Fig. 1A

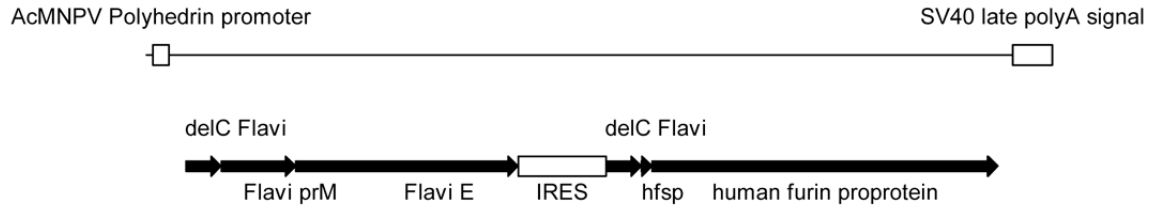


Fig. 1B

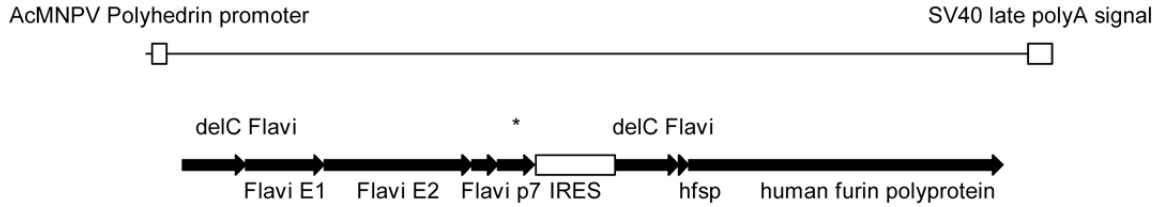


Fig. 1C

Molecule Features: (6051 bps)

Start	End	Name	Draw As
43	152	AcMNPV Polyhedrin promoter	Region
266	499	delC Flavi	Gene
500	997	Flavi prM	Gene
998	2482	Flavi E	Gene
2486	3071	IRES	Gene
3072	3305	delC flavi	Gene
3306	3377	hfsp	Gene
3378	5687	human furin proprotein	Gene
5786	6051	SV40 late polyA signal	Region

Fig. 1D

Molecule Features: (6663 bps)

Start	End	Name	Draw As
43	152	AcMNPV Polyhedrin promoter	Region
269	733	delC Flavi	Gene
734	1309	Flavi E1	Gene
1310	2398	Flavi E2	Gene
2399	2587	Flavi p7	Gene
2588	2854	*	Gene
2864	3449	IRES	Gene
3450	3917	delC Flavi	Gene
3918	3989	hfsp	Gene
3990	6299	human furin polyprotein	Gene
6486	6663	SV40 late polyA signal	Region

Fig. 2A

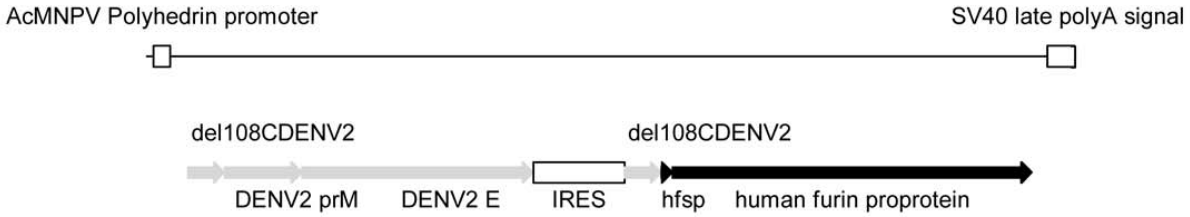


Fig. 2B

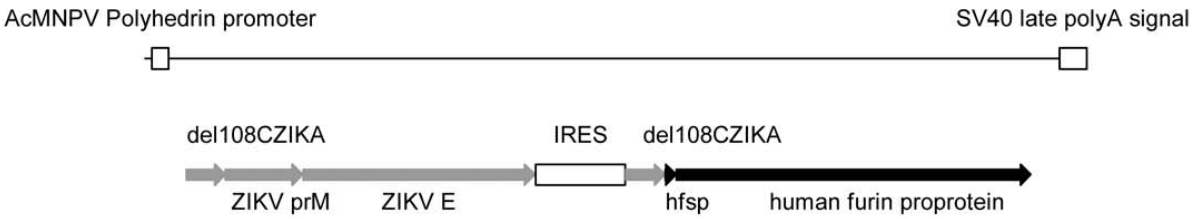


Fig. 2C

