Figure S1.

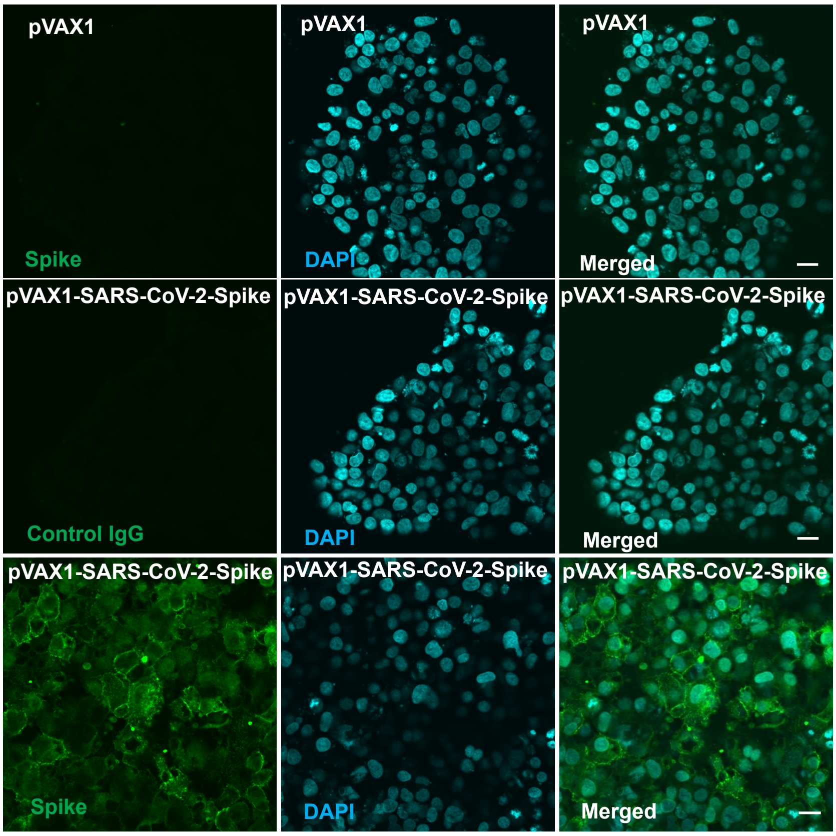

Figure S1. The membrane localization of the spike glycoprotein.
The localization of pVAX1-SARS-CoV-2 Spike in HEK293 cells assessed by immunostaining. The membrane was permeabilized by Triton X-100. The transfected spike protein was stained with a polyclonal spike antibody and a secondary antibody labeled with Alexa Fluor 488 (green). The nucleus was stained with DAPI (blue). Scale bar=20 μm. See also Figure 1.

Figure S2.

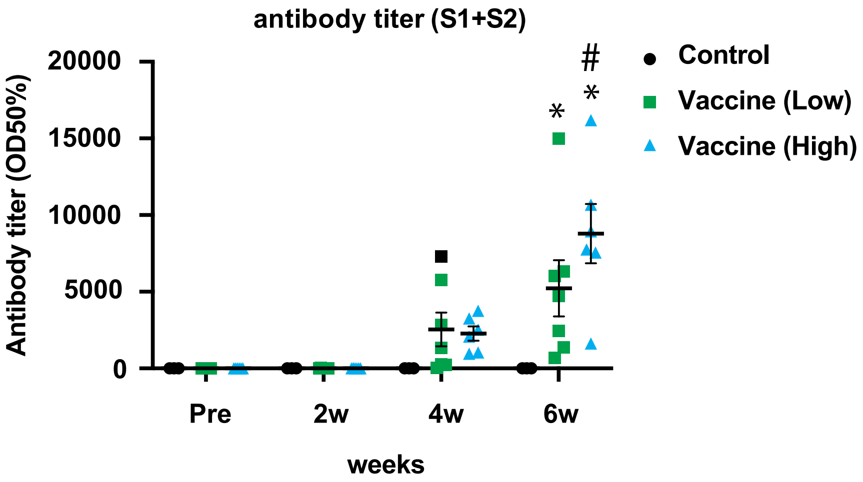

Figure S2. Dose-dependent DNA vaccine-induced anti-spike antibody production in rats.
Different doses of DNA vaccine (low dose: 66.6 μg/rat, high dose: 666.6 μg/rat) was injected into SD rats (female) 3 times at 2 weeks interval (at 0, 2, 4wks). Blood samples were collected at pre, 2w, 4w, and 6w to measure anti-Spike antibody titer. *$p<0.05$ vs. Control, #$p<0.05$ vs. Vaccine (Low).

Figure S3.

