Cross-protective immunity following coronavirus vaccination and coronavirus infection

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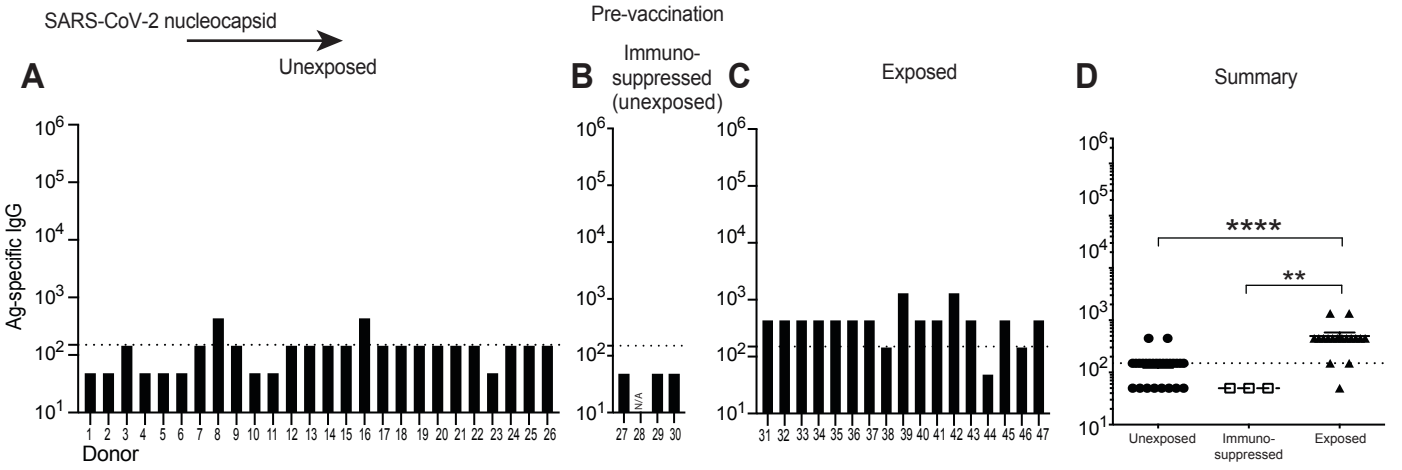
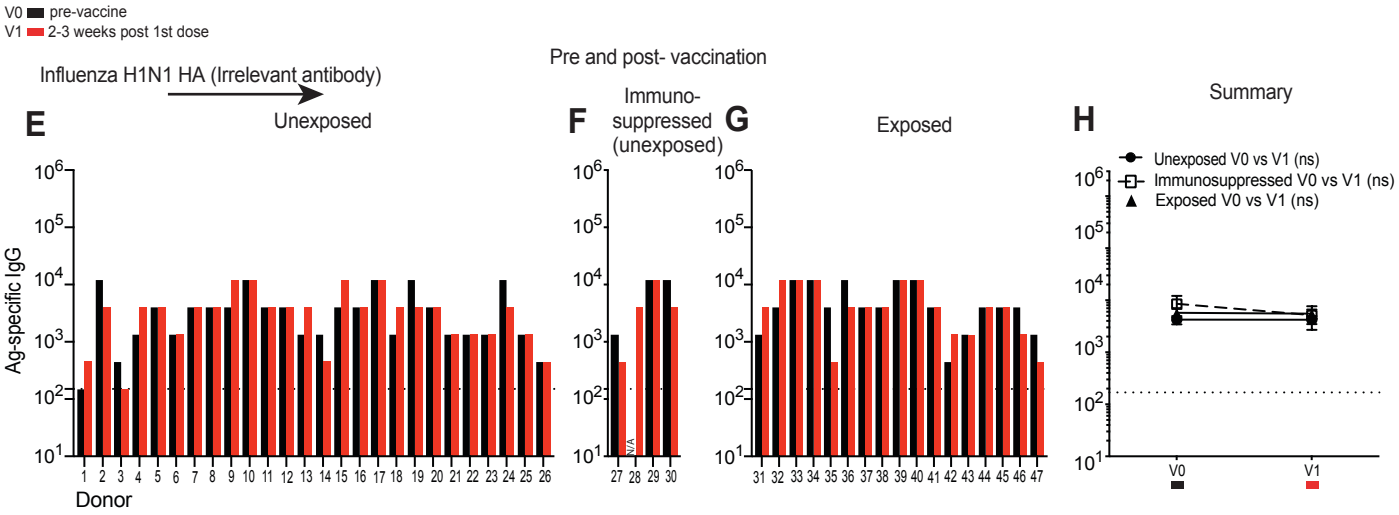
Supplemental Figure Legends:

Supplemental Figure 1. Serology screening in humans prior to vaccination and unrelated cross-reactive antibodies post vaccination. SARS-CoV-2 nucleocapsid specific antibody titers prior to vaccination in **(A)** unexposed, (**B**) unexposed immunosuppressed, and (**C)** exposed participants. (**D**) Summary of nucleocapsid specific antibody responses. Influenza virus H1N1 HA specific antibodies pre (V0) and post (V1) vaccination in (**E**) unexposed, (**F**) unexposed immunosuppressed, and (**G**) exposed participants. **(H)** Summary of Influenza virus H1N1 HA specific antibodies for V0 and V1. **, P <0.01, **** P <0.0001, and ns=not significant by one way ANOVA with multiple comparisons in panel D and by paired student t test V0 vs V1 within each cohort (unexposed, immunosuppressed, and exposed) in panel H. Dashed lines represent LOD. D-H, error bars represent SEM.

