198178	-1.938282
FGF1	9.45E-07	0.0204953	-2.779317
ALDH8A1	9.61E-07	0.0208405	-2.166629
GPC5	9.62E-07	0.0208458	-3.226437
SCNN1A	9.94E-07	0.0215439	-2.229127
GK	1.01E-06	0.0219022	-1.575015
HYAL1	1.02E-06	0.022083	-1.568686
ATP6V0D2	1.03E-06	0.0223506	-2.771273

CYP24A1	1.04E-06	0.022448	-1.794136
NOX4	1.04E-06	0.0226322	-1.82919
CTH	1.06E-06	0.023004	-1.514472
MIOX	1.07E-06	0.0231295	-2.574922
CLDN10	1.08E-06	0.0233803	-1.809871
ARG2	1.10E-06	0.0239534	-1.880238
MST1L	1.11E-06	0.0241468	-1.840206
BPHL	1.12E-06	0.0243413	-1.70901
AKR7A3	1.13E-06	0.024537	-1.606421
MTTP	1.14E-06	0.0247339	-2.495126
MUC15	1.14E-06	0.0247409	-2.973386
AP1M2	1.16E-06	0.0251313	-1.695384
CYP4F2	1.18E-06	0.0255739	-3.209358
RGN	1.21E-06	0.0261455	-1.651565
NAP1L2	1.23E-06	0.0267686	-2.166378
ACOX2	1.23E-06	0.0267686	-1.953158
PDE1A	1.27E-06	0.0276167	-1.808258
EPHX2	1.30E-06	0.0282658	-1.689277
RBP4	1.30E-06	0.0282658	-1.806513
RP11-999E24.3	1.34E-06	0.0290926	-2.873693
RHCG	1.38E-06	0.03002	-3.038727
CRYAA	1.38E-06	0.03002	-3.063907
ACAA1	1.40E-06	0.030282	-1.762274
GPD1L	1.51E-06	0.0326467	-1.655589
CRYM	1.52E-06	0.0328906	-1.46971
RNF212B	1.56E-06	0.0339263	-2.604098
FOLR1	1.57E-06	0.0341304	-1.666048
TST	1.62E-06	0.0351473	-1.623348
AOC1	1.63E-06	0.035405	-1.717878
ABCB1	1.63E-06	0.035405	-1.779083
SELENBP1	1.74E-06	0.0377888	-1.525566
OLFM4	1.81E-06	0.0392671	-2.680395
PBLD	1.90E-06	0.041152	-1.906001
IGFBP2	1.90E-06	0.041152	-1.875242
SLC17A1	1.91E-06	0.0414421	-1.600745
ENPP6	1.92E-06	0.0415511	-3.150511
MT1E	1.97E-06	0.0426177	-1.763841
MT1X	2.05E-06	0.0444277	-1.662576
CRHBP	2.08E-06	0.0451402	-2.595646
RAB25	2.14E-06	0.0463809	-2.729915
ELF5	2.16E-06	0.0469301	-1.958689
DMRT2	2.20E-06	0.0476441	-2.454041
SLC7A13	2.26E-06	0.0489301	-3.273216
MAN1C1	2.27E-06	0.0492051	-2.063707

Supplementary Table 2

Correlation analysis for the immune related lncRNAs.

