Article

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A humanized minipig model for the toxicological testing of therapeutic recombinant antibodies

In the format provided by the authors and unedited

Contents

Supplementary Fig. 1 I V(D)J sequencing. **Supplementary Fig. 2 I** Sequence and structural mapping of the different interactions of PD-L1 epitope amino acid side-chains with atezolizumab paratope residues.

Supplementary Table 1 I List of Ab compounds Supplementary Table 2 I List of primers.



VH3-30:	ADSVKGRFTISRDNSKNTLYLQMNS LRAEDTAVYYCAK	N (D) N	JH	CY	
>p1	ADSVKGRFT ISRDNSKNTLYLOMNS LRAEDTAV YYCPK	EGR	GQGTLVTVSS (4) ASTKGPSVFPLA	PSSKSTSGGTAAL
>p2	ADSVKGRFT ISRDNSKNTLYLOPINS LRAEDTAV YYCAK		DAFDIWGQGTMVTVSS (3) ASTKGPSVFPLA	PSSKSTSGGTAAL
>p3	ADSVKGRFT ISRDNSKNTLYLOMNS LRAEDTAV YYCAK	DPY	YFDYWGQGTLVTVSS(4) ASTKGPSVFPLA	PSSKSTSGGTAA L
>p4	ADSVKGRFT ISRDNSKNTLYLOMNS LRAEDTAV YYCA	NMVRE	FDYWGQGTLVTVSS (4) ASTKGPSVFPLA	PSSKSTSGGTAAL
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>p15	ADSVKGRFT ISRDNSKNTLYLOPINS LRAEDTAV YYCAK	DQ LANWG	FDYWGQGTLVTVSS (4) ASTKGPSVFPLA	PSSKSTSGGTAAL
>p17	ADSVKGRFT ISRDNSKNTLYLOMNS LRAEDTAV YYCAK	ANWGS	FDIWGQGTMVTVSS(3) ASTKGPSVFPLA	PSSKSTSGGTAA L
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>p34	ADSVKGRFT ISRDNSKNTLYLOPINS LRAEDTAV YYCAK	DQFANWGS	FDIWGQGTMVTVSS(3) ASTKGPSVFPLA	PSSKSTSGGTAAL
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>p2	AD SVKGRFTI SRDN SKNT LYLQ INSLRAED TAVY YCAK	DRG	FDYWGQGT LVTV	SS (4) ASTKGPSVFPLAPSSKSTSGGTAAL	
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>p5	AD SVKGRFTI SRDN SKNT LYLOMNSLRAED TAVY YCA	ITGV	DYWGQGT LVTV	SS (4) ASTKGPSVFPLAPSSKSTSGGTAAL	
>рб	AD SVKGRFTI SRDN SKNT LYLQMNSLRAED TAVY YCAK	APP	FDIWGQGTMVTV	SS(3)ASTKGPSVFPLAPSSKSTSGGTAAL	
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>p1528	AD SVKGRFTI SRDN SKNMLYLOMNSLRAGD TAVY YCA	ROEYSSSYKW	FDP WGQGTLVTV	SS(6)ASTKGPSVFPLAPCSRSTSESTAAL	
>p1565	AD SVKGRFTI SRDNAKNT LELOMNSLRAED TAVY YCA	RFS SESPDYF	YG LDVWGQGTMVTV	SS(6)ASTKGPSVFPLAPCSRSTSESTAAL	
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VH1-18: GISWVROAPGOGLEWMGWI SAYNGNTN YAOK LOGR VTMT TDTS TSTA YMEL RSLR SDDT AVYY CAR N (D) N JH Ch GISWVRQAPCOGLEWMGWISAYNGNTN YAQKLOGR VTMT TDTS TSTA YMELRSLR SDDT AVYY CAR YFDLWGRGT LVTVSS (2) AST KGPS VFPLAPSS KSTS GGTAAL >p1 >p8 GISWVROAPGOGLEWMGWISAYNGNTN YAOK LOGRVTMT TDTS TSTA YMELRSLR SDDT AVYY CAR V YFDLWGRGT LVTVSS (2) ASTKGPSVFPLAPCSRSTSESTAAL GISWVROAPCOGLEWMOWISAYN ONTNYAOK LOGR VTMT TDTS TSTA YMEL RSLR SDDT AVYY CAR DYWGQGT LVTV SS (4) AST KGPS VFPLAPSS KST SGGTAAL >p2 >p10 >p15 GISWVRQAPQQGLEWMGWISAYNGNTN YAQK LQGRVTMT TDTS TSTA YMELRSLR SDDT AVYY CAR D DYWCQGT LVTVSS (4) ASTKGPSVFPLAPCSRSTSESTAAL GISWVRQAPCQGLEWMGWISAYNGNTN YAQKLQGRVTMT TDTSTSTAYMELRSLRSDDTAVYYCAR D DYWGRGT LVTVSS (4) ASTKGPSVFPLAPSSKSTSGGTAAL >p3 GISWVROAPGOGLEWMGWISAYN GNTN YAOK LOGR VTMT TDTS TSTA YMEL RSLR SDDT AVYY CAR AFDIWGOGTMVTVSS(3)ASTKGPSVFPLAPSSKSTSGGTAAL GISWVROAPGOGLEWMCWI SAYNGNTN YAOK LOGR VTMT TDTS TSTA YMELRSLR SDDT AVYY CAR AFDIWCQGTMVTVSS (3) ASTKGPSVFPLAPCSRSTSESTAAL . >p14 ->p4 >p13 GISWVROAPGOGLEWMGWISAYN GNTN YAOK LOGR VTMT TDTS TSTA YMELRSLR SDDT AVYY CA s