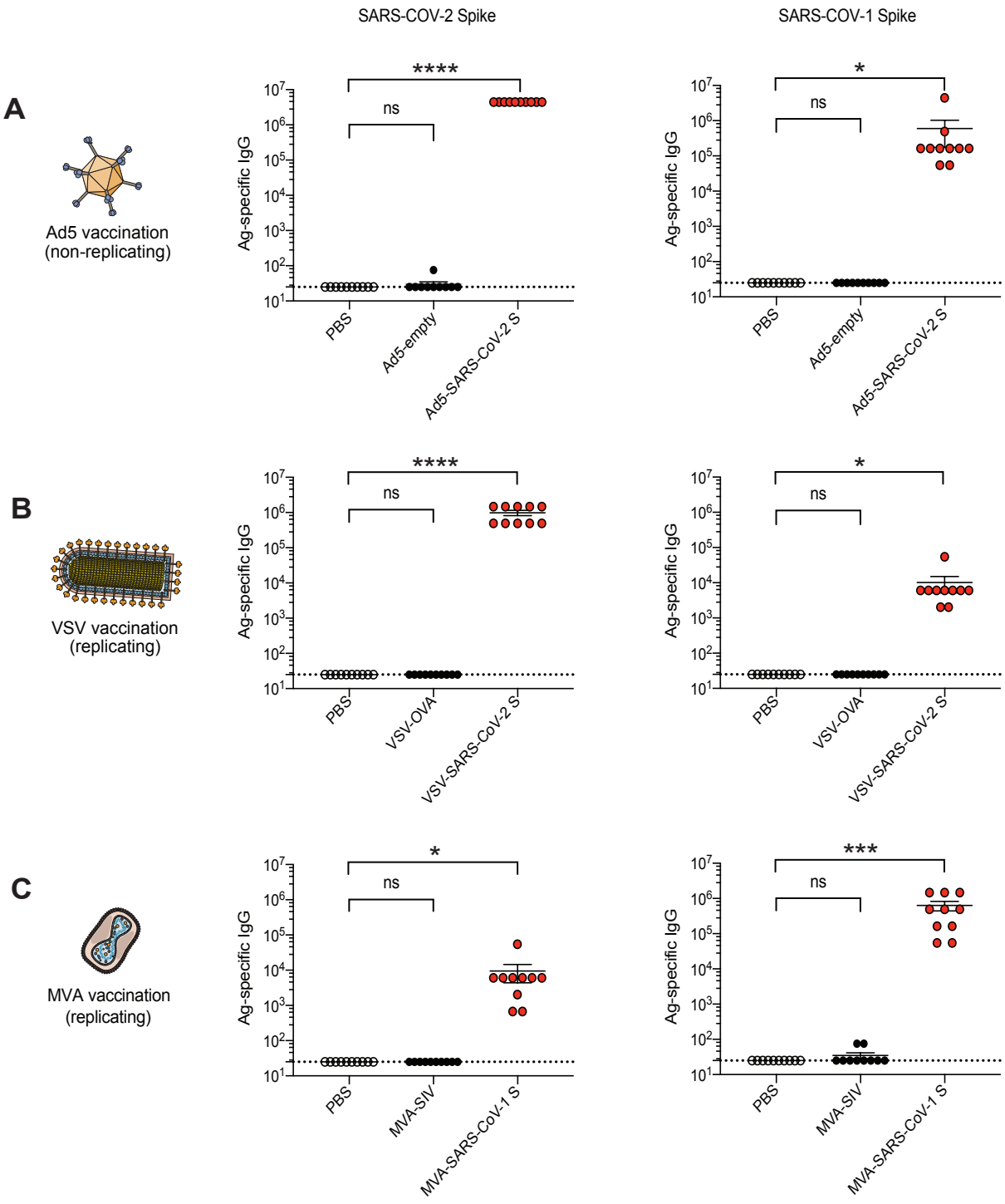
Fig. S1


SARS-CoV-2 nucleocapsid
Unexposed
Pre-vaccination
A
B
Immuno-suppressed (unexposed)
C
Exposed
D
Summary
Ag-specific IgG
Donor
N/A
****
**
Unexposed
Immuno-suppressed
Exposed


V0 pre-vaccine
V1 2-3 weeks post 1st dose
Influenza H1N1 HA (Irrelevant antibody)
Unexposed
Pre and post- vaccination
E
F
Immuno-suppressed (unexposed)
G
Exposed
H
Summary
Unexposed V0 vs V1 (ns)
Immunosuppressed V0 vs V1 (ns)
Exposed V0 vs V1 (ns)
Ag-specific IgG
Donor
N/A
V0
V1

Supplemental Figure 2. SARS-CoV-1 and SARS-CoV-2 spike specific antibody responses in mice immunized with irrelevant vaccine vectors. (A) Antibody responses after immunization with PBS, Ad5-empty or Ad5-SARS-CoV-2 spike. **(B)** Antibody responses after immunization with PBS, VSV-Ova or VSV-SARS-CoV-2 spike. **(C)** Antibody responses after immunization with PBS, MVA-SIV or MVA-SARS-CoV-1 spike. Data are from two independent experiments with n=5/group. Data from all experiments are shown. *, P <0.05, ***, P <0.001, and ****, P <0.0001, and ns=not significant by Mann Whitney U Test. Dashed lines represent LOD. Error bars represent SEM.

Fig. S2


SARS-COV-2 Spike
SARS-COV-1 Spike
A
Ad5 vaccination
(non-replicating)
B
VSV vaccination
(replicating)
C
MVA vaccination
(replicating)
Ag-specific IgG
ns
****
*
***
PBS
Ad5-empty
Ad5-SARS-CoV-2 S
VSV-OVA
VSV-SARS-CoV-2 S
MVA-SIV
MVA-SARS-CoV-1 S

Supplemental Figure 3. Gene alignment of conserved epitopes across various bat coronaviruses. (**A**) Clustal Omega Multiple Sequence Alignment of SARS-CoV-1, SARS-CoV-2, and other betacoronaviruses, showing conservation of the VVLSFELL and VNFNFNGL epitopes. (**B**) Phylogenetic tree showing the genetic distance between 2 different coronavirus subgenera: sarbecoviruses and embecoviruses.