Immune Gene	lncRNA	cor	pvalue	Regulation
VEGFA	AL022328.1	0.540812527	2.86E-42	postive
TYMP	LINC01871	0.508138488	9.99E-37	postive
ISG20	LINC01871	0.567796453	2.50E-47	postive
CCL5	LINC01871	0.625785141	6.20E-60	postive
GZMB	LINC01871	0.558556219	1.52E-45	postive
FCER1G	LINC01871	0.514758382	8.41E-38	postive
VEGFA	AL662844.4	0.559137724	1.18E-45	postive
FGF9	AC104958.2	0.718882773	7.40E-87	postive
DEFB1	AC104958.2	0.509906312	5.19E-37	postive
FGF9	LINC01187	0.864982495	6.10E-163	postive
DEFB1	LINC01187	0.55521758	6.52E-45	postive
EGF	LINC01187	0.574224284	1.33E-48	postive
IL10RA	MIR155HG	0.534038466	4.53E-41	postive
CCL5	MIR155HG	0.6300528	5.73E-61	postive
FGF9	LINC01802	0.54634272	2.87E-43	postive
DEFB1	LINC01802	0.675600914	4.18E-73	postive
EGF	LINC01802	0.645974874	5.63E-65	postive
S100A2	HSD11B1-AS1	0.625938198	5.70E-60	postive
VEGFA	LINC00342	0.538603622	7.10E-42	postive
FGF9	HOXB-AS3	0.611727133	1.23E-56	postive
DEFB1	HOXB-AS3	0.761029298	5.35E-103	postive
FGF9	GATA2-AS1	0.61499606	2.18E-57	postive
DEFB1	GATA2-AS1	0.591568839	3.46E-52	postive
EGF	GATA2-AS1	0.540709987	2.99E-42	postive
FCER1G	AC098613.1	0.529475426	2.81E-40	postive
FLT1	AP001189.3	0.504994532	3.18E-36	postive
FGF9	AC007996.1	0.562322624	2.90E-46	postive
ITGB2	LINC01150	0.558921008	1.30E-45	postive
IL10RA	LINC01150	0.54321618	1.06E-42	postive
HCK	LINC01150	0.571305835	5.08E-48	postive
FCER1G	LINC01150	0.509767654	5.46E-37	postive
DEFB1	AC073896.2	0.60635435	2.03E-55	postive
FGF9	AC006547.1	0.542860526	1.23E-42	postive
VEGFA	AL928654.2	0.595133597	5.96E-53	postive
PSMB8	HCP5	0.565991586	5.64E-47	postive
HLA-DMA	HCP5	0.515694787	5.90E-38	postive
TAP1	HCP5	0.695368147	4.41E-79	postive
PTPRC	HCP5	0.500268625	1.77E-35	postive
C3	AC008760.2	0.540295727	3.54E-42	postive
DEFB1	LMO7-AS1	0.624484327	1.27E-59	postive

VEGFA	AL109811.2	0.53041949	1.93E-40	postive
VEGFA	AC138028.4	0.540369527	3.44E-42	postive
IL10RA	AC138207.5	0.584972121	8.47E-51	postive
DEFB1	ZNF503-AS2	0.564981395	8.87E-47	postive
EGF	LINC00645	0.528367494	4.36E-40	postive
ESRRG	LINC00645	0.588762525	1.36E-51	postive
GMFG	CYTOR	0.536299509	1.82E-41	postive
FLT1	AL158206.1	0.526850886	7.93E-40	postive
TYROBP	PCED1B-AS1	0.723328932	2.04E-88	postive
ITGB2	PCED1B-AS1	0.674308161	9.89E-73	postive
IL10RA	PCED1B-AS1	0.818681212	1.82E-131	postive
