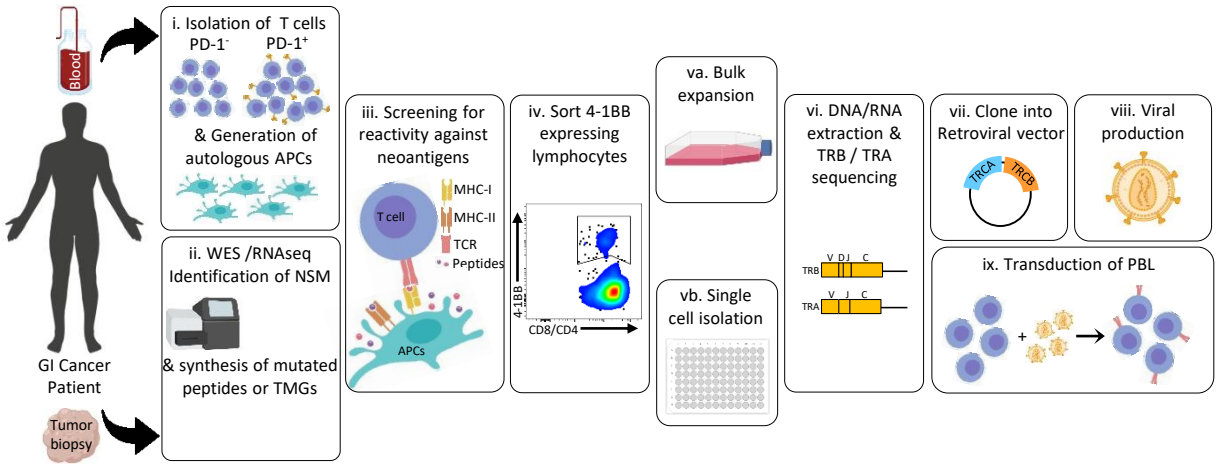
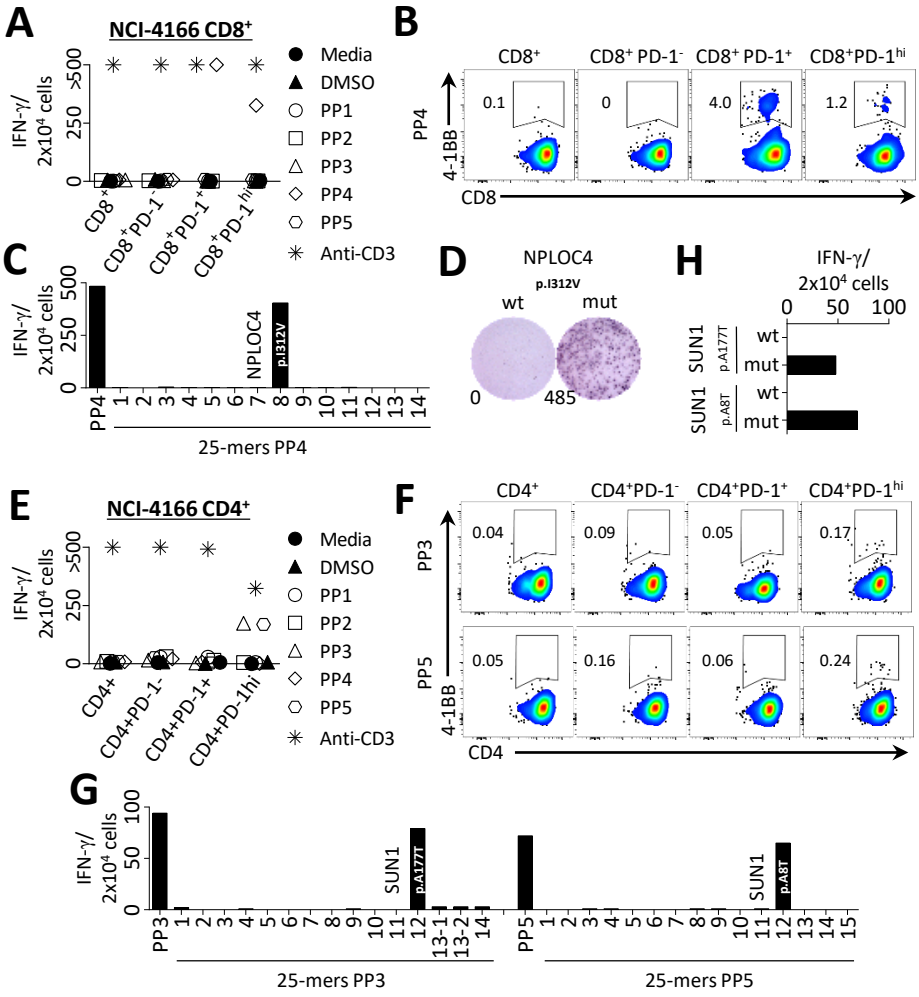
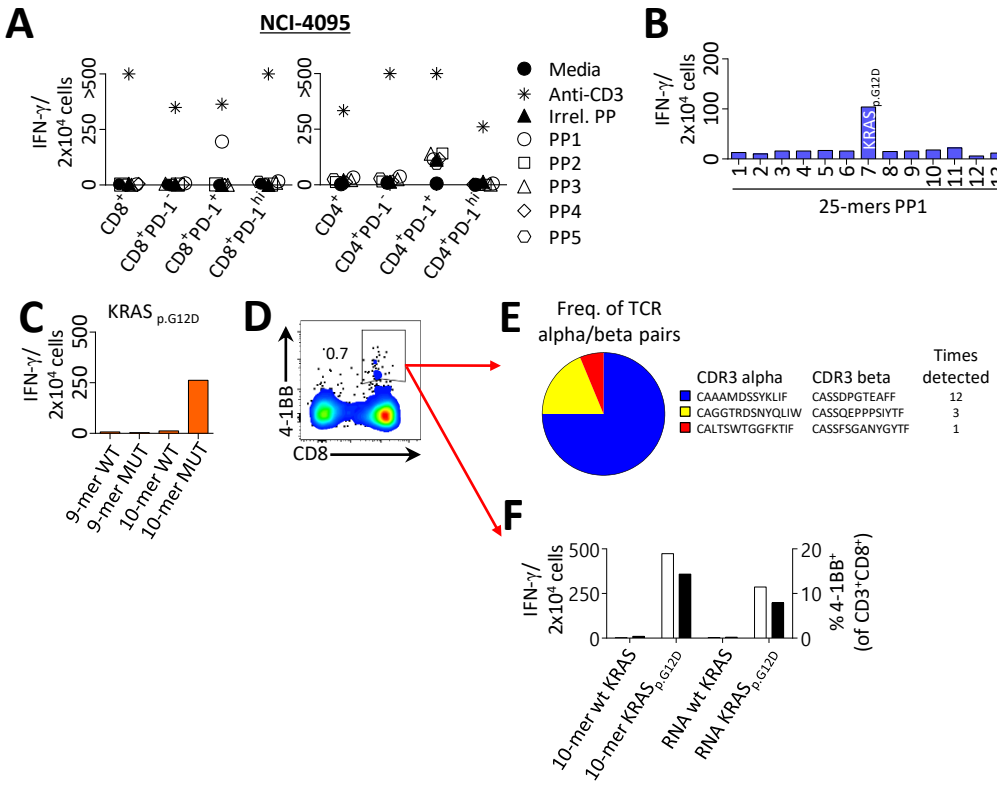


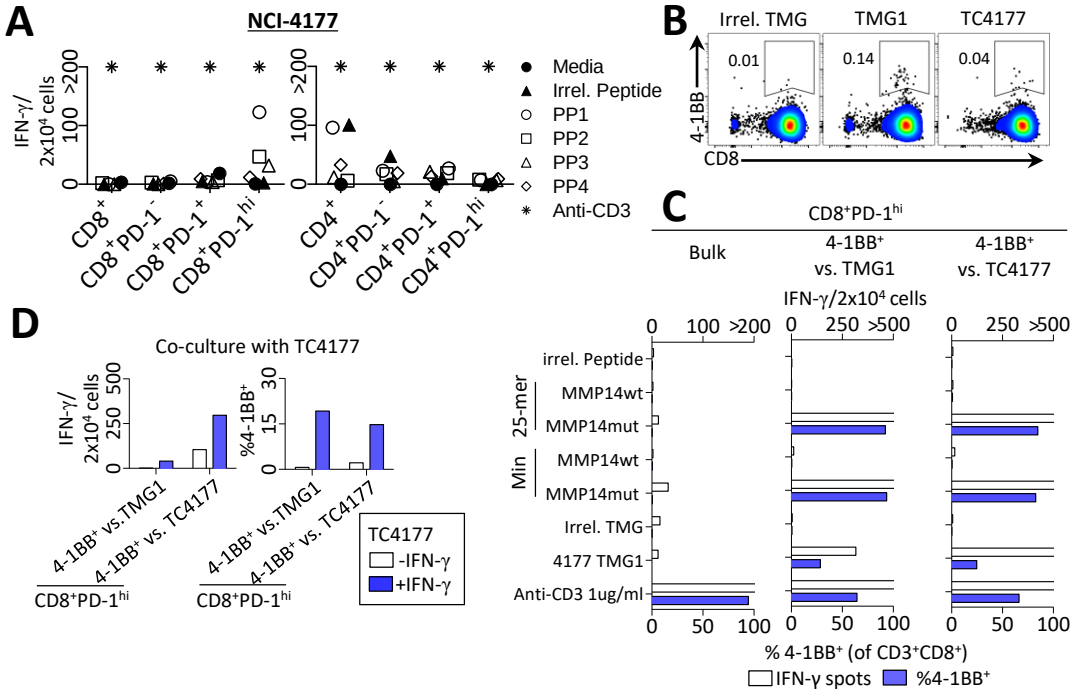
Supplemental Figure 1. Outline of personalized screening strategy used to identify and isolate neoantigen specific T-cell receptors circulating in the blood of GI cancer patients. (i) Lymphocytes were sorted from a pre-treatment peripheral blood sample or leukapheresis product based on PD-1 expression and expanded *in vitro* for 14 days, and autologous antigen presenting cells (APCs) were established. (ii) Fresh or archive formalin fixed paraffin embedded tumor biopsies were used to perform tumor WES and, when possible, RNA sequencing to identify non-synonymous mutations (NSM), and this information was used to synthesize mutated 25-mers or concatenated mutated minigenes encoding for all the candidate neoantigens. (ii) T cells were screened for recognition of putative neaontigens by co-culturing the effector T cells subsets with autologous APCs pulsed with or encoding for all the NSM identified. (iv) Cells upregulating 4-1BB following co-culture with a specific neoantigen were sorted to high purity and either (va) expanded non-specifically in vitro or (vb) isolated at the single cell level. (vi) DNA or RNA was extracted from ex vivo expanded and/or single cells from (va) and (vb) and TRA and TRB sequencing was performed to identify candidate neoantigen-reactive TCR-αβ pairs. (vii) Variable TRA and TRB pairs identified were cloned into a retroviral vector to (viii) generate a retrovirus used to (ix) infect and express the candidate neoantigen-specific TCR in peripheral blood lymphocytes.



