Supplementary Materials

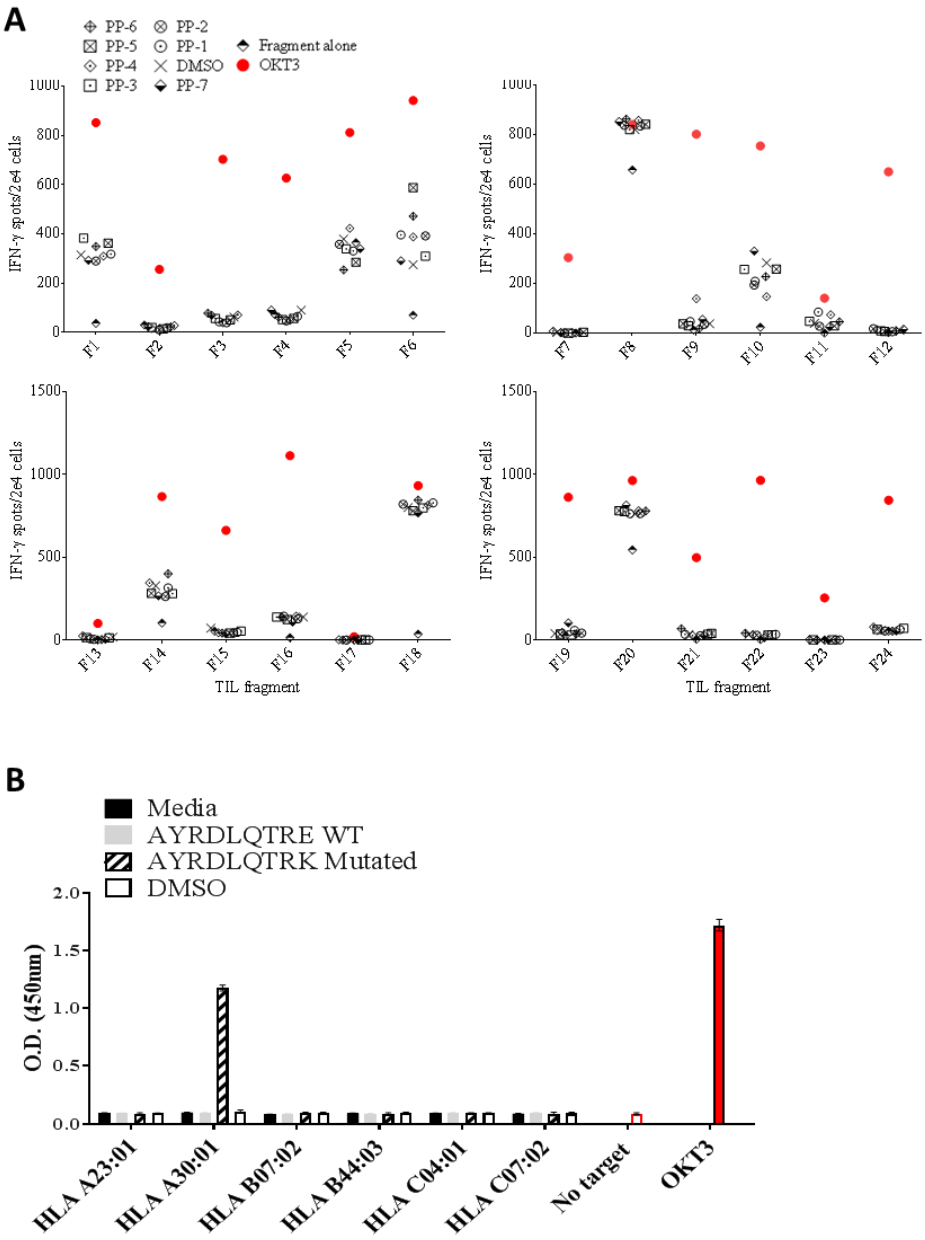
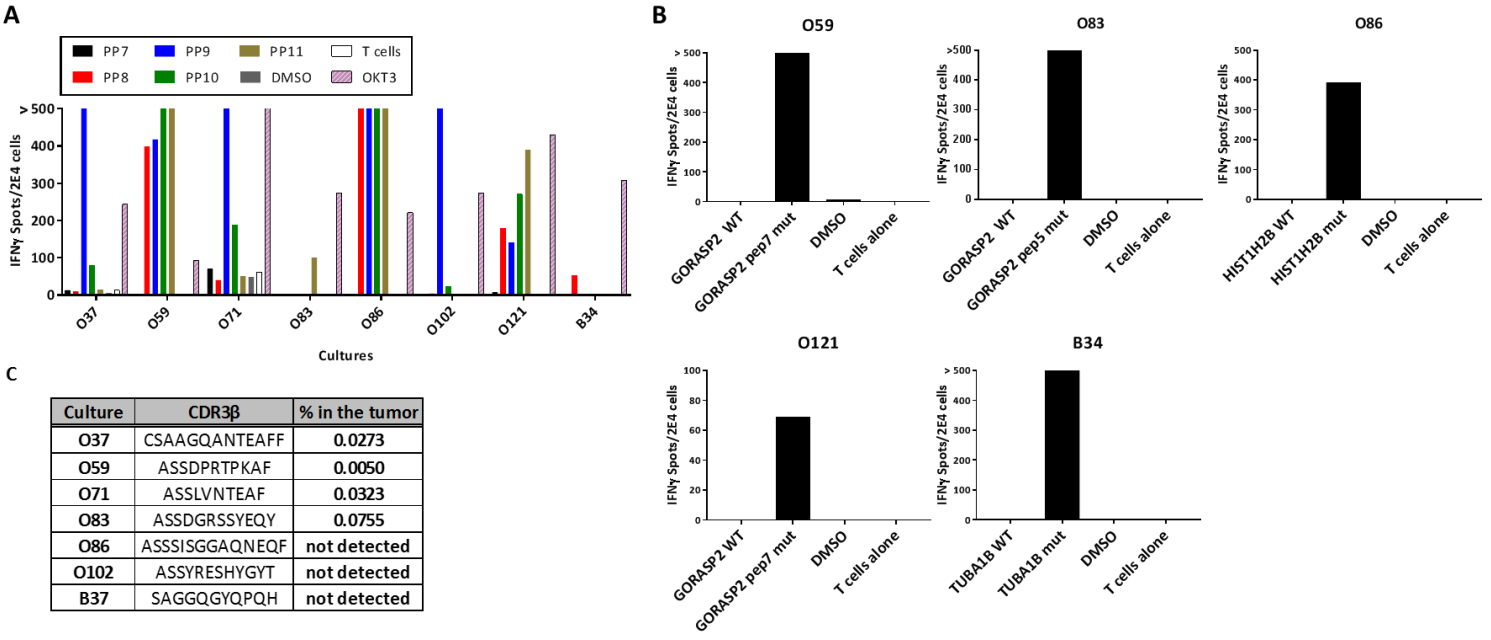


Figure S1: Pt.4078 fragment TIL screen, GBAS HLA-restriction and minimal epitope. (**A**) IFNγ secretion of TIL fragments following co-incubation with autologous APCs pulsed with peptide pools. (**B**) IFNγ ELISA of W18 following co-incubation with COS7 transfected with plasmids encoding the indicated HLA and pulsed with $GBAS^{E207K}$ or $GBAS^{WT}$ predicted minimal epitopes.



C

Culture	CDR3β	% in the tumor
O37	CSAAGQANTEAFF	0.0273
O59	ASSDPRTPKAF	0.0050
O71	ASSLVNTEAF	0.0323
O83	ASSDGRSSYEQY	0.0755
O86	ASSSISGGAQNEQF	not detected
O102	ASSYRESHYGYT	not detected
B37	SAGGQGYQPQH	not detected

Figure S2: Pt.4127 peptide pool screening, specificity test, and TCR frequencies in the tumor. (**A**) Representative IFNγ-ELISPOT assay of TIL microwell cultures co-incubated with autologous DCs pulsed with the individual peptide pools to identify the pool containing the putative neoantigen. (**B**) Neoantigen-reactive TIL cultures co-incubated with autologous DCs pulsed with mutated or WT counterpart HPLC-grade 25mer peptides. (**C**) CDR3β frequency of neoantigen-reactive TIL cultures in the tumor. Deep sequencing of TCRα and TCRβ chains was done on a sample of the tumor digest to determine the frequency of the neoantigen-reactive T cells.