DYWGOGT LVTVSS (4) ASTKGPSVFPLAPSSKSTSGGTAAL GIS WVROAPCOGLEWMCWI SAYN GNTN YAOK LOGR VTMT TDTS TSTA YMELRS LR SDDT AVYY CA DYWGOGT LVTVSS (4) ASTKGPSVFPLAPCSRSTSESTAAL >p26 GIS WVROAPGOGLEWMGWISAYN GNTN YAOK LOGR VTMT TDTS TSTA YMELRSLR SDDT AVYY CAR N WGOGT LVTVSS (4) AST KGPS VEPLAPSS KSTS GGTAAL -p30 GISWVRQAPQQGLEWMCWISAYN GNTN YAQKLQGR VTMT TDTS TSTA YMELRSLR SDDT AVYY CAR DD YYYYMDVWGKGTTVTVSS(6)ASTKGPSVFPLAPSSKSTSGGTAAL ->p41 >p52 GISWVRQAPGOGLEWMGWISAYNGNTN YAOK LOGR VTMT TDTS TSTA YMELRSLR SDDT AVYY CAR AGMGV WGKGT TVTVSS (6) AST KGPS VFPLAPSS KSTS GGTAAL GISWVRQAPQQGLEWMGWISAYN GNTN YAQKLQGRVTMT TDTSTSTAYMELRSLRSDDTAVYY CAR DHWGL Y FDLWGRGT LVTVSS (2) AST KGPS VFPLAPSS KGTS GGTAAL >p113 GISWVRQAPCQGLEWMCWISAYNGNTN YAOK LOGRVTMT TDTSTSTAYMELRSLRSDDTAVYYCAR DHWGL Y FDLWGRGT LVTVSS (2) ASTKSPSVFPLAPCSRSTSESTAAL >p60 GISWVROAPGOGLEWMGWI SAYN ONTN YAOK LOGR VTMT TDTS TSTA YMEL RSLR SDDT AVYY CAR GY Y FDYWGOGT LVTVSS (4) ASTKGPSVFPLAPCSRSTSGGTAAL Y FDYWGRGT LVTVSS (4) ASTKGPS VFPLAPCSRSTSESTAAL >p83 GISWVRQAPGQGLEWMGWISAYNGNTN YAQKLQGRVTMT TDTS TSTA YMELRSLRSDDT AVYY CAR GY >p67 GIS WVRO APGOGLEWMGWI SAYN GNTN YAOK LOGR VTMT TDTS TSTA YMELRSLR SDDT AVYY CA SY Y FDYWCOGT LVTVSS (4) AST KGPS VFPLAPSS KSTAGGTAAL >p73 GISWVRO APGOGLEWMGWI SAYNGNTN YAOK LOGR VTMT TDTS TSTA YMEL RSLR SDDT AVYY CA GDHWGL_YFDLWGRGTLVTVSS(2)ASTKGPSVFPLAPSSKSTSGGTAAL GISWVRQAPGQGLEWMGWI SAYN GNTN YAQK LQGR VTMT TDTS TSTA YMELRSLR SDDT AVYY CA SDHWGL YFDLWGRGT LVTVSS (2) ASTKGPSVFPLAPSSKSTSGGTAAL >p96

VK3-20	GTLSLSPGERATLSCRASQ SVSS SYLAWYQQKPGQAPRL LIYGASSRATGI PDRF SGSG SGTD FTLT ISRLEPED FAVY YCQQ YGSS P	N	Jĸ	
>p1	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPCQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSSP	PNWVTNWG	TEGPGT	KVDIK(3)
>p2	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSSP		YTFGQGT	KLEIK(2)
>p3	GTLSLSPGERATLSCRASOSVSSSYLAWYOOKPGOAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCOOYGRS		RS FGGG TI	KVEIK(4)
>p4	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSSP		LT FGGG TI	KVEIK(4)
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>p0 >p7	GTLSLSPGERATLISCRASOSYSS SYLAWYOCKPCDAPRILLTYCASSRATGT PDRFSGSGSGTD FTLT ISRLEPED FAVY YCOCYGSS	PM	YTEGOGTI	KLETK(2)
>p8	GTLSLSPGERATLSCRASOSVSSSYLAWYOOKPCOAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYOOQYGSS	VVYKK	YTFCQGT	KLEIK(2)
- >p9	GTL SLSP GERATLSC RASQ SVSS SYLAWYOO KPGO APRLLIYG ASSRATGI PDRF SGSG SGTD FTLT I SRLEPED FAVY YCOO YGSS		RGGT	KVEIK(4)
>p11	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSSQN	AT TVOP LW	YT FGQG TI	KLEIK(2)
>p12	GTLSLSPGERATLSCRASOSVSSSYLAWYOOKPGOAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCOOYGSSP	PM	YTFGQGT	KLEIK(2)
>p14	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSSP		FTFGPGT	KVDIK(3)
>p15	GTLSLSPGERATLSCRASQSVSS SYLAWYOUKPGAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCOUYGS GTLSLSPGERATLSCRASQSVSS SYLAWYOUKPGAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCOUYGS	LT DTIM	WT FGQGTI	KVEIK(1)
>p10	GILSISP GER TLASCRAGG VAS SYLAW WYO KYOG APRILITY ASSR ATG THER SOSG SOTTETITISELEPERTAVITOG TOSST	PIVE	TEGOGTI	KLEIK(2)
