

Supporting Information

Title

Pre-fractionation extends, but also creates a bias in the detectable HLA class I ligandome

Authors

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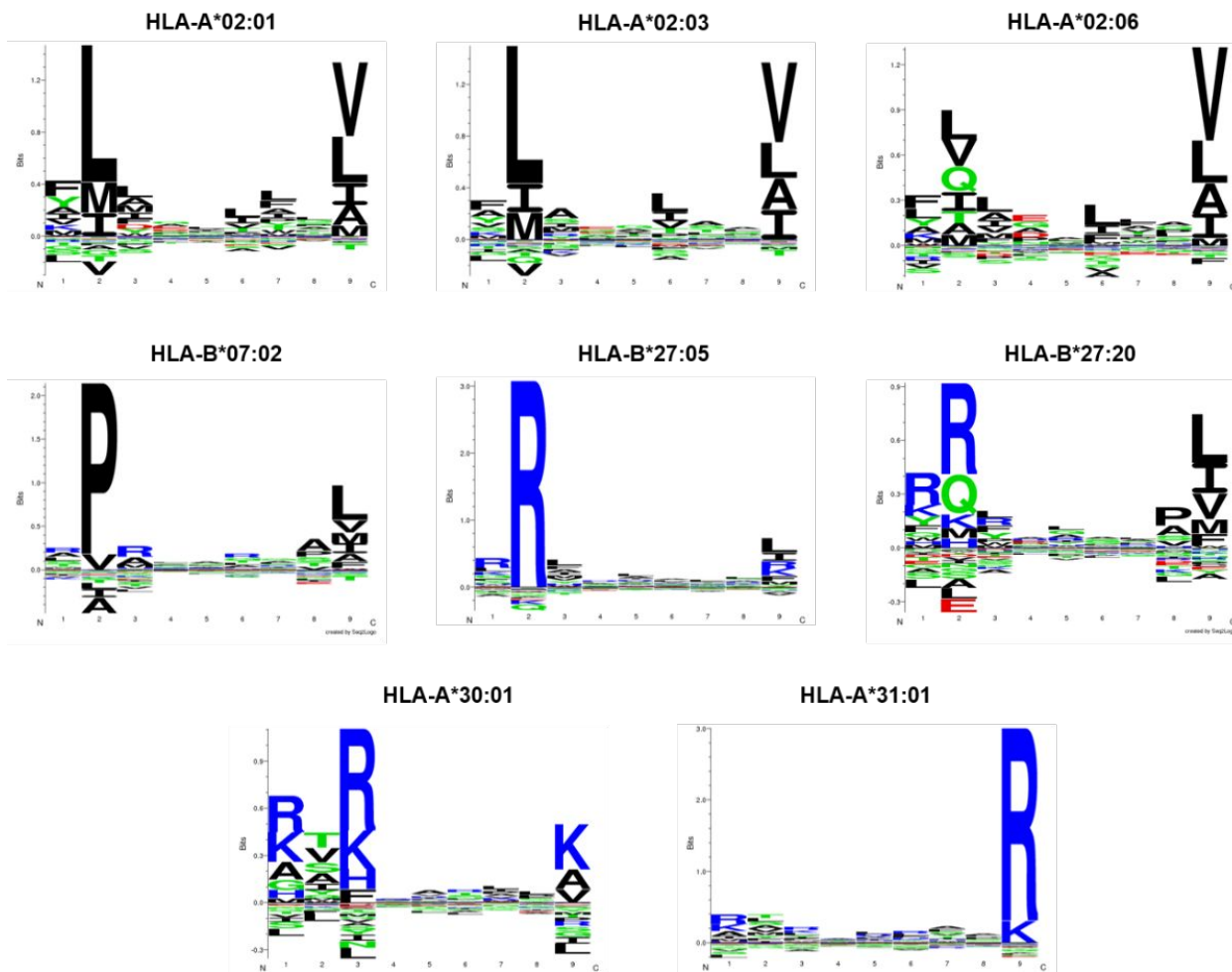
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Supplementary Figure S1: Gibbs clustering motifs for nine different HLA types.

Supporting Table S1

(A) Phosphopeptides identified by High pH-RP

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
RPQRATSNVF	1xPhospho [S7]	100	HLA-B*07:02	O14950	MYL12B	Myosin regulatory light chain 12B
CIIGLSILLEL	1xPhospho [S6]	100	Not Assigned	O15397	IPO8	Importin-8
SPASPLKEL	1xPhospho [S4]	100	HLA-B*07:02	O43572	AKAP10	A-kinase anchor protein 10, mitochondrial
APRTPSKRRGL	1xPhospho [S6]	100	HLA-B*07:02	O43663	PRC1	Protein regulator of cytokinesis 1
SPSSPSVRRQL	1xPhospho [S4]	100	HLA-B*07:02	O75179	ANKRD17	Ankyrin repeat domain-containing protein 17
YPSFRRSSL	1xPhospho [S8]	50	HLA-B*07:02	O95071	UBR5	E3 ubiquitin-protein ligase UBR5
HRYSTPHAF	1xPhospho [S4]	100	HLA-C*07:02	P04049	RAF1	RAF proto-oncogene serine/threonine-protein kinase
RQLSSGVSEI	1xPhospho [S4]	50	HLA-A*02:01	P04792	HSPB1	Heat shock protein beta-1
RQISIRGIVGV	1xPhospho [S4]	100	Not Assigned	P06737	PYGL	Glycogen phosphorylase, liver form
RTASKRASRSL	1xPhospho [S4]	100	Not Assigned	P11171	EPB41	Protein 4.1
RPKSNIVLL	1xPhospho [S4]	100	HLA-B*07:02	P11836	MS4A1	B-lymphocyte antigen CD20
RLYSVSYLL	1xPhospho [S4]	100	HLA-A*02:01	P21333	FLNA	Filamin-A
KPRSPVVEL	1xPhospho [S4]	100	HLA-B*07:02	P25098	GRK2	Beta-adrenergic receptor kinase 1
LQLSPLKGLSL	1xPhospho [S4]	100	Not Assigned	P31350	RRM2	Ribonucleoside-diphosphate reductase subunit M2
KLIDRTESEL	1xPhospho [S8]	100	HLA-A*02:01	P33241	LSP1	Lymphocyte-specific protein 1
IRSSYIRVL	1xPhospho [S4]	100	HLA-C*07:02	P33992	MCM5	DNA replication licensing factor MCM5
KILSLVGLS	1xPhospho [S9]	100	Not Assigned	P42338	PIK3CB	Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit beta
RRLSFLVSY	1xPhospho [S4]	100	HLA-C*07:02	P47897	QARS	Glutamine--tRNA ligase (EC 6.1.1.18) (Glutaminyl-tRNA synthetase) (GlnRS)
KPFKLSGLSF	1xPhospho [S9]	100	HLA-B*07:02	P49006	MARCKSL1	MARCKS-related protein
KRFSGTVRL	1xPhospho [S4]	100	HLA-C*07:02	P62906	RPL10A	60S ribosomal protein L10a
RPQKVCNFL	1xPhospho [S7]	100	HLA-B*07:02	P63218	GNG5	Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-5
RPRSPGSNSKVP	1xPhospho [S4]	100	HLA-B*07:02	P78347	GTF2I	General transcription factor II-I
RPRSPGSNSKV	1xPhospho [S4]	100	HLA-B*07:02	P78347	GTF2I	General transcription factor II-I
VRPLGSENLLL	1xPhospho [S6]	100	Not Assigned	P98196	ATP11A	Probable phospholipid-transporting ATPase 1H
RQISQDVKL	1xPhospho [S4]	100	Not Assigned	Q01433	AMPD2	AMP deaminase 2

