

Table S1. Details of panel used for CyTOF on PBMC in study patients.

Target	Source	Cat #
CD45	Fluidigm	3089003B
CD8a	Fluidigm	3146001B
Ki67	Fluidigm	3168007B
CD86	BioLegend	305402
CD3	Fluidigm	3141019B
CD19	Fluidigm	3142001B
CD117	Fluidigm	3143001B
CD11b	Fluidigm	3144001B
CD4	Fluidigm	3145001B
CD11c	Fluidigm	3147008B
CD14	Fluidigm	3148010B
FcER1	Fluidigm	3150027B
CD123	Fluidigm	3151001B
gdTCR	Fluidigm	3152008B
CD45RA	Fluidigm	3153001B
TIM3	Fluidigm	3154010B
CD64	BioLegend	305002
PD-L1 (CD274)	Fluidigm	3156026B
CD27	Fluidigm	3158010B
Tbet	Fluidigm	3160010B
CD152 (CTLA-4)	Fluidigm	3161004B
Foxp3	Fluidigm	3162011A
CD33	Fluidigm	3163023B
CD45RO	Fluidigm	3164007B
CD127	Fluidigm	3165008B
CCR7 (CD197)	Fluidigm	3167009A
ICOS (CD278)	Fluidigm	3168024B
CD25	Fluidigm	3169003B
TCR Va24-Ja18 (iNKT cell)	Fluidigm	3170015B
CD40	BioLegend	334302
CD38	Fluidigm	3172007B
CD192 (CCR2)	BioLegend	357202
HLA-DR	Fluidigm	3174001B
PD-1	Fluidigm	3175008B

CD56	Fluidigm	3176088B
CD16	Fluidigm	3209002B

Immune populations were defined as following, after gating for live singlets(24): CD4 and CD8 T naïve, effector and memory populations were identified based on CD45RA vs CCR7 expression, Tregs were identified based on FoxP3 expression. B cells were identified based on CD19 expression and further distinguished in memory vs naïve vs plasmablast based on expression of CD38 vs CD27. NK cells were identified based on CD56 expression and further subdivided based on CD56 vs CD16 expression. Monocytes were identified based on expression of CD14 and HLA-DR and further subdivided in classical, non-classical and intermediate based on the expression of CD14 vs CD16. Dendritic cells were defined as CD14 and CD16 negative monocytes and further distinguish between myeloid and plasmacytoid based on expression of CD11c vs CD123.

Table S2. RNA signatures used to evaluate patterns of CB in patients treated with ipilimumab-based therapy that previously progressed on PD-1

Signature	Genes
myeloid	ARG1
myeloid	NOS2
myeloid	CXCL3
myeloid	CXCL2
myeloid	CSF1R
myeloid	CCR2
myeloid	CXCR2
myeloid	CCR5
tcf7	NSG2
tcf7	TNFSF11
tcf7	ID3
tcf7	SOSTDC1
tcf7	CD22
tcf7	TCF7
tcf7	CD83
tcf7	SLFN5
tcf7	XCL1
tcf7	LRIG1
tcf7	MNDA
tcf7	IFI205
tcf7	PLAGL1
tcf7	CXCR5
tcf7	SLAMF6
tcf7	GPR183
tcf7	TNFRSF25
tcf7	NT5E
tcf7	ZBTB18

tcf7	CCR6
tcf7	CPNE3
tcf7	SOX4
tcf7	MYB
tcf7	SH3BP5
tcf7	CRTAM
tcf7	MS4A4C
tcf7	KBTBD11
tcf7	CXCL10
tcf7	H2-OB
tcf7	P2RX7
tcf7	WIPF3
tcf7	CD2AP
tcf7	IL7R
tcf7	AFF3
tcf7	OASL2
tcf7	GPM6B
tcf7	ST6GAL1
tcf7	CD200
tcf7	CAMSAP2
tcf7	DAPL1
tcf7	SELL
tcf7	SPOCK2
tcf7	H2-OA
tcf7	1700019D03RIK
tcf7	TESPA1
tcf7	SYNPO
tcf7	TMEM180
tcf7	BCL6
tcf7	HGSNAT
tcf7	ADK
tcf7	TNFSF14
tcf7	BTLA
tcf7	CXCR4
tcf7	CES2D-PS
tcf7	CES2C
tcf7	SATB1
tcf7	EMB
tcf7	TGFBR3