>p18	GTLSLSPGERATLSCRASSSYSSSYLAWYOOKPGOAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCOOYGSSP	PCARMHV	SFGPGT	KVDIK(3)
>p19	GTLSLSPGERATLSCRASO SVSS SYLAWYOO KPCOAPRLLIYGASSRATGI PDRF SGSG SGTD FTLT ISRLEPED FAVY YOO YGSS P		PTFGQGT	KVEIK(1)
>p20	GTL SLSP GERA TLSC RASO SVSS SYLAWYOO KPGO APRL LIYGASSR ATGI PDRF SGSG SGTD FTLT I SRLEPED FAVY YCOO YDSS	YRLTD	YTFGQGT	KLEIK(2)
>p21	GTLSLSPGERATLSCRASOSVSSSYLAWYOOKPGOAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCOOYGSS	LKG	RTFCQGT	KVEIK(1)
>p22	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSSP		HT FCQG TI	KLEIK(2)
>p23	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIVGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSS	GPDKPPM	YT FGQG TI	KLEIK(2)
>p2= >p2=	GILGESPERTISCHARGESTSSTERNUGARGARGERUNGERUNGEN UND SAGSSTERTISCHER SAGSTERTISCHER SAGSSTERTISCHER SAGSSTERTISCHER SAGSTERTISCHER SAGSSTERTISCHER SAGSSTERTISCHER SAGSSTERTISCHER SAGSSTERTISCHER SAGSSTERTISCHER SAGSSTERTISCHER SAGSSTERTISCHE	TVS	VSFODOTI	KVEIK(I)
>p20	GTLSLSPGERATLSCRASOSYSS SYLAWYOOKPGOAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCOOYGSSP	HAPPRT	WTFGOGT	KVEIK(1)
>p27	GTLSLSPGERATLSCRASQSVSSSYLDWYQQKPQQAPRLLIYGASSRATGIPDRFSGSGSGADFTLTISRLEPEDFAVYYCQQYGSS	L	YTFGQGT	KLEIK(2)
- >p28	GTL SLSP GERATLSC RASO SVSS SYLAWYOO KPGO APRLLIYG ASSRATGI PDRF SGSG SGTD FTLT I SRLEPED FAVY YCOO YGSS	SP	FGPGT	KVDIK(3)
>p29	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQY		VLCQGT	KVEIK(1)
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>p31	GTLSLSPGERATLSCRASOSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSS		YT FGQG TI	KLEIK(2)
>p32	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGS	PKS	GGT	KVEIK(4)
>p33	GTLSLSPGENATLSCHASQSVSSSYLAWYQXPPGAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYQQYGSS GTLSLSPGENATLSCHASQSVSSSYLAWYQXPGQAPRLLIYGASSRATGIPDRFSGSGSGTTFTLTISRLEPEDFAVYYQQYGSS	N D	TECOGTI	KVEIK(4)
>p35	GILGESFORM I LSCHARGEVESSTILLTUNGAFGAFELLTUNGSSRATUT PDF SGGGGGTD FTI TSELFEDTAVI I GUIGGS	1	TROOGT	KVEIK(I)
>p36	GTLSLSPGERATLSCRASSSYSSSYLAWYOOKPGOAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCOOYGSS	OGKAE	FGOGT	KVEIK(1)
>p37	GTLSLSPGERATLSCRASQ SVSS SYLAWYOOKPOOAPRLLIYGASSRATGIPDRFSGSG SGTDFTLTISRLEPEDFAVYYCOOYGSS P	-	FGQGT	KVEIK(1)
>p38	GTLSLSPGERATLSCRASOSVSSSYLAWYOOKPGOAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCOOYGSS		FGGGT	KVEIK(4)
>p39	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSSP	P	WT FGQG TI	KVEIK(1)
>p40	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSSP		FGGGT	KVEIK(4)
>p41	GTLSLSPGERATLSCRASQSVSSSYLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYQQQYGSS	ESKE	YT FGQG TI	KLEIK(2)
>p42	GTLSLSPGENATLSCHASQSVSSSYLAWTQKPGQAPKLLITGASSRATGIPDRESGSGSGTDFTLTISKLEPEDFAVYTQQTGSSP	PLWLF	PGQGTI	KLEIK(2)
>p45	OILSESFOERTESCRAQSVSSTERNIQKFOQRFREETORSSREIGTERESSSSSTETETESKEREPERVITOQTOSSF	IN .	1110001	KLEIK(2)
	TOWEGODD CLICK OTCODITET FOR A COLUMN TO A COLUMN TO A A CCLOCOTION FOR COLUMN TO A CCLOPER FOR COLUMN TO A CCLUPER FOR COLUMN TO A			
VK1-17	: Ignigspassakavobkviiitekkageikkblowiggkpakkkelitekaabgaavpaktaaaaatteiteitaisabgebbekiit	CLOHNSYP	N	Jk
