

Supplemental Information

Defining Influenza A Virus Hemagglutinin Antigenic Drift by Sequential Monoclonal Antibody Selection

Suman R. Das, Scott E. Hensley, William L. Ince, Christopher B. Brooke, Anju Subba, Mark G. Delboy, Gustav Russ, James S. Gibbs, Jack R. Bennink, and Jonathan W. Yewdell

Inventory of Supplemental Information:

- 1) Figure S1: Egg titers of Sequential Variants (also see Figure 1).
- 2) Table S1: SEQ12 escape from PR8-neutralizing antibody response in vivo (also see Table 2)
- 3) Table S2: Functional interaction of H17-L10 and H17-L2 with escape mutants (also see Figure 4).
- 4) Table S3: Escape mutants selected by H17-L10 and H17-L2 in PR8, SEQ-7 and SEQ-8 Stocks (for compiled analysis also see Table 3).

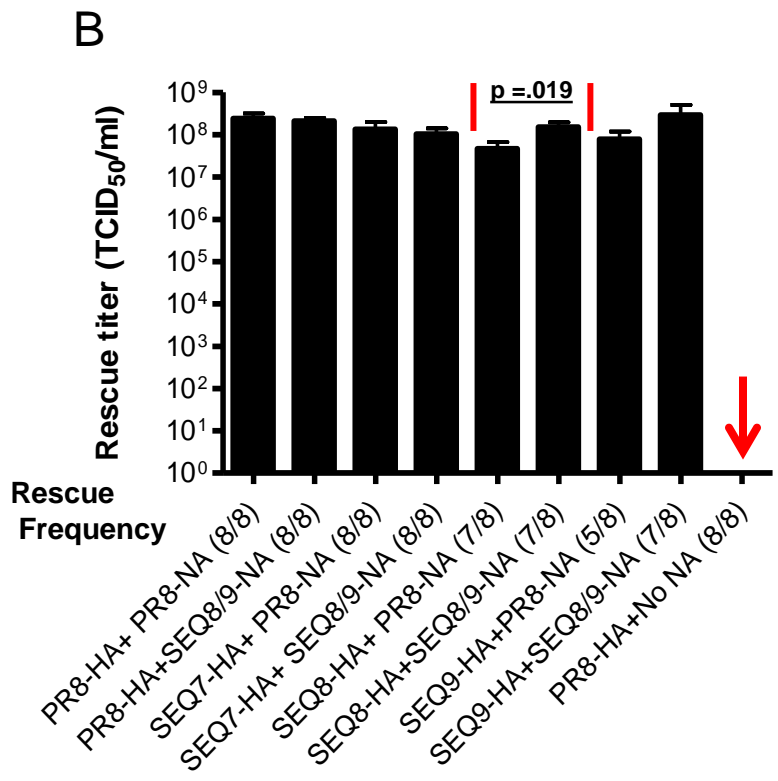
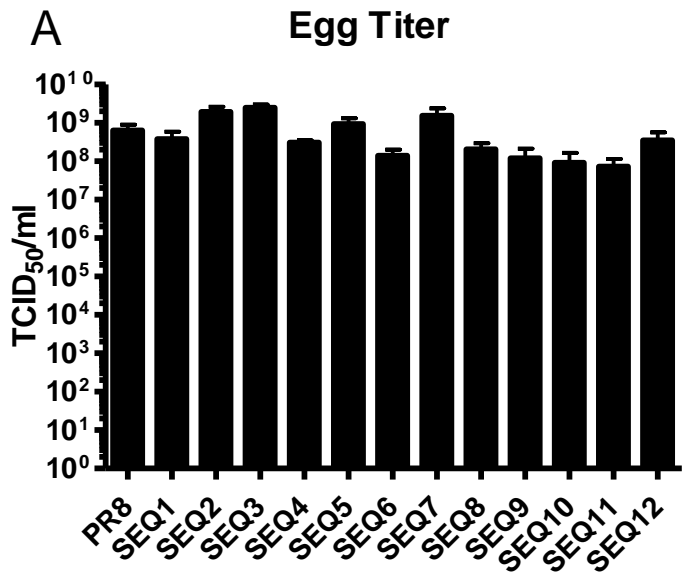


Figure S1: Egg titers of Sequential Variants (also see Figure 1). A. Egg titers of PR8 and Sequential variants were calculated as TCID₅₀/ml. All experiments were performed in quadruplet. B. Recombinant viruses with *wt* PR8, SEQ7, 8 or 9 HA and PR8 or SEQ8/9 NA combinations were generated in 8 separate experiments. Titers of virus after amplifying in MDCK cells (P₁-M passage) are shown with p values (Students's T test). Data are represented as mean +/- SEM. Rescue success is shown in the 8 experiments is shown in parentheses.