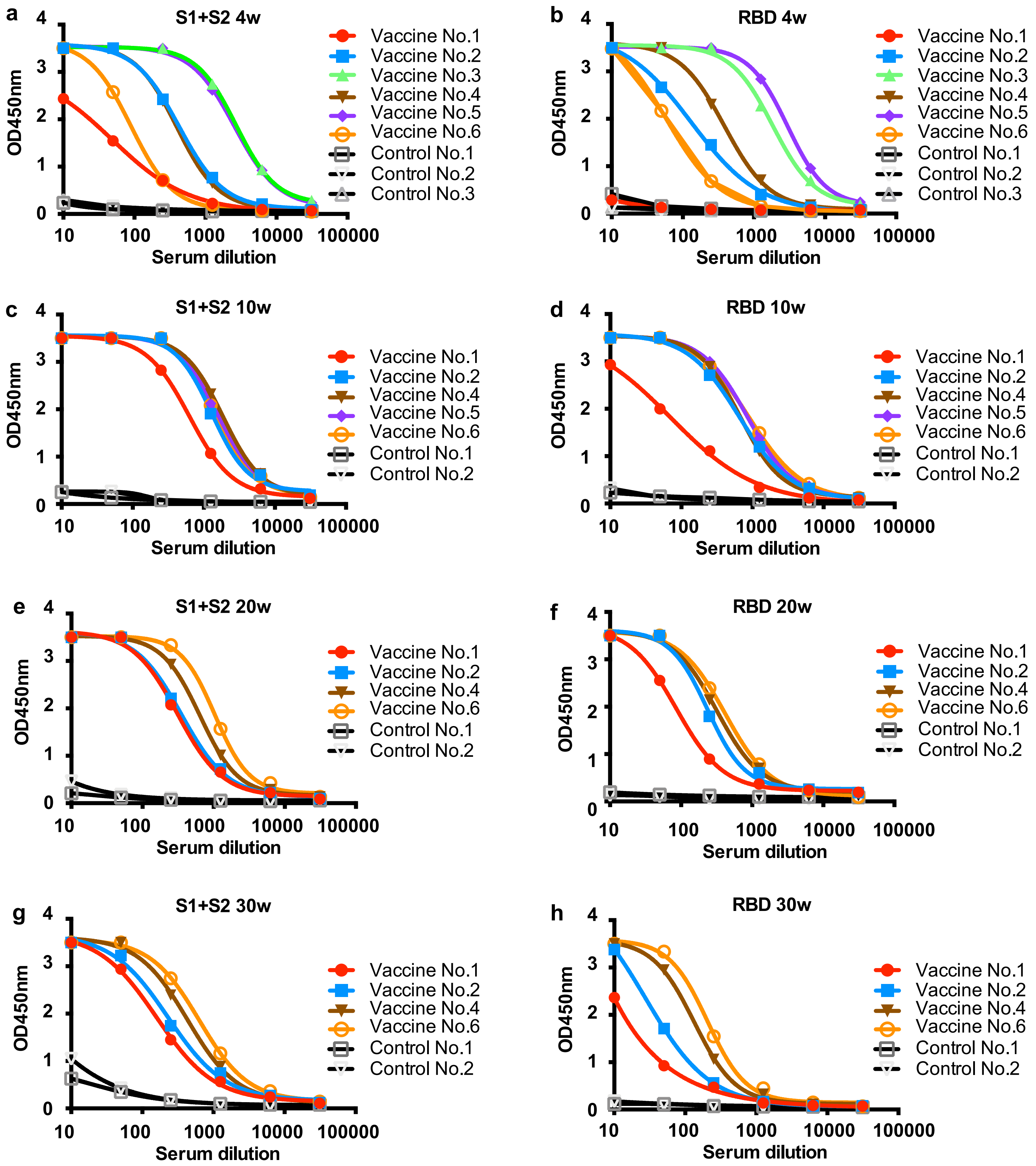

Figure S3. Spike glycoprotein-specific antibody titer from 4 weeks through 30 weeks. Antibody titers for recombinant S1+S2 and RBD protein measured by ELISA. Serum dilution from 10x to x31250. (**a**) 4 weeks: S1+S2. (**b**) 4 weeks: RBD. (**c**) 10 weeks: S1+S2. (**d**) 10 weeks: RBD. (**e**) 20 weeks: S1+S2. (**f**) 20 weeks: RBD. (**g**) 30 weeks: S1+S2. (**h**) 30 weeks: RBD. See also Fig.2.

Figure S4.

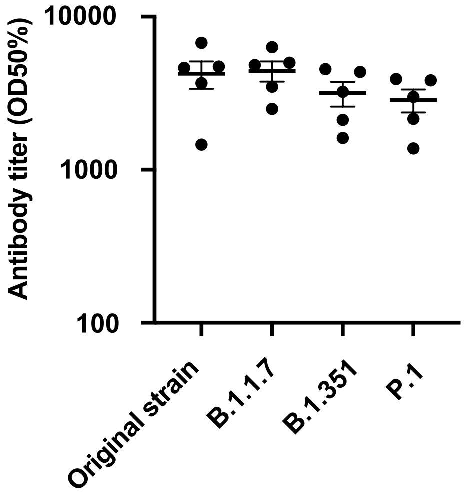

Figure S4. Antibody titer for the spike glycoprotein from original strain and variants (B.1.1.7, B. 1. 351, and P.1)

Antibody titer for recombinant spike glycoprotein from original strain or variants assessed by ELISA at 10 weeks after the 1st vaccination. Serum dilution from 10x to x31250. The antibody titer is shown as the serum dilution exhibiting half maximum binding at optical density at 450 nm (OD50%). Data are shown as mean ± SEM.See also Fig.2.

Figure S5.

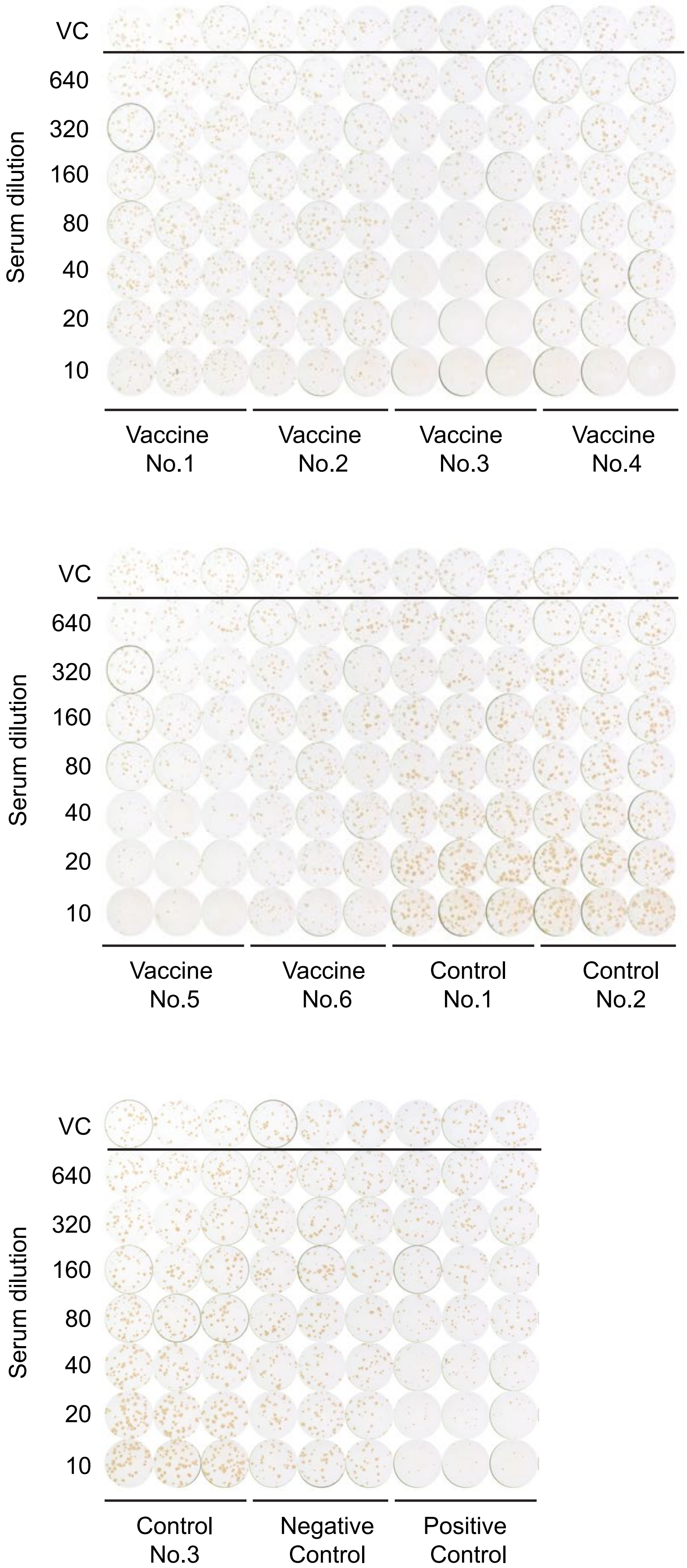

Figure S5. Neutralization activity of vaccinated serum against live SARS-CoV-2 by FRNT. Neutralization activity of serial dilution of vaccinated or control serum at 8 w was performed with live SARS-CoV-2 infection. VC: viral control. Acute-phase sera of SARS-CoV-2 infected patients was used as negative control, convalescent-phase sera serum of SARS-CoV-2 infected patients was used as positive control.Vaccine No.3 and Control No.3: 7 weeks sample. See also Fig.4.

Figure S6.