VK1-17 >p1	ARCD IQMT QSPS SLAAS VOD KYTT TCRASQOT RIDLOW OUR POR ARKKLITAASS DISO YPSRTSOS GOT DET TTTS SLOPEDRATT ARCD IQMT QSPS SLAAS VOD KYTT TCRASQOT RIDLOW YQOK PG KAPKRLITAASS DISO YPSRTSOS GSGT EFTLTTISS LOPEDRATT	CLQHINS YF CLQHINS Y	E	Jk YTFGQGTKLEIK(2)
>p1 >p2	ARCD IQMT QSPS SLGASYOD RVTI TCRASQCI RNDLGMYQQKPGKAPKRLTHASS UQSOYPSRISOS GSGT ETLIISS UQPEDRATTY ARCD IQMT QSPS SLGASYOD RVTI TCRASQCI RNDLGMYQQKPGKAPKRLTY AASS UQSOYPSRISOS GSGT ETLIISS UQPEDRATTY ARCD IQMT QSPS SLGASYOD RVTI TCRASQCI RNDLGMYQQKPGKAPKRLIY AASS UQSOYPSRISOS GSGT ETLIISS UQPEDRATY	CLOHNSYP CLOHNSY CLOHNSYP	N E RAAGEP	Jk YTFGQGTKLEIK(2) FTFGPGTKVDIK(3)
>p1 >p2 >p3	ARCD IQHT QSPS SLGASYODRYT I TCRASOGI RKDLGWYQQKPGKAPKRLITAASS LQSOYPSRFSGSGSGT EFTLTISS LQPEDFAT YI ARCD IQHT QSPS SLGASYODRYT I TCRASOGI RKDLGWYQQKPGKAPKRLIY AASS LQSOYPSRFSGSGSGT EFTLTISS LQPEDFAT YI ARCD IQHT QSPS SLGASYODRYT I TCRASOGI RKDLGWYQQKPGKAPKRLIY AASS LQSOYPSRFSGSGSGT EFTLTISS LQPEDFAT YI ARCD IQHT QSPS SLGASYODRYT I TCRASOGI RKDLGWYQQKPGKAPKRLIY AASS LQSOYPSRFSGSGSGT EFTLTISS LQPEDFAT YI	CLOHNSYP CLOHNSY CLOHNSYP CLOHNSY	E RAAGFP TW	Jk YTFGQGTKLEIK(2) FTFGPGTKVDIK(3) TFGQGTKVEIK(1)
VK1-17 >p1 >p2 >p3 >p4	ARCD IQMIGSPS SLGASYODDRVT I TCRASQCI RNDLGMYQQKPCKAPKRLITAASS LQSGYPSRFSGSGSGTEFTLTISS LQPEDFATTY ARCD IQMIQSPS SLGASYODRVT I TCRASQCI RNDLGMYQQKPGKAPKRLIY AASS LQSGYPSRFSGSGSGTEFTLTISS LQPEDFATTY	CLOHNSYP CLOHNSY CLOHNSYP CLOHNSYP CLOHNSYP	E RAAGFP TW VIDGE	Jk YT FGQGTKLEIK(2) FT FGPGTKVDIK(3) T FGQGTKVEIK(1) YT FGQGTKLEIK(2)
>p1 >p2 >p3 >p4 >p5 >p6	ARCD IQHT QSPS SLGAS YOUR WTITCRASOCI RWDLGWYQ KPG KAPKRLIY AASS LOSGYPSR FSGS GSGT EFTLTISS LOPEDFATTY ARCD IQHT QSPS SLGAS YOUR WTITCRASOCI RWDLGWYQ QKPG KAPKRLIY AASS LOSGYPSR FSGS GSGT EFTLTISS LOPEDFATTY ARCD IQHT QSPS SLGAS YOUR WTITCRASOCI RWDLGWYQ QKPG KAPKRLIY AASS LOSGYPSR FSGS GSGT EFTLTISS LOPEDFATTY ARCD IQHT QSPS SLGAS YOUR WTITCRASOCI RWDLGWYQ QKPG KAPKRLIY AASS LOSGYPSR FSGS GSGT EFTLTISS LOPEDFATTY ARCD IQHT QSPS SLGAS YOUR WTITCRASOCI RWDLGWYQ QKPG KAPKRLIY AASS LOSGYPSR FSGS GSGT EFTLTISS LOPEDFATTY ARCD IQHT QSPS SLGAS YOUR WTITCRASOCI RWDLGWYQ QKPG KAPKRLIY AASS LOSGYPSR FSGS GSGT EFTLTISS LOPEDFATTY ARCD IQHT QSPS SLGAS YOUR WTITCRASOCI RWDLGWYQ QKPG KAPKRLIY AASS LOSGYPSR FSGS GSGT EFTLTISS LOPEDFATTY ARCD IQHT QSPS SLGAS YOUR WTITCRASOCI RWDLGWYQ QKPG KAPKRLIY AASS LOSGYPSR FSGS GSGT EFTLTISS LOPEDFATTY	CLOHNSY CLOHNSY CLOHNSY CLOHNSY CLOHNSY CLOHNSYP CLOHNSYP	E RAAGFP TW VIDGE HKSQ D	Jk YTFQQGTKLEIK(2) FTFGPGTKVDIK(3) TFQQGTKVEIK(1) YTFQQGTKLEIK(2) LTFGGGTKVEIK(4) FGPGTKVDIK(3)
VR1-17 >p1 >p2 >p3 >p4 >p5 >p6 >p7	ARCD IQHTQSPS SLGAS YOD RVTI TCRASQCI RKDL GWYQQKPCKAPKRLITAASS UQSO'PERISOS GOOT ETTLISS UQPEDRATTY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQCI RKDL GWYQQKPCKAPKRLIY AASS UQSO'PSRFSOS GSCTEFTLISS UQPEDRATY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQCI RKDL GWYQQKPCKAPKRLIY AASS UQSO'PSRFSOS GSCTEFTLISS UQPEDRATY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQCI RKDL GWYQQKPCKAPKRLIY AASS UQSO'PSRFSOS GSCTEFTLISS UQPEDRATY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQCI RKDL GWYQQKPCKAPKRLIY AASS UQSO'PSRFSOS GSCTEFTLISS UQPEDRATY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQCI RKDL GWYQQKPCKAPKRLIY AASS UQSO'PSRFSOS GSCTEFTLISS UQPEDRATY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQCI RKDL GWYQQKPCKAPKRLIY AASS UQSO'PSRFSOS GSCTEFTLISS UQPEDRATY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQCI RKDL GWYQQKPCKAPKRLIY AASS UQSO'PSRFSOS GSCTEFTLISS UQPEDRATY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQCI RKDL GWYQQKPCKAPKRLIY AASS UQSO'PSRFSOS GSCTEFTLISS UQPEDRATY	CLOHNSY CLOHNSY CLOHNSY CLOHNSY CLOHNSY CLOHNSYP CLOHNSY CLOHNS	P RAAGEP TW VIDGE HKSQ D PRPAPM	Jk YTFQQGTKLEIK(2) FTFGPGTKVDIK(3) TFGQGTKVEIK(1) YTFGQGTKLEIK(2) LTFGGGTKVEIK(4) FGPGTKVDIK(3) WTFGQGTKVEIK(1)
VR1-17 >p1 >p2 >p3 >p4 >p5 >p6 >p7 >p8	ARCD IQHT QSPS SLGAS YOD RVT I TCRASOCI RWDLGWYQ QKPCKAPKRLIY AASS LQSOYPSRFSOS GSGTEFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVT I TCRASOCI RWDLGWYQ QKPCKAPKRLIY AASS LQSOYPSRFSOS GSGTEFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVT I TCRASOCI RWDLGWYQ QKPCKAPKRLIY AASS LQSOYPSRFSOS GSGTEFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVT I TCRASOCI RWDLGWYQ QKPCKAPKRLIY AASS LQSOYPSRFSOS GSGTEFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVT I TCRASOCI RWDLGWYQ QKPCKAPKRLIY AASS LQSOYPSRFSOS GSGTEFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVT I TCRASOCI RWDLGWYQ QKPCKAPKRLIY AASS LQSOYPSRFSOS GSGTEFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVT I TCRASOCI RWDLGWYQ QKPCKAPKRLIY AASS LQSOYPSRFSOS GSGTEFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVT I TCRASOCI RWDLGWYQ QKPCKAPKRLIY AASS LQSOYPSRFSOS GSGTEFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVT I TCRASOCI RWDLGWYQ QKPCKAPKRLIY AASS LQSOYPSRFSOS GSGTEFTL TISS LQPEDFATYY	CLOHNSYP CLOHNSY CLOHNSYP CLOHNSYP CLOHNSYP CLOHNSYP CLOHNS CL	E RAAGFP TW VIDGE HKSQ D PRPAPM TVRG	Jk YTFGQGTKUEIK(2) FTFGGGTKVDIK(3) TFQQGTKVEIK(1) YTFGQGTKVEIK(4) LTFGGGTKVEIK(4) WTFCQGTKVEIK(1)
VK1-17 >p1 >p2 >p3 >p4 >p5 >p6 >p7 >p8 >p9	ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOD RVTI TCRA SOGI RNDL GMYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFATYY	CLQHNSYP CCLQHNSY CCLQHNSYP CCLQHNSYP CCLQHNSYP CCLQHNS CCL CCLQHNSYP CCLQHNSYP	E RAAGF P TW VIDGE HKSQ D PRPAPM TVRG RGFA	Jk TFGQGTKLEIK(2) FTFGGGTKVDIK(3) TFCQGTKVEIK(1) YTFGQGTKVEIK(2) LTFGGGTKVEIK(2) K(3) WTFCQGTKVEIK(1) PGTKVDIK(3)
VK1-17 >p1 >p2 >p3 >p4 >p5 >p6 >p7 >p8 >p9 >p10	ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YOD RVTI TCRASOGI RKDL GMYQQKPGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI ARCD IQHT QSPS SLGAS YGD RVTI TCRASOGI RKDL GMYQ GYFGKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFAT YI	CLQHNSYP CCLQHNSY CCLQHNSY CCLQHNSYP CCLQHNSYP CCLQHNSYP CCLQH CCLQH CCLQHNSYP CCLQHNSYP	E RAAGF P TW VIDGE HKSQ D PRPAPM TVRG RGFA I	Jk TFGQGTKLEIK(2) FTFGGGTKVDIK(3) TFGQGTKVEIK(1) YTFGQGTKVEIK(2) LTFGGGTKVEIK(4) FGPGTKVDIK(3) WTFGQGTKVEIK(1) PGFGTKVDIK(3)
VK1-17 >p1 >p2 >p3 >p4 >p5 >p6 >p7 >p8 >p9 >p10 >p11	ARCD IQHTQSPS SLGAS YOD RVTI TCRASOGI RKDLGWYQQKPGKAPKRLIYAASS LQSGYPSRFSGSGSGTEFTLTISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASOGI RKDLGWYQQKPGKAPKRLIYAASS LQSGYPSRFSGSGSGTEFTLTISS LQPEDFATYY	CLQHNSYP CCLQHNSYP CCLQHNSYP CCLQHNSYP CCLQHNSYP CCLQHNSYP CCLQHNSYP CCLQHNSYP CCLQHNSYP CCLQHNSYP CCLQHNSYP	PRAAGFP TW VIDGE HKSQ D PRPAPM TVRG RGFA I PPQP	Jk JK YTFQQGTKLEIK(2) FTFQGGTKVDIK(3) TFQQGTKVEIK(1) YTFQQGTKVEIK(2) LTFGGGTKVEIK(4) FGFGTKVDIK(3) NTFQQGTKVDIK(3) ITFCQGTRLEIK(5)