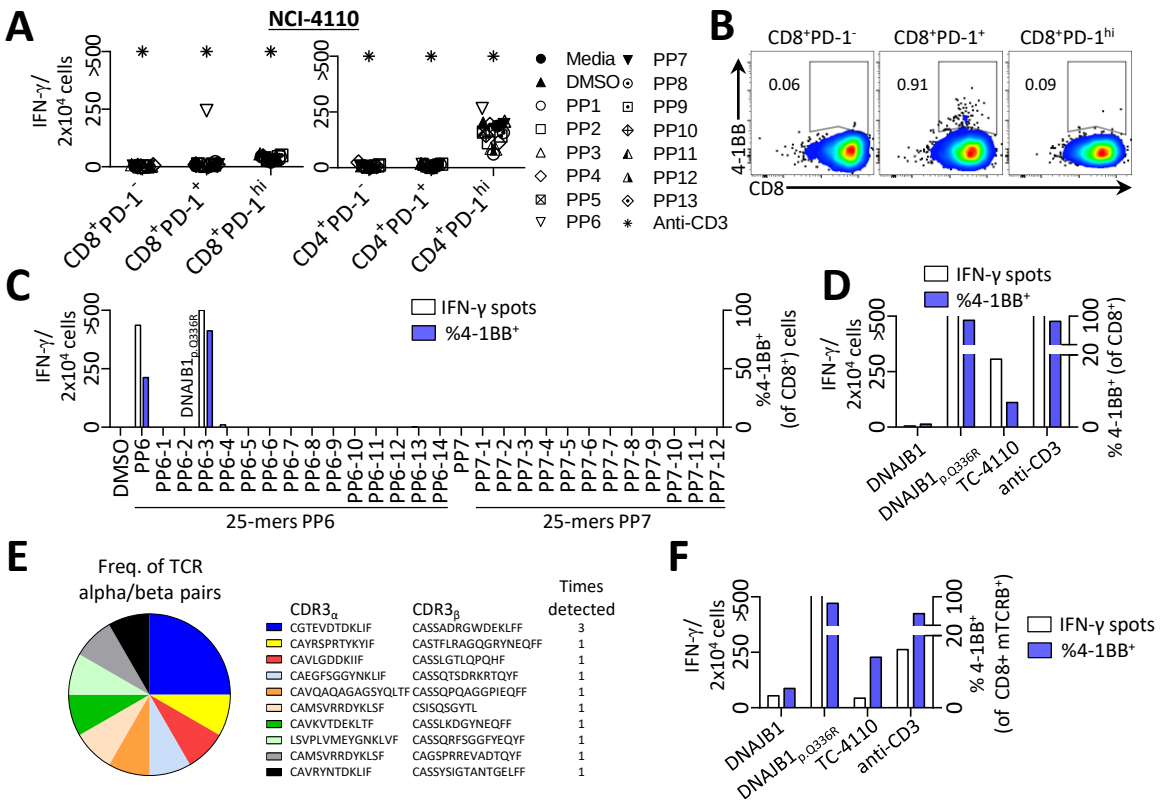
Supplemental Figure 2. Identification of CD8⁺ and CD4⁺ mutation-specific lymphocytes in peripheral blood of a patient with colon cancer NCI-4166. Reactivity of *in vitro* expanded peripheral blood (A-D) CD8⁺ and (E-H) CD4⁺ lymphocytes subsets to neoantigens. (A-B) CD8⁺ and (E-F) CD4⁺ lymphocyte subsets specified were co-cultured with autologous DCs pulsed with DMSO or with the indicated peptide pools encoding for the putative non-synonymous mutations identified by WES from an archived FFPE tumor biopsy. (A,E) IFN-γ ELISPOT assay and (B,F) flow cytometric analysis of 4-1BB expression is shown. Representative plots show the percentage of 4-1BB⁺ expression of (B) live CD3⁺CD8⁺ or (F) CD3⁺CD4⁺ cells from the indicated peripheral blood subsets against selected peptide pools (PPs). (C-D) IFN-γ ELISPOT assay of peripheral blood CD8⁺PD-1⁺ cells co-cultured with autologous DCs pulsed with (C) PP4 and individual 25-mers from PP4 or with (D) the HPLC-grade wild type and mutated $NPLOC4_{p.I312V}$ 25-mers. Numbers represent the spots per 2e4 effector cells. (G-H) IFN-γ ELISPOT assay of peripheral blood CD4⁺PD-1^{hi} cells co-cultured with autologous DCs pulsed with (G) PP3 and PP5 and individual 25-mers from PP3 and PP5 or with (H) the HPLC-grade wild type and mutated $SUN1_{p.A8T}$ and $SUN1_{p.A177T}$ 25-mers. Spots per 2x10^4 effector cells are plotted. The individual neoantigens recognized and the amino acid position and change are noted. '>' denotes greater than 500 spots per 2x10^4 effector cells. Experiments were performed without technical duplicates. Data from A-G are representative of at least two independent experiments.



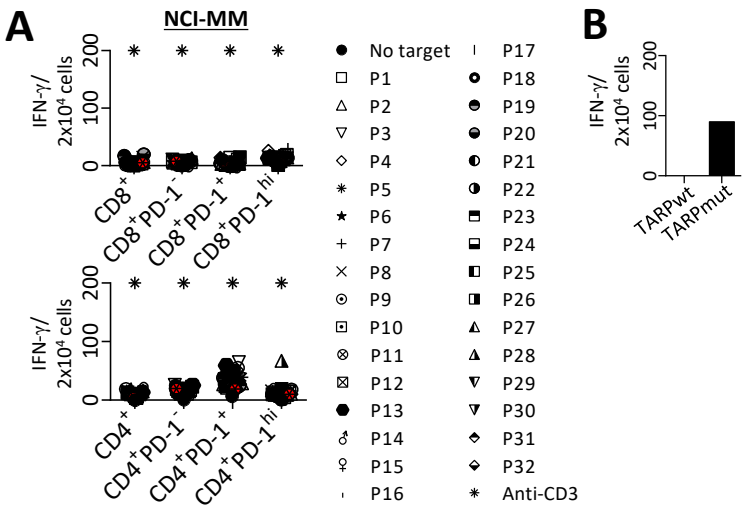
Supplemental Figure 3. Identification of $KRAS_{p.G12D}$ specific $CD8^+$ lymphocytes and candidate TCR-αβ pairs in the peripheral blood of a patient with colon cancer NCI-4095. (A) IFN-γ ELISPOT assay of *in vitro* expanded peripheral blood $CD8^+$ and $CD4^+$ lymphocytes subsets co-cultured overnight with DCs pulsed with an irrelevant peptide pool (PP) or the indicated PP containing the various mutated 25-mers identified by whole exome sequencing. (B) Reactivity of the $CD8^+PD\text{-}1^+$ cells to autologous DCs pulsed with individual 25-mers from PP1. IFN-γ spots per 2e4 effector cells are plotted. (C) IFN-γ ELISPOT assay and (D) flow cytometric detection of 4-1BB expression after co-culture of the $CD8^+PD\text{-}1^+$ cells with APCs pulsed with HLA-C*08:02 restricted wild type (WT) and mutated (MUT) $KRAS_{p.G12D}$ 9-mers and 10-mers. Representative plot displays the percentage of 4-1BB upregulation on the $CD8^+PD\text{-}1^+$-derived cells when co-cultured with DCs pulsed with the mutated $KRAS_{p.G12D}$ 10-mer. (E) Candidate $KRAS_{p.G12D}$ reactive TCR-αβ pairs identified by single cell TRA and TRB sequencing from $CD8^+4\text{-}1BB^+$ T cells isolated in (D). The number of times each TCR-αβ pair was detected and the $CDR3_\alpha$ and $CDR3_\beta$ amino acid sequences are specified. (F) IFN-γ ELISPOT assay and flow cytometric analysis of 4-1BB expression on in vitro expanded $KRAS_{p.G12D}$-reactive $CD8^+$ T cells isolated in (D) following overnight co-culture with DCs pulsed with WT and mut $KRAS_{p.G12D}$ 10-mers or electroporated with RNA encoding for full-length wt and mutated $KRAS_{p.G12D}$. The mean number of spots per $2x10^4$ effector cells and percentage of $CD8^+$ cells that are 4-1BB are plotted. The individual neoantigens recognized and the amino acid position and change are noted. '>' denotes greater than 500 spots/2 x 10^4 cells. Except in (F), experiments were performed without technical duplicates. Data from A-F are representative of at least two independent experiments.



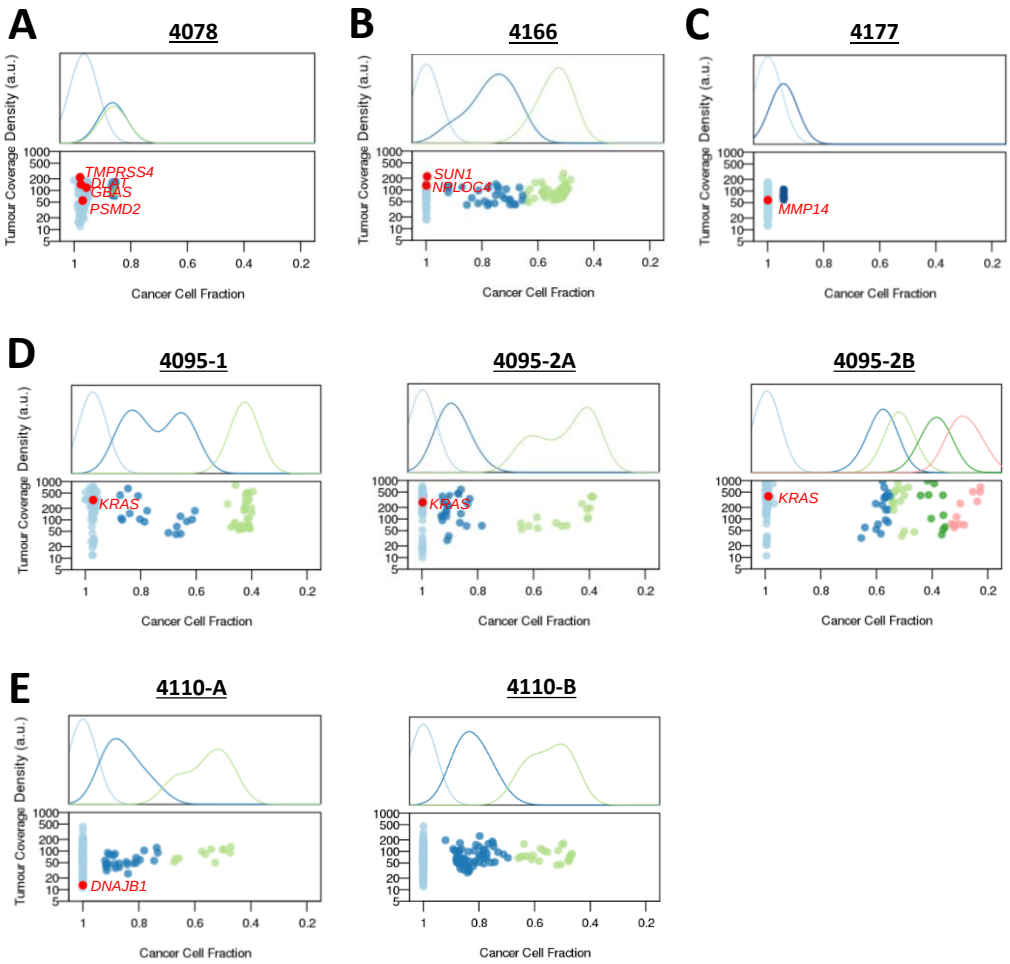
Supplemental Figure 4. Identification of personalized neoantigen-specific lymphocytes in the peripheral blood of a patient with metastatic pancreatic cancer NCI-4177. (A) IFN-γ ELISPOT assay of *in vitro* expanded peripheral blood $CD8^+$ and $CD4^+$ lymphocyte subsets co-cultured overnight with DCs pulsed with an irrelevant peptide pool (PP) or the indicated PP containing the various mutated 25-mers identified by whole exome sequencing. Reactivities observed in the CD4+ bulk population were not reproducible. (B) Flow cytometric detection of 4-1BB expression on the $CD8^+PD\text{-}1^{hi}$ cells following co-culture with autologous DCs electroporated with an Irrelevant TMG RNA, TMG1 RNA, encoding for the 25-mers within PP1, or with the autologous tumor cell line TC4177. Representative plots gated on live $CD3^+$ lymphocytes show the percentage of 4-1BB expression. Note that figure SF4B is identical to figure 3E but is included here for convenience and completeness of the figure. (C) IFN-γ ELISPOT assay and flow cytometric analysis of 4-1BB expression on *in vitro* expanded Bulk, TMG1 and TC4177-reactive $CD8^+$ $PD\text{-}1^+$-derived T cells isolated in (B) following overnight co-culture with DCs pulsed with WT and MUT $MMP14_{p.R158C}$ 25-mers or minimal epitopes (Min; 9-mers), or DCs electroporated with RNA encoding for an irrelevant TMG, or TMG1. Spots per 2e4 effector cells and percentage of $CD8^+$ cells that are $4\text{-}1BB^+$ are plotted. (D) IFN-γ ELISPOT assay (left panel) and flow cytometric analysis of 4-1BB expression (right panel) on *in vitro* expanded TMG1 and TC4177-reactive $CD8^+$ T cells isolated in (B) following overnight co-culture with the autologous tumor cell line +/- pre-treatment with IFN-γ. Spots per $2x10^4$ effector cells and percentage of $CD8^+$ cells that are $4\text{-}1BB^+$. The mean of two technical replicates is plotted. '>' denotes greater than 200 or 500 spots/$2x10^4$ cells. Except in (D), experiments were performed without duplicates. Data from A-D are representative of at least two independent experiments.



