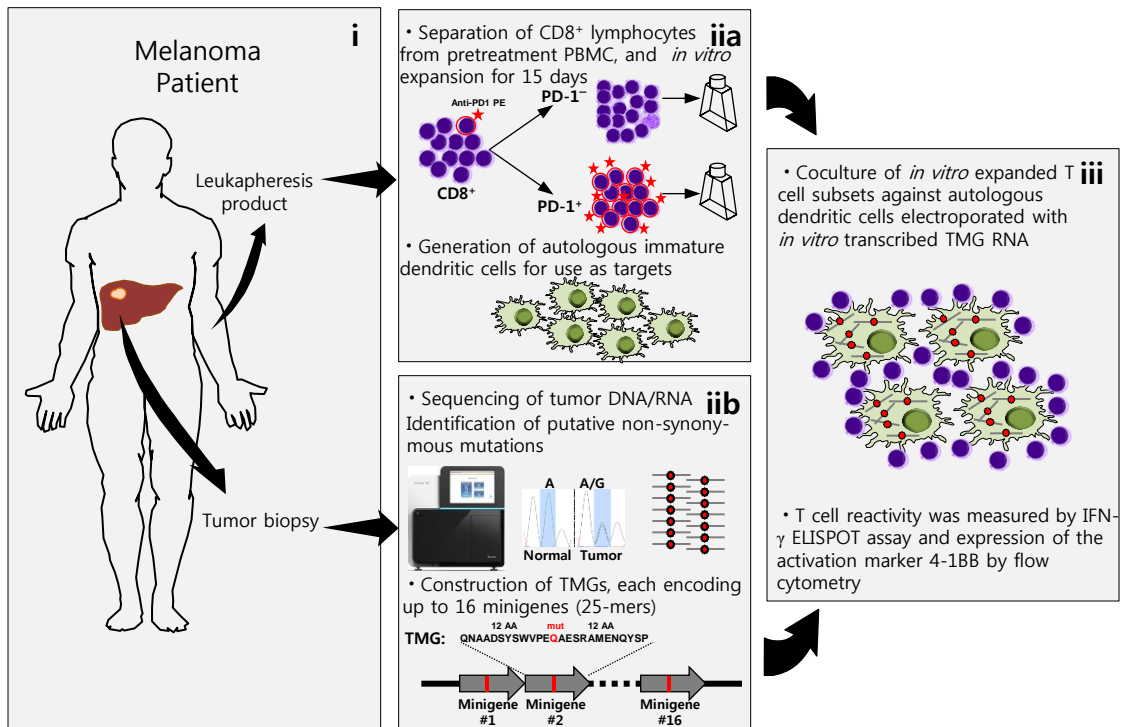
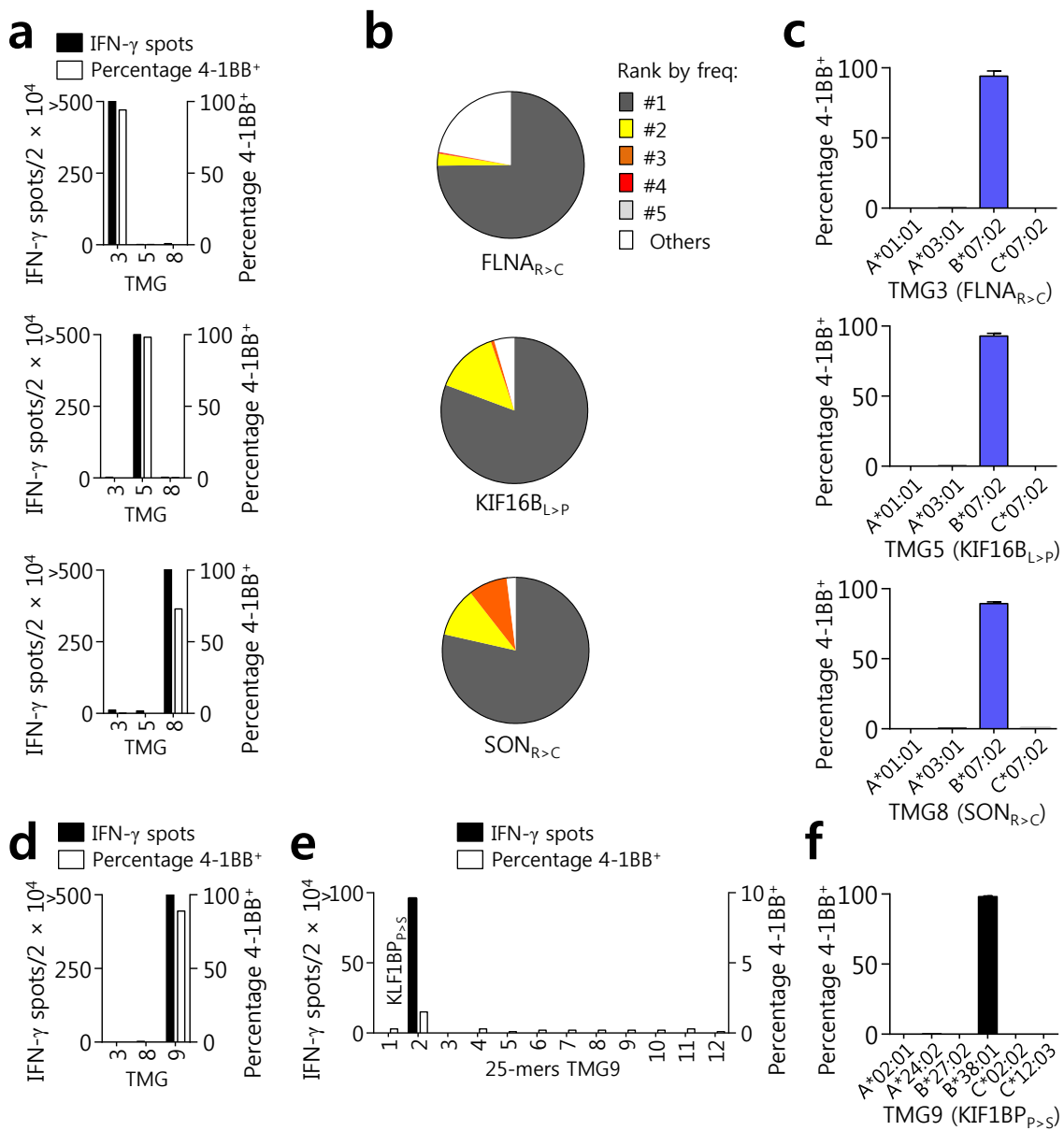


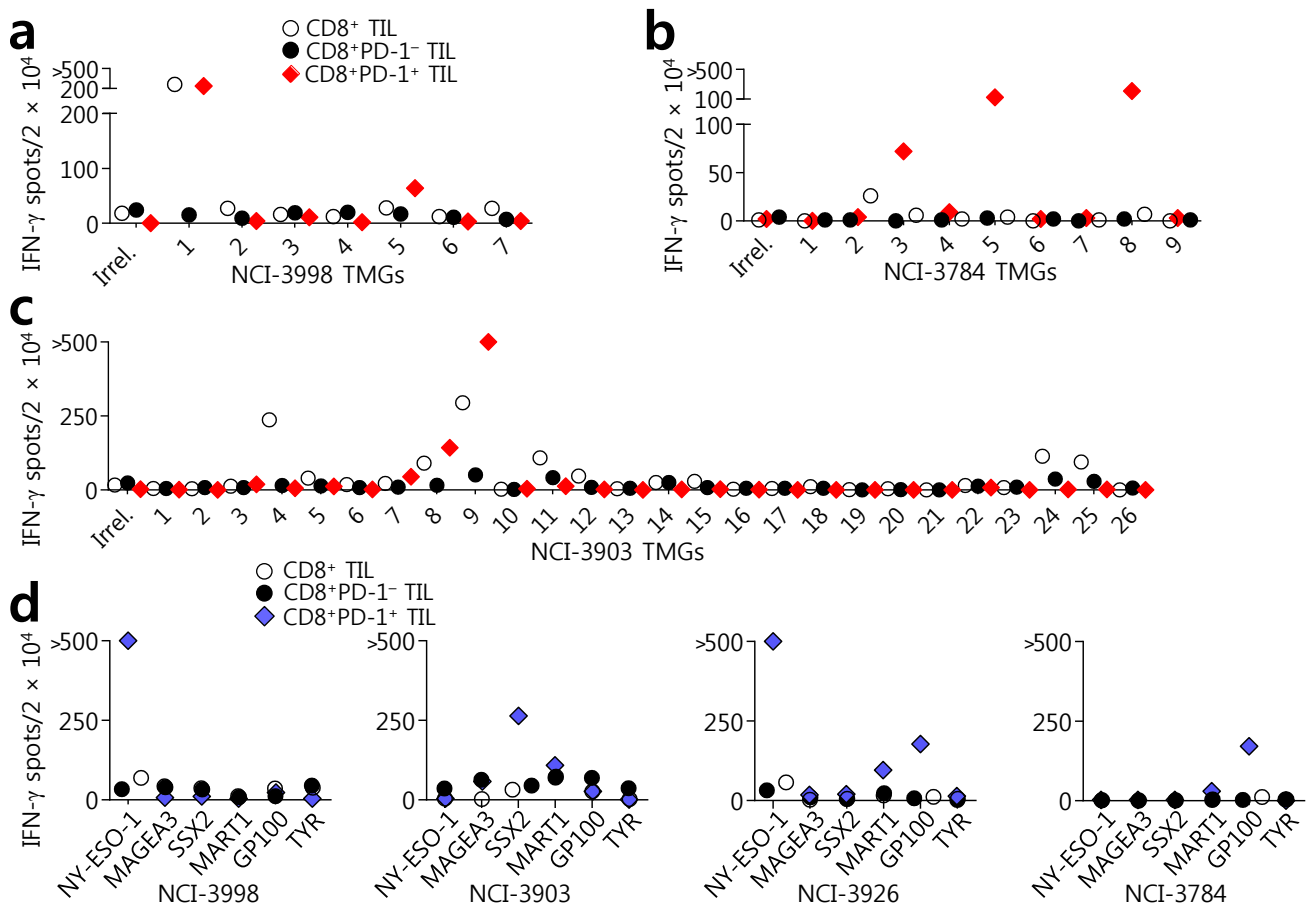
**Supplementary Figure 1** Phenotypic characterization of the circulating CD8<sup>+</sup>PD-1<sup>+</sup> lymphocytes from melanoma patients. Peripheral blood mononuclear cells (PBMC) from patients with metastatic melanoma (n=18) were thawed, and rested 16 h in T cell media without cytokines. Cells were harvested, stained with the antibodies indicated, and acquired. Flow cytometry data were analyzed using FlowJo software. Data were gated on live cells (PI negative), single cells, and CD3<sup>+</sup>CD8<sup>+</sup>PD-1<sup>+</sup> lymphocytes. Gates were set based on fluorescence minus one (FMO) controls. Each dot represents one sample. The mean  $\pm$  s.e.m. is plotted.



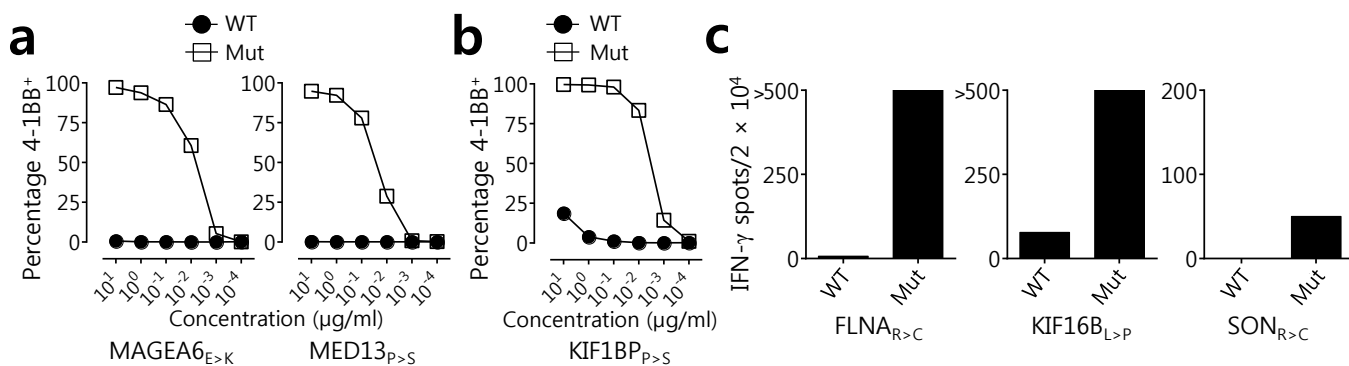
**Supplementary Figure 2** High-throughput personalized screening strategy to detect T cell reactivity to cancer somatic mutations in peripheral blood of melanoma patients. (i) peripheral blood mononuclear cells (PBMC) were obtained from a pre-treatment leukapheresis product. Tumor was resected to obtain DNA and RNA. (iia) PBMC were labeled (anti-CD3/ CD8/ PD-1), sorted based on PD-1 expression, and expanded *in vitro*. In parallel, the adherent fraction of the leukapheresis was cultured to generate autologous immature dendritic cells (DCs). (iib) Tumors underwent whole-exome sequencing (WES) and RNA sequencing to identify non-synonymous somatic mutations. Tandem minigene (TMG) constructs encoding up to 16 minigenes (mutant 25-mers) were used as templates to generate *in vitro* transcribed (IVT) RNA. (iii) IVT TMG RNA was used to transfect immature autologous dendritic cells (DCs) employed as targets in a coculture with the *in vitro* expanded peripheral blood subsets. At 20 h, T cell reactivity was analyzed by IFN- $\gamma$  enzyme-linked immunosorbent spot assay (ELISPOT), and by determining the percentage of the activation marker 4-1BB.



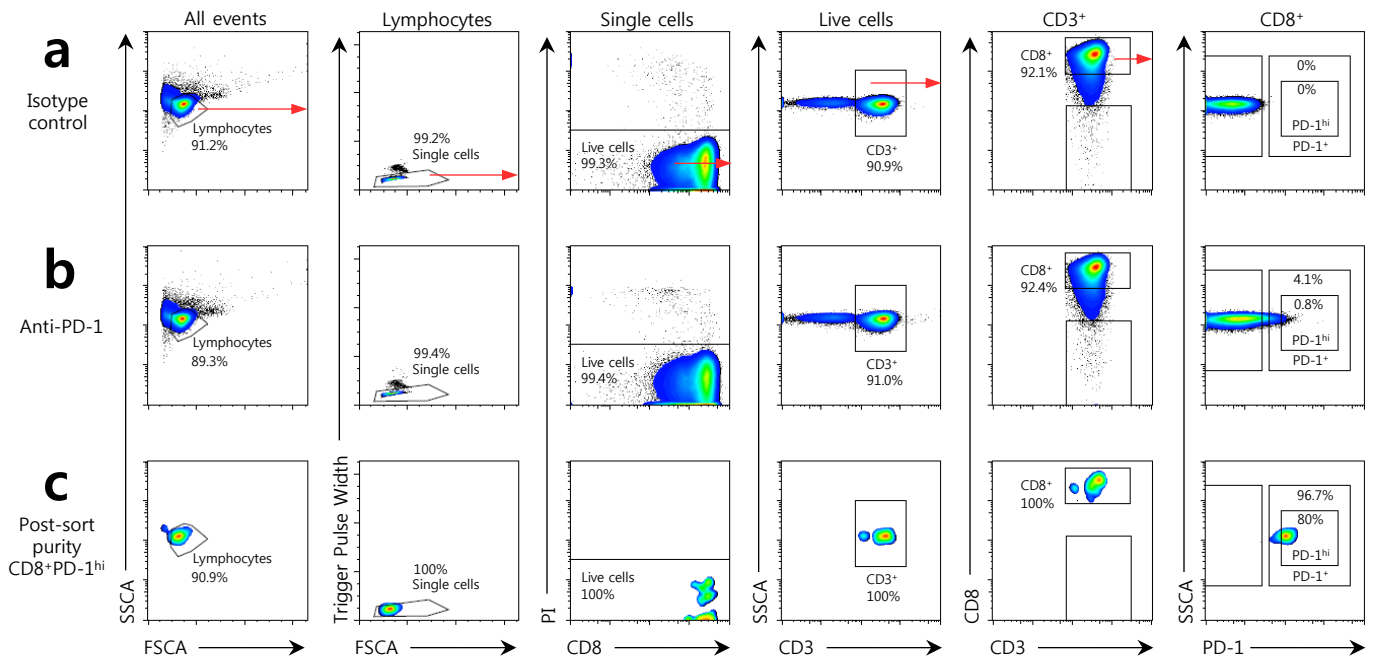
**Supplementary Figure 3** Characterization of neoantigen-reactive lymphocytes isolated from the circulating CD8<sup>+</sup>PD1<sup>+</sup> subset of subjects NCI-3784, and 3903. Enriched populations of TMG-reactive cells were generated by selecting 4-1BB<sup>+</sup> lymphocytes and expanding the cells *in vitro* for 15 d. **(a–c)** NCI-3784 TMG3- (top), TMG5- (middle), and TMG8-reactive (bottom) lymphocytes, recognizing FLNA<sub>R>C</sub>, KIF16B<sub>L>P</sub>, or SON<sub>R>C</sub>, respectively, were cocultured with DCs transfected with the indicated TMGs **(a)**. IFN- $\gamma$  ELISPOT assay and flow cytometry detection of 4-1BB upregulation at 20 h are shown. Data are gated on CD3<sup>+</sup>CD8<sup>+</sup> cells. **(b)** TRB deep sequencing of the TMG-enriched populations. Data show the frequency of the top five TRB clonotypes (unique V-D-J sequences) for each population. **(c)** TMG3-, TMG5- and TMG8-reactive lymphocytes were co-incubated with COS7 cotransfected with the corresponding constructs expressing the indicated TMG and individual HLA alleles encoding the HLA class I molecules indicated on the x axis (such as HLA-A\*01:01). Flow cytometry detection of 4-1BB at 20 h after the coculture is shown. Data are gated on CD3<sup>+</sup>CD8<sup>+</sup>. **(d–f)** NCI-3903 TMG9-reactive cells were cocultured with DCs transfected with the indicated TMGs **(d)**, DCs pulsed with the individual 25-mers encoded by 3903 TMG9 **(e)**, or COS7 cells co-transfected with TMG9 and DNA constructs encoding for the HLA-I molecules indicated in the x axis **(f)**. IFN- $\gamma$  ELISPOT assay and or flow cytometry detection of 4-1BB upregulation are shown. Data are gated on CD3<sup>+</sup>CD8<sup>+</sup> cells. “>” denotes greater than 500 spots /2  $\times 10^4$  cells. Data are representative of at least two independent experiments.



**Supplementary Figure 4** Immunological screening of tumor-derived lymphocytes for recognition of mutated neoantigens and shared tumor antigens. **(a–d)** NCI-3998, 3784 and 3903 CD8<sup>+</sup> lymphocytes were separated from fresh tumor single cell suspensions based on PD-1 expression, and expanded *in vitro*. Tumor-infiltrating lymphocyte (TIL) subsets from NCI-3998 **(a)**, NCI-3784 **(b)**, and NCI-3903 **(c)** were cocultured with autologous dendritic cells (DCs) transfected with an irrelevant TMG (Irrel.) or the indicated TMG constructs. IFN- $\gamma$  spots/2  $\times 10^4$  cells is shown. **(d)** TIL subsets from subjects (indicated below each graph) were cocultured with autologous DCs transfected with full-length RNA encoding for NY-ESO-1, MAGEA3, MART1, GP100, and TYR. IFN- $\gamma$  spots/2  $\times 10^4$  cells at 20 h is shown. ">" denotes greater than 500 spots /2  $\times 10^4$  cells. Data are representative of at least two independent experiments.



**Supplementary Figure 5** Recognition of neoantigens by enriched populations of TMG-reactive cells isolated from the tumor-derived CD8<sup>+</sup>PD-1<sup>+</sup> subsets from subjects NCI-3998, 3903, and 3784. **(a)** NCI-3998 TMG1- (left) and TMG5-reactive TIL (right) were cocultured with DCs pulsed with WT and Mut MAGEA6<sub>E>K</sub> or MED13P>S minimal epitopes. TMG9-reactive TIL isolated from the tumor of NCI-3903 were cocultured with DCs pulsed with WT or Mut KIF1BP<sub>P>S</sub> minimal epitopes **(b)**, and NCI-3784 TMG3- (left), TMG5- (middle) and TMG8-reactive TIL (right) were cocultured with autologous DCs pulsed with the WT or Mut 25-mers indicated **(c)**. Percentage of 4-1BB expression or IFN-γ spots/2 × 10<sup>4</sup> cells at 20 h is shown. ">" denotes greater than 500 spots per 2 × 10<sup>4</sup> cells. All data are representative of at least two independent experiments.



**Supplementary Figure 6** Example of the gating strategy used for sorting circulating CD8<sup>+</sup> lymphocytes based on PD-1 expression. Flow cytometry analysis of one representative melanoma patient is shown. CD8<sup>+</sup> cells were positively selected from a pre-treatment leukapheresis product using CD8 microbeads, and then stained with fluorochrome-labeled anti-CD3, CD8, and either isotype control (IgG4-AF647) or anti-PD-1 (AMP-514 AF647) antibody. Dot plots of the CD8-enriched cells stained with isotype control (a), and anti-PD-1 (b) are displayed. The hierarchy of the gating strategy is depicted from left to right. The gate used to sort for CD8<sup>+</sup>PD-1<sup>+</sup> cells was set based on the isotype control. (c) The post-sort purity for the CD8<sup>+</sup>PD-1<sup>hi</sup> sorted cells is shown.