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
FASGQLLKFL	1xPhospho [S3]	100	HLA-A*02:01	Q01638	IL1RL1	Interleukin-1 receptor-like 1
PGSQNNLLLK	1xPhospho [S3]	100	Not Assigned	Q05707	COL14A1	Collagen alpha-1(XIV) chain
RPRTSSNASTI	1xPhospho [S5]	50	HLA-B*07:02	Q12778	FOXO1	Forkhead box protein O1
RLIESLFT	1xPhospho [S5]	100	Not Assigned	Q12789	GTF3C1	General transcription factor 3C polypeptide 1
RPRSAVLL	1xPhospho [S4]	100	HLA-B*07:02	Q12802	AKAP13	A-kinase anchor protein 13
RPRSAVLLV	1xPhospho [S4]	100	HLA-B*07:02	Q12802	AKAP13	A-kinase anchor protein 13
KPSSLRRVTI	1xPhospho [S4]	100	HLA-B*07:02	Q12912	LRMP	Lymphoid-restricted membrane protein
SPRSPSTTYL	1xPhospho [S4]	99.2	HLA-B*07:02	Q13111	CHAF1A	Chromatin assembly factor 1 subunit A
WSPVFRNYI	1xPhospho [S2]	100	Not Assigned	Q13144	EIF2B5	Translation initiation factor eIF-2B subunit epsilon
YMLSKSLYP	1xPhospho [S6]	100	HLA-A*02:01	Q13224	GRIN2B	Glutamate receptor ionotropic, NMDA 2B
RRYSDPPTY	1xPhospho [S4]	100	HLA-C*07:02	Q13459	MYO9B	Unconventional myosin-IXb
APRKGSFSAL	1xPhospho [S6]	100	HLA-B*07:02	Q13619	CUL4A	Cullin-4A
RAALRSCSL	1xPhospho [S8]	50	HLA-B*07:02	Q14318	FKBP8	Peptidyl-prolyl cis-trans isomerase FKBP8
RPYSPSQYAL	1xPhospho [S4]	99.3	HLA-B*07:02	Q14494	NFE2L1	Endoplasmic reticulum membrane sensor NFE2L1
RPSTPKDSEL	1xPhospho [S3]	100	HLA-B*07:02	Q14693	LPIN1	Phosphatidate phosphatase LPIN1
RVRKLPSTTL	1xPhospho [S7]	100	HLA-B*07:02	Q15418	RPS6KA1	Ribosomal protein S6 kinase alpha-1 S6 kinase
RPTSRLNRL	1xPhospho [S4]	100	HLA-B*07:02	Q15788	NCOA1	Nuclear receptor coactivator 1
RPISPGLSY	1xPhospho [S4]	100	HLA-B*07:02	Q16204	CCDC6	Coiled-coil domain-containing protein 6
SPRRSRSISLRR	2xPhospho [S5; S7]	S(5): 66.7; S(7): 66.7; S(9): 66.7	HLA-B*07:02	Q16629	SRSF7	Serine/arginine-rich splicing factor 7
SPRRSRSISL	1xPhospho [S]	S(5): 0.4; S(7): 49.8; S(9): 49.8	HLA-B*07:02	Q16629	SRSF7	Serine/arginine-rich splicing factor 7
HPRSPNVLSV	1xPhospho [S4]	100	HLA-B*07:02	Q16665	HIF1A	Hypoxia-inducible factor 1-alpha
KKDKHKKAKKE	1xPhospho [S6]	100	Not Assigned	Q2TBE0	CWF19L2	CWF19-like protein 2
VPTSPKGRLL	1xPhospho [S4]	100	HLA-B*07:02	Q53EL6	PDCD4	Programmed cell death protein 4
RLGSFHELLL	1xPhospho [S4]	100	HLA-A*02:01	Q5H9R7	PPP6R3	Serine/threonine-protein phosphatase 6 regulatory subunit 3
KMVPSIPYLG I	1xPhospho [S5]	100	HLA-A*02:01	Q5JS13	RALGPS1	Ras-specific guanine nucleotide-releasing factor RalGPS1
RVRESSCLAL	1xPhospho [S6]	98.9	HLA-B*07:02	Q5VYK3	ECPAS	Proteasome adapter and scaffold protein ECM29
RPFHGISTVSL	1xPhospho [S10]	100	HLA-B*07:02	Q5VZ89	DENND4C	DENN domain-containing protein 4C

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
RRSSQSWSL	1xPhospho [S]	S(3): 50.0; S(4): 50.0	HLA-C*07:02	Q641Q2	WASHC2A	WASH complex subunit 2A
APRRYSSSL	1xPhospho [S6]	100	HLA-B*07:02	Q68EM7	ARHGAP17	Rho GTPase-activating protein 17
RRFSGTAVY	1xPhospho [S4]	100	HLA-C*07:02	Q6AHZ1	ZNF518A	Zinc finger protein 518A
KIFSGVFKV	1xPhospho [S4]	100	HLA-A*02:01	Q6DK11	RPL7L1	60S ribosomal protein L7-like 1
RPAFFSPSL	1xPhospho [S6]	100	HLA-B*07:02	Q6ICG6	KIAA0930	Uncharacterized protein KIAA0930
KPASPKFIVTL	1xPhospho [S4]	100	HLA-B*07:02	Q6PJT7	ZC3H14	Zinc finger CCCH domain-containing protein 14
KRVSFSEQL	1xPhospho [S4]	100	Not Assigned	Q6WKZ4	RAB11FIP1	Rab11 family-interacting protein 1
QRKSKLQSL	1xPhospho [S4]	100	Not Assigned	Q6ZMZ3	SYNE3	Nesprin-3
KIYSRLLSL	1xPhospho [S4]	100	HLA-A*02:01	Q6ZS30	NBEAL1	Neurobeachin-like protein 1
FINPLSALQSI	1xPhospho [S6]	100	Not Assigned	Q6ZSZ6	TSHZ1	Teashirt homolog 1
PRASTPRPL	1xPhospho [S4]	100	HLA-C*07:02	Q6ZVL6	KIAA1549L	UPF0606 protein
KPRRFSRSL	1xPhospho [S6]	100	HLA-B*07:02	Q7L4I2	RSRC2	Arginine/serine-rich coiled-coil protein 2
RPDSPTRPTL	1xPhospho [S4]	100	HLA-B*07:02	Q7RTP6	MICAL3	[F-actin]-monooxygenase MICAL3
VPREVLRLSL	1xPhospho [S9]	100	HLA-B*07:02	Q7Z591	AKNA	AT-hook-containing transcription factor
KPRSPRALVL	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
KPRSPRALVLP	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
KPRSPRALV	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
KPRSPRAL	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
SPRRSLYKL	1xPhospho [S5]	100	HLA-B*07:02	Q86UA6	RPAIN	RPA-interacting protein
RPFSPREAL	1xPhospho [S4]	100	HLA-B*07:02	Q86V48	LUZP1	Leucine zipper protein 1
LPRNNSIGESL	1xPhospho [S6]	100	HLA-B*07:02	Q86VY9	TMEM200A	Transmembrane protein 200A
RPRARSVDAL	1xPhospho [S6]	100	HLA-B*07:02	Q86X29	LSR	Lipolysis-stimulated lipoprotein receptor
ALGSRESLATL	1xPhospho [S4]	100	Not Assigned	Q86YV0	RASAL3	RAS protein activator like-3
EIRDLSSSFR	1xPhospho [S8]	97.6	Not Assigned	Q8N3F8	MICALL1	MICAL-like protein 1
RKFSEPNTY	1xPhospho [S4]	100	Not Assigned	Q8N4X5	AFAP1L2	Actin filament-associated protein 1-like 2
SSIPRWLLEI	1xPhospho [S2]	50	Not Assigned	Q8NHP6	MOSPD2	Motile sperm domain-containing protein 2
RLASLNAEAL	1xPhospho [S4]	100	HLA-A*02:01	Q8TBE0	BAHD1	Bromo adjacent homology domain-containing 1 protein

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
SPHSPFYQL	1xPhospho [S4]	100	HLA-B*07:02	Q8TEK3	DOT1L	Histone-lysine N-methyltransferase, H3 lysine-79 specific
SPASPKISL	1xPhospho [S4]	100	HLA-B*07:02	Q8WWM7	ATXN2L	Ataxin-2-like protein
RPRDTRRISL	1xPhospho [S9]	100	HLA-B*07:02	Q92508	PIEZO1	Piezo-type mechanosensitive ion channel component 1
RPRANSGGVDL	1xPhospho [S6]	100	HLA-B*07:02	Q92766	RREB1	Ras-responsive element-binding protein 1
KRASGQAFEL	1xPhospho [S4]	100	Not Assigned	Q93045	STMN2	Stathmin-2
KSINFLHQV	1xPhospho [S2]	100	HLA-A*02:01	Q96CW5	TUBGCP3	Gamma-tubulin complex component 3
FRRSPTKSSL	1xPhospho [S4]	100	Not Assigned	Q96PK6	RBM14	RNA-binding protein 14
RLYSRFTSL	1xPhospho [S4]	100	HLA-A*02:01	Q99653	CHP1	Calcineurin B homologous protein 1
RPRSPRQNSI	1xPhospho [S4]	100	HLA-B*07:02	Q99700	ATXN2L	Ataxin-2
RRPSQNAISF	1xPhospho [S4]	100	HLA-B*07:02	Q9BXB4	OSBPL11	Oxysterol-binding protein-related protein 11
RPDSRLGKTEL	1xPhospho [S4]	100	HLA-B*07:02	Q9BYW2	SETD2	Histone-lysine N-methyltransferase SETD2
RQASLSISV	1xPhospho [S4]	100	HLA-A*02:01	Q9BZL6	PRKD2	Serine/threonine-protein kinase D2
RPRSAVEQL	1xPhospho [S4]	100	HLA-B*07:02	Q9HAU0	PLEKHA5	Pleckstrin homology domain-containing family A member 5
KPLSRVTSL	1xPhospho [S8]	100	HLA-B*07:02	Q9NR81	ARHGEF3	Rho guanine nucleotide exchange factor 3
RPRIPSPIGF	1xPhospho [S6]	100	HLA-B*07:02	Q9NRA8	EIF4ENIF1	Eukaryotic translation initiation factor 4E transporter
RPWSNSRGL	1xPhospho [S4]	50	HLA-B*07:02	Q9NRR8	CDC42SE1	CDC42 small effector protein 1
RLLSAAENFL	1xPhospho [S4]	100	HLA-A*02:01	Q9NSI8	SAMSN1	SAM domain-containing protein SAMSN-1
RPYSPPFFSL	1xPhospho [S4]	100	HLA-B*07:02	Q9NYF3	FAM53C	Protein FAM53C
SPRAPVSPLKF	1xPhospho [S7]	100	HLA-B*07:02	Q9UBS0	RPS6KB2	Ribosomal protein S6 kinase beta-2
RPSSARRHHL	1xPhospho [S4]	100	HLA-B*07:02	Q9UIS9	MBD1	Methyl-CpG-binding domain protein 1
FVAVSGIILVGL	1xPhospho [S5]	100	Not Assigned	Q9UKR8	TSPAN16	Tetraspanin-16
TPAQPQRRSL	1xPhospho [S9]	100	HLA-B*07:02	Q9ULW0	TPX2	Targeting protein for Xklp2
SPRSSLNNSL	1xPhospho [S9]	100	HLA-B*07:02	Q9UPW0	FOXJ3	Forkhead box protein J3
IPRSLAKCSAL	1xPhospho [S9]	100	HLA-B*07:02	Q9UQ13	SHOC2	Leucine-rich repeat protein SHOC-2
RISSRRSRSL	2xPhospho [S7; S]	S(7): 100.0; S(9): 100.0	HLA-B*07:02	Q9UQ35	SRRM2	Serine/arginine repetitive matrix protein 2
RQISFKAEV	1xPhospho [S4]	100	HLA-A*02:01	Q9Y385	UBE2J1	Ubiquitin-conjugating enzyme E2 J1
GPRSASLLSL	1xPhospho [S6]	100	HLA-B*07:02	Q9Y4H4	GPSM3	G-protein-signaling modulator 3