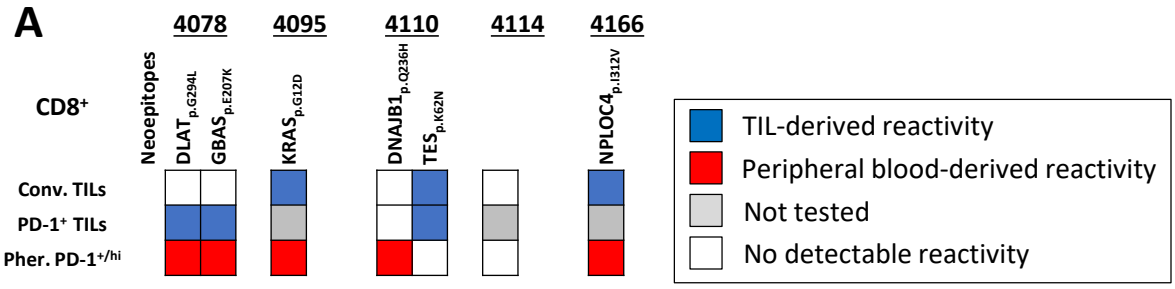
Supplemental Figure 5. Identification of personalized neoantigen-specific lymphocytes in the peripheral blood of a patient with metastatic bile duct cancer NCI-4110. (A) IFN-γ ELISPOT assay of *in vitro* expanded peripheral blood CD8$^+$ and CD4$^+$ lymphocyte subsets co-cultured overnight with DCs pulsed with an irrelevant peptide pool (PP) or the indicated PP containing the various mutated 25-mers identified by whole exome sequencing. (B) Flow cytometric detection of 4-1BB expression on the indicated lymphocyte subsets following co-culture with autologous DCs pulsed with PP6. Representative plots gated on live CD3$^+$ lymphocytes show the percentage of 4-1BB expression. (C-D) IFN-γ ELISPOT assay and flow cytometric analysis of 4-1BB expression on *in vitro* expanded PP6/7-reactive CD8$^+$PD-1$^+$-derived T cells (C) following overnight co-culture with DCs pulsed with DMSO, PP6, PP7, or with the individual 25-mers from PP6 or PP7, or (D) after co-culture with DCs pulsed with HPLC-grade wt or Mutated DNAJB1$_{p.Q336R}$ 25-mers, or with the tumor cell line. Spots per 2x10^4 effector cells and percentage of CD8$^+$ cells that are 4-1BB$^+$ are plotted. (E) Frequency of candidate DNAJB1$_{p.Q336R}$ -reactive TCR-αβ pairs identified by single cell TRA and TRB sequencing within the 4-1BB$^+$ T cells following co-culture of the CD8$^+$PD-1$^+$ cells co-cultured with PP6/7. The number of times each TCR-αβ pair was detected and the CDR3$_\alpha$ and CDR3$_\beta$ amino acid sequences are specified. (F) Reactivity of gene-engineered PBL with dominant TCR-αβ pair from (E) to autologous DCs pulsed with wild type and mutated DNAJB1$_{p.Q336R}$ 25-mers. Spots per 2x10^4 cells effector cells and percentage of CD8$^+$ cells that are 4-1BB$^+$ are plotted. '>' denotes greater than 500 spots per 2x10^4 cells. Experiments were performed without technical duplicates. Except in (E), data from A-F are representative of at least two independent experiments.



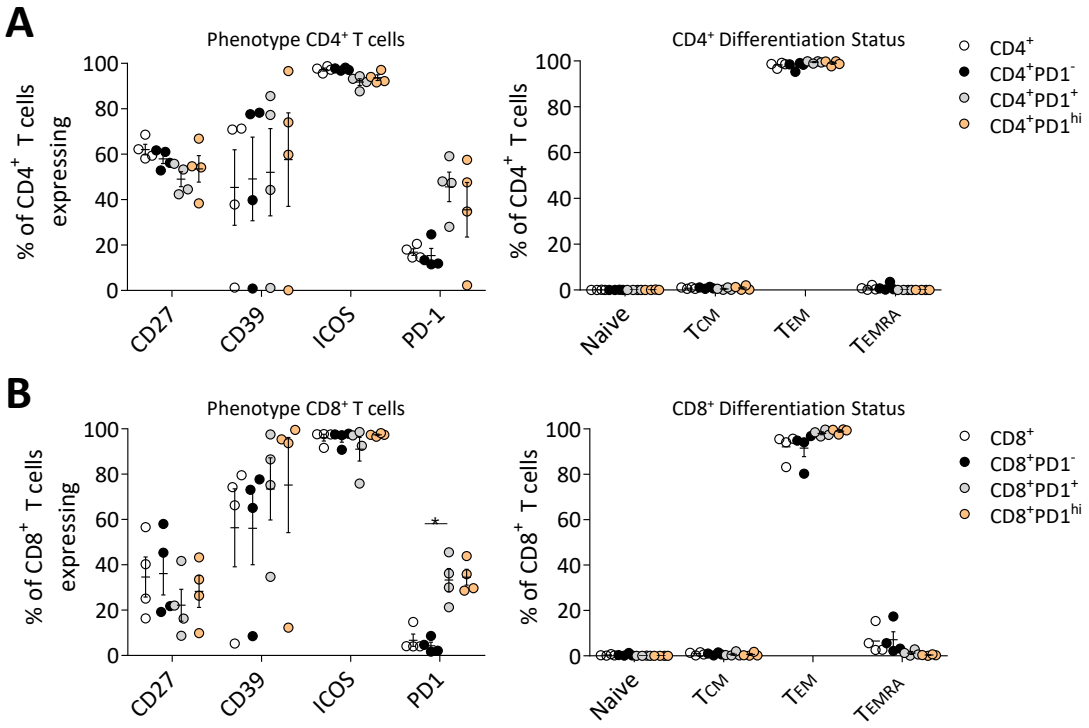
Supplemental Figure 6. Identification of personalized neoantigen-specific lymphocytes in the peripheral blood of a patient with metastatic pancreatic cancer NCI-MM. (A) IFN-γ ELISPOT assay of *in vitro* expanded peripheral blood $CD8^+$ (top panel) and $CD4^+$ (bottom panel) lymphocyte subsets co-cultured overnight with DCs pulsed with the individual mutated 25-mers identified by whole exome sequencing. (B) IFN-γ ELISPOT assay of $CD4^+PD\text{-}1^{hi}$ lymphocytes following co-culture with autologous DCs pulsed with wt or mutated TARP 25-mers. Spots per $2x10^4$ cells effector cells. Plate bound anti-CD3 was used as a positive control in all co-culture assays. Experiments were performed without technical duplicates. Data are representative of at least two independent experiments.



Supplemental Figure 7. Intra- and inter-tumoral heterogeneity of mutated genes that resulted in neoantigens recognized by circulating lymphocytes in patients with GI cancer (n=5). Clonal architecture of the resected tumors from patients (A) NCI-4078, (B) NCI-4166, (C) NCI-4177, (D) NCI-4095, and (E) NCI-4110. Each plot represents and individual tumor sequenced. Each dot represents one non-synonymous somatic mutation identified. The fraction of tumor cells with each variant and coverage is plotted. Non-synonymous mutations encoding for a neoepitope recognized by peripheral blood T cells are highlighted in red.



Supplemental Figure 8. Comparison of neoepitopes targeted by ex vivo expanded CD8$^+$ tumor-infiltrating lymphocytes and peripheral blood lymphocytes (n=5). (A) Neoepitopes recognized by conventional TILs derived from tumor fragments expanded in IL-2 (Conv. TILs), ex vivo expanded CD8$^+$PD-1$^+$ lymphocytes sorted from the fresh tumor (Tumor PD-1$^+$), and peripheral blood-derived CD8$^+$PD-1$^{+/hi}$ (Pher. PD-1$^{+/hi}$). The patient ID as well as the individual neoantigens recognized and the amino acid position and change are specified above. Blue and red squares indicate that reactivity was detected in the TILs or peripheral blood, respectively.



Supplemental Figure 9. Phenotypic characterization of ex vivo expanded peripheral blood CD4⁺ and CD8⁺ T-cell subsets. Ex vivo expanded peripheral blood (A) $CD4^+$ and (B) $CD8^+$ lymphocytes subsets from n=4 patients (NCI-4166, NCI-4095, NCI-4078 and MM) were thawed, rested overnight in media containing IL-2, washed and stained to evaluate the expression of selected co-stimulatory and co-inhibitory receptors specified (left panel) or the differentiation status based on expression of CCR7 and CD45RO (right panel; Naïve=$CCR7^+/CD45RO^-$; T_{CM}=$CCR7^+/CD45RO^+$; T_{EM}=$CCR7^-/CD45RO^+$; T_{EMRA}=$CCR7^-/CD45RO^-$). Percentages of lymphocytes derived from the different peripheral blood T-cell subsets expressing individual or combinations of markers are shown (mean ± SEM; n=4 patients). Each dot represents one sample analysed. *P<0.05 $CD8^+PD\text{-}1^-$ vs. $CD8^+PD\text{-}1^+$ using 1-way ANOVA and Dunn's test for multiple comparisons, *P* value adjusted for number of comparisons. Immunophenotyping experiment was performed once.

Supplemental Table 1. Patient Characteristics

Patient ID	Age/Sex	Tumor Type	Prior Therapies	% PD-1$^+$ of CD8$^+$ PBMCs	% PD-1$^+$ of CD4$^+$ PBMCs
NCI-MM	60/M	Pancreatic	Pancreatectomy and splenectomy, adjuvant gemcitabine	5.4%	2.62%
NCI-4078	48/M	Gastro-esophageal	Neoadjuvant chemotherapy (mitomycin C, Abraxane, Oxaliplatin, 5-Fluorouracil, Carboplatin, Avastin), Ivor Lewis esophagectomy	2.80%	2.95%
NCI-4095	50/F	Colon	Sigmoid colectomy and partial cystectomy, adjuvant FOLFOX	0.37%	0.80%
NCI-4110	67/F	Bile duct	Gemcitabine/cisplatin, radiation	2.76%	2.64%
NCI-4114	45/F	Pancreatic	Neoadjuvant FOLFIRINOX, neoadjuvant gemcitabine, whipple procedure, adjuvant FOLFOX	2.94%	1.99%
NCI-4166	45/F	Colon	Surgery, FOLFOX and Bevacizumab, 5-Fluorouracil and Bevacizumab, FOLFIRI and Cetuximab, Trifluridine/Tipiracil	0.41%	0.57%
NCI-4177	40/M	Pancreatic	Surgery, Folfirinox, Radiation and Capecitabine, Gemzar and Abraxane,	19%	15.5%

Supplemental Table 2. Amino acid sequence of the functional mutation-reactive T-cell receptors isolated from the peripheral blood $CD8^{+}PD\text{-}1^{+/hi}$ or $CD4^{+}PD\text{-}1^{hi}$ subsets of NCI-4078, NCI-4110 and NCI-4095