**Supplementary Table 1. Patient characteristics**

Patient ID	Cancer type	Prior therapy	Months from end of last therapy to leukapheresis (mo)	%PD-1 <sup>+</sup> (of CD8 <sup>+</sup> ) PBMC	# putative mutations <sup>d</sup>	Mutations evaluated <sup>e</sup>
NCI-3713	Mel <sup>a</sup>	IL-2, anti-CTLA-4	7 mo	4.1%	4359	7 minimal epitopes
NCI-3998	Mel	No treatment	-	1.9%	279	115 (TMG#1-7)
NCI-3784	Mel	Surgery, IFN	14 mo	2.1%	440	140 (TMG1-9)
NCI-3903	Mel	Surgery, MART-F5 TCR <sup>b</sup>	55 mo	3.4%	414	308 (TMG#1-26)
NCI-3926	Mel	IL-2, surgery, chemo. <sup>c</sup>	8 mo	7.4%	346	128 (TMG#1-11)
NCI-3759*	Mel	Surgery, IFN	1 mo	1.0%	n.d. <sup>f</sup>	n.e. <sup>g</sup>
NCI-3992*	Mel	Anti-PD-1, anti-CTLA-4	5 mo	8%	n.d.	n.e.

<sup>a</sup>Melanoma; <sup>b</sup> Adoptive transfer of autologous T cells that were gene-engineered to express a MART1 HLA-A\*0201-restricted T cell receptor (TCR). <sup>c</sup>Chemotherapy NCI- 3926: dacarbazine and vinblastine. <sup>d</sup>Putative non-synonymous mutations were defined by: >2 exome variant reads, ≥ 10% variant frequency in the exome, ≥10 normal reads, and tumor/normal variant frequency ≥5. Common single nucleotide polymorphisms were filtered. <sup>e</sup>Mutations screened were selected based on whole-exome and transcriptome analysis. <sup>f</sup>Not determined. <sup>g</sup>Not evaluated. \*NCI-3759 and 3992 were only included in Fig.4i

**Supplementary Table 2. Mutated tandem minigenes (TMGs) screened for subjects NCI-3998, 3784, 3903, and 3926**

Patient ID	TMG#	Mutation type	Gene	Transcript ID	WT AA	Mut AA	AA position	Wild-type 25-mer	Mutated 25-mer
NCI-3998	TMG1	SNV	AMER1	uc022byb.1	P	L	686	SQISHRGITSAPPTASS EPDWRDF	SQISHRGITS AFLTTASSE PDWRDF
		SNV	LOC100133957	uc011mlt.1	A	V	141	RACEQGPSGNKPANG GLQKRRLEPM	RACEQGPSGNKPVNGG LQKRRLEPM
		SNV	CXorf22	uc004ddj.3	M	I	865	SNELVLRPRGFFMKTCTF RGTVRLYN	SNELVLRPRGFFIKTCFR GTVRLYN
		SNV	MAGEA6	uc022chf.1	E	K	168	DSLQLVFGIELMEVDPI GHVYIFAT	DSLQLVFGIELMKVDPI GHVYIFAT
		SNV	GPR112	uc010nsb.1	P	S	2870	EISFPNDDFDKDPYCSS P	EISFPNDDFDKDSYCSSP
		SNV	RBMXL3	uc011mte.1	D	N	577	GGCSADAYSGGHSSS QSNRYGGGG	GGCSADAYSGGHSSS QSNRYGGGG
		SNV	CHRD1	uc011mss.2	R	Q	226	TKQECKKIHCNPYPCK YPQKIDGK	TKQECKKIHCNPYQCK YPQKIDGK
		SNV	CDKN2B	uc022beo.1	E	K	3	MREENKGMPSGGGSD EGLASAAARG	MRKENKGMPSGGGSD
		SNV	CDKN2B	uc022beo.1	G	R	17	NKGMPSGGGSDEGLAS AAARGLVEK	NKGMPSGGGSDERLAS AAARGLVEK
		SNV	UBAC1	uc004cgt.3	E	K	276	SATDEEARDELTEIFKKI RRKREFR	SATDEEARDELTKIFKKI RRKREFR
		SNV	GOLGA2	uc011maw.2	A	V	785	ASAQKEPEAAPAPGT GGDSVCGET	ASAQKEPEAAPVPGT GGDSVCGET
		SNV	PAPPA	uc004bjn.3	R	Q	151	GLYDKCSYISRDRGWV VGIHTISDQ	GLYDKCSYISRDQGWV VGIHTISDQ
		SNV	OR13C5	uc011lvp.2	H	Y	176	VQLPFCRNIIINHFTCEI LAVMKLA	VQLPFCRNIIINYFTCEIL AVMKLA
		SNV	PSD3	uc003wza.3	H	Y	796	AVYKSGFLARKIHADM DGKKTPRGK	AVYKSGFLARKIYADMD GKKTPRGK
		SNV	CSMD3	uc011lhx.2	E	K	1460	FQCDPGYELQGEERITCI QVENRYF	FQCDPGYELQGEKRITCI QVENRYF
		SNV	PVRIG	uc003uuf.1	I	V	114	PARQARWETQSSISLILE GSGASSP	PARQARWETQSSVSLIL EGSGASSP
NCI-3998	TMG2	SNV	CYP3A43	uc003urz.1	E	K	144	LLSPAFTSVKFKEMVPII SQCGDML	LLSPAFTSVKFKKMVPIIS QCGDML
		SNV	ENSG000000021 461	ENST000000043 3277	E	K	93	LLSPAFTSVKFKEVK RK	LLSPAFTSVKFKKVRK
		SNV	SAMD9L	uc022ahh.1	R	Q	1188	ETENWSPQKSQRRYD MYNTACFLGE	ETENWSPQKSQRQYD MYNTACFLGE



		SNV	NPC1L1	uc011kbw.2	P	L	459	LQERLRHLQVWSPEAQ RNISLQDIC	LQERLRHLQVWSLEAQ RNISLQDIC
		SNV	FAM20C	uc003sip.3	P	L	224	FLSPGEEAAVDSYPNWL KFHIGINRY	FLSPGEEAAVDSYLNWLK FHIGINRY
		SNV	TCRBV22S1A2 N1T	uc022amx.2	E	K	39	QKVEFLVSFYNNKISEKS EIFDDQF	QKVEFLVSFYNNKISEKS EIFDDQF
		SNV	BRAF	uc003vvc.4	V	E	600	LTVKIGDFGLATVKSRW SGSHQFEQ	LTVKIGDFGLATEKSRW SGSHQFEQ
		SNV	PRRT4	uc022aky.1	P	S	706	CRGFEGAAAANPAPSPA SSPCSDYTV	CRGFEGAAAANPASSPAS SPCSDYTV
		SNV	POP7	uc022ais.1	V	A	108	LQVAANTSTVELVDELE PETDTREP	LQVAANTSTVELADELE PETDTREP
		SNV	PRIM2	uc003pdx.3	R	W	79	TEQYQSKLESELRLKFS YRENLED	TEQYQSKLESELWKLKFS SYRENLED
		SNV	TCTE1	uc003oxi.2	D	N	115	EHQQKVLNHLSPDLPLA VTANLIDS	EHQQKVLNHLSPNLPLA VTANLIDS
		SNV	SERAC1	uc031sqr.1	I	M	34	KSGTHWRDIRNIIKFTG SLILGGSL	KSGTHWRDIRNIMKFT GSLILGGSL
		SNV	AK9	uc003ptr.4	P	L	381	EEALKPFLNPRPYLLPP MPGPPCK	EEALKPFLNPRLYLLPP MPGPPCK
		SNV	CDH18	uc003jgd.3	M	I	569	SRTVQDVVYLPIMISDG GIPSLSSS	SRTVQDVVYLPPIISDGGI PSLSSS
		SNV	ZFP62	uc021yjo.1	L	F	794	CECGKSFNYRSVLDQHK RIHTGKKP	CECGKSFNYRSVFDQHK RIHTGKKP
NCI-3998	TMG3	SNV	SH3PXD2B	uc003mbr.3	N	S	278	KEGWAPASYLKKNSGE PLPPKPGPG	KEGWAPASYLKKSSGEP LPPKPGPG
		SNV	PPM1K	uc003hrm.5	A	V	181	KAFSSHARLSADATLLTS GTTATVA	KAFSSHARLSADVTLLTS GTTATVA
		SNV	PDS5A	uc003guv.4	Y	F	1000	MATEKLLSLLPEYVVPY MIHLLAHDPDFTRSQ	MATEKLLSLLPEFVVPY MIYLLAHDPDFTRSQ
		SNV			H	Y	1007		
		SNV	FAT1	uc003izf.3	S	L	2713	PKFSEPFYFTVSEDVPI GTEIDLI	PKFSEPFYFTVLEDVPI GTEIDLI
		SNV	TENM3	uc003ive.1	G	E	538	HVLDVQNGILYKNGE NQFISQQPP	HVLDVQNGILYKENGE NQFISQQPP
		SNV	CNOT10	uc011axj.2	S	L	511	SIQNTVYNDGQSSAIPV ASMEFAAI	SIQNTVYNDGQSLAIPV ASMEFAAI
		SNV	DLG1	uc011bue.2	S	L	481	LSGELRKGDRIISVNSVD LRAASHE	LSGELRKGDRIILVNSVD LRAASHE
		SNV	ZBTB21	uc021wjo.1	L	F	682	YICTYCGKAYRFLSQFKQ HIKMHPG	YICTYCGKAYRFFSQFKQ HIKMHPG

		SNV	TSHZ2	uc021wex.1	E	K	468	ELKKESKKERPEETSKDE KVVKSED	ELKKESKKERPEKTSKDE KVVKSED
		SNV	ADNP	uc002xvu.1	S	F	1032	QGDREQLKWKNSYK VEGFWSKDQ	QGDREQLKWKNSFYK VEGFWSKDQ
		SNV	CST9	uc002wtl.3	G	S	20	KAMPWALSLLLMGFQL LVTYAWCSE	KAMPWALSLLMSFQL LVTYAWCSE
		SNV	PCBP1-AS1	uc002sga.3	L	F	9	MVSVDGGFLWTLINQ LLFDSSAEP	MVSVDGGFFWTLINQ LLFDS
		SNV	SRBD1	uc010yoc.2	P	L	54	RNLRQLLLTSPVPGRTL MGVDPGYK	RNLRQLLLTSPVLGRTL MGVDPGYK
		SNV	CAD	uc010eyw.3	S	F	1947	TSSVQKGESLADSVQT MSCYADVVV	TSSVQKGESLADVFQT MSCYADVVV
		SNV	ENSG00000168 918	ENST0000045 5936	E	K	375	YADLLSHDQLLTERREQ KVFLHFEE	YADLLSHDQLLTKRREQ KVFLHFEE
NCI-3998	TMG4	SNV	ZDBF2	uc031rqy.1	P	S	301	RMGTGKSLRVKSPSKLA VNPNTDM	RMGTGKSLRVKSSSKLA VNPNTDM
		SNV	TTN	uc031rqd.1	D	N	16446	TDIKAESCYLTWDAPLD NGGSEITH	TDIKAESCYLTWNAPLD NGGSEITH
		SNV	ZNF586	uc010euh.3	T	I	186	YTSSLIKHRRHTGERPY ECSEGR	YTSSLIKHRRHIGERPYE CSEGR
		SNV	NLRP2	uc021vbq.1	G	E	139	FKTEAQAFETKGNVIC LKEVFKG	FKTEAQAFETKENVICL GKEVFKG
		SNV	NLRP2	uc010eso.3	G	E	136	LERFKTEAQETKGNVIC GKEVFKG	LERFKTEAQETKENVICL GKEVFKG
		SNV	NLRP2	uc010esn.3	G	E	115	RKPLSLAFTETKGNVIC GKEVFKG	RKPLSLAFTETKENVICL GKEVFKG
		SNV	ENSG00000022 556	ENST0000058 8619	G	E	139	FKTEAQAFETKGN HPTMPLPVH	FKTEAQAFETKEN HPT
		SNV	FAM90A27P	uc031rmv.1	E	K	7	MQEAWKEPAEDCLFLR HPTMPLPVH	MQEAWKPAEDCLFLR HPT
		SNV	C19orf73	uc002pmq.4	G	E	10	MRLKVGFGGGGCFRK DALCLEGGVS	MRLKVGFGGEGCFRKD ALCLEG
		SNV	RELB	uc021uvq.1	L	F	153	RYECEGRSAGSILGESST EASKTLP	RYECEGRSAGSIFGESST EASKTLP
		FS insertion	HNRNPL	uc021uui.1			291	VKFMKSKPGAAMVEM ADGYAVDRAI	VKFMKSKPGAAMVGD G
		SNV	RYR1	uc002oiu.3	H	Y	821	PCHEAVLPRERLHLEPIK EYRREGP	PCHEAVLPRERLYLEPIK EYRREGP
		SNV	NFIC	uc010xhj.2	R	W	122	DQKGMRRIDCLRQAD KVVRLDLVM	DQKGMRRIDCLWQA DKVVRLDLVM
SNV	LRP3	uc010edh.3	S	F	756	PLGVCRNPPPCSPMLE ASDDEALL	PLGVCRNPPPCPFMLE ASDDEALL		

		SNV	CSNK1G2	uc010dsu.3	P	S	328	LNSTNGELNADDPTAG HSNAPITAP	LNSTNGELNADDSTAG HSNAPITAP
NCI-3998	TMG5	SNV	ARRDC2	uc002nhv.3	P	L	202	IDRKGYPGEVIVPFAEI DNGSTRP	IDRKGYPGEVILVFAEI DNGSTRP
		SNV	CTDP1	uc021ult.1	G	R	660	PGPEVRIYDSNTGKLIRT GARGPPA	PGPEVRIYDSNTRKLIRT GARGPPA
		SNV	SERPINB3	uc002lji.3	E	K	250	GKDLSMIVLLPNEIDGL QKLEEKLT	GKDLSMIVLLPNKIDGL QKLEEKLT
		SNV	HEXDC	uc002kew.3	A	V	63	YEGPLRLLRAKYAYSPSE IKEILHL	YEGPLRLLRAKYVYSPSEI KEILHL
		SNV	ENSG00000169 660	ENST0000057 8775	A	V	24	YEGPLRLLRAKYAYRLEC SGAILAH	YEGPLRLLRAKYVYRLEC SGAILAH
		SNV	EVPL	uc010wst.1	E	K	59	QSLGTEKETAQKECEAF LSTRPVGP	QSLGTEKETAQKCEAF LSTRPVGP
		SNV	MED13	uc002izo.3	P	S	1691	PHIKSTVSVQIIPCQYLL QPVKHED	PHIKSTVSVQIISCQYLLQ PVKHED
		SNV	HEATR6	uc010ddk.1	P	S	265	GEVICKCMGEADPSIQL HGAKLLEE	GEVICKCMGEADSSIQL HGAKLLEE
		SNV	ABCC3	uc002isl.3	E	K	209	FSAKNVDPNPYPETSAG FLSRLFFW	FSAKNVDPNPYPKTSAG FLSRLFFW
		SNV	PLEKHM1	uc010wjn.1	R	C	530	EEHTCVENCSSLRCEV GPAHSDGR	EEHTCVENCSSLCCESV GPAHSDGR
		SNV	SLFN14	uc010ctu.1	R	C	827	IAILCRRGEDRGRYRLAL LKAMELI	IAILCRRGEDRGCYRLAL LKAMELI
		SNV	TVP23B	uc002gum.2	S	F	148	VLWVIFAFSALFSFRVK WLAVVIMG	VLWVIFAFSALFFFRVK WLAVVIMG
		SNV	KCNG4	uc010voc.2	R	W	257	DLRAEEDQGECSRKY IFIVETIC	DLRAEEDQGECSWKCY YIFIVETIC
		SNV	ADAMTS18	uc002ffc.4	P	S	265	FCGRRKKYAPKPPTEDT YLRFDEYG	FCGRRKKYAPKPSTEDT YLRFDEYG
SNV	ENSG00000140 873	ENST0000044 9265	S	F	266	CGRKKKICISQASHRGH LSKV	CGRKKKICISQAFHRGH LSKV		
NCI-3998	TMG6	SNV	TIGD7	uc021tcc.1	R	Q	130	DFKASTGWLFRFRNRH AIGNRKGC	DFKASTGWLFRFQNRH AIGNRKGC
		SNV	CIITA	uc010bup.1	G	E	225	SSSSLSCLNLPEGPIQFV PTISTLP	SSSSLSCLNLPEEPIQFVP TISTLP
		SNV	EFTUD1	uc002bgu.1	E	D	427	QDGSIAIETCPKGEEPRG DEQQVESM	QDGSIAIETCPKGDEPRG DEQQVESM
		SNV	FAH	uc010unl.2	R	Q	159	RLFLSAACYQRRNHVQ GQGECVDA	RLFLSAACYQRQNHVQ GQGECVDA
		SNV	FAH	uc002bfn.2	G	R	68	DFYSSRQHATNVGIMF RDKENALMP	DFYSSRQHATNVRIMFR DKENALMP

		SNV	NOP10	uc001zie.1	T	I	47	FSPDDKYSRHRITIKKRF KVLMTQQ	FSPDDKYSRHRIIIKKRFK VLMTQQ
		SNV	ENSG00000182 117	ENST0000055 7912	P	S	28	TLKMTNTLDTESPSRNA SRCS	TLKMTNTLDTESSRNA SRCS
		SNV	STON2	uc010tvu.3	P	S	724	GFSANRDPLTQVPCEN VMIRYPVPS	GFSANRDPLTQVSCENV MIRYPVPS
		SNV	SLC8A3	uc001xlz.3	R	C	889	RRPHLGGEELGGPRGCK LATTWLFVS	RRPHLGGEELGGPCGCKL ATTWLFVS
		SNV	OR4K1	uc001vwj.2	A	V	150	RRLCVIFVSISWAVGVL HSVSHLAF	RRLCVIFVSISWVVGVL HSVSHLAF
		SNV	AHNAK2	uc010axc.1	M	V	2187	SVDVSPPKVEADMSLPS MQGDLKTT	SVDVSPPKVEADVSLPS MQGDLKTT
		SNV	HTR2A	uc010acr.4	P	S	405	RYIQCCQYKENKKPLQLIL VNTIPAL	RYIQCCQYKENKKSLLQLIL VNTIPAL
		SNV	NBEA	uc021rid.1	P	L	2468	REDEVVNDVDLPPWA KKPEDFVRI	REDEVVNDVDLLPWA KKPEDFVRI
		SNV	KMT2D	uc001rta.4	S	F	654	SPMSPPPEVSRLSPLPV VSRLSPPP	SPMSPPPEVSRLFPLPV VSRLSPPP
		SNV	LRRK2	uc009zjw.3	P	L	689	LLVNPDPQRLTIPISQIA PDLILAD	LLVNPDPQRLTILISQIAP DLILAD
		SNV	EP400	uc010tbo.2	P	S	61	RKGGKISFCAHTPLNCM FGFFCFVK	RKGGKISFCAHTSLNCM FGFFCFVK
		SNV	HECTD4	uc021reb.1	P	S	2876	ISESKVNMDVNFPGAA FVVVSCKES	ISESKVNMDVNFSGAAF VVVVSCKES
NCI-3998	TMG7	FS insertion	SWAP70	uc001mhw.3			99	KIEFNRMCWTLVCVKKN LTKNPLLIT	KIEFNRMCWTLVCVKKK HKESPAHYRRRCI
		FS insertion	ENSG00000133 789	ENST0000052 6358			117	RLNSIGCVGPSVSKKTS QRIPCSLQ	RLNSIGCVGPSVSKKNLT KNPLITEEDAFKIWVIF NFLSEDKYPLA
		SNV	ZFP91	uc001nmy.4	T	I	233	EEIPFKDDPRDETYKPHL ERETPKP	EEIPFKDDPRDEIYKPHL ERETPKP
		SNV	PRDM11	uc031qab.1	R	W	216	SERIYFRACRDIRPGEW LRVWYSED	SERIYFRACRDIWPGEW LRVWYSED
		SNV	MOB2	uc001ltp.1	S	F	176	LLWGWGLLSQRPFFPL TPPLPASPG	LLWGWGLLSQRPFFPLT PPLPASPG
		SNV	LGI1	uc021pwk.1	E	I	84	LSFVRSGFTEISEGSFLFT PSLQLL	LSFVRSGFTEISIGSFLFT PSLQLL
		SNV	MYOF	uc001kio.3	E	D	1477	LKIYNCELENVAEFEGLT DFSDFTK	LKIYNCELENVADFEGLT DFSDFTK
		SNV	POLR3A	uc001jzn.3	G	A	1066	HFAGVASMNITLGVPRI KEIINASK	HFAGVASMNITLAVPRI KEIINASK
		SNV	C10orf120	uc001lgn.3	H	Y	334	IWKERM RKATPYHY	IWKERM RKATPYYY

		SNV	ACSL5	uc009xxz.3	S	F	148	GIFAQNRPEWIISELACY TYSMVAV	GIFAQNRPEWIIFELACY TYSMVAV
		SNV	PRKAA2	uc031pms.1	M	I	239	FYLASSPPSGSFMDDSA MHIPPGLK	FYLASSPPSGSFIDDSAM HIPPPGLK
		SNV	ZBTB41	uc001gtx.1	P	L	425	NETEFHKKEHKPCYCNK LHASKKTL	NETEFHKKEHKCLYCNK LHASKKTL
		SNV	KCNT2	uc009wyu.3	G	E	129	FETILLGYLSYKGNIEWEQ ILRIPFI	FETILLGYLSYKENIWEQI LRIPFI
		SNV	INSRR	uc010pht.2	D	N	669	CHRGLRLPTSNNDRPF DGEDGDPEA	CHRGLRLPTSNNNPRFD GEDGDPEA
		SNV	PDE4DIP	uc021ouh.1	R	Q	2291	LLELRTKVSKQERLLQST TEHLKNA	LLELRTKVSKQEQLLQST TEHLKNA
		SNV	AP4B1	uc010owp.2	P	S	548	WLSLKVAHQQVLPWR GEFHPDTLQM	WLSLKVAHQQVLSWR GEFHPDTLQM