Fig. S3

A

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Bat_coronavirus_BM48-31/BGR/2008        SNVLFNPSGGTCSA-EGLNCYKPLASYGFTQSSGIGFQPYRVVVLSFELLNAPATVCGPK  515
SARS-CoV-2                              STEIYQAGSTPCNGVEGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPK  528
Bat_CoV_RatG13                          STEIYQAGSKPCNGQTGLNCYYPLYRYGFYPTDGVGHQPYRVVVLSFELLNAPATVCGPK  537
Bat_SARS-like_coronavirus_RsSHC014      SNDIYSPGGQSCSA-VGPNCYNPLRPYGFFTTAGVGHQPYRVVVLSFELLNAPATVCGPK  515
Bat_SARS-like_coronavirus_WIV1          SNVPFSPDGKPCTP-PAFNCYWPLNDYGFYITNGIGYQPYRVVVLSFELLNAPATVCGPK  515
Bat_SARS-like_coronavirus_Rs3367        SNVPFSPDGKPCTP-PAFNCYWPLNDYGFYITNGIGYQPYRVVVLSFELLNAPATVCGPK  515
Coronavirus_BtRs-BetaCoV/YN2018B        SNVPFSPDGKPCTP-PAFNCYWPLNDYGFFTTNGIGYQPYRVVVLSFELLNAPATVCGPK  515
SARS-CoV-1                              SNVPFSPDGKPCTP-PALNCYWPLNDYGFYTTTGIGYQPYRVVVLSFELLNAPATVCGPK  514
SARS-like_coronavirus_WIV16             SNVPFSPDGKPCTP-PAFNCYWPLNDYGFYITNGIGYQPYRVVVLSFELLNAPATVCGPK  514
Coronavirus_BtRI-BetaCoV/SC2018         SSDDG-------------NGVYTLSTYDFNPNVPVAYQATRVVVLSFELLNAPATVCGPK  500
Bat_coronavirus_Rp/Shaanxi2011          SSD-E-------------NGVYTLSTYDFYPSVPLDYQATRVVVLSFELLNAPATVCGPK  499
BtRs-BetaCoV/HuB2013                    SSDDG-------------NGVYTLSTYDFNPNVPVAYQATRVVVLSFELLNAPATVCGPK  500
Bat_coronavirus_Cp/Yunnan2011           SSD-E-------------NGVRTLSTYDFYPSVPLEYQATRVVVLSFELLNAPATVCGPK  500
Bat_SARS_CoV_Rm1/2004                   SSD-E-------------NGVYTLSTYDFYPSIPVEYQATRVVVLSFELLNAPATVCGPK  500
Bat_SARS                                SSDDG-------------NGVYTLSTYDFNPNVPVAYQATRVVVLSFELLNAPATVCGPK  501
BtRs-BetaCoV/GX2013                     SSDDG-------------NGVYTLSTYDFNPNVPVAYQATRVVVLSFELLNAPATVCGPK  501
                                        *.                *    *  *.*  .  : .*  **********:*********

Bat_coronavirus_BM48-31/BGR/2008        QSTELVKNKCVNFNFNGLTGTGVLTNSTKKFQPFQQFGRDVSDFTDSVRDPKTLEILDIA  575
SARS-CoV-2                              KSTNLVKNKCVNFNFNGLTGTGVLTESNKKFLPFQQFGRDIADTTDAVRDPQTLEILDIT  588
Bat_CoV_RatG13                          KSTNLVKNKCVNFNFNGLTGTGVLTESNKKFLPFQQFGRDIADTTDAVRDPQTLEILDIT  597
Bat_SARS-like_coronavirus_RsSHC014      LSTDLIKNQCVNFNFNGLTGTGVLTPSSKRFQPFQQFGRDVSDFTDSVRDPKTSEILDIS  575
Bat_SARS-like_coronavirus_WIV1          LSTDLIKNQCVNFNFNGLTGTGVLTPSSKRFQPFQQFGRDVSDFTDSVRDPKTSEILDIS  575
Bat_SARS-like_coronavirus_Rs3367        LSTDLIKNQCVNFNFNGLTGTGVLTPSSKRFQPFQQFGRDVSDFTDSVRDPKTSEILDIS  575
Coronavirus_BtRs-BetaCoV/YN2018B        LSTDLIKNQCVNFNFNGLTGTGVLTPSSKRFQPFQQFGRDVSDFTDSVRDPKTSEILDIS  575
SARS-CoV-1                              LSTDLIKNQCVNFNFNGLTGTGVLTPSSKRFQPFQQFGRDVSDFTDSVRDPKTSEILDIS  574
SARS-like_coronavirus_WIV16             LSTDLIKNQCVNFNFNGLTGTGVLTPSSKRFQPFQQFGRDVLDFTDSVRDPKTSEILDIS  574
Coronavirus_BtRI-BetaCoV/SC2018         LSTQLVKNQCVNFNFNGLTGTGVLTPSSKRFQPFQQFGRDVSDFTDSVRDPKTSEILDIS  560
Bat_coronavirus_Rp/Shaanxi2011          LSTTLVKNQCVNFNFNGLKGTGVLTASSKKFQSFQQFGRDASDFTDSVRDPQTLEILDIS  559
BtRs-BetaCoV/HuB2013                    LSTELVKNQCVNFNFNGLKGTGVLTKSSKRFQSFQQFGRDTSDFTDSVRDPQTLEILDIS  560
Bat_coronavirus_Cp/Yunnan2011           LSTSLIKNQCVNFNFNGLKGTGVLTDSSKKFQSFQQFGRDASDFTDSVRDPQTLQILDIS  560
Bat_SARS_CoV_Rm1/2004                   LSTQLVKNQCVNFNFNGLRGTGVLTTSSKRFQSFQQFGRDTSDFTDSVRDPQTLEILDIS  560
Bat_SARS                                LSTQLVKNQCVNFNFNGLKGTGVLTPSSKRFQSFQQFGRDTSDFTDSVRDPQTLEILDIS  561
BtRs-BetaCoV/GX2013                     LSTQLVKNQCVNFNFNGLKGTGVLTPSLKRFQSFQQFGRDTSDFTDSVRDPQTLEILDIS  561
                                         ** *:**:********* ****** * *:*  *******  * **:****:* :****:

SARS-CoV-2      VVLSFELLHA--PATVCG---PKKSTNLVKNKCVNFNFNGLTGTGVLTESNKKFL-PFQQ 564
OC43            NIFANFILHDVNSGLTCSTDLQKANTDIILGVCVNYDLYGILGQGIFVEVNATYYNSWQN 648
MHV-1           HIFSNLLLNGINSGTTCSTDLQLPNTEVVTGVCVKYHLFGITGQGVFKEVKADYYHSWQN 648
MHV-A59         QIFANILLNGINSGTTCSTDLQLPNTEVVTGICVKYDLYGITGQGVFKEVKADYYNSWQT 607
                 :::  :*:   . .*.     .*::: . **::.: *: * *:: * :  :   :*
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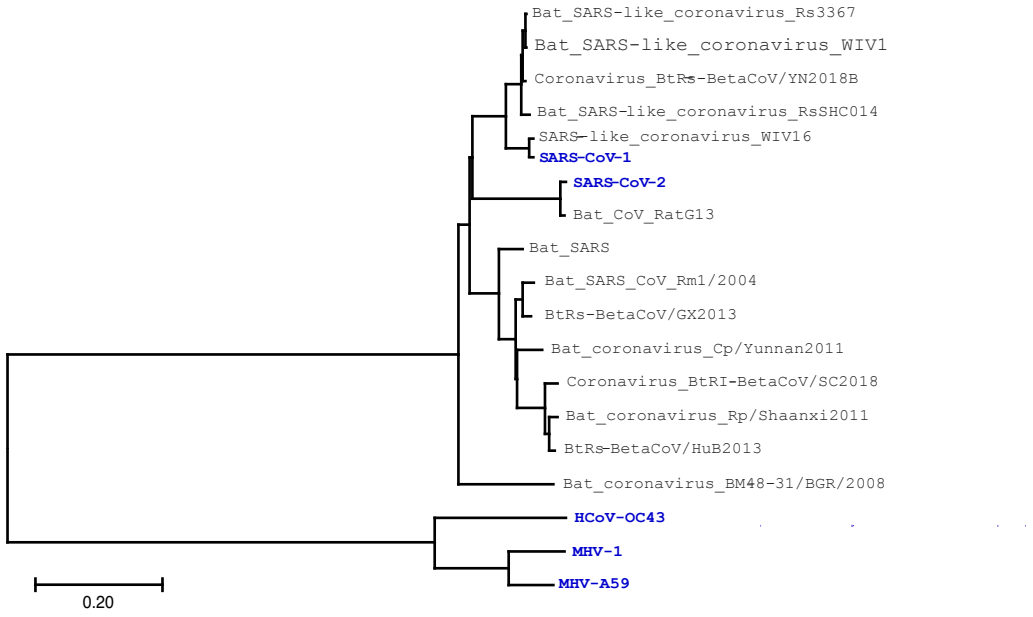
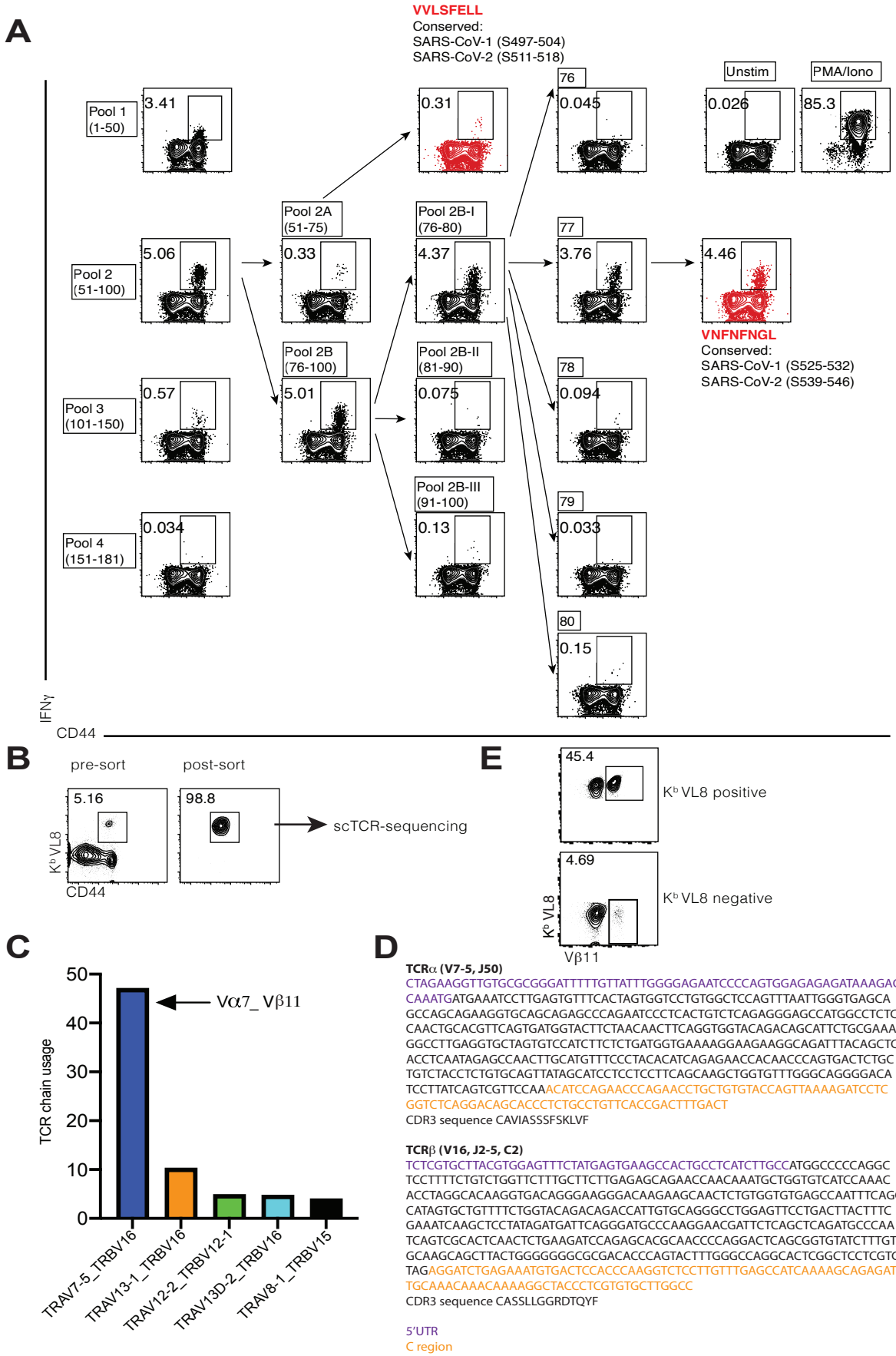
B