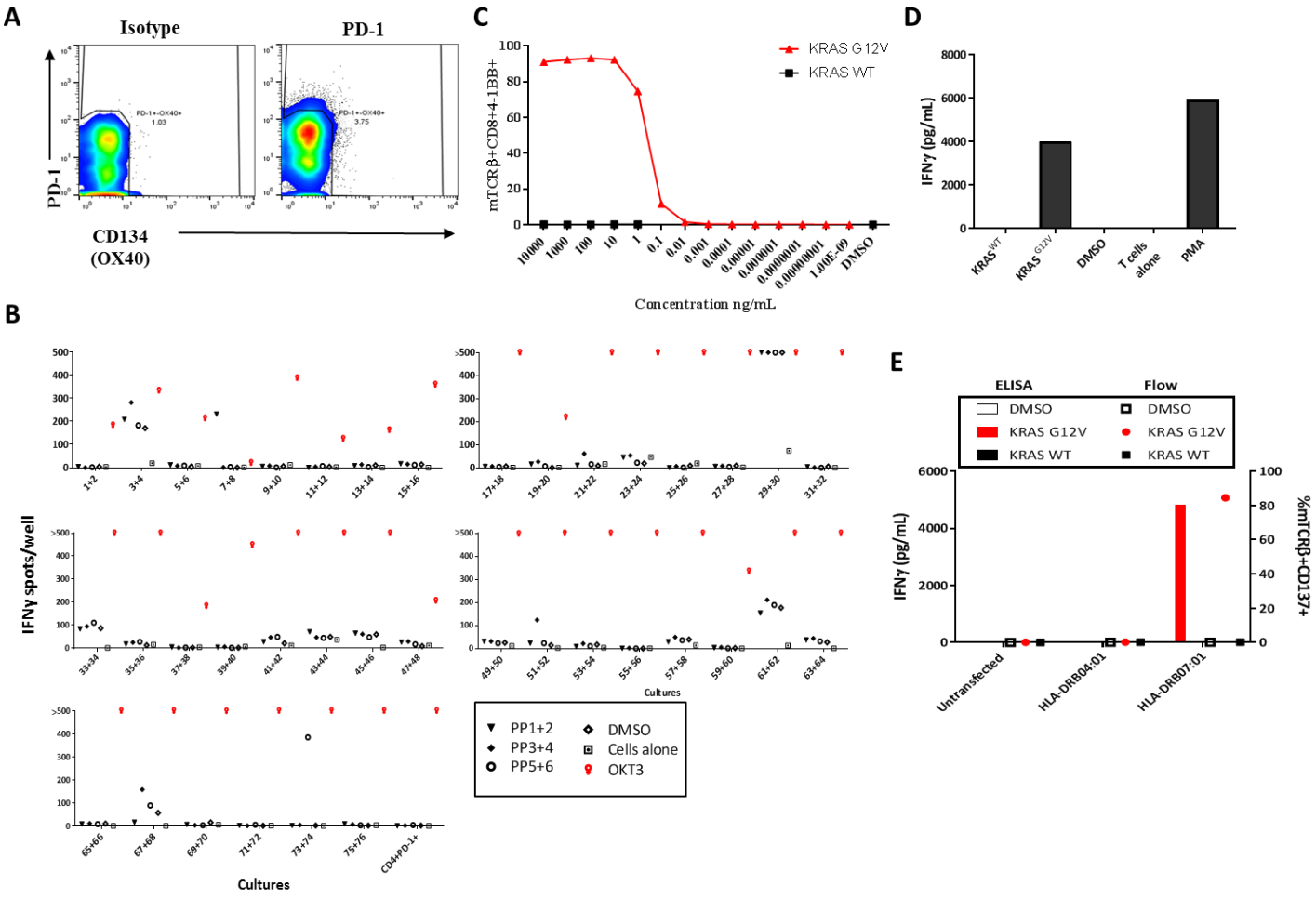


Figure S3: Pt.4148 sorting strategy, first TIL microwell cultures screen, and characterization of the KRAS^{G12V}-reactive TCR. (**A**) Gating strategy used to enrich for reactive TILs. (**B**) IFNγ secretion of pooled TIL cultures tested against autologous DCs pulsed with pools of 2 peptide pools. W73 + W74 showed enhanced reactivity against PP5+PP6 however further testing did not show specific reactivity against mutated peptides. (**C**) CD137+ (4-1BB) upregulation on gated CD8^{+}mTCRβ^{+} following incubation with DCs pulsed with serial dilution of HPLC KRAS peptides. (**D**) IFNγ secretion of sorted CD8^{+}mTCRβ^{+} tested against DCs pulsed with 10ug/mL KRAS^{WT} or 10ng/mL KRAS^{G12V} 24mer HPLC peptides. (**E**) HEK293-CIITA cells were transfected with plasmids encoding HLA-DRB1*07:01 or control HLA-DRB1*04:01 and pulsed with *KRAS* 24mer peptides. IFNγ secretion and upregulation of surface T-activation markers were assessed. The symbols represent the peptide pools pulsed on the DCs and the controls.

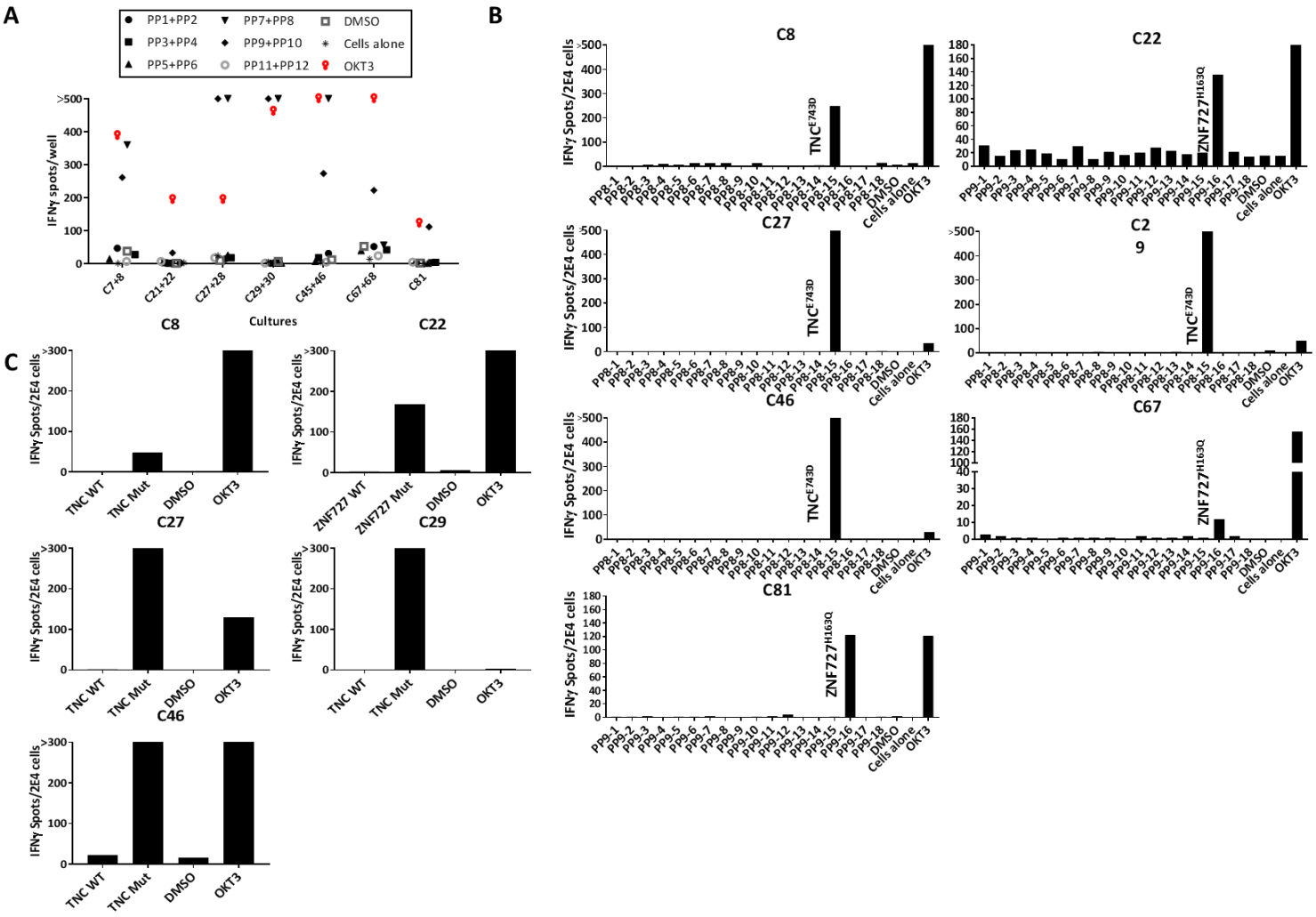
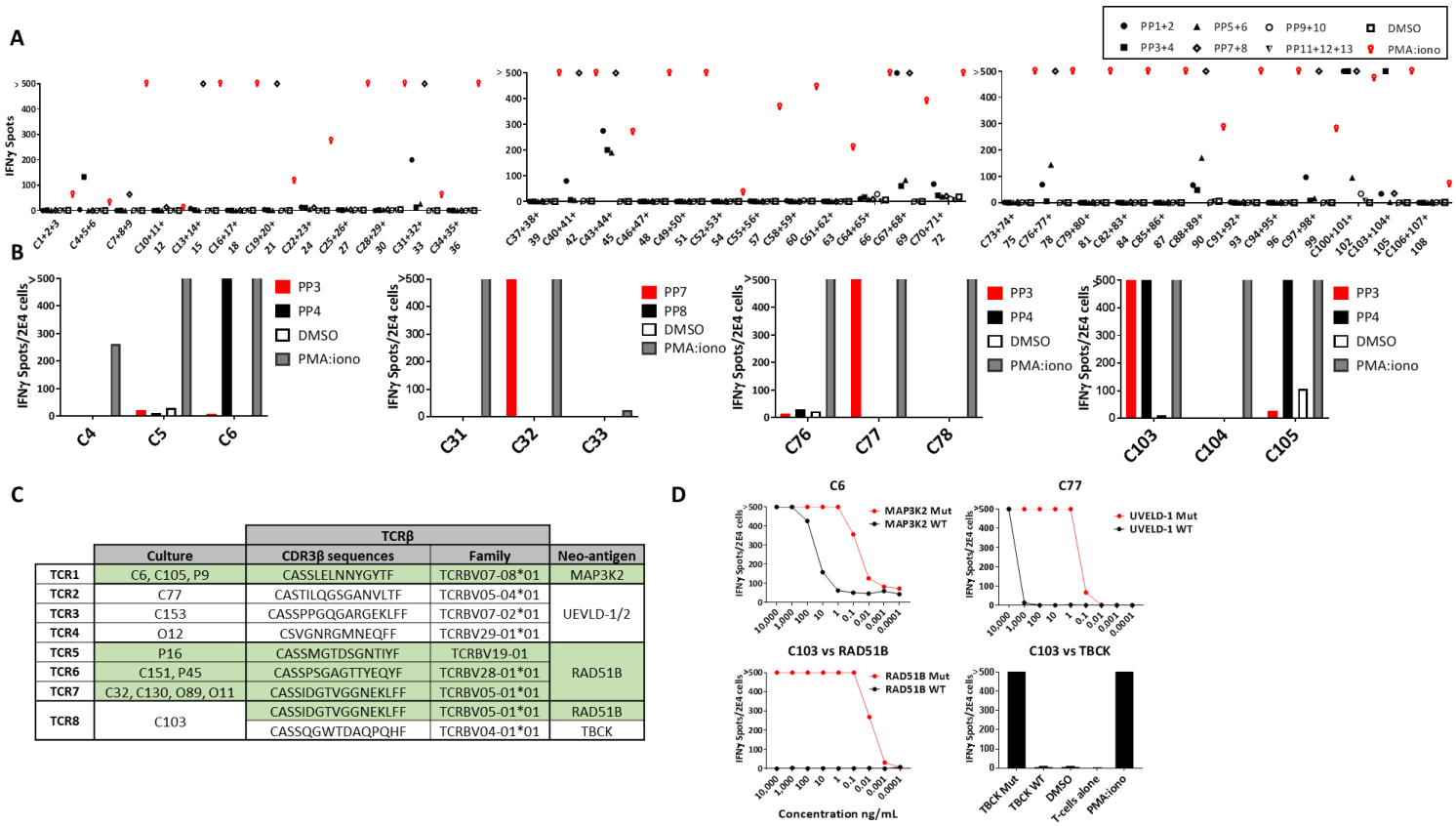