HLA-DMA	PCED1B-AS1	0.686623767	2.22E-76	postive
TYMP	PCED1B-AS1	0.604972766	4.13E-55	postive
HCK	PCED1B-AS1	0.604502202	5.26E-55	postive
ISG20	PCED1B-AS1	0.640811625	1.19E-63	postive
CCL5	PCED1B-AS1	0.855352412	1.66E-155	postive
TAP1	PCED1B-AS1	0.625646497	6.70E-60	postive
CXCL9	PCED1B-AS1	0.610462962	2.39E-56	postive
GZMB	PCED1B-AS1	0.554694558	8.17E-45	postive
PTPRC	PCED1B-AS1	0.623676067	1.99E-59	postive
FCER1G	PCED1B-AS1	0.771848621	1.08E-107	postive
BPHL	TMEM246-AS1	0.526202593	1.02E-39	postive
FGF9	AC148477.4	0.626775938	3.58E-60	postive
DEFB1	AC148477.4	0.68685065	1.90E-76	postive
EGF	AC148477.4	0.615255349	1.90E-57	postive
BPHL	AC007406.2	0.515145222	7.27E-38	postive
VEGFA	HIF1A-AS2	0.505335013	2.80E-36	postive
FGF9	AC055720.2	0.676763436	1.92E-73	postive
DEFB1	AC055720.2	0.540579851	3.15E-42	postive
EGF	AC055720.2	0.520802643	8.37E-39	postive
VEGFA	MIR210HG	0.53253073	8.31E-41	postive
VEGFA	AC009084.1	0.566663794	4.17E-47	postive
FGF9	AL606834.1	0.540407443	3.38E-42	postive
BPHL	U91328.1	0.584474111	1.07E-50	postive
VEGFA	LINC01011	0.520619403	8.98E-39	postive
VEGFA	AC090589.3	0.548938525	9.59E-44	postive
FGF9	AC103563.7	0.721660132	7.91E-88	postive
DEFB1	AC103563.7	0.764430941	1.91E-104	postive
EGF	AC103563.7	0.659924054	1.09E-68	postive
ESRRG	AC103563.7	0.508793474	7.84E-37	postive
FGF9	GAS6-DT	0.765216137	8.75E-105	postive
DEFB1	GAS6-DT	0.677166828	1.46E-73	postive
EGF	GAS6-DT	0.607369513	1.20E-55	postive
GMFG	AC011445.2	0.530957254	1.56E-40	postive

S100A2	AC011445.2	0.665272858	3.64E-70	postive
VEGFA	AC022150.2	0.532207947	9.45E-41	postive
TYROBP	LINC01857	0.658031122	3.58E-68	postive
CCL18	LINC01857	0.514030268	1.11E-37	postive
FCER1G	LINC01857	0.646355997	4.49E-65	postive
BPHL	LINC01507	0.599593713	6.39E-54	postive
GMFG	SNHG19	0.547160551	2.03E-43	postive
S100A2	SNHG19	0.701657801	4.36E-81	postive
VEGFA	AC007566.1	0.503019315	6.53E-36	postive
INHBB	AL355803.1	0.524946202	1.67E-39	postive
FLT1	AL355803.1	0.585184928	7.64E-51	postive
DEFB1	SPINT1-AS1	0.715536694	1.06E-85	postive
IL10RA	TNRC6C-AS1	0.538168869	8.48E-42	postive
FGF9	AC021087.4	0.535923045	2.11E-41	postive
DEFB1	AC021087.4	0.574416459	1.22E-48	postive
EGF	AC021087.4	0.54774615	1.59E-43	postive
GMFG	ZSCAN16-AS1	0.553604754	1.31E-44	postive
S100A2	ZSCAN16-AS1	0.675930202	3.35E-73	postive
FGF9	LINC00265	0.614765671	2.46E-57	postive