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
RVWEDRPSSA	1xPhospho [S9]	99	Not Assigned	Q9Y618	NCOR2	Nuclear receptor corepressor 2
RPPYNRAVSL	1xPhospho [S9]	100	HLA-B*07:02	Q9Y6Q9	NCOA3	Nuclear receptor coactivator 3

(B) Phosphopeptides identified by SCX

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
RPQRATSNVF	1xPhospho [S7]	100	HLA-B*07:02	O14950	MYL12B	Myosin regulatory light chain 12B
RTSSKRVSRL	1xPhospho [S4]	99.3	Not Assigned	O43491	EPB41L2	Band 4.1-like protein 2
SPSSPSVRRQL	1xPhospho [S4]	100	HLA-B*07:02	O75179	ANKRD17	Ankyrin repeat domain-containing protein 17
YPSFRRSSL	1xPhospho [S8]	N/A	HLA-B*07:02	O95071	UBR5	E3 ubiquitin-protein ligase UBR5
RQLSSGVSEI	1xPhospho [S4]	99.4	HLA-A*02:01	P04792	HSPB1	Heat shock protein beta-1
LKPSETLSLTC	1xPhospho [S8]	100	Not Assigned	P06331	IGHV4-34	Immunoglobulin heavy variable 4-34
SAPVGASEIAEE	1xPhospho [S1]	N/A	Not Assigned	P0CG23	ZNF853	Zinc finger protein 853
RTASKRASRSL	1xPhospho [S4]	100	Not Assigned	P11171	EPB41	Protein 4.1
RPKSNIVLL	1xPhospho [S4]	100	HLA-B*07:02	P11836	MS4A1	B-lymphocyte antigen CD20
KPRSPVVEL	1xPhospho [S4]	100	HLA-B*07:02	P25098	GRK2	Beta-adrenergic receptor kinase 1
KLIDRTESL	1xPhospho [S8]	100	HLA-A*02:01	P33241	LSP1	Lymphocyte-specific protein 1
PRRSLEQNIQL	1xPhospho [S4]	100	Not Assigned	P33993	MCM7	DNA replication licensing factor MCM7
KPRSAASL	1xPhospho [S4]	100	HLA-B*07:02	P48736	PIK3CG	Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit gamma
SPFKRQLSL	1xPhospho [S8]	100	HLA-B*07:02	P49757	NUMB	Protein numb homolog
AVALSIALLI	1xPhospho [S5]	100	Not Assigned	P56750	CLDN17	Claudin-17
LRLSVLVSL	1xPhospho [S8]	100	Not Assigned	P59535	TAS2R40	Taste receptor type 2 member 40
RPRSSNAETL	1xPhospho [S4]	98.8	HLA-B*07:02	P61289	PSME3	Proteasome activator complex subunit 3
KRFSGTVRL	1xPhospho [S4]	100	HLA-C*07:02	P62906	RPL10A	60S ribosomal protein L10a
RPRSPGSNSKV	1xPhospho [S4]	100	HLA-B*07:02	P78347	GTF2I	General transcription factor II-I
RSRSVPSSL	1xPhospho [S4]	99.3	HLA-B*07:02	P83369	LSM11	U7 snRNA-associated Sm-like protein LSm11
RQISQDVKL	1xPhospho [S4]	100	Not Assigned	Q01433	AMPD2	AMP deaminase 2
ISSSILYVH	1xPhospho [S3]	99.4	Not Assigned	Q03938	ZNF90	Zinc finger protein 90
KPSSLRRVTI	1xPhospho [S4]	100	HLA-B*07:02	Q12912	LRMP	Lymphoid-restricted membrane protein
SPRSPSTTYL	1xPhospho [S4]	100	HLA-B*07:02	Q13111	CHAF1A	Chromatin assembly factor 1 subunit A
RRYSDPPTY	1xPhospho [S4]	100	HLA-C*07:02	Q13459	MYO9B	Unconventional myosin-IXb

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
APRKGFSFAL	1xPhospho [S6]	100	HLA-B*07:02	Q13619	CUL4A	Cullin-4A
RPRSPPRHQ	1xPhospho [S4]	100	HLA-B*07:02	Q14493	SLBP	Histone RNA hairpin-binding protein
RPSTPKSDSEL	1xPhospho [S3]	100	HLA-B*07:02	Q14693	LPIN1	Phosphatidate phosphatase LPIN1
APRRPSRKGL	1xPhospho [S6]	100	HLA-B*07:02	Q14839	CHD4	Chromodomain-helicase-DNA-binding protein 4
RVRKLPSTTL	1xPhospho [S7]	100	HLA-B*07:02	Q15418	RPS6KA1	Ribosomal protein S6 kinase alpha-1
SPRRRSISL	1xPhospho [S]	S(7): 50.0; S(9): 50.0	HLA-B*07:02	Q16629	SRSF7	Serine/arginine-rich splicing factor 7
HPRSPNVLSV	1xPhospho [S4]	100	HLA-B*07:02	Q16665	HIF1A	Hypoxia-inducible factor 1-alpha
RPRSNSGREL	1xPhospho [S6]	99.3	HLA-B*07:02	Q5JSH3	WDR44	WD repeat-containing protein 44
SPKSGSPKSSSL	1xPhospho [S6]	100	HLA-B*07:02	Q5TCZ1	SH3PXD2A	SH3 and PX domain-containing protein 2A
RRSSQSWSL	1xPhospho [S4]	S(3): 50.0; S(4): 50.0	HLA-C*07:02	Q641Q2	WASHC2A	WASH complex subunit 2A
APRRYSSSL	1xPhospho [S6]	100	HLA-B*07:02	Q68EM7	ARHGAP17	Rho GTPase-activating protein 17
RRFSGTAVY	1xPhospho [S4]	100	HLA-C*07:02	Q6AHZ1	ZNF518A	Zinc finger protein 518A
KPASP KFIVTL	1xPhospho [S4]	100	HLA-B*07:02	Q6PJT7	ZC3H14	Zinc finger CCCH domain-containing protein 14
KPRRFSRSL	1xPhospho [S6]	100	HLA-B*07:02	Q7L4I2	RSRC2	Arginine/serine-rich coiled-coil protein 2
RSSARQALGITI	1xPhospho [S3]	S(2): 50.0; S(3): 50.0	Not Assigned	Q7Z7G8	VPS13B	Vacuolar protein sorting-associated protein 13B
KPRSPPRALVL	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
KPRSPPRALVLP	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
RSPPRALVLP	1xPhospho [S2]	100	Not Assigned	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
KPRSPPRALV	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
RSPPRALVL	1xPhospho [S2]	100	Not Assigned	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
KPRSPPRAL	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
RPRARSVDAL	1xPhospho [S6]	100	HLA-B*07:02	Q86X29	LSR	Lipolysis-stimulated lipoprotein receptor
GPRSPKAWL	1xPhospho [S4]	100	HLA-B*07:02	Q8IV32	CCDC71	Coiled-coil domain-containing protein 71
RKFSEPN TY	1xPhospho [S4]	N/A	Not Assigned	Q8N4X5	AFAP1L2	Actin filament-associated protein 1-like 2
GRTSELILHQRL	1xPhospho [S4]	100	Not Assigned	Q8N9K5	ZNF565	Zinc finger protein 565
RPRRSYSSTSI	1xPhospho [S6]	S(4): 0.3; S(6): 33.2; S(8): 33.2; S(9): 33.2;	HLA-B*07:02	Q8NFH8	REPS2	RalBP1-associated Eps domain-containing protein 2