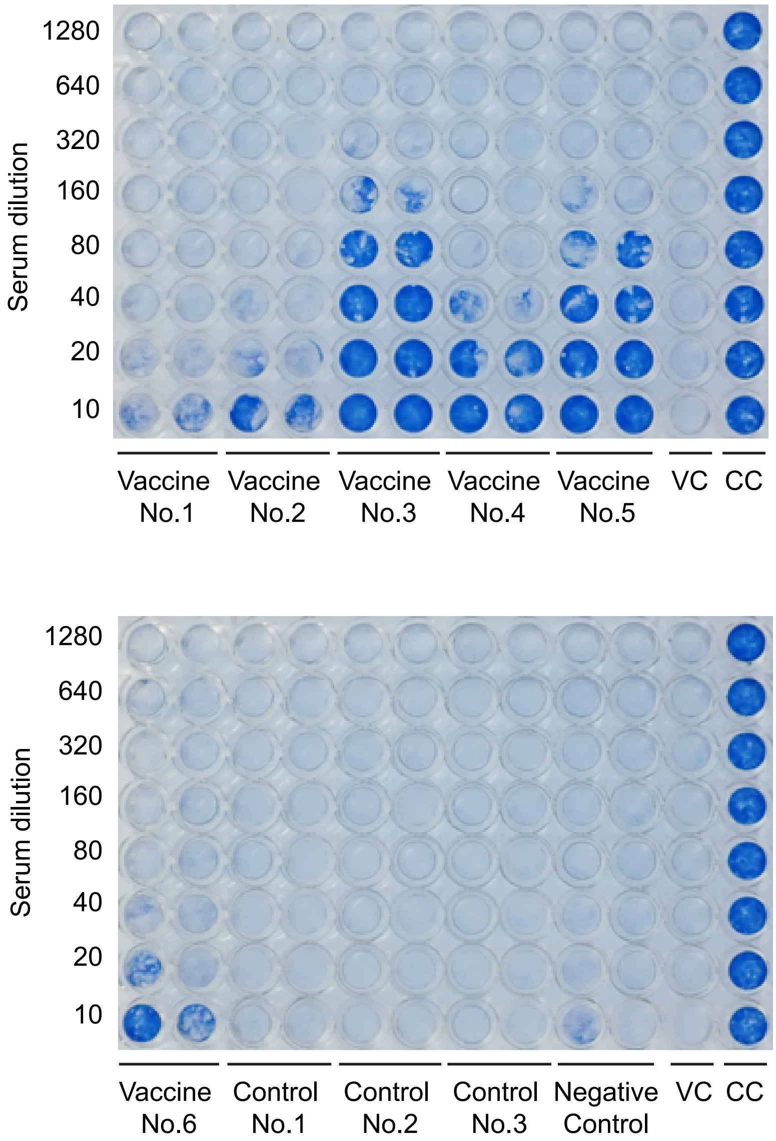

Figure S6. Neutralization activity of vaccinated serum against live SARS-CoV-2 by TCID. Neutralization activity of serial dilution of vaccinated or control serum at 8w was performed with live SARS-CoV-2 infection. VC: viral control. CC: cell control. Acute-phase sera of SARS-CoV-2 infected patients was used as negative control. Vaccine No.3 and Control No.3: 7 weeks sample. See also Fig.4.

Figure S7.

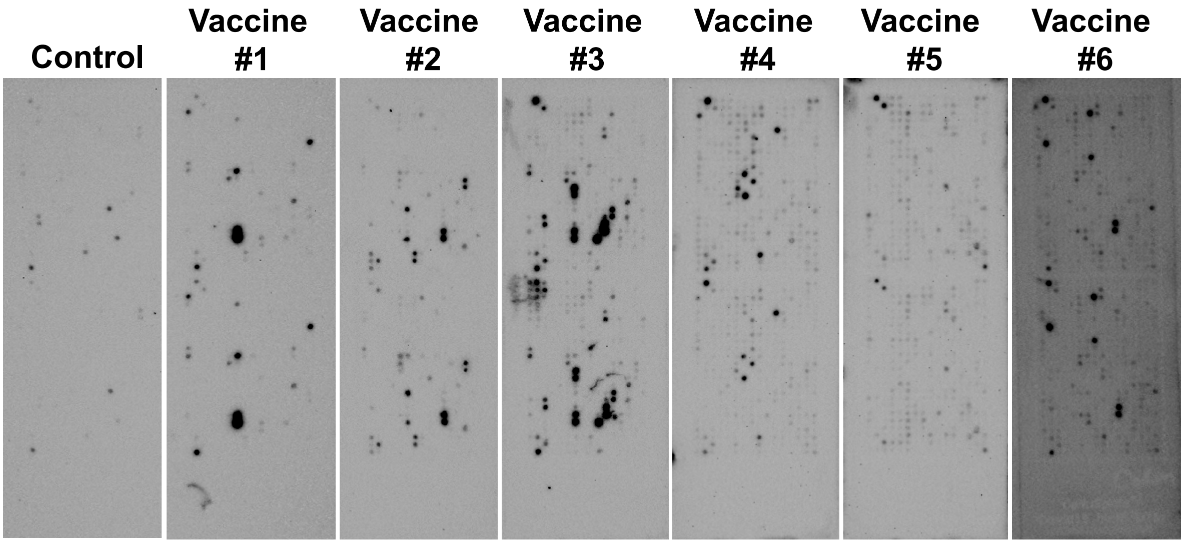

Figure S7. Epitope profiles of vaccine-induced antibodies (peptide array coated with the SARS-CoV-2 Spike glycoprotein). Spike peptide-coated membranes treated with immunized or nonimmunized rat serum at 6 weeks were developed by chemiluminescence. Images were acquired by a Bio-Rad instrument. See also Fig.5, Table 2, and Table S1.