Figure S4: Pt.4166 neoantigen-reactivity screenings. (**A**) Representative IFNγ-ELISPOT results of reactive TIL cultures co-cultured with autologous APCs pulsed with pooled peptide pools. Cells from 2 microwell cultures were combined for the assay. The symbols represent the peptide pools pulsed on the DCs and the controls. (**B**) To identify the putative neoantigen, autologous DCs pulsed with single peptides from the indicated peptide pools were co-incubated with TIL cultures that demonstrated reactivity in the previous assays. (**C**) To test neoantigen specificity, DCs were pulsed with HPLC-grade mutated or WT peptides and then cultured with the indicated TIL cultures. Based on TCR sequencing, cultures C22, C67, and C81 express the same TCRβ.



		TCRβ		
	Culture	CDR3β sequences	Family	Neo-antigen
TCR1	C6, C105, P9	CASSLELNNYGYTF	TCRBV07-08*01	MAP3K2
TCR2	C77	CASTILQGSGANVLTF	TCRBV05-04*01	UEVLD-1/2
TCR3	C153	CASSPPGQGARGEKLFF	TCRBV07-02*01	
TCR4	O12	CSVGNRGMNEQFF	TCRBV29-01*01	
TCR5	P16	CASSMGTDSGNTIYF	TCRBV19-01	RAD51B
TCR6	C151, P45	CASSPSGAGTTYEQYF	TCRBV28-01*01	
TCR7	C32, C130, O89, O11	CASSIDGTVGGNEKLFF	TCRBV05-01*01	
TCR8	C103	CASSIDGTVGGNEKLFF	TCRBV05-01*01	RAD51B
		CASSQGWTDAQPQHF	TCRBV04-01*01	TBCK

Figure S5: Pt.4217 neoantigen-reactivity screening, TCR sequences, and peptide titration. (**A**) Representative IFNγ-ELISPOT assay following co-incubation of pooled TIL microwell cultures with autologous DCs pulsed with 2 peptide pools. (**B**) Representative co-cultures of three TIL microwell cultures that demonstrated reactivity in the first screen against DCs pulsed with individual peptide pools. *e.g.* C4, C5, and C6 showed IFNγ secretion against PP3+4 in the first screen (a) and they were tested individually against PP3 or PP4. C103 showed reactivity against both peptide pools, however against single peptides from each pool it demonstrated specific reactivity against a peptide from PP3 (**C**) TCRβ sequencing of all cultures that showed reactivity against target peptides. Several cultures express the same TCR chains. In C103 cultures, 2 TCRs were expressed targeting 2 putative neoantigens. (**D**) Representative co-cultures demonstrating the specificity of TIL microwell cultures against mutated peptides.

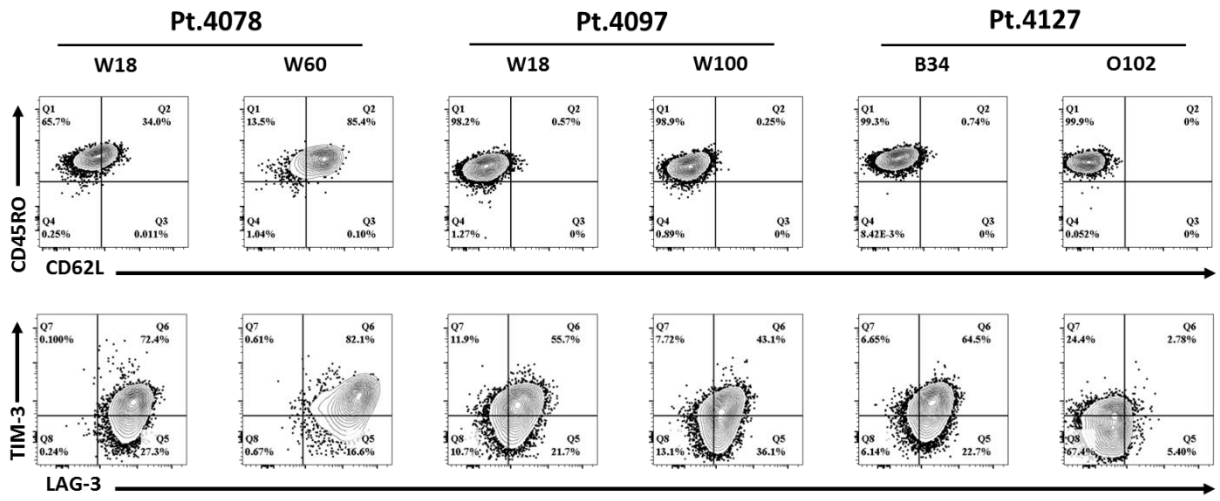


Figure S6: Exhaustion phenotype of neoantigen-reactive cultures following in vitro expansion. FACS-stain of neoantigen-reactive microwell cultures that underwent two or three rounds of REP. Five of the six cultures have a $CD45RO^{+}CD62L^{-}$ effector memory phenotype. All six cultures express the inhibitory receptors TIM-3 and LAG-3, five of them have high levels of expression.

Patient	Sex, Age†	Primary tumor	Metastatic sites	Number of mutations assessed
Pt.4078	M, 48	GE junction adenocarcinoma	Liver; Retroclavicular, mediastinal, hilar, retrocural, and RP LNs; L adrenal	104
Pt.4166	F, 45	Sigmoid colon cancer	Liver, lung, RP LN, Cervical LN	157
Pt.4217	M, 49	Sigmoid colon cancer	Mediastinum, Lung, Liver	176
Pt.4148	F, 68	Endometrial cancer	Lung	108
Pt.4097	F, 59	Serous carcinoma of ovary	Gastrohepatic ligament, R iliac LN	317
Pt.4127	F, 58	Ovarian	bilateral axilla	180

Table S1: Patient characteristics

† At the time of admission

Table S2: Sequences of alpha and beta chains of the isolated and tested TCRs.