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
SPASPKISL	1xPhospho [S4]	100	HLA-B*07:02	Q8WWM7	ATXN2L	Ataxin-2-like protein
RPRDTRRISL	1xPhospho [S9]	100	HLA-B*07:02	Q92508	PIEZO1	Piezo-type mechanosensitive ion channel component 1
RRSSIQSTF	1xPhospho [S3]	99.4	HLA-C*07:02	Q92542	NCSTN	Nicastrin
RPRANSGGVDL	1xPhospho [S6]	100	HLA-B*07:02	Q92766	RREB1	Ras-responsive element-binding protein 1
KRASGQAFEL	1xPhospho [S4]	100	Not Assigned	Q93045	STMN2	Stathmin-2
SPRRSPRISF	1xPhospho [S5]	100	HLA-B*07:02	Q96FF9	CDCA5	Sororin
RPRSPTGPSNSF	1xPhospho [S4]	100	HLA-B*07:02	Q96I25	RBM17	Splicing factor 45
FRRSPTKSSLDY	1xPhospho [S4]	100	Not Assigned	Q96PK6	RBM14	RNA-binding protein 14
FRRSPTKSSL	1xPhospho [S4]	100	Not Assigned	Q96PK6	RBM14	RNA-binding protein 14
FRRSPTKSSLD	1xPhospho [S4]	100	Not Assigned	Q96PK6	RBM14	RNA-binding protein 14
RPRSLSSPTVTL	1xPhospho [S6]	99.4	HLA-B*07:02	Q96PU5	NEDD4L	E3 ubiquitin-protein ligase NEDD4-like
RSLSSPTVTL	1xPhospho [S4]	99.4	HLA-A*02:01	Q96PU5	NEDD4L	E3 ubiquitin-protein ligase NEDD4-like
RPRSLSSPTV	1xPhospho [S6]	N/A	HLA-B*07:02	Q96PU5	NEDD4L	E3 ubiquitin-protein ligase NEDD4-like
RPRSPRQNSI	1xPhospho [S4]	100	HLA-B*07:02	Q99700	ATXN2	Ataxin-2
RLSSRRSSIR	1xPhospho [S8]	N/A	Not Assigned	Q9BRR9	ARHGAP9	Rho GTPase-activating protein 9
RRKSQVAEL	1xPhospho [S4]	100	HLA-C*07:02	Q9BYG3	NIFK	MKI67 FHA domain-interacting nucleolar phosphoprotein
RPDSRLGKTEL	1xPhospho [S4]	100	HLA-B*07:02	Q9BYW2	SETD2	Histone-lysine N-methyltransferase SETD2
PRSLALLRTL SV	1xPhospho [S3]	100	Not Assigned	Q9H228	S1PR5	Sphingosine 1-phosphate receptor 5
KPLIRSQSL	1xPhospho [S8]	100	HLA-B*07:02	Q9H6H4	REEP4	Receptor expression-enhancing protein 4
SPRGSGSSTSL	1xPhospho [S7]	49.8	HLA-B*07:02	Q9H7P9	PLEKHG2	Pleckstrin homology domain-containing family G member 2
RPRSAVEQL	1xPhospho [S4]	100	HLA-B*07:02	Q9HAU0	PLEKHA5	Pleckstrin homology domain-containing family A member 5
RPWSNSRGL	1xPhospho [S4]	0.5	HLA-B*07:02	Q9NRR8	CDC42SE1	CDC42 small effector protein 1
RPYSPFFSL	1xPhospho [S4]	100	HLA-B*07:02	Q9NYF3	FAM53C	Protein FAM53C
SPFLSKRSL	1xPhospho [S8]	100	HLA-B*07:02	Q9NYV4	CDK12	Cyclin-dependent kinase 12
SPRAPVSPLKF	1xPhospho [S7]	100	HLA-B*07:02	Q9UBS0	RPS6KB2	Ribosomal protein S6 kinase beta-2
TPAQPQRRSL	1xPhospho [S9]	100	HLA-B*07:02	Q9ULW0	TPX2	Targeting protein for Xklp2
SPRSSLNNSL	1xPhospho [S9]	100	HLA-B*07:02	Q9UPW0	FOXJ3	Forkhead box protein J3
RISSRRSRSL	1xPhospho [S9]	99.4	HLA-B*07:02	Q9UQ35	SRRM2	Serine/arginine repetitive matrix protein 2

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
KLRSPKSEL	1xPhospho [S4]	100	HLA-B*07:02	Q9Y2R2	PTPN22	Tyrosine-protein phosphatase non-receptor type 22
RQISFKAEV	1xPhospho [S4]	100	HLA-A*02:01	Q9Y385	UBE2J1	Ubiquitin-conjugating enzyme E2 J1
GPRSASLLSL	1xPhospho [S]	S(4): 0.0; S(6): 0.0; S(9): 100.0	HLA-B*07:02	Q9Y4H4	GPSM3	G-protein-signaling modulator 3
QSNALLVQL	1xPhospho [S2]	100	Not Assigned	Q9Y5X0	SNX10	Sorting nexin-10
INMTSSSSKHL	1xPhospho [S8]	98.7	Not Assigned	Q9Y616	IRAK3	Interleukin-1 receptor-associated kinase 3
RVWEDRPSSA	1xPhospho [S9]	N/A	Not Assigned	Q9Y618	NCOR2	Nuclear receptor corepressor 2

(C) Phosphopeptides identified without fractionation

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
RPQRATSNVF	1xPhospho [S7]	100	HLA-B*07:02	O14950	MYL12B	Myosin regulatory light chain 12B (SHUJUN-1)
RKNSFVMEY	1xPhospho [S4]	100	Not Assigned	O43463	SUV39H1	Histone-lysine N-methyltransferase SUV39H1
SPSSPSVRRQL	1xPhospho [S4]	100	HLA-B*07:02	O75179	ANKRD17	Ankyrin repeat domain-containing protein 17
RPNSSALETL	1xPhospho [S4]	99.4	HLA-B*07:02	O94804	STK10	Serine/threonine-protein kinase 10
YPSFRRSSL	1xPhospho [S8]	99.5	HLA-B*07:02	O95071	UBR5	E3 ubiquitin-protein ligase UBR5
KRYSGNMEY	1xPhospho [S4]	100	HLA-C*07:02	O95835	LATS1	Serine/threonine-protein kinase LATS1
RQLSSGVSEI	1xPhospho [S4]	50	HLA-A*02:01	P04792	HSPB1	Heat shock protein beta-1
RPKSNIVLL	1xPhospho [S4]	100	HLA-B*07:02	P11836	MS4A1	B-lymphocyte antigen CD20
SPRTPVSPVKF	1xPhospho [S7]	100	HLA-B*07:02	P23443	RPS6KB1	Ribosomal protein S6 kinase beta-1
LPKSPPYTAF	1xPhospho [S4]	N/A	HLA-B*07:02	P23588	EIF4B	Eukaryotic translation initiation factor 4B
LQLSPLKGLSL	1xPhospho [S4]	100	Not Assigned	P31350	RRM2	Ribonucleoside-diphosphate reductase subunit M2
KLIDRTESL	1xPhospho [S8]	100	HLA-A*02:01	P33241	LSP1	Lymphocyte-specific protein 1
RQASIELPSM	1xPhospho [S4]	100	Not Assigned	P33241	LSP1	Lymphocyte-specific protein 1
KTVSQRFGLL	1xPhospho [S4]	100	Not Assigned	P42336	PIK3CA	Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit alpha
RRGSLQAYTF	1xPhospho [S4]	100	Not Assigned	P46934	NEDD4	E3 ubiquitin-protein ligase NEDD4
RRLSFLVSY	1xPhospho [S4]	100	HLA-C*07:02	P47897	QARS	Glutamine--tRNA ligase
RIVSQLLTL	1xPhospho [S4]	100	HLA-A*02:01	P55072	VCP	Transitional endoplasmic reticulum ATPase
KRFSGTVRL	1xPhospho [S4]	100	HLA-C*07:02	P62906	RPL10A	60S ribosomal protein L10a
YLWRTSLYL	1xPhospho [S6]	100	HLA-A*02:01	Q00325	SLC25A3	Phosphate carrier protein, mitochondrial
RQISQDVKL	1xPhospho [S4]	100	Not Assigned	Q01433	AMPD2	AMP deaminase 2
QSLLYELLY	1xPhospho [S2]	100	Not Assigned	Q01804	OTUD4	OTU domain-containing protein 4
RRLSFLVL	1xPhospho [S4]	100	HLA-C*07:02	Q03518	TAP1	Antigen peptide transporter 1
RPRLQHSFSF	1xPhospho [S9]	100	HLA-B*07:02	Q07352	ZFP36L1	mRNA decay activator protein ZFP36L1
KPSSLRRVTI	1xPhospho [S4]	100	HLA-B*07:02	Q12912	LRMP	Lymphoid-restricted membrane protein
SPRSPSTTYL	1xPhospho [S4]	100	HLA-B*07:02	Q13111	CHAF1A	Chromatin assembly factor 1 subunit A
RRYSDPPTY	1xPhospho [S4]	100	HLA-C*07:02	Q13459	MYO9B	Unconventional myosin-IXb

