

**Table S1 The 33 immune signatures represented by 33 different immune gene sets**

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| aDCs               | CD83 LAMP3 CCL1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| APC co inhibition  | C10orf54 CD274 LGALS9 PDCD1LG2 PVRL3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| APC co stimulation | CD40 CD58 CD70 ICOSLG SLAMF1 TNFSF14<br>TNFSF15 TNFSF18 TNFSF4 TNFSF8 TNFSF9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| B cells            | BACH2 BANK1 BLK BTLA CD79A CD79B<br>FCRL1 FCRL3 HVCN1 RALGPS2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| CCR                | CCL16 TPO TGFBR2 CXCL2 CCL14 TGFBR3<br>IL11RA CCL11 IL4I1 IL33 CXCL12 CXCL10<br>BMPER BMP8A CXCL11 IL21R IL17B TNFRSF9<br>ILF2 CX3CR1CCR8 TNFSF12 CSF3 TNFSF4 BMP3<br>CX3CL1 BMP5 CXCR2 TNFRSF10D BMP2 CXCL14<br>CCL28 CXCL3 BMP6 CCL21 CXCL9 CCL23 IL6<br>TNFRSF18 IL17RD IL17D IL27CCL7 IL1R1<br>CXCR4 CXCR2P1 TGFB1I1 IFNGR1 IL9R<br>IL1RAPL1 IL11 CSF1 IL20RA IL25 TNFRSF4<br>IL18 ILF3 CCL20 TNFRSF12A IL6ST CXCL13<br>IL12B TNFRSF8 IL6R BMPR2 IFNE IL1RAPL2 IL3RA<br>BMP4 CCL24 TNFSF13B CCR4 IL2RA IL32<br>TNFRSF10C IL22RA1 BMPR1A CXCR5 CXCR3<br>IFNA8 IL17REL IFNB1 IFNAR1 TNFRSF1B CCL17<br>IFNL1 IL16IL1RL1 ILK CCL25 ILDR2 CXCR1<br>IL36RN IL34TGFB1 IFNG IL19ILKAP BMP2K<br>CCR10 ILDR1 EPOCCR7 IL17C IL23A CCR5 IL7<br>EPOR CCL13 IL2RG IL31RA TNFAIP6 IFNL2<br>BMP1 IL12RB1 TNFAIP8 IL4R TNFRSF6B<br>TNFAIP8L1 TNFRSF10B IFNL3 CCL5 CXCL6 CXCL1<br>CCR3 TNFSF11 CSF1R IL21 IL1RAP IL12RB2<br>CCL1 IL17RA CCR1 IL1RN TNFRSF11B TNFRSF14<br>IL13IL2RB BMP8B CCL2 IL24 IL18RAP TGFB1<br>TNFSF10 TNFRSF11A CXCL5 IL5RA TNFSF9<br>IL1RL2 TNFRSF13C IL36G IL15RA TNFRSF21<br>CXCL8 IL22RA2 TNFAIP8L2 IL18R1 IFNLR1<br>CXCR6 CCL3L3 TNFRSF1A IL17RE IFNGR2 IL17RC<br>TNFAIP8L3 ILVBL TGFBRAP1 CCL4L1 CSF2RA<br>CCRN4L CCL26 TNFAIP1 CCRL2 IFNA10<br>TNFRSF17 IFNA13 IL20IL18BP CCL3L1<br>TNFSF12-TNFSF13 IL5 IL23R IL26 TNF TGFA<br>CSF2 IL1F10 CXCL17 TNFSF13 IFNA4 IL37<br>IL12A IL7R IFNA1 IL1A IL4 IL2 CCL22 CSF3R<br>IL10IFNK TGFB2 IL1R2 IL1B IL17F IL27RA<br>IL15 TNFSF8 IL36B XCL1 CXCL16 TNFRSF19 IL3<br>CCL3 IFNA2 BMPR1B IFNA21 TNFSF18 CCL8 |