Patient ID	TMG#	Mutation type	Gene	Transcript ID	WT AA	Mut AA	AA position	Wild-type 25-mer	Mutated 25-mer
NCI-3784	TMG1	SNV	ABHD16A	NM_021160	P	S	322	WNHPGFAGSTGVFPF QNEANAMDVV	WNHPGFAGSTGVSFPO NEANAMDVV
		SNV	ALMS1	NM_015120	P	F	892	HLTEEALKVSIVPGPGD KKTGIPSA	HLTEEALKVSIVFGPGDQ KTGIPSA
		SNV	ANKHD1- EIF4EBP3	NM_020690	P	S	1555	RKNKKNKTKETPPTAH LILPEQHMS	RKNKKNKTKETPSTAHLIL PEQHMS
		SNV	ATP8B1	NM_005603	R	K	946	RLLLVHGRWSYIRMCK FLRYFFYKN	RLLLVHGRWSYIKMCKFL RYFFYKN
		SNV	ATR	NM_001184	L	F	1405	AYGLLMELTRAYLAYA DNSRAQDSA	AYGLLMELTRAYFAYADN SRAQDSA
		SNV	ATXN7	NM_000333	P	L	780	VNVRHDQSGRGPPTG SPAESIKRMS	VNVRHDQSGRGPPLTGSP AESIKRMS
		SNV	B4GALT5	NM_004776	S	F	326	VSRPEGDTGKYKSIPIH HHRGEVQFL	VSRPEGDTGKYKFIPIHHH RGEVQFL
		SNV	BLM	NM_000057	A	V	1351	MPASQRSKRRKTASS GSKAKGGSAT	MPASQRSKRRKTVSSGSK AKGGSAT
		SNV	BRAF	NM_004333	V	E	600	LTVKIGDFGLATVKSR WSGSHQFEQ	LTVKIGDFGLATEKSRWS GSHQFEQ
		SNV	BRAT1	NM_152743	T	I	418	APASSVGGHLCGTLAG CVRVQRAAL	APASSVGGHLCGILAGCV RVQRAAL
		SNV	BRD9	NM_023924	S	F	554	GGSRPSSNLSSLSNASE RDQHHLGS	GGSRPSSNLSSLFNASER DQHHLGS
		SNV	BRF1	NM_001519	T	I	109	GNQLQLNQHCLDTAF NFFKMAVSRH	GNQLQLNQHCLDIAFNF FKMAVSRH
		SNV	C11orf30	NM_020193	P	L	992	IHLQADQLQHKLQPM PQLSIRHQKL	IHLQADQLQHKLQMPQ LSIRHQKL
		SNV	C2CD3	NM_015531	S	L	486	SKKISQSTALARSSKVL ESSDHKLK	SKKISQSTALARLSKVLESS DHKLK
		SNV	CAMKK2	NM_172226	P	L	124	GGSLDMNGRCICPSLP YSPVSSPQS	GGSLDMNGRCICLSLPYS PVSSPQS
		SNV	CD164	NM_006016	L	P	50	PISNVTAPVTSPLPLVT TPAPETCE	PISNVTAPVTSPLPLVTP APETCE
NCI-3784	TMG2	SNV	CDCA3	NM_031299	P	S	145	EEQMPPWNQTEFPSK QVFSKEEARQ	EEQMPPWNQTEFSSKQ VFSKEEARQ

		SNV	CDK13	NM_031267	R	W	757	FPITAIKILRQLTHQ SIINMKE	FPITAIKILWQLTHQSII NMKE
		SNV	CHPF	NM_024536	R	C	629	DTVLTPDFLNRCRMH AISGWQAFFP	DTVLTPDFLNRCMHAIS GWQAFFP
		SNV	CLEC4F	NM_173535	P	S	19	RFCTDNQCVSLSHPQE VDSVAMAPAA	RFCTDNQCVSLSHSQEVD SVAMAPAA
		SNV	COL5A2	NM_000393	G	E	1110	GQRGDPGSRGPIGPP GRAGKRGLPG	GQRGDPGSRGPIEPPGR AGKRGLPG
		SNV	COL7A1	NM_000094	G	E	1412	GDKGDRGERGPPGPG EGGIAPGEPG	GDKGDRGERGPPPEPGE GIAPGEPG
		FS deletion	CTSC	NM_148170			42	CTYLDLLGTWVFQVGS SGSQRDVNC	CTYLDLLGTWVFRWAPA VPSAMSTARLWDHKKKK
		SNV	CTTN	NM_005231	S	F	261	GWDHQEKQLLHESQK DYKTGFGGKF	GWDHQEKQLLHEFQKD YKTGFGGKF
		SNV	CTTN	NM_138565	S	F	261	GWDHQEKQLLHESQK DYSKGFGGKY	GWDHQEKQLLHEFQKD YSKGFGGKY
		SNV	DBF4	uc011khf.1	P	L	16	KELVVVHKKQEKPCSP FDVKPSSM	KELVVVHKKQEKLCSPFD VDKPSSM
		SNV	DBF4	NM_006716	P	L	249	TNMPFINYSIQKPCSPF DVKPSSM	TNMPFINYSIQKLCSPFD VDKPSSM
		SNV	DCLRE1A	NM_0012718 16	P	H	1009	YLEMKRFVQWLKPKQ IIPVNVGTW	YLEMKRFVQWLKHQKIIP TVNVGTW
		SNV	DDX42	NM_007372	P	L	565	VATDVAARGLDIPSIKT VINYDVAR	VATDVAARGLDILSIKTVI NYDVAR
		SNV	DHX16	NM_003587	P	S	573	STFFDDAPVFRIPGRRF PVDIFYTK	STFFDDAPVFRISGRRFPV DIFYTK
		SNV	DOLPP1	NM_020438	S	F	111	MPSSHSQFMWFFSVY SFLFLYLRMH	MPSSHSQFMWFFFVYSF LFLYLRMH
		SNV	DTNA	NM_032979	T	I	87	ELNVSRLAVALSTIFYQ LNKRMPPT	ELNVSRLAVALSIIFYQLNK RMPPT
NCI-3784	TMG3	SNV	DTNB	NM_183361	L	F	110	STHQISVEQSIISLLNF MIAAYDSE	STHQISVEQSIISLLNFMI AAYDSE
		SNV	ENSG00000006 634	ENST00000041 3643	P	S	229	KPFVKVEDMSQSPAV HLM	KPFVKVEDMSQSSAVHL M
		SNV	ENSG000000089 902	ENST00000056 0472	T	M	35	SGNMAEIFRQSQT	SGNMAEIFRQSQM
		SNV	ENSG000000099 995	ENST00000041 1423	S	F	32	KQPLVRRSVRRRSRSQ RKR	KQPLVRRSVRRRSRQRK R
		SNV	ENSG000000163 738	ENST00000043 3372	P	L	3	MDPRVSGILVQLPLPD HVDERTICN	MDLRVSGILVQLPLP
		SNV	ENSG000000164 124	ENST00000051 1532	P	L	160	EIPNNTCSMDTTLPLITE HGLQSCSD	EIPNNTCSMDTTLITEHG LQSCSD
		SNV	ENSG000000164 124	ENST00000051 4558	P	L	160	EIPNNTCSMDTTLPLITE HVSIV	EIPNNTCSMDTTLITEHV SIV
		SNV	ENSG000000187 098	ENST00000047 8490	P	L	103	KFEEQNRAESECPDG MLKTSSGKKEVPVAIK	KFEEQNRAESECLDG MLKTSSGKKEVPMIAIKTL
		SNV	EPHA2	NM_004431	V	M	643	TLKAGYTEK	KAGYTEK
		SNV	ESPL1	NM_012291	A	V	1380	VCPTESKPEVPQAPRV QQRVQTRLK	VCPTESKPEVPQVPRVQ QRVQTRLK
		SNV	EXOC3	NM_007277	A	V	49	ARKKASVEARLKAAIQ SQLDGVRTG	ARKKASVEARLKVAIQSQ LDGVRTG

		SNV	EXOC4	NM_021807	R	Q	423	EPSAQLSYASTGREFA AFFAKKKPQ	EPSAQLSYASTGQEFAAF FAKKKKPQ
		SNV	FKTN	NM_0011989 63	G	E	359	GKVEDSLELSFQKDD VKLDVFFFY	GKVEDSLELSFQEKDDVK LDVFFFY
		SNV	FLNA	NM_0011105 56	R	C	2049	VVISQSEIGDASRVRS GQGLHEGH	VVISQSEIGDASCVRVSG QGLHEGH
		SNV	FLNC	NM_001458	P	S	2595	IVGSPFKAKVTGPRLSG GHSLHETS	IVGSPFKAKVTGSRLSGG HSLHETS
		SNV	FREM1	NM_144966	G	E	1200	TQKPRHGLLIDRGFSK DFSENKQPA	TQKPRHGLLIDREFSKDFS ENKQPA
NCI-3784	TMG4	SNV	FSCN1	NM_003088	T	A	484	GDHAGVVKASAETVD PASLWEY	GDHAGVVKASAEAVDPA SLWEY
		SNV	GAA	NM_0010798 03	S	F	144	SYPSYKLENLSSEMGY TATLTRTT	SYPSYKLENLSSFEMGYT ATLTRTT
		SNV	GNB5	uc031qrz.1	P	S	84	DMKTALALYEFPPMG LLSALDHGII	DMKTALALYEFPSMGLLS ALDHGII
		SNV	GNB5	NM_016194	P	L	377	GHENRVSTLRVSPDGT AFCSGSWDH	GHENRVSTLRVSLDGTA FCSGSWDH
		SNV	GPATCH8	NM_0010029 09	S	F	865	RSRSGRRHSSHRSRR SYSSSDAS	RSRSGRRHSHRFRRSY SSSDAS
		SNV	GPR98	NM_032119	R	Q	6009	YVLVMNDEHTERRYL FFLLSWGGLP	YVLVMNDEHTERQYLLFF LLSWGGLP
		SNV	GPRIN1	NM_052899	P	L	887	PMTMQAAAPPAPFEV RVRPGSALAA	PMTMQAAAPPAPFLEVRV RPGSALAA
		SNV	GSE1	NM_014615	R	Q	718	LKPGSPYRPPVPRAPD PAYIYDEFL	LKPGSPYRPPVPQAPDPA YIYDEFL
		SNV	HIF3A	NM_152795	E	K	17	LQRARSTTELKRSRD AARSRRSQ	LQRARSTTELKRSRDA ARSRRSQ
		SNV	HIF3A	NM_152794	E	K	15	WQDHRSTTELKRSR DAARSRRSQ	WQDHRSTTELKRSRDA AARSRRSQ
		SNV	IFIT5	NM_012420	G	E	98	SDKEEVRSVLTWGN AWVYHMDQL	SDKEEVRSVLTWENYAW VYHMDQL
		SNV	IFT140	NM_014714	R	K	1141	CSDFFIEHSQYERAVEL LLAARKYQ	CSDFFIEHSQYEKAVELL AARKYQ
		SNV	IK	uc003lgq.3	P	L	555	KKMEADGVEVKRPKY ELSGSDNVPYVTLSSV	KKMEADGVEVKRLKY ELSGSDNVPYVILLSVIN
		SNV	INF2	NM_032714	T	I	196	INAVILGP	INAVILGP
		SNV	IRF2BP1	NM_015649	S	F	7	MASVQASRRQWCYLC DLPKMPWAMV	MASVQAFRRQWCYLCD LPK
		SNV	ITCH	NM_0012571 37	V	I	831	IDNEKRMRLQFVTGT CRLPVGGA	IDNEKRMRLQFITGT CRLPVGGA
NCI-3784	TMG5	SNV	ITPR3	NM_002224	H	N	290	SSNALWEVEVVHNDP CRGGAGHWNG	SSNALWEVEVVHNDP CRGGAGHWNG
		SNV	KAZN	NM_015209	T	I	409	QRKSLDPGLFDGTAPD YYIEEDADW	QRKSLDPGLFDGIAPD YYIEEDADW
		SNV	KDM7A	NM_030647	D	N	758	YSTCLQRQIQSTDCSG ERNLQDPS	YSTCLQRQIQSTNC ERNLQDPS
		SNV	KIF16B	NM_024704	L	P	1009	REKQREALERALARL ERRHSALQR	REKQREALERAPARLER RHSALQR
		SNV	KRT10	NM_000421	S	Y	547	SGGGGGYGGGSSG GGSSGGGYGG	SGGGGGYGGGSSG SSGGGGYGG
		SNV	LPHN2	NM_012302	R	Q	803	TQGCKLVDNKTTRTTC ACSHLTNFA	TQGCKLVDNKTQTTC ACSHLTNFA
		SNV	LTBP4	uc002ooj.1	P	L	281	DDFEALCNVLRPPAYS PPRPGGFGL	DDFEALCNVLRPLAYSPP RPGGFGL

		SNV	MBNL2	NM_207304	G	S	119	GTPLHPVPTFPVGP GTNTAISFA	GTPLHPVPTFPVSPAIG NTAISFA
		SNV	MED4	NM_014166	R	W	173	VCAPLTWVPGDPRR YPTDLEMRSRG	VCAPLTWVPGDPRPYP TDLEMRSRG
		SNV	MFI2	NM_033316	R	K	190	ETSYSESLCRLCRGD GEGVCDKS	ETSYSESLCRLCKGDSS GVCDKS
		SNV	MITF	NM_198177	P	L	194	KFEEQNRAESECPGM NTHSRASCMQ	KFEEQNRAESECLGMNT HSRASCMQ
		SNV	MOSPD3	NM_0010400 98	P	L	141	KDITSILRAPAYPLELQ GQDPAPR	KDITSILRAPAYLLELQ PDPAPR
		SNV	MTHFD2L	NM_0011449 78	P	L	138	ELLDVTDQLNMDPRV SGILVQLPLP	ELLDVTDQLNMDLRVSGI LVQLPLP
		SNV	MYH9	NM_002473	R	Q	1576	AMKAQFERDLQGRDE QSEKKKQLV	AMKAQFERDLQGGDEQ SEKKKQLV
		SNV	NBPF9	uc010oye.3	M	I	217	VSAGPLSSEKAEMNIL EINEKLHPQ	VSAGPLSSEKAENILEINE KLHPQ
		SNV	NCLN	NM_020170	A	V	202	GVQSKAVSDWLIASVE GRLTGLGGE	GVQSKAVSDWLIVSVEG RLTGLGGE
NCI-3784	TMG6	SNV	NCOA2	NM_006540	S	F	593	DSKDCFLYGEPESEGT TGQAESSCH	DSKDCFLYGEPEFEGTTG QAESSCH
		SNV	NELL1	NM_201551	E	K	433	GYISVQGDSAYCEDID ECAAKMHYC	GYISVQGDSAYCKDIDEC AAKMHYC
		SNV	NFKB1	NM_003998	S	F	618	GADLSLLDRLGNSVLH LAAKEGHDK	GADLSLLDRLGNFVLHLA AKEGHDK
		SNV	NOL6	NM_139235	Q	L	380	TMSGYQVLRVSVLQFLA TTDLTVNGI	TMSGYQVLRVSVLLFLATT DLTVNGI
		SNV	NOL6	uc010mjv.3	Q	L	380	TMSGYQVLRVSVLQFLD LTVNGISLC	TMSGYQVLRVSVLLFLDLT VNGISLC
		SNV	NOL8	NM_0012563 94	R	C	291	KLHSLIGLGIKNRVSCH DSDDDIMR	KLHSLIGLGIKNVCSCHDS DDDDIMR
		SNV	NPIP5	NM_0011358 65	P	L	388	PLPPSADDNLKTPSER QLTPLPPSA	PLPPSADDNLKTLSEKRL TPLPPSA
		SNV	NQO2	NM_000904	P	S	103	KVREADLVIFQPLYW FSVPAILKG	KVREADLVIFQFSLYWFS VPAILKG
		SNV	PABPC5	NM_080832	P	L	183	NNRQVYVGRFKFPEER AAEVTRDR	NNRQVYVGRFKFLEERA AEVTRDR
		SNV	PAM	NM_0011773 06	G	D	861	KMQEKQKLIKEPGSGV PVVLTITLL	KMQEKQKLIKEPDSGVP VVLITITLL
		SNV	PARP10	NM_032789	P	L	1015	TCEHVPRASPDDPSGL PGRSPDT	TCEHVPRASPDDLSGLPG RSPDT
		SNV	PCDH18	NM_019035	D	N	886	GRGDSEAGSDYDLG RDSPIRLLG	GRGDSEAGSDYNLGRD SPIDRLLG
		SNV	PCSK7	NM_004716	P	L	14	PKGRQKVPPLDAPLGL PTCLWLELA	PKGRQKVPPLDALLGLPT CLWLELA
		SNV	PHIP	NM_017934	P	L	166	KLNGKYRLERLVPTAV YQHMKMHR	KLNGKYRLERLVLTAVYQ HMKMHR
		SNV	PHOSPHO2- KLHL23	NM_0011992 90	S	F	268	IYNALNPMHKEISQRS TATMYIIGG	IYNALNPMHKEIFQRSTA TMYIIGG
		SNV	PI4K2A	NM_018425	L	F	162	VFKPKNEEPYGHLPK WTKWLQKLC	VFKPKNEEPYGHFNPKW TKWLQKLC
		NCI-3784	TMG7	SNV	PRR14L	NM_173566	P	S	2020
SNV	PRRC2A			NM_080686	P	S	1098	ETRSEGSEYEEIPKRRR QRGSETGS	ETRSEGSEYEEISKRRRQR GSETGS



		SNV	PTPN11	NM_080601	H	Y	426	TVWQYHFRTWPDHG VPSDPGGVLD	TVWQYHFRTWPDYGP SDPGGVLD
		SNV	RALGDS	uc004ccv.1	H	Y	629	AALQPAGGRLLYHPR QPGRGQWQH	AALQPAGGRLLYPRQP GRGQWQH
		SNV	RAP1GDS1	NM_021159	E	K	571	ICALMGSECLHKEVQD LAFLDVVSK	ICALMGSECLHKKVQDLA FLDVVSK
		SNV	RNF145	NM_144726	P	S	256	ALGMSLWNQLVVPVL FMVFWLVLFA	ALGMSLWNQLVVSVLF MVFWLVLFA
		NFS deletion	RPL11	NM_0011998 02			97	GLKVREYELRKNNFSD TGNFGFGIQ	GLKVREYELRKNNSDTGN FGFGIQE
		SNV	RRBP1	uc021waw.1	Q	P	436	GAQNQKKAEQAQ QKKAEGAQ	GAQNQKKAEQAPNQ KKAEGAQ
		SNV	SCRIB	NM_182706	S	F	1561	TPVEDLGPQTSTSPGR LPLSGKKFD	TPVEDLGPQTSTFPGRLP LSGKKFD
		SNV	SCRIB	NM_015356	S	F	1561	TPVEDLGPQTSTSPGR LSPDFAEEL	TPVEDLGPQTSTFPGRLS PDFAEEL
		SNV	SEC31A	NM_016211	E	K	435	QQHHVFISQVVEKEF LSRSDQLQ	QQHHVFISQVVKKEFLS RSDQLQ
		SNV	SENP5	NM_152699	L	F	503	ASPVDEQLSVCLSGF LDEVMMKYG	ASPVDEQLSVCFSGFLD EVMKYG
		SNV	SERINC2	uc009vtw.1	L	F	143	GLVLLRRRGLLPHPHP AGAAHRLC	GLVLLRRRGLLPHFHPA GAAHRLC
		SNV	SETD2	NM_014159	C	Y	1501	KSHRDIKRMQCECTPL SKDERAQGE	KSHRDIKRMQCEYTPLSK DERAQGE
		SNV	SH3TC2	NM_024577	H	Y	243	LVSALPLPLPFHQWF LKNYPGSCG	LVSALPLPLPFYQWFLK NYPGSCG
		SNV	SLC30A5	NM_022902	L	P	594	GGGMNANMRGVFLH VLADTLGSIGV	GGGMNANMRGVFPHV LADTLGSIGV
NCI-3784	TMG8	SNV	SLIT2	NM_004787	G	E	715	QDVAIQDFTCDGND DNSCSPLSRC	QDVAIQDFTCDENDDN SCSPLSRC
		SNV	SNW1	NM_012245	F	L	499	GREGPVQFEEDPFGLD KFLEEAKQH	GREGPVQFEEDPLGLDKF LEEAKQH
		SNV	SON	NM_138927	R	C	1927	RKTVRARSRTPSRRSRS HTPSRRRR	RKTVRARSRTPSCRSRSH TPSRRRR
		SNV	SPATA20	NM_022827	P	S	285	EEYGGFAEAPKFPTPVI LSFLFSYW	EEYGGFAEAPKFSTPVILS FLFSYW
		SNV	ST6GALNAC3	NM_152996	P	L	252	DTYCKTEGYRKVPYHY YEQGRDECD	DTYCKTEGYRKVLYHYE QGRDECD
		SNV	ST6GALNAC3	uc010orh.1	P	L	151	TGKDRTEGYRKVPYHY YEQGRDECD	TGKDRTEGYRKVLYHYE QGRDECD
		SNV	STS	NM_000351	E	K	532	EPRFYEILKVMQEAAD RHTQTLPEV	EPRFYEILKVMQKAADRH TQTLPEV
		SNV	SZT2	NM_015284	S	L	1576	LTLPLEVELPTASDPQH HRSTSESS	LTLPLEVELPTALDPQHH RSTSESS
		SNV	TAF8	NM_138572	P	L	277	AEKENTSVLQQNPSLS GSRNGEENI	AEKENTSVLQQNLSLGS RNGEENI
		SNV	TAF8	uc003oru.1	P	S	318	PRRRTPLSCSRTPPCRV AGMGRRTS	PRRRTPLSCSRTSPCRVA GMGRRTS
		SNV	TBL1XR1	NM_024665	P	L	305	WDAHTGEAKQQFPF HSAPALDVDWQ	WDAHTGEAKQQFLHSA PALDVDWQ
		SNV	TMEM144	NM_018342	P	L	160	EIPNNTCSMDTTLPLITE HVINTTQD	EIPNNTCSMDTTLITEHV INTTQD
		SNV	TRIM24	NM_015905	P	L	750	VIVKQESDEESRPQNA NYPRISLTS	VIVKQESDEESRLQNA PRISLTS
		SNV	TRIM35	NM_171982	D	N	115	LHRGQLSLFCLDKELL CCSCQADP	LHRGQLSLFCLDKELLCC SCQADP
		SNV	TRIM51	NM_032681	H	Y	346	QAFTSGKYYWEVHM	QAFTSGKYYWEVYMGDS