Patient ID	Neoantigen	CD4/CD8	TRBV	TRAV
4078	GBAS^{E207K}	CD8	CASSETGWGAF	CAVRAARQNFVF
	PLXNB3^{W609G}	CD4	CASNLQRAVNTEAF	CAVKGEGGGADGLTF
	DLAT^{G294L}	CD4	CASTGANVLT	CAAGLNTGFQKLVF
	TMPRSS4^{H233Y}	CD4	CASSSSGAFQPQHF	CAGSGGSEKLVF
	PSMD2^{G644A}	CD4	CASRGVGGGTEAFF	CAVGPPSGNTPLVF
4148	KRAS^{G12V}	CD4	CSAREGAGGMGTQYF	CAASTGGGNKLTF
4217	MAP3K2^{S153F}	CD4	CASSLELNNYGYTF	CAVRDGGATNKLIF
	UEVLD-1/2^{F191V}	CD4	CASTILQGSGANVLTF	CAMTRPSGNTPLVF
			CASSPPGQGARGEKLFF	CAAFKGAQKLVF
			CSVGNRGMNEQFF	CAAFKGDYKLSF
	RAD51B^{L202R}	CD4	CASSPSGAGTTYEQYF	CAYRRQYGNKLVF
			CASSIDGTVGGNEKLFF	CALDIGGNQFYF
	TBCK^{R747S}	CD4	CASSIDGTVGGNEKLFF	CALDIGGNQFYF
4127	TP53^{G245S}	CD4	CASSYRESHYGYTF	CAVKWTGGFKTIF
			CSAAGQANTEAFF	CAVNDAGNMLTF
			CASSLVNTEAFF	CAVKGDYKLSF
	HIST1H2BM^{E77V}	CD4	CASSSISGGAQNEQFF	CAVGLHTGGFKTIF
	GORASP^{L248FS}	CD4	CASSDPRTPKAFF	CAVGGSNDYKLSF
			CASSDGRSSYEQYF	CVGGLSGTYKYIF
	TUBA1B^{S287T}	CD4	CSAGGQGYQPQHF	CIVSGNNAGNMLTF

Table S3: Pt.4078 mutated peptides and peptide pools

4078 PP1	Mutated peptide		4078 PP5	Mutated peptide	
4078_ACAP3	LCSVKPCEDIERSFCFEVLSPTKSC	1	4078_Ex_KRT10	GGSSGGGYGGGSSSGGHGGGSSSGG	1
4078_NBPF9	YKVLVHSQERELMQLKEKLQEGRDA	2	4078_Ex_ADAMTSL5	QTPTLAPDPCPPSPDTRGRAHRLLH	2
4078_NBPF15	TKITFEEDKVDSALIGSSSHVEWED	3	4078_Ex_ZBTB45	FSHRALLERHLAVHPAP	3
4078_FAM171A1	SMSHINLLFSRRSSEFPGPLSVTSH	4	4078_Ex_THNSL2	FMPEELPQLDRGPLCQWSTLSYPGL	4
4078_ZNF518A	MQSPLLNSEQKKNIIVQTSKGFLIP	5	4078_Ex_ENSG00000144115	MELPQLDRGPLCQWSTLSYPGL	5
4078_DLAT	PTPSAPCPATPAVPKGRVFVSPLAK	6	4078_Ex_JPH2	PASPASDGPALPLPAIPRGGFALSL	6
4078_TMPRSS4	KQHVCGGSILDPYWVLTAAHCFRKH	7	4078_Ex_ENSG00000179253	YDFDHLLSPALPSSTSVAREGPSLI	7
4078_OSBPL5	ESGSDQSETPGALVRRGTTYVEQVQ	8	4078_Ex_PCDHB15	YEALQAFEFRVGTTDRGFPALSSEA	8
4078_SHANK2	EIDGSHLPNLQKDDLIDLGVTRVGH	9	4078_Ex_MAK	IFKICQVLGTPKNSDWPEGYQLASS	9
4078_FBRSL1	HRHTPQPPPPQPRLLPTHVPASLGA	10	4078_Ex_RIMS1	RDMAKPAACKTPGNAENQPHQPSPR	10
4078_G2E3	LAIPITNTYKEFHENMDFTIRNTLR	11	4078_Ex_NEFM	RSNEKEQLQGLNNRFAGYIEKVHYL	11
4078_LRRC49	TVCPIINGEDHLCLLNFQHNFITRI	12	4078_Ex_PREX2	QWVYNSIESAQEYLQKSHSKPPGDE	12
4078_TBL3	LWALQDFSCLKTIEGHDASVLKVAF	13	4078_Ex_ACTL7B	RPTYFISSTVGKCCPEAADAGDTRK	13
4078_SH2B1	RQQEPTTSHDPPPPPEPPSWTDPPQ	14	4078_Ex_ADAMTS13	VRRILYCARAHGKDDGEEILLDTQC	14
4078_ZNF768	DSSYLLRHQRTHYGQKPYKCPHCGK	15	4078_Ex_ZNF658	CNECGRSFAHISDLKAHQRIHTGEK	15
4078 PP2	**Mutated peptide**		4078_Ex_IDNK	KDGVALKCEESGNEAKQAEMQLLVV	16
4078_ENSG00000135722(1)	RVCRAWAAAATCSVWHDTKIRFHPV	1	**4078 PP6**	**Mutated peptide**	
4078_ENSG00000135722(2)	RVCRAWAAAATCSVWHDTKISQPSP	2	4078_Ex_GABRA3	DSPTETKTYNSVRKVDKISRIIFPV	1
4078_ENSG00000135722(3)	RVCRAWAAAATCSVWHDTKIRRPTR	3	4078_Ex_PLXNB3	PGISSQHFTYQGGVGGSWPVCSGLG	2
4078_PIEZO1	GPTNCSSPHALVFNTGLDWPVYASP	4	4078_Ex_DCAF8L2	NTTVKGVNFYGPMSEFVVSGSDCGH	3
4078_TCF25	PRQRQRVYPKCTCLTTPKSTWPRYS	5	4078_Ex_NYX	VLEHLLLNDNLLSELPADAFRGLRR	4
4078_TP53	RCSDSDGLAPPQNLIRVEGNLRVEY	6	4078_Ex_ZNF157	KIFSMKKSLCQHLRTHTGEKPYECS	5
4078_KMT2B	PSQGLTASPADPPRTFAWLPGAPGV	7	4078_Ex_KDM5C	AERHGSRARGRARERRRRRKVDRGG	6
4078_ZNF180	CGKSFSQSYVLVEHQRTHTGEKPYE	8	4078_Ex_ENSG00000268674-1	RAGTGASREEGTFGQNVWDKSDGSS	7
4078_GULP1	RIQDLETENMELKIKYKIWKTN	9	4078_Ex_ENSG00000268674-2	GTFGQNVWDKSDGSSIQVPQKMRVR	8
4078_DNAH7	DLQDVQRYLKKARILNGKLDLAADK	10	4078_Ex_ENSG00000268674-3	SDGSSIQVPQKMRVRKMRAQT	9
4078_CUL3	RYGCIRDHLRQTVLDMIARERKGEV	11	4078_Ex_AGAP6-1	EVGEDLHMHHVRDGRCLKLWSLTFL	10
4078_THUMPD2	SKDSHTDEPGIKKVLES	12	4078_Ex_AGAP6-2	VRDGRCLKLWSLTFLPIQSQAQYSR	11
4078_GGCX	ELNPSNTDSSHSKPPESNPDPVHSE	13	4078_Ex_AGAP6-3	SLTFLPIQSQAQYSRGTLKQKLWSL	12
4078_ABHD16B	PELGALVLDATFEDLVPLALKVMPH	14	4078_Ex_AGAP6-4	AQYSRGTLKQKLWSLTLLPIQRQAQ	13
4078_PSMD2	VRLAQGLTHLGKATLTLCPYHSDRQ	15	4078_Ex_AGAP6-5	KLWSLTLLPIQRQAQYSRGTLKQML	14
4078 PP3	**Mutated peptide**		4078_Ex_ENSG00000204149-1	EVGEDLHMHHVRDGRCLKLWSLTLL	15
4078_AIMP1	GDEKKAKEKIEKNGEKKEKKQQSIA	1	4078_Ex_ENSG00000204149-2	VRDGRCLKLWSLTLLPIQRQAQYSR	16
4078_PCDHB12	TVTDLGTPRLKTKHNITVLVSDVND	2	4078_Ex_ENSG00000204149-3	SLTLLPIQRQAQYSRGTLKQML	17
4078_TRIO	QFQHAIEKTHQSTLQVQQKAEAMLQ	3	**4078 PP7**	**Mutated peptide**	
4078_RICTOR	RGYVAKQLEKWHGEYNSKYVDLIEE	4	4078_Ex_FAIM2(1)	GMKAGAFPPAPTVVPLHPSWAYVDP	1
4078_MSH5-SAPCD1	EVARKELENLDSCIPSCSVIYIPLI	5	4078_Ex_IQSEC1	GHHTQYCHMQNPAPYHHHHHHHPPQ	2
4078_FAXC	FSFYSRTETFEDAGAENSFSRTPDT	6	4078_Ex_ENSG00000148926(1)	MGSQVAFVPPPPARSSPDAA	3