Supplemental Figure 4. Mapping of conserved CD8 T cell epitopes following SARS-CoV-2 vaccination. (**A**) Epitope mapping using Ad5-SARS-CoV-2 spike immune splenocytes (week 2 post-boost), stimulated with overlapping SARS-CoV-2 spike peptide pools for 5 hr at 37°C in a CO_2 incubator. This study identified 2 potential K^b binding epitopes that are highly conserved among multiple sarbecoviruses listed in Figure S3A: a subdominant VVLSFELL epitope and a dominant VNFNFNGL epitope. Cells are gated on live CD8+ lymphocytes. (**B**) K^b VNFNFNGL (K^b VL8) tetramer+ CD8 T cells were FACS-sorted for TCR-sequencing (week 4 post-prime). (**C**) Top 5 TCR usages (percent of total VL8-specific). (**D**) TCR sequences in VL8-specific CD8 T cells. (**E**) TCR Vβ11 frequency in K^b VL8+ or K^b VL8- CD8 T cells by confirmatory flow cytometry. Data from panel A represent a pooled sample from 5 spleens. Single-cell TCR-seq data from panels B-D are from 2,032 individual cells from 1 mouse spleen. Experiment was repeated with 2431 individual cells from 1 mouse spleen and similar results were observed (see accession data in Methods). FACS data from panel E are representative from one experiment with n=5 mice (experiment was repeated once with n=5 mice, with similar results).