							GDSWNWAFGVC	WNWAFGVC	
NCI-3784	TMG9	SNV	TLL5	NM_015072	Y	F	279	LTNYSVNKKSGDYVSC DDPEVEDYG	LTNYSVNKKSGDFVSCDD PEVEDYG
		SNV	WDFY3	NM_014991	S	T	3352	LDEKDGFIIVNYSEGG TRAHLQGPL	LDEKDGFIIVNYTEGQTR AHLQGPL
		SNV	WDR20	NM_0012424 17	P	S	459	NSVTTPGNSVPPPLPR SNSLPHSAV	NSVTTPGNSVPPSLPRSN SLPHSAV
		SNV	ZBTB4	NM_020899	R	Q	691	AGGASVGGGSLPRGR RPPRWQRKLE	AGGASVGGGSLPQGRPR PRWRQKLE
		SNV	ZBTB9	NM_152735	R	W	409	KRDRHIMLTFSLRPF CGICNKRFK	KRDRHIMLTFSLWPF GICNKRFK
		SNV	ZC3H13	NM_015070	P	S	1102	PGSTPSPLSLLPPPP VATATATT	PGSTPSPLSLLSPPPPVA TATATT
		SNV	ZFAT	NM_0010299 39	E	K	1214	GGEASEFIVVQEQAM QPVEEQAVEQ	GGEASEFIVVQKAMQP VEEQAVEQ
		SNV	ZNF25	NM_145011	P	S	215	ECNQCEKSFYQKPHLT EHQKTHTGE	ECNQCEKSFYQKSHLTH EQKTHTGE
		SNV	ZNF32	NM_006973	S	F	85	RQRVYECQECGKFR QKGSLLTHER	RQRVYECQECGKFRQK GSLTHER
		SNV	ZNF346	NM_012279	H	Y	108	KHANKVKRYLAIHGM ETLKGETKKL	KHANKVKRYLAIGMETL KGETKKL
		SNV	ZNF703	NM_025069	S	F	182	SGSSVSSTSSSSSSP GDKAGFRV	SGSSVSSTSSSFSSSPGD KAGFRV
		SNV	ZNF714	uc002npl.3	K	E	382	RSGVQDQPGQHKGKTP SLLKIQKFAG	RSGVQDQPGQHGETPSL LKIQKFAG
		SNV	ZNF761	NM_0010084 01	T	I	342	ECGKTRQKSILTRHH RLHTGEKPY	ECGKTRQKSILIRHRLH TGEKPY

Patient ID	TMG#	Mutation type	Gene	Transcript ID	WT AA	Mut AA	AA position	Wild-type 25-mer	Mutated 25-mer
NCI-3903	TMG1	SNV	ANKDD1B	NM_0012767 13	L	P	221	AAERGHVEMIEKLTFL NLHTSEKDK	AAERGHVEMIEKPTFLNL HTSEKDK
		SNV	C12orf28	uc010stn.1	P	L	71	LQVPEITFCEILPCQETY CCPIRGM	LQVPEITFCEILLCQETYCC PIRGM
		SNV	C3orf56	NM_0010075 34	E	K	171	WTPASSAPRAAVEGP SRGAPYLKTC	WTPASSAPRAAVKGPSPR GAPYLKTC
		SNV	MRDS1	uc003myh.1	G	A	125	NLLEEDDELHSQGD TDHSVKGKS	NLLEEDDELHSQADSLTD HSVKGKS
		SNV	MUC3A	uc003uxl.1	S	F	18	MTLRITENTPISSF VVIPETP	MTLRITENTPISFFSTSI IPETP
		SNV	ZNF487	ENST0000043 1662	R	Q	8	LIRHQRIHTGEKPYTCH ECGDSFSH	MASRPPQTPSRGSPDL RFR
		SNV	ZNF891	NM_0012772 91	P	S	108	RFSNRSHLLQHRVHT GERPYRCLQ	DQEIRNMKKRISQAICP DQKIQPK
		SNV	CALU	uc003vns.3	W	S	96	KDGFVTVDELKDWIKF AQKRWIYED	KDGFVTVDELKDSIKFAQ KRWIYED
		SNV	RPL5	NM_000969	E	K	70	RDIIQIAYARIEGDMI VCAAYAHE	RDIIQIAYARIKGDMI VCAAYAHE
		SNV	EIF3A	NM_003750	R	Q	794	RLAERHNRLEERKRQ RKEERRITY	RLAERHNRLEEQRQRK EERRITY
		SNV	LAMA1	NM_005559	E	K	78	CRICDGNANPRERHP ISHAIDGTN	CRICDGNANPRKRHPIS HAIDGTN

		SNV	GADD45GIP1	NM_052850	R	C	23	LLGVAATLAPGSRGYR ARPPRRRP	LLGVAATLAPGSCGYRAR PPRRRP
NCI-3903	TMG2	SNV	C19orf2	NM_0012526 41	R	K	386	GSGHSAQELPTIRTPA DIYRAFVDV	GSGHSAQELPTIKTPADIY RAFVDV
		SNV	RUVBL1	NM_003707	G	E	421	LLTPANLLAKINGKDSI EKEHVEEI	LLTPANLLAKINEKDSIEKE HVEEI
		SNV	RND3	NM_0012547 38	A	D	44	SQCGKTALLHVFAKDC FPENYVPTV	SQCGKTALLHVFDKDCFP ENYVPTV
		SNV	MATN2	uc003yid.3	E	K	421	NKPGCEHECVNMEES YYCRCHRGYT	NKPGCEHECVNMKESYY CRCHRGYT
		SNV	EPB41L2	NM_0011355 54	R	C	516	PKAKFLTGSKFRYSGR TQAQTRQA	PKAKFLTGSKFCYSGR QAQTRQA
		SNV	DIP2B	NM_173602	D	N	401	LGTKNEPVLKPGDRVA LVYPNNDPV	LGTKNEPVLKPGNRVALV YPNNDPV
		SNV	CMTM6	NM_017801	E	K	162	LDFITMLYEKRQESQL RKPENTTRA	LDFITMLYEKRQKSQLRK PENTTRA
		SNV	RNF10	NM_014868	D	N	747	ENSLVPPAPVDSGDGS DNSDRVPVP	ENSLVPPAPVDSNGESD NSDRVPVP
		SNV	SSFA2	NM_0012875 04	R	Q	288	QPVSRRSSVSKQSCE SITDEFERF	SNKETDPPPPLTQSNTAN RLMKTLS
		SNV	MARK3	NM_0011289 21	S	R	443	AYPKRSQTSTADSDLK EDGISSRKS	AYPKRSQTSTADRLKED GISSRKS
		SNV	PSMF1	NM_006814	P	L	224	PLRSGFPRALIDPSSGL PNRLPPGA	PLRSGFPRALIDLSSGLPN RLPPGA
		SNV	C12orf49	NM_024738	R	C	70	PWKVQFNLGNSSRPS NQCRRNSIQGK	PWKVQFNLGNSSCPSNQ CRNSIQGK
		NCI-3903	TMG3	SNV	STK25	NM_0012719 78	P	L	214
SNV	CSNK1E			NM_001894	Y	H	201	EQSRRDDLESGLGYVLM YFNLGSLPW	EQSRRDDLESGLGHVLMYF NLGSLPW
SNV	VKORC1L1			NM_0012843 42	E	K	45	LSVSASPEKSYSRPSPL VLPSSRIE	AYHVEREKERDPKHRALC DLGPWVK
SNV	CRELD1			NM_015513	R	Q	220	HLVCSACFGPCARCSG PEESNCLQC	HLVCSACFGPCAQCSGPE ESNCLQC
SNV	PLXND1			NM_015103	P	S	134	DLTKELNRSQGIPFLEY KHFVTRTF	DLTKELNRSQGISFLEYKH FVTRTF
SNV	KIAA1967			NM_021174	H	Y	227	KKPRHDLPPYRVHLTP YTVDSPICD	KKPRHDLPPYRVYLTPYT VDSPICD
SNV	NUP107			NM_020401	G	E	392	GWKLYHDPNVNGGTE LEPVEGNPYR	GWKLYHDPNVNGETELE PVEGNPYR
SNV	RCC1			NM_001269	G	E	407	QLENRVVLSVSSGGQ HTVLLVKDKE	QLENRVVLSVSSEGQHTV LLVKDKE
SNV	DHX38			NM_014003	S	L	305	GRGRREEGEEGIFDFT EEERQQWED	GRGRREEGEEGILFDTEE ERQQWED
SNV	UBTF			NM_0010766 83	P	S	202	TLECTVAGTPELSTKW FKDGKELTS	AKKSDIPEKPKTSQQLWY THEKKVY
SNV	LSG1			NM_018385	L	F	433	TKHFQTLVVEPGLCLC DCPGLVMPS	TKHFQTLVVEPGFCLCDC PGLVMPS
SNV	NUP98			NM_005387	P	L	381	KLTTFGSSTTSAPSGFT TSGGLFGN	KLTTFGSSTTSALSFGTTS GGLFGN
NCI-3903	TMG4			SNV	RBM6	NM_0011675 82	P	S	884
		SNV	CPSF2	NM_017437	I	V	523	MDQDLSDVPTKCIETT ESIEIKARV	MDQDLSDVPTKCVSTTE SIEIKARV
		SNV	TNS3	NM_022748	P	L	711	IEQLNRLILELDPTFEPI PTHMNAL	IEQLNRLILELDLTFEPIPT HMNAL
		SNV	BLVRB	uc002onw.2	S	F	88	GTRNDLSPTTVMSEG ARNIVAAMKA	GTRNDLSPTTVMFEGAR NIVAAMKA

		SNV	CLDN1	uc003fsh.3	T	Y	80	DSLLNLSSTLQATRAL MVGILLGV	DSLLNLSSTLQAYRALMV VGILLGV		
		SNV	LMBR1	uc010lqn.3	G	E	259	LQRRNLNVGMLCAGNP EVATGRQVPE	LQRRNLNVGMLCAENPEV ATGRQVPE		
		SNV	TJP1	uc010azl.3	P	L	364	VSTPVKHADDHTPKTV EEVTVERNE	VSTPVKHADDHTLKTVEE VTVERNE		
		SNV	GPD1L	uc003cew.3	E	K	126	KALGITLIKIGIDEGPEGL KLISDII	KALGITLIKIGIDKGPEGLK ISDII		
		SNV	FAM176A	uc002snk.1	E	K	125	TSAEELERAQRLEERER IIREIWMN	TSAEELERAQLKERERIIR EIWMN		
		SNV	TDRD7	uc004axj.3	V	G	59	PTLEAYLRSVPVAVVRIE TSRSGEIT	PTLEAYLRSVPAGVRIETS RSGEIT		
		SNV	TBC1D15	uc010stt.2	G	R	368	NVDNMKQMIFRGGLS HALRKQAWKF	NVDNMKQMIFRGRLSH ALRKQAWKF		
		SNV	NFATC3	uc010vlb.2	A	T	1024	IKPEPEDREPINFATIGL QDITLDDV	IKPEPEDREPNTTIGLQD ITLDDV		
NCI-3903	TMG5	SNV	KRT18	uc009zmn.2	R	K	325	MRNLKASLENSLREVE ARYALQMEQ	MRNLKASLENSLKEVEAR YALQMEQ		
		SNV	CSGALNACT1	uc011kyp.2	P	S	404	PGIYGHHDVAVPPLEQ QLVIKKETG	PGIYGHHDVAVPSLEQQL VIKKETG		
		SNV	PCYT2	uc031rex.1	P	L	321	KTEIIPDRDGDSPYQEP KRRGIFRQ	KTEIIPDRDGDSDLYQEPKR RGIFRQ		
		SNV	SEC24B	uc011cfq.2	P	L	371	EYVNNQASSAPTLSS TSDDEEEEE	EYVNNQASSAPTLSSSTS DDEEEEE		
		SNV	CARKD	uc001vrc.3	P	L	342	TPTSPHLLLSPPQVQP SPGGRVWR	TPTSPHLLLSPLQVQVQSP GGRVWR		
		SNV	PIGN	uc021ulb.1	T	K	916	FLVFLNGLAQLLTTKKL RLCGKPKS	FLVFLNGLAQLLTKKRLRL CGKPKS		
		SNV	SUMF1	uc003bpz.2	G	N	17	ALGLVCGRCPELGLVLL LLLLLLC	ALGLVCGRCPELNLVLLLL LLLLLLC		
		NFS deletion	LARP7	uc003iay.4			22	KVMEEESTEKKKEVEK KKRSRVKQV	KVMEEESTEKKKVEKKKR SRVKQV		
		SNV	FAM120B	uc003qxp.3	E	K	178	YGLQHNCLGILGEDTD YLIYDTCPY	YGLQHNCLGILGKDTDYLI YDTCPY		
		SNV	TRPM7	uc010bew.2	S	F	103	AYGVINFQGGSHSYRA KYVRLSYDT	AYGVINFQGGSHFYRAKY VRLSYDT		
		SNV	USP6NL	uc001ikt.3	R	H	687	LSVSASPEKSYSRPSPL VLPSSRIE	LSVSASPEKSYSRPSPLVL PSSRIE		
		SNV	LIG3	uc010cth.1	E	K	464	ERVLHNAQEVEKEPG QRRALSVQAS	ERVLHNAQEVEKKPGQR RALSVQAS		
		NCI-3903	TMG6	SNV	CAPN7	uc003bzn.3	P	S	806	EGPFFLDFNSIPIKITQL Q	EGPFFLDFNSIISIKITQLQ
				SNV	DBR1	uc003erv.3	H	Y	182	IFLSDHWPRSIYHYGN KKQLLTKTS	IFLSDHWPRSIYYGNKK QLLTKTS
SNV	UNC119B			uc001tyz.4	EH	DP	180	SNFRMIERHYFREHLL KNFDFDFGFC	SNFRMIERHYFRDPLLKN FDFDFGFC		
SNV	UNC119B			uc001tyz.4	E	D	180	SNFRMIERHYFREHLL KNFDFDFGF	SNFRMIERHYFRDHLKN FDFDFGF		
SNV	PMS2CL			uc011jxb.1	P	L	84	TSDAISDKGVLRPQKE AVSSSQGPS	TSDAISDKGVLRQLQKEAV SSSQGPS		
SNV	RNF213			uc021uen.2	P	L	837	VFMMVVVCIELKIPLFLV GKPGSSKS	VFMMVVVCIELKILLFLVGK PGSSKS		
SNV	TCF20			uc003bck.1	P	L	467	SLSALSTQVANLPNTV QHMLLSDAL	SLSALSTQVANLLNTVQH MLLSDAL		
SNV	AGAP1			uc002vvt.3	P	S	632	GNSHCVDCEQNP WASLNLGALMC	GNSHCVDCEQNSNWA SLNLGALMC		

		SNV	TMEM2	uc011lsa.1	N	S	122	DENCPDQNPRLRNW DPGQDSAKQVV	DENCPDQNPRLRSWDP GDQSAKQVV
		SNV	SORCS1	uc021pxw.1	E	K	301	AYSQDQKLYSSAEFGR RWQLIQEGV	AYSQDQKLYSSAKFGRR WQLIQEGV
		SNV	CHST14	uc001zlw.3	E	V	270	VTFPEFLRYLVDDEPER MNEHWMPV	VTFPEFLRYLVDVDPERM NEHWMPV
		SNV	VPS13C	uc002ahc.2	L	F	74	IDKLTLPKIPWKNLYGEA VVATLEGL	IDKLTLPKIPWKNFYGEAV VATLEGL
NCI-3903	TMG7	SNV	NDRG2	uc010tll.2	S	F	338	SRSRTASLTSAAASVDG NRSRSTLS	SRSRTASLTSAAAFVDGNR SRSRSTLS
		SNV	SLC25A22	uc009yci.3	P	S	281	LDCARKILRHGSPSAFL KGAYCRAL	LDCARKILRHGSSAFLKG AYCRAL
		SNV	SLC27A4	uc004but.3	G	S	180	CLTTSRARALVFGSEM ASAICEVHA	CLTTSRARALVFSSEMAS AICEVHA
		SNV	IFNGR1	uc011edm.1	P	S	328	LEKEVVCEEPLSPATVP GMHTEDNP	LEKEVVCEEPLSSATVPG MHTEDNP
		SNV	CPS1	uc010fus.3	G	S	731	LSRSSALASKATGYPLA FIAAKIAL	LSRSSALASKATSYPLAFIA AKIAL
		SNV	CSGALNACT2	uc001jan.4	H	Y	304	FRDVCIHQDKKIHLTV VYFGKEGLS	FRDVCIHQDKKIYLVVYF GKEGLS
		SNV	ZNF263	uc010uww.2	P	S	630	LIRHQRIHTGEKPYTCH ECGDSFSH	LIRHQRIHTGEKSYTCHEC GDSFSH
		SNV	ANKRD27	uc002ntn.1	E	K	412	CLFKHIASGNQKEVER LLSQEDHDK	CLFKHIASGNQKKVERLLS QEDHDK
		SNV	BCL9L	uc009zal.3	P	S	963	NLKSPQTPSQMVPLPS ANPPGPLKS	NLKSPQTPSQMVSLPSA NPPGPLKS
		SNV	ADCY9	uc002cvx.3	H	Y	292	ELLSRGLLHGCIHAIGV HLFVMSQV	ELLSRGLLHGCIYAIGVHL FVMSQV
		SNV	LONRF2	uc002tal.4	R	K	566	LHVFEPRYRLMIRRCM ETGTRKFGM	LHVFEPRYRLMIKRCMET GTRKFGM
		SNV	LONRF2	uc002tal.4	N	I	323	EVLFSATANVHENLTS SIQSRLKAQ	EVLFSATANVHEILTSSIQ SRLKAQ
		NCI-3903	TMG8	SNV	DNAH14	uc001how.2	L	F	3052
SNV	VPS13B			uc003yiv.4	IP	MS	3284	KDIPKFEVYCKKIPSECS IHHELYH	KDIPKFEVYCKKMSSECSI HHELYH
SNV	PIAS4			uc002lzg.3	S	F	222	PNIAVKVNHSYCSVPG YYPNSKPGV	PNIAVKVNHSYCFVPGY PSNKPGV
SNV	SLC5A4			uc003ami.3	E	K	139	TMPEYLKRFGGGERLQ VYLSILSLF	TMPEYLKRFGGKRLQVY LSILSLF
SNV	LRRC42			uc001cwk.2	G	D	132	SAAEARQKFTEPGAGL RALQKFTEA	SAAEARQKFTEPDAGLRA LQKFTEA
SNV	PHKA1			uc011mqi.2	P	L	34	ILCHQNPVTGLLPASY DQKDAWVRD	ILCHQNPVTGLLLASYDQ KDAWVRD
SNV	GPSM2			uc010ove.1	A	T	682	ALLEFKNSGKKSADH GASSHQPRVPLFPENG	ALLEFKNSGKKSTDH GASSHQPRVPLFSENGLH
SNV	N4BP1			uc002efp.3	P	S	522	LHQQPEPLL	QHQPEPLL
SNV	FASTKD3			uc011cmp.2	P	L	598	DIHKRIALCIDGPKRFC SNSKHLLG	DIHKRIALCIDGLKRFCSN SKHLLG
SNV	ARAP3			uc003llo.1	S	F	280	TSDDLISPYASFSFTAD RLTPLLSG	TSDDLISPYASFFFTADRL TPLLSG
SNV	ASH1L			uc009wqr.1	M	I	534	QPPVYCTSPDFKMGG ASDVSTAKSP	QPPVYCTSPDFKIGGASD VSTAKSP
SNV	ZXDC			uc003eix.2	P	L	494	LLPQLEAPSSLTPSSELS SPGQSEL	LLPQLEAPSSLTSSSELSSP GQSEL
NCI-3903	TMG9	SNV	CABIN1	uc021wnc.1	R	C	1783	SDLERTPPLLGRPAR DRGPESRPT	SDLERTPPLLGPARDR GPESRPT