4078_TSPAN12	LTHAWNFFQREFTCCGVVYFTDWLE	7
4078_ING3	KSKNNNKSSSQQTSSSSSSSSLSSC	8
4078_URGCP	RNTTMVLDVLPDTRPVEKESQMEEE	9
4078_GBAS	HHLWAYRDLQTRKDIRNAAWHKHGW	10
4078_BCL7B	PSPQQSESLSPAYTSDFRTDDSQPP	11
4078_ENSG00000147687	TNGILIFLLPKKN	12
4078_HMBOX1	RYHANSMGQRSYRFEASEEDLDVDD	13
4078_HSPA5	LEEIVQPIISKLDGSAGPPPTGEED	14
4078_ANGPTL2	PSARPVPQPPPAGPPRVYQPPTYNR	15
4078_POLA1	LKKKKYAALVVEATSDGNYVTKQEL	16

4078 PP4	**Mutated peptide**	
4078_Ex_IGFN1	EAGYRKDLGAPEGIGSGSKAGFRDG	1
4078_Ex_ENSG00000116883	PAHLLPTSSLPIFPGLICCLLTCLL	2
4078_Ex_ELTD1	VVGVIYNKGFLHTNFYIFGYLSPAV	3
4078_Ex_WDFY4	CTQLTFFPALHERLHSEDFLELCRE	4
4078_Ex_ENSG00000148926(2)	KGASRSPEDSCLCSPSPRPQQSGCR	5
4078_Ex_ENSG00000184956	MDTSRTQSVCRETGGAALS	6
4078_Ex_OTOG	PQLSQESPRTPTPRPALTPAAPLTT	7
4078_Ex_RAG2	LPLGSPAVNCTVFPGGISVSSAILT	8
4078_Ex_GALNT9	VSGDGVRASAATESGDGVRASAAMA	9
4078_Ex_VWF	QGDDFLTPSGLAGPRVEDFGNAWKL	10
4078_Ex_GOLGA8CP	GSPHDKPTAQPIMQDHQEHPGLGSN	11
4078_Ex_PDILT	SCKGVVESAALVIWLRRQISQKAFL	12
4078_Ex_HS3ST4	GVEPHFFDRNYEEGLEWYRNVMPKT	13
4078_Ex_NARR	GTPRPRVIVGSPLARVADADPASAP	14
4078_Ex_ENSG00000076604	CPEDQLPLDYAKLPHPYPQIYPDPE	15
4078_Ex_MLLT6	CCVCSDERGWAETPLVYCDGHACSV	16

4078_Ex_KRTAP9-7	PTCCRTTCWKPTIVTTCSSTPCCQP	4
4078_FBXL8	RVCRAWAAAATCSVWHDTKISCECE	5
4078_Ex_GPR182	QPKSRRHCLLLCTYVAVFVMCWLPY	6
4078_NEK11	LLSKLDHPAIVKLHASFVEQDNFCI	7
4078_ARIH2	NHMQCSKCKHDFRWMCLGDWKTHGS	8
4078_VPS41	WKDNVTLIIGWGNSVKVCSVKERHA	9

Table S4: Pt.4127 mutated peptides and peptide pools

4127PP-1	Mutated peptides	#	4127PP-4	Mutated peptides	#
4127 PDE4DIP p.P123R	KLKGVTKNWEDVRGDQVKPDQYTEA	1	4127 SKIDA1 p.Q254P	AAAYYQVSAAGPPPKAAAGAGGPGS	1
4127 PDE4DIP p.D84G	AATPWMRDYFAEGDGEMVPRTSHTA	2	4127 OR10S1 p.G63S	TVAGNLLILLTVSSDSHLSLPMYHF	2
4127 LMNA p.S553R	NLVTRSYLLGNSRPRTQSPQNCSIM	3	4127 OR4C45 p.L256fs	LFFVPFSYLYLRL	3
4127 NBPF1 p.T650P	RCYSTPSGYLELPDSCQPYRSAFYI	4	4127 APBB1 p.V160G	GGAVMGREDVGGGGTRLSTGWYWET	4
4127 ACOT11 p.P165L	REITKVKLKQITLRTEEEKMEHSVA	5	4127 SHANK2 p.P26fs (1)	VASSHTSAAQAPRTHEARAALPSAS	5
4127 ARHGAP21 p.S1950T	NAQPHKLSETPGTKAEFHPCL	6	4128 SHANK2 p.P26fs (2)	HTSAAQAPRTHEARAALPSASPRVL	6
4127 SLCO2B1 p.S370F	THQTSAHPGLELFPSCMEACSCPLD	7	4127 C11orf16 p.R442Q	ELVSKATHMKPPQTPPGEAEHRKRS	7
4127 ERP27 p.T4I	MKEICQLEIQVDNEQL	8	4127 TAS2R46 p.Y271Cp.P272Sp.T274A (1)	PVFMFCEAIAFSCSSAHPFILIWGN	8
4127 VWF p.A2178S	DSCHQEQVCEVISSYAHLCRTNGVC	9	4128 TAS2R46 p.Y271Cp.P272Sp.T274A (2)	MFCEAIAFSCSSAHPFILIWGNKKL	9
4127 RBP5 p.E70Q	FRNYTVQFDVGVQFEEDLRSVDGRK	10	4127 TAS2R46 p.E265Q	ESLENKPVFMFCQAIAFSYPSTHPF	10
4127 TM9SF1 p.G179R	QISDAISRPMGFRDDVDEDELLEEL	11	4127 TAS2R46 p.S254N	FLSIIMSVWSFENLENKPVFMFCEA	11
4127 IGHV4OR15-8 p.V42A	LVKPSETLSLTCAVSGGSISSSNWW	12	4127 TAS2R30 p.A227V	GSQDPSTKVHIKVLQTVTSFLLLCA	12
4127 NMB p.P73T	LEPSSPSPLGTATHTSLRDQRLQLS	13	4127 TAS2R30 p.Q210H	LICSLCKHLKKMHLHGKGSQDPSTK	13
4127 CPPED1 p.K241R	KKLADKFIHAGVRVVFSGHYHRNAG	14	4127 DNAH10 p.L1631V	SAEGEVMEFRKIVRAEGRVEDWMTA	14
4127 TPSB2 p.G245D	NGTWLQAGVVSWDEGCAQPNRPGIY	15	4127 NACA p.I1395N	AMTPPSPKRGPANPSPKGDPTSPAV	15
4127 ABCC6 p.H644Q	SGSAAGKDCITIQSATFAWSQESPP	16	4127 MYRFL p.R184G	DSGECRVWACHCGPMTSRSRSSEVQ	16
4127 DNAAF1 p.L397S	FTDIFKKEAKRDSEIRKQDTKSPRP	17	4127 PSPC1 p.M492V	GSRTGSETPQAPVSGVGPVSGGPGG	17
4127PP-2	**Mutated peptides**	#	4127 OR11H12 p.A140V	LLLTVMAFDQYLVICRPLLYPNIMT	18
4127 GRWD1 p.124_124del	HGTKPPPSEGSDEEEEEDEEDEEER	1	**4127PP-5**	**Mutated peptides**	#
4127 LILRA6 p.L69W	EYQLDKEGSPEPWDRNNPLEPKNKA	2	4127 OR4N2 p.P58A	IFTIKSDPGLTAALYFFLGNLAFLD	1
4127 ZNF274 p.V42I	DGSLSADAPSEQIQQQGKHPGDPEA	3	4127 SPTB p.S578F	KFRFFSMARDLLFWMESIIRQIETQ	2
4127 TBC1D8 p.R1079G	PQDSQAFPEAAEGDWTVSLEHILAS	4	4127 ACOT4 p.R57C	LFRAHARYCADACGELDLERAPALG	3
4127 CAPN14 p.D520N	FSKEIEDQNERQNEFFTKFFEKHPE	5	4127 COQ6 p.D314V	SARQLPPSVARVVAKSRVLFPLGLG	4
4127 AAK1 p.541_542del	QNFYQQQQQQQQQQQQLATALHQQ	6	4127 GOLGA8O p.P450L	EAPRPMPSVPEDLESREAMSSFMDH	5
4127 NCOA3 p.1050_1050del	VAMMMQQQQQQQQQQQQQQQQQQQ	7	4127 PEAK1 p.S1542T	GGTAQGFGPAEPTPTSSYPTRLIVS	6
4127 RUNX1 p.H241P	EQLRRTAMRVSPPHPAPTPNPRASL	8	4127 ACAN p.P864L	TELPSSGEESGALDVSGDFTGSGDV	7
4127 WDR4 p.K71N	QGSGAILASTFSNSGSYFALTDDSK	9	4127 IFT140 p.V398I	WGSRKNLLAVNSIISVAILSERAMS	8
4127 PRMT2 p.P248H	PLHVLLACCLPLHCTCASVPLHVLL	10	4127 LINC00273 p.P41T	PDIPYTHTTEHPTMGSPLPNLRAHV	9
4127 TTC28 p.A2323P	GHQSPAGSAPSPPLSYSSAGSARSS	11	4127 C16orf3 p.V60I	VGCPIACPVSCPIACPVGCPVGSMA	10
4127 FRG1 p.G163E	ASNSCFIRCNEAEDIEAKSKTAGEE	12	4127 C16orf3 p.I52T	RACPVACPVGCPTACPVSCPVACPV	11
4127 ZNF721 p.V297E	RIHTGEKPYTCEECGKAFRQSANLY	13	4127 RPH3AL p.P44Q	GSLTRQQGGPHQQTPMPGTPFTSGR	12
4127 HSD17B4 p.R131H	DVVVNNAGILRDHSFARISDEDWDI	14	4127 MAP2K3 p.L186W	HVKMCDFGISGYWVDSVAKTMDAGC	13
4127 HLA-A p.A270Sp.E277Q (1)	RPAGDGTFQKWASVVVPSGQEQRYT	15	4127 KCNJ12 p.I249V	VTEEGEYIPLDQVDIDVGFDKGLDR	14
4128 HLA-A p.A270Sp.E277Q (2)	TFQKWASVVVPSGQEQRYTCHVQHEG	16	4127 KRT26 p.W118R	EANADLEQKIKGRYEKCEPGSSREH	15
4127 VARS2 p.V118L	DPRDIISGVEMQLLQEKLRSGNLDP	17	4127 CDC27 p.Y574C	CFRNAIRVNPRHCNAWYGLGMIYYK	16
4127PP-3	**Mutated peptides**	#	4127 C17orf99 p.W88R	LKSSPDLLTYFCRASSTSGAHVDSA	17
4127 TCRBV12S2 p.N89K	GEVSDGYSVSRSKTEDLPLTLESAA	1	**4127PP-6**	**Mutated peptides**	#
4127 RARRES2 p.R126S	LVHCPIETQVLRSCVVPPGPLRVVT	2	4127 LINC00668 p.L63P	CIPTGPAGGGQLPGSLLKQTGSHSV	1