BPHL	ADAMTS9-AS1	0.514013752	1.11E-37	postive
FGF9	COLCA1	0.52458234	1.93E-39	postive
EGF	COLCA1	0.535129968	2.92E-41	postive
FGF9	LINC00886	0.628156417	1.66E-60	postive
DEFB1	LINC00886	0.580709745	6.43E-50	postive
EGF	LINC00886	0.625609074	6.84E-60	postive
ESRRG	LINC00886	0.615440225	1.72E-57	postive
FGF9	SCAMP1-AS1	0.652265441	1.26E-66	postive
DEFB1	SCAMP1-AS1	0.568383288	1.92E-47	postive
S100A2	AL513165.1	0.648513609	1.23E-65	postive
VEGFA	AL160006.1	0.573317568	2.02E-48	postive
DEFB1	CA3-AS1	0.595211499	5.73E-53	postive
TLR3	WDFY3-AS2	0.515238598	7.01E-38	postive
DEFB1	SEMA3B-AS1	0.6336219	7.59E-62	postive
BPHL	EMX2OS	0.546258211	2.97E-43	postive
IL10RA	HLA-DQB1-AS1	0.525487732	1.35E-39	postive
VEGFA	AL365330.1	0.573238823	2.09E-48	postive
INHBB	AC093278.2	0.51462083	8.86E-38	postive
FLT1	AC093278.2	0.768599698	2.96E-106	postive
S100A2	AC023509.3	0.551094959	3.83E-44	postive
IL10RA	ITGB2-AS1	0.519872398	1.20E-38	postive
TYMP	ITGB2-AS1	0.550389879	5.18E-44	postive
CCL5	ITGB2-AS1	0.517529542	2.94E-38	postive
FGF9	SBF2-AS1	0.687603491	1.12E-76	postive
DEFB1	SBF2-AS1	0.509121082	6.95E-37	postive

ESRRG	SBF2-AS1	0.519789609	1.24E-38	postive
VEGFA	HCG27	0.52153829	6.30E-39	postive
FGF9	AC007637.1	0.539132407	5.71E-42	postive
EGF	AC007637.1	0.507267713	1.38E-36	postive
VEGFA	AL360181.2	0.505071747	3.09E-36	postive
VEGFA	AP001830.1	0.538093199	8.74E-42	postive
FGF9	FGD5-AS1	0.504150883	4.32E-36	postive
DEFB1	AP000894.4	0.511855892	2.51E-37	postive
HSPA2	AC130371.2	0.547951765	1.46E-43	postive
S100A2	AC130371.2	0.609463958	4.03E-56	postive
VEGFA	AL162586.1	0.500551602	1.60E-35	postive
GMFG	AC147067.1	0.589135248	1.13E-51	postive
FGF9	AL138756.1	0.654334658	3.54E-67	postive
EGF	AL138756.1	0.504048707	4.49E-36	postive
TYMP	U62317.2	0.617767659	4.94E-58	postive
INHBB	LINC00987	0.502059122	9.25E-36	postive
FLT1	LINC00987	0.565251815	7.86E-47	postive
TLR3	AP001372.2	0.515131681	7.30E-38	postive
GMFG	AP004609.3	0.557504909	2.41E-45	postive
S100A2	AP004609.3	0.642429867	4.61E-64	postive
VEGFA	AL139287.1	0.627538371	2.34E-60	postive
VEGFA	C1RL-AS1	0.508859824	7.65E-37	postive
PSMB8	PSMB8-AS1	0.665829856	2.54E-70	postive
IL10RA	PSMB8-AS1	0.558978996	1.27E-45	postive
HLA-DMA	PSMB8-AS1	0.628829735	1.14E-60	postive
CCL5	PSMB8-AS1	0.619541114	1.90E-58	postive
TAP1	PSMB8-AS1	0.652391995	1.17E-66	postive