Table S1. SEQ12 escape from PR8-neutralizing antibody response in vivo (also see Table 2)

Virus sample	immunization ^a	HI titer (PR8)	Lung viral titer (Log ₁₀) ^b	% Seq. 12 (N) ^c	P value ^d
Input	--	--	--	20 (41)	
Mouse #					
1	PR8	160	5.9	100 (30)	<0.0001
2	PR8	80	6.2	100 (29)	<0.0001
3	PR8	160	6.7	100 (26)	<0.0001
4	PR8	320	6.0	100 (30)	<0.0001
5	PR8	160	7.1	100 (30)	<0.0001
6	MOCK	<20	7.9	5 (22)	0.14
7	MOCK	<20	7.9	16 (19)	1.00
8	MOCK	<20	7.3	0 (24)	0.02
9	MOCK	<20	8.1	9 (23)	0.31
10	MOCK	<20	6.4	6 (47)	0.10

a2000 HAUs of formaldehyde-inactivated PR8 virus injected I.P. 3 weeks pre-challenge.
bTCID₅₀s per 100mg of lung tissue.cGenotype of plaque-cloned variants sampled from each mouse determined by sequencing and tabulated as number of sequences.
dFisher's exact test for differences in SEQ-12 and WT- PR8 frequencies relative to input.

Table S2. Functional interaction of H17-L10 and H17-L2 with escape mutants (also see Figure 4).

Virus	H17-L10		H17-L2	
	Micro-Neut Titer	HI Titer	Micro-Neut Titer	HI Titer
PR8	17,066	900	10,240	300
SEQ-7	7,680	1200	16,700	800

Data represent the arithmetic mean of quadruplicate samples.

Table S3. Escape mutants selected by H17-L10 and H17-L2 in PR8, SEQ-7 and SEQ-8 Stocks (for compiled analysis also see Table 3)

No of Mutant	Name	Origin	Selecting Antibody	Cell-Type	HA
1	F14	PR8-WG	H17-L10	MDCK	S207L
2	F15	PR8-WG	H17-L10	MDCK	I93T
3	F16	PR8-WG	H17-L10	MDCK	G240E, D241N
4	F17	PR8-WG	H17-L10	MDCK	G173E
5	F18	PR8-WG	H17-L10	MDCK	G240R
6	F21	PR8-WG	H17-L10	MDCK	D241N
7	F22	PR8-WG	H17-L10	MDCK	E141K, G240E
8	F23	PR8-WG	H17-L10	MDCK	E141K, G240E
9	F24	PR8-WG	H17-L10	MDCK	G240R
10	F25	PR8-WG	H17-L10	MDCK	G240R
11	F26	PR8-WG	H17-L10	MDCK	G240R
12	F27	PR8-WG	H17-L10	MDCK	S207L
13	F28	PR8-WG	H17-L10	MDCK	G173R
14	F29	PR8-WG	H17-L10	MDCK	G240R
15	F30	PR8-WG	H17-L10	MDCK	G173R
16	F31	PR8-WG	H17-L10	MDCK	G240E
17	F32	PR8-WG	H17-L10	MDCK	G240R
18	F33	PR8-WG	H17-L10	MDCK	G240R, D241N
19	F34	PR8-WG	H17-L10	MDCK	V223R, G240R
20	F35	PR8-WG	H17-L10	MDCK	G173R
21	F36	PR8-WG	H17-L10	MDCK	G173E
22	F37	PR8-WG	H17-L10	MDCK	G240R
23	F38	PR8-WG	H17-L10	MDCK	G173R
24	F39	PR8-WG	H17-L10	MDCK	G173R
25	F40	PR8-WG	H17-L10	MDCK	G240E
26	F41	PR8-WG	H17-L10	MDCK	S207L
27	F42	PR8-WG	H17-L10	MDCK	G173R, P186S
28	F43	PR8-WG	H17-L10	MDCK	G173E
29	F44	PR8-WG	H17-L10	MDCK	S207L
30	F45	PR8-WG	H17-L10	MDCK	S207L
31	F46	PR8-WG	H17-L10	MDCK	S207L
32	F47	PR8-WG	H17-L10	MDCK	K222Q, D241N
33	F48	PR8-WG	H17-L10	MDCK	G173R, P186S
34	F49	PR8-WG	H17-L10	MDCK	G173E
35	F50	PR8-WG	H17-L10	MDCK	G240E
36	F51	PR8-WG	H17-L10	MDCK	G173R
37	F52	PR8-WG	H17-L10	MDCK	G173W
38	F53	PR8-WG	H17-L10	MDCK	G240E