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
APRKGFSFAL	1xPhospho [S6]	100	HLA-B*07:02	Q13619	CUL4A	Cullin-4A
FRKSMVEHY	1xPhospho [S4]	100	HLA-C*07:02	Q14088	RAB33A	Ras-related protein Rab-33A
RPYSPSQYAL	1xPhospho [S]	S(4): 99.3; S(6): 0.7	HLA-B*07:02	Q14494	NFE2L1	Endoplasmic reticulum membrane sensor NFE2L1
RVRKLPSTTL	1xPhospho [S7]	100	HLA-B*07:02	Q15418	RPS6KA1	Ribosomal protein S6 kinase alpha-1kinase 1a
RLFSKELRC	1xPhospho [S4]	100	Not Assigned	Q15543	TAF13	Transcription initiation factor TFIIID subunit 13
SLNYTKVEQL	1xPhospho [S1]	100	HLA-A*02:01	Q15555	MAPRE2	Microtubule-associated protein RP/EB family member 2
IFVTLSIVVTV	1xPhospho [S6]	100	HLA-A*02:01	Q15825	CHRNA6	Neuronal acetylcholine receptor subunit alpha-6
SPRRSRSISL	2xPhospho [S7; S9]	S(5): 0.6; S(7): 99.5; S(9): 0.0	HLA-B*07:02	Q16629	SRSF7	Serine/arginine-rich splicing factor 7
SPRRSRSISL	1xPhospho [S]	S(5): 0.6; S(7): 99.5	HLA-B*07:02	Q16629	SRSF7	Serine/arginine-rich splicing factor 7
HPRSPNVLSV	1xPhospho [S4]	100	HLA-B*07:02	Q16665	HIF1A	Hypoxia-inducible factor 1-alpha
RLLDLGSSPSGV	1xPhospho [S8]	33.3	HLA-A*02:01	Q2TAC2	CCDC57	Coiled-coil domain-containing protein 57
RPFHGISTVSL	1xPhospho [S10]	100	HLA-B*07:02	Q5VZ89	DENND4C	DENN domain-containing protein 4C
RRSSQSWSL	1xPhospho [S4]	50	HLA-C*07:02	Q641Q2	WASHC2A	WASH complex subunit 2A
APRRYSSSL	1xPhospho [S6]	100	HLA-B*07:02	Q68EM7	ARHGAP17	Rho GTPase-activating protein 17
RRFSGTAVY	1xPhospho [S4]	100	HLA-C*07:02	Q6AHZ1	ZNF518A	Zinc finger protein 518A
KIFSGVFVKV	1xPhospho [S4]	100	HLA-A*02:01	Q6DKI1	RPL7L1	60S ribosomal protein L7-like 1
MPRQPSATRL	1xPhospho [S6]	100	HLA-B*07:02	Q6NZ67	MZT2B	Mitotic-spindle organizing protein 2B
KVLSTEEMEL	1xPhospho [S4]	100	HLA-A*02:01	Q6NZ67	MZT2B	Mitotic-spindle organizing protein 2B
KPASPKFIVTL	1xPhospho [S4]	100	HLA-B*07:02	Q6PJT7	ZC3H14	Zinc finger CCCH domain-containing protein 14
KPRRFSRSL	2xPhospho [S6; S8]	S(6): 100.0; S(8): 100.0	HLA-B*07:02	Q7L4I2	RSRC2	Arginine/serine-rich coiled-coil protein 2
KPRRFSRSL	1xPhospho [S6]	S(6): 100.0; S(8): 100.0	HLA-B*07:02	Q7L4I2	RSRC2	Arginine/serine-rich coiled-coil protein 2
VPREVLRLSL	1xPhospho [S9]	100	HLA-B*07:02	Q7Z591	AKNA	AT-hook-containing transcription factor
SPRPLSCLEL	1xPhospho [S6]	100	HLA-B*07:02	Q7Z6I6	ARHGAP30	Rho GTPase-activating protein 30
RPAKSMDSL	1xPhospho [S5]	100	HLA-B*07:02	Q7Z6I6	ARHGAP30	Rho GTPase-activating protein 30
AGSQLSQAMEV	1xPhospho [S3]	0.8	Not Assigned	Q7Z6K3	PTAR1	Protein prenyltransferase alpha subunit repeat-containing protein 1
KPRSPRALVL	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
KPRSPRALV	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
KPRSPRALVLP	1xPhospho [S4]	100	HLA-B*07:02	Q86TG7	PEG10	Retrotransposon-derived protein PEG10
RPFSPREAL	1xPhospho [S4]	100	HLA-B*07:02	Q86V48	LUZP1	Leucine zipper protein 1
RPRARSVDAL	1xPhospho [S6]	100	HLA-B*07:02	Q86X29	LSR	Lipolysis-stimulated lipoprotein receptor
GPRSPKAWL	1xPhospho [S4]	100	HLA-B*07:02	Q8IV32	CCDC71	Coiled-coil domain-containing protein 71
RLLESNRKL	1xPhospho [S5]	100	HLA-A*02:01	Q8NHP6	MOSPD2	Motile sperm domain-containing protein 2
RTYSGPMNKV	1xPhospho [S4]	100	Not Assigned	Q8WVV4	POF1B	Protein POF1B
SPASPKISL	1xPhospho [S4]	100	HLA-B*07:02	Q8WWM7	ATXN2L	Ataxin-2-like protein
LSSEISQVRL	2xPhospho [S2; S3]	S(2): 100.0; S(3): 100.0	Not Assigned	Q8WXI4	ACOT11	Acyl-coenzyme A thioesterase 11
RPRDTRRISL	1xPhospho [S9]	100	HLA-B*07:02	Q92508	PIEZO1	Piezo-type mechanosensitive ion channel component 1
RPRANSGGVDL	1xPhospho [S6]	100	HLA-B*07:02	Q92766	RREB1	Ras-responsive element-binding protein 1
KRASGQAFEL	1xPhospho [S4]	100	Not Assigned	Q93045	STMN2	Stathmin-2
RILSLSWH	1xPhospho [S6]	100	Not Assigned	Q969X6	UTP4	U3 small nucleolar RNA-associated protein 4 homolog
PPSQLTSSSL	1xPhospho [S5]	50	Not Assigned	Q96B97	SH3KBP1	SH3 domain-containing kinase-binding protein 1
KSINFLHQV	1xPhospho [S2]	N/A	HLA-A*02:01	Q96CW5	TUBGCP3	Gamma-tubulin complex component 3
FRRSPTKSSL	1xPhospho [S4]	100	Not Assigned	Q96PK6	RBM14	RNA-binding protein 14
FRRSPTKSSLD	1xPhospho [S4]	100	Not Assigned	Q96PK6	RBM14	RNA-binding protein 14
FRRSPTKSSLDY	1xPhospho [S4]	100	Not Assigned	Q96PK6	RBM14	RNA-binding protein 14
RPRSPRQNSI	1xPhospho [S4]	100	HLA-B*07:02	Q99700	ATXN2	Ataxin-2
RRPSQNAISF	1xPhospho [S4]	100	HLA-B*07:02	Q9BXB4	OSBPL11	Oxysterol-binding protein-related protein 11
RPDSRLGKTEL	1xPhospho [S4]	100	HLA-B*07:02	Q9BYW2	SETD2	Histone-lysine N-methyltransferase SETD2
HRSWVEKI	1xPhospho [S3]	100	Not Assigned	Q9GZN4	PRSS22	Brain-specific serine protease 4
KPLIRSQSL	1xPhospho [S8]	100	HLA-B*07:02	Q9H6H4	REEP4	Receptor expression-enhancing protein 4
RPRSAVEQL	1xPhospho [S4]	100	HLA-B*07:02	Q9HAU0	PLEKHA5	Pleckstrin homology domain-containing family A member 5
RPWSNSRGL	1xPhospho [S4]	100	HLA-B*07:02	Q9NRR8	CDC42SE1	CDC42 small effector protein 1
RLLSAAENFL	1xPhospho [S4]	100	HLA-A*02:01	Q9NSI8	SAMSN1	SAM domain-containing protein SAMSN-1
LTTILHSDGDL	1xPhospho [S7]	100	Not Assigned	Q9NTI5	PDS5B	Sister chromatid cohesion protein PDS5 homolog B

Peptide	Modification	Localization Probability	Allele Assignment	Uniprot accession	Gene Name	Protein Name
KLYSSEQLLI	1xPhospho [S4]	99.5	HLA-A*02:01	Q9NX09	DDIT4	DNA damage-inducible transcript 4 protein
RPYSPPFFSL	1xPhospho [S4]	100	HLA-B*07:02	Q9NYF3	FAM53C	Protein FAM53C
APRHPSTNSLL	1xPhospho [S6]	100	HLA-B*07:02	Q9P032	NDUFAF4	NADH dehydrogenase [ubiquinone] 1 alpha subcomplex assembly factor 4
APRHPSTNSL	1xPhospho [S6]	100	HLA-B*07:02	Q9P032	NDUFAF4	NADH dehydrogenase [ubiquinone] 1 alpha subcomplex assembly factor 4
SRKSFVFEL	1xPhospho [S4]	100	HLA-C*07:02	Q9P219	CCDC88C	Protein Daple
SPRAPVSPLKF	1xPhospho [S7]	100	HLA-B*07:02	Q9UBS0	RPS6KB2	Ribosomal protein S6 kinase beta-2
SPSINRQTSI	1xPhospho [S9]	100	HLA-B*07:02	Q9UJ41	RABGEF1	Rab5 GDP/GTP exchange factor
TPAQPQRRSL	1xPhospho [S9]	100	HLA-B*07:02	Q9ULW0	TPX2	Targeting protein for Xklp2
RQISFKAEV	1xPhospho [S4]	100	HLA-A*02:01	Q9Y385	UBE2J1	Ubiquitin-conjugating enzyme E2 J1
GPRSASLLSL	1xPhospho [S6]	100	HLA-B*07:02	Q9Y4H4	GPSM3	G-protein-signaling modulator 3
RPKSVDFDSL	1xPhospho [S4]	100	HLA-B*07:02	Q9Y5K6	CD2AP	CD2-associated protein
RLDSYVRSL	1xPhospho [S4]	100	HLA-A*02:01	Q9Y5R8	TRAPPC1	Trafficking protein particle complex subunit 1
RVWEDRPSSA	1xPhospho [S9]	99.3	Not Assigned	Q9Y618	NCOR2	Nuclear receptor corepressor 2