Fig. S4

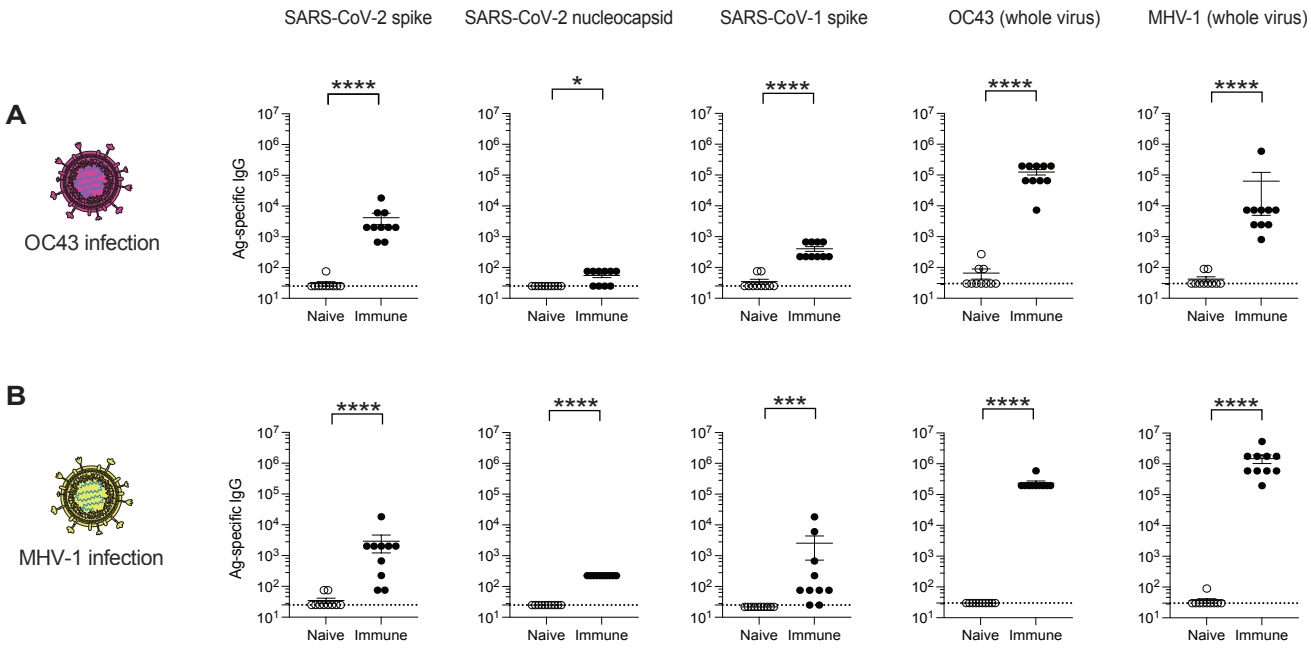

A
VVLSFELL
Conserved:
SARS-CoV-1 (S497-504)
SARS-CoV-2 (S511-518)
Unstim
PMA/Iono
Pool 1 (1-50)
3.41
0.31
76
0.045
0.026
85.3
Pool 2A (51-75)
Pool 2B-I (76-80)
Pool 2 (51-100)
5.06
0.33
4.37
77
3.76
4.46
VNFNFNGL
Conserved:
SARS-CoV-1 (S525-532)
SARS-CoV-2 (S539-546)
Pool 2B (76-100)
Pool 2B-II (81-90)
Pool 3 (101-150)
0.57
5.01
0.075
78
0.094
Pool 2B-III (91-100)
Pool 4 (151-181)
0.034
0.13
79
0.033
80
0.15
IFNγ
CD44
B
pre-sort
post-sort
5.16
98.8
scTCR-sequencing
Kᵇ VL8
CD44
E
45.4
Kᵇ VL8 positive
4.69
Kᵇ VL8 negative
Kᵇ VL8
Vβ11
C
TCR chain usage
50
40
30
20
10
0
Vα7_ Vβ11
TRAV7-5_TRBV16
TRAV13-1_TRBV16
TRAV12-2_TRBV12-1
TRAV13D-2_TRBV16
TRAV8-1_TRBV15
D
TCRα (V7-5, J50)
CTAGAAGGTTGTGCGCGGGATTTTTGTTATTTGGGGAGAATCCCCAGTGGAGAGAGATAAAGAG
CAAATGATGAAATCCTTGAGTGTTTCACTAGTGGTCCTGTGGCTCCAGTTTAATTGGGTGAGCA
GCCAGCAGAAGGTGCAGCAGAGCCCAGAATCCCTCACTGTCTCAGAGGGAGCCATGGCCTCTCT
CAACTGCACGTTCAGTGATGGTACTTCTAACAACTTCAGGTGGTACAGACAGCATTCTGCGAAA
GGCCTTGAGGTGCTAGTGTCCATCTTCTCTGATGGTGAAAAGGAAGAAGGCAGATTTACAGCTC
ACCTCAATAGAGCCAACTTGCATGTTTCCCTACACATCAGAGAACCACAACCCAGTGACTCTGC
TGTCTACCTCTGTGCAGTTATAGCATCCTCCTCCTTCAGCAAGCTGGTGTTTGGGCAGGGGACA
TCCTTATCAGTCGTTCCAAACATCCAGAACCCAGAACCTGCTGTGTACCAGTTAAAAGATCCTC
GGTCTCAGGACAGCACCCTCTGCCTGTTCACCGACTTTGACT
CDR3 sequence CAVIASSSFSKLVF

TCRβ (V16, J2-5, C2)
TCTCGTGCTTACGTGGAGTTTCTATGAGTGAAGCCACTGCCTCATCTTGCCATGGCCCCCAGGC
TCCTTTTCTGTCTGGTTCTTTGCTTCTTGAGAGCAGAACCAACAAATGCTGGTGTCATCCAAAC
ACCTAGGCACAAGGTGACAGGGAAGGGACAAGAAGCAACTCTGTGGTGTGAGCCAATTTCAGGA
CATAGTGCTGTTTTCTGGTACAGACAGACCATTGTGCAGGGCCTGGAGTTCCTGACTTACTTTC
GAAATCAAGCTCCTATAGATGATTCAGGGATGCCCAAGGAACGATTCTCAGCTCAGATGCCCAA
TCAGTCGCACTCAACTCTGAAGATCCAGAGCACGCAACCCCAGGACTCAGCGGTGTATCTTTGT
GCAAGCAGCTTACTGGGGGGGCGCGACACCCAGTACTTTGGGCCAGGCACTCGGCTCCTCGTGT
TAGAGGATCTGAGAAATGTGACTCCACCCAAGGTCTCCTTGTTTGAGCCATCAAAAGCAGAGAT
TGCAAACAAACAAAAGGCTACCCTCGTGTGCTTGGCC
CDR3 sequence CASSLLGGRDTQYF

5'UTR
C region

Supplemental Figure 5. Cross-reactive antibody responses following coronavirus infections in mice. (**A**) Antibody responses after infection with OC43 common cold coronavirus. (**B**) Antibody responses after infection with MHV-1 coronavirus. Mice were intranasally primed and boosted after 3 weeks (see Methods for virus dose information). Antibody responses were evaluated by ELISA at week 2 post-boost. Experiments were done using wild type C57BL/6 mice. Dashed lines represent LOD. Data are from two independent experiments with n=5/group. Data from all experiments are shown. *, $P < 0.05$, ***, $P < 0.001$, and ****, $P < 0.0001$ by Mann Whitney U Test. Error bars represent SEM.

Fig. S5


SARS-CoV-2 spike
SARS-CoV-2 nucleocapsid
SARS-CoV-1 spike
OC43 (whole virus)
MHV-1 (whole virus)
A
OC43 infection
B
MHV-1 infection
Ag-specific IgG
Naive
Immune
****
*
***

Supplemental Table Legends:

Supplemental Table 1. SARS-CoV-2 spike overlapping peptide pools spanning 1273 amino acids. Each individual peptide consisted of 13-17 amino acids, with 10 amino acid overlaps.