VK1-17 >p1 >p2 >p3 >p4 >p5 >p6 >p7 >p8 >p9 >p10 >p11 >p13 >p14 >p2	ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SQGI RNDL GMYQQKPCKAPKRLIY AASS LQSGYPSRFSGS GSGT EFTL TISS LQPED	CLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP	N E RAAGFP TW VIDGE HKSQ D PRPAPM TVRG RGFA I PPQP R R PROPDE	Jk TFCQGTKLEIK(2) FTFCPGTKVDIK(3) TFCQGTKVEIK(1) YTFCQGTKVEIK(2) LTFCGGTKVEIK(3) WTFCQGTKVEIK(1) WTFCQGTKVEIK(3) FGCTKVDIK(3) ITFCQGTRLEIK(5) YTFCQGTRLEIK(2) TFCQGTRLEIK(2)
VK1-17 >p1 >p2 >p3 >p4 >p5 >p6 >p7 >p8 >p9 >p10 >p11 >p13 >p14 >p1	ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFA TY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFAT YY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFAT YY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFAT YY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFAT YY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR FSGS GSGT EFTL TISS LQPEDFAT YY ARCD IQHT QSPS SLGAS YOOD RVT I TORA SOOT RWDL GWYQQKPGKAPKRLIY AASS LQSGYPSR F	CLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP CCLONNSYP	PRAAGFP TW VIDGE HKSQ D PRPAPM TVRG RGFA I PPQP R PSPRPL VDPF	Jk Jk TFGQGTKLEIK(2) FTFGGGTKVDIK(3) TFGQGTKVEIK(1) YTFGQGTKVEIK(2) LTFGGGTKVEIK(4) WTFGQGTKVEIK(1) WTFGQGTKVEIK(1) PGTKVDIK(3) TFGGGTKVEIK(3) YTFGQGTKLEIK(5) YTFGGGTKVDIK(3)
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vm:1 >p2 >p3 >p5 >p6 >p7 >p8 >p9 >p10 >p11 >p13 >p15 >p16 >p19 >p20 >p21 >p22 >p23 >p24 >p27 >p29	ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS UQSOYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS UQSOYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS UQSOYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS UQSOYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS UQSOYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS UQSOYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS UQSOYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS UQSOYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGYD RFSGS GSGT EFTL TISS LQPEDFATYY ARCD IQHTQSPS SLGAS YOD RVTI TCRASQGI RNDL GNYQQKPGKAPKRLIY AASS LQSGY	CCLONNS YF CCLONNS YF	E F RAAGFP TW VIDCE PRAPM TVRG RGFA PPQP R PSPPL VDPF PS PTR QLM IVTPGRS PSV PGVL PSV RDP RAAGLP RAGEA PGVL PGVL PGVL RDP RAAGLP	Jk Jk YT FGQGTKVE IK (2) FT FGPGTKVD IK (3) T FGQGTKVE IK (1) YT FGQGTKVE IK (2) LT FGGGTKVE IK (3) WT FGQGTKVE IK (1) WT FGQGTKVE IK (3) IT FGGGTKVE IK (3) IT FGGGTKVE IK (3) YT FGGGTKLE IK (2) GFGTKVD IK (3) YT FGGGTKLE IK (2) YT FGGGTKLE IK (2) T FGGGTKLE IK (3) YT FGGGTKLE IK (3) YT FGGGTKLE IK (3) YT FGGGTKLE IK (2) T FGGGTKLE IK