Figure S8

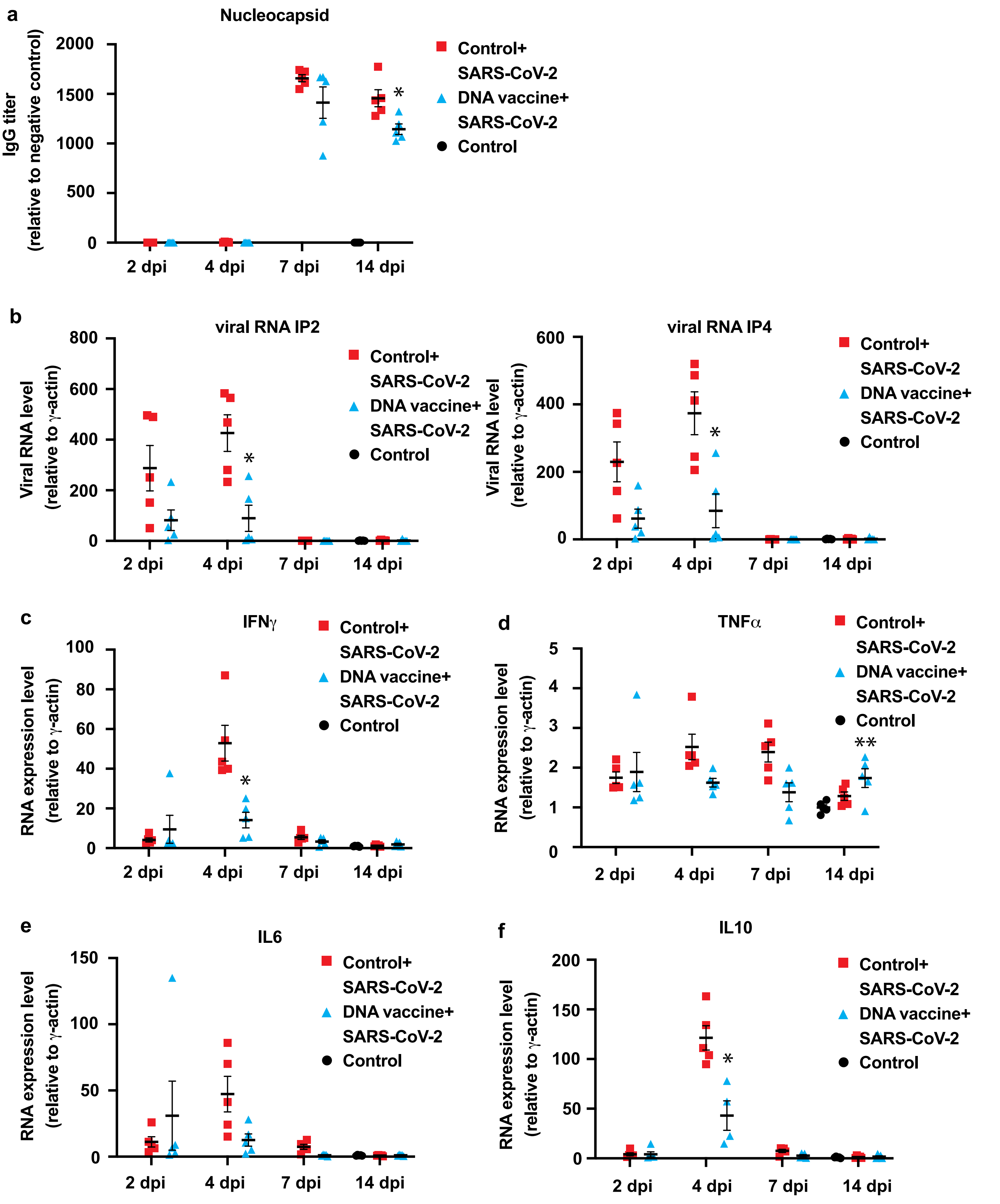

Figure S8. Antibody titer in serum, viral RNA level in lung, and expression of inflammation-related cytokines in lung of hamster after infection. (**a**) IgG antibody titer specific for nucleocapsid. (**b**) viral RNA level using IP2, IP4 primers in the lung. The value was normalized with γ-actin. (**c**) IFNγ, (**d**) TNFα, (**e**) IL6, (**f**) IL10 expression in the lung at 2, 4, 7, and 14 pdi with SARS-CoV-2 challenge. In IL10 (f), One sample from DNA vaccine + SARS-CoV-2 group at 4 dpi was below detection limit.The values were normalized with γ-actin.* $p<0.05$ vs. Control+SARS-CoV-2. ** $p<0.05$ vs. Control. Data are shown as mean ± SEM. ANOVA followed by Bonferroni comparison. See also Fig.7.

Figure S9.

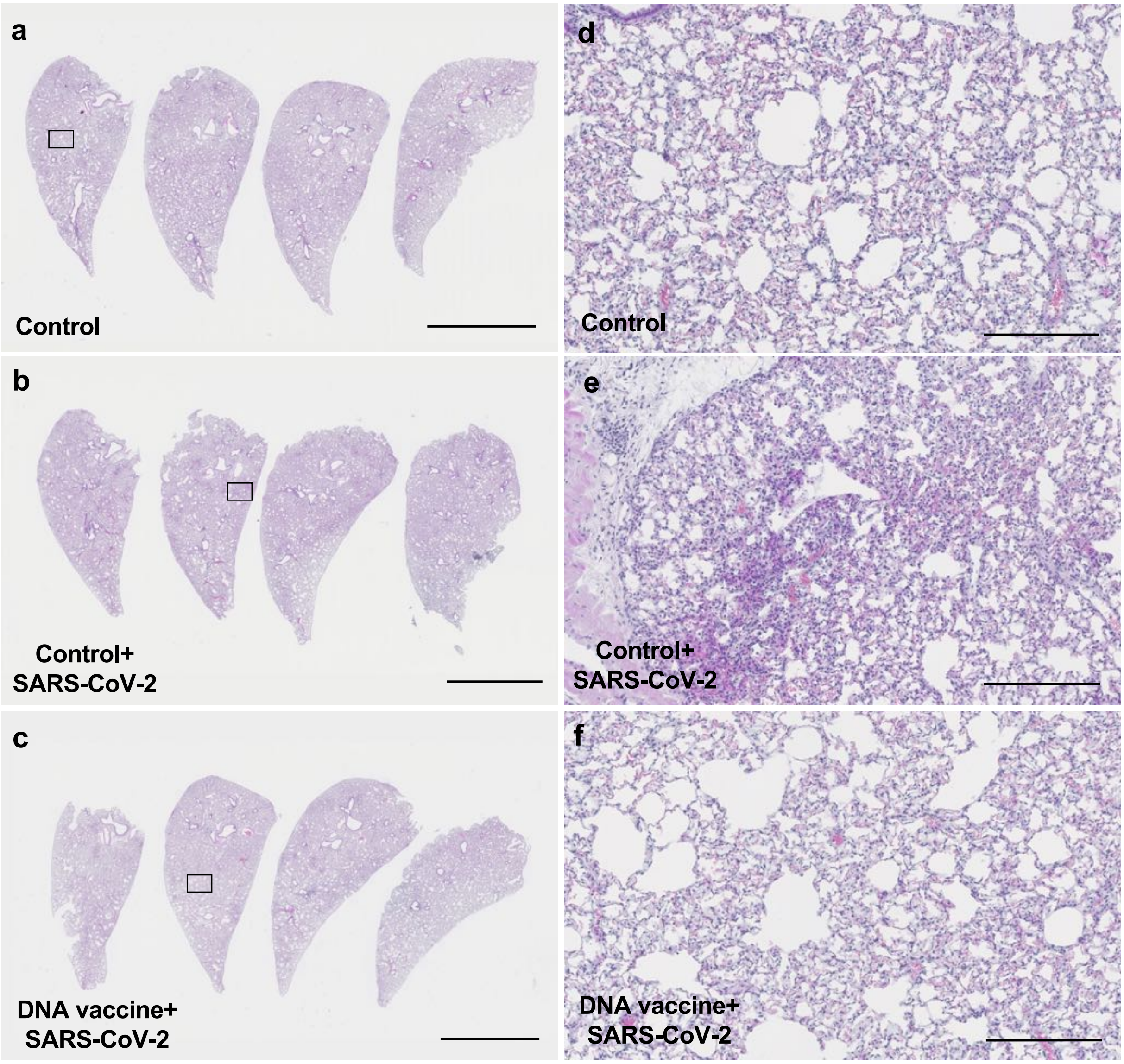

Figure S9. Histological analysis in the lung of hamster at 14 days after infection.
Paraffin embedded lung was sectioned and stained with Hematoxylin-Phloxin (H&P) to visualize histomorphometric changes (inflammation). Shown are representative image from each groups, (**a** and **d**) Control, (**b** and **e**) Control+SARS-CoV-2 infection, (**c** and **f**) DNA vaccine + SARS-CoV-2 infection. (**c**-**f**) Enlarged images of the area with black rectangle from **a**-**c** respectively. (**a**)-(**c**) Scale bar=5mm. (**d**)-(**f**) Scale bar=250μm. See also Fig.7.

Table S1. Top 30 strongest epitope recognized by vaccine-induced antibody from each animal (No.1-No.6) : red color indicates RBD. See also Fig.5, Fig.S7, and Table 2.

No.1	Position	Amino Acid Sequence
1	1176 - 1190	V-V-N-I-Q-K-E-I-D-R-L-N-E-V-A
2	1171 - 1185	G-I-N-A-S-V-V-N-I-Q-K-E-I-D-R
3	1131 - 1145	G-I-V-N-N-T-V-Y-D-P-L-Q-P-E-L
4	31 - 50	S-F-T-R-G-V-Y-Y-P-D-K-V-F-R-S
5	1056 - 1070	A-P-H-G-V-V-F-L-H-V-T-Y-V-P-A
6	1166 - 1180	L-G-D-I-S-G-I-N-A-S-V-V-N-I-Q
7	311 - 325	G-I-Y-Q-T-S-N-F-R-V-Q-P-T-E-S
8	1256 - 1270	F-D-E-D-D-S-E-P-V-L-K-G-V-K-L
9	1181 - 1195	K-E-I-D-R-L-N-E-V-A-K-N-L-N-E
10	1051 - 1065	S-F-P-Q-S-A-P-H-G-V-V-F-L-H-V
11	1096 - 1110	V-S-N-G-T-H-W-F-V-T-Q-R-N-F-Y
12	816 - 830	S-F-I-E-D-L-L-F-N-K-V-T-L-A-D
13	286 - 300	T-D-A-V-D-C-A-L-D-P-L-S-E-T-K
14	1136 - 1150	T-V-Y-D-P-L-Q-P-E-L-D-S-F-K-E
15	1251 - 1265	G-S-C-C-K-F-D-E-D-D-S-E-P-V-L
16	456 - 470	F-R-K-S-N-L-K-P-F-E-R-D-I-S-T
17	821 - 835	L-L-F-N-K-V-T-L-A-D-A-G-F-I-K
18	81 - 95	N-P-V-L-P-F-N-D-G-V-Y-F-A-S-T
19	1066 - 1080	T-Y-V-P-A-Q-E-K-N-F-T-T-A-P-A
20	36 - 55	V-Y-Y-P-D-K-V-F-R-S-S-V-L-H-S
21	151 - 165	S-W-M-E-S-E-F-R-V-Y-S-S-A-N-N
22	1061 - 1075	V-F-L-H-V-T-Y-V-P-A-Q-E-K-N-F
23	786 - 800	K-Q-I-Y-K-T-P-P-I-K-D-F-G-G-F
24	106 - 120	F-G-T-T-L-D-S-K-T-Q-S-L-L-I-V
25	891 - 905	G-A-A-L-Q-I-P-F-A-M-Q-M-A-Y-R
26	26 - 40	P-A-Y-T-N-S-F-T-R-G-V-Y-Y-P-D
27	291 - 305	C-A-L-D-P-L-S-E-T-K-C-T-L-K-S
28	76 - 95	T-K-R-F-D-N-P-V-L-P-F-N-D-G-V
29	331 - 345	N-I-T-N-L-C-P-F-G-E-V-F-N-A-T
30	1126 - 1040	C-D-V-V-I-G-I-V-N-N-T-V-Y-D-P