39	F54	PR8-WG	H17-L10	MDCK	S207L
40	F55	PR8-WG	H17-L10	MDCK	G240R
41	F56	PR8-WG	H17-L10	MDCK	G240R
42	F57	PR8-WG	H17-L10	MDCK	G240R
43	F58	PR8-WG	H17-L10	MDCK	G240R
44	F59	PR8-WG	H17-L10	MDCK	G240R
45	F60	PR8-WG	H17-L10	MDCK	G173R
46	F62	PR8-WG	H17-L10	MDCK	G240E
47	F63	PR8-WG	H17-L10	MDCK	G240R
48	F64	PR8-WG	H17-L10	MDCK	G173R
49	F65	PR8-WG	H17-L10	MDCK	E141K, G240E
50	F66	PR8-WG	H17-L10	MDCK	G173R
51	F67	PR8-WG	H17-L10	MDCK	V169M
52	F68	PR8-WG	H17-L10	MDCK	G240R
53	F69	PR8-WG	H17-L10	MDCK	G240R
54	F70	PR8-WG	H17-L10	MDCK	S125R, G240R
55	F71	PR8-WG	H17-L10	MDCK	G240E
56	F72	PR8-WG	H17-L10	MDCK	G173R, I217M
57	J1	PR8-WG	H17-L10	MDCK	G240R
58	J2	PR8-WG	H17-L10	MDCK	G240R
59	J3	PR8-WG	H17-L10	MDCK	G173R
60	J4	PR8-WG	H17-L10	MDCK	G240R
61	J5	PR8-WG	H17-L10	MDCK	E142K, N210S
62	J6	PR8-WG	H17-L10	MDCK	V169E
63	J7	PR8-WG	H17-L10	MDCK	T206I
64	J8	PR8-WG	H17-L10	MDCK	N208S
65	J9	PR8-WG	H17-L10	MDCK	K172T, P186S
66	J10	PR8-WG	H17-L10	MDCK	G173R, R224K
67	J13	PR8-WG	H17-L10	MDCK	S207P
68	J14	PR8-WG	H17-L10	MDCK	S207P
69	J16	PR8-WG	H17-L10	MDCK	G173E
70	J17	PR8-WG	H17-L10	MDCK	D241Y
71	J18	PR8-WG	H17-L10	MDCK	G240R
72	J19	PR8-WG	H17-L10	MDCK	I93T
73	J20	PR8-WG	H17-L10	MDCK	S207P
74	J21	PR8-WG	H17-L10	MDCK	D241Y
75	J22	PR8-WG	H17-L10	MDCK	V169A
76	J23	PR8-WG	H17-L10	MDCK	G173R, P186S
77	J24	PR8-WG	H17-L10	MDCK	G240R
78	J25	PR8-WG	H17-L10	MDCK	G240R
79	J26	PR8-WG	H17-L10	MDCK	P186S, S207P, R262K
80	J27	PR8-WG	H17-L10	MDCK	E142K, G240E
81	J28	PR8-WG	H17-L10	MDCK	G240E

82	J29	PR8-WG	H17-L10	MDCK	V169A
83	J30	PR8-WG	H17-L10	MDCK	G173R, P186S
84	J31	PR8-WG	H17-L10	MDCK	I93T
85	J32	PR8-WG	H17-L10	MDCK	V169A
86	J33	PR8-WG	H17-L10	MDCK	E142K, G240E
87	J34	PR8-WG	H17-L10	MDCK	S207P
88	J35	PR8-WG	H17-L10	MDCK	G240R
89	J36	PR8-WG	H17-L10	MDCK	G240R
90	J37	PR8-WG	H17-L10	MDCK	G173E
91	J38	PR8-WG	H17-L10	MDCK	S207L
92	J39	PR8-WG	H17-L10	MDCK	I93T
93	J40	PR8-WG	H17-L10	MDCK	E124G, G240R
94	J41	PR8-WG	H17-L10	MDCK	G240R
95	J42	PR8-WG	H17-L10	MDCK	S140P, G173R
96	J43	PR8-WG	H17-L10	MDCK	S207L
97	J44	PR8-WG	H17-L10	MDCK	G173R
98	J46	PR8-WG	H17-L10	MDCK	G240R
99	J47	PR8-WG	H17-L10	MDCK	V169M
100	J48	PR8-WG	H17-L10	MDCK	G173E
101	J49	PR8-WG	H17-L10	MDCK	T242K
102	J50	PR8-WG	H17-L10	MDCK	G240R
103	J51	PR8-WG	H17-L10	MDCK	G240R
104	J52	PR8-WG	H17-L10	MDCK	F99L, S207P
105	J53	PR8-WG	H17-L10	MDCK	G240R
106	J54	PR8-WG	H17-L10	MDCK	G240R
107	J56	PR8-WG	H17-L10	MDCK	G173E
108	J57	PR8-WG	H17-L10	MDCK	G240R
109	J59	PR8-WG	H17-L10	MDCK	S207L
110	J60	PR8-WG	H17-L10	MDCK	G173R
111	J61	PR8-WG	H17-L10	MDCK	I93T
112	J62	PR8-WG	H17-L10	MDCK	A218T
113	J63	PR8-WG	H17-L10	MDCK	G240R
114	J64	PR8-WG	H17-L10	MDCK	S207L, P186S
115	J65	PR8-WG	H17-L10	MDCK	G173R
116	J66	PR8-WG	H17-L10	MDCK	V169A
117	J67	PR8-WG	H17-L10	MDCK	E142K,G240E
118	J68	PR8-WG	H17-L10	MDCK	G240E
119	J70	PR8-WG	H17-L10	MDCK	S271L
120	J71	PR8-WG	H17-L10	MDCK	G240E, A247T
121	J72	PR8-WG	H17-L10	MDCK	G240R