tcf7	ARHGAP5
tcf7	KLRB1F
tcf7	GPR18
tcf7	FAM43A
tcf7	TLR3
tcf7	CLDN10
tcf7	POU2AF1
tcf7	ABCA1
tcf7	HECTD2
tcf7	ASAP1
tcf7	PTGFRN
tcf7	FAM84A
tcf7	AFAP1
tcf7	GUCY1A3
tcf7	DSCAM
tcf7	KRT10
tcf7	PLXDC2
tcf7	FHIT
tcf7	GALNT9
tcf7	CD24A
tcf7	SH2B3
tcf7	IGF1R
tcf7	CD81
tcf7	LEF1
tcf7	GSTK1
tcf7	EFNB2
tcf7	ART3
tcf7	CCR7
tcf7	FAM213A
tcf7	LTA
tcf7	AI956758
tcf7	CPQ
tcf7	HMG3
tcf7	NTRK3
tcf7	DZIP1
tcf7	ZSCAN12
tcf7	PECAM1
tcf7	SERPINA9
tcf7	DDC

tcf7	GM2663
tcf7	1810009J06RIK
tcf7	CNN3
tcf7	TDRP
tcf7	A930041H05RIK
tcf7	RNF157
tcf7	TIAM1
tcf7	JUN
tcr	AKT1
tcr	AKT2
tcr	AKT3
tcr	BCL10
tcr	CARD11
tcr	CBL
tcr	CBLB
tcr	CBLC
tcr	CD247
tcr	CD28
tcr	CD3D
tcr	CD3E
tcr	CD3G
tcr	CD4
tcr	CD40LG
tcr	CD8A
tcr	CD8B
tcr	CDC42
tcr	CDK4
tcr	CHP1
tcr	CHP2
tcr	CHUK
tcr	CSF2
tcr	CTLA4
tcr	DLG1
tcr	FOS
tcr	FYN
tcr	GRAP2
tcr	GRB2
tcr	GSK3B
tcr	HRAS

tcr	ICOS
tcr	IFNG
tcr	IKBKB
tcr	IKBKG
tcr	IL10
tcr	IL2
tcr	IL4
tcr	IL5
tcr	ITK
tcr	JUN
tcr	KRAS
tcr	LAT
tcr	LCK
tcr	LCP2
tcr	MALT1
tcr	MAP2K1
tcr	MAP2K2
tcr	MAP2K7
tcr	MAP3K14
tcr	MAP3K7
tcr	MAP3K8
tcr	MAPK1
tcr	MAPK11
tcr	MAPK12
tcr	MAPK13
tcr	MAPK14
tcr	MAPK3
tcr	MAPK9
tcr	NCK1
tcr	NCK2
tcr	NFAT5
tcr	NFATC1
tcr	NFATC2
tcr	NFATC3
tcr	NFATC4
tcr	NFKB1
tcr	NFKBIA
tcr	NFKBIB
tcr	NFKBIE

tcr	NRAS
tcr	PAK1
tcr	PAK2
tcr	PAK3
tcr	PAK4
tcr	PAK5
tcr	PAK6
tcr	PDCD1
tcr	PDPK1
tcr	PIK3CA
tcr	PIK3CB
tcr	PIK3CD
tcr	PIK3CG
tcr	PIK3R1
tcr	PIK3R2
tcr	PIK3R3
tcr	PIK3R5
tcr	PLCG1
tcr	PPP3CA
tcr	PPP3CB
tcr	PPP3CC
tcr	PPP3R1
tcr	PPP3R2
tcr	PRKCQ
tcr	PTPN6
tcr	PTPRC
tcr	RAF1
tcr	RASGRP1
tcr	RELA
tcr	RHOA
tcr	SOS1
tcr	SOS2
tcr	TEC
tcr	TNF
tcr	VAV1
tcr	VAV2
tcr	VAV3
tcr	ZAP70
ifna	AC004551.1

ifna	ADAR
ifna	B2M
ifna	BATF2
ifna	BST2
ifna	C1S
ifna	CASP1
ifna	CASP8
ifna	CCRL2
ifna	CD47
ifna	CD74
ifna	CMPK2
ifna	CMTR1
ifna	CNP
ifna	CSF1
ifna	CXCL10
ifna	CXCL11
ifna	DDX60
ifna	DHX58
ifna	EIF2AK2
ifna	ELF1
ifna	EPSTI1
ifna	GBP2
ifna	GBP4
ifna	GMPR
ifna	HELZ2
ifna	HERC6
ifna	HLA-C
ifna	IFI27
ifna	IFI30
ifna	IFI35
ifna	IFI44
ifna	IFI44L
ifna	IFIH1
ifna	IFIT2
ifna	IFIT3
ifna	IFITM1
ifna	IFITM2
ifna	IFITM3
ifna	IL15