No.2	Position	Amino Acid Sequence
1	576 - 590	V-R-D-P-Q-T-L-E-I-L-D-I-T-P-C
2	571 - 585	D-T-T-D-A-V-R-D-P-Q-T-L-E-I-L
3	176 - 190	L-M-D-L-E-G-K-Q-G-N-F-K-N-L-R
4	1156 - 1170	F-K-N-H-T-S-P-D-V-D-L-G-D-I-S
5	181 - 195	G-K-Q-G-N-F-K-N-L-R-E-F-V-F-K
6	1176 - 1190	V-V-N-I-Q-K-E-I-D-R-L-N-E-V-A
7	1066 - 1080	T-Y-V-P-A-Q-E-K-N-F-T-T-A-P-A
8	221 - 235	S-A-L-E-P-L-V-D-L-P-I-G-I-N-I
9	1071 - 1085	Q-E-K-N-F-T-T-A-P-A-I-C-H-D-G
10	1251 - 1265	G-S-C-C-K-F-D-E-D-D-S-E-P-V-L
11	1256 - 1270	F-D-E-D-D-S-E-P-V-L-K-G-V-K-L
12	566 - 580	N-K-K-F-L-P-F-Q-Q-F-G-R-D-I-A
13	851 - 865	C-A-Q-K-F-N-G-L-T-V-L-P-P-L-L
14	456 - 470	F-R-K-S-N-L-K-P-F-E-R-D-I-S-T
15	786 - 800	K-Q-I-Y-K-T-P-P-I-K-D-F-G-G-F
16	1131 - 1145	G-I-V-N-N-T-V-Y-D-P-L-Q-P-E-L
17	311 - 325	G-I-Y-Q-T-S-N-F-R-V-Q-P-T-E-S
18	451 - 465	Y-L-Y-R-L-F-R-K-S-N-L-K-P-F-E
19	691 - 705	S-I-I-A-Y-T-M-S-L-G-A-E-N-S-V
20	1261 - 1275	S-E-P-V-L-K-G-V-K-L-H-Y-T
21	416 - 430	G-K-I-A-D-Y-N-Y-K-L-P-D-D-F-T
22	581 - 595	T-L-E-I-L-D-I-T-P-C-S-F-G-G-V
23	296 - 310	L-S-E-T-K-C-T-L-K-S-F-T-V-E-K
24	461 - 475	L-K-P-F-E-R-D-I-S-T-E-I-Y-Q-A
25	561 - 575	P-F-Q-Q-F-G-R-D-I-A-D-T-T-D-A
26	301 - 315	C-T-L-K-S-F-T-V-E-K-G-I-Y-Q-T
27	696 - 710	T-M-S-L-G-A-E-N-S-V-A-Y-S-N-N
28	1216 - 1230	I-W-L-G-F-I-A-G-L-I-A-I-V-M-V
29	556 - 570	N-K-K-F-L-P-F-Q-Q-F-G-R-D-I-A
30	1211 - 1225	K-W-P-W-Y-I-W-L-G-F-I-A-G-L-I

No.3	Position	Amino Acid Sequence
1	816 - 830	S-F-I-E-D-L-L-F-N-K-V-T-L-A-D
2	691 - 705	S-I-I-A-Y-T-M-S-L-G-A-E-N-S-V
3	686 - 700	S-V-A-S-Q-S-I-I-A-Y-T-M-S-L-G
4	1176 - 1190	V-V-N-I-Q-K-E-I-D-R-L-N-E-V-A
5	1141- 1155	L-Q-P-E-L-D-S-F-K-E-E-L-D-K-Y
6	1171 - 1185	G-I-N-A-S-V-V-N-I-Q-K-E-I-D-R
7	1146 - 1160	D-S-F-K-E-E-L-D-K-Y-F-K-N-H-T
8	556 - 570	N-K-K-F-L-P-F-Q-Q-F-G-R-D-I-A
9	561 - 575	P-F-Q-Q-F-G-R-D-I-A-D-T-T-D-A
10	571 - 585	D-T-T-D-A-V-R-D-P-Q-T-L-E-I-L
11	681 - 695	P-R-R-A-R-S-V-A-S-Q-S-I-I-A-Y
12	626 - 640	A-D-Q-L-T-P-T-W-R-V-Y-S-T-G-S
13	311 - 325	G-I-Y-Q-T-S-N-F-R-V-Q-P-T-E-S
14	886 - 900	W-T-F-G-A-G-A-A-L-Q-I-P-F-A-M
15	811 - 825	K-P-S-K-R-S-F-I-E-D-L-L-F-N-K
16	1256 - 1270	F-D-E-D-D-S-E-P-V-L-K-G-V-K-L
17	696 - 710	T-M-S-L-G-A-E-N-S-V-A-Y-S-N-N
18	1166 - 1180	L-G-D-I-S-G-I-N-A-S-V-V-N-I-Q
19	321 - 335	Q-P-T-E-S-I-V-R-F-P-N-I-T-N-L
20	821 - 835	L-L-F-N-K-V-T-L-A-D-A-G-F-I-K
21	1151 - 1165	E-L-D-K-Y-F-K-N-H-T-S-P-D-V-D
22	621 - 635	P-V-A-I-H-A-D-Q-L-T-P-T-W-R-V
23	491 - 505	P-L-Q-S-Y-G-F-Q-P-T-N-G-V-G-Y
24	1251 - 1265	G-S-C-C-K-F-D-E-D-D-S-E-P-V-L
25	1131 - 1145	G-I-V-N-N-T-V-Y-D-P-L-Q-P-E-L
26	836 - 850	Q-Y-G-D-C-L-G-D-I-A-A-R-D-L-I
27	176 - 190	L-M-D-L-E-G-K-Q-G-N-F-K-N-L-R
28	971 - 985	G-A-I-S-S-V-L-N-D-I-L-S-R-L-D
29	566 - 580	G-R-D-I-A-D-T-T-D-A-V-R-D-P-Q
30	806 - 820	L-P-D-P-S-K-P-S-K-R-S-F-I-E-D