1	F73	PR8-WG	H17-L2	MDCK	G240R
2	F74	PR8-WG	H17-L2	MDCK	G240R

3	F75	PR8-WG	H17-L2	MDCK	S207L
4	F76	PR8-WG	H17-L2	MDCK	G173R
5	F77	PR8-WG	H17-L2	MDCK	T242K
6	F78	PR8-WG	H17-L2	MDCK	G173E
7	F79	PR8-WG	H17-L2	MDCK	G173E
8	F80	PR8-WG	H17-L2	MDCK	S207L
9	F81	PR8-WG	H17-L2	MDCK	G240R
10	F82	PR8-WG	H17-L2	MDCK	G240R
11	F83	PR8-WG	H17-L2	MDCK	L152P
12	F84	PR8-WG	H17-L2	MDCK	G240E
13	F86	PR8-WG	H17-L2	MDCK	S207L
14	F87	PR8-WG	H17-L2	MDCK	S207L
15	F88	PR8-WG	H17-L2	MDCK	G173R
16	F89	PR8-WG	H17-L2	MDCK	G240R
17	F91	PR8-WG	H17-L2	MDCK	G240R
18	F92	PR8-WG	H17-L2	MDCK	G173R
19	F93	PR8-WG	H17-L2	MDCK	G173R
20	F94	PR8-WG	H17-L2	MDCK	G240R
21	F95	PR8-WG	H17-L2	MDCK	P127S, G173R
22	F97	PR8-WG	H17-L2	MDCK	G173E
23	F98	PR8-WG	H17-L2	MDCK	E142K, G240E
24	F99	PR8-WG	H17-L2	MDCK	G173R, I217M
25	F100	PR8-WG	H17-L2	MDCK	G173R
26	F101	PR8-WG	H17-L2	MDCK	G240E
27	F102	PR8-WG	H17-L2	MDCK	G173E, E124G
28	F103	PR8-WG	H17-L2	MDCK	G173R
29	F104	PR8-WG	H17-L2	MDCK	G240R
30	F105	PR8-WG	H17-L2	MDCK	G240R
31	F106	PR8-WG	H17-L2	MDCK	G173R
32	F107	PR8-WG	H17-L2	MDCK	I93T
33	F109	PR8-WG	H17-L2	MDCK	G240E, A247T
34	F110	PR8-WG	H17-L2	MDCK	G240R
35	F111	PR8-WG	H17-L2	MDCK	S207L
36	F112	PR8-WG	H17-L2	MDCK	V169M
37	F113	PR8-WG	H17-L2	MDCK	G173R, S207P
38	F114	PR8-WG	H17-L2	MDCK	S207P, G240E
39	F116	PR8-WG	H17-L2	MDCK	G240E
40	F117	PR8-WG	H17-L2	MDCK	S140P, G173E
41	F118	PR8-WG	H17-L2	MDCK	S124G, S207P
42	F119	PR8-WG	H17-L2	MDCK	D241N
43	F120	PR8-WG	H17-L2	MDCK	G240R
44	F121	PR8-WG	H17-L2	MDCK	S207L
45	F122	PR8-WG	H17-L2	MDCK	G173R