		SNV	KIF1BP	uc001joy.3	P	S	246	TLKRQLEHNAYHPIEW AINAATLSQ	TLKRQLEHNAYHSIEWAI NAATLSQ
		SNV	CASD1	uc003unj.4	S	L	647	FSNKISNLLFISVVSFL TYSIWAS	FSNKISNLLFILVVSFLTYS IWAS
		SNV	RAPGEF6	uc010jdk.3	S	G	94	VLVKGSMVLPPCSFGK QFGGKRGCD	VLVKGSMVLPPCGFGKQ FGGKRGCD
		SNV	FMN2	uc010pyf.1	K	Q	1417	NRAQSDELEKIEKHGR SSKDKENAK	NRAQSDELEKIEQHGRSS KDKENAK
		SNV	EXOC6	uc010qnr.2	S	F	284	EEILTVQDLVDFSPVYR CLHIYSVL	EEILTVQDLVDFFPVYRCL HIYSVL
		SNV	DOCK9	uc021rlw.1	P	S	1824	GKEYIYKEPKLTPLEIS QRLLKLY	GKEYIYKEPKLTLSEISQR LLKLY
		SNV	HEG1	uc011bke.2	S	F	400	TGNPGDEEFIEPSTENE FGLTSLRW	TGNPGDEEFIEPFTENEF GLTSLRW
		SNV	HDAC4	uc010fyy.3	S	F	861	QAFYSDPSVLYMSLHR YDDGNFFPG	QAFYSDPSVLYMFLHRYD DGNFFPG
		SNV	BRAF	uc003vwc.4	V	E	600	LTVKIGDFGLATVKSR WSGSHQFEQ	LTVKIGDFGLATEKSRWS GSHQFEQ
		SNV	LINS1	uc002bwi.3	S	F	46	PAVSDQDCSTATSLE WANTCGIQGR	PAVSDQDCSTATFLEWA NTCGIQGR
		SNV	ZNF550	uc031rnf.1	A	V	9	DAAQMLVTFKDVAVT FTREEWRQLD	DAAQMLVTFKDVVVVTF REEWRQLD
NCI-3903	TMG10	SNV	KLHL36	uc002fig.3	A	V	363	GGFSFRDNGGDAASN LLRYDPRCK	GGFSFRDNGGDAVSNLL YRYDPRCK
		SNV	ALKBH4	uc003uzl.3	E	K	37	ICERQRGSDPPWELPP AKTYRFIYC	ICERQRGSDPPWKLPPAK TYRFIYC
		SNV	BCAR3	uc001dqb.4	S	F	32	PLASSMDLLSSRPLAE HRPDAYQD	PLASSMDLLSSRFPLAEH RPDAYQD
		SNV	KATNAL1	uc001ust.4	R	W	56	RDPAIKGKWQVQRQE LLEEYEQVKS	RDPAIKGKWQVWQEL LEEYEQVKS
		SNV	CP110	uc002dgl.4	G	R	765	FVSANEAPFYLWGSST SGLTKLSVT	FVSANEAPFYLWRSSTSG LTKLSVT
		SNV	C6orf70	uc011ehb.1	R	C	502	MPENRCVLKDLDRLPT ETWPQLLRE	MPENRCVLKDLDCLPET WPQLLRE
		SNV	LMF1	uc021tae.1	E	K	356	LQMQRDIRGARPEPR FGSVVRAAN	LQMQRDIRGARPKPRFG SVVRAAN
		SNV	DEPDC6	uc003yow.4	H	Y	99	KLMQKLADRGIHHVC DEHKEFKDV	KLMQKLADRGIHYHVCDE HKEFKDV
		SNV	GMEB1	uc001brb.3	G	R	79	AVETHTHIKIEEGIDTG TIEANEDM	AVETHTHIKIEERIDTGIE ANEDM
		SNV	VPS13A	uc004aks.3	P	L	2313	SSFNITRIVTFTPFIYMIK NKSKEYHI	SSFNITRIVTFTLFYMIKKN SKYHI
		SNV	ZNF142	uc010ftv.4	H	Y	185	KKRTHLVEHLHLHFPD PSLQCPNCQ	KKRTHLVEHLHLHFPDPSL QCPNCQ
		SNV	PALLD	uc011cjx.2	E	K	941	HFLQAPGDLTVQEGKL CRMDCKVSG	HFLQAPGDLTVQKGKLC RMDCKVSG
		NCI-3903	TMG11	SNV	SH3TC1	uc003gkw.4	P	S	762
SNV	TMEM132A			uc001nqj.3	R	G	1018	LKDPEELRNYMERIRG SS	LKDPEELRNYMEGIRGSS
SNV	TNRC6C			uc002juf.2	P	S	1298	SVKDPSQSQSRLPQW THPNMNDNLP	SVKDPSQSQSRLSQWTH PNMNDNLP
SNV	RING1			uc003odl.3	G	S	322	QQEAGEPGGGGGAS DTGGPDGCGG	QQEAGEPGGGGGASDT GGPDGCGG
SNV	OPTN			uc001ily.1	H	Y	3	MSHQPLSCLTEKEDS INQLKIEGVEHLPRRVT	MSYQPLSCLTEKEDS INQLKIEGVEHLSSRRVTNE
SNV	ERCC4			uc010bva.3	P	S	85	NEITSNSR	ITSNSR
SNV	NICN1			uc011bcr.2	R	C	63	KNYYTAFLSIRVRQYTS	KNYYTAFLSIRVCQYSAH

							AHTPAKWV	TPAKWV	
		SNV	SGEF	uc021xgc.1	P	S	648	INSQLEFKIKPFPLVSSSR RWLVKRG	INSQLEFKIKPFSLVSSSR WLVKRG
		SNV	KIFC2	uc003zcz.3	E	K	163	RPPSPDGSTSQEESPS HFTAVPGEP	RPPSPDGSTSQEKSPSHF TAVPGEP
		SNV	C4orf23	uc003glg.2	R	K	159	EGHPGRGIDVRRRRIW DMYGPQTQL	EGHPGRGIDVRRRRIWD MYGPQTQL
		SNV	CUL9	uc010jyk.3	H	Y	2069	VHQAQAVPVRPDHCP VCVSPLGCDD	VHQAQAVPVRPDYCPVC VSPLGCDD
		SNV	HOXA3	uc011jzl.2	P	L	322	ASYPASLPSCAPPPPP QKRYTAAGA	ASYPASLPSCAPLPPPPQK RYTAAGA
NCI-3903	TMG12	SNV	FREM2	uc001uwv.3	P	S	1185	FSERQFFPIVIPTNDE QPENFMRE	FSERQFFPIVIISTNDEQPE MFMRE
		SNV	FANCC	uc022bkl.1	A	T	226	ILQPEFFEAVNEAILLKK ISLPSMA	ILQPEFFEAVNETILLKKISL PMSA
		SNV	CACNA2D1	uc003uhr.1	D	N	662	APRDYCNDLKISDNNT EFLNFMRE	APRDYCNDLKISNNNTEF LLNFMRE
		SNV	HEYL	uc010oiw.2	R	Q	67	RRDRINSSLELRLVLP TAFEKQGS	RRDRINSSLELQRLVPTA FEKQGS
		SNV	ZFP62	uc021yjo.1	L	F	744	VECGKSFYSYSSLSQHK RIHTGEKP	VECGKSFYSYSLFSQHKRI HTGEKP
		SNV	ANKMY1	uc010fzd.1	P	L	201	ELDARIFLNEIPFVED GEPWFIIN	ELDARIFLNEIPLFVEDGE PWFIIN
		SNV	C16orf55	uc031qxq.1	S	F	103	TRASNETLVSCSSSGSD QRTIREP	TRASNETLVSCSFSGSDQ QRTIREP
		SNV	ARHGAP39	uc011llk.1	M	I	1032	VFVQPANVAVTKMDV SNLAMVMAPN	VFVQPANVAVTKIDVSNL AMVMAPN
		SNV	HIVEP1	uc003nac.3	R	Q	2608	RTESPQGLPTVQRENA KKVLNPPAP	RTESPQGLPTVQQENAK KVLNPPAP
		SNV	ZNF653	uc002mrz.2	P	F	501	NLVHRKGGTKVCPHP GCGKKFYLSN	NLVHRKGGTKVCFHPGC GKKFYLSN
		SNV	PCDHGB6	uc003lkj.2	L	F	338	GLSTQCKVIIIEILDEND NSPEIIT	GLSTQCKVIIIEIFDENDNS PEIIT
		SNV	AKD1	uc003ptr.4	R	K	229	QMVAEILHHLVQRPE DYLENVENIV	QMVAEILHHLVQKPEDYL ENVENIV
NCI-3903	TMG13	SNV	TNFAIP2	uc001ymm.1	E	K	24	PLEAGAAPYREEEEAA KKKKEKKK	PLEAGAAPYREEEAAKK KKEKKK
		SNV	CEBPA	uc002nun.3	R	H	264	ALKGLGAAHPDLRASG GSGAGAKK	ALKGLGAAHPDLHASGG SGAGAKK
		SNV	ANKDD1A	uc010bha.3	M	V	205	NTALHLAAGRGHMAV LQRLVDIGLD	NTALHLAAGRGHVAVLQ RLVDIGLD
		SNV	C14orf79	uc001ypy.1	A	S	66	ISMPREGGSTCTARCP DPGEHSSTW	ISMPREGGSTCTSRCPDP GEHSSTW
		SNV	PRICKLE1	uc010skw.2	E	K	276	QMTYDGGQHWATEA CFSCAQCKASL	QMTYDGGQHWATKACF SCAQCKASL
		SNV	DNAH2	uc002giu.1	D	N	2632	SKVFQGMRLRANKDFH DTKSSITRLW	SKVFQGMRLRANKNFHDT KSSITRLW
		SNV	CLSTN3	uc001qss.3	T	I	313	SERALRKLCGAATGEV DLLPMPGPN	SERALRKLCGAAIGEVDLL PMPGPN
		SNV	ANKRD5	uc010gbz.3	S	L	514	AGDLASLKKAFESGIPV DMKDNYYK	AGDLASLKKAFELGIPVD MKDNYYK
		SNV	CLIC6	uc010gmt.1	K	E	514	VIFNVTTVDLKRKPADL QNLAPGTN	VIFNVTTVDLKRKPADLQ NLAPGTN
		SNV	FRY	uc001utx.3	R	C	1143	AGPFSIMFTPLDRYSD RNHQITRYQ	AGPFSIMFTPLDCYSDRN HQITRYQ
		SNV	ANK3	uc001jky.3	P	S	2141	GFETRSEKTPSAPQSA ESTGPKPLF	GFETRSEKTPSASQSAEST GPKPLF

		SNV	TBX19	uc001gfl.3	S	F	141	PNFGAHWMKAPISFS KVKLTNKLNG	PNFGAHWMKAPIFFSKV KLTNKLNG
NCI-3903	TMG14	SNV	BTC	uc003hig.2	E	K	159	KRRKRKKKEEMETLG KDITPINED	KRRKRKKKEEMKTLGKD ITPINED
		SNV	SAMD9L	uc022ahh.1	T	A	1255	LLEYLNPNYKDATTME SIVNEYAFL	LLEYLNPNYKDAATMESI VNEYAFL
		SNV	KIAA0895	uc003tfd.2	G	R	37	RWKRWFKFRKRKGEK RPRPNHKAVA	RWKRWFKFRKRKREKRP RPNHKAVA
		SNV	GPR158	uc001isk.3	D	N	713	NSAWSEHSLDPEDIRD ELKKLYAQL	NSAWSEHSLDPENIRDEL KKLYAQL
		SNV	PCDHGA1	uc011dan.2	R	C	293	FHNVDHRVAQIFRLDS YTGEISNKE	FHNVDHRVAQIFCLDSYT GEISNKE
		SNV	SLC12A5	uc010zxl.1	P	L	305	IYAGVIKSAFDPPNFPI CLLGNRTL	IYAGVIKSAFDPLNFPICLL GNRTL
		SNV	PCLO	uc003uhx.2	P	S	4870	GIFPDPSKDMQVPTIE KSHSSPGSS	GIFPDPSKDMQVSTIEKS HSSPGSS
		SNV	RDH12	uc001xjz.4	R	Q	95	IRVDTKNSQVLVRKLD LSDTKSIRA	IRVDTKNSQVLVQKLDLS DTKSIRA
		SNV	PCDH18	uc003ihg.4	S	L	777	INGTLPIRSHHRSSPSS SPTLERGQ	INGTLPIRSHHRLSPSSPT LERGQ
		SNV	CETP	uc002eki.2	D	N	297	RVFHSLAKVAFQDGRLL MLSLMGDEF	RVFHSLAKVAFQNGRLM LSLMGDEF
		SNV	LGI2	uc003grf.2	E	K	337	KPNDIELFQIDDETFVVI ADSSKAG	KPNDIELFQIDDKTFFVIA DSSKAG
		SNV	MRAP2	uc003pkg.4	E	K	26	QSASNSDYTWWEYEEYE IGPVSEFGL	QSASNSDYTWWEYKYYEIG PVSFGL
		NCI-3903	TMG15	SNV	TTN	uc031rqd.1	S	N	7616
SNV	OLIG2			uc021wil.1	D	G	97	STSSAAASSTKKDKKQ MTEPELQQL	STSSAAASSTKKGKKQMT EPELQQL
SNV	SAMD14			uc002iqg.4	T	N	254	TDSGKGSASSGTTSP TCSPKHEGF	TDSGKGSASSGNTSPTC SPKHEGF
SNV	ILDR2			uc001gdx.2	G	E	239	DSCCCPQALYEAGKAA KAGYPPSVS	DSCCCPQALYEAKEAKAA GYPPSVS
SNV	EFCAB5			uc010wbj.2	G	R	325	LQEFFQNPDFKLGSHC KQLDITDST	LQEFFQNPDFKLRSHCKQ LDITDST
SNV	LRRC36			uc010vjk.2	E	K	621	LVRVLEENLILSEKIQQL EEGAAIS	LVRVLEENLILSKIQQL GAAIS
SNV	GPC5			uc010tif.2	A	T	137	LFCSTYRNMALEAAAS VQEFFTDVG	LFCSTYRNMALETAASVQ EFFTDVG
SNV	RP1			uc003xsd.1	E	K	490	KMIGQFSYSEERESGE NKSEYHMFT	KMIGQFSYSEERKSGENK SEYHMFT
SNV	DNAH10			uc001uft.4	G	E	2881	GFLELINNMLTSGIVPA LFSEEEKE	GFLELINNMLTSEIVPALF SEEEKE
SNV	APOB48R			uc002dqb.2	A	T	331	AETASGGEEAGTASG GEEAGIASGG	AETASGGEEAGTSGGEE AGIASGG
SNV	DNAH1			uc011bef.2	M	V	1484	DLVALVRGKLSRMQR AVLSALIVIE	DLVALVRGKLSRVQRAVL SALIVIE
SNV	CFI			uc011cft.2	H	Y	95	PTYCQQKSLECLHPGT KFLNNGTCT	PTYCQQKSLECLYPGTKFL NNGTCT
NCI-3903	TMG16			SNV	IL2RB	uc003aqv.1	R	H	131
		SNV	RYR3	uc010bar.3	G	R	4338	QAAEMKAANEAEKGV ESEKADMEDG	QAAEMKAANEAEKRVES EKADMEDG
		SNV	FILIP1L	uc021xbr.1	V	I	417	RETLQSKDFKLEVEKLS KRIMALEK	RETLQSKDFKLEIEKLSKRI MALEK
		SNV	NXPH3	uc002ipa.3	R	H	85	GEAWGILGQPPNRPN HSPPPSAKVK	GEAWGILGQPPNHPNHS PPPSAKVK



		SNV	FAM171A1	uc001iob.3	H	Y	398	EAPGTKELMSGVHLE MMSPGGEGDL	EAPGTKELMSGVYLEMM SPGGEGDL		
		SNV	MXRA5	uc004crg.4	S	F	1260	VSSRASGSKPSPSPENK HRNIVTPS	VSSRASGSKPSPFPENKH RNIVTPS		
		SNV	CCDC116	uc002zve.3	D	N	437	SHFSNRLYEELADFLTQ QAASLVIR	SHFSNRLYEELANFLTQQ AASLVIR		
		SNV	CA9	uc003zxo.4	E	K	302	EQLLSRLEEIAEEGSET QVPGLDIS	EQLLSRLEEIAEKGSETQV PGLDIS		
		SNV	GRM8	uc003vlt.2	P	S	573	RPNMNRGTGCQLIPIIKL EWHSPWAV	RPNMNRGTGCQLISIikle WHSPWAV		
		SNV	OLFML2B	uc010pkq.2	D	N	525	NEGAWMKDPLAKDE RIYVTNYYGN	NEGAWMKDPLAKNERIY VTNYYGN		
		SNV	FGD3	uc004ata.3	R	Q	256	LKMYGEYVKNFDRAV GLVSTWTQRS	LKMYGEYVKNFDQAVGL VSTWTQRS		
		SNV	TAS2R3	uc003vwp.1	P	S	277	AKMIGEVMTMFYPAG HSFILILGNS	AKMIGEVMTMFYSAGHS FILILGNS		
NCI-3903	TMG17	SNV	C12orf56	uc021qzu.1	D	N	96	LIDDYPEFLSSPDREISQ HIRIIS	LIDDYPEFLSSPNREISQHI RIIIS		
		SNV	GPR98	uc003kju.3	G	R	1589	FTGACIPEIAEEGSTISC VVERTRG	FTGACIPEIAEERSTISCVV ERTRG		
		SNV	KIAA1543	uc002mgv.4	R	Q	762	TGPKAASPSARRVPA TRRSPGGPGP	TGPKAASPSARQVPATR RSPGGPGP		
		SNV	KIAA1543	uc002mgw.3	A	T	1072	HNNLGVKRPTSRAPSP SGLMSPSRL	HNNLGVKRPTSRTPSPSG LMSPSRL		
		SNV	ARHGEF4	uc010fmw.1	G	R	570	RPSAQRMGHLHYPGRG SAISMVSLGS	RPSAQRMGHLHYPRRGS ISMVSLGS		
		SNV	CNGA1	uc003gxu.3	R	Q	629	GSDPKDLEEKVTRME GSVDLLQTRF	GSDPKDLEEKVTQMEGS VDLLQTRF		
		SNV	CNGA1	uc003gxu.3	I	S	297	FQRTETRTNYPNIFRIS NLVMIYIVI	FQRTETRTNYPNSFRISNL VMIYIVI		
		SNV	GRIN3A	uc004bbq.1	R	K	730	SALNICYALLFGRTVAI KPPKCWTG	SALNICYALLFGKTVAIKP PKCWTG		
		SNV	PREX2	uc011lez.1	M	R	218	AVCSNINEAKRQMEKL EVLEEWQSH	AVCSNINEAKRQREKLEV LEEWQSH		
		SNV	PREX2	uc003xxu.1	S	F	954	EFLLLPPLLGISQDGR QHCIPEDL	EFLLLPPLLGFQDGRQH CIPEDL		
		SNV	TRIML2	uc011cle.1	G	R	365	ALRPVFLCIPNGDTSP DSLILQH	ALRPVFLCIPNRDTPSPDS LILQH		
		SNV	COL28A1	uc003src.1	P	S	259	PGDPGPPGTHGNPGI KGERGPKGNP	PGDPGPPGTHGNSGIK ERGPKGNP		
		NCI-3903	TMG18	SNV	SAMD12	uc010mda.1	G	R	123	LLRLTDKCLERMGIAQ ENLRQHILQ	LLRLTDKCLERMRIAQEN LRQHILQ
				SNV	VWDE	uc003ssj.2	D	N	411	VNEDFLWNNYIPDSIQ IKVKDVPTA	VNEDFLWNNYIPNSIQIK VKDVPTA
SNV	ABCA12			uc010zjn.2	E	K	1883	SQVIYNLTGQRVENYLI STANEFVQ	SQVIYNLTGQRVKNYLIST ANEFVQ		
SNV	COL4A6			uc011msn.2	P	L	548	LGPSGPKGKKGEPILST IQGMPGDR	LGPSGPKGKKGELILSTIQ GMPGDR		
SNV	IL22RA1			uc010oeg.1	P	L	512	SSVQIEGHPMSLPLQP PSRPCSPSD	SSVQIEGHPMSLLLQPPS RPCSPSD		
SNV	ALPK3			uc002ble.3	P	S	1073	GLSQEVPTMPSLPGTG LTASPKAGP	GLSQEVPTMPSLPGTGLT ASPKAGP		
SNV	GJB7			uc021zcyj.1	D	N	167	IKCDLKPCPNTVDFIS KPTektIF	IKCDLKPCPNTVNCFISK TEKTIF		
SNV	ISL1			uc003jor.3	G	R	5	MGDMGDPPKKRLIS LC	MGDMRDPPKKRLISLC		
SNV	KIAA1324			uc021orb.1	P	L	643	QPYGVQACVPCGPGT KNNKIHSCLY	QPYGVQACVPCGLGTKN NKIHSCLY		
SNV	COL11A2			uc003ocz.1	P	L	1440	KGDRGLPGPQGSPGQ	KGDRGLPGPQGSLGQKG		