4127 AOAH p.D28N	LLSLQSSASPANNDQSRPSLSNGHT	3	4127 LINC00668 p.P49Q	SEGTIHIGLHGPQSCIPTGPAGGGQ	2
4127 ZMIZ2 p.L31F	PFLPDLKPNLNSFHSSPSGSGPCDE	4	4127 ZNF491 p.G346V	KAFRSAKYIRIHVRTHTGEKPYECK	3
4127 ASAP1 p.I721V	ESDDDLDDKPSPVKKERSPRPQSFC	5	4127 ZNF20 p.G365V	RHEKTHTEDKPYVCKQCGKGFRCAS	4
4127 FKBP15 p.P925T	MVPSEQVVEEAVTLPPQALTTSQDG	6	4127 CYP4F12 p.P13L	MSLLSLPWLGLRLVATSPWLLLLLV	5
4127 MGC21881 p.P63L	QNLDPNPPIARFLLPLERISEVPRR	7	4127 RHPN2 p.Q233R	GTDLDHQEKCLSRLYDHMPEGLTPL	6
4127 PPIAL4G p.A128V	TAKTEWLDGKHVVFGKVKERVNIVE	8	4127 MAMSTR p.C151S	PHPRMKPSPLTPSPPGVPSPSPPPH	7
4127 PDE4DIP p.T2297A	KVSKQERLLQSTAEHLKNANQQKES	9	4127 DHDH p.C132R	HGLWRAEAREDFRRGKAS	8
4127 SEC22B p.R107Q	DEQHGKKVPTVSQPYSFIEFDTFIQ	10	4127 NAPSA p.I40T	RIPLHRVQPGRRTLNLLRGWREPAE	9
4127 AX747988 p.R6P	MRKPRPAGWETLSRKAPG	11	4127 ZNF841 p.V506F	FSQHSHLAVHQRFHTGEKPYKCNEC	10
4127 MST1L p.376_377del	GTVSKTRKGVQCWSAETPHKLQALT	12	4127 ZNF324B p.S26G	ADASSKPQPLLQGQPHLFFFPKLLS	11
4127 C1orf220 p.P3L	MILVRGLWYCYLQVK	13	4127 FBN3 p.P1958H	QNLEGSFRCICPHGFQVQSDHCIDI	12
4127 LAD1 p.184_185del	QRGPWALEEESLGREPEERKKGVPE	14	4127 MUC16 p.G12402Ep.G12406R (1)	FTLNFTITNLQYEEDMRHPGSRKFN	13
4127 OR2T3 p.H239R	LHLIHRMNSAAGRRKALATCSSHMI	15	4128 MUC16 p.G12402Ep.G12406R (2)	FTITNLQYEEDMRHPGSRKFNTTER	14
4127 LDLRAP1 p.V174E	AQAFKVAFEFWQESKEEKEKRDKAS	16	4127 GCKR p.L256P	QALAHSTVGQTLPIPLKKLFPSIIS	15
4127 PTGER3 p.S375P	RRLREQAPLLPTPTVIDPSRFCAQP	17	4127 FRG1B p.G17R	LSDSRIALKSGYRKYLGINSDELVG	16
4127PP-7	**Mutated peptides**	#	4127 CTCFL p.E50Q	EKDHRSPSELEAQRTSGAFQDSVLE	17
4127 KRTAP15-1 p.L43M	PSNAIYSPNTCQMGSSLYNGCQETY	1	4127 RTEL1-TNFRSF6B p.R326C	DIAKLKSKCCPPCLLAAGWGLLLAR	18
4127 PCP4 p.L28F	TSGENVGCPILFFTHS	2	**4127PP-10**	**Mutated peptides**	#
4127 FBXW12 p.P6L	MEIRLLDLALKRIFSFLD	3	4127_SBSN_p.F361V	KFGQGVHHAASQVGKETEKLGHGVH	1
4127 ZNF717 p.V648I	THQGTHTGEKPYICNECGKTFHRKS	4	4127_IFNL2_p.Y160H	GPRTRGRLHHWLHRLQEAPKKESPG	2
4127 FRG1 p.R128C	YLGINSDGLVVGCSDAIGPREQWEP	5	4127_ZNF548_p.R312S	QRVHTGERPYECSECGKFFMDSSTL	3
4127 FRG1 p.R135K	GLVVGRSDAIGPKEQWEPVFQNGKM	6	4127_POTEF_p.I211T	LNVLDNKKRTALTKAVQCQEDECAL	4
4127 FRG1 p.P140Q	RSDAIGPREQWEQVFQNGKMALLAS	7	4127_SP9_p.S159R	AGRACRAPPGGGRRGARYHGAGGGG	5
4127 SLC2A9 p.R265H	VSQEVEEVLAESHVQRSIRLVSVLE	8	4127_SERTAD2_p.T94P	LRPMFTPSSQPTPEPSDSYREAPPA	6
4127 C5orf60 p.Q210K	REPLCPLKHPSHKPPASTLSPNPTS	9	4127_SEMG2_p.A396D	GKSQNQVRIPSQDQEYGHKENKISY	7
4127 DHFR p.A96T	WQPGGRAWRGARTRGRSSQASAGAS	10	4127_PCNT_p.A205P	EQRGIFTISDHPPEQRGMFTKECEQ	8
4127 AGPAT4-IT1 p.R173fs	TDLVSSHELSPFLTPTCSVLRAL	11	4127_NEFH_p.A528P	AKSPVKEEAKSPPEAKSPEKEEAKS	9
4127 DST p.P2138L	KENENSMVPQGALVGSLSVKNKAHC	12	4127_TRIOBP_p.D426E	ASRTSSPNRATRENPRTSCAQRDNP	10
4127 PRSS1 p.P3Lp.L14V	MNLLLILTFVAAAVAAPFDDDDKIVG	13	4127_ETFDH_p.L217F	CEPQTYGIGLKEFWVIDEKNWKPGR	11
4127 KMT2C p.P309S	CCEEKCTQMYHYSCAAGAGTFQDFS	14	4127_FTMT_p.L49Q	PLDPRQIAPRRPQAAAASSRDPTGP	12
4127 COA1 p.58_58del	LRPDLLLACSCSIRGNT	15	4127_DPCR1_p.L356Q	ENREMTANENTTQFPAEPTEHGERT	13
4127 PNPLA7 p.W282S	PARTVEWLNMRSSCSGHLHLCCPRR	16	4127_DPCR1_p.R386M	TPSPAEPTEHGEMTANENTTPSPAE	14
4127 ANXA2P2 p.A271P	LVQRIQNKPLYFPDQLYDSMKGKGT	17	4127_LFNG_p.R97P	RRDAGPPPGAAPPPADGHPRPLAEP	15
4127 SPATA31A3 p.H139Q	GERAPDGASQSSQEPMEDAAPILSL	18	4127_GTF2IRD2P1_p.K269E	AELKSICCIIHPESLCAQKLKMDHV	16
4127 RBMXL3 p.N609Y	RSLDANSGGRSPYAYSGGHDSSSWS	19	4127_AQP7_p.R234S	GYAINPSRDLPPSIFTFIAGWGKQV	17
4127 MAGEC1 p.P299A	SPERTQSTFEGFAQSPLQIPVSSSS	20	4127_AQP7_p.M219I	GILVVIIGVSLGINTGYAINPSRDL	18
4127PP-8	**Mutated peptides**	#	**4127PP-11**	**Mutated peptides**	#
4127_CKAP4_p.A167T	LQGVEQKVQSLQTTFGTFESILRSS	1	4127_GORASP2_p.L284fs_1	GLPPLPSMPPRNLTWHCTSPPAIRV	1
4127_SELPLG_p.T242P	TPPAAMEAQTTQPTAMEAQTTAPEA	2	4127_GORASP2_p.L284fs_2	PSMPPRNLTWHCTSPPAIRVPPVIP	2
4127_LMNA_p.S622R	NLVTRSYLLGNSRPRTQSPQNCSIM	3	4127_GORASP2_p.L284fs_3	RNLTWHCTSPPAIRVPPVIPLGSRE	3
4127_CD68_p.N53K	GTTSHGPTTATHKPTTTSHGNVTVH	4	4127_GORASP2_p.L284fs_4	HCTSPPAIRVPPVIPLGSRELFCSK	4