46	F123	PR8-WG	H17-L2	MDCK	G240R
47	F124	PR8-WG	H17-L2	MDCK	G240R
48	F125	PR8-WG	H17-L2	MDCK	G240R
49	F126	PR8-WG	H17-L2	MDCK	D241N
50	F127	PR8-WG	H17-L2	MDCK	S207P
51	F128	PR8-WG	H17-L2	MDCK	E124G, G240R
52	F130	PR8-WG	H17-L2	MDCK	G240R
53	F131	PR8-WG	H17-L2	MDCK	G240R
54	F132	PR8-WG	H17-L2	MDCK	G240R
55	J73	PR8-WG	H17-L2	MDCK	V169A, R262K
56	J74	PR8-WG	H17-L2	MDCK	G173R
57	J75	PR8-WG	H17-L2	MDCK	G240R
58	J76	PR8-WG	H17-L2	MDCK	G240R
59	J77	PR8-WG	H17-L2	MDCK	T242K
60	J78	PR8-WG	H17-L2	MDCK	S207L, R224K
61	J79	PR8-WG	H17-L2	MDCK	S207L
62	J80	PR8-WG	H17-L2	MDCK	V169M
63	J81	PR8-WG	H17-L2	MDCK	S207L
64	J82	PR8-WG	H17-L2	MDCK	G240R
65	J83	PR8-WG	H17-L2	MDCK	G240R
66	J84	PR8-WG	H17-L2	MDCK	G240R
67	J85	PR8-WG	H17-L2	MDCK	G240R
68	J86	PR8-WG	H17-L2	MDCK	G240R
69	J89	PR8-WG	H17-L2	MDCK	P186S, S207L
70	J90	PR8-WG	H17-L2	MDCK	T242K
71	J91	PR8-WG	H17-L2	MDCK	V169A
72	J92	PR8-WG	H17-L2	MDCK	G240R
73	J93	PR8-WG	H17-L2	MDCK	I93T
74	J94	PR8-WG	H17-L2	MDCK	V169M
75	J95	PR8-WG	H17-L2	MDCK	G240R
76	J96	PR8-WG	H17-L2	MDCK	G173R
77	J97	PR8-WG	H17-L2	MDCK	G173R, I244M
78	J98	PR8-WG	H17-L2	MDCK	E124G, S207P
79	J99	PR8-WG	H17-L2	MDCK	G240R
80	J100	PR8-WG	H17-L2	MDCK	G240E
81	J101	PR8-WG	H17-L2	MDCK	G173R
82	J102	PR8-WG	H17-L2	MDCK	G240R
83	J103	PR8-WG	H17-L2	MDCK	E142K, G240E
84	J104	PR8-WG	H17-L2	MDCK	P186S, S207L
85	J105	PR8-WG	H17-L2	MDCK	S207L
86	J106	PR8-WG	H17-L2	MDCK	T242K
87	J107	PR8-WG	H17-L2	MDCK	G173R, P186S
88	J108	PR8-WG	H17-L2	MDCK	V169A

89	J109	PR8-WG	H17-L2	MDCK	S207L
90	J110	PR8-WG	H17-L2	MDCK	G240R
91	J111	PR8-WG	H17-L2	MDCK	V169A, E219D
92	J112	PR8-WG	H17-L2	MDCK	V169A
93	J113	PR8-WG	H17-L2	MDCK	G173E
94	J114	PR8-WG	H17-L2	MDCK	V169A
95	J116	PR8-WG	H17-L2	MDCK	D241N
96	J118	PR8-WG	H17-L2	MDCK	S207L
97	J121	PR8-WG	H17-L2	MDCK	G240R
98	J122	PR8-WG	H17-L2	MDCK	G173R, P186S
99	J124	PR8-WG	H17-L2	MDCK	G173W, P186S
100	J125	PR8-WG	H17-L2	MDCK	G240R
101	J126	PR8-WG	H17-L2	MDCK	S207L
102	J127	PR8-WG	H17-L2	MDCK	G240E
103	J128	PR8-WG	H17-L2	MDCK	V169A
104	J130	PR8-WG	H17-L2	MDCK	G240R
105	J132	PR8-WG	H17-L2	MDCK	V169A
106	J134	PR8-WG	H17-L2	MDCK	G240R
107	J136	PR8-WG	H17-L2	MDCK	G173R
108	J137	PR8-WG	H17-L2	MDCK	G173R, S186P
109	J138	PR8-WG	H17-L2	MDCK	S207L, Y256F
110	J139	PR8-WG	H17-L2	MDCK	R224K, G240E
111	J140	PR8-WG	H17-L2	MDCK	G240E
112	J142	PR8-WG	H17-L2	MDCK	V169A
113	J143	PR8-WG	H17-L2	MDCK	G173W
114	J144	PR8-WG	H17-L2	MDCK	S207L

1	A109	SEQ-7	H17-L10	MDCK	T242K
2	A110	SEQ-7	H17-L10	MDCK	G240R
3	A111	SEQ-7	H17-L10	MDCK	G240R
4	A112	SEQ-7	H17-L10	MDCK	G240R
5	A113	SEQ-7	H17-L10	MDCK	G240R
6	A114	SEQ-7	H17-L10	MDCK	G173R
7	A115	SEQ-7	H17-L10	MDCK	G240R
8	A116	SEQ-7	H17-L10	MDCK	G240R
9	A117	SEQ-7	H17-L10	MDCK	G173R
10	A118	SEQ-7	H17-L10	MDCK	G240R
11	A119	SEQ-7	H17-L10	MDCK	S271L
12	A120	SEQ-7	H17-L10	MDCK	G240R
13	A121	SEQ-7	H17-L10	MDCK	G240R
14	A122	SEQ-7	H17-L10	MDCK	G240N
15	A123	SEQ-7	H17-L10	MDCK	G240R
16	A124	SEQ-7	H17-L10	MDCK	G240R