VEGFA	AL731533.2	0.500228852	1.79E-35	postive
S100A2	RTCA-AS1	0.567152295	3.35E-47	postive
VEGFA	TTC28-AS1	0.629134404	9.59E-61	postive
VEGFA	SNHG20	0.582489888	2.77E-50	postive
FGF9	PLBD1-AS1	0.615219095	1.93E-57	postive
EGF	PLBD1-AS1	0.579345617	1.22E-49	postive
FGF9	AC009779.2	0.564402642	1.15E-46	postive
DEFB1	AC009779.2	0.547182467	2.01E-43	postive
EGF	AC009779.2	0.620704268	1.01E-58	postive
FGF9	AL031123.1	0.611005088	1.80E-56	postive
FGF9	PRDM16-DT	0.67362746	1.56E-72	postive
DEFB1	PRDM16-DT	0.752177396	2.44E-99	postive
EGF	PRDM16-DT	0.62570891	6.47E-60	postive
ESRRG	PRDM16-DT	0.528922153	3.50E-40	postive
ITGB2	AC090559.1	0.629052876	1.00E-60	postive
IL10RA	AC090559.1	0.684320025	1.11E-75	postive
HCK	AC090559.1	0.668688167	4.00E-71	postive

PTPRC	AC090559.1	0.643463516	2.50E-64	postive
TYROBP	USP30-AS1	0.612128416	9.96E-57	postive
ITGB2	USP30-AS1	0.588974548	1.23E-51	postive
PSMB8	USP30-AS1	0.627960273	1.85E-60	postive
IL10RA	USP30-AS1	0.66779314	7.15E-71	postive
HLA-DMA	USP30-AS1	0.681597824	7.21E-75	postive
TYMP	USP30-AS1	0.659499939	1.43E-68	postive
HCK	USP30-AS1	0.514071449	1.09E-37	postive
ISG20	USP30-AS1	0.522992694	3.58E-39	postive
CCL5	USP30-AS1	0.742417985	1.76E-95	postive
TAP1	USP30-AS1	0.712863273	8.60E-85	postive
CXCL9	USP30-AS1	0.596951374	2.41E-53	postive
PTPRC	USP30-AS1	0.548063875	1.39E-43	postive
FCER1G	USP30-AS1	0.629577718	7.48E-61	postive
GMFG	AC012510.1	0.547299417	1.92E-43	postive
S100A2	RPARP-AS1	0.602234846	1.68E-54	postive
VEGFA	AC004148.2	0.534069851	4.47E-41	postive
GMFG	PCAT19	0.619742276	1.70E-58	postive
VEGFA	AC060780.1	0.528200104	4.66E-40	postive
S100A2	AC090425.1	0.545028939	4.97E-43	postive
FGF9	AP000757.1	0.660319161	8.51E-69	postive
DEFB1	AP000757.1	0.712093985	1.56E-84	postive
EGF	AP000757.1	0.586265015	4.55E-51	postive
INHBB	AC007998.3	0.568045914	2.24E-47	postive
S100A2	AC087379.2	0.531569567	1.22E-40	postive
VEGFA	AL354733.3	0.544926467	5.19E-43	postive
FGF9	AL035661.1	0.538351691	7.87E-42	postive
DEFB1	AL035661.1	0.750444701	1.22E-98	postive
EGF	AL035661.1	0.650108979	4.69E-66	postive
VEGFA	AC136475.2	0.548721438	1.05E-43	postive
VEGFA	AC110285.2	0.513294947	1.46E-37	postive
VEGFA	PTOV1-AS2	0.513109752	1.57E-37	postive
VEGFA	AC011472.1	0.59138615	3.78E-52	postive
TYROBP	LINC01094	0.524348495	2.11E-39	postive
ITGB2	LINC01094	0.6225054	3.77E-59	postive