No.4	Position	Amino Acid Sequence
1	1146 - 1160	D-S-F-K-E-E-L-D-K-Y-F-K-N-H-T
2	621 - 635	P-V-A-I-H-A-D-Q-L-T-P-T-W-R-V
3	1131 - 1145	G-I-V-N-N-T-V-Y-D-P-L-Q-P-E-L
4	1016 - 1030	A-E-I-R-A-S-A-N-L-A-A-T-K-M-S
5	946 - 960	G-K-L-Q-D-V-V-N-Q-N-A-Q-A-L-N
6	1261 - 1275	S-E-P-V-L-K-G-V-K-L-H-Y-T
7	986 - 1000	K-V-E-A-E-V-Q-I-D-R-L-I-T-G-R
8	1006 - 1020	T-Y-V-T-Q-Q-L-I-R-A-A-E-I-R-A
9	996 - 1010	L-I-T-G-R-L-Q-S-L-Q-T-Y-V-T-Q
10	1266 - 1280	E-P-V-L-K-G-V-K-L-H-Y-T
11	851 - 865	C-A-Q-K-F-N-G-L-T-V-L-P-P-L-L
12	121 - 135	N-N-A-T-N-V-V-I-K-V-C-E-F-Q-F
13	1101 - 1115	H-W-F-V-T-Q-R-N-F-Y-E-P-Q-I-I
14	846 - 860	A-R-D-L-I-C-A-Q-K-F-N-G-L-T-V
15	1096 -1110	V-S-N-G-T-H-W-F-V-T-Q-R-N-F-Y
16	971 - 985	G-A-I-S-S-V-L-N-D-I-L-S-R-L-D
17	456 - 470	F-R-K-S-N-L-K-P-F-E-R-D-I-S-T
18	1256 - 1270	F-D-E-D-D-S-E-P-V-L-K-G-V-K-L
19	1 - 15	M-F-V-F-L-V-L-L-P-L-V-S-S-Q-C
20	1211 - 1225	K-W-P-W-Y-I-W-L-G-F-I-A-G-L-I
21	951 - 965	V-V-N-Q-N-A-Q-A-L-N-T-L-V-K-Q
22	181 - 195	G-K-Q-G-N-F-K-N-L-R-E-F-V-F-K
23	811 - 825	K-P-S-K-R-S-F-I-E-D-L-L-F-N-K
24	116 - 130	S-L-L-I-V-N-N-A-T-N-V-V-I-K-V
25	506 - 520	Q-P-Y-R-V-V-V-L-S-F-E-L-L-H-A
26	126 - 140	V-V-I-K-V-C-E-F-Q-F-C-N-D-P-F
27	231 - 245	I-G-I-N-I-T-R-F-Q-T-L-L-A-L-H
28	1251 - 1265	G-S-C-C-K-F-D-E-D-D-S-E-P-V-L
29	991 - 1005	V-Q-I-D-R-L-I-T-G-R-L-Q-S-L-Q
30	431 - 445	G-C-V-I-A-W-N-S-N-N-L-D-S-K-V

No.5	Position	Amino Acid Sequence
1	116- 130	S-L-L-I-V-N-N-A-T-N-V-V-I-K-V
2	221 - 235	S-A-L-E-P-L-V-D-L-P-I-G-I-N-I
3	661 - 675	E-C-D-I-P-I-G-A-G-I-C-A-S-Y-Q
4	1211 - 1225	K-W-P-W-Y-I-W-L-G-F-I-A-G-L-I
5	621 - 635	P-V-A-I-H-A-D-Q-L-T-P-T-W-R-V
6	346 - 360	R-F-A-S-V-Y-A-W-N-R-K-R-I-S-N
7	616 - 630	N-C-T-E-V-P-V-A-I-H-A-D-Q-L-T
8	506 - 520	Q-P-Y-R-V-V-V-L-S-F-E-L-L-H-A
9	1221 - 1235	I-A-G-L-I-A-I-V-M-V-T-I-M-L-C
10	106 - 120	F-G-T-T-L-D-S-K-T-Q-S-L-L-I-V
11	121 - 135	N-N-A-T-N-V-V-I-K-V-C-E-F-Q-F
12	811 - 825	K-P-S-K-R-S-F-I-E-D-L-L-F-N-K
13	326 - 340	I-V-R-F-P-N-I-T-N-L-C-P-F-G-E
14	1216 - 1230	I-W-L-G-F-I-A-G-L-I-A-I-V-M-V
15	1121 -1135	F-V-S-G-N-C-D-V-V-I-G-I-V-N-N
16	851 - 865	C-A-Q-K-F-N-G-L-T-V-L-P-P-L-L
17	971 - 985	G-A-I-S-S-V-L-N-D-I-L-S-R-L-D
18	451 - 465	Y-L-Y-R-L-F-R-K-S-N-L-K-P-F-E
19	1126 - 1240	C-D-V-V-I-G-I-V-N-N-T-V-Y-D-P
20	76 - 95	T-K-R-F-D-N-P-V-L-P-F-N-D-G-V
21	1 - 15	M-F-V-F-L-V-L-L-P-L-V-S-S-Q-C
22	486 - 500	F-N-C-Y-F-P-L-Q-S-Y-G-F-Q-P-T
23	706 - 720	A-Y-S-N-N-S-I-A-I-P-T-N-F-T-I
24	946 - 960	G-K-L-Q-D-V-V-N-Q-N-A-Q-A-L-N
25	1056 - 1070	A-P-H-G-V-V-F-L-H-V-T-Y-V-P-A
26	876 - 890	A-L-L-A-G-T-I-T-S-G-W-T-F-G-A
27	586 - 600	D-I-T-P-C-S-F-G-G-V-S-V-I-T-P
28	176 - 190	L-M-D-L-E-G-K-Q-G-N-F-K-N-L-R
29	111 - 125	D-S-K-T-Q-S-L-L-I-V-N-N-A-T-N
30	846 - 860	A-R-D-L-I-C-A-Q-K-F-N-G-L-T-V

No.6	Position	Amino Acid Sequence
1	971 - 985	G-A-I-S-S-V-L-N-D-I-L-S-R-L-D
2	691 - 705	S-I-I-A-Y-T-M-S-L-G-A-E-N-S-V
3	686 - 700	S-V-A-S-Q-S-I-I-A-Y-T-M-S-L-G
4	1001 - 1015	L-Q-S-L-Q-T-Y-V-T-Q-Q-L-I-R-A
5	76 - 95	T-K-R-F-D-N-P-V-L-P-F-N-D-G-V
6	946 - 960	G-K-L-Q-D-V-V-N-Q-N-A-Q-A-L-N
7	851 - 865	C-A-Q-K-F-N-G-L-T-V-L-P-P-L-L
8	116 - 130	S-L-L-I-V-N-N-A-T-N-V-V-I-K-V
9	1256 - 1270	F-D-E-D-D-S-E-P-V-L-K-G-V-K-L
10	1176 - 1190	V-V-N-I-Q-K-E-I-D-R-L-N-E-V-A
11	846 - 860	A-R-D-L-I-C-A-Q-K-F-N-G-L-T-V
12	621 - 635	P-V-A-I-H-A-D-Q-L-T-P-T-W-R-V
13	491 - 505	P-L-Q-S-Y-G-F-Q-P-T-N-G-V-G-Y
14	1251 - 1265	G-S-C-C-K-F-D-E-D-D-S-E-P-V-L
15	681 - 695	P-R-R-A-R-S-V-A-S-Q-S-I-I-A-Y
16	1211 - 1255	I-A-G-L-I-A-I-V-M-V-T-I-M-L-C
17	106 - 120	F-G-T-T-L-D-S-K-T-Q-S-L-L-I-V
18	1171 - 1185	G-I-N-A-S-V-V-N-I-Q-K-E-I-D-R
19	191 - 205	E-F-V-F-K-N-I-D-G-Y-F-K-I-Y-S
20	1131 - 1145	G-I-V-N-N-T-V-Y-D-P-L-Q-P-E-L
21	321 - 335	Q-P-T-E-S-I-V-R-F-P-N-I-T-N-L
22	1216 - 1230	I-W-L-G-F-I-A-G-L-I-A-I-V-M-V
23	326 - 340	I-V-R-F-P-N-I-T-N-L-C-P-F-G-E
24	431 - 445	G-C-V-I-A-W-N-S-N-N-L-D-S-K-V
25	416 - 430	G-K-I-A-D-Y-N-Y-K-L-P-D-D-F-T
26	91 - 105	Y-F-A-S-T-E-K-S-N-I-I-R-G-W-I
27	456 - 470	F-R-K-S-N-L-K-P-F-E-R-D-I-S-T
28	906 - 920	F-N-G-I-G-V-T-Q-N-V-L-Y-E-N-Q
29	221 - 235	S-A-L-E-P-L-V-D-L-P-I-G-I-N-I
30	136 - 150	C-N-D-P-F-L-G-V-Y-Y-H-K-N-N-K