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vxt.1 >p1 >p2 >p3 >p5 >p6 >p7 >p8 >p9 >p10 >p13 >p16 >p19 >p20 >p21 >p24 >p25 >p26 >p27 >p28 >p20 >p21 >p22 >p23 >p24 >p25 >p26 >p27 >p29 >p20 >p21 >p22 >p23 >p31 >p34	ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY AASS LQSGYPSR FSGS GSGT EFT LTISS LQPEDFATYY ARCD IQHT GSPS SLGAS YOOD RVT I TORA SQGT RNDL GWYQQKPG KAPKRLIY A	CLOHNS YF CLOHNS	R AAGFP TW VIDCE VIDCE VIDCE VIDCE PRPAPM PRPAPM PPOP R PS PTR QLM VVDFF PS PTR QLM IVTPGRS PGVL PPOP RAAGLP RDP RAAGLP LEP RCIHHL LEP E LWSPL PCLLM E	Jk Jk YT FCQGTKVE IK (1) YT FCQGTKVE IK (1) YT FCQGTKVE IK (1) FCFGGTKVE IK (2) LT FCGGTKVE IK (2) WT FCQGTKVE IK (3) WT FCQGTKVE IK (1) PGTKVD IK (3) IT FCQGTKVE IK (1) YT FCQGTKLE IK (2) YT FCQGTKVE IK (1) YT FCQGTKLE IK (2) TFCQGTKLE IK (2) TFCQGTKLE IK (2) TFCQGTKLE IK (2) TFCQGTKLE IK (2) TFCQGTKLE IK (2) TFCQGTKLE IK (2) YT FCQGTKLE IK (2) YT FCQGTKLE IK (2) TFCQGTKLE IK (2) TFCQGTKLE IK (2) YT FCQGTKLE IK (2) TFCQGTKLE IK (2)
vm:1 vp:1 vp:2 vp:3 vp:5 vp:6 vp:7 vp:10 vp:11 vp:13 vp:14 vp:15 vp:16 vp:19 vp:22 vp:23 vp:24 vp:29 vp:30 vp:32 vp:33 vp:34 vp:35	ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RVTI TCRASQCI NDL GWYQQKPGKAPKRLIYAASS LQSOVPSRFSGS GSGT EFTLTISS LQPEDFATYY ARCD IQMTQSPS SLSASSYGD RV	CLOHNSYF CLOHNSYF	R AAGFP TW F NLSQ PRPAPM TVRG RGFA PPQP RF PS PTR QLM VDPF PS PTR QLM IVTPGRS PS PGVL PFQP RDP RAGLP RDP RAAGLP LUP E LUSPL PCIRLM E PCIRLM PL	Jk Jk YT FGQGTKLE IK (2) FT FGPGTKVD IK (3) T FGQGTKVE IK (1) YT FGQGTKVE IK (4) FGFGTKVD IK (3) WT FGQGTKVE IK (1) WT FGQGTKVE IK (1) PGTKVD IK (3) IT FGQGTKLE IK (2) YT FGQGTKLE IK (2) YT FGQGTKLE IK (2) YT FGQGTKLE IK (2) T FGGGTKVE IK (1) YT FGQGTKLE IK (2) T FGGGTKVE IK (1) IT FGGGTKLE IK (2) T FGGGTKLE IK (2) T FGGGTKLE IK (2) YT FGQGTKLE IK (2) YT FGGGTKLE
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Supplementary Fig. 1 I V(D)J sequencing. a, Graphical representation of a total of 3.95 million read pairs obtained from V(D)J sequencing displayed for each PCR product. Read pairs represent the number of paired end reads obtained from the sequencer. After merging (merged reads), the reads were selected based on the presence of the forward and reverse primer sequences which represent all rearrangements. The number of unique amino acid sequences after translating are depicted as unique rearrangements. These sequences were further filtered for the presence of the primer including 5 expected adjacent amino acids in the correct reading frame and the absence of stop codons to obtain potentially functional rearrangements. The isotype of the potentially functional rearrangements was determined by the presence of the protein tag SSKSTSGG (Cy1) or CSRSTSES (Cy4). In total, Cy4 switch variants are very rare, summing up to an average of 0,76% of all functional transgenic VH gene rearrangements found. b, Selection of the most prominent sequences of potentially functional rearrangements of the transgenic human lg genes found in the transgenic minipigs are shown as amino acid sequences. Rare Cy4 switch variants are also included. The sequence of the transgenic V genes is depicted (in blue) above rearranged sequences, indicating the position of the amino acids corresponding to N(D)N, J and C regions. Where identified, D gene segments are underlined and named right to the sequence. The numbers in parenthesis in VH and Vk sequences indicate the corresponding J element used. Amino acid variants resulting from point mutations are shown in red. The Cy4 region of switch variants is in brown colour. Same V gene sequences of Cy4 switch variants are also often associated with Cy1.