IL10RA	LINC01094	0.502512016	7.85E-36	postive
HCK	LINC01094	0.694963453	5.92E-79	postive
PTPRC	LINC01094	0.609259399	4.49E-56	postive
FCER1G	LINC01094	0.631075013	3.22E-61	postive
ITGB2	AL161785.1	0.522015494	5.24E-39	postive
IL10RA	AL161785.1	0.561708978	3.81E-46	postive
HCK	AL161785.1	0.533248678	6.23E-41	postive
FGF9	MAP4K3-DT	0.551886054	2.73E-44	postive
ITGB2	AC145098.1	0.603356094	9.46E-55	postive

IL10RA	AC145098.1	0.661435515	4.21E-69	postive
HCK	AC145098.1	0.619635202	1.80E-58	postive
PTPRC	AC145098.1	0.508314489	9.36E-37	postive
FCER1G	AC145098.1	0.56411292	1.31E-46	postive
VEGFA	AL022328.2	0.580183023	8.24E-50	postive
FGF9	NNT-AS1	0.539178547	5.61E-42	postive
DEFB1	NNT-AS1	0.512531444	1.95E-37	postive
EGF	NNT-AS1	0.532941028	7.05E-41	postive
ESRRG	NNT-AS1	0.537305935	1.21E-41	postive
VEGFA	ARHGAP27P1-BPTFP1-KPNA2P3	0.509682535	5.64E-37	postive
FGF9	OLMALINC	0.615548876	1.62E-57	postive
DEFB1	OLMALINC	0.595127887	5.97E-53	postive
S100A2	ENTPD3-AS1	0.570689947	6.73E-48	postive
GMFG	LINC01023	0.537117465	1.30E-41	postive
S100A2	LINC01023	0.678368208	6.49E-74	postive
VEGFA	AP000355.1	0.531521775	1.24E-40	postive
FGF9	AL031710.1	0.55633222	4.02E-45	postive
DEFB1	AL031710.1	0.874983578	2.69E-171	postive
EGF	AL031710.1	0.580082056	8.65E-50	postive
FLT1	AC096921.2	0.625505868	7.24E-60	postive
VEGFA	AC005104.1	0.505167753	2.98E-36	postive
C3	LINC01426	0.512584997	1.91E-37	postive
PSMB8	AC242842.1	0.511881996	2.48E-37	postive
VEGFA	RUSC1-AS1	0.519614488	1.32E-38	postive
VEGFA	LENG8-AS1	0.535761725	2.26E-41	postive
IL10RA	AL133371.2	0.530405631	1.94E-40	postive
HCK	AL133371.2	0.503888165	4.76E-36	postive
PTPRC	AL133371.2	0.560859052	5.54E-46	postive
S100A2	AP001505.1	0.52558702	1.30E-39	postive
TLR3	AC098484.1	0.501054353	1.33E-35	postive
VEGFA	AL512791.1	0.507614971	1.21E-36	postive
IL10RA	NCK1-DT	0.540202759	3.68E-42	postive
PTPRC	NCK1-DT	0.574605466	1.11E-48	postive
VEGFA	AC018730.1	0.558381928	1.64E-45	postive
VEGFA	AC097534.2	0.531877489	1.08E-40	postive
FGF9	ZNF710-AS1	0.520398564	9.78E-39	postive
EGF	ZNF710-AS1	0.616498357	9.76E-58	postive
ESRRG	ZNF710-AS1	0.560769058	5.76E-46	postive
VEGFA	AC078864.1	0.519744535	1.26E-38	postive
S100A2	AC244090.1	0.657849056	4.01E-68	postive

Supplementary Table 3

The 29 immune signatures represented by 29 different gene sets.