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|                         | IL17RB TNFRSF25 IL22 IL10RB IFNAR2 CCL18<br>IFNA16 CSF2RB IL36A TNFAIP3 IL13RA2<br>IL13RA1 CCR9 TNFRSF10A IFNA7 IFNW1 XCL2<br>TNFSF14 CCR2 BMP15 BMP10 CCL15-CCL14<br>TGFB1 IFNA5 BMP7 IFNA14 IL20RB IL10RA<br>IFNA17 CCR6 TGFB3 CCL15 CCL4 CCL27<br>TNFRSF13B TNFAIP2 IL31 IL17A TNFSF15 CCL19<br>IFNA6 IL9                                |
| CD4+ Regulatory T cells | IL32 CTLA4 FOXP3 C15orf53 GPR15 IL4 IL5                                                                                                                                                                                                                                                                                                     |
| CD8+ T cells            | CD8A                                                                                                                                                                                                                                                                                                                                        |
| Immune cell infiltrate  | CSF2 CD57 CD1A CD3FOXP3 CXCR5 CD20<br>CD45RO IL17A CD68 CD8A IL3RA ENG PDPN<br>TPSB2                                                                                                                                                                                                                                                        |
| Immune Check-point      | IDO1 LAG3 CTLA4 TNFRSF9 ICOS CD80<br>PDCD1LG2 TIGIT CD70 TNFSF9 ICOSLG<br>KIR3DL1 CD86 PDCD1 LAIR1 TNFRSF8<br>TNFSF15 TNFRSF14 IDO2 CD276 CD40<br>TNFRSF4 TNFSF14 HHLA2 CD244 CD274<br>HAVCR2 CD27 BTLA LGALS9 TMIGD2 CD28<br>CD48 TNFRSF25 CD40LG ADORA2A VTCN1 CD160<br>CD44 TNFSF18 TNFRSF18 BTNL2 C10orf54<br>CD200R1 TNFSF4 CD200 NRP1 |
| Cytolytic activity      | PRF1 GZMA                                                                                                                                                                                                                                                                                                                                   |
| DCs                     | CCL17 CCL22 CD209 CCL13                                                                                                                                                                                                                                                                                                                     |
| HLA                     | HLA-E HLA-DPB2 HLA-C HLA-J HLA-DQB1<br>HLA-DQB2 HLA-DQA2 HLA-DQA1 HLA-A<br>HLA-DMA HLA-DOB HLA-DRB1 HLA-H HLA-B<br>HLA-DRB5 HLA-DOA HLA-DPB1 HLA-DRA<br>HLA-DRB6 HLA-L HLA-F HLA-G HLA-DMB<br>HLA-DPA1                                                                                                                                      |
| iDCs                    | CD1A CD1E                                                                                                                                                                                                                                                                                                                                   |
| Inflammation-promoting  | CCL5 CD19 CD8B CXCL10 CXCL13 CXCL9<br>GNLY GZMB IFNG IL12A IL12B IRF1 PRF1<br>STAT1 TBX21                                                                                                                                                                                                                                                   |
| Macrophages             | C11orf45 CD68 CLEC5A CYBB FUCA1 GPNMB<br>HS3ST2 LGMN MMP9 TM4SF19                                                                                                                                                                                                                                                                           |
| Mast cells              | CMA1 MS4A2 TPSAB1                                                                                                                                                                                                                                                                                                                           |
| Metastasis inhibiting   | IRF1 PIK3CG FAM108A1 SLC9A3R2 RNF10<br>IRF7 ATPBD4                                                                                                                                                                                                                                                                                          |
| Metastasis-promoting    | CYBA SPNS2 NCF2 ARHGEF1 BACH2 CYBB<br>HSP90AA1 TBC1D22A FBXO7 LRIG1 NBEAL2<br>ENTPD1 FAM175B C17orf62 GRSF1                                                                                                                                                                                                                                 |
| MHC class I             | B2M HLA-A TAP1                                                                                                                                                                                                                                                                                                                              |