Supplementary Information
Sequences of pVAX-SARS-CoV-2 Spike plasmid

GCTGCTTCGCGATGTACGGGCCAGATATACGCGTTGACATTGATTATTGACTAGTTA
TTAATAGTAATCAATTACGGGGTCATTAGTTCATAGCCCATATATGGAGTTCCGCGT
TACATAACTTACGGTAAATGGCCCGCCTGGCTGACCGCCCAACGACCCCCGCCCATT
GACGTCAATAATGACGTATGTTCCCATAGTAACGCCAATAGGGACTTTCCATTGACG
TCAATGGGTGGAGTATTTACGGTAAACTGCCCACTTGGCAGTACATCAAGTGTATCA
TATGCCAAGTACGCCCCCTATTGACGTCAATGACGGTAAATGGCCCGCCTGGCATTA
TGCCCAGTACATGACCTTATGGGACTTTCCTACTTGGCAGTACATCTACGTATTAGTC
ATCGCTATTACCATGGTGATGCGGTTTTGGCAGTACATCAATGGGCGTGGATAGCGG
TTTGACTCACGGGGATTTCCAAGTCTCCACCCCATTGACGTCAATGGGAGTTTGTTTT
GGCACCAAAATCAACGGGACTTTCCAAAATGTCGTAACAACTCCGCCCCATTGACG
CAAATGGGCGGTAGGCGTGTACGGTGGGAGGTCTATATAAGCAGAGCTCTCTGGCT
AACTAGAGAACCCACTGCTTACTGGCTTATCGAAATTAATACGACTCACTATAGGGA
GACCCAAGCTGGCTAGCCACCATGTTCGTGTTCCTGGTGCTGCTGCCCCTGGTGAGC
AGCCAGTGCGTGAACCTGACCACCAGAACCCAGCTGCCCCCCGCCTACACCAACAG
CTTCACCAGAGGCGTGTACTACCCCGACAAGGTGTTCAGAAGCAGCGTGCTGCACA
GCACCCAGGACCTGTTCCTGCCCTTCTTCAGCAACGTGACCTGGTTCCACGCCATCC
ACGTGAGCGGCACCAACGGCACCAAGAGATTCGACAACCCCGTGCTGCCCTTCAAC
GACGGCGTGTACTTCGCCAGCACCGAGAAGAGCAACATCATCAGAGGCTGGATCTT
CGGCACCACCCTGGACAGCAAGACCCAGAGCCTGCTGATCGTGAACAACGCCACCA
ACGTGGTGATCAAGGTGTGCGAGTTCCAGTTCTGCAACGACCCCTTCCTGGGCGTGT
ACTACCACAAGAACAACAAGAGCTGGATGGAGAGCGAGTTCAGAGTGTACAGCAGC
GCCAACAACTGCACCTTCGAGTACGTGAGCCAGCCCTTCCTGATGGACCTGGAGGG
CAAGCAGGGCAACTTCAAGAACCTGAGAGAGTTCGTGTTCAAGAACATCGACGGCT
ACTTCAAGATCTACAGCAAGCACACCCCCATCAACCTGGTGAGAGACCTGCCTCAG
GGCTTTAGCGCCCTGGAGCCACTGGTGGACCTGCCAATCGGCATCAACATCACCAG
ATTCCAGACCCTGCTGGCCCTGCACAGAAGCTACCTGACACCAGGCGATTCTAGCTC
TGGATGGACAGCCGGCGCCGCTGCCTATTACGTGGGCTACCTGCAGCCTAGAACCTT
CCTGCTGAAGTACAACGAGAACGGCACCATCACCGATGCCGTGGACTGCGCCCTGG
ATCCCCTGAGCGAGACCAAGTGTACCCTGAAGAGCTTCACCGTGGAGAAGGGCATC
TACCAGACCAGCAACTTCAGAGTGCAGCCCACCGAGAGCATCGTGAGATTCCCCAA
CATCACCAACCTGTGCCCCTTCGGCGAGGTGTTCAACGCCACCAGATTCGCCAGCGT
GTACGCCTGGAACAGAAAGAGAATCAGCAACTGCGTGGCCGACTACAGCGTGCTGT
ACAACAGCGCCAGCTTCAGCACCTTCAAGTGCTACGGCGTGAGCCCCACCAAGCTG
AACGACCTGTGCTTCACCAACGTGTACGCCGACAGCTTCGTGATCAGAGGCGACGA
GGTGAGACAGATTGCCCCTGGCCAGACCGGCAAGATCGCCGACTACAACTACAAGC
TGCCCGACGACTTCACCGGCTGCGTGATCGCCTGGAACAGCAACAACCTGGACAGC
AAGGTGGGCGGCAACTACAACTACCTGTACAGACTGTTCAGAAAGAGCAACCTGAA
GCCCTTCGAGAGAGACATCAGCACCGAGATCTACCAGGCCGGCTCTACCCCATGCA
ATGGCGTGGAGGGCTTCAATTGCTACTTCCCCCTGCAGAGCTACGGCTTCCAGCCCA
CCAACGGCGTGGGCTACCAGCCCTACAGAGTGGTGGTGCTGAGCTTTGAACTGCTGC
ACGCCCCTGCCACCGTGTGCGGCCCAAAGAAGAGCACCAATCTGGTGAAGAACAAG
TGCGTGAACTTCAACTTCAACGGCCTGACCGGCACCGGCGTGCTGACCGAGAGCAA