4127_TUBA1B_p.S287T	VISAEKAYHEQLTVAEITNACFEPA	5
4127_HELQ_p.S987L	NPEVLVRTIDHLLRRQAKQIVSSAK	6
4127_NCOR2_p.Q1756P	AMDRLAYLPTAPPPFSSRHSSSPLS	7
4127_MAP3K8_p.N54S	YEPSLMTMCQDSSQNDERSKSLLLS	8
4127_TUBGCP6_p.S1174T	GHVSDASISLGETVSDMAPARPRWN	9
4127_HIST1H2BM_p.E77V	SFVNDIFERIAGVASRLAHYNKRST	10
4127_NBPF1_p.K184E	EDVQVEVAEKVQESSAPREMPKAEE	11
4127_MST1L_p.P38fs	ALMTSRHQSWTPPRPGAV	12
4127_IGFN1_p.A1330D	SMDEAGYRKDLGDPEGISSGSKADY	13
4127_RHCE_p.C16W	KYPRSVRRCLPLWALTLEAALILLF	14
4127_MXI1_p.Q34P	APPAVPPAVAAPPPPALPEDPAGAK	15
4127_SKIDA1_p.Q254P	AAAYYQVSAAGPPPKAAAGAGGPGS	16
4127_AX747977_p.A58P	LNLPSSWDYRHMPTCPWLIFVFLVE	17

4127PP-9	**Mutated peptides**	#
4127_ENTPD1_p.T8R	MKGTKDLRSQQKESNVKTFC	1
4127_OR10G9_p.A90T	KMLMTLVSPSGRTISFHSCVAQLYF	2
4127_KRTAP5-5_p.C221S	GSSCCQSSCYKPSCCQSSCCVPVCC	3
4127_CDHR5_p.K538E	PATPGGDTAQTPEPGTSQPMPPGVG	4
4127_SELPLG_p.T265M	EATEAQTTQPTAMEAQTTPLAAMEA	5
4127_KRAS_p.G12D	MTEYKLVVVGADGVGKSALTIQLI	6
4127_PABPC3_p.V365L	MNGRIVATKPLYLALAQRKEERQAY	7
4127_POTEM_p.R66S	MKTLRSKMGKWCSHCFPWCRGSGKS	8
4127_HNRNPC_p.D268C	GADDSAEEGDLLCDDDNEDRGDDQL	9
4127_TUFM_p.M4V	MTTVAAATLLRATPHF	10
4127_KRTAP1-5_p.S57C	CGFPSFSTSGTCCSSCCQPSCCETS	11
4127_KRTAP1-3_p.F44C	TSCCQPSCCQTSCCGFPSFSTSGTC	12
4127_TP53_p.G245S	HYNYMCNSSCMGSMNRRPILTIITL	13
4127_RPTOR_p.A941T	MFDKGPEQTADDTDDAAGHKSFISA	14
4127_TXNDC2_p.S129T	GDIPKAPEETIQTKKEDLPKSSEKA	15
4127_EMR2_p.L153F p.K154I	GSYTCQCLPGFKFIPEDPKLCTDVNE	16
4127_ZNF737_p.F322L	EKPYKCEECGKALKHPSVLTTHKRI	17
4127_ZNF676_p.E389V	VSTLNTHKAIHAVEKPYKCEECGKA	18

4127_GORASP2_p.L284fs_5	PAIRVPPVIPLGSRELFCSKLRRAA	5
4127_GORASP2_p.L284fs_6	PPVIPLGSRELFCSKLRRAAVFPPA	6
4127_GORASP2_p.L284fs_7	LGSRELFCSKLRRAAVFPPAHQQRT	7
4127_GORASP2_p.L284fs_8	LFCSKLRRAAVFPPAHQQRTLRPCH	8
4127_GORASP2_p.L284fs_9	LRRAAVFPPAHQQRTLRPCHNYCKG	9
4127_GORASP2_p.L284fs_10	VFPPAHQQRTLRPCHNYCKGRRCLL	10
4127_GORASP2_p.L284fs_11	HQQRTLRPCHNYCKGRRCLLTHCGC	11
4127_GORASP2_p.L284fs_12	LRPCHNYCKGRRCLLTHCGCDAPHC	12
4127_GORASP2_p.L284fs_13	NYCKGRRCLLTHCGCDAPHCQGPHHR	13
4127 LILRB2 p.V354I	HLGVVIGILVAVILLLLLLLLLFLI	14
4127 SKIDA1 p.G429delinsEEG	EGEEEEEEEEEEEEGGSGASDSSEV	15