aDCs	CD83, LAMP3, CCL1
APC co inhibition	C10orf54, CD274, LGALS9, PDCD1LG2, PVRL3
APC co stimulation	CD40, CD58, CD70, ICOSLG, SLAMF1, TNFSF14, TNFSF15, TNFSF18, TNFSF4, TNFSF8, TNFSF9
B cells	BACH2, BANK1, BLK, BTLA, CD79A, CD79B, FCRL1, FCRL3, HVCN1, RALGPS2
CCR	CCL16, TPO, TGFB2, CXCL2, CCL14, TGFB3, IL11RA, CCL11, IL4I1, IL33, CXCL12, CXCL10, BMPER, BMP8A, CXCL11, IL21R, IL17B, TNFRSF9, ILF2, CX3CR1, CCR8, TNFSF12, CSF3, TNFSF4, BMP3, CX3CL1, BMP5, CXCR2, TNFRSF10D, BMP2, CXCL14, CCL28, CXCL3, BMP6, CCL21, CXCL9, CCL23, IL6, TNFRSF18, IL17RD, IL17D, IL27, CCL7, IL1R1, CXCR4, CXCR2P1, TGFB1I1, IFNGR1, IL9R, IL1RAPL1, IL11, CSF1, IL20RA, IL25, TNFRSF4, IL18, ILF3, CCL20, TNFRSF12A, IL6ST, CXCL13, IL12B, TNFRSF8, IL6R, BMPR2, IFNE, IL1RAPL2, IL3RA, BMP4, CCL24, TNFSF13B, CCR4, IL2RA, IL32, TNFRSF10C, IL22RA1, BMPR1A, CXCR5, CXCR3, IFNA8, IL17REL, IFNB1, IFNAR1, TNFRSF1B, CCL17, IFNL1, IL16, IL1RL1, ILK, CCL25, ILDR2, CXCR1, IL36RN, IL34, TGFB1, IFNG, IL19, ILKAP, BMP2K, CCR10, ILDR1, EPO, CCR7, IL17C, IL23A, CCR5, IL7, EPOR, CCL13, IL2RG, IL31RA, TNFAIP6, IFNL2, BMP1, IL12RB1, TNFAIP8, IL4R, TNFRSF6B, TNFAIP8L1, TNFRSF10B
CD8+ T cells	CD8A
Check-point	<i>IDO1, LAG3, CTLA4, TNFRSF9, ICOS, CD80, PDCD1LG2, TIGIT, CD70, TNFSF9, ICOSLG, KIR3DL1, CD86, PDCD1, LAIR1, TNFRSF8, TNFSF15, TNFRSF14, IDO2, CD276, CD40, TNFRSF4, TNFSF14, HHLA2, CD244, CD274, HAVCR2, CD27, BTLA, LGALS9, TMIGD2, CD28, CD48, TNFRSF25, CD40LG, ADORA2A, VTCN1, CD160, CD44, TNFSF18, TNFRSF18, BTNL2, C10orf54, CD200R1, TNFSF4, CD200, NRPI</i>
Cytolytic activity	<i>PRF1, GZMA</i>
DCs	<i>CCL17, CCL22, CD209, CCL13</i>
HLA	<i>HLA-E, HLA-DPB2, HLA-C, HLA-J, HLA-DQB1, HLA-DQB2, HLA-DQA2, HLA-DQAI, HLA-A, HLA-DMA, HLA-DOB, HLA-DRB1, HLA-H, HLA-B, HLA-DRB5, HLA-DOA, HLA-DPB1, HLA-DRA, HLA-DRB6, HLA-L, HLA-F, HLA-G, HLA-DMB, HLA-DPA1</i>
Inflammation-promoting	<i>CCL5, CD19, CD8B, CXCL10, CXCL13, CXCL9, GNLV, GZMB, IFNG, IL12A, IL12B, IRF1, PRF1, STAT1, TBX21</i>
Macrophages	<i>C11orf45, CD68, CLEC5A, CYBB, FUCA1, GPNMB, HS3ST2, LGMN, MMP9, TM4SF19</i>
MHC class I	<i>B2M, HLA-A, TAP1</i>
Neutrophils	<i>EVI2B, HSD17B11, KDM6B, MEGF9, MNDA, NLRP12, PADI4, SELL, TRANK1, VNN3</i>
NK cells	<i>KLRC1, KLRF1</i>