Supplementary Fig. 2 I Sequence and structural mapping of the different interactions of PD-L1 epitope amino acid side-chains with atezolizumab paratope residues. a, Sequence alignment of PD-L1 orthologs, human, mouse, and pig. Epitope residues are marked with a C (contact residues); an amino acid 1-letter code is marked in red when the contact is occurring exclusively via the side-chain atoms (amino acids with backbone contact only are kept in black). b-f, Molecular models of PD-L1 interaction with atezolizumab. Fourteen interacting side-chains show their contact with paratope residues. The corresponding residue position of PD-L1 interacting with atezolizumab is depicted for human (Hu) mouse (Mu) and pig (Pig) amino acids. Pig PD-L1 residues are indicated in the ball and stick mode (orange carbon atoms) and atezolizumab residues are represented in sticks (grey carbon atoms for the heavy variable region and cyan carbon atoms for the light variable region). PD-L1 and atezolizumab VH and VL are numbered consecutively starting from the first N-terminal residue.

Supplementary Table. 1 | List of Ab compounds.

Compound tested	Specificity	Clinical immunogenicity	Immunogenicity in hulgG1 tg mouse model*	Cross-reactivity mouse / pig
bevacizumab (Avastin)	VEGF	0,63 %	0/10 (8/10)	no ⁴¹ / yes ⁴²
daratumumab (Darzalex)	CD38	0 %	0/10 (4/10)	no / no
atezolizumab (Tecentriq)	PD-L1	30 %	10/10 (10/10)	yes / yes
cergutuzumab amunaleukin	CEA / IL2R	79 %	7/10 (7/10)20	yes (IL2R) / yes (IL2R)

*Given as the number of ADA-positive mice of 10 mice immunised in each group. Corresponding numbers for wild type mice are in parenthesis. Unpublished data, manuscript in preparation.

Supplementary Table. 2 I List of primers.

PCR amplification target	Primer name	Sequence 5'->3'
IGH-γ1-γ4 (transgene presence)	IGH_F	CTGTCCTACAGTCCTCAGGAC
	IGH_R	GTGGCACTCATTTACCCGGAG
IGK (transgene presence)	IGK_F	TTGTGTGCCTGCTGAAT
	IGK_R	GCCGCGTGTGAGTAGGTATA
BS (transgene presence)	BS_F	ATGGCCAAGCCTTTGTCTC
	BS_R	GGCGAAGAACTCCAGCATGA
IGH-γ1-γ4 (ddPCR)	dIGH_F	CACCCAGTGCGAGACGAC
	dIGH_R	CTCCTCCTCCCTCGCTCT
IGK (ddPCR)	dIGK_F	GCTATGTAGAAGAGGCAGCT
	dIGK_R	ACCACCTTTCCACCATTACAA
GAPDH (ddPCR)	ddGAPDH_F	CTCAACGACCACTTCGTCAA
	ddGAPDH_R	CCCTGTTGCTGTAGCCAAAT
First VH PCR (RNA sequencing)	Vh1-69_L	TGGCAGCAGCTACAGGTGTC
	Vh4-59_L	GCTCCCAGATGGGTCCTGT
	Vh3-30_L	CGTTGCTCTTTTAAGAGGTGTCC
	Vh3-23_L	GCTATTTTAAAAGGTGTCCAGTGTG
	Vh1-18_L	CAGCAACAGGTGCCCACT
	Cg1_4-rev_long	GGTGTTGCTGGGCTTGTG
Nested VH CR (RNA sequencing)	VH1-18_A	ATGGTATCAGCTGGGTGCGAC
	VH1-69_A	AGGCACCTTCAGCAGCTATGC
	VH3-23/30_A	GCAGACTCCGTGAAGGGCCG
	VH4-59_A	AAGGGACTGGAGTGGATTGGG
	Cg1_4-PCR_A	AGTAGTCCTTGACCAGGCAGC
VK PCR (RNA sequencing)	Vk1-17_A	GCCAGGTGTGACATCCAGATG
	Vk3-20_A	AGGCACCCTGTCTTTGTCTCC
	Ck-PCR_A	CAGATGGTGCAGCCACAGTTC