CAAGAAGTTCCTGCCCTTCCAGCAGTTCGGCAGAGACATCGCCGACACCACCGATG
CCGTGAGAGATCCCCAGACCCTGGAGATCCTGGACATCACCCCCTGTAGCTTTGGCG
GCGTGAGCGTGATTACCCCCGGCACCAATACCAGCAACCAGGTGGCCGTGCTGTAC
CAGGACGTGAACTGCACCGAGGTGCCAGTGGCCATCCATGCCGACCAGCTGACCCC
AACCTGGAGAGTGTACAGCACCGGCAGCAACGTGTTCCAGACAAGAGCCGGCTGTC
TGATTGGCGCCGAGCACGTGAATAACAGCTACGAGTGCGATATCCCAATCGGCGCC
GGCATCTGTGCCAGCTATCAGACCCAGACCAATAGCCCCAGAAGAGCCAGAAGCGT
GGCCAGCCAGAGCATCATCGCCTACACCATGAGCCTGGGCGCCGAGAACAGCGTGG
CCTACAGCAACAACAGCATCGCCATCCCCACCAACTTCACCATCAGCGTGACCACCG
AGATCCTGCCCGTGAGCATGACCAAGACCAGCGTGGACTGCACCATGTACATCTGC
GGCGACAGCACCGAGTGCAGCAACCTGCTGCTGCAGTACGGCAGCTTCTGCACCCA
GCTGAACAGAGCCCTGACCGGCATCGCCGTGGAGCAGGACAAGAACACCCAGGAG
GTGTTCGCCCAGGTGAAGCAGATCTACAAGACCCCCCCCATCAAGGACTTCGGCGG
CTTCAACTTCAGCCAGATCCTGCCCGACCCCAGCAAGCCCAGCAAGAGAAGCTTCAT
CGAGGACCTGCTGTTCAACAAGGTGACCCTGGCCGACGCCGGCTTCATCAAGCAGT
ACGGCGACTGCCTGGGCGACATCGCCGCCAGAGACCTGATCTGCGCCCAGAAGTTT
AATGGACTGACAGTGCTGCCACCCCTGCTGACCGATGAGATGATCGCCCAGTACAC
CAGCGCTCTGCTGGCCGGCACAATCACCAGCGGCTGGACATTTGGAGCCGGAGCCG
CTCTGCAGATCCCATTTGCCATGCAGATGGCCTACAGATTCAACGGCATCGGCGTGA
CCCAGAACGTGCTGTACGAGAACCAGAAGCTGATCGCCAACCAGTTCAACAGCGCC
ATCGGCAAGATCCAGGACAGCCTGTCTAGCACAGCCTCTGCCCTGGGCAAGCTGCA
GGATGTGGTGAACCAGAACGCCCAGGCCCTGAACACCCTGGTGAAGCAGCTGAGCA
GCAACTTCGGCGCCATCAGCAGCGTGCTGAACGACATCCTGAGCAGACTGGACAAG
GTGGAGGCCGAGGTGCAGATCGACAGACTGATCACCGGCAGACTGCAGAGCCTGCA
GACCTACGTGACCCAGCAGCTGATCAGAGCCGCCGAAATCAGAGCCAGCGCCAATC
TGGCCGCCACCAAGATGAGCGAGTGCGTGCTGGGCCAGAGCAAGAGAGTGGACTTC
TGCGGCAAGGGCTACCACCTGATGAGCTTTCCCCAGAGCGCCCCTCACGGCGTGGTG
TTTCTGCACGTGACCTACGTGCCTGCCCAGGAGAAGAACTTCACCACCGCCCCTGCC
ATCTGCCACGATGGCAAGGCCCACTTCCCTAGAGAGGGCGTGTTCGTGAGCAACGG
CACCCACTGGTTCGTGACCCAGAGAAACTTCTACGAGCCCCAGATCATCACCACCGA
CAACACCTTCGTGAGCGGCAACTGCGACGTGGTGATCGGCATCGTGAACAACACCG
TGTACGACCCCCTGCAGCCCGAGCTGGACAGCTTCAAGGAGGAGCTGGACAAGTAC
TTCAAGAACCACACCAGCCCCGATGTGGACCTGGGCGATATCAGCGGCATCAATGC
CAGCGTGGTGAACATCCAGAAGGAGATCGACCGGCTCAATGAGGTGGCCAAGAACC
TGAACGAGAGCCTGATCGACCTGCAGGAACTGGGCAAATATGAGCAGTACATCAAG
TGGCCCTGGTACATCTGGCTGGGCTTCATCGCCGGCCTGATCGCCATCGTGATGGTG
ACCATCATGCTGTGCTGCATGACCAGCTGCTGCAGCTGCCTGAAGGGCTGCTGCAGC
TGCGGGTCTTGTTGCAAGTTCGACGAGGACGACAGCGAGCCCGTGCTGAAGGGCGT
GAAGCTGCACTACACCTAATCTAGAGGGCCCGTTTAAACCCGCTGATCAGCCTCGAC
TGTGCCTTCTAGTTGCCAGCCATCTGTTGTTTGCCCCTCCCCCGTGCCTTCCTTGACC
CTGGAAGGTGCCACTCCCACTGTCCTTTCCTAATAAAATGAGGAAATTGCATCGCAT
TGTCTGAGTAGGTGTCATTCTATTCTGGGGGGTGGGGTGGGGCAGGACAGCAAGGG
GGAGGATTGGGAAGACAATAGCAGGCATGCTGGGGATGCGGTGGGCTCTATGGCTT
CTACTGGGCGGTTTTATGGACAGCAAGCGAACCGGAATTGCCAGCTGGGGCGCCCT
CTGGTAAGGTTGGGAAGCCCTGCAAAGTAACTGGATGGCTTTCTTGCCGCCAAGG
ATCTGATGGCGCAGGGGATCAAGCTCTGATCAAGAGACAGGATGAGGATCGTTTCG

CATGATTGAACAAGATGGATTGCACGCAGGTTCTCCGGCCGCTTGGGTGGAGAGGC
TATTCGGCTATGACTGGGCACAACAGACAATCGGCTGCTCTGATGCCGCCGTGTTCC
GGCTGTCAGCGCAGGGGCGCCCGGTTCTTTTTGTCAAGACCGACCTGTCCGGTGCCC
TGAATGAACTGCAAGACGAGGCAGCGCGGCTATCGTGGCTGGCCACGACGGGCGTT
CCTTGCGCAGCTGTGCTCGACGTTGTCACTGAAGCGGGAAGGGACTGGCTGCTATTG
GGCGAAGTGCCGGGGCAGGATCTCCTGTCATCTCACCTTGCTCCTGCCGAGAAAGTA
TCCATCATGGCTGATGCAATGCGGCGGCTGCATACGCTTGATCCGGCTACCTGCCCA
TTCGACCACCAAGCGAAACATCGCATCGAGCGAGCACGTACTCGGATGGAAGCCGG
TCTTGTCGATCAGGATGATCTGGACGAAGAGCATCAGGGGCTCGCGCCAGCCGAAC
TGTTCGCCAGGCTCAAGGCGAGCATGCCCGACGGCGAGGATCTCGTCGTGACCCAT
GGCGATGCCTGCTTGCCGAATATCATGGTGGAAAATGGCCGCTTTTCTGGATTCATC
GACTGTGGCCGGCTGGGTGTGGCGGACCGCTATCAGGACATAGCGTTGGCTACCCGT
GATATTGCTGAAGAGCTTGGCGGCGAATGGGCTGACCGCTTCCTCGTGCTTTACGGT
ATCGCCGCTCCCGATTCGCAGCGCATCGCCTTCTATCGCCTTCTTGACGAGTTCTTCT
GAATTATTAACGCTTACAATTTCCTGATGCGGTATTTTCTCCTTACGCATCTGTGCGG
TATTTCACACCGCATCAGGTGGCACTTTTCGGGGAAATGTGCGCGGAACCCCTATTT
GTTTATTTTTCTAAATACATTCAAATATGTATCCGCTCATGAGACAATAACCCTGATA
AATGCTTCAATAATAGCACGTGCTAAAACTTCATTTTTAATTTAAAAGGATCTAGGT
GAAGATCCTTTTTGATAATCTCATGACCAAAATCCCTTAACGTGAGTTTTCGTTCCAC
TGAGCGTCAGACCCCGTAGAAAAGATCAAAGGATCTTCTTGAGATCCTTTTTTTCTG
CGCGTAATCTGCTGCTTGCAAACAAAAAAACCACCGCTACCAGCGGTGGTTTGTTTG
CCGGATCAAGAGCTACCAACTCTTTTTCCGAAGGTAACTGGCTTCAGCAGAGCGCAG
ATACCAAATACTGTTCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCT
GTAGCACCGCCTACATACCTCGCTCTGCTAATCCTGTTACCAGTGGCTGCTGCCAGT
GGCGATAAGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGGATAAGGC
GCAGCGGTCGGGCTGAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCGAACGA
CCTACACCGAACTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCC
GAAGGGAGAAAGGCGGACAGGTATCCGGTAAGCGGCAGGGTCGGAACAGGAGAGC
GCACGAGGGAGCTTCCAGGGGGAAACGCCTGGTATCTTTATAGTCCTGTCGGGTTTC
GCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAGGGGGGCGGAGCCTAT
GGAAAAACGCCAGCAACGCGGCCTTTTTACGGTTCCTGGCCTTTTGCTGGCCTTTTG
CTCACATGTTCTT