17	A125	SEQ-7	H17-L10	MDCK	G240R, R262K
18	A126	SEQ-7	H17-L10	MDCK	G240R
19	A127	SEQ-7	H17-L10	MDCK	G240R
20	A128	SEQ-7	H17-L10	MDCK	G240R
21	A129	SEQ-7	H17-L10	MDCK	G240R
22	A130	SEQ-7	H17-L10	MDCK	G240R
23	A131	SEQ-7	H17-L10	MDCK	G240R
24	A132	SEQ-7	H17-L10	MDCK	G240E
25	A133	SEQ-7	H17-L10	MDCK	G240R
26	A134	SEQ-7	H17-L10	MDCK	G240R
27	A135	SEQ-7	H17-L10	MDCK	G173E
28	A136	SEQ-7	H17-L10	MDCK	G240R
29	A137	SEQ-7	H17-L10	MDCK	G240R
30	A138	SEQ-7	H17-L10	MDCK	G240R
31	A139	SEQ-7	H17-L10	MDCK	D225Y
32	A140	SEQ-7	H17-L10	MDCK	G240R
33	A141	SEQ-7	H17-L10	MDCK	N279D
34	A142	SEQ-7	H17-L10	MDCK	G240R
35	A143	SEQ-7	H17-L10	MDCK	G240R
36	A144	SEQ-7	H17-L10	MDCK	G240R
37	K1	SEQ-7	H17-L10	MDCK	G240R
38	K2	SEQ-7	H17-L10	MDCK	G173R, G240R, A257S
39	K3	SEQ-7	H17-L10	MDCK	G240R
40	K4	SEQ-7	H17-L10	MDCK	G240R
41	K5	SEQ-7	H17-L10	MDCK	G240R
42	K6	SEQ-7	H17-L10	MDCK	G240R
43	K7	SEQ-7	H17-L10	MDCK	G240R
44	K8	SEQ-7	H17-L10	MDCK	G173E
45	K9	SEQ-7	H17-L10	MDCK	G240R
46	K10	SEQ-7	H17-L10	MDCK	G240R
47	K11	SEQ-7	H17-L10	MDCK	G240R
48	K12	SEQ-7	H17-L10	MDCK	G240R
49	K13	SEQ-7	H17-L10	MDCK	G240R
50	K15	SEQ-7	H17-L10	MDCK	D225G
51	K16	SEQ-7	H17-L10	MDCK	G240R
52	K17	SEQ-7	H17-L10	MDCK	G240R
53	K19	SEQ-7	H17-L10	MDCK	G240R
54	K20	SEQ-7	H17-L10	MDCK	G240R
55	K21	SEQ-7	H17-L10	MDCK	G240R
56	K22	SEQ-7	H17-L10	MDCK	G240R
57	K23	SEQ-7	H17-L10	MDCK	D225Y
58	K24	SEQ-7	H17-L10	MDCK	G240R
59	K25	SEQ-7	H17-L10	MDCK	G240R

60	K26	SEQ-7	H17-L10	MDCK	G240R
61	K27	SEQ-7	H17-L10	MDCK	G240R
62	K28	SEQ-7	H17-L10	MDCK	G240R
63	K29	SEQ-7	H17-L10	MDCK	G240R
64	K30	SEQ-7	H17-L10	MDCK	D225Y
65	K31	SEQ-7	H17-L10	MDCK	T242K
66	K32	SEQ-7	H17-L10	MDCK	G173R
67	K33	SEQ-7	H17-L10	MDCK	D225Y
68	K34	SEQ-7	H17-L10	MDCK	G240R
69	K35	SEQ-7	H17-L10	MDCK	G240R
70	K36	SEQ-7	H17-L10	MDCK	G240R
71	K38	SEQ-7	H17-L10	MDCK	G240R
72	K39	SEQ-7	H17-L10	MDCK	G240R
73	K40	SEQ-7	H17-L10	MDCK	G240R
74	K41	SEQ-7	H17-L10	MDCK	G240R
75	K42	SEQ-7	H17-L10	MDCK	G240R
76	K43	SEQ-7	H17-L10	MDCK	T242K
77	K44	SEQ-7	H17-L10	MDCK	G240R
78	K45	SEQ-7	H17-L10	MDCK	G240R
79	K46	SEQ-7	H17-L10	MDCK	T242K
80	K47	SEQ-7	H17-L10	MDCK	G240R
81	K48	SEQ-7	H17-L10	MDCK	G240R
82	K49	SEQ-7	H17-L10	MDCK	G240R
83	K50	SEQ-7	H17-L10	MDCK	G240R
84	K51	SEQ-7	H17-L10	MDCK	G240R
85	K52	SEQ-7	H17-L10	MDCK	G240R
86	K53	SEQ-7	H17-L10	MDCK	G240R
87	K55	SEQ-7	H17-L10	MDCK	G240R
88	K56	SEQ-7	H17-L10	MDCK	G240R
89	K57	SEQ-7	H17-L10	MDCK	G240R
90	K58	SEQ-7	H17-L10	MDCK	G240R
91	K59	SEQ-7	H17-L10	MDCK	G240R
92	K60	SEQ-7	H17-L10	MDCK	G173R
93	K61	SEQ-7	H17-L10	MDCK	G240R
94	K62	SEQ-7	H17-L10	MDCK	G240R
95	K63	SEQ-7	H17-L10	MDCK	G240R
96	K64	SEQ-7	H17-L10	MDCK	G240R
97	K66	SEQ-7	H17-L10	MDCK	G240R
98	K67	SEQ-7	H17-L10	MDCK	G240R
99	K68	SEQ-7	H17-L10	MDCK	G240R
100	K69	SEQ-7	H17-L10	MDCK	G240R
101	K70	SEQ-7	H17-L10	MDCK	G240R
102	K71	SEQ-7	H17-L10	MDCK	G240R