Supporting Table S2

(A) Citrullinated peptides identified by High pH-RP

Peptide	Modification	Allele Assignment	Uniprot accession	Gene Name	Protein Name
MDRVEEILEL	1xDeamidated [R3]	Not Assigned	A6PVC2	TTLL8	Protein monoglycylase TTLL8
RPQRATSNVF	1xDeamidated [R4]	HLA-B*07:02	O14950	MYL12B	Myosin regulatory light chain 12B
RARNGEYITL	1xDeamidated [R3]	HLA-B*07:02	O15055	PER2	Period circadian protein homolog 2
TPRLPQRNLSL	1xDeamidated [R7]	HLA-B*07:02	O43516	WIPF1	WAS/WASL-interacting protein family member 1
PRSGPRPPLP	1xDeamidated [R6]	Not Assigned	O43516	WIPF1	WAS/WASL-interacting protein family member 1
APRNSAELTVI	1xDeamidated [R3]	HLA-B*07:02	O60566	BUB1B	Mitotic checkpoint serine/threonine-protein kinase BUB1 beta
RLLNTTDVYL	1xDeamidated [R1]	HLA-A*02:01	O75976	CPD	Carboxypeptidase D
TQRAPGSVVELL	1xDeamidated [R3]	Not Assigned	O95363	FARS2	Phenylalanine--tRNA ligase, mitochondrial
VPRDGRRAGNAL	1xDeamidated [R7]	HLA-B*07:02	P0C1Z6	TFPT	TCF3 fusion partner
QPREPQVYTL	1xDeamidated [R3]	HLA-B*07:02	P0DOX5		Immunoglobulin gamma-1 heavy chain
AASKERNGLSL	1xDeamidated [R6]	Not Assigned	P16401	HIST1H1B	Histone H1.5
RKQQVLETV	1xDeamidated [R1]	Not Assigned	P17948	FLT1	Vascular endothelial growth factor receptor 1
SPGERHGSRHQ	1xDeamidated [R9]	Not Assigned	P20930	FLG	Filaggrin
DGSRHSGSRHHE	2xDeamidated [R4; R9]	Not Assigned	P20930	FLG	Filaggrin
SPGERHGSRHQQ	1xDeamidated [R9]	Not Assigned	P20930	FLG	Filaggrin
SKRMEPIAI	1xDeamidated [R3]	Not Assigned	P24588	AKAP5	A-kinase anchor protein 5
VPNAGRGLVRL	1xDeamidated [R6]	HLA-B*07:02	P27695	APEX1	DNA-(apurinic or apyrimidinic site) lyase
APRGQRPESAL	1xDeamidated [R6]	HLA-B*07:02	P28062	PSMB8	Proteasome subunit beta type-8
NPRNFSDNQL	1xDeamidated [R3]	HLA-B*07:02	P37802	TAGLN2	Transgelin-2
RRSWQENISL	2xDeamidated [R1; R2]	Not Assigned	P38935	IGHMBP2	DNA-binding protein SMUBP-2
RPQTGLSFL	1xDeamidated [R1]	HLA-B*07:02	P43686	PSMC4	26S proteasome regulatory subunit 6B
RLLDLDP RP	1xDeamidated [R8]	Not Assigned	P49913	CAMP	Cathelicidin antimicrobial peptide
RPTSRYNSSSI	2xDeamidated [R1; R5]	HLA-B*07:02	P51116	FXR2	Fragile X mental retardation syndrome-related protein 2
RLIEHQRM	1xDeamidated [R7]	Not Assigned	P51786	ZNF157	Zinc finger protein 157
APRLQSEVAEL	1xDeamidated [R3]	HLA-B*07:02	P53990	IST1	IST1 homolog

Peptide	Modification	Allele Assignment	Uniprot accession	Gene Name	Protein Name
RGKALRTQL	1xDeamidated [R1]	Not Assigned	P55058	PLTP	Phospholipid transfer protein
GPREAFRQL	1xDeamidated [R7]	HLA-B*07:02	P57086	SCAND1	SCAN domain-containing protein 1
NIRNIGKTL	1xDeamidated [R3]	HLA-B*07:02	P61247	RPS3A	40S ribosomal protein S3a
RPDDRSQGAIL	1xDeamidated [R5]	HLA-B*07:02	Q04637	EIF4G1	Eukaryotic translation initiation factor 4 gamma 1
KPNGVRQRPIAF	1xDeamidated [R6]	HLA-B*07:02	Q12766	HMGXB3	HMG domain-containing protein 3
FLYPGKNGRL	1xDeamidated [R9]	HLA-A*02:01	Q13889	GTF2H3	General transcription factor IIH subunit 3
EMAKRRIDEI	1xDeamidated [R6]	Not Assigned	Q14683	SMC1A	Structural maintenance of chromosomes protein 1A
RVDPNGSRYLL	1xDeamidated [R8]	HLA-B*07:02	Q16531	DDB1	DNA damage-binding protein 1
SPSRNRSLQL	1xDeamidated [R4]	HLA-B*07:02	Q3KQU3	MAP7D1	MAP7 domain-containing protein 1
RLDAARQAL	1xDeamidated [R6]	HLA-B*07:02	Q5TZA2	CROCC	Rootletin
KLFDPRQELKL	1xDeamidated [R5]	HLA-A*02:01	Q5VZ89	DENND4C	DENN domain-containing protein 4C
RLQEEVHLL	1xDeamidated [R1]	HLA-A*02:01	Q674X7	KAZN	Kazrin
RSFERSHRRRISE	3xDeamidated [R5; R8; R9]	Not Assigned	Q68DN1	C2orf16	Uncharacterized protein C2orf16
RAATLESLREL	2xDeamidated [R1; R9]	Not Assigned	Q6NSJ5	LRRC8E	Volume-regulated anion channel subunit LRRC8E
RLLGEEVPRPIL	1xDeamidated [R9]	Not Assigned	Q6SZW1	SARM1	Sterile alpha and TIR motif-containing protein 1
RPSLRLQLL	1xDeamidated [R5]	HLA-B*07:02	Q7L2H7	EIF3M	Eukaryotic translation initiation factor 3 subunit M
RPVNGVINTL	1xDeamidated [R1]	HLA-B*07:02	Q7Z3B3	KANSL1	KAT8 regulatory NSL complex subunit 1
PQRRIRRWLRRF	3xDeamidated [R4; R6; R7]	Not Assigned	Q7Z3K3	POGZ	Pogo transposable element with ZNF domain
LPRNNSIGESL	1xDeamidated [R3]	HLA-B*07:02	Q86VY9	TMEM200A	Transmembrane protein 200A
SPRVNGLTTVAL	1xDeamidated [R3]	HLA-B*07:02	Q86YP4	GATAD2A	Transcriptional repressor p66-alpha
DPLLLRCKL	1xDeamidated [R6]	Not Assigned	Q8IY34	SLC15A3	Solute carrier family 15 member 3
QGRDDHVVITL	1xDeamidated [R3]	Not Assigned	Q8N0Z2	ABRA	Actin-binding Rho-activating protein
GRRRSRLAL	2xDeamidated [R2; R3]	HLA-C*07:02	Q8N2H9	PELI3	E3 ubiquitin-protein ligase pellino homolog 3
SRRNGNLTAFA	1xDeamidated [R3]	Not Assigned	Q8N8Q9	NIPA2	Magnesium transporter NIPA2
YRAKSRQLLQ	2xDeamidated [R2; R6]	Not Assigned	Q8NEE8	TTC16	Tetratricopeptide repeat protein 16
QARLLRAQSL	1xDeamidated [R3]	HLA-B*07:02	Q8NFW9	MYRIP	Rab effector MyRIP
RPNGTKVAVLL	1xDeamidated [R1]	HLA-B*07:02	Q8NHH9	ATL2	Atlantin-2