Parainflammation	<i>CXCL10, PLAT, CCND1, LGMN, PLAUR, AIM2, MMP7, ICAM1, MX2, CXCL9, ANXA1, TLR2, PLA2G2D, ITGA2, MX1, HMOX1, CD276, TIRAP, IL33, PTGES, TNFRSF12A, SCARB1, CD14, BLNK, IFIT3, RETNLB, IFIT2, ISG15, OAS2, REL, OAS3, CD44, PPARG, BST2, OAS1, NOX1, PLA2G2A, IFIT1, IFITM3, ILIRN</i>
pDCs	<i>CLEC4C, CXCR3, GZMB, IL3RA, IRF7, IRF8, LILRA4, PHEX, PLD4, PTCRA</i>

T cell co-inhibition	<i>BTLA, C10orf54, CD160, CD244, CD274, CTLA4, HAVCR2, LAG3, LAIR1, TIGIT</i>
T cell co-stimulation	CD2, CD226, CD27, CD28, CD40LG, ICOS, SLAMF1, TNFRSF18, TNFRSF25, TNFRSF4, TNFRSF8, TNFRSF9, TNFSF14
T helper cells	CD4
Tfh	PDCD1
Th1 cells	IFNG, TBX21, CTLA4, STAT4, CD38, IL12RB2, LTA, CSF2
Th2 cells	PMCH, LAIR2, SMAD2, CXCR6, GATA3, IL26
TIL	ITM2C, CD38, THEMIS2, GLYR1, ICOS, F5, TIGIT, KLRD1, IRF4, PRKCQ, FCRL5, SIRPG, LPXN, IL2RG, CCL5, LCK, TRAF3IP3, CD86, MAL, LILRB1, DOK2, CD6, PAG1, LAX1, PLEK, PIK3CD, SLAMF1, XCL1, GPR171, XCL2, TBX21, CD2, CD53, KLHL6, SLAMF6, CD40, SIT1, TNFRSF4, CD79A, CD247, LCP2, CD3D, CD27, SH2D1A, FYB, ARHGAP30, ACAP1, CST7, CD3G, IL2RB, CD3E, FCRL3, CORO1A, ITK, TCL1A, CYBB, CSF2RB, IKZF1, NCF4, DOCK2, CCR2, PTPRC, PLAC8, NCKAP1L, IL7R, 6-Sep, CD28, STAT4, CD8A, LY9, CD48, HCST, PTPRCAP, SASH3, ARHGAP25, LAT, TRAT1, IL10RA, PAX5, CCR7, DOCK11, PARVG, SPNS1, CD52, HCLS1, ARHGAP9, GIMAP6, PRKCB, MS4A1, GPR18, TBC1D10C, GVINP1, P2RY8, EVI2B, VAMP5, KLRK1, SELL, MPEG1, MS4A6A, ARHGAP15, MFNG, GZMK, SELPLG, TARP, GIMAP7, FAM65B, INPP5D, ITGA4, MZB1, GPSM3, STK10, CLEC2D, IL16, NLRC3, GIMAP5, GIMAP4, IFFO1, CFH, PVRIG, CFHR1
Treg	IL12RB2, TMPRSS6, CTSC, LAPTM4B, TFRC, RNF145, NETO2, ADAT2, CHST2, CTLA4, NFE2L3, LIMA1, IL1R2, ICOS, HSDL2, HTATIP2, FKBP1A, TIGIT, CCR8, LTA, SLC35F2, IL21R, AHCYL1, SOCS2, ETV7, BCL2L1, RRAGB, ACSL4, CHRNA6, BATF, LAX1, ADPRH, TNFRSF4, ANKRD10, CD274, CASP1, LY75, NPTN, SSTR3, GRSF1, CSF2RB, TMEM184C, NDFIP2, ZBTB38, ERI1, TRAF3, NAB1, HS3ST3B1, LAYN, JAK1, VDR, LEPROT, GCNT1, PTPRJ, IKZF2, CSF1, ENTPD1, TNFRSF18, METTL7A, KSR1, SSH1, CADM1, IL1R1, ACP5, CHST7, THADA, CD177, NFAT5, ZNF282, MAGEH1
Type I IFN Reponse	DDX4, IFIT1, IFIT2, IFIT3, IRF7, ISG20, MX1, MX2, RSAD2, TNFSF10
Type II IFN Reponse	GPR146, SELP, AHR
iDCs	CD1A, CD1E
Mast cells	CMA1, MS4A2, TPSAB1