103	K72	SEQ-7	H17-L10	MDCK	G240R
1	A37	SEQ-7	H17-L2	MDCK	T242K, R262K
2	A38	SEQ-7	H17-L2	MDCK	G240R, A253P
3	A39	SEQ-7	H17-L2	MDCK	G240R
4	A40	SEQ-7	H17-L2	MDCK	D225Y, R262K
5	A41	SEQ-7	H17-L2	MDCK	D225Y, A253P
6	A42	SEQ-7	H17-L2	MDCK	E219K, G240R
7	A43	SEQ-7	H17-L2	MDCK	I93T
8	A44	SEQ-7	H17-L2	MDCK	T242K
9	A45	SEQ-7	H17-L2	MDCK	G240R
10	A46	SEQ-7	H17-L2	MDCK	D225Y
11	A47	SEQ-7	H17-L2	MDCK	G240R, A253T
12	A48	SEQ-7	H17-L2	MDCK	D225Y
13	A52	SEQ-7	H17-L2	MDCK	G240R
14	A53	SEQ-7	H17-L2	MDCK	G240R
15	A54	SEQ-7	H17-L2	MDCK	G173R
16	A55	SEQ-7	H17-L2	MDCK	G173R
17	A56	SEQ-7	H17-L2	MDCK	G173R
18	A57	SEQ-7	H17-L2	MDCK	G240R
19	A58	SEQ-7	H17-L2	MDCK	G173R
20	A59	SEQ-7	H17-L2	MDCK	G240R
21	A60	SEQ-7	H17-L2	MDCK	G240R
22	A61	SEQ-7	H17-L2	MDCK	G240R
23	A62	SEQ-7	H17-L2	MDCK	G240R
24	A63	SEQ-7	H17-L2	MDCK	G240R
25	A65	SEQ-7	H17-L2	MDCK	G240R
26	A66	SEQ-7	H17-L2	MDCK	G240R
27	A67	SEQ-7	H17-L2	MDCK	G240R
28	A68	SEQ-7	H17-L2	MDCK	G240R
29	A69	SEQ-7	H17-L2	MDCK	D225Y
30	A70	SEQ-7	H17-L2	MDCK	E219K, G240R, A253T
31	A71	SEQ-7	H17-L2	MDCK	D225Y
32	A72	SEQ-7	H17-L2	MDCK	G173R
33	K73	SEQ-7	H17-L2	MDCK	G240R
34	K74	SEQ-7	H17-L2	MDCK	G240R
35	K75	SEQ-7	H17-L2	MDCK	G240R
36	K76	SEQ-7	H17-L2	MDCK	G50E, G240R
37	K77	SEQ-7	H17-L2	MDCK	G240R
38	K78	SEQ-7	H17-L2	MDCK	D225G
39	K79	SEQ-7	H17-L2	MDCK	G240R
40	K80	SEQ-7	H17-L2	MDCK	G240R
41	K81	SEQ-7	H17-L2	MDCK	T242K