							KGEMGIPGAS	EMGIPGAS	
		SNV	C3orf15	uc011bje.2	P	S	255	RAREKRAWEASLPALS DTSQFEKRR	RAREKRAWEASLSALSDT SQFEKRR
		SNV	NEFL	uc003xee.4	S	L	63	LSVRRSYSSSSGSLMPS LENLDLSQ	LSVRRSYSSSSGSLMPSLE NLDLSQ
NCI-3903	TMG19	SNV	MMEL1	uc001ajy.2	R	K	393	QNLENIIDTYSARTIQN YLVWRLVL	QNLENIIDTYSAKTIQNYL VWRLVL
		SNV	DNAH5	uc003jfd.2	E	K	1279	QISIDFQVGPPIEESYALL NRYGLLI	QISIDFQVGPPIEKSYALLN RYGLLI
		SNV	MYO15A	uc021trm.1	G	S	2147	VWHNNHNAHNAERG WLLLAACLSGFA	VWHNNHNAHNAERSWLL LAACLSGFA
		SNV	FPR1	uc021uyo.1	G	R	172	VIIRVTTVPGKGTVAC TFNFSPWT	VIIRVTTVPGKTRTVACTF NFPDWT
		SNV	DLEC1	uc010hgv.1	R	Q	1125	TRQLILTNRSPTRFSL KFEYFGS	TRQLILTNRSPIQTRFSLKF EYFGS
		SNV	KIAA1409	ENST0000055 5664	M	I	1	LNDDVLSTLPYTMISTL ATFPPFLH	LNDDILSTLPYTIISTLATFP PFLH
		SNV	CD3E	uc010rya.2	G	S	29	VGWVGQDGNEMMG GITQTPYKVSIS	VGWVGQDGNEMMSGIT QTPYKVSIS
		SNV	DCC	uc010xdr.1	S	F	868	THDAVRVSWADNSVP KNQKTSEVRL	THDAVRVSWADNFVPK NQKTSEVRL
		SNV	SCN2A	uc021vry.1	S	N	1930	RYLLKQKVKKVSIIYKK DKGKECDG	RYLLKQKVKKVSNIYKDK GKECDG
		SNV	MAPT	uc010dau.3	G	E	385	QLKARMVSKSKDGTG SDDKAKTST	QLKARMVSKSKDETGSD DKKAKTST
		SNV	CXCR7	uc021vys.1	N	S	62	IYIFIVIGMIANSVVV WVNIQAKT	IYIFIVIGMIASSVVVVV NIQAKT
		SNV	CDH6	uc003jhe.2	D	N	294	PPGTPIGRIKASDADV GENAEIEYS	PPGTPIGRIKASNADVGE NAEIEYS
		NCI-3903	TMG20	SNV	FAM133A	uc022bx.1	G	E	128
SNV	DNAH7			uc002utj.4	S	F	3327	PYANLCTWLPQKSWD EICRLDDLPA	PYANLCTWLPQKFWDEI CRLDDLPA
SNV	DMBX1			uc001cpx.3	P	L	338	AAAAAHQGVWGSPLL PAPPAGLAPA	AAAAAHQGVWGSLLPA PPAGLAPA
SNV	SLC4A10			uc010zcs.2	R	Q	135	EICWREGEDAEWRET ARWLKFEEDV	EICWREGEDAEWQETAR WLKFEEDV
SNV	LRRIQ1			uc021rbo.1	D	N	1269	EPDSPDIPEKWMDSV SSHSPLSKSA	EPDSPDIPEKWMNSVSS HSPLSKSA
SNV	KNDC1			uc001llz.1	P	S	1600	LSGLEHLAVRQSPA RILPAKIAEV	LSGLEHLAVRQSSAWRIL PAKIAEV
SNV	HYDIN			uc031qwy.1	D	N	4151	EGWIPPLSRFPIDIFFTP KQEGDVN	EGWIPPLSRFPINIFFTPK QEGDVN
SNV	MYH6			uc001wjl.3	E	K	1529	QLGEGGKNVHELEKV RKQLEVEKLE	QLGEGGKNVHELKVKR QLEVEKLE
SNV	COL29A1			uc021xdz.1	E	K	2225	LNSGRESFPVKTEDNG SDYLVYLP	LNSGRESFPVKTKDNGSD YLVYLP
SNV	CSMD3			uc011lhx.2	K	E	2209	TSLYFHSDYSQNKQGF HIVYQAYQL	TSLYFHSDYSQNEQGFHI VYQAYQL
SNV	PKHD1			uc003pah.1	P	S	3449	FVDVFSSVNIANPCSTS GSVSTFYS	FVDVFSSVNIANISCSTSGS VSTFYS
SNV	LRP1B			uc010fnl.1	S	F	1102	GTIRLCDHKTFCSCWS TGRKINKAW	GTIRLCDHKTFCFCWSTG RCINKAW
NCI-3903	TMG21			SNV	ZNF711	uc011mqy.1	P	S	517
		SNV	PRSS54	uc002eng.3	S	F	36	LYSSTSCGVQKASVYF GPDPKLEGLV	LYSSTSCGVQKAFVYGP DPKLEGLV

		SNV	ABCC12	uc002efc.1	S	L	631	SDRQLYLLDDPLSAVD AHVGKHFVE	SDRQLYLLDDPLLAVDAH VGKHFVE		
		SNV	ALB	uc011cbf.2	E	K	165	DNEETFLKKYLYEIARR HPYFYAPE	DNEETFLKKYLYKIARRHP YFYAPE		
		SNV	ASGR2	uc010clw.2	S	N	101	LQAE LRSLKEAFSNFSS STLTEVQA	LQAE LRSLKEAFNNFSSST LTEVQA		
		SNV	BANK1	uc010ill.3	P	S	206	TIPLAVVLPTEIPCENP GEIFIILR	TIPLAVVLPTEISCENPGEI FIILR		
		SNV	BDKRB1	uc021sbj.1	R	Q	176	VGGLLSIPTFLLRSIQAV PDLNITA	VGGLLSIPTFLLQSIQAVP DLNITA		
		SNV	BTBD11	uc001tml.1	A	V	775	SLEEILAEGTDLAETAP PPLCASRN	SLEEILAEGTDLVETAPP LCASRN		
		SNV	C1orf100	uc031psw.1	R	C	13	MTAIRLREFIERRPVIP PSIFIAHQ	MTAIRLREFIERCPVIPPSI FIAHQ		
		SNV	C6	uc003jml.2	E	K	651	EADSGCPQVPPEENG FIRNEKQLYL	EADSGCPQVPKNGFIR NEKQLYL		
		SNV	C9orf79	uc004app.4	G	E	896	RVESVPKVPIFLGKRPQ NGPGDNRT	RVESVPKVPIFLEKRPQN GPGDNRT		
		SNV	CACNA1E	uc009wxt.3	P	L	2118	TSTPRRSRRQLPPVPP KPRPLLSYS	TSTPRRSRRQLPLVPPKPR PLLSYS		
NCI-3903	TMG22	SNV	CACNA1I	uc003ayf.3	D	N	250	RCFLEENFTIQGDVALP PYYQPEED	RCFLEENFTIQGNVALPP YYQPEED		
		SNV	CAPN9	uc001hua.1	H	Y	132	DQSFPGPYAGIFHFQF WQHSEWLDV	DQSFPGPYAGIFYFQFW QHSEWLDV		
		SNV	CATSPERB	uc010aub.1	S	F	1114	SISLSELIHRKSKSEE NHDEDTWVECEDPFD	SISLSELIHRKSKFEE NHDEDTWVECEDSFDLR		
		SNV	CD5L	uc001frk.4	P	S	241	LRLVGGDNLC	LVGGDNLC		
		SNV	CDH12	uc011cno.1	A	V	740	PTAPPYDSLATYAYEGS GSAESLS	PTAPPYDSLATYVYEGSG SVAESLS		
		SNV	CHRM2	uc022ame.1	I	K	301	VSAVASNMRRDDEITQ DENTVSTSLG	VSAVASNMRRDDEKTQDE NTVSTSLG		
		SNV	CNTN5	uc021qpc.1	G	E	1068	ASSQIRVPSYSGGKITS AQSTLHSL	ASSQIRVPSYSGEKITSAQ STLHSL		
		SNV	CRP	uc001ftx.1	P	S	30	GQTDMSRKAFVFPKE SDTSYVSLKA	GQTDMSRKAFVFSKESD TSYVSLKA		
		SNV	CSN3	uc003hfe.4	T	I	133	PPKKIQDKIIPTINTIAT VEPTPA	PPKKIQDKIIPIINTIATVE PTPA		
		SNV	CTNNA2	uc010ysj.2	S	L	939	TRVRRGSQKKHISPVQ ALSEFKAMD	TRVRRGSQKKHILPVQAL SEFKAMD		
		SNV	CYP4F2	uc010xou.1	D	N	252	LLHIDFLYYLTPDGQRF RRACRLVH	LLHIDFLYYLTPNGQRFRR ACRLVH		
		SNV	CYP4F22	uc002nbh.4	G	R	290	VIQERRRALRQQGAEA WLKAKQGKT	VIQERRRALRQQRAEAW LKAKQGKT		
		NCI-3903	TMG23	SNV	GPRIN2	uc021pNCI-1	R	Q	110	VSTMGGSDLCRLRAPSA AAAMQRSHS	VSTMGGSDLCRLQAPSA AAMQRSHS
				SNV	DAOA	uc001vqb.3	F	C	28	SRYTLGKIYFIGFQRSIL LSKSENS	SRYTLGKIYFIGCQRSILLS KSENS
SNV	DNAH8			uc021yzh.1	D	N	1019	FQKYKTLWTEDRDVK VKEFLANNPS	FQKYKTLWTEDRNVKVK EFLANNPS		
SNV	DNAH8			uc021yzh.1	E	K	4381	KGWALDVTIHNVEVLR QTKEEITSP	KGWALDVTIHNKVLRLQ TKEEITSP		
SNV	FAM170A			uc003ksm.2	H	Y	323	RRSWSQCPGCVFHSP KDRNS	RRSWSQCPGCVFYS PKD RNS		
SNV	FGA			uc003iod.1	G	E	824	CQAANLNGIYYPGGSY DPRNNSPYE	CQAANLNGIYYPEGSYDP RNNSPYE		
SNV	FKSG83				P	S	164	RLTCAILNMIISCLPHS FLLHQRN	RLTCAILNMIISCLPHSFL LHQRN		
SNV	GADL1			uc003cep.2	G	R	488	KGSLMLGYQPHRGKV NFFRQVVISP	KGSLMLGYQPHRRKVN FRQVVISP		

		SNV	GLYATL2	uc009ymq.3	D	N	198	ERSLKYIERCLQDFLGF GVLGPEGQ	ERSLKYIERCLQNFLGFGV LGPEGQ
		SNV	GPRIN2	uc021pNCI-1	R	Q	110	VSTMGGSDLCRLRAPSA AAAMQRSHS	VSTMGGSDLCRLQAPSA AAMQRSHS
		SNV	GRHL2	uc010mbu.3	H	Y	407	TYSYNNRSNKPIHRAY CQIKVFCDK	TYSYNNRSNKPIYRAYCQI KVFCDK
		FS deletion	GZMA	uc003jpm.3			248	DPRGPGVYILLSKKHLN WIIMTIKG	DPRGPGVYILLSKNTSTG
NCI-3903	TMG24	SNV	KANK4	uc001dah.4	A	T	228	GYPELASAIKQPASKLS SIQSQLS	GYPELASAIKQPTSKLSSI QSQLS
		SNV	KANK4	uc001dah.4	V	D	228	SSPRASTRIPELVQEGA EPPEGVVK	SSPRASTRIPELDQEGAEP PEGVVK
		SNV	KIAA0748	uc001sgn.4	P	F	389	APSQTLDSNPKVPCCT HSLPIEDPQ	APSQTLDSNPKVFCCTHS LPIEDPQ
		SNV	KIAA2022	uc004eby.3	E	K	1343	QRFMMASIEPLWEP MEHHGDPNIFY	QRFMMASIEPLWKPME HHGDPNIFY
		SNV	KL	uc001uus.3	E	K	897	QLRVYYMQNYINEALK AHILDGINL	QLRVYYMQNYINKALKA HILDGINL
		SNV	KRT38	uc002hwq.1	R	K	21	SCPLGCTMAPGARNV SVSPIDIGCQ	SCPLGCTMAPGAKNVSV SPIDIGCQ
		SNV	KRT77	uc009zmi.3	A	V	353	QYELIAQRSKDEAEALY QTKYQELQ	QYELIAQRSKDEVEALYQ TKYQELQ
		SNV	KRTAP20-2	uc011adg.2	G	R	57	GYGYGCCRPSCYGRY WSCGFY	GYGYGCCRPSCYRRYWS CGFY
		SNV	LALBA	uc001rrt.3	R	K	89	KLWCKSSQVPOSRNIC DISCDKFLD	KLWCKSSQVPOSKNICDI SCDKFLD
		SNV	MAB21L2		N	T	209	PNRVAEVKAEGFNLLS KECYSLTGK	PNRVAEVKAEGFTLLSKE CYSLTGK
		SNV	MAB21L2	uc003ilw.3	E	K	58	EVQEPFRFISSLSEIDARY EGLEVIS	EVQEPFRFISSLKIDARYE GLEVIS
		SNV	MGC26647	uc022ahc.1	R	K	235	FMDPATFINMYNRPIH ITLDSEVVW	FMDPATFINMYNKPIHIT LDSEVVW
		NCI-3903	TMG25	SNV	MNDA	uc001fsz.1	E	K	282
SNV	MOV10L1			uc011arq.1	G	R	403	LSRKQMTPEPEPGLVLP PGGKTFIVV	LSRKQMTPEPEPGRLVPPG GKTFIVV
SNV	MUC15			uc001mqx.3	R	Q	284	RRLYDDRNEPVLRLDN APEPYDVSF	RRLYDDRNEPVLQLDNA PEPYDVSF
SNV	MUC16			uc002mkp.3	S	F	8189	ETSTETITRLPTSSIMTE SAEMMIK	ETSTETITRLPTFSIMTESA EMMIK
SNV	MUC16			uc002mkp.3	P	S	1490	SPSSPMSTFAIFPPMST PSHELKSKS	SPSSPMSTFAIFSPMSTPS HELKSKS
SNV	MUC21			uc021yuf.1	G	E	532	HGLNHGLGPGPGGN HGAPHRPRWSP	HGLNHGLGPGPGENHG APHRPRWSP
SNV	MYH8			uc002gmm.2	L	V	1304	RQLDEKDALVSQLSRS KQASTQQIE	RQLDEKDALVSQVSRKQ ASTQQIE
SNV	NEUROD6			uc022abi.1	G	R	269	EGPLSPPPINYNGIFSL KQEETLDY	EGPLSPPPINYNRIFSLKQ EETLDY
SNV	NLRP13			uc010ygg.2	E	K	147	QGCQDPNQEELDELE EETGNVQAQG	QGCQDPNQEELDKLEE TGNVQAQG
SNV	NWD1			uc002nev.4	G	E	474	VHLILSACSGALGVLDL LQRVLLDP	VHLILSACSGALEVLDLQ RVLLDP
SNV	OR10J3			uc010piu.2	P	F	80	SISETCYTVAIIPHMLS GLLNPHQP	SISETCYTVAIIFHMLSGLL NPHQP
SNV	OR51G2			uc001lzt.1	L	F	115	FAQLFFIIHCFSSFLESSVL LSMAFDR	FAQLFFIIHCFSSFESSVLLS MAFDR
NCI-3903	TMG26			SNV	OR56B1	uc009yev.1	A	T	173

	SNV	OR5D16	uc010rio.2	A	V	127	ILFAVMAYDHFVAICN PLLYTVAIS	ILFAVMAYDHFVVICNPL LYTVAIS
	SNV	OR9K2	uc010spe.2	S	F	173	MSTRCTQLVAGSYFC GCISSVIQT	MSTRCTQLVAGFYFCGC ISSVIQT
	SNV	PCDHA6	uc011dab.2	G	R	193	DVKINSDDNKQIGLLK KSLDREEA	DVKINSDDNKQIRLLKKS LDREEA
	SNV	PCDHAC1	uc003lih.2	V	A	435	PPLSTRRTITVSVADVN DNTPNFPQ	PPLSTRRTITVSAADVND NTPNFPQ
	SNV	PDE1A	uc010zfq.2	S	F	403	QGDKEAELGLPFSPLC DRKSTMVAQ	QGDKEAELGLPFFPLCDR KSTMVAQ
	SNV	PDYN	uc021vzu.1	D	N	243	RRQFKVTRSQEDPN AYSGLFDA	RRQFKVTRSQENPNAY SGELFDA
	SNV	PEG3	uc010etr.2	S	F	1313	VTVHKNEPEYEGSSYT HTSFLTEPL	VTVHKNEPEYEGFSYHT SFLTEPL
	SNV	PIK3C2G	uc010sic.2	E	K	703	LPLVLGSAPGWDERTV SEMHTILRR	LPLVLGSAPGWDKRTVSE MHTILRR
	SNV	PLCZ1	ENST0000054 1695	P	S	402	IKKNGQGNMVIIPA QIVLVLKAKVQCELNIT	IKKNGQGNMVIISA QIVLVLKAKVQCKLNITA
	SNV	PTH2R	uc010zjb.2	E	K	49	AQLQEGEG	QLQEGEG
	FS deletion	TMEM132D	uc009zyl.1			577	GRGCTLQYQHAMVR VLTQFVAEAG	GRGCTLQYQHAMVGS

Patient ID	TMG#	Mutation Type	Gene	Transcript ID	WT AA	Mut AA	AA position	Wild-type 25-mer	Mutated 25-mer
NCI-3926	TMG1	SNV	FAM86C1	uc009ysr.3	A	S	7	MAPEENAGSELLQSF KRR	MAPEENAGSELLQSF R
		SNV	ENSG00000228 532	ENST000004 49327	I	N	18	PKEGVKTENNDHINLK VAGQDGSVV	PKEGVKTENNDHNNLK AGQDGSVV
		SNV	ENSG00000153 230	ENST000002 83225	S	F	237	RISQRQRQSKAFSNCV PHLIVVTVF	RISQRQRQSKAFFNCVPH LIVVTVF
		SNV	FAM5C	uc010pot.1	S	N	159	DYLQERFVQAALSYIA CNSEGEFIC	DYLQERFVQAALNYIACN SEGEFIC
		SNV	LOC440295	uc002bhl.2	R	C	204	QEERLREQEERLREQE ERLHEQEER	QEERLREQEERLCEQEER LHEQEER
		SNV	MRC1	uc001ipk.4	S	F	1046	GKGYPGGRRSSLSYED ADCVVIIGG	GKGYPGGRRSSLFYEDAD CVVIIGG
		SNV	OR11H2	uc021rno.1	L	F	177	VCGFLWFLIPIVLISQK PFCGNII	VCGFLWFLIPIVVISQKPF CGPNII
		SNV	OR11H2	uc021rno.1	L	F	177	VCGFLWFLIPIVLISQM PFCGNII	VCGFLWFLIPIVVISQMPF CGPNII
		SNV	TCRBV9S1A1T	uc003vxf.3	A	V	91	VPNRFSPKSPDKAHLN LHINSLELG	VPNRFSPKSPDKVHLNLH INSLELG
		SNV	ENSG00000211 941	ENST000003 90601	S	N	54	AASGFTFSDYYMSWIR QAPGKGLEW	AASGFTFSDYYMNWIRQ APGKGLEW
		SNV	ENSG00000211 941	ENST000003 90601	I	V	56	SGFTFSDYYMSWIRQA PGKGLEWVS	SGFTFSDYYMSWVRQAP GKGLEWVS
		SNV	DUX2	uc031sid.1	A	P	240	GVSQPAPARGDFAYA APAPDGALS	GVSQPAPARGDFPYAAP APPDGALS
		NCI-3926	TMG2	SNV	TRIM49B	uc021qix.1	L	F	49

		SNV	USP17L17	uc031sdl.1	G	E	86	RPAAVGAGLQNMGN TCYVNASLQCL	RPAAVGAGLQNMENTC YVNASLQCL		
		SNV	AK9	uc003ptr.4	S	L	367	YSVSFLGKIYCLSSEAL KPFLLNP	YSVSFLGKIYCLLSEALKP FLLNP		
		SNV	RPL19	uc002hrq.1	A	G	169	DQAEARRSKTKEARKR REERLQAKK	DQAEARRSKTKEGRKRRE ERLQAKK		
		SNV	NES	uc001fpq.3	G	D	205	YQERVAHMETS LGQA RERLGRAVQG	YQERVAHMETS LDQARE RLGRAVQG		
		SNV	COL11A1	uc009weh.3	G	E	1274	GAKGEAGAEGPPGKT GPVGPQGPAG	GAKGEAGAEGPPEKTGP VGPQGPAG		
		SNV	PI15	uc003yam.3	N	K	75	SQNDMIAILDYHNQV RGKVFPPAAN	SQNDMIAILDYHKQVRG KVFPAAAN		
		SNV	ATF5	uc010enq.2	S	P	126	DFFLDAPPLPPSPPL PPPLPPA	DFFLDAPPLPPPPPLPP PLPPA		
		SNV	L1CAM	uc031tks.1	P	S	372	PQPEVTWRINGIPVEE LAKDQKYRI	PQPEVTWRINGISVEELA KDQKYRI		
		SNV	MSH2	uc002rvz.4	G	E	902	LILLTWKRKL RGGKRSA CSRPERQN	LILLTWKRKL RGEKRSACS RPERQN		
		SNV	MET	uc011kna.1	P	S	518	TGKKVSCSHREFP	TGKKVSCSHREFS		
		SNV	CRELD2	uc031ryb.1	R	P	85	WIDSQDRPLRFLRPSA VRTGLSDSY	WIDSQDRPLRFLPPSAVR TGLSDSY		
NCI-3926	TMG3	SNV	PAM	uc011cuz.2	V	A	56	PPTRLPKGVGFRVGGE TGSKYFVLQ	PPTRLPKGVGFRAGGETG SKYFVLQ		
		SNV	DROSHA	uc003jhi.2	P	L	922	NIMSRLGQDDPTPSRI NHNERLEFL	NIMSRLGQDDPTLSRINH NERLEFL		
		SNV	YTHDF2	uc021okf.1	G	E	360	PTRWVAPRNRGSGFG HNGVDGNGVG	PTRWVAPRNRGSEFGHN GVDGNGVG		
		SNV	PARP4	uc001upl.3	Q	R	1059	CSPSCHSVSVK WQQL NPDVPEALQA	CSPSCHSVSVKWRQLNP DVPEALQA		
		SNV	GALNT5	uc002tzc.3	H	Y	421	HIKALLPEDSGTHQVL RIDVTLSPR	HIKALLPEDSGTYQVLRID VTLSPR		
		SNV	AKAP6	uc010aml.3	P	L	695	VKKKHTRLGRVSPSSSS DIASSLGE	VKKKHTRLGRVSLSSSSDI ASSLGE		
		SNV	E2F4	uc002erz.3	S	T	323	SSSSSSSSNSNSSSSS GPNPSTSF	SSSSSSSSNSNTSSSSGP NPSTSF		
		SNV	ZNF532	uc010xeg.2	T	S	891	FKSAPSTHSHAYTQHP GIKIGEPKI	FKSAPSTHSHAYSQHPI KIGEPKI		
		SNV	COL19A1	uc010kam.2	P	S	25	WFLWQVLNQNPQI SIVVDGGKKV	WFLWQVLNQNIQISI VVDGGKKV		
		SNV	C1QTNF1	uc002jwt.3	P	S	92	LPNSVPSLCVSFPPGP GRKMGSRGQ	LPNSVPSLCVSFSPGPR KMGSRGQ		
		SNV	LOC150776	uc002tsz.3	E	K	14	DTSGSYTANDLDEM QDSVRKTDEY	DTSGSYTANDLDMGQD SVRKTDEY		
		FS- insertion	PARP6	uc031qsq.1			236	PSVVDPTDPKTLAFNP KKKNYERLQ	PSVVDPTDPKTL SGL		
		NCI-3926	TMG4	SNV	UBR7	uc010auq.3	K	N	101	VPEQKDDVREV KVE QNSEPCAGSS	VPEQKDDVREV NVEQ NSEPCAGSS
				SNV	GXYLT1	uc001rmt.4	A	T	91	IQPVEKMHLAVVACG ERLEETMTML	IQPVEKMHLAVVTCGERL EETMTML
SNV	SYVN1			uc009yqc.3	P	R	308	EPADQGPPPAPHPPPL LPQPPNFPQ	EPADQGPPPAPHRPPLLP QPPNFPQ		
SNV	SETX			uc010mzt.3	Y	H	2095	SGFAKTSVAASLYHTPS DSKEITLT	SGFAKTSVAASLHHTPSD SKEITLT		
SNV	NCAPH			uc002svz.1	R	Q	20	LPATMNNSSSETRGH PHSASSPSE	LPATMNNSSSETQGHPH SASSPSE		
SNV	NCAPH			uc010fhv.1	R	Q	9	MGPPGPETRGHPHSA SSPSE	MGPPGPETQGHPHSASS PSE		