ifna	IL4R
ifna	IL7
ifna	IRF1
ifna	IRF2
ifna	IRF7
ifna	IRF9
ifna	ISG15
ifna	ISG20
ifna	LAMP3
ifna	LAP3
ifna	LGALS3BP
ifna	LPAR6
ifna	LY6E
ifna	MOV10
ifna	MVB12A
ifna	MX1
ifna	NCOA7
ifna	NMI
ifna	NUB1
ifna	OASL
ifna	OGFR
ifna	PARP12
ifna	PARP14
ifna	PARP9
ifna	PLSCR1
ifna	PNPT1
ifna	PROCR
ifna	PSMA3
ifna	PSMB8
ifna	PSMB9
ifna	PSME1
ifna	PSME2
ifna	RIPK2
ifna	RNF31
ifna	RSAD2
ifna	RTP4
ifna	SAMD9
ifna	SAMD9L
ifna	SELL

ifna	SLC25A28
ifna	SP110
ifna	STAT2
ifna	TAP1
ifna	TDRD7
ifna	TENT5A
ifna	TMEM140
ifna	TRAFD1
ifna	TRIM14
ifna	TRIM21
ifna	TRIM25
ifna	TRIM26
ifna	TRIM5
ifna	TXNIP
ifna	UBA7
ifna	UBE2L6
ifna	USP18
ifna	WARS
ifng	ACVR1
ifng	APC
ifng	ARID4B
ifng	BCAR3
ifng	BMP2
ifng	BMPR1A
ifng	BMPR2
ifng	CDH1
ifng	CDK9
ifng	CDKN1C
ifng	CTNNB1
ifng	ENG
ifng	FKBP1A
ifng	FNTA
ifng	FURIN
ifng	HDAC1
ifng	HIPK2
ifng	ID1
ifng	ID2
ifng	ID3
ifng	IFNGR2

ifng	JUNB
ifng	KLF10
ifng	LEFTY2
ifng	LTBP2
ifng	MAP3K7
ifng	NCOR2
ifng	NOG
ifng	PMEPA1
ifng	PPM1A
ifng	PPP1CA
ifng	PPP1R15A
ifng	RAB31
ifng	RHOA
ifng	SERPINE1
ifng	SKI
ifng	SKIL
ifng	SLC20A1
ifng	SMAD1
ifng	SMAD3
ifng	SMAD6
ifng	SMAD7
ifng	SMURF1
ifng	SMURF2
ifng	SPTBN1
ifng	TGFB1
ifng	TGFBR1
ifng	TGIF1
ifng	THBS1
ifng	TJP1
ifng	TRIM33
ifng	UBE2D3
ifng	WWTR1
ifng	XIAP
antigen.proc	B2M
antigen.proc	CALR
antigen.proc	CANX
antigen.proc	CD4
antigen.proc	CD74
antigen.proc	CD8A

antigen.proc	CD8B
antigen.proc	CIITA
antigen.proc	CREB1
antigen.proc	CTSB
antigen.proc	CTSL
antigen.proc	CTSS
antigen.proc	HLA-A
antigen.proc	HLA-B
antigen.proc	HLA-C
antigen.proc	HLA-DMA
antigen.proc	HLA-DMB
antigen.proc	HLA-DOA
antigen.proc	HLA-DOB
antigen.proc	HLA-DPA1
antigen.proc	HLA-DPB1
antigen.proc	HLA-DQA1
antigen.proc	HLA-DQA2
antigen.proc	HLA-DQB1
antigen.proc	HLA-DRA
antigen.proc	HLA-DRB1
antigen.proc	HLA-DRB3
antigen.proc	HLA-DRB4
antigen.proc	HLA-DRB5
antigen.proc	HLA-E
antigen.proc	HLA-F
antigen.proc	HLA-G
antigen.proc	HSP90AA1
antigen.proc	HSP90AB1
antigen.proc	HSPA1A
antigen.proc	HSPA1B
antigen.proc	HSPA1L
antigen.proc	HSPA2
antigen.proc	HSPA4
antigen.proc	HSPA5
antigen.proc	HSPA6
antigen.proc	HSPA8
antigen.proc	IFI30
antigen.proc	IFNA1
antigen.proc	IFNA10