SARS-CoV-2 overlapping peptide pools		
Peptide pools	**Peptide**	**Sequence**
Pool 1 (1-50)	**1**	1-MFVFLVLLPLVSSQCVN-17
	2	8-LPLVSSQCVNLTTRTQL-24
	3	15-CVNLTTRTQLPPAYTNS-31
	4	22-TQLPPAYTNSFTRGVYY-38
	5	29-TNSFTRGVYYPDKVFRS-45
	6	36-VYYPDKVFRSSVLHSTQ-52
	7	43-FRSSVLHSTQDLFLPFF-59
	8	50-STQDLFLPFFSNVTWFH-66
	9	57-PFFSNVTWFHAIHVSGT-73
	10	64-WFHAIHVSGTNGTKRFD-80
	11	71-SGTNGTKRFDNPVLPFN-87
	12	78-RFDNPVLPFNDGVYFAS-94
	13	85-PFNDGVYFASTEKSNII-101
	14	92-FASTEKSNIIRGWIFGT-108
	15	99-NIIRGWIFGTTLDSKTQ-115
	16	106-FGTTLDSKTQSLLIVNN-122
	17	113-KTQSLLIVNNATNVVIK-129
	18	120-VNNATNVVIKVCEFQFC-136
	19	127-VIKVCEFQFCNDPFLGV-143
	20	134-QFCNDPFLGVYYHKNNK-150
	21	141-LGVYYHKNNKSWMESEF-157
	22	148-NNKSWMESEFRVYSSAN-164
	23	155-SEFRVYSSANNCTFEYV-171
	24	162-SANNCTFEYVSQPFLMD-178
	25	169-EYVSQPFLMDLEGKQGN-185
	26	176-LMDLEGKQGNFKNLREF-192
	27	183-QGNFKNLREFVFKNIDG-199
	28	190-REFVFKNIDGYFKIYSK-206
	29	197-IDGYFKIYSKHTPINLV-213
	30	204-YSKHTPINLVRDLPQGF-220
	31	211-NLVRDLPQGFSALEPLV-227
	32	218-QGFSALEPLVDLPIGIN-234
	33	225-PLVDLPIGINITRFQTL-241
	34	232-GINITRFQTLLALHRSY-248
	35	239-QTLLALHRSYLTPGDSS-255
	36	246-RSYLTPGDSSSGWTAGA-262
	37	253-DSSSGWTAGAAAYYVGY-269
	38	260-AGAAAYYVGYLQPRTFL-276
	39	267-VGYLQPRTFLLKYNENG-283
	40	274-TFLLKYNENGTITDAVD-290

	41	281-ENGTITDAVDCALDPLS-297
	42	288-AVDCALDPLSETKCTLK-304
	43	295-PLSETKCTLKSFTVEKG-311
	44	302-TLKSFTVEKGIYQTSNF-318
	45	309-EKGIYQTSNFRVQPTES-325
	46	316-SNFRVQPTESIVRFPNI-332
	47	323-TESIVRFPNITNLCPFG-339
	48	330-PNITNLCPFGEVFNATR-346
	49	337-PFGEVFNATRFASVYAW-353
	50	344-ATRFASVYAWNRKRISN-360
Pool 2 (51-100)	**51**	351-YAWNRKRISNCVADYSV-367
	52	358-ISNCVADYSVLYNSASF-374
	53	365-YSVLYNSASFSTFKCYG-381
	54	372-ASFSTFKCYGVSPTKLN-388
	55	379-CYGVSPTKLNDLCFTNV-395
	56	386-KLNDLCFTNVYADSFVI-402
	57	393-TNVYADSFVIRGDEVRQ-409
	58	400-FVIRGDEVRQIAPGQTG-416
	59	407-VRQIAPGQTGKIADYNY-423
	60	414-QTGKIADYNYKLPDDFT-430
	61	421-YNYKLPDDFTGCVIAWN-437
	62	428-DFTGCVIAWNSNNLDSK-444
	63	435-AWNSNNLDSKVGGNYNY-451
	64	442-DSKVGGNYNYLYRLFRK-458
	65	449-YNYLYRLFRKSNLKPFE-465
	66	456-FRKSNLKPFERDISTEI-472
	67	463-PFERDISTEIYQAGSTP-479
	68	470-TEIYQAGSTPCNGVEGF-486
	69	477-STPCNGVEGFNCYFPLQ-493
	70	484-EGFNCYFPLQSYGFQPT-500
	71	491-PLQSYGFQPTNGVGYQP-507
	72	498-QPTNGVGYQPYRVVVLS-514
	73	505-YQPYRVVVLSFELLHAP-521
	74	512-VLSFELLHAPATVCGPK-528
	75	519-HAPATVCGPKKSTNLVK-535
	76	526-GPKKSTNLVKNKCVNFN-542
	77	533-LVKNKCVNFNFNGLTGT-549
	78	540-NFNFNGLTGTGVLTESN-556
	79	547-TGTGVLTESNKKFLPFQ-563
	80	554-ESNKKFLPFQQFGRDIA-570
	81	561-PFQQFGRDIADTTDAVR-577
	82	568-DIADTTDAVRDPQTLEI-584
	83	575-AVRDPQTLEILDITPCS-591