		ENSG00000121	ENST000004							MNNSSETRGHPHSA	MNNSSETQGHPHSASS	
		SNV	152	55200	R	Q	9			SSPSE	PSE	
		SNV	PCIF1	uc002xqs.3	R	C	265			SNCEPVVSPSMFREIM	SNCEPVVSPSMFCEIMN	
										NDIPIRLSR	DIPIRLSR	
		SNV	CHEK2	uc010gvh.1	K	E	282			DCLIKITDFGHSKILGET	DCLIKITDFGHSEILGETSL	
										SLMRTL	MRTL	
		SNV	CHEK2	uc003adv.1	K	E	344			LLAVQITDFGHSKILGE	LLAVQITDFGHSEILGETS	
										TSLMRTL	LMRTL	
		SNV	TWIST1	uc022aah.1	A	S	195			LSYAFSVWRMEGAWS	LSYAFSVWRMEGSWSM	
										MSASH	SASH	
		SNV	ENSG00000122	ENST000003						RLSYAFSVWRMEGA	RLSYAFSVWRMEVAWS	
			691	54571	G	V	127			WSMSASH	MSASH	
NCI-3926	TMG5	SNV	MLLT4	uc021zim.1	T	S	8			MDGVVTVTPRMDA	MDGVVTVSPRMDAETY	
										ETVEG	VEG	
		SNV	MLLT4	uc021zik.1	T	S	421			CDLTNMDGVVTVTPR	CDLTNMDGVVTVSPR	
											MDAETYVEG	MDAETYVEG
		SNV	FASTKD2	uc002vbx.3	S	L	504			TISSENLLDAVYSFCLM	TISSENLLDAVYLFCLMNY	
											NYFPLAPF	FPLAPF
		SNV	UBE3B	uc009zvj.2	P	S	420			ESQEPAAHAQPASPQN	ESQEPAAHAQPASSQNVL	
											VLPVKSLKR	PVKSLKR
		SNV	SEC14L1	uc021udx.1	L	F	461			SPFIDDNTRRKFLIYAG	SPFIDDNTRRKFFIYAGND	
											NDYQGGG	YQGGG
		SNV	NCOR1	uc010cpb.2	Y	S	20			PNQGAFSTEQSRYPH	PNQGAFSTEQSRSPHVS	
											SVQYTFPNT	QYTFPNT
		SNV	CRYZ	uc001dgm.3	I	V	51			ILGTAGTEEGQKIVLQ	ILGTAGTEEGQKVVLLQNG	
											NGAHEVFNH	AHEVFNH
SNV	AKAP9	uc003uli.3	R	C	1570			ERQIQEKTDIIDRLEQE	ERQIQEKTDIIDCLEQELL			
									LLCASNRL	CASNRL		
SNV	STK39	uc002uea.3	R	Q	406			EEGKAAFSQEKSRVK	EEGKAAFSQEKSRVKEE			
									EENPEIAVS	NPEIAVS		
SNV	MLLT6	uc002hqi.4	K	E	557			SPLLGAGIYTSNKDPIS	SPLLGAGIYTSNEDPISHS			
									HSGGMLRA	GGMLRA		
SNV	SETDB1	uc009wmf.2	L	P	727			GKGVFINTGPEFLVGC	GKGVFINTGPEFPVGCDC			
									DCKDGRD	KDGRD		
SNV	SETDB1	uc009wmg.2	L	P	726			GKGVFINTGPEFLVGC	GKGVFINTGPEFPVGCDC			
									DCKDGRDK	KDGRDK		
NCI-3926	TMG6	SNV	SORL1	uc001pxx.3	D	N	299			RENQEVILEEVRDFQL	RENQEVILEEVRNFQLRD	
										RDKYMFATK	KYMFATK	
		SNV	CPEB2	uc003gnn.2	P	S	783			DWPHKAESKSYFPPKG	DWPHKAESKSYFSPKGY	
										YAFLLFQEE	AFLLFQEE	
		SNV	LAMA5	uc021wfw.1	R	W	2601			ALQGARTQLRDVRAK	ALQGARTQLRDVWAKK	
											KDQLEAHIQA	DQLEAHIQA
		SNV	PABPC1L	uc010ggv.1	S	F	399			STMRTLNSPLLGSFQQ	STMRTLNSPLLGFQQPS	
											PSSYFLPAM	SYFLPAM
		SNV	ANKHD1-EIF4EBP3	uc011czh.1	M	I	851			SEPAPLTLTSPRMVAA	SEPAPLTLTSPRIVAADN	
											DNQDTSNLP	QDTSNLP
		SNV	KIAA0556	uc010vco.2	P	L	44			LAMVSHLVGGILPTCE	LAMVSHLVGGILLTCEPT	
									PTVPYHTIL	VPYHTIL		
SNV	GOSR1	uc002hff.3	R	K	15			ETMAIEIEQLLARLTGV	ETMAIEIEQLLAKLTGVN			
									NDKMAEYT	DKMAEYT		
SNV	CNTNAP4	uc010chb.1	R	W	615			CEQEFTYYCKKSRLVN	CEQEFTYYCKKSWLVNK			
									KQDGTPLSW	QDGTPLSW		
SNV	CNTNAP4	uc010chb.1	P	S	435			CPDKSFGSKCKSPLGG	CPDKSFGSKCKSSLGGFQ			
									FQGCMLIS	GCMRLIS		
SNV	NAF1	uc010iqw.1	I	V	162			PPVLSGDGDDLQIEKE	PPVLSGDGDDLQVEKEN			
									NKNFPLKTK	KNFPLKTK		

							VWSGMCPEHRRVVQ				
		SNV	SDHAP2	uc011btb.1	V	M	196	A	VWSGMCPEHRRVMQA		
		SNV	SDHAP2	uc003fuu.4	H	Q	104	AKNTIVATGLRAHLEL HVCPHQH	AKNTIVATGLRAQLLELH VCPHQHQ		
NCI-3926	TMG7	SNV	BRAF	uc003vwc.4	V	E	600	LTVKIGDFGLATVKSR WSGSHQFEQ	LTVKIGDFGLATEKSRWS GSHQFEQ		
		SNV	ZNF343	uc010gao.1	H	Y	36	ENVETMKKLTQNHKA KGLPSNDTDC	ENVETMKKLTQNYKAKG LPSNDTDC		
		SNV	ENSG00000004 139	ENST000004 57710	A	D	336	LQGKTKVFSDIGAIQSL KRLVSYST	LQGKTKVFSDIGDIQSLKR LVSYST		
		SNV	SASS6	uc009wdz.3	K	E	194	QEQKVLEENGEKNQ VQLGKLEATI	QEQKVLEENGEENQVQ LGKLEATI		
		SNV	NCOA1	uc010eye.3	I	T	481	LNLNNSPMEGTGISLA QFMSPRRQV	LNLNNSPMEGTGTSLAQ FMSPRRQV		
		SNV	OGFOD2	uc009zxs.1	S	N	52	LLYPDCGGGRLDSHRA FVVKYAPGQ	LLYPDCGGGRLDNHRAF VVKYAPGQ		
		SNV	NBPF1	uc010oce.1	D	E	408	QHLQALLTPDEPKSQ GQDLQEQLA	QHLQALLTPDEPEKSQG QDLQEQLA		
		SNV	DOPEY2	uc011aeb.2	P	S	856	NPFFGKLMQMTVPPIA PGILKVIAE	NPFFGKLMQMTVSPPIAG ILKVIAE		
		SNV	SNAPC4	uc004chh.3	P	S	750	RLLNRRLLAVTPWVG DVVPCTQA	RLLNRRLLAVTSWVGDV VVPCTQA		
		SNV	CNTRL	uc004bkb.1	V	L	226	LKPLQDLISLILVENPVV TLPHYLQ	LKPLQDLISLILLENPVVTL PHYLQ		
		FS- deletion	KIAA1841	uc002sav.4			375	RCREDKIHTCIFVYIYI	RCREDKIHTCIFVYIYI		
		SNV	TRPC1	uc003evc.3	L	R	508	LVAEGLFANVLSYLR LFFMYTTS	LVAEGLFANVRSYLR FMYTTS		
		NCI-3926	TMG8	SNV	ARHGEF17	uc001otu.3	S	L	1570	GLQPRCHREPPSLRS PPETAPEPA	GLQPRCHREPPPLLRSP ETAPEPA
				SNV	SALL2	uc010tma.1	S	F	701	EMDSNEKTTQQSSLPP PPPDSDLQ	EMDSNEKTTQQSFLPPP PPDSDLQ
SNV	ARMCX5- GPRASP2			uc022cbh.1	S	F	409	ASLEGGASAICESEPGT EEGAIGGS	ASLEGGASAICEFEPGTEE GAIGGS		
SNV	PTPRH			uc010esv.3	N	S	120	SSVGTVTATAPNPVR NLTVEAQTN	SSVGTVTATAPSPVRNL TVEAQTN		
SNV	PTPRH			uc002qjs.2	N	S	305	SSVEIVTSATAPNPVR NLTVEAQTN	SSVEIVTSATAPSPVRNL VEAQTN		
SNV	TCEAL2			uc022car.1	E	K	209	NLQDPFYPRGPRFRGG GCRAPRRDT	NLQDPFYPRGPRKFRGG CRAPRRDT		
SNV	SHROOM3			uc011cbx.2	G	S	1650	QSLSHDPVSGTQGLEK KVSPDPQKS	QSLSHDPVSGTQSLKVV SPDPQKS		
SNV	NLGN3			uc011mps.2	R	Q	696	LAFALYRDKRRQE PLRQSPQR	LAFALYRDKRQREPL RQSPQR		
SNV	AHDC1			uc021ojw.1	E	K	1210	LSSLEKLMMDWNEAS SAPGYNWNQS	LSSLEKLMMDWKNKASSA PGYNWNQS		
SNV	TMEM44			uc011bsv.2	H	N	24	WDWDYLDRCFARHR VCISFLWICA	WDWDYLDRCFARNRVC SFLWICA		
SNV	SNX29			uc002dby.5	S	F	104	EVLNKHELQRFYSLRHI ASDVGRGR	EVLNKHELQRFYFLRHIA DVGRGR		
SNV	LAPTM5			uc001bsc.2	D	N	2	MDPRLSTVRQTCCC	MNPRLSTVRQTCCC		
NCI-3926	TMG9			SNV	MAN1A1	uc003pym.2	A	V	486	LTCFAGGMFALGADA APEGMAQHYL	LTCFAGGMFALGVDAAP EGMAQHYL
				SNV	MAPK8IP1	uc001nbr.3	S	F	341	ISEEEGFDCLSPERA EPPGGGWR	ISEEEGFDCLSFPERAEP PGGGWR
		SNV	PZP	uc009zgm.1	T	I	101	VAEVGVTVPDITIEWK	VAEVGVTVPDITIEWKAG		



							AGAFCLSED	AFCLSED			
		SNV	SLC4A8	uc010snk.2	R	C	454	TFGGLLGEATEGRISAI ESLFGASM	TFGGLLGEATEGCISAIESL FGASM		
		SNV	PHLDB2	uc003dye.4	P	S	499	AIFLFSPAILLPISLLIGL FGYLE	AIFLFSPAILLISILLIGLFG YLE		
		SNV	RYR2	uc001hyl.1	D	N	753	VSSPNQHLLRTDDVIS CCLDLSAPS	VSSPNQHLLRTDNVISCC LDLSAPS		
		SNV	DPY19L2	uc010sso.1	I	V	94	AVFAGAMPTMASIKLS TLHPIVNHP	AVFAGAMPTMASVKLST LHPIVNHP		
		SNV	FAM115C	uc011ktn.1	R	Q	479	KMLRGSGLPAVSREN VADSYEAA	KMLRGSGLPAVSQENPV ASDSYEAA		
		SNV	NBPF10	uc031poc.1	G	E	2580	CPRLSRELLDEKGPEVL QDSLDRCY	CPRLSRELLDEKEPEVLQD SLDRCY		
		SNV	ENSG00000163 386	ENST000003 69339	G	E	357	GPRLSRELLDEKGPEVL QDSLDRCY	GPRLSRELLDEKEPEVLQ DSLDRCY		
		FS- deletion	TGFB2	uc001hll.3			216	CCCCCCCCFRQTL LCHRLEYS	CCCCCCCCFRQTL QARVQWHDHSSLQP		
		SNV	PCLO	uc003uhx.2	A	T	2955	VVYKLPFGRSCTAQQP ATLPEDRF	VVYKLPFGRSCTTQQPAT TLPEDRF		
NCI-3926	TMG10	SNV	RGAG1	uc011msr.1	D	A	109	SGALSPLLMPASDSGA LSPLLMPAL	SGALSPLLMPASASGALS PLLMPAL		
		FS- deletion	CASP5	uc010ruz.1			23	FIFLIEDSGKKRRKNFE AMFKGIL	FIFLIEDSGKKKVRILKLC SKVSRVDWITS		
		FS- deletion	CASP5	NM_004347			10	MAEDSGKKRRKNFE AMFKGIL	MAEDSGKKKVRILKLC KVSFRVDWITS		
		SNV	CDKL5	uc022btn.1	R	C	234	PSEQMKLFYSNPRFHG LRFPAVNHP	PSEQMKLFYSNPCFHGLR FPAVNHP		
		SNV	LRP2	uc002ues.3	I	M	777	IFKQKIDGTGREILAAN RVENVESL	IFKQKIDGTGREMLAANR VENVESL		
		SNV	LRP2	uc010zdf.1	I	M	640	LTDDERHCIGREILAAN RVENVESL	LTDDERHCIGREMLAAN RVENVESL		
		SNV	TRIL	uc003szt.3	P	L	503	QQPSPSVAAGAP QSLDLHKKPQ	QQPSPSVAAGLAPQS LDLHKKPQ		
		SNV	MUC5B	uc001lta.3	I	T	2095	PTTRGSTVTPSSIPGTT HTATVLTT	PTTRGSTVTPSSTPGTTH TATVLTT		
		SNV	PSG4	uc002owb.4	E	K	264	RSGENLYLSCFAESNPR AQYSWTIN	RSGENLYLSCFAKSNPRA QYSWTIN		
		SNV	SPARCL1	uc011cdd.2	D	N	333	ADQQGKPHCVCQDP VTCPPTKPLDQ	ADQQGKPHCVCQNPVT CPPTKPLDQ		
		SNV	SLC38A3	NM_006841	G	S	81	GMSVFNLNAIMGSG ILGLAYAMAN	GMSVFNLNAIMSSGILG LAYAMAN		
		SNV	GOLGA6B	uc010uks.1	E	D	421	LWDQEERLWKKERL QKQEERLALS	LWDQEERLWKKEDRLQK QEERLALS		
		NCI-3926	TMG11	SNV	KRT7	uc001saa.1	Y	N	283	MAKCSRAEAEAWYQT KFETLQAQAG	MAKCSRAEAEAWNQTK FETLQAQAG
				SNV	PCDHB17	uc003lis.3	R	C	461	PAFTQTSYTLFVRENN SPALHIGSV	PAFTQTSYTLFVCENN ALHIGSV
SNV	PLEKHA6			uc009xbc.1	S	F	67	PVYYDELDAASSLRR SLQPRSHS	PVYYDELDAASSFLRR SLQPRSHS		
SNV	SLIT2			uc003gps.1	G	S	1022	NNYTCLCPPEYTGELC EEKLDFCAQ	NNYTCLCPPEYSELCEEK LDFCAQ		
SNV	ENSG00000145 147			ENST000002 73739	A	T	1034	NNYTCLCPPEYTAANL NEVEKGELC	NNYTCLCPPEYTANLNE VEKGELC		
SNV	CSMD1			uc022aqr.1	R	K	1407	GMPQNGTRYGDSREA GDTVTFQCDP	GMPQNGTRYGDSKEAG DTVTFQCDP		

AA = Amino acid. SNV = non-synonymous single nucleotide variant. FS = frameshift. Green highlight = identified immunogenic; NFS = Non-frameshift

**Supplementary Table 3. Binding affinity of candidate immunogenic peptides to the patient-specific HLA-I molecules based on prediction algorithms**

Patient ID	Mutated protein	Wild-type epitope	Mutated epitope	Affinity wild-type (nM)	Affinity mutant (nM)	Rank wild-type (%-tile)	Rank mutant (%-tile)	Allele	
NCI-3998	MAGEA6 <sub>E168K</sub>	EVDPIGHVYI	<b>K</b> VDPIGHVYI	12	6	0.4	0.2	C*05:01	
		EVDPIGHVYIF	<b>K</b> VDPIGHVYIF	9	5	0.3	0.2	C*05:01	
		EVDPIGHVY	<b>K</b> VDPIGHVY	36	77	0.35	0.3	A*01:01	
		LMEVDPIGHVY	<b>L</b> M <b>K</b> VDPIGHVY	394	47	2.8	0.5	B*15:01	
	PDSA5 <sub>Y1000F;H1007Y</sub>	PEYVVPYMIH	<b>P</b> EFVVPYMIY	6823	105	4.05	0.25	B*18:01	
		YVVPYMIHLL	<b>F</b> VVPYMIYLL	6	6	0.4	0.4	C*03:03	
		SLLPEYVVPY	SLL <b>P</b> EFVVPY	29	23	0.55	0.5	B*15:01	
		LSLLPEYVVPY	LSLL <b>P</b> EFVVPY	3278	3232	0.7	0.7	A*01:01	
		LLPEYVVPY	LL <b>P</b> EFVVPY	43	58	0.6	0.5	B*15:01	
		YMIHLLAH	YMI <b>Y</b> LLAH	93	74	1.1	0.9	B*15:01	
		MED13 <sub>P1691S</sub>	VQIIPCQY	<b>V</b> QIISCQY	253	165	0.75	0.55	A*30:02
	VQIIPCQY		<b>V</b> QIISCQY	81	48	0.9	0.6	B*15:01	
	VSVQIIPCQY		<b>V</b> SVQIISCQY	202	148	0.8	0.65	A*30:02	
	SVQIIPCQY		<b>S</b> VQIISCQY	605	300	1.35	0.95	A*30:02	
	VSVQIIPCQYL		<b>V</b> SVQIISCQYL	17	17	1	1	C*03:03	
	SVQIIPCQY		<b>S</b> VQIISCQY	5190	5168	1.6	1.6	A*01:01	
	NCI-3784	FLNA <sub>R2049C</sub>	RVRVSGQGL	<b>C</b> VRVSGQGL	17	553	0.5	2	B*07:02
			QSEIGDASRV	QSEIGDAS <b>C</b> V	15084	14548	5.85	4.7	A*01:01
		KIB16B <sub>L1009P</sub>	ALARLERRHSA	<b>A</b> PARLERRHSA	6270	33	19.9	1	B*07:02
ALARLERRHS			<b>A</b> PARLERRHS	25367	1572	32	1.5	B*07:02	
SON <sub>R1927C</sub> *		RARSRTPSR	RARSRT <b>P</b> SC	5568	178	2.4	1.2	B*07:02	
		TPSRRSRSH	TPS <b>C</b> RSRSH	503	1188	1.2	1.5	B*07:02	
		TPSRRSR	TPS <b>C</b> RSRS	10901	4212	3.05	1.8	B*07:02	
NCI-3903		KIF1BP <sub>P246S</sub>	EHNAYHPIEWAI	<b>H</b> SNAYHSIEWAI	333	347	0.3	0.3	B*38:01
			HNAYHPIEWAI	<b>H</b> NAYHSIEWAI	12630	12554	5.4	5.4	B*38:01
	NAYHPIEWAI		<b>N</b> AYHSIEWAI	16	21	0.5	0.6	C*12:03	
	AYHPIEWAI		<b>A</b> YHSIEWAI	158	115	0.6	0.6	A*24:02	
	YHPIEWAI		<b>Y</b> HSIEWAI	2742	308	1.1	0.3	B*38:01	
	HPIEWAI		<b>H</b> SIIEWAI	n.d.	n.d.	n.d.	n.d.	n.d.	

Predictions determined by IEDB<sup>1</sup>, interrogating 8-11-mer peptides. Candidate minimal mutated epitopes were synthesized based on <500 nM affinity or top 2 percentile (%-tile) rank. Binding affinity and percentile rank for each peptide and HLA allele specified is shown.