42	K82	SEQ-7	H17-L2	MDCK	G240R
43	K83	SEQ-7	H17-L2	MDCK	S207P, D225Y
44	K84	SEQ-7	H17-L2	MDCK	G240R
45	K85	SEQ-7	H17-L2	MDCK	G240R
46	K86	SEQ-7	H17-L2	MDCK	T242K
47	K87	SEQ-7	H17-L2	MDCK	G240R
48	K88	SEQ-7	H17-L2	MDCK	G240E
49	K89	SEQ-7	H17-L2	MDCK	D225Y
50	K90	SEQ-7	H17-L2	MDCK	G240R
51	K91	SEQ-7	H17-L2	MDCK	D225Y
52	K92	SEQ-7	H17-L2	MDCK	G240R
53	K93	SEQ-7	H17-L2	MDCK	D225Y
54	K94	SEQ-7	H17-L2	MDCK	G240R
55	K95	SEQ-7	H17-L2	MDCK	D225Y
56	K96	SEQ-7	H17-L2	MDCK	T242K
57	K121	SEQ-7	H17-L2	MDCK	G240R
58	K122	SEQ-7	H17-L2	MDCK	D225Y
59	K123	SEQ-7	H17-L2	MDCK	G240R
60	K124	SEQ-7	H17-L2	MDCK	D225Y
61	K125	SEQ-7	H17-L2	MDCK	G240R
62	K126	SEQ-7	H17-L2	MDCK	G240R
63	K127	SEQ-7	H17-L2	MDCK	G240R
64	K128	SEQ-7	H17-L2	MDCK	G240R
65	K129	SEQ-7	H17-L2	MDCK	G240R
66	K130	SEQ-7	H17-L2	MDCK	D225Y
67	K131	SEQ-7	H17-L2	MDCK	G240R
68	K132	SEQ-7	H17-L2	MDCK	V169M
69	K133	SEQ-7	H17-L2	MDCK	G173E
70	K134	SEQ-7	H17-L2	MDCK	G140R
71	K135	SEQ-7	H17-L2	MDCK	G240E
72	K136	SEQ-7	H17-L2	MDCK	G240R
73	K137	SEQ-7	H17-L2	MDCK	G240R
74	K139	SEQ-7	H17-L2	MDCK	G240R
75	K140	SEQ-7	H17-L2	MDCK	G240R, A253P
76	K141	SEQ-7	H17-L2	MDCK	G240R
77	K142	SEQ-7	H17-L2	MDCK	G240R
78	K143	SEQ-7	H17-L2	MDCK	D225Y
79	K144	SEQ-7	H17-L2	MDCK	D225Y
80	SEQ-A1	SEQ-7	H17-L2	MDCK	N197D
81	SEQ-A2	SEQ-7	H17-L2	MDCK	T242K
82	SEQ-A3	SEQ-7	H17-L2	MDCK	D225G
83	SEQ-A4	SEQ-7	H17-L2	MDCK	D225G
84	SEQ-A5	SEQ-7	H17-L2	MDCK	G240E

85	SEQ-A6	SEQ-7	H17-L2	MDCK	G240R
86	SEQ-A7	SEQ-7	H17-L2	MDCK	A253P
87	SEQ-A8	SEQ-7	H17-L2	MDCK	G240R
88	SEQ-A8	SEQ-7	H17-L2	MDCK	G240R
89	SEQ-A8	SEQ-7	H17-L2	MDCK	G240R

1	D40	SEQ-8	H17-L10	MDCK	G240E
2	D43	SEQ-8	H17-L10	MDCK	G240E
3	D44	SEQ-8	H17-L10	MDCK	I93T
4	D45	SEQ-8	H17-L10	MDCK	I93T
5	D46	SEQ-8	H17-L10	MDCK	K172T
6	D48	SEQ-8	H17-L10	MDCK	G240E
7	D50	SEQ-8	H17-L10	MDCK	V169M
8	D51	SEQ-8	H17-L10	MDCK	I93T
9	D53	SEQ-8	H17-L10	MDCK	V169M
10	D54	SEQ-8	H17-L10	MDCK	G173R
11	D55	SEQ-8	H17-L10	MDCK	G240R
12	D57	SEQ-8	H17-L10	MDCK	G173R
13	D58	SEQ-8	H17-L10	MDCK	G173R
14	D60	SEQ-8	H17-L10	MDCK	G173R
15	D62	SEQ-8	H17-L10	MDCK	K238T
16	D63	SEQ-8	H17-L10	MDCK	G240E
17	D65	SEQ-8	H17-L10	MDCK	K172T
18	D66	SEQ-8	H17-L10	MDCK	I93T
19	D68	SEQ-8	H17-L10	MDCK	G268R
20	D72	SEQ-8	H17-L10	MDCK	S207A
21	E13	SEQ-8	H17-L10	MDCK	G173R
22	E14	SEQ-8	H17-L10	MDCK	S125P
23	E15	SEQ-8	H17-L10	MDCK	D241N
24	E16	SEQ-8	H17-L10	MDCK	G173R
25	E17	SEQ-8	H17-L10	MDCK	G173R
26	E18	SEQ-8	H17-L10	MDCK	N210S
27	E21	SEQ-8	H17-L10	MDCK	I93T
28	E26	SEQ-8	H17-L10	MDCK	K222Q, G240R
29	E28	SEQ-8	H17-L10	MDCK	D241N
30	E29	SEQ-8	H17-L10	MDCK	T235N
31	E30	SEQ-8	H17-L10	MDCK	N210S
32	E34	SEQ-8	H17-L10	MDCK	S266N
33	E35	SEQ-8	H17-L10	MDCK	N210H
34	E36	SEQ-8	H17-L10	MDCK	G173R
35	E37	SEQ-8	H17-L10	MDCK	Q191T, A253T
36	E38	SEQ-8	H17-L10	MDCK	N210S
37	E39	SEQ-8	H17-L10	MDCK	N210S

38	E44	SEQ-8	H17-L10	MDCK	G173R
39	E45	SEQ-8	H17-L10	MDCK	A253T
40	E46	SEQ-8	H17-L10	MDCK	K222Q, A253T
41	E47	SEQ-8	H17-L10	MDCK	K222Q, G240E