Table S5: Pt.4148 mutated peptides and peptide pools

4148PP-1	Mutated Peptide	#	4148PP-4	Mutated Peptide	#
4148_HSD3B2_p.R20C	TGAGGLLGQRIVCLLVEEKELKEIR	1	4148_SIX5_p.L194V	AVDKYRLRKKFPVPKTIWDGEETVY	1
4148_SPTA1_p.Q1981K	KQDTLDASLQSFKQERLPEITDLKD	2	4148_SHANK1_p.A1435P	RAGLGSQEKSLPPSPPAARRSLLHR	2
4148_CACNA1E_p.A10T	MARFGEAVVTRPGSGDGDSDQS	3	4148_ZNF841_p.R505I	VFSQHSHLAVHQIVHTGEKPYKCNE	3
4148_IGFN1_p.S2058C	SGSKAGFRDGLGCSVEMGSVNEAGY	4	4148_ZNF841_p.V493D	GEKPYKCNECGKDFSQHSHLAVHQR	4
4148_TRIM58_p.A76V	FRPSGFRPNRQLVGLVESVRRLGLG	5	4148_ZNF83_p.R224Q	KVFHQISHLAQHQTIHTGEKPYECN	5
4148_LRRIQ3_p.F274L	KGYEDKLLKDLFLKPETNIKGKLAY	6	4148_EPS8L1_p.V17G	WPRRIWGSSQDEGGFASSVRRPHLT	6
4148_ZWINT_p.V45I	ELPAKILVEFVVICTR	7	4148_ZNF497_p.S175L	ACRECGKAFRAHLQLIHHQETHSGL	7
4148_AK302451_p.W100C	CQSSGTSSTSCSCQFSRTSSTCRCQ	8	4148_SLC20A1_p.G408S	HLAKVGDCMGDSSDKPLRRNNSYTS	8
4148_PTEN_p.M270K	FHKQNKMLKKDKKFHFWVNTFFIPG	9	4148_POTEE_p.H67L	KTLRSKMGKWCHLCFPCCRGSGKSN	9
4148_RRP12_p.R68S	VKLHNELQSGSLSLGKSEAPETPME	10	4148_MYT1L_p.V257F	RKSELSLDLDSDFVRETVDSLKLLA	10
4148_MMP10_p.V214I	WTEDASGTNLFLIAAHELGHSLGLF	11	4148_PUM2_p.S512P	QLFPPSRLRYNRPDIMPSGRSRLLE	11
4148_MUC5B_p.L4424Q	SSTPGTTWILTEQTTTATTTASTGS	12	4148_ITSN2_p.R1658C	LLHEVPTGEVWVCFDLQLFEQKTLL	12
4148_OR5AS1_p.A247T	SKTFSTCASHLITVTLFYGALLFMY	13	4148_ACTR3BP2_p.E150K	IINVGYKRFLQPKIFFYPEFANPDF	13
4148_CUX2_p.H1253P	SGGPGILPPGHSPPDPTPQSPDSET	14	4148_STK4_p.F487fs	DAIEAKKRRQQNF	14
4148_ZNF605_p.R514W	HTGEKPYECSECWKTFSEKSSLIHH	15	4148_EPPIN_p.W96G	NPSSPCPHLLPSGTGFVP	15
4148_AEBP2_p.R204G	GGGGSSATSGGRGGSLEMSSDGEPL	16	4148_SOX18_p.A16P	SPPGYGAQDDPPPRRDCAWAPGHGA	16
4148_KRAS_p.G12V	MTEYKLVVVGAVGVGKSALTIQLI	17	4148_SUMO3_p.P124H	LCKLCLLSSRHSHASASQVAGTIGA	17
4148PP-2	**Mutated Peptide**	**#**	**4148PP-5**	**Mutated Peptide**	**#**
4148_OR6C6_p.R62H	DPRLKTPMYFFLHNFSFLEVIFTTV	1	4148_TXNRD2_p.V26G	RFRWRTQAVAGGGRGAARGAAAGQR	1
4148_HELB_p.C781Y	QSRLVFGIGDKIYCTRNAYLSDLLP	2	4148_TRIOBP_p.R576T	TSSPNRATRDNPTTSCAQRDNPRAS	2
4148_OR10G2_p.T121S	FHFLGSTQCFLYSLMAYDRYLAICQ	3	4148_PIK3CA_p.R88Q	EAEREEFFDETRQLCDLRLFQPFLK	3
4148_TGM1_p.R656Q	DRVTMPVAYKEYQPHLVDQGAMLLN	4	4148_DGKG_p.T390P	KGELVMQYKIIPPPGTHPLLVLVNP	4
4148_BC107108_p.V3I	MYIRVEIENVPCEFV	5	4148_PTPN23_p.S1038R	PLPAHSGALPFPRPGPPQPPHPPLA	5
4148_LCMT2_p.K453M	SPALGVLQLHFFMSEDNNTEDLKVT	6	4148_COL7A1_p.G120W	RELSYKGGNTRTWAAILHVADHVFL	6
4148_DUOX2_p.G1388E	KFEVSVLVGGGIEVTPFASILKDLV	7	4148_UBA3_p.E32Q	WEGRWNHVKKFLQRSGPFTHPDFEP	7
4148_SEMA6D_p.G431R	YRLTAISVDHSARPYQNYTVIFVGS	8	4148_IL17RC_p.A686G	PGRGVGPGAGPGGGDGT	8
4148_GOLGA6A_p.Q198H_p.W200R	EDRSSSCREAVLHRRLQQTIKERALLN	9	4148_PCDH18_p.D992V	KSFSTFGKDSPNVEDTGDTSTSSLL	9
4148_ZNF592_p.G472R	SPSCSSGPRVPKRAAPGSQTGKKQQ	10	4148_ADAM29_p.P279S	HLYCKWKSENITSRMQHDTSHLFTT	10
4148_NUDT16L1_p.R198G_p.W200G	EGSGAGRPGKEGGGGGPALGLPQGCVT	11	4148_FAT1_p.F18S	IVRNKEKKVIFESSGQISGSSFRSH	11
4148_RBL2_p.P967S	ELNKDRTSRDSSSVMRSSSTLPVPQ	12	4148_ZNF732_p.R270I	AFNRSSTLTKHKIIHAEEKPFTCEE	12
4148_GNAO1_p.D218E	RSERKKWIHCFEEVTAIIFCVALSG	13	4148_KLHL5_p.E226K	IQYAYTGRLELKKDNIECLLSTACL	13
4148_MSLNL_p.P107Q	HLPMHTVTYPCTQSPTRAHSCHLPV	14	4148_UGT2B17_p.D341Y	LAQIPQKVLWRFYGKKPNTLGSNTR	14
4148_CHTF18_p.G263R	FRHPAQSQVGGGRGSPALGGP	15	4148_FEM1C_p.547_547del	AALNNHPDIMNLIKSGAHFDATNLH	15
4148_TUBB4Q_p.K177R	CIDNEALYDICSRTLKLPTPIYGDL	16	4148_C9_p.E215K	IYETKGEKNFRTKHYEEQIEAFKSI	16
4148_PROCA1_p.S297L	GQGELSSEDIVELSSPRKRENTVQA	17	4148_RAD17_p.D415V	ILYCKRASLTELVSPRLPSHLSEYE	17
4148PP-3	**Mutated Peptide**	**#**	**4148PP-6**	**Mutated Peptide**	**#**
4148_HDAC5_p.R189W	VDWVGSELVGLGWGG	1	4148_MCTP1_p.G71R	GTSDPYVKFKIGRKEVFRSKIIHKN	1
4148_CUEDC1_p.P152fs_1	VFDRPYPLAPPTPASPYRRAGLWSP	2	4148_PDE7B_p.R43S	RLRGQTGVRAERSGSYPFIDFRLLN	2
4148_CUEDC1_p.P152fs_2	YPLAPPTPASPYRRAGLWSPYKPET	3	4148_SLC17A3_p.T150I	GTKRVVGISLFAISFLTLCIPLATD	3
4148_CUEDC1_p.P152fs_3	PTPASPYRRAGLWSPYKPETLSELE	4	4148_PIM1_p.D219delinsDH	FVLILERPEPVQDHLFDFITERGAL	4
4148_CUEDC1_p.P152fs_4	PYRRAGLWSPYKPETLSELEPTTAG	5	4148_GBX1_p.A133T	LAAAAAAAAATATRNNPEPGGRRPE	5
4148_CUEDC1_p.P152fs_5	AGLWSPYKPETLSELEPTTAGQPSG	6	4148_WDR86_p.A412V	PRGPCRRQPRHPVAPRAPRPATRGG	6
4148_PRCD_p.W228G	GCLGSWGAMWAGGGGCLPQGAGWLW	7	4148_SPDYE1_p.G234R	EDSKQNIFHFLYRKNRSRIPLLRKR	7
4148_TMC6_p.A466V	VFSEFMIQSPEAVGQEAVLLVLPLV	8	4148_NPTX2_p.N408Y	TNMPGNIIPWVDYNVDVFGGASKWP	8
4148_ACTG1_p.E3fs	MEGDRRAGH	9	4148_FOXH1_p.Q19P	SRLGPPEAESPSPPPKRRKKRYLRH	9
4148_RBBP8_p.P217A	KVSKSSTHPQHNANENEILVADTYD	10	4148_KIF13B_p.H1609P	TAPEAEPEAPISPPPPPTAVPAEEP	10
4148_ZNF700_p.S605R	KPYECKQCGKAFRCASNLRKHGRTH	11	4148_WHSC1L1_p.V410F	QPEEALSQAKKSFASKTEVKKTRRP	11
4148_ZNF709_p.F513L	EKPYECKQCGKALSCSSSFRMHERT	12	4148_PLEKHF2_p.T12A	MVDRLANSEANARRISIVENCFGA	12
4148_ZNF14_p.T511A	GEKPYECKLCGKAFSFSSSLREHEK	13	4148_LAMC3_p.T191N	LRPGEDERVAFCNSEFSDISPLSGG	13
4148_ZNF100_p.T359N	CEECGKAFNQSSNLTTHKITHAGEK	14	4148_AQP7_p.L217H	VIGILVVIIGVSHGMNTGYAINPSR	14
4148_ZFN99_p.H740N	CEECALRKHEIINTGKKPYKCEECG	15	4148_AQP7_p.Q192R_p.N194K	GMLQLCLFAITDREKNPALPGTEALVI	15
4148_ZNF730_p.Q257K	THKRIHTGEKPYKCEKCGKFFNQST	16	4148_RAB40AL_p.C261fs_1	HKRSSLCKVKIVWPTPEPTQKLHQKQ	16
4148_ZNF724P_p.S295L	KCKECGKAFNQSLTLTRHKIIHAGE	17	4148_RAB40AL_p.C261fs_2	LCKVKIVWPTPEPTQKLHQKQLQNFL	17
4148_ZNF675_p.I313K	THKKIHTGEQPYKCEECGKAFTQSS	18	4148_LOC100129520_p.R689S	VPQGTAPLMFSRSHSLKKVPVMPKE	18
4148_SBSN_p.K223M	HHGLSEGWKETEMFGQGIHHAAGQV	19	4148_GTPBP6_p.S93I	QGVPVVSVVPYDICGEHVPRRGGSH	19
4148_ZNF383_p.Q327H	CGKAFTQSSKLVHHQRIHTGEKPYE	20			
4148_ZNF227_p.V440E	RVHTGEKPYKCDECGKGFSHNSPLI	21			