Patient ID	Reactivity	TRAV/TRAJ	TCR alpha chain V-J amino acid sequence (CDR3 highlighted)	TRBV/TRBJ	TCR beta chain V-D-J amino acid sequence (CD3 highlighted)
4078	$DLAT_{p.G294L}$	*TRAV10*01 / TRAJ35*01*	MKKHLTTFLVILWLYFYRGNGK NQVEQSPQSLIILEGKNCTLQCN YTVSPFSNLRWYKQDTGRGPVS LTIMTFSENTKSNGRYTATLDA DTKQSSLHITASQLSDSASYICVV GFGNVLHCGSGTQVIVLP	*TRBV5-1*01/ TRBJ2*01*	MGSRLLCWVLLCLLGAGPVKAGV TQTPRYLIKTRGQQVTLSCSPISGH RSVSWYQQTPGQGLQFLFEYFSE TQRNKGNFPGRFSGRQFSNSRSE MNVSTLELGDSALYLCASSLETSGL VGEQFFGPGTRLTVL
	$GBAS_{p.E207K}$	*TRAV5*01/ TRAJ3*01*	MKTFAGFSFLFLWLQLDCMSR GEDVEQSLFLSVREGDSSVINCT YTDSSSTYLYWYKQEPGAGLQL LTYIFSNMDMKQDQRLTVLLNK KDKHLSLRIADTQTGDSAIYFCA YSSASKIIFGSGTRLSIRP	*TRBV27*01/ TRBJ2-1*01*	MGPQLLGYVVLCLLGAGPLEAQV TQNPRYLITVTGKKLTVTCSQNM NHEYMSWYRQDPGLGLRQIYYS MNVEVTDKGDVPEGYKVSRKEKR NFPLILESPSPNQTSLYFCASSLIPG AGDEQFFGPGTRLTVL
	$TMPRSS4_{p.H233Y}$	*TRAV41*01 / TRAJ57*01*	MVKIRQFLLAILWLQLSCVSAAK NEVEQSPQNLTAQEGEFITINCS YSVGISALHWLQQHPGGGIVSL FMLSSGKKKHGRLIATINIQEKH SSLHITASHPRDSAVYICAGSGG SEKLVFGKGTKLTVNPD	*TRBV7-2*01/ TRBJ1-5*01*	MGTRLLFWVAFCLLGADHTGAG VSQSPSNKVTEKGKDVELRCDPIS GHTALYWYRQSLGQGLEFLIYFQG NSAPDKSGLPSDRFSAERPGGSVS TLTIQRTQQEDSAVYLCASSSSGAF QPQHFGDGTRLSIL
	$PSMD2_{p.G644A}$	*TRAV39*01 / TRAJ40*01*	MKKLLAMILWLQLDRLSGELKV EQNPLFLSMQEGKNYTIYCNYS TTSDRLYWYRQDPGKSLESLFVL LSNGAVKQEGRLMASLDTKARL STLHITAAVHDLSATYFCAVVSG TYKYIFGTGTRLKVLA	*TRBV11-2*01/ TRBJ2-1*01*	MGTRLLCWAALCLLGAELTEAGV AQSPRYKIIEKRQSVAFWCNPISG HATLYWYQQILGQGPKLLIQFQN NGVVDDSQLPKDRFSAERLKGVD STLKIQPAKLEDSAVYLCASSVGLA GAYEQFFGPGTRLTVL
4110	$DNAJB1_{p.Q336R}$	*TRAV30*01 / TRAJ34*01*	METLLKVLSGTLLWQLTWVRS QQPVQSPQAVILREGEDAVINC SSSKALYSVHWYRQKHGEAPVF LMILLKGGEQKGHEKISASFNEK KQQSSLYLTASQLSYSGTYFCGT EVDTDKLIFGTGTRLQVFP	*TRBV7-6*01/ TRBJ1-4*01*	MGTSLLCWVVLGFLGTDHTGAG VSQSPRYKVTKRGQDVALRCDPIS GHVSLYWYRQALGQGPEFLTYFN YEAQQDKSGLPNDRFSAERPEGSI STLTIQRTEQRDSAMYRCASSADR GWDEKLFFGSGTQLSVL
4095	$KRAS_{p.G12D}$	*TRAV12-2*01/ TRAJ12*01*	MKSLRVLLVILWLQLSWVWSQ QKEVEQNSGPLSVPEGAIASLN CTYSDRGSQSFFWYRQYSGKSP ELIMFIYSNGDKEDGRFTAQLN KASQYVSLLIRDSQPSDSATYLC AAAMDSSYKLIFGSGTRLLVRP	*TRBV10-2*01/ TRJ10-3*01*	MGTRLFFYVALCLLWAGHRDAGI TQSPRYKITETGRQVTLMCHQTW SHSYMFWYRQDLGHGLRLIYYSA AADITDKGEVPDGYVVSRSKTENF PLTLESATRSQTSVYFCASSDPGTE AFFGQGTRLTVV

The amino acid sequences of the *TRAV-TRAJ* or the *TRBV-TRBJ* rearrangements, encoding for the hypervariable region of the *TRA* and *TRB* genes, used to construct each TCR are shown. The amino acid sequence of the complementarity determining region 3 (CDR3) important for peptide recognition is highlighted in grey.

Supplemental Table 3. Detection of peripheral blood neoantigen-specific TRB CDR3 amino acid sequences in the blood and metastatic tumor deposits from GI patients NCI-4078, NCI-4110, and NCI-4095

				Blood		Tumor							
				CD8+		Bulk		CD8+		CD8+PD-1-		CD8+PD-1+	
NCI-4078	4078 CDR3 TCRB	Peripheral blood T-cell subset	Neoantigen targeted	rank	freq	rank	freq	rank	freq	rank	freq	rank	freq
	CASSLETSGLVGEQFF	$CD8^+PD\text{-}1^{hi}$	$DLAT_{p.G294L}$	8803	0.0074	1192	0.0094	429	0.0363	-	-	24	0.5906
	CASSLIPGAGDEQFF	$CD8^+PD\text{-}1^{hi}$	$GBAS_{p.E207K}$	-	-	11780	0.0019	-	-	-	-	88	0.1969
				CD4+		Bulk		CD4+		CD4+PD-1-		CD4+PD-1+	
	4078 CDR3 TCRB	Peripheral blood T-cell subset	Neoantigen targeted	rank	freq	rank	freq	rank	freq	rank	freq	rank	freq
	CASSSSGAFQPQHF	$CD4^+PD\text{-}1^{hi}$	$TMPRSS4_{p.H233Y}$	-	-	2015	0.0057	-	-	-	-	12	0.765
	CASSVGLAGAYEQFF	$CD4^+PD\text{-}1^{hi}$	$PSMD2_{p.G644A}$	-	-	5150	0.0038	-	-	-	-	-	-

				Blood		Tumor 4110-A		Tumor 4110-B	
				CD8+		Bulk		Bulk	
NCI-4110	4110 CDR3 TCRB	Peripheral blood T-cell subset	Neoantigen targeted	rank	freq	rank	freq	rank	freq
	CASSADRGWDEKLFF	$CD8^+PD\text{-}1^+$	$DNAJB1_{p.Q336R}$	-	-	-	-	-	-

				Blood		Tumor 4095-1		Tumor 4095-2A		Tumor 4095-2B	
				CD8+		Bulk		Bulk		Bulk	
NCI-4095	4095 CDR3 TCRB	Peripheral blood T-cell subset	Neoantigen targeted	rank	freq	rank	freq	rank	freq	rank	freq
	CASSDPGTEAFF	$CD8^+PD\text{-}1^+$	$KRAS_{p.G12D}$	-	-	1	2.6800	1	2.8100	2	2.7100
	CASSLGEGRVDGYTF*	-	$KRAS_{p.G12D}$	-	-	20	0.2100	26	0.2000	33	0.1600
	CASSFGQSSTYGYTF*	-	$KRAS_{p.G12D}$	-	-	-	-	-	-	-	-
	CASSLGRASNQPQHF*	-	$KRAS_{p.G12D}$	-	-	917	0.0200	1589	0.0100	2243	0.0080

We mined the tumor TRB deep sequencing data (bulk sequencing or T-cell subsets sorted to high purity from tumor) for the presence of the amino acid (AA) sequence of the TRB complementarity determining region 3 (CDR3) from each of the circulating neoantigen-specific TCRs identified. The frequency (percentage) and the rank of the specific CDR3 AA sequence in each population is shown. For patients NCI-4110 and NCI-4095, multiple tumors were resected and interrogated for the presence of the specific CDR3 AA sequences. – Not detected.*TRB CDR3 AA sequences exclusively detected in TILs, not in peripheral blood (15).

Supplemental Table 4. Immunohistochemical quantification of T cells infiltrating the gastrointestinal tumor specimens from the cancer patients studied

Patient ID	Tumor type	Biopsy/ surgical site	Infiltrating lymphocytes		
			Description	tumor	periphery
NCI-4078	Gastro-esophageal	Adrenal gland	CD4 predominant	2+	3+
NCI-4095*	Colon	Lung	CD4 and CD8	1+	2+
NCI-4110	Bile duct	Omental mass	CD4 only	1+	1+
NCI-4114	Pancreatic	Lung	CD4 and CD8	1+	2+
NCI-4166	Colon	Lung	CD4 and CD8	1+	3+
NCI-4177	Pancreatic	Liver	CD8 predominant	1+	2+

T-cell infiltration was measured in 6 of the 7 patients studied. The level of T-cell infiltration was reported as: 3+ abundant, 2+ moderate, 1+ occasional, 0 none.

Supplemental Table 5. Expansion of neoantigen-specific lymphocytes enriched from peripheral blood of GI cancer patients

Patient ID	population	Est. freq. neoantigen-reactive (%4-1BB$^+$) cells After REP 1	Neoantigen recognized	Fold expansion REP2 day 14	Est. freq. neoantigen-reactive (%4-1BB$^+$) cells After REP2
4078	CD8$^+$PD-1^{hi}	6.5%	*DLAT$_{p.G294L}$	7100	9.23%
	CD4$^+$PD-1^{hi}	5.6%	*PSMD2$_{p.G644A}$	94000	92.1%
4095	CD8$^+$PD-1$^+$	1.6%	$^{\$}$KRAS$_{p.G12D}$	12000	42.8%

CD8$^+$ or CD4$^+$ lymphocytes were sorted from peripheral blood of the patients indicated based on PD-1 expression as described in materials and methods and expanded using a rapid expansion protocol (REP) for 14 days. The estimated frequency of neoantigen-reactive cells after REP 1 based on 4-1BB$^+$ expression within the populations indicated is shown. Next, CD8$^+$PD-1$^+$, CD8$^+$PD-1^{hi} or CD4$^+$PD-1^{hi} from the indicated patients were co-cultured with autologous B cells pulsed with long peptides* or minimal epitopes$^{\$}$ derived from DLAT$_{p.G294L}$, PSMD2$_{p.G644A}$ or KRAS$_{p.G12D}$, respectively. Sorted 4-1BB$^+$ lymphocytes were expanded in a second REP (REP2) for 14 days. The fold-expansion and the estimated frequency of neoantigen-specific cells based on 4-1BB expression is shown. Est. freq.=Estimated frequency.

Supplemental Table 6. Mutated epitopes screened for subjects 4078, 4095, 4110, 4114, 4166, 4177, and MM

Patient ID	Peptide Pool (PP)	Pos. within PP	Gene	Mutated Amino Acid Sequence
4078	PP1	1	*ACAP3*	LCSVKPCEDIERSFCFEVLSPTKSC
		2	*NBPF9*	YKVLVHSQERELMQLKEKLQEGRDA
		3	*NBPF15*	TKITFEEDKVDSALIGSSSHVEWED
		4	*FAM171A1*	SMSHINLLFSRRSSEFPGPLSVTSH
		5	*ZNF518A*	MQSPLLNSEQKKNIIVQTSKGFLIP
		6	*DLAT*	PTPSAPCPATPALPKGRVFVSPLAK
		7	*TMPRSS4*	KQHVCGGSILDPYWVLTAAHCFRKH
		8	*OSBPL5*	ESGSDQSETPGALVRRGTTYVEQVQ
		9	*SHANK2*	EIDGSHLPNLQKDDLIDLGVTRVGH
		10	*FBRSL1*	HRHTPQPPPPQPRLLPTHVPASLGA
		11	*G2E3*	LAIPITNTYKEFHENMDFTIRNTLR
		12	*LRRC49*	TVCPIINGEDHLCLLNFQHNFITRI
		13	*TBL3*	LWALQDFSCLKTIEGHDASVLKVAF
		14	*SH2B1*	RQQEPTTSHDPPPPPEPPSWTDPPQ
		15	*ZNF768*	DSSYLLRHQRTHYGQKPYKCPHCGK
	PP2	1	*ENSG00000135722*	RVCRAWAAAATCSVWHDTKIRFHPV
		2	*ENSG00000135722*	RVCRAWAAAATCSVWHDTKISQPSP
		3	*ENSG00000135722*	RVCRAWAAAATCSVWHDTKIRRPTR
		4	*PIEZO1*	GPTNCSSPHALVFNTGLDWPVYASP
		5	*TCF25*	PRQRQRVYPKCTCLTTPKSTWPRYS
		6	*TP53*	RCSDSDGLAPPQNLIRVEGNLRVEY
		7	*KMT2B*	PSQGLTASPADPPRTFAWLPGAPGV
		8	*ZNF180*	CGKSFSQSYVLVEHQRTHTGEKPYE
		9	*GULP1*	RIQDLETENMELKIKYKIWKTN
		10	*DNAH7*	DLQDVQRYLKKARILNGKLDLAADK
		11	*CUL3*	RYGCIRDHLRQTVLDMIARERKGEV
		12	*THUMPD2*	SKDSHTDEPGIKKVLES
		13	*GGCX*	ELNPSNTDSSHSKPPESNPDPVHSE
		14	*ABHD16B*	PELGALVLDATFEDLVPLALKVMPH
		15	*PSMD2*	VRLAQGLTHLGKATLTLCPYHSDRQ
	PP3	1	*AIMP1*	GDEKKAKEKIEKNGEKKEKKQQSIA
		2	*PCDHB12*	TVTDLGTPRLKTKHNITVLVSDVND
		3	*TRIO*	QFQHAIEKTHQSTLQVQQKAEAMLQ
		4	*RICTOR*	RGYVAKQLEKWHGEYNSKYVDLIEE
		5	*MSH5-SAPCD1*	EVARKELENLDSCIPSCSVIYIPLI
		6	*FAXC*	FSFYSRTETFEDAGAENSFSRTPDT
		7	*TSPAN12*	LTHAWNFFQREFTCCGVVYFTDWLE
		8	*ING3*	KSKNNNKSSSQQTSSSSSSSLSSC
		9	*URGCP*	RNTTMVLDVLPDTRPVEKESQMEEE

		10	*GBAS*	HHLWAYRDLQTRKDIRNAAWHKHGW
		11	*BCL7B*	PSPQQSESLSPAYTSDFRTDDSQPP
		12	*ENSG00000147687*	TNGILIFLLPKKN
		13	*HMBOX1*	RYHANSMGQRSYRFEASEEDLDVDD
		14	*HSPA5*	LEEIVQPIISKLDGSAGPPPTGEED
		15	*ANGPTL2*	PSARPVPQPPPAGPPRVYQPPTYNR
		16	*POLA1*	LKKKKYAALVVEATSDGNYVTKQEL
	PP4	1	*IGFN1*	EAGYRKDLGAPEGIGSGSKAGFRDG
		2	*ENSG00000116883*	PAHLLPTSSLPIFPGLICCLLTCLL
		3	*ELTD1*	VVGVIYNKGFLHTNFYIFGYLSPAV
		4	*WDFY4*	CTQLTFFPALHERLHSEDFLELCRE
		5	*ENSG00000148926*	KGASRSPEDSCLCSPSPRPQQSGCR
		6	*ENSG00000184956*	MDTSRTQSVCRETGGAALS
		7	*OTOG*	PQLSQESPRTPTPRPALTPAAPLTT
		8	*RAG2*	LPLGSPAVNCTVFPGGISVSSAILT
		9	*GALNT9*	VSGDGVRASAATESGDGVRASAAMA
		10	*VWF*	QGDDFLTPSGLAGPRVEDFGNAWKL
		11	*GOLGA8CP*	GSPHDKPTAQPIMQDHQEHPGLGSN
		12	*PDILT*	SCKGVVESAALVIWLRRQISQKAFL
		13	*HS3ST4*	GVEPHFFDRNYEEGLEWYRNVMPKT
		14	*NARR*	GTPRPRVIVGSPLARVADADPASAP
		15	*ENSG00000076604*	CPEDQLPLDYAKLPHPYPQIYPDPE
		16	*MLLT6*	CCVCSDERGWAETPLVYCDGHACSV
	PP5	1	*KRT10*	GGSSGGGYGGGSSSGGHGGGSSSGG
		2	*ADAMTSL5*	QTPTLAPDPCPPSPDTRGRAHRLLH
		3	*ZBTB45*	FSHRALLERHLAVHPAP
		4	*THNSL2*	FMPEELPQLDRGPLCQWSTLSYPGL
		5	*ENSG00000144115*	MELPQLDRGPLCQWSTLSYPGL
		6	*JPH2*	PASPASDGPALPLPAIPRGGFALSL
		7	*ENSG00000179253*	YDFDHLLSPALPSSTSVAREGPSLI
		8	*PCDHB15*	YEALQAFEFRVGTTDRGFPALSSEA
		9	*MAK*	IFKICQVLGTPKNSDWPEGYQLASS
		10	*RIMS1*	RDMAKPAACKTPGNAENQPHQPSPR
		11	*NEFM*	RSNEKEQLQGLNNRFAGYIEKVHYL
		12	*PREX2*	QWVYNSIESAQEYLQKSHSKPPGDE
		13	*ACTL7B*	RPTYFISSTVGKCCPEAADAGDTRK
		14	*ADAMTS13*	VRRILYCARAHGKDDGEEILLDTQC
		15	*ZNF658*	CNECGRSFAHISDLKAHQRIHTGEK
		16	*IDNK*	KDGVALKCEESGNEAKQAEMQLLVV
	PP6	1	*GABRA3*	DSPTETKTYNSVRKVDKISRIIFPV
		2	*PLXNB3*	PGISSQHFTYQGGVGGSWPVCSGLG
		3	*DCAF8L2*	NTTVKGVNFYGPMSEFVVSGSDCGH
		4	*NYX*	VLEHLLLNDNLLSELPADAFRGLRR
		5	*ZNF157*	KIFSMKKSLCQHLRTHTGEKPYECS

		6	*KDM5C*	AERHGSRARGRARERRRRRKVDRGG
		7	*ENSG00000268674-1*	RAGTGASREEGTFGQNVWDKSDGSS
		8	*ENSG00000268674-2*	GTFGQNVWDKSDGSSIQVPQKMRVR
		9	*ENSG00000268674-3*	SDGSSIQVPQKMRVRKMRAQT
		10	*AGAP6-1*	EVGEDLHMHHVRDGRCLKLWSLTFL
		11	*AGAP6-2*	VRDGRCLKLWSLTFLPIQSQAQYSR
		12	*AGAP6-3*	SLTFLPIQSQAQYSRGTLKQKLWSL
		13	*AGAP6-4*	AQYSRGTLKQKLWSLTLLPIQRQAQ
		14	*AGAP6-5*	KLWSLTLLPIQRQAQYSRGTLKQML
		15	*Ex_ENSG00000204149-1*	EVGEDLHMHHVRDGRCLKLWSLTLL
		16	*Ex_ENSG00000204149-2*	VRDGRCLKLWSLTLLPIQRQAQYSR
		17	*Ex_ENSG00000204149-3*	SLTLLPIQRQAQYSRGTLKQML
	PP7	1	*FAIM2(1)*	GMKAGAFPPAPTVVPLHPSWAYVDP
		2	*IQSEC1*	GHHTQYCHMQNPAPYHHHHHHHPPQ
		3	*ENSG000000148926(1)*	MGSQVAFVPPPPARSSPDAA
		4	*KRTAP9-7*	PTCCRTTCWKPTIVTTCSSTPCCQP
		5	*FBXL8*	RVCRAWAAAATCSVWHDTKISCECE
		6	*GPR182*	QPKSRRHCLLLCTYVAVFVMCWLPY
		7	*NEK11*	LLSKLDHPAIVKLHASFVEQDNFCI
		8	*ARIH2*	NHMQCSKCKHDFRWMCLGDWKTHGS
		9	*VPS41*	WKDNVTLIIGWGNSVKVCSVKERHA
NCI-4095	PP1	1	*KLF5*	ATYFPPSPPSSEAGSPDRQAEMLQN
		2	*ZC3H3*	HGPRKPSASQRPPRQTPSSAALTAA
		3	*WRNIP1*	MEVSGPEDDPFISQLHQVQCPVCQ
		4	*SENP2*	LMVGNHALIQGLNKEKFDLLLVDPN
		5	*UGT8*	ATRIQIALKYDENNKQFAILIIQLS
		6	*WWC1*	SDQGENVAEINREVGQKLGLSNGGQ
		7	*PEX1*	MTEYKLVVVGADGVGKSALTIQLI
		8	*KRAS*	GDPSYPWLADSWTATSLPVNNSNSG
		9	*ROBO2*	KGLVLRQHGIRLMEAQIATGGIIDP
		10	*PGBD1*	YKRRPEVDPLPFLGPFPAGPLAVAG
		11	*PLEC*	QMKQSRGADLKNWALVVYEMVPSNS
		12	*ESRRA*	EEDPVLPPVPDGTGEPTVPEGAIWE
	PP2	1	*LIX1L*	LLEELANSDPKLSLTGVPIVQWPKR
		2	*TACC2*	VFTPYSAAFLLKDTEEGPPATECGY
		2	*KDM2A*	QMKQSRGADLKNWALVVYEMVPSNS
		3	*KCNH2*	EEDPVLPPVPDGTGEPTVPEGAIWE
		4	*PCSK5*	LLEELANSDPKLSLTGVPIVQWPKR
		5	*KCNN3*	VFTPYSAAFLLKDTEEGPPATECGY
		6	*DNAJB6*	FFFLLRSKGECHHSCPDHYYVEQST
		7	*FAM109A*	SVAVGTTHTPISYSPIGVSSTSFPT
		8	*DDX60*	DALAEERMRRGQTALPAQPAGLRPP
		9	*DUOX2*	QSHPCLLPQPRSPPCPCPAGPVPSR

		10	*COL17A1*	DAEYAYFNFPELISLRTALILHLQK
		11	*WISP1*	YWFENTRNGLFSNKEIEDIRNTTLR
		12	*COL17A1*	GAGGGPWGPAPAGCPCGSCCSWWKW
		13	*WISP1*	VLATALSPAPTTKDFTPAPLEDTSS
	PP3	1	*AGAP3*	SSSPKLDPPPSPPSNRKKHRRKKST
		2	*ZC3H3*	ALRGKSSPVLKKPPNKGLVQVTTHR
		3	*C8orf82*	RLYHPAPERAGGGGLVRSALAFELS
		4	*LINC00115*	VFHRPHPRPSWPHRAALGFGRRQSS
		5	*TRIM11*	CAACERSGEHWALRVRPLQDAAEDL
		6	*CPEB3*	DPRKTIFVGGVPLPLRAVELAMIMD
		7	*PRB1*	PQGPPPQGGNRPLGPPPPGKPQGPP
		8	*PRG4*	AGGAEGETPHMLFRPHVFMPEVTPD
		9	*HLA-DQB1*	TVEWRAQSESAQRKMLSGVGGFVLG
		10	*ZNF717*	GICHRSLVELQEL
		11	*MUC4*	VSTGHTTPLPVTYTSSASTGHATSL
		12	*MCHR2*	PLCTIITSLDTCTQFACSAIMTVMS
		13	*OBSCN*	WHKGMERIQPGGWFEVVSQGRQQML
	PP4	1	*DSPP*	SNSSDSSDSSNSRDSSDSSDSSDGS
		2	*ADAMTSL2*	EQAGGGACEGPPWGKGFRDRNVTGT
		3	*RSAD2*	QIKALNPVRWKVLQCLLIEGENCGE
		4	*AEBP1*	EEWTPTEKVKCPRIGMESHRIEDNQ
		5	*AKAP6*	EALKKGGVLLPNYLLEKVDSINEKW
		6	*TMEM132D*	SSSMGLMEGRGTMTDRSILQKKKGQ
		7	*DPY19L2*	FEKVIFGILTVMPIQGYANLRNQWS
		8	*ARL14EPL*	DFNPETRQQKKKSRMSKMNEYFSTK
		9	*SPTB*	MRETWLSENQRLMAQDNFGYDLAAV
		10	*PPM1K*	NCAWSAALDLEPMDTICGASVEREI
		11	*TTN*	SWFKDGKEIAASERYRIAFVEGTAS
		12	*IL17F*	GIINENQRVSMSHNIESRSTSPWNY
	PP5	1	*FRMPD1*	SVKLLARQCTALMAAVFCLTQKFRA
		2	*LRFN5*	GCIQFTTEQDYVHCHFMQSQFLGGT
		3	*ANKRD18B*	NEEMITKKVAQYLQQLNDLKAENAR
		4	*NPC1L1*	GSGIQPLNEGVACCNESQGDDVATC
		5	*PCDHB3*	NFEAINSYEVDIKAKDGGGLSGKST
		6	*LRRC4*	LTVIPSGAFEYLYKLRELWLRNNPI
		7	*MAGI2*	ELQQIIRDNLYLCTVPCTTRPHKEG
		8	*LMOD1*	PKPSPQPSPKPSTKNSPKKGGAPAA
		9	*ZNF853*	ELMVLPAVAAPAMVAIPGPAGSAAL
		10	*TENM3*	APDPGNLAALGSFPHGHSEGAPRQE
		11	*MYO1G*	GTITDRIFLQTLVMHHRHHLHYTSR
		12	*SYT7*	TTSQSLGQLQAHLASAPGPNPRAYG
NCI-4110	PP1	1	*DNAH1*	DKRRKGVFGPPLRRNFIFFIDDLNM
		2	*PCDH10*	KALGHSDRCWMPYFVPSDGRQAADY

		3	*TRIM2*	FTLSLRLYDQHIQGSPFKLKVIRSA
		4	*FSTL5*	IHTQPVGKQFDRLDDFFIPTTTLII
		5	*C4orf22*	KILNVDPKAQPGGNSTRITILTELY
		6	*PDHA2*	DEICLTLYGDGAVNQGQIAEAFNMA
		7	*42069*	LVWLREQIVHGGEPIWLEHAAPPFN
		8	*SLC6A3*	PAKEPNAVGPKELELILVKEQNGVQ
		9	*SLC34A1*	SSTSTSIIVSMVPSGLLEVSSAIPI
		10	*MCTP1*	GPGAHLCHQKSSFLPGTACLEQLLE
		11	*KIF25*	RASQGALAPQLVLGNPAGHAEQVQA
		12	*TRERF1*	PRVLGDHLLLDPPHELPPYTPPPML
		13	*ZAN*	ISPEKPTISTEKHTIPTEKPTIPTE
		14	*MUC12*	TTLSPASMTSLGIGEESTTSRSQPG
		15	*MUC17*	SPEASTLSTTPVNSNSPVITSTEVS
	PP2	1	*CNTNAP2*	RVTAERNVKQASQQVDRLPQQIRKA
		2	*NFE2L3*	LDINIFDEINLMLLATEDNFDPIDV
		3	*CARD11*	METLKDEEDALWDNVECNRHMLSRY
		4	*IKZF1*	MGCHGFRDPFECSMCGYHSQDRYEF
		5	*STEAP4*	FVLIMPCVDNTLKRIRQGWERNSKH
		6	*RP1L1-2*	GVEAPEAEGDAQPESEDVEAPEAEG
		7	*OXR1-1*	QGDLGCGSPPHRSPAPSSPEGPDTG
		8	*OXR1-2*	QGDLGCGSPPHRSPAPSSPEGPDYY
		9	*KIFC2*	AVLHAPVPTTARVRLSRPQRACPSS
		10	*KCTD9*	TPTKSELRCQGLKFSGADLSRLDLR
		11	*AKNA*	SFTIPQPRSAEWGPGPAEDPQASAA
		12	*BARX1*	PFHSHLAVLKAELAAVFKFPLAPLG
		13	*RBMXL3*	GRDRVGRPDRGLSLPMETGSPPLHD
		14	*GLUD2*	DCDILIPAATEKKLTKSNAPRVKAK
		15	*FAM47C*	TGVSHLRPEPPKTRVSSLRPEPLET
	PP3	1	*SLC7A3*	MPWQAFRIFGQKLVRRRTLE
		2	*TGIF2LX*	LPLWPLPKGQMSIEKQPDPESAPSQ
		3	*PRDM13*	RSAFKPAGLARAGAAAHGDPYREES
		4	*GRID2IP*	RAPRCGRGLALGCELLRLAGRKRPD
		5	*RTKN*	CSPASVAPAPDWAHPLPWGRPRTFS
		6	*KIFC2*	GAGQVCACRSPPPRARPPAPLARRS
		7	*RTKN*	SPASVAPAPDWTPPLPWGRPRTFSL
		8	*DBF4B*	PCLPVSQPWSQPPPQPQPHAGRELL
		9	*ETV3L*	GELPGVASFTPPHPPPLPSNWTCLS
		10	*SELP-1*	RFRQKDDGKCPLIPHSHLGTYGVFT
		11	*SELP-2*	VPTCQDDGKCPLIPHSHLGTYGVFT
		12	*EXOC8*	GASRLRRQLESGSFEARLYVKQLSQ
		13	*CSMD2*	SEELLCLSGERRNWDRPLPTCVAEC
		14	*KANK4*	REQRIRELEFTVDQLEGQFHQENAK
		15	*CLCA1*	MFAQHVDSIVEFYTEQNHNKEAPNK
	PP4	1	*CNNM1-1*	FEPGLGLRQMLAVPL

		2	*STK32C*	WSVGVMAYELLRRWRPYDIHSSNAV
		3	*ADAM8*	PSRGPQELVPTTPPGQPARHPASSV
		4	*SSRP1*	TTGKNEVTLEFHRNDDAEVSLMEVR
		5	*OR52E8*	ILSYVRILYAVFSLPSWEARLKALN
		6	*CDHR5*	TSTSHQPATPSGVTAQTPEPGTSQP
		7	*TCIRG1*	ATLVVLALAMVPVLLLGTPLHLLHR
		8	*DDX47-1*	LDIPHVDVVVNFHIPTHSKDYIHRV
		9	*DDX47-2*	LDIPHVDVVVNFHIPTHSKVSPIAN
		10	*BICD1*	KSKIGSPKVSGESSVTVPTIDTYLL
		11	*KRT84*	EIATYRRLLEGEKSRLCEGVGPVNI
		12	*ZIC5*	GTPVGAPLSPVLEPARSHSSTLSPQ
		13	*IL25*	EELLRWSTVPVPLLEPARPNRHPES
		14	*SIPA1L1*	PKNIRSHFQHVFAIVRVHNPCSDSV
	PP5	1	*CYP11A1*	TLQRYLVNDLVLQDYMIPAKTLVQV
		2	*ACAN*	VPSPGEEEGGTPSSPSGVEEWIVTQ
		3	*ZNF768*	AQSSKFQEGAEMVLNPEEKSPLNIS
		4	*PIGQ*	MWWALGPPGILPPGMVLK
		5	*HYDIN-1*	DQEHIPFGPVVYETQATRRILMMNT
		6	*RBFOX1-1*	LVLSSLQASIYRRGYNRFAPY
		7	*RBFOX1-2*	TYGVGAMASIYRRGYNRFAPY
		8	*HS3ST3B1*	PALATAPDGTPPSLPFRAPPATPLA
		9	*FAM64A*	LPLRAVNLNLRAEPSWKRLETPEPG
		10	*SIRT7-1*	MRLLMAELGLEILAYSRWQDPIFSL
		11	*SIRT7-2*	AGISTAASIPDYQGPNGVWTLLQKG
		12	*SIGLEC15*	RPEHLDTPDTPPQSQAQESNYENLS
		13	*DCC*	VPTLESAQYPGIFPSPTCGYPHPQF
		14	*SOGA2*	QEEVELGGTRWNSLDSKPILWHWDR
	PP6	1	*SOGA2*	WNSLDSKPILWHWDRQVCAGACGEL
		2	*DCAF15*	FCQILYDHSTCPQAPASPPEPQSPE
		3	*DNAJB1*	ERIPQTSRTVLERVLPI
		4	*MYO9B*	LPRWAPGAREAAVPVRRREPPARRP
		5	*UBA2-3*	NLSAKRSRIEQKKELDDVIALD
		6	*LAIR1-1*	PSISAEPGTVIPPGEPCDFRVPGPG
		7	*LAIR1-2*	IPPGEPCDFRVPGPGWGSNIPPGEGE
		8	*BRSK1*	FRDRERLHRELRIEEENQEKMIYYL
		9	*FBLN7*	RPCRHLPKTISFNYLSLPSNLKTPI
		10	*DCAF17*	QQKLDLGCACRWDGTTGTVGEAPFG
		11	*TTN*	PPIVETLKNAEVMLECELSGTPPFE
		12	*EFR3B*	SVAVEEQERERRQQVVEKFQKAPFE
		13	*THADA*	TGQEQSFPSLGSFNSRGALGALMAC
		14	*SIRPD*	MPIPASLLHPPLPSLLLYL
	PP7	1	*LCE1D*	CGSNSGGCCSSGRGGCCLSHHRRHR
		2	*NUP210L*	KTYLTNTLNSTVLKLFITTGRNGVN
		3	*FCRL3*	AAAALLHYARARKKPGGLSATGTSS

		4	*KIAA0754*	AASVPTSEEPASQAAAVSNPEEPTS
		5	*ANKRD13C*	AHYPVHECVFKGNVRRLSSLIRTHN
		6	*SSX2IP*	RILKSHVEKLDNHVSKVHLEGFNDE
		7	*CDC7*	DLTALAQIMTIRRSRETIQAAKTFG
		8	*CNNM1-2*	RTFAVSRGDSLARSPVNRSPSRCSG
		9	*C10orf2*	PLISRRDAEVVLASRELDSLALNQS
		10	*SMC3*	EGDQVSHRGALTEGYYDTRKSRLEL
		11	*USP6NL*	DRTPFTLNLRIWVIYIFEGERVLTA
		12	*EIF3A-1*	EDDRGPWRNMDDMDDNRLSRRADDD
	PP8	1	*EIF3A-2*	DDMDDNRLSRRADDDRFP
		2	*GJD4*	PTEKSLLMLFLWSVSALSFLLGLAD
		3	*ZCCHC24*	CSWQFSRTSSTCSCQSSRTSSTSCS
		4	*OR52A1*	IAAVVRSFFICCLFIFLVYRLTYCG
		5	*DCHS1*	KVMAVSGSKAELRQQTGTATVRVSI
		6	*TMTC1*	ADVLACLLFLLAILSYNRSLDQGCV
		7	*SLC38A4*	LVILVPTIKYIFRFIGASSATMLIF
		8	*POTEG*	GSSKSNVGTSGDNDDSAMKTLRSKM
		9	*ESR2*	SRKLAHLLNAVTYALVWVIAKSGIS
		10	*HERC2*	KMIVDPADSSYMRSLVVVSGGNSLN
		11	*ATP8B4*	CEVPNNKLDKFMVILSWKDSKHSLN
		12	*ACSBG1*	ELIITAGGENVPSVPIEEAVKMELP
	PP9	1	*ZKSCAN2*	DSDDDEIGIEFICKSEIHGAPVLFQ
		2	*HYDIN*	TQATRRILMMNTVDVGARFKWDIKK
		3	*CTU2*	GEDYGEPAPEEPTPAPRPSREQKCV
		4	*SLFN5*	AIKVEKFCCAVFIKVPSSWQVKDNR
		5	*KRTAP4-7*	ETTCCHPRCCISTCCRPSCCMSSCC
		6	*ACLY*	DIGALNGIFVLGWSMGFIGHYLDQK
		7	*RND2*	ERSVRDVFHVATLASLGRGHRQLRR
		8	*SCN4A*	NLFLALLLSSFSATVWQPRMRMAR
		9	*FADS6*	SLFALPAGFLCLHWENALVFASGIT
		10	*TP53*	NSFEVRVCACPGSDRRTEEENLRKK
		11	*ODF4*	QNSPLPFQWRITQSFRWMAQVLASE
		12	*KIAA1328*	PQRGTVTGVRKDESTSPMPTGSLKD
	PP10	1	*MTCL1-1*	CPGRGPEGTWQEEVELGGTRWNSLD
		2	*MTCL1-4*	WHWDRQVCAGACGELLCSSDRGTAH
		3	*MTCL1-5a*	ACGELLCSSDRGTAHCRHCPPPVSA
		4	*MTCL1-5b*	RGTAHCRHCPPPVSADREHLEV
		5	*ZNF98*	FAQDLWPKQGKKKYFQKVILRTYKK
		6	*ZNF99*	TVHKVIHTAEKPFKCEECGKAFKRF
		7	*UBA2-1a*	AQPSTSTAQEQDNVLIVDSNEEDSS
		8	*UBA2-1b*	QDNVLIVDSNEEDSSNNADVSE
		9	*UBA2*	DSSNNADVSEEEKSRKRKLDEKENL
		10	*SRRM5*	ARDCSRSRSPYKERDRSRSRSPNKA
		11	*OPA3*	CSCLMLEYWRHQSQQRRKEKERRVA

		12	*ZNF628*	VCGKSFTQSTNLLQHQRVHTGERPF
	PP11	1	*PNPLA6*	NMRSWCSGHLHLCCPRRLFSRRSPA
		2	*GMEB2*	TLKDWKRAIRMNSIMLRKIMDSGEL
		3	*SON*	ASNTMDSQMLASTTMDSQMLATSSM
		4	*ATP11B*	FLSKLLFVHGHFHYIRIATLVQYFF
		5	*ACAA1*	GIRPSTTMEGLAELKPAFKKDGSTT
		6	*OR5H6*	IGTILISYTIILLTILEKKSIKGIR
		7	*LPHN3-1*	EDNRPFIKSWVICAIALLCLLGLTW
		8	*LPHN3-2*	SGCLDNIKSWVICAIALLCLLGLTW
		9	*DDX41*	SLLDQHQHLKEKPEARKESAKEKQL
		10	*IRX1*	PYGQFQYGDPGRHKNATRESTSTLK
		11	*SREK1IP1*	VRAGCKKCGYPGYLTFECRNFLRVD
		12	*BVES*	RFLCWSRERLTYVLESEPFLYEIFR
	PP12	1	*TAAR5*	NGSCPRTVHTLGSQLVIYLACAAGM
		2	*OLIG3*	SPDMDEMYLRDHPHRHHHHQESRLN
		3	*ARID1B*	MMVPDQRINHESKWPSHVSQRQPYM
		4	*DPCR1*	APPTSEENSSNQRKDPMIRNQRSVD
		5	*MDGA1*	KNGKPARMSKRLRVTRNDPELPAVT
		6	*PKHD1*	DLTSGTEPFCGRLSLRQPRHLVLTP
		7	*TES*	EHDVLLSNEEDRNVGKLFEDTKYTT
		8	*TTC26*	GACVGIFQMIIAEREPKETLREVLH
		9	*GPC2*	CLNVVRGCLSSRRLEPDWGNYLDGL
		10	*RP1L1-1*	QEAEEAAQEAEGESQPESEVIESQE
		11	*GML*	FALLLAMELPLVSASATMRAQWTYS
		12	*PCMTD1-1a*	AMKPEEPPQNLLTEKIMKLTLPESL
		13	*PCMTD1-1b*	LLTEKIMKLTLPESLKAYLTYF
	PP13	1	*RXRA*	CEGCKGFFKRTVHKDLTYTCRDNKD
		2	*PRSS3-1a*	TRIQVRLGEHNIEVLEGNEQFIYAV
		3	*PRSS3-1b*	NIEVLEGNEQFIYAVKIIRHPKYNR
		4	*ALG13*	NLKPVTQVMSVPPWNAMPSRKGRGY
		5	*SMARCA1*	SQMTRLLDILEDDCMWRGYEYCRLD
		6	*SASH3*	TQKKKLSLQRSSIFKDFAKSKPSSP
		7	*MAGED2*	MPATETKKVSHVSDTKVNTKAQETE
		8	*AWAT2*	RGGRRFTCVRHWHLWKHYSDYFPLK
		9	*AQP7*	TDQENNPALPGTHALVIGILVVIIG
		10	*IGFN1*	SKAGFRDGLGSSEEMGSVNEAGYRK
		11	*FAM186A*	PLNPQQAQTLGITLTPKQAQALGIP
		12	*NPIPL2*	KPKRRRADEVEQPPKPKRQREAEAQ
		13	*IGFN1*	SVNKAGYRKDLGDPKGMGSGSKASF
NCI-4114	PP1	1	*MSTO1*	PYHRGEAQRNIYCLLNTAFGLVHLT
		2	*NUF2*	LVTHLDSFLPICWVNDFETADILCP
		3	*GPAM*	LLGPLLEAYSSAVIFVHNFSGPVPE
		4	*CORO1B*	RMSERQLALWDPKNLEEPMALQELD

		5	*PIWIL4*	VGCVASVNPRITSWFSRCILQRTMT
		6	*SVOP*	TSVVFVGMMSSSMLWGNISDQYGRK
		7	*WDR66*	SIVNWYSHLKLGTIRTLSFSKTPAT
		8	*SKP1P2*	MLCHATVVASSSAFLF
		9	*ENSG00000185958*	PGISLTTQQAQKIGIPLTPQQAQAL
		10	*ZMYND15-1*	KPAQGSGARPAPGPPPPTPIPNSLC
		11	*ZMYND15-2*	PGPPPPTPIPNSLCSSCPHPKAPRR
		12	*ZMYND15-3*	LCSSCPHPKAPRRKETWAGGPPAEM
		13	*TP53-1*	TCTYSPALNKMFRQLAKTCPVQLWV
		14	*TP53-2*	NVLYSPALNKMFRQLAKTCPVQLWV
		15	*TP53-3*	SGTAKSVTCTMFRQLAKTCPVQLWV
	PP2	1	*DHAH17*	LGSLDGTLESMEKIPSSLDNLLLHA
		2	*NTN1*	TWARRLRKFQQREKGKCKKA
		3	*ZNF486*	KAYTTSSNLTEHMTTHTGEKPYKCK
		4	*ZNF626*	AFKYSSTLTTHKIIHTGEKPYKCEE
		5	*ZNF91*	LTKHKIIHSGEKPYKCEECGKAFNR
		6	*ZNF681-1*	KPYKCEECGKAFSQSSHLTTHKIIH
		7	*ZNF681-2*	PYKCEECGKAFNKSSHLTRHKIIHT
		8	*ZNF254*	CEECGKSFSQSSNLTTHKIIHTGEK
		9	*ZNF57*	QFKANGSVSLQDIYGQEKSKEQTIP
		10	*ZNF304*	SHLVQHKKVHTGERPKECSECGKFF
		11	*MUC16*	LVFSQSSENSETPALVDSSAGLERA
		12	*ZNF121*	FRASSHLQKHVRNHTGEKPYICNEC
		13	*WNT10A*	RPHNRNGGQLEPCPAGAPSPAPGAP
		14	*ADRA2B*	FLVSLAAADILVTTLIIPFSLANEL
		15	*SEZ6L*	IPALSPLLPEEACPKHALPPKKKLP
	PP3	1	*SCN10A*	GVTDDGVFPGDHKSHRGSLLLGGGA
		2	*YIPF5*	YDYSQQGRFVPPNMMQPQQPYTGQI
		3	*TTC26*	AVYLQQIPDSTITLNLKACNHFRLY
		4	*ZNF853*	QVLQQQEQLQQQLQEQQLLQQQQEQ
		5	*TFPI2*	CEGNANNFYTWETCDDACWRIEKVP
		6	*CSMD3*	WEPGKRRCAKCGHLDFILMKKMGIK
		7	*VPS37A*	LMDKQGVYVTSPSVNNFTMHSDLGK
		8	*DENND1A*	TAWSGSTLPSRPPTPNVATPFTPQF
		9	*NOTCH1*	GLCVDAGNTHHCCCQAGYTGSYCED
		10	*HIATL2*	LSDVWGRKPFLLSTVFFTCFPIPLM
		11	*KIAA1210*	MRAGWTPQGFSAFHASLLPG
		12	*KCND1*	LAEDEEAEQAGDSPALPAGSSLRQR
		13	*HUWE1*	PDIFTEVANCCIHIALPAPRGSGTA
NCI-4166	PP1	1	*AMBP*	TPPDNIQVQENFSISRIYGKWYNLA
		2	*GOLGA8J*	PPAVPSEVELQHVRKELERVAGELQ
		3	*PPFIBP1*	KMMSDASDMLAASLEQMDGIIAGSK
		4	*HLA-DQA2*	IVVGTVFIIQGLCSVGASRHQGLL

		5	*ZNF727*	GKAFGLCSIFTEQKKIFSREKCYKC
		6	*ING5*	SGGRGLKSKSVNYFFFILLLL
		7	*SCN9A*	ACFTDGCVRRFSYCQVNIESGKGKI
		8	*PDE4DIP*	LPGAKPGPSMTDELVPVSLTGL
		9	*DNAH1*	EFRVIFDSLEPHQEPLPGIWDQYLD
		10	*RNF133*	SKYSETWLALIEWGGCTFTQKIKVA
		11	*CXorf22*	SVRLQKKQAEREHMYSYDDTDIGLE
		12	*GBA3*	HYRFSLSWSRLLRDGTTGFINQKGI
		13	*MAP3K5*	GGSLSALLRSKWAPLKDNEQTIGFY
		14	*ENPP6*	LQDRLNVIIFSDQGMTDIFWMDKVI
		15	*ATAD3A*	ADIIREQIRLKASEHRQTVLESIRT
	PP2	1	*SCN9A*	ACFTDGCVWRFSYCQVNIESGKGKI
		2	*SLAIN1*	MVVVGLCLRLLLFFR
		3	*GBA3*	HYRFSLSWSRLLRDGTTGFINQKAI
		4	*MDH1B*	LFDNKQAEEHLKRLVVETQDLASPV
		5	*ZKSCAN3*	QFLTILPGNLQSCVREQHPESGEEV
		6	*FRMPD1*	PDRACLASNPGLYNVSQGDTLELQL
		7	*VWF*	AFVLEGSDKIGETDFNRSKEFMEEV
		8	*CD19*	YENEDEELTQPVTRTMDFLSPHGSA
		9	*ANKRD30A*	HIHEQIMEYIRKSSKNHQNTNPEGT
		10	*TP53*	YMCNSSCMGGMNWRPILTIITLEDS
		11	*STARD9*	ATVPRPPCRSKLMSCSSLSPQRLCS
		12	*ARHGAP11A*	YESVGWRLANQQTLKNRIESVKTGL
		13	*FAT4*	ASPRGSEAPVEYFIVSVRCEEKTVG
		14	*MST1*	QCQRWSAETPHKLQFTFTSEPHAQL
		15	*FANCM*	DIKAVQQVITNLPIGQIELRSEDSP
	PP3	1	*PPFIBP1*	MMSDASDMLAASLEQMDGIIAGSK
		2	*FANCM*	YCQAVQQVITNLPIGQIELRSEDSP
		3	*ANHX*	HYRLVMRRLGVAVLTPVQKFRCRKR
		4	*NTMT1*	GMLGGYGHISSIGINSSRKFLQRFL
		5	*SUN1*	AIQGNGDVGAAATTAHNGFSCSNCS
		6	*TTN*	GGSMITGYIVEKHDLPDGRWMKASF
		7	*TP53*	YMCNSSCMGGMNW
		8	*CCDC64*	SMQVHALREDFRDKNSSTNQHIIRL
		9	*SLC26A1*	FANLIYFLMGTSWHVSVGIFSLLCL
		10	*RUFY3*	LDVEKELEMQISIRQEMELAMKMLE
		11	*GATA2*	HSGHILPTPTPIPPSSSLSFGHPHP
		12	*C2CD5*	TNCQSSCTEGEVAT
		13	*MFSD8*	VVRSYTAGATSLLERTSSMANISMC
		14	*UBE3C*	GRIGPLQSTLDVSLESPPLSVSEER
		15	*NOD1*	EMEIIPSESHPHLQLLKSNRELLVT
	PP4	1	*CNTN5*	IVVICSAEGEPSDAPTDVKATSVSV
		2	*NYAP2*	SGRSLLRKSSSGQRSKEPAEKSTEE
		3	*MST1*	SASAGPLRRRTSCSSRLPPNRMHNW

		4	*PRLHR*	SLQLVHQLKGLIMLLYSVVVVVGLV
		5	*UBE3C*	SELIKVLKCVLVSLESPPLSVSEER
		6	*EBF1*	CRVLLTHEIMCSHCCDKKSCGNRNE
		7	*ATR*	TQDIASDLCQLSAQTVFSMLDHLTQ
		8	*KANK1*	INDPKALTSKDMSFCLNTLQHEWFR
		9	*TNFSF13B*	IYGQVLYTDKTYTMGHLIQRKKVHV
		10	*NPLOC4*	VYTFSISQNPFPVENRDVLGETQDF
		11	*WNK3*	CDNIFITGPTGSLKIGDLGLATLMR
		12	*PLEKHH1*	RSETGQYATYCQWAVERTLRTGERE
		13	*MCAT*	AVEPLTQALKAVNIKKPLVSVYSNV
		14	*NPAS1*	SSSSSSSLADTPKIEASLTKVPPSS
	PP5	1	*HIST2H2BF*	GPRALAAAAPRYGRRLQYAHAATVW
		2	*WNT8B*	ERALQLSSHGGLHSANRETAFVHAI
		3	*OR10K2*	TLVLAIPLLLILLSYVHILSAILQF
		4	*KIF7*	LEVGTASRDIQLWEDERGNVVLCGV
		5	*SUN1*	GDVGAAATTAHNGFSCSNCS
		6	*SIGLEC11*	VAALLAFCSCLVIFRVKICRKEARK
		7	*NPAS1*	SSSSSSSLADTPKIESATTWTWGPQ
		8	*AKAP6*	GDAVNVLKQKFTNEGESIKLPNSSQ
		9	*OR9K2*	LRNKDVQEALKKILEKKNIIL
		10	*RYR2*	PNIFLGVSEGSAHYKKWYYELMVDH
		11	*USP24*	SSIRVEEIIPAAQVAIQTMEVSDFT
		12	*GP1BA*	DRCELTKLQVDGMLPVLGTLDLSHN
		13	*WNK1*	EMYEEKYDESVDIYAFGMCMLEMAT
		14	*KANK1*	TLREADAGGSHESFCLNTLQHEWFR
		15	*PSD2*	YHLEGFQRCDVAWQLGKNNEFSRLV
NCI-4177	PP1/TMG1	1	*KDM6A-1*	KSCSNTSALAARSKYLQNTSDNWSG
		2	*ZNF233*	LLTTSSATSLAQYPRIHRPGLLQQL
		3	*OR5W2*	AVFLAVYIINFSENLGMIVLIRMDY
		4	*MMP14*	KAFRVWESATPLCFREVPYAYIREG
		5	*USP51*	PSLCLVCEMSSLCHAMYSGSRTPHI
		6	*TRIM42*	HLVNHLNCPMCSQLRLHSFMLPCNH
		7	*NLRP8*	KRCQYLHEVELTITLNFMNVWKLSS
		8	*ETV6*	TNMTYEKMSRALRHYYTTTN
		9	*DCHS1*	RAPGSGTATSGGEGRTRREAPRELR
		10	*ZNF880*	QRIHTGEKPYKCNECGKVFTQNSHL
		11	*PAQR5*	FDYIGHSHQLFHMCVILATHMQMEA
		12	*ANKRD36C*	GANIEECSEDEYSPLFLAVSQRKVK
		13	*TP53*	SQKTYQGSYGFRQGFLHSGTAKSVT
		14	*OR7D4*	MDTFLLAVMAYDWFVAICHPLHYTV
		15	*UBE3D-1*	ICKRCKVMLGETLSSGKNFITRSQN
		16	*PXDN*	RGINPHRLYNGHTLPMPRLVSTTLI
	PP2/TMG2	1	*PLA2G4B*	PHLCLLDVGYLISTSCLPLLQPTRD

		2	*MC5R*	SSPCEDMGIAVELFLTLGVISLLEN
		3	*UBE3D-2*	ICKRCKVMLGETLSSETTKFYMTEI
		4	*NDUFA4L2*	TRASPGLVAMTTTLSQRWDRKNNPE
		5	*RHPN2*	DFFQKLGPLSVFLANKRWTPPRSIR
		6	*PASK*	NLKELFFSDQTDRTSSNCSCATSEL
		7	*KDM6A-2*	KSCSNTSALAARSKYLQACKPHHPN
		8	*MAGEC1*	FEGFPQSPLQIPLSSSSSSSTLLSL
		9	*TRIM17*	VEEEQRLLQALEKEEEETASRLRES
		10	*SPATA31A6*	QAKGKPSPWQSSMSTGESSKEAQKV
		11	*ZNF91*	CGKAFSRSSTLTNHKTIHTGEKPYK
		12	*SHANK1*	AGLGSQEKSLPARPPAARRSLLHRL
		13	*KMT2D*	ASRLSPPPEDSPLSPPPEESPMSPP
		14	*PRAMEF4*	STLEELPTELFPQLFMEAFSRRRCE
		15	*HCN3*	DSPATLLARSAWCSAGSPASPLVPV
		16	*MYT1L*	EDGCHERDDDTTPVNSDRSEEVFDM
	PP3/TMG3	1	*SNX17*	GQQLREGSFRVTCMRCWRVTSSVPL
		2	*CNTNAP2*	PWGVFLENMGKEGFIKLELKSATEV
		3	*KDM6A-3*	KSCSNTSALAARSKYLQAQLCNLPQ
		4	*WDR5B*	TENLIASAALENYKTIKLWMSNH
		5	*KRAS*	MTEYKLVVVGAVGVGKSALTIQLI
		6	*ZNF710*	HQNVRPFVCTECSMEFSQIHHLKQH
		7	*HPSE2*	HCYIDGRVVKVMVFLKTRLLDTLSD
		8	*EIF2B1*	TLLFTDLGVLTPSMSSSSSIC
		9	*EMR1*	NIFSVLDKVCENNTTVVSLKNTTES
		10	*MYT1L*	RNPDMEVDENGTPDLSMNKQRPRDS
		11	*NAALAD2*	GYPAKEYTFRLDGEEGVGIPRIPVH
		12	*POTEG*	SGDHDDSAMKTLSSKMGKWCRHCFP
		13	*ZNF555*	KPYECKQCGKAFRLSACFREHVRMH
		14	*PDGFC*	PQHERIITVSTNESIHSPRFPHTYP
		15	*ZNF287*	KAYRQGANLTQHHRIHTGEKPYKCN
		16	*PCDHB4*	ENNSPALHIGSVRATDRDSGTNAQV
	PP4/TMG4	1	*SLITRK2*	CENKGFTTVSLLQPPPVSNLSAFSQ
				LLQPPPVSNLSAFSQWKPLDKTVSK
				SAFSQWKPLDKTVSKRICQLLQRGD
				KTVSKRICQLLQRGDSSPR
		2	*TTC9C*	STSPAHSLLLPGRGGGGSNRKAEAS
				PGRGGGGSNRKAEASVPGVLTPATI
				KAEASVPGVLTPATIPE
		3	*ZMYND15*	KPAQGSGARPAPGPPPPHPHPQLPL
				APGPPPPHPHPQLPLLLLPPPEGAE
				PQLPLLLLPPPEGAEEKRNLGGGPA
				PEGAEEKRNLGGGPAGGN
		4	*PIEZO1*	EEEEDSRDEGLGGATPHQATQVPEG
		5	*ZNF81*	KTIGHGQVFTQNASYSHHENTHTGV

NCI-MM	No PP	1	*DSPP*	DSSDSSDSSDSSESSDSSDSSESSD
		2	*FAM155B*	VPCKQYCLEVQTQCPFILPDNEEMV
		3	*FAM71F1*	SFPHRKTWRKSKTTVKVTRSYPTFP
		4	*FANCM*	TKIVSLKKKVSKDIKKDQLKKENNH
		5	*FOLH1*	TPGYPANEYAYRHGIAEAVGLPSIP
		6	*IVL*	EGQLKHLEQQEGSLEHLEHQEGQLG
		7	*JAKMIP1*	VLRDGAADKVKTVLLTEAREEARRA
		8	*KIRREL*	GATIGASILLIFHFIALVFFLYRRR
		9	*KRAS*	MTEYKLVVVGADGVGKSALTIQLI
		10	*MUC4*	LHVTDASSASTGHATPLPVTSLSSV
		11	*NRG1*	AQEPVKKLANSRQAKRTKPNGHIAN
		12	*OR5H14*	LYPAIMTNGLCIWLLILSYVGGLLH
		13	*PAPD5*	QAVGKMQSTQTTSTSNSTNKSQHGS
		14	*PHLDB3*	TESSRDAPEATPLIAMAATPPASTS
		15	*PLAC4*	PSLLTLDTLTHPRYPHSSPWTLSLT
		16	*POM121*	ATTEALSPPKTPNLLPPLGLSQSGP
		17	*SCN4B*	NEKSDPKVTLKDNDRITLVGSTKEK
		18	*TAS2R31*	VKRQKISFADQIVTALAVSRVGLLW
		19	*TEX14*	QTALFVAALLGLGKFVDVLVDYGSD
		20	*UPK3BL*	GPYRVKFLVMNDKGPVAETKWSSDT
		21	*VCPIP1*	GAAFATRSKAQRENSVEELEEMDSQ
		22	*ZNF587*	KNLDDTAYLHQHRKQHIGEKFYRKS
		23	*USP17L11*	ALGAEDTDRRAKIGRLKRDHPCLQAPE
		24	*USP17L18*	ALGAEDTDRRATIGRLKRDHPCLQAPE
		25	*ZP3*	DCGTPSHSRRQPRVMSQWSRSASRN
		26	*FAM194A*	EEEEVEEEEEEVEEEELVGEEQELE
		27	*PRR21*	ALRPCLFTHGPSPMPLHPRPFVHAS
		28	*TARP*	VVYFAIITCCLLGRTAFCCNGEKS
		29	*TAS2R30*	CAIYFLSMIISVWNFGRLEKQPVFM
		30	*NOTCH2NL*	VPCAPSPCVNGGSCRQTGDFTFECN
		31	*TAS2R30*	YEGNVTWKIKLRRAMYHSNMTLTML
		32	*PRR21*	PPCLFTHGPSSMALHPRPFVHASSP

Pos. = Position

Supplemental Table 7. HLA-I restriction elements from the patients included in the study

Patient ID	HLA-I					
	A	A	B	B	C	C
4078	23:01	30:01	07:02	44:03	04:01	07:02
4095	02:01	03:01	14:01	44:03	08:02	16:01
4110	02:01	03:01	14:02	44:02	07:04	08:02
4114	01:01	02:01	51:01	44:03	07:04	08:02
4166	02:01	03:01	07:02	55:01	03:03	07:02
4177	02:01		15:18	40:02	03:04	08:01

HLA was determined from next generation sequencing data using the algorithm PHLAT, as described in (35).