Peptide	Modification	Allele Assignment	Uniprot accession	Gene Name	Protein Name
RPNGTKVAVL	1xDeamidated [R1]	HLA-B*07:02	Q8NHH9	ATL2	Atlastin-2
RNPDIRVL	1xDeamidated [R1]	Not Assigned	Q8TAF3	WDR48	WD repeat-containing protein 48
KCERIAKAIEV	1xDeamidated [R4]	Not Assigned	Q8TCG1	CIP2A	Protein CIP2A
WAGPEERLRR	2xDeamidated [R9; R10]	Not Assigned	Q8WWP7	GIMAP1	GTPase IMAP family member 1
IRQQRLISI	1xDeamidated [R5]	Not Assigned	Q92540	SMG7	Protein SMG7
RARNISGVVL	1xDeamidated [R3]	HLA-B*07:02	Q92542	NCSTN	Nicastrin
GVSMRFFTKL	1xDeamidated [R5]	Not Assigned	Q92835	INPP5D	Phosphatidylinositol 3,4,5-trisphosphate 5-phosphatase 1
PQQLVERL	1xDeamidated [R7]	Not Assigned	Q93009	USP7	Ubiquitin carboxyl-terminal hydrolase 7
RPREQNGAIYL	1xDeamidated [R3]	HLA-B*07:02	Q95460	MR1	Major histocompatibility complex class I-related gene protein
RIINGIISV	1xDeamidated [R1]	HLA-A*02:01	Q96D96	HVCN1	Voltage-gated hydrogen channel 1
RPSVRNGQLL	1xDeamidated [R5]	HLA-B*07:02	Q96EB1	ELP4	Elongator complex protein 4
RPNGRVALRTL	1xDeamidated [R]	HLA-B*07:02	Q96HS1	PGAM5	Serine/threonine-protein phosphatase PGAM5
QGDRERGGSLR	2xDeamidated [R4; R6]	Not Assigned	Q96L73	NSD1	Histone-lysine N-methyltransferase, H3 lysine-36 and H4 lysine-20 specific
PSRDNPRRLR	1xDeamidated [R10]	Not Assigned	Q96LA8	PRMT6	Protein arginine N-methyltransferase 6
RPNGVITGL	1xDeamidated [R1]	HLA-B*07:02	Q96QD9	FYTTD1	UAP56-interacting factor
AFSRLHKL	1xDeamidated [R4]	Not Assigned	Q9BTN0	LRFN3	Leucine-rich repeat and fibronectin type-III domain-containing protein 3
RTSASSVLLSV	1xDeamidated [R1]	Not Assigned	Q9C0C7	AMBRA1	Activating molecule in BECN1-regulated autophagy protein 1
HPEASRKNLVL	1xDeamidated [R6]	HLA-B*07:02	Q9H6T0	ESRP2	Epithelial splicing regulatory protein 2
APNQRRRLLL	1xDeamidated [R6]	HLA-B*07:02	Q9NNW5	WDR6	WD repeat-containing protein 6
KRQEAFEL	1xDeamidated [R2]	HLA-C*07:02	Q9NR81	ARHGEF3	Rho guanine nucleotide exchange factor 3
RIPRLILRP	2xDeamidated [R1; R4]	Not Assigned	Q9NX95	SYBU	Syntabulin
RPNGVSAVAL	1xDeamidated [R1]	HLA-B*07:02	Q9NZ63	C9orf78	Telomere length and silencing protein 1 homolog
RPIRQILYL	1xDeamidated [R4]	HLA-B*07:02	Q9UBQ5	EIF3K	Eukaryotic translation initiation factor 3 subunit K
RLPRDLLQVY	1xDeamidated [R]	HLA-B*07:02	Q9UFD9	RIMBP3	RIMS-binding protein 3A
LGRKEVVATLL	1xDeamidated [R3]	Not Assigned	Q9UJG1	MOSPD1	Motile sperm domain-containing protein 1
RPANHRQLTF	1xDeamidated [R6]	HLA-B*07:02	Q9UNM6	PSMD13	26S proteasome non-ATPase regulatory subunit 13
VEAHVRAQLLQ	1xDeamidated [R6]	Not Assigned	Q9UNX9	KCNJ14	ATP-sensitive inward rectifier potassium channel 14
RLRNGTFLTL	1xDeamidated [R3]	HLA-A*02:01	Q9UQ53	MGAT4B	Alpha-1,3-mannosyl-glycoprotein 4-beta-N-acetylglucosaminyltransferase B

Peptide	Modification	Allele Assignment	Uniprot accession	Gene Name	Protein Name
VLLDVNGHIRL	1xDeamidated [R10]	HLA-A*02:01	Q9Y5S2	CDC42BPB	Serine/threonine-protein kinase MRCK beta
RAYLRNRSKL	2xDeamidated [R5; R7]	HLA-B*07:02	Q9Y605	MRFAP1	MORF4 family-associated protein 1
TPRLQEGSLSS	1xDeamidated [R3]	Not Assigned	Q9Y618	NCOR2	Nuclear receptor corepressor 2

(B) Citrullinated peptides identified by SCX

Peptide	Modification	Allele Assignment	Uniprot accession	Gene Name	Protein Name
ARNRRGRARRL	2xDeamidated [R9; R10]	Not Assigned	I0J062	PANO1	Proapoptotic nucleolar protein 1
GSANINDRSLLG	1xDeamidated [R8]	Not Assigned	O14939	PLD2	Phospholipase D2
RPQRATSNVF	1xDeamidated [R4]	HLA-B*07:02	O14950	MYL12B	Myosin regulatory light chain 12B
VPNQKRLTLL	1xDeamidated [R6]	HLA-B*07:02	O60488	ACSL4	Long-chain-fatty-acid--CoA ligase 4
DRRPGIIVDL	2xDeamidated [R2; R3]	Not Assigned	O76041	NEBL	Nebulette
KARAQAEAL	1xDeamidated [R3]	HLA-B*07:02	O95503	CBX6	Chromobox protein homolog 6
RRVDAENRL	1xDeamidated [R8]	Not Assigned	P02545	LMNA	Prelamin-A/C
YDSMKGKGTRD	1xDeamidated [R10]	Not Assigned	P07355	ANXA2	Annexin A2
DGSRHSWSHHHE	1xDeamidated [R4]	Not Assigned	P20930	FLG	Filaggrin
YESTRKENL	1xDeamidated [R5]	Not Assigned	P20930	FLG	Filaggrin
EKNKTENTRLGD	1xDeamidated [R9]	Not Assigned	P20930	FLG	Filaggrin
SPTHREEEY	1xDeamidated [R5]	Not Assigned	P20930	FLG	Filaggrin
YSPTHREEE	1xDeamidated [R6]	Not Assigned	P20930	FLG	Filaggrin
SPNQARAQAAL	1xDeamidated [R6]	HLA-B*07:02	P26599	PTBP1	Polypyrimidine tract-binding protein 1
APRQRPESAL	1xDeamidated [R6]	HLA-B*07:02	P28062	PSMB8	Proteasome subunit beta type-8
SPRNQQLHTVTL	1xDeamidated [R3]	HLA-B*07:02	P32519	ELF1	ETS-related transcription factor Elf-1
RLAQHITYV	1xDeamidated [R1]	HLA-A*02:01	P33993	MCM7	DNA replication licensing factor MCM7
NPRNFSDNQL	1xDeamidated [R3]	HLA-B*07:02	P37802	TAGLN2	Transgelin-2
ANAPEESRKKIN	1xDeamidated [R8]	Not Assigned	P48594	SERPINB4	Serpin B4
RGKALRTQL	1xDeamidated [R1]	Not Assigned	P55058	PLTP	Phospholipid transfer protein
EPIKREDEEE	1xDeamidated [R5]	Not Assigned	P55072	VCP	Transitional endoplasmic reticulum ATPase
ALREQQLQQE	1xDeamidated [R3]	Not Assigned	P56524	HDAC4	Histone deacetylase 4
GPREAFRQL	1xDeamidated [R7]	HLA-B*07:02	P57086	SCAND1	SCAN domain-containing protein 1
NIRNIGKTL	1xDeamidated [R3]	HLA-B*07:02	P61247	RPS3A	40S ribosomal protein S3a
RPSSQYIVAL	1xDeamidated [R1]	HLA-B*07:02	Q01650	SLC7A5	Large neutral amino acids transporter small subunit 1

Peptide	Modification	Allele Assignment	Uniprot accession	Gene Name	Protein Name
PEKRRRQEL	1xDeamidated [R4]	Not Assigned	Q07283	TCHH	Trichohyalin
APHARNGLSL	1xDeamidated [R5]	HLA-B*07:02	Q13422	IKZF1	DNA-binding protein Ikaros
RPRARYVQV	1xDeamidated [R5]	HLA-B*07:02	Q14213	EBI3	Interleukin-27 subunit beta
KPEEQRQAL	1xDeamidated [R6]	HLA-B*07:02	Q15149	PLEC	Plectin
APREGQGSSAV	1xDeamidated [R3]	HLA-B*07:02	Q16566	CAMK4	Calcium/calmodulin-dependent protein kinase type IV
PSRRSTKR	1xDeamidated [R8]	Not Assigned	Q2WVGJ9	FER1L6	Fer-1-like protein 6
SPSRNRSLQL	1xDeamidated [R]	HLA-B*07:02	Q3KQU3	MAP7D1	MAP7 domain-containing protein 1
PVWIKETRTRHL	1xDeamidated [R10]	Not Assigned	Q5D0E6	DALRD3	DALR anticodon-binding domain-containing protein 3
KRGRRNNSVGSL	2xDeamidated [R4; R5]	Not Assigned	Q5JU85	IQSEC2	IQ motif and SEC7 domain-containing protein 2
NRVLREDNRRL	2xDeamidated [R5; R9]	Not Assigned	Q5VU43	PDE4DIP	Myomegalin
RSFERSHRRISE	3xDeamidated [R5; R8; R9]	Not Assigned	Q68DN1	C2orf16	Uncharacterized protein C2orf16
RLGHQKYKSKI	1xDeamidated [R1]	Not Assigned	Q6DN14	MCTP1	Multiple C2 and transmembrane domain-containing protein 1
APSQQRQQIA	1xDeamidated [R6]	HLA-B*07:02	Q6P2Q9	PRPF8	Pre-mRNA-processing-splicing factor 8
APSQQRQQI	1xDeamidated [R6]	HLA-B*07:02	Q6P2Q9	PRPF8	Pre-mRNA-processing-splicing factor 8
CGKFFRHSSSL	1xDeamidated [R6]	Not Assigned	Q6PK81	ZNF773	Zinc finger protein 773
SPRQERLNFWL	1xDeamidated [R6]	HLA-B*07:02	Q6ZN16	MAP3K15	Mitogen-activated protein kinase kinase kinase 15
RVSLIKQR	1xDeamidated [R8]	Not Assigned	Q75QN2	INTS8	Integrator complex subunit 8
RPSLRQLL	1xDeamidated [R5]	HLA-B*07:02	Q7L2H7	EIF3M	Eukaryotic translation initiation factor 3 subunit M
PRRFSRSLSRT	1xDeamidated [R10]	Not Assigned	Q7L4I2	RSRC2	Arginine/serine-rich coiled-coil protein 2
RPVNGVINTL	1xDeamidated [R1]	HLA-B*07:02	Q7Z3B3	KANSL1	KAT8 regulatory NSL complex subunit 1
RPEARRPRGPR	3xDeamidated [R6; R8; R11]	HLA-B*07:02	Q86TL0	ATG4D	Cysteine protease ATG4D
GRRRSRLAL	2xDeamidated [R2; R3]	HLA-C*07:02	Q8N2H9	PELI3	E3 ubiquitin-protein ligase pellino homolog 3
KSFYSSSF	1xDeamidated [R4]	Not Assigned	Q8NCK3	ZNF485	Zinc finger protein 485
TPRNLNRSLQ	1xDeamidated [R3]	HLA-B*07:02	Q8NCN4	RNF169	E3 ubiquitin-protein ligase RNF169
IKRIRREL	1xDeamidated [R5]	Not Assigned	Q8TCB0	IFI44	Interferon-induced protein 44
RARNISGVVL	1xDeamidated [R3]	HLA-B*07:02	Q92542	NCSTN	Nicastrin
KPQGQRTSL	1xDeamidated [R6]	HLA-B*07:02	Q92547	TOPBP1	DNA topoisomerase 2-binding protein 1