antigen.proc	IFNA13
antigen.proc	IFNA14
antigen.proc	IFNA16
antigen.proc	IFNA17
antigen.proc	IFNA2
antigen.proc	IFNA21
antigen.proc	IFNA4
antigen.proc	IFNA5
antigen.proc	IFNA6
antigen.proc	IFNA7
antigen.proc	IFNA8
antigen.proc	KIR2DL1
antigen.proc	KIR2DL2
antigen.proc	KIR2DL3
antigen.proc	KIR2DL4
antigen.proc	KIR2DL5A
antigen.proc	KIR2DS1
antigen.proc	KIR2DS3
antigen.proc	KIR2DS4
antigen.proc	KIR2DS5
antigen.proc	KIR3DL1
antigen.proc	KIR3DL2
antigen.proc	KIR3DL3
antigen.proc	KLRC1
antigen.proc	KLRC2
antigen.proc	KLRC3
antigen.proc	KLRC4
antigen.proc	KLRD1
antigen.proc	LGMN
antigen.proc	LTA
antigen.proc	NFYA
antigen.proc	NFYB
antigen.proc	NFYC
antigen.proc	PDIA3
antigen.proc	PSME1
antigen.proc	PSME2
antigen.proc	PSME3
antigen.proc	RFX5
antigen.proc	RFXANK

antigen.proc	RFXAP
antigen.proc	TAP1
antigen.proc	TAP2
antigen.proc	TAPBP
vegf	AKT1
vegf	AKT2
vegf	AKT3
vegf	BAD
vegf	CASP9
vegf	CDC42
vegf	CHP1
vegf	CHP2
vegf	HRAS
vegf	HSPB1
vegf	JMJD7-
vegf	PLA2G4B
vegf	KDR
vegf	KRAS
vegf	MAP2K1
vegf	MAP2K2
vegf	MAPK1
vegf	MAPK11
vegf	MAPK12
vegf	MAPK13
vegf	MAPK14
vegf	MAPK3
vegf	MAPKAPK2
vegf	MAPKAPK3
vegf	NFAT5
vegf	NFATC1
vegf	NFATC2
vegf	NFATC3
vegf	NFATC4
vegf	NOS3
vegf	NRAS
vegf	PIK3CA
vegf	PIK3CB
vegf	PIK3CD
vegf	PIK3CG

vegf	PIK3R1
vegf	PIK3R2
vegf	PIK3R3
vegf	PIK3R5
vegf	PLA2G10
vegf	PLA2G12A
vegf	PLA2G12B
vegf	PLA2G1B
vegf	PLA2G2A
vegf	PLA2G2C
vegf	PLA2G2D
vegf	PLA2G2E
vegf	PLA2G2F
vegf	PLA2G3
vegf	PLA2G4A
vegf	PLA2G4B
vegf	PLA2G4E
vegf	PLA2G5
vegf	PLA2G6
vegf	PLCG1
vegf	PLCG2
vegf	PPP3CA
vegf	PPP3CB
vegf	PPP3CC
vegf	PPP3R1
vegf	PPP3R2
vegf	PRKCA
vegf	PRKCB
vegf	PRKCG
vegf	PTGS2
vegf	PTK2
vegf	PXN
vegf	RAC1
vegf	RAC2
vegf	RAC3
vegf	RAF1
vegf	SH2D2A
vegf	SHC2
vegf	SPHK1

vegf	SPHK2
vegf	SRC
vegf	VEGFA
nk	ARAF
nk	BID
nk	BRAF
nk	CASP3
nk	CD244
nk	CD247
nk	CD48
nk	CHP1
nk	CHP2
nk	CSF2
nk	FAS
nk	FASLG
nk	FCER1G
nk	FCGR3A
nk	FCGR3B
nk	FYN
nk	GRB2
nk	GZMB
nk	HCST
nk	HLA-A
nk	HLA-B
nk	HLA-C
nk	HLA-E
nk	HLA-G
nk	HRAS
nk	ICAM1
nk	ICAM2
nk	IFNA1
nk	IFNA10
nk	IFNA13
nk	IFNA14
nk	IFNA16
nk	IFNA17
nk	IFNA2
nk	IFNA21
nk	IFNA4

nk	IFNA5
nk	IFNA6
nk	IFNA7
nk	IFNA8
nk	IFNAR1
nk	IFNAR2
nk	IFNB1
nk	IFNG
nk	IFNGR1
nk	IFNGR2
nk	ITGAL
nk	ITGB2
nk	KIR2DL1
nk	KIR2DL2
nk	KIR2DL3
nk	KIR2DL4
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nk	KIR2DS1
nk	KIR2DS3
nk	KIR2DS4
nk	KIR2DS5
nk	KIR3DL1
nk	KIR3DL2
nk	KLRC1
nk	KLRC2
nk	KLRC3
nk	KLRD1
nk	KLRK1
nk	KRAS
nk	LAT
nk	LCK
nk	LCP2
nk	MAP2K1
nk	MAP2K2
nk	MAPK1
nk	MAPK3
nk	MICA
nk	MICB
nk	NCR1