	84	582-LEILDITPCSFGGVSVI-598
	85	589-PCSFGGVSVITPGTNTS-605
	86	596-SVITPGTNTSNQVAVLY-612
	87	603-NTSNQVAVLYQDVNCTE-619
	88	610-VLYQDVNCTEVPVAIHA-626
	89	617-CTEVPVAIHADQLTPTW-633
	90	624-IHADQLTPTWRVYSTGS-640
	91	631-PTWRVYSTGSNVFQTRA-647
	92	638-TGSNVFQTRAGCLIGAE-654
	93	645-TRAGCLIGAEHVNNSYE-661
	94	652-GAEHVNNSYECDIPIGA-668
	95	659-SYECDIPIGAGICASYQ-675
	96	666-IGAGICASYQTQTNSPR-682
	97	673-SYQTQTNSPRRARSVAS-689
	98	680-SPRRARSVASQSIIAYT-696
	99	687-VASQSIIAYTMSLGAEN-703
	100	694-AYTMSLGAENSVAYSNN-710
Pool 3 (101-150)	**101**	701-AENSVAYSNNSIAIPTN-717
	102	708-SNNSIAIPTNFTISVTT-724
	103	715-PTNFTISVTTEILPVSM-731
	104	722-VTTEILPVSMTKTSVDC-738
	105	729-VSMTKTSVDCTMYICGD-745
	106	736-VDCTMYICGDSTECSNL-752
	107	743-CGDSTECSNLLLQYGSF-759
	108	750-SNLLLQYGSFCTQLNRA-766
	109	757-GSFCTQLNRALTGIAVE-773
	110	764-NRALTGIAVEQDKNTQE-780
	111	771-AVEQDKNTQEVFAQVKQ-787
	112	778-TQEVFAQVKQIYKTPPI-794
	113	785-VKQIYKTPPIKDFGGFN-801
	114	792-PPIKDFGGFNFSQILPD-808
	115	799-GFNFSQILPDPSKPSKR-815
	116	806-LPDPSKPSKRSFIEDLL-822
	117	813-SKRSFIEDLLFNKVTLA-829
	118	820-DLLFNKVTLADAGFIKQ-836
	119	827-TLADAGFIKQYGDCLGD-843
	120	834-IKQYGDCLGDIAARDLI-850
	121	841-LGDIAARDLICAQKFNG-857
	122	848-DLICAQKFNGLTVLPPL-864
	123	855-FNGLTVLPPLLTDEMIA-871
	124	862-PPLLTDEMIAQYTSALL-878
	125	869-MIAQYTSALLAGTITSG-885
	126	876-ALLAGTITSGWTFGAGA-892

	127	883-TSGWTFGAGAALQIPFA-899
	128	890-AGAALQIPFAMQMAYRF-906
	129	897-PFAMQMAYRFNGIGVTQ-913
	130	904-YRFNGIGVTQNVLYENQ-920
	131	911-VTQNVLYENQKLIANQF-927
	132	918-ENQKLIANQFNSAIGKI-934
	133	925-NQFNSAIGKIQDSLSST-941
	134	932-GKIQDSLSSTASALGKL-948
	135	939-SSTASALGKLQDVVNQN-955
	136	946-GKLQDVVNQNAQALNTL-962
	137	953-NQNAQALNTLVKQLSSN-969
	138	960-NTLVKQLSSNFGAISSV-976
	139	967-SSNFGAISSVLNDILSR-983
	140	974-SSVLNDILSRLDKVEAE-990
	141	981-LSRLDKVEAEVQIDRLI-997
	142	988-EAEVQIDRLITGRLQSL-1004
	143	995-RLITGRLQSLQTYVTQQ-1011
	144	1002-QSLQTYVTQQLIRAAEI-1018
	145	1009-TQQLIRAAEIRASANLA-1025
	146	1016-AEIRASANLAATKMSEC-1032
	147	1023-NLAATKMSECVLGQSKR-1039
	148	1030-SECVLGQSKRVDFCGKG-1046
	149	1037-SKRVDFCGKGYHLMSFP-1053
	150	1044-GKGYHLMSFPQSAPHGV-1060
Pool 4 (151-181)	**151**	1051-SFPQSAPHGVVFLHVTY-1067
	152	1058-HGVVFLHVTYVPAQEKN-1074
	153	1065-VTYVPAQEKNFTTAPAI-1081
	154	1072-EKNFTTAPAICHDGKAH-1088
	155	1079-PAICHDGKAHFPREGVF-1095
	156	1086-KAHFPREGVFVSNGTHW-1102
	157	1093-GVFVSNGTHWFVTQRNF-1109
	158	1100-THWFVTQRNFYEPQIIT-1116
	159	1107-RNFYEPQIITTDNTFVS-1123
	160	1114-IITTDNTFVSGNCDVVI-1130
	161	1121-FVSGNCDVVIGIVNNTV-1137
	162	1128-VVIGIVNNTVYDPLQPE-1144
	163	1135-NTVYDPLQPELDSFKEE-1151
	164	1142-QPELDSFKEELDKYFKN-1158
	165	1149-KEELDKYFKNHTSPDVD-1165
	166	1156-FKNHTSPDVDLGDISGI-1172
	167	1163-DVDLGDISGINASVVNI-1179
	168	1170-SGINASVVNIQKEIDRL-1186
	169	1177-VNIQKEIDRLNEVAKNL-1193

	170	1184-DRLNEVAKNLNESLIDL-1200
	171	1191-KNLNESLIDLQELGKYE-1207
	172	1198-IDLQELGKYEQYIKWPW-1214
	173	1205-KYEQYIKWPWYIWLGFI-1221
	174	1212-WPWYIWLGFIAGLIAIV-1228
	175	1219-GFIAGLIAIVMVTIMLC-1235
	176	1226-AIVMVTIMLCCMTSCCS-1242
	177	1233-MLCCMTSCCSCLKGCCS-1249
	178	1240-CCSCLKGCCSCGSCCKF-1256
	179	1247-CCSCGSCCKFDEDDSEP-1263
	180	1254-CKFDEDDSEPVLKGVKL-1270
	181	1261-SEPVLKGVKLHYT-1273