Peptide	Modification	Allele Assignment	Uniprot accession	Gene Name	Protein Name
GVSMRFFTKL	1xDeamidated [R5]	Not Assigned	Q92835	INPP5D	Phosphatidylinositol 3,4,5-trisphosphate 5-phosphatase 1
RPSLGRVL	1xDeamidated [R6]	HLA-B*07:02	Q96AB3	ISOC2	Isochorismatase domain-containing protein 2
STRWLLVVV	1xDeamidated [R3]	Not Assigned	Q96EY1	DNAJA3	DnaJ homolog subfamily A member 3, mitochondrial
RPNGVITGL	1xDeamidated [R1]	HLA-B*07:02	Q96QD9	FYTTD1	UAP56-interacting factor
HPEASRKNLVL	1xDeamidated [R6]	HLA-B*07:02	Q9H6T0	ESRP2	Epithelial splicing regulatory protein 2
LPRNSKTRPESI	1xDeamidated [R8]	HLA-B*07:02	Q9HAU0	PLEKHA5	Pleckstrin homology domain-containing family A member 5
PRSSSDNRNFLR	2xDeamidated [R8; R12]	Not Assigned	Q9HBU6	ETNK1	Ethanolamine kinase 1
IPQKQREITL	1xDeamidated [R6]	HLA-B*07:02	Q9NR30	DDX21	Nucleolar RNA helicase 2
QEFLTAAKKAR	1xDeamidated [R11]	Not Assigned	Q9NZT1	CALML5	Calmodulin-like protein 5
LPDLQRSKQAL	1xDeamidated [R6]	HLA-B*07:02	Q9UL45	BLOC1S6	Biogenesis of lysosome-related organelles complex 1 subunit 6
RPANHRQLTF	1xDeamidated [R6]	HLA-B*07:02	Q9UNM6	PSMD13	26S proteasome non-ATPase regulatory subunit 13
RADSIGSGRA	1xDeamidated [R9]	Not Assigned	Q9UPQ3	AGAP1	Arf-GAP with GTPase, ANK repeat and PH domain-containing protein 1
RVNNNRGNSL	1xDeamidated [R1]	HLA-B*07:02	Q9Y5M8	SRPRB	Signal recognition particle receptor subunit beta

(C) Citrullinated peptides identified without fractionation

Peptide	Modification	Allele Assignment	Uniprot accession	Gene Name	Protein Name
LPRNNSIGESL	1xDeamidated [R3]	HLA-B*07:02	Q86VY9	TMEM200A	Transmembrane protein 200A
RLLNNTDVYL	1xDeamidated [R1]	HLA-A*02:01	O75976	CPD	Carboxypeptidase D
RAATLESLREL	2xDeamidated [R1; R9]	Not Assigned	Q6NSJ5	LRRC8E	Volume-regulated anion channel subunit LRRC8E
RARNISGVVL	1xDeamidated [R3]	HLA-B*07:02	Q92542	NCSTN	Nicastrin
SLRPIGNIVLI	1xDeamidated [R3]	Not Assigned	O95180	CACNA1H	Voltage-dependent T-type calcium channel subunit alpha-1H
PRRFSRSLSRT	1xDeamidated [R]	Not Assigned	Q7L4I2	RSRC2	Arginine/serine-rich coiled-coil protein 2
NPRNFSDNQL	1xDeamidated [R3]	HLA-B*07:02	P37802	TAGLN2	Transgelin-2
LNQGARVNARD	2xDeamidated [R6; R10]	Not Assigned	Q86SG2	ANKRD23	Ankyrin repeat domain-containing protein 23
QFIEEIRQL	1xDeamidated [R7]	Not Assigned	Q96LB3	IFT74	Intraflagellar transport protein 74 homolog
APRANLTVVLL	1xDeamidated [R3]	HLA-B*07:02	P05362	ICAM1	Intercellular adhesion molecule 1
HSRPLLLAL	1xDeamidated [R3]	HLA-B*07:02	Q9NXH8	TOR4A	Torsin-4A
RLMEDRNARL	2xDeamidated [R6; R9]	HLA-B*07:02	P59046	NLRP12	NACHT, LRR and PYD domains-containing protein 12
LRQDLRDGVIL	1xDeamidated [R2]	Not Assigned	Q155Q3	DIXDC1	Dixin
SPRQERLNFWL	1xDeamidated [R6]	HLA-B*07:02	Q6ZN16	MAP3K15	Mitogen-activated protein kinase kinase kinase 15
ISRENAKNSL	1xDeamidated [R3]	Not Assigned	P01766	IGHV3-13	Immunoglobulin heavy variable 3-13
RDQGRQVYLSR	1xDeamidated [R1]	Not Assigned	Q08345	DDR1	Epithelial discoidin domain-containing receptor 1
MDRVEEILEL	1xDeamidated [R3]	Not Assigned	A6PVC2	TTL8	Protein monoglycylase TTL8
KSFYSSSF	1xDeamidated [R4]	Not Assigned	Q8NCK3	ZNF485	Zinc finger protein 485
ESRRSSLLSLM	2xDeamidated [R3; R4]	Not Assigned	Q6WKZ4	RAB11FIP1	Rab11 family-interacting protein 1
PRSSPSGREASL	1xDeamidated [R8]	HLA-B*07:02	Q6NUI2	GPAT2	Glycerol-3-phosphate acyltransferase 2, mitochondrial
VRVEHRVSSLQL	2xDeamidated [R2; R6]	Not Assigned	Q9NRJ4	TULP4	Tubby-related protein 4
RVSELEKTQVA	1xDeamidated [R1]	Not Assigned	Q7Z7A1	CNTRL	Centriolin
RRPLYKNIVL	1xDeamidated [R1]	HLA-B*07:02	P61158	ACTR3	Actin-related protein 3
RVQRHLELL	2xDeamidated [R1; R4]	Not Assigned	Q86UT6	NLRX1	NLR family member X1
SGDLMIRNIQL	1xDeamidated [R7]	Not Assigned	Q9P232	CNTN3	Contactin-3
SRSEKDYRL	1xDeamidated [R2]	Not Assigned	Q9P2F5	STOX2	Storkhead-box protein 2

Peptide	Modification	Allele Assignment	Uniprot accession	Gene Name	Protein Name
APRANLTVVL	1xDeamidated [R3]	HLA-B*07:02	P05362	ICAM1	Intercellular adhesion molecule 1
PRTCLSLLSL	1xDeamidated [R2]	Not Assigned	Q70UQ0	IKBIP	Inhibitor of nuclear factor kappa-B kinase-interacting protein
RVNNSIDGVSL	1xDeamidated [R1]	Not Assigned	P78312	FAM193A	Protein FAM193A
RILRDTRILLI	1xDeamidated [R1]	Not Assigned	Q9H845	ACAD9	Acyl-CoA dehydrogenase family member 9, mitochondrial
RVLNVSYNV	1xDeamidated [R1]	HLA-A*02:01	Q86YC3	NRROS	Negative regulator of reactive oxygen species
KCERIAKAIEV	1xDeamidated [R4]	Not Assigned	Q8TCG1	CIP2A	Protein CIP2A
RPRYLEIRAV	1xDeamidated [R8]	HLA-B*07:02	Q9HAV4	XPO5	Exportin-5
KEEEIRKYSI	1xDeamidated [R6]	Not Assigned	Q15742	NAB2	NGFI-A-binding protein 2
NRRLQQHLL	2xDeamidated [R2; R3]	Not Assigned	A6NKD9	CCDC85C	Coiled-coil domain-containing protein 85C
RMFNRTYKL	1xDeamidated [R5]	HLA-A*02:01	O75354	ENTPD6	Ectonucleoside triphosphate diphosphohydrolase 6