nk	NCR2
nk	NCR3
nk	NFAT5
nk	NFATC1
nk	NFATC2
nk	NFATC3
nk	NFATC4
nk	NRAS
nk	PAK1
nk	PIK3CA
nk	PIK3CB
nk	PIK3CD
nk	PIK3CG
nk	PIK3R1
nk	PIK3R2
nk	PIK3R3
nk	PIK3R5
nk	PLCG1
nk	PLCG2
nk	PPP3CA
nk	PPP3CB
nk	PPP3CC
nk	PPP3R1
nk	PPP3R2
nk	PRF1
nk	PRKCA
nk	PRKCB
nk	PRKCG
nk	PTK2B
nk	PTPN11
nk	PTPN6
nk	RAC1
nk	RAC2
nk	RAC3
nk	RAET1E
nk	RAET1G
nk	RAET1L
nk	RAF1
nk	SH2D1A

nk	SH2D1B
nk	SH3BP2
nk	SHC1
nk	SHC2
nk	SHC3
nk	SHC4
nk	SOS1
nk	SOS2
nk	SYK
nk	TNF
nk	TNFRSF10A
nk	TNFRSF10B
nk	TNFRSF10C
nk	TNFRSF10D
nk	TNFSF10
nk	TYROBP
nk	ULBP1
nk	ULBP2
nk	ULBP3
nk	VAV1
nk	VAV2
nk	VAV3
nk	ZAP70
wnt	ACTB
wnt	APC
wnt	AXIN1
wnt	B2M
wnt	BCL9
wnt	BTRC
wnt	CCN4
wnt	CCND1
wnt	CCND2
wnt	CCND3
wnt	CSNK1A1
wnt	CSNK1D
wnt	CSNK1G1
wnt	CSNK2A1
wnt	CTBP1
wnt	CTBP2

wnt	CTNNB1
wnt	CTNNBIP1
wnt	CXXC4
wnt	DAAM1
wnt	DIXDC1
wnt	DKK1
wnt	DVL1
wnt	DVL2
wnt	EP300
wnt	FBXW11
wnt	FBXW2
wnt	FBXW4
wnt	FGF4
wnt	FOSL1
wnt	FOXN1
wnt	FRAT1
wnt	FRZB
wnt	FSHB
wnt	FZD1
wnt	FZD2
wnt	FZD3
wnt	FZD4
wnt	FZD5
wnt	FZD6
wnt	FZD7
wnt	FZD8
wnt	GAPDH
wnt	GSK3A
wnt	GSK3B
wnt	HPRT1
wnt	JUN
wnt	KREMEN1
wnt	LEF1
wnt	LRP5
wnt	LRP6
wnt	MYC
wnt	NKD1
wnt	NLK
wnt	PITX2

wnt	PORCN
wnt	PPP2CA
wnt	PPP2R1A
wnt	PYGO1
wnt	RHOU
wnt	RPL13A
wnt	SEN2
wnt	SFRP1
wnt	SFRP4
wnt	SLC9A3R1
wnt	SOX17
wnt	TBXT
wnt	TCF7
wnt	TCF7L1
wnt	TLE1
wnt	TLE2
wnt	TLE5
wnt	WIF1
wnt	WNT1
wnt	WNT10A
wnt	WNT11
wnt	WNT16
wnt	WNT2
wnt	WNT2B
wnt	WNT3
wnt	WNT3A
wnt	WNT4
wnt	WNT5A
wnt	WNT5B
wnt	WNT6
wnt	WNT7A
wnt	WNT7B
wnt	WNT8A
wnt	WNT9A
ras	AKT1
ras	BAD
ras	CASP9
ras	CDC42
ras	CHUK

ras	ELK1
ras	FOXO4
ras	HRAS
ras	MAP2K1
ras	MAPK3
ras	NFKB1
ras	PIK3CA
ras	PIK3CG
ras	PIK3R1
ras	PLD1
ras	RAC1
ras	RAF1
ras	RALA
ras	RALBP1
ras	RALGDS
ras	RELA
ras	RHOA
Active immune	ARG1
Active immune	Nos2
Active immune	CXCL3
Active immune	CXCL2
Active immune	CSF1r
Active immune	CCR2
Active immune	CXCR2
Active immune	CCR5