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| Neutrophils           | EVI2B HSD17B11 KDM6B MEGF9 MNDA NLRP12<br>PADI4 SELL TRANK1 VNN3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| NK cells              | KLRC1 KLRF1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Parainflammation      | CXCL10 PLAT CCND1 LGMN PLAUR AIM2 MMP7<br>ICAM1 MX2 CXCL9 ANXA1 TLR2 PLA2G2D<br>ITGA2 MX1 HMOX1 CD276 TIRAP IL33 PTGES<br>TNFRSF12A SCARB1 CD14 BLNK IFIT3 RETNLB<br>IFIT2 ISG15 OAS2 REL OAS3 CD44 PPARG<br>BST2 OAS1 NOX1 PLA2G2A IFIT1 IFITM3<br>IL1RN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| pDCs                  | CLEC4C CXCR3 GZMB IL3RA IRF7 IRF8 LILRA4<br>PHEX PLD4 PTCRA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| T cell co-inhibition  | BTLA C10orf54 CD160 CD244 CD274 CTLA4<br>HAVCR2 LAG3 LAIR1 TIGIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| T cell co-stimulation | CD2 CD226 CD27 CD28 CD40LG ICOS<br>SLAMF1 TNFRSF18 TNFRSF25 TNFRSF4 TNFRSF8<br>TNFRSF9 TNFSF14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| T helper cells        | CD4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Tfh                   | PDCD1 CXCL13 CXCR5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Th1 cells             | IFNG TBX21 CTLA4 STAT4 CD38 IL12RB2<br>LTACSF2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Th2 cells             | PMCH LAIR2 SMAD2 CXCR6 GATA3 IL26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| TIL                   | ITM2C CD38 THEMIS2 GLYR1 ICOS F5<br>TIGIT KLRD1 IRF4 PRKCQ FCRL5 SIRPG LPXN<br>IL2RG CCL5 LCK TRAF3IP3 CD86 MAL<br>LILRB1 DOK2 CD6PAG1 LAX1 PLEK PIK3CD<br>SLAMF1 XCL1 GPR171 XCL2 TBX21 CD2 CD53<br>KLHL6 SLAMF6 CD40 SIT1 TNFRSF4 CD79A<br>CD247 LCP2 CD3D CD27 SH2D1A FYBARHGAP30<br>ACAP1 CST7 CD3G IL2RB CD3E FCRL3<br>CORO1A ITKN TCL1A CYBB CSF2RB IKZF1 NCF4<br>DOCK2 CCR2 PTPRC PLAC8 NCKAP1L IL7R<br>CD28 STAT4 CD8A LY9 CD48 HCST PTPRCAP<br>SASH3 ARHGAP25 LATTRAT1 IL10RA PAX5<br>CCR7 DOCK11 PARVG SPNS1 CD52 HCLS1<br>ARHGAP9 GIMAP6 PRKCB MS4A1 GPR18<br>TBC1D10C GVINP1 P2RY8 EVI2B VAMP5 KLRK1<br>SELL MPEG1 MS4A6A ARHGAP15 MFNG GZMK<br>SELPLG TARP GIMAP7 FAM65B INPP5D ITGA4<br>MZB1 GPSM3 STK10 CLEC2D IL16NLRC3<br>GIMAP5 GIMAP4 IFFO1 CFHPVRIG CFHR1 |
| Treg                  | IL12RB2 TMPRSS6 CTSC LAPTM4B TFRC<br>RNF145 NETO2 ADAT2 CHST2 CTLA4 NFE2L3<br>LIMA1 IL1R2 ICOS HSDL2 HTATIP2 FKBP1A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

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|                     | TIGIT CCR8 LTASLC35F2IL21R AHCYL1 SOCS2<br>ETV7 BCL2L1 RRAGB ACSL4 CHRNA6 BATF LAX1<br>ADPRH TNFRSF4 ANKRD10 CD274 CASP1 LY75<br>NPTN SSTR3 GRSF1 CSF2RB TMEM184C NDFIP2<br>ZBTB38 ERI1 TRAF3 NAB1 HS3ST3B1 LAYN JAK1<br>VDR LEPROT GCNT1 PTPRJ IKZF2 CSF1<br>ENTPD1 TNFRSF18 METTL7A KSR1 SSH1<br>CADM1 IL1R1 ACP5 CHST7 THADA CD177<br>NFAT5 ZNF282 MAGEH1 |
| Type I IFN Reponse  | DDX4 IFIT1 IFIT2 IFIT3 IRF7 ISG20 MX1<br>MX2 RSAD2 TNFSF10                                                                                                                                                                                                                                                                                                   |
| Type II IFN Reponse | GPR146 SELP AHR                                                                                                                                                                                                                                                                                                                                              |