The mutated amino acid is bolded in red. Peptides highlighted in grey or yellow were recognized. The most immunogenic minimal neo-epitopes, which showed a greater reactivity either by IFN- $\gamma$  ELISPOT or percentage 4-1BB upregulation compared to the rest of the peptides tested, are highlighted in yellow. \*The SON mutation-specific lymphocytes did not recognize any of the candidate minimal epitopes tested thus far

**Supplementary Table 4. Amino acid sequence of the functional mutation-reactive T cell receptors isolated from the peripheral blood CD8<sup>+</sup>PD-1<sup>+</sup> subset of NCI-3998**

Patient ID	Reactivity	TRA rank/ TRB rank (T cell population of origin)	TRAV /TRAJ	TCR alpha chain V-J amino acid sequence (CDR3 highlighted)	TRBV/TRBJ	TCR beta chain V-D-J amino acid sequence (CDR3 highlighted)
NCI-3998	MAGEA6 <sub>E168K</sub> -specific TCR	A1/B1 (TMG1- enriched)	TRAV21*01/ TRAJ21*01F	METLLGLLILWLQLQWVSSK QEVTPQIPAALSVPEGENLVLN CSFTDSAIYNLQWFRQDPGK GLTSLLIQSSQREQTSGLRNA SLDKSSGRSTLYIAASQPGDSA TYLCAVDNFKFYFGSGTKLN VKP	TRBV7-3*01/ TRBJ1-2*01	MGTRLLCWAALCLLGADHTGAGVS QTPSNKVTEKGYVELRCDPISGHTA LYWYRQSLGQGPEFLIYFQGTGAAD DSGLPNDRFFAVRPEGSVSTLKIQRTE RGDSAVYLCASSSQGGYGYTFGSGTR LTVV
	MAGEA6 <sub>E168K</sub> -specific TCR	A2/B2 (TMG1- enriched)	TRAV39*01/ TRAJ58*01	MKKLLAMILWLQLDRLSGELK VEQNPLFLSMQEGKNYTIYCN YSTTSDRLYWYRQDPGKSLKES LFVLLSNGAVKQEGRLMASLD TKARLSTLHITAAVHDLSATYF CAGSGSRLTFEGEGTQLTVNP	TRBV7-6*01/ TRBJ1-2*01	MGTSLLCWVVLGFLGTDHTGAGVS QSPRYKVTKRGQDVALRCDPISGHVS LYWYRQALGQGPEFLTYFNIEAQQD KSGLPNDRFSAERPEGSISTLTIQRTE QRDSAMYRCASSFDRGYGYTFGSGT RLTVV
	PDS5A <sub>Y1000F;H1</sub> 007Y -specific TCR	A1/B2 (TMG3- enriched)	TRAV38- 1*01/ TRAJ53*01	MTRVSLWVAVVSTCLES AQTVTQSQPEMSVQEAETVT LSCYDTSENNYLFWYKQPP SRQMILVIRQEAYKQQNATE NRFVSNFQKAAKSFLKISDS QLGDTAMYFCAFTELNSGGG NYKLTFGKGTLLTVNP	TRBV27*01/ TRBJ2-2*01	MGPQLLGYVVLCLLGAGPLEAQVTQ NPRYLITVTGKKLTVTCSQNMNHEY MSWYRQDPGLRQIYYSMNVEVT DKGDVPEGYKVSKEKRNFLILESPS PNQTSLYFCASSLGGLLRTGELFFGE GSRLTVL
	MED13 <sub>P1691S</sub> -specific TCR	A1/B1 (TMG5- enriched)	TRAV12- 1*01/ TRAJ27*01	MISLRVLLVILWLQLSWVWS QRKEVEQDPGPFNVPEGATV AFNCTYSNSASQSFFWYRQD CRKEPKLLMSVYSSGNEGGRF TAQLNRASQYISLLIRDSKLS SATYLCVVNTNAGKSTFGDGT TLTVKP	TRBV9*01/ TRBJ2-1*01	MGFRLLCCVAFCLLGAGPVDGVTQ TPKHLITATGQQRVTLRCSRSGDLSVY WYQQSLDQGLQFLIQYYNGEERAKG NILERFSAQQFPDLHSELNLSLELGD SALYFCASSGRVTGGFYNEQFFGPGT RLTVL
	MED13 <sub>P1691S</sub> -specific TCR	A2/B2 (TMG5- enriched)	TRAV12- 2*01/ TRAJ29*01	MKSLRVLLVILWLQLSWVWS QQKEVEQNSGPLSVPEGAIAS LNCTYSDRGSSQFFWYRQYS GKSPPELIMFIYSNGDKEDGRF TAQLNKASQYVSLIRDSQPS DSATYLCASSGGNTPLVFGKG TRLSVIA	TRBV27*01/ TRBJ2-7*01	MGPQLLGYVVLCLLGAGPLEAQVTQ NPRYLITVTGKKLTVTCSQNMNHEY MSWYRQDPGLRQIYYSMNVEVT DKGDVPEGYKVSKEKRNFLILESPS PNQTSLYFCASSFGGAYEQYFGPGTR LTVT

The amino acid sequences of the TRAV-TRAJ or the TRBV-TRBD-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.

**Supplementary Table 5. Relative frequency of T cell reactivities in the circulating or tumor-infiltrating T cell subsets targeting mutated neoantigens, self-antigens, and the autologous tumor cell lines**

		Peripheral blood				Tumor	
		CD8 <sup>+</sup> PD-1 <sup>+</sup>		CD8 <sup>+</sup> PD-1 <sup>hi</sup>		CD8 <sup>+</sup> PD-1 <sup>+</sup>	
Patient ID		Percentage 4-1BB <sup>+</sup>	Percentage of total reactivities detected	Percentage 4-1BB <sup>+</sup>	Percentage of total reactivities detected	Percentage 4-1BB <sup>+</sup>	Percentage of total reactivities detected
NCI-3998	MAGEA6 <sub>E168K</sub> (TMG1)	2.4	10.0	2.9	8.8	3.8	30.1
	PDS5A <sub>V1000F;H1007Y</sub> (TMG3)	0.6	2.5	0.5	1.5	0.2	1.6
	MED13 <sub>P1691S</sub> (TMG5)	0.3	1.3	N.D.	N.D.	0.9	7.4
	<b>Mutated antigens</b>	<b>3.3</b>	<b>13.8</b>	<b>3.4</b>	<b>10.3</b>	<b>4.9</b>	<b>40.2</b>
	NY-ESO-1	20.7	86.2	29.7	89.7	7.3	59.8
	<b>Self-antigens</b>	<b>20.7</b>	<b>86.2</b>	<b>29.7</b>	<b>89.7</b>	<b>7.3</b>	<b>59.8</b>
	<b>3998mel</b>	9.5		7.2			11.2
NCI-3784	FLNA <sub>R2049C</sub> (TMG3)	0.4	16.0	1.4	26.4	0.4	16.0
	KIB16B <sub>L1009P</sub> (TMG5)	0.4	16.0	0.4	7.5	0.6	24.0
	SON <sub>R1927C</sub> (TMG8)	1	40.0	0.6	11.3	0.6	24.0
	<b>Mutated antigens</b>	<b>1.8</b>	<b>72.0</b>	<b>2.4</b>	<b>45.3</b>	<b>1.6</b>	<b>64.0</b>
	MAGEA3	N.D.	<b>N.D.</b>	0.8	15.1	N.D.	N.D.
	GP100	0.7	28.0	2.1	39.6	0.9	36.0
	<b>Self-antigens</b>	<b>0.7</b>	<b>28.0</b>	<b>2.9</b>	<b>54.7</b>	<b>0.9</b>	<b>36.0</b>
	<b>3784mel</b>	*24.6		*44.9			*45.2
NCI-3903	KIF1BP <sub>P246S</sub> (TMG9)	1.3	39.4			5.8	75.3
	TMG4 (antigen unknown)	N.D.	N.D.			0.3	3.9
	<b>Mutated antigens</b>	<b>1.3</b>	<b>39.4</b>			<b>6.5</b>	<b>79.2</b>
	SSX2	2.0	60.6			1.6	20.8
	<b>Self-antigens</b>	<b>2.0</b>	<b>66.6</b>			<b>1.6</b>	<b>20.8</b>
	<b>3903mel</b>	7.8					10.2
NCI-3926	<b>Mutated antigens</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
	NY-ESO-1	1.7	100.0	1.4	100.0	3.4	70.8
	MART1	N.D.		N.D.		0.5	10.4
	GP100	N.D.		N.D.		0.9	18.8
	<b>Self-antigens</b>	<b>1.7</b>	<b>100.0</b>	<b>1.4</b>	<b>100.0</b>	<b>4.8</b>	<b>100.0</b>
	<b>3926mel</b>	*6.3		*7.7			*13.3

The absolute and relative frequency of circulating or tumor-infiltrating CD8<sup>+</sup>PD-1<sup>+</sup> T cells targeting mutations, self-antigens, and the corresponding autologous tumor cell lines (3998mel, 3784mel, 3903mel, or 3926mel) is shown. Recognition of mutated antigens (TMGs), self-antigens (NY-ESO-1, MAGEA3, SSX2, MART1, GP100, and TYR), and the autologous tumor cell line for each of the patients was evaluated simultaneously in one experiment. IFN-γ ELISPOT and 4-1BB up-regulation were analyzed at 20 h. Only the frequencies from the conditions that demonstrated >40 spots and >twice the background by IFN-γ ELISPOT are shown. For subjects NCI-3998 and 3903 the frequency of T cells recognizing a given antigen was based on the percentage 4-1BB up-regulation at 20 h after coculture. Data are gated on CD3<sup>+</sup> cells. The frequency of 4-1BB expression against the irrelevant control was subtracted. For subjects NCI-3784 and 3926 the frequency of the reactivities was calculated based on IFN-γ ELISPOT data, as the frequencies were low and sometimes undetectable over background using 4-1BB upregulation. N.D. = Not detected. \*The frequency of tumor-reactive cells for subjects NCI-3784 and NCI-3926 using IFN-γ ELISPOT was off-scale. For these, the frequency of autologous tumor-reactive cells was based on the percentage of 4-1BB up-regulation. Data are representative of at least two independent experiments

**Supplementary Table 6. Summary of TRB overlap between circulating and tumor-resident CD8<sup>+</sup> lymphocyte subsets**

		PBMC																									
		3903			3926			3998				3992				3713			3759			3784					
		CD8+	CD8+PD-1-	CD8+PD-1+	CD8+	CD8+PD-1-	CD8+PD-1+	CD8+	CD8+PD-1-	CD8+PD-1+	CD8+PD-1hi	CD8+	CD8+PD-1-	CD8+PD-1+	CD8+PD-1hi	CD8+	CD8+PD-1-	CD8+PD-1+	CD8+	CD8+PD-1-	CD8+PD-1+	CD8+	CD8+PD-1-	CD8+PD-1+			
Fresh Tumor	3903	CD8+	0.227	0.262	0.597																						
		CD8+PD-1-	0.396	0.382	0.203																						
		CD8+PD-1+	0.097	0.133	0.630																						
	3926	CD8+				0.134	0.119	0.190																			
		CD8+PD-1-				0.134	0.118	0.099																			
		CD8+PD-1+				0.094	0.072	0.316																			
	3998	CD8+						0.123	0.081	0.445	0.307																
		CD8+PD-1-						0.114	0.101	0.140	0.045																
		CD8+PD-1+						0.098	0.060	0.484	0.363																
	3992	CD8+										0.420	0.261	0.525	0.371												
		CD8+PD-1-										0.449	0.307	0.468	0.245												
		CD8+PD-1+										0.211	0.035	0.576	0.710												
	3713	CD8+														0.414	0.352	0.388									
		CD8+PD-1-														0.465	0.438	0.271									
		CD8+PD-1+														0.067	0.041	0.290									
	3759	CD8+																	0.157	0.104	0.467						
		CD8+PD-1-																	0.264	0.256	0.134						
		CD8+PD-1+																	0.055	0.010	0.482						
	3784	CD8+																							0.215	0.200	0.228
		CD8+PD-1-																							0.209	0.206	0.081
		CD8+PD-1+																							0.096	0.083	0.256

Analysis of TRB overlap of nucleotide sequences encoding for the variable V-D-J region of the TRB gene was performed using immunoSEQ (Adaptive Biotechnologies) using the following formula (Sample TCRB overlap between population A and B = [shared sequence reads in A + shared sequence reads in B]/Σsequence reads in A + B). A TRB overlap of 1 represents 100% overlap between two populations. The cells were color coded based on lower (yellow) to greater (blue) TRB overlap

**Supplementary Table 7. Relative frequency of the specificities detected in the TIL infusion product of subjects NCI-3998, 3784, 3903, 3926**

Patient ID	Clinical outcome in response to TIL therapy	Specificities detected in the infusion bag
NCI-3998	NR	TMG1 (MAGEA6 <sub>E&gt;K</sub> ), TMG5 (MED13 <sub>P&gt;S</sub> ), NY-ESO-1
NCI-3784	CR	TMG3 (FLNA <sub>R&gt;C</sub> ), TMG4, TMG5 (KIF16B <sub>L&gt;P</sub> ), TMG8 (SON <sub>R&gt;C</sub> ), GP100
NCI-3903	CR	TMG8, TMG9 (KIF1BP <sub>P&gt;S</sub> ), SSX2
NCI-3926	NR	MART1, GP100, TYR, NY-ESO-1

Clinical outcome of the patients following treatment with non-myeloablative preparative regimen, TIL, and high-dose IL-2 was evaluated using RECIST criteria. CR = complete responder; NR = non-responder. The TIL infusion bag was co-incubated with autologous DCs transfected with the autologous TMG RNA encoding for mutated neoantigens identified by exome sequencing, or with RNA encoding for self-antigens MART1, GP100, TYR, NY-ESO-1, MAGEA3, and SSX2. IFN- $\gamma$  ELISPOT at 20 h was used to evaluate reactivity. Reactivities >40 spots and >than twice the background are shown. The specific antigen recognized encoded by the TMG is shown in parenthesis. TIL infusion products were generated as previously described<sup>2</sup>

**Supplementary Table 8. Subjects included in the phenotypic characterization of TIL and circulating lymphocytes**

<b>Variable/trait</b>	<b>Total (%)</b>
Total no. patients	18
<b>Sex</b>	
Male	14 (78)
Female	4 (22)
<b>Age</b>	
31-40	4 (22)
41-50	3 (17)
51-60	9 (50)
61-70	2 (11)
<b>Prior Treatment</b>	
Surgery	17 (94)
Chemotherapy	2 (11)
Radiotherapy	2 (11)
Immunotherapy	12 (67)
Any 2 or more	13 (72)
Any 3 or more	8 (44)
No treatment	1 (5)



**Supplementary Table 9. Reactivity of circulating CD8<sup>+</sup>PD-1<sup>+</sup> T cell replicate cultures derived from subjects NCI-3713 or 3784**

T cell subsets	IFN-γ ELISPOT NCI-3713 circulating T cell subsets after <i>in vitro</i> expansion (spots/2 × 10 <sup>4</sup> cells)															3713mel	Anti-CD3
	WDR46 <sub>T&gt;I</sub>		SRPX <sub>P&gt;L</sub>		AFMID <sub>A&gt;V</sub>		HELZ2 <sub>D&gt;N</sub>		CENPL <sub>P&gt;L</sub>		AHNAK <sub>S&gt;F</sub>		PRDX3 <sub>P&gt;L</sub>				
	DMSO	WT	MUT	WT	MUT	WT	MUT	WT	MUT	WT	MUT	WT	MUT	WT	MUT		
CD8 <sup>+</sup> PD-1 <sup>-</sup> 3 × 10 <sup>3</sup> /1	1	0	2	3	5	1	3	3	1	2	7	5	3	2	3	2	<b><u>1447</u></b>
CD8 <sup>+</sup> PD-1 <sup>-</sup> 3 × 10 <sup>3</sup> /2	0	0	0	2	1	4	2	0	2	7	1	0	2	5	3	2	<b><u>1428</u></b>
CD8 <sup>+</sup> PD-1 <sup>+</sup> 3 × 10 <sup>3</sup> /1	24	12	<b><u>142</u></b>	8	<b><u>266</u></b>	5	<b><u>52</u></b>	109	<b><u>466</u></b>	5	<b><u>74</u></b>	3	<b><u>49</u></b>	79	15	<b><u>1156</u></b>	<b><u>1438</u></b>
CD8 <sup>+</sup> PD-1 <sup>+</sup> 3 × 10 <sup>3</sup> /2	1	16	<b><u>318</u></b>	14	<b><u>172</u></b>	4	<b><u>61</u></b>	17	<b><u>509</u></b>	13	<b><u>104</u></b>	10	14	10	<b><u>176</u></b>	<b><u>1030</u></b>	<b><u>1288</u></b>
CD8 <sup>+</sup> PD-1 <sup>+</sup> 1 × 10 <sup>3</sup> /3	5	1	<b><u>213</u></b>	3	<b><u>215</u></b>	0	4	88	<b><u>294</u></b>	6	<b><u>44</u></b>	3	3	7	18	<b><u>967</u></b>	<b><u>1231</u></b>
CD8 <sup>+</sup> PD-1 <sup>+</sup> 1 × 10 <sup>3</sup> /4	7	1	18	2	<b><u>157</u></b>	42	<b><u>177</u></b>	21	<b><u>274</u></b>	14	<b><u>339</u></b>	11	19	15	<b><u>331</u></b>	<b><u>867</u></b>	<b><u>1406</u></b>
CD8 <sup>+</sup> PD-1 <sup>hi</sup> 1 × 10 <sup>3</sup> /1	5	8	<b><u>80</u></b>	4	<b><u>172</u></b>	7	1	0	<b><u>378</u></b>	11	<b><u>81</u></b>	1	5	4	45	<b><u>764</u></b>	<b><u>601</u></b>
CD8 <sup>+</sup> PD-1 <sup>hi</sup> 3 × 10 <sup>3</sup> /2	3	5	<b><u>287</u></b>	4	<b><u>95</u></b>	87	164	10	<b><u>206</u></b>	2	<b><u>361</u></b>	7	22	8	<b><u>138</u></b>	<b><u>994</u></b>	<b><u>1205</u></b>

IFN-γ ELISPOT NCI-3784 circulating T cell subsets after <i>in vitro</i> expansion (spots/2 × 10 <sup>4</sup> cells)						
T cell subsets	DC + irrel.	DC+TMG3	DC+TMG5	DC+TMG8	3784 mel	anti-CD3
CD8 <sup>+</sup> PD-1 <sup>-</sup> 3.5 × 10 <sup>3</sup> /1	1	5	2	9	<b><u>305</u></b>	<b><u>1147</u></b>
CD8 <sup>+</sup> PD-1 <sup>-</sup> 3.5 × 10 <sup>3</sup> /2	2	3	2	3	<b><u>109</u></b>	<b><u>1478</u></b>
CD8 <sup>+</sup> PD-1 <sup>+</sup> 3.5 × 10 <sup>3</sup> /1	10	<b><u>178</u></b>	<b><u>57</u></b>	<b><u>115</u></b>	<b><u>1003</u></b>	<b><u>1243</u></b>
CD8 <sup>+</sup> PD-1 <sup>+</sup> 3.5 × 10 <sup>3</sup> /2	7	<b><u>297</u></b>	<b><u>58</u></b>	<b><u>201</u></b>	<b><u>1142</u></b>	<b><u>739</u></b>
CD8 <sup>+</sup> PD-1 <sup>+</sup> 1.5 × 10 <sup>3</sup> /3	8	<b><u>149</u></b>	<b><u>314</u></b>	<b><u>196</u></b>	<b><u>792</u></b>	<b><u>932</u></b>
CD8 <sup>+</sup> PD-1 <sup>+</sup> 1.5 × 10 <sup>3</sup> /4	50	<b><u>280</u></b>	<b><u>118</u></b>	<b><u>325</u></b>	<b><u>1147</u></b>	<b><u>1277</u></b>
CD8 <sup>+</sup> PD-1 <sup>hi</sup> 1.5 × 10 <sup>3</sup> /1	1	<b><u>533</u></b>	0	<b><u>273</u></b>	<b><u>1545</u></b>	<b><u>953</u></b>
CD8 <sup>+</sup> PD-1 <sup>hi</sup> 1.5 × 10 <sup>3</sup> /2	0	<b><u>364</u></b>	<b><u>48</u></b>	<b><u>581</u></b>	<b><u>1324</u></b>	<b><u>1427</u></b>

The specified circulating T cell subsets were sorted from pretreatment PBMC from subjects NCI-3713 or NCI-3784. Replicates of each T cell population, each containing the number of T cells indicated, were expanded independently in separate culture vessels for 15 days and evaluated for recognition of autologous cells pulsed with the minimal mutated neoepitopes (NCI-3713), or with autologous DCs electroporated with NCI-3784 TMG3, 5, and 8, encoding for FLNA<sub>R>C</sub>, KIF16B<sub>L>P</sub>, and SON<sub>R>C</sub>, respectively (NCI-3784), and the corresponding autologous tumor cell lines. T cells cultured with autologous cells pulsed with DMSO or irrelevant TMG, and stimulated with plate-bound anti-CD3 were used as controls. The number of spots/2 × 10<sup>4</sup> cells is shown. Reactivities >40 spots, and >than twice the background were considered positive and are shown underlined and bold. >500 spots is off-scale

## References

- 1 Vita, R. *et al.* The immune epitope database (IEDB) 3.0. *Nucleic acids research* **43**, D405-412, doi:10.1093/nar/gku938 (2015).
- 2 Rosenberg, S. A. *et al.* Durable complete responses in heavily pretreated patients with metastatic melanoma using T cell transfer immunotherapy. *Clinical cancer research : an official journal of the American Association for Cancer Research* **17**, 4550-4557, doi:10.1158/1078-0432.CCR-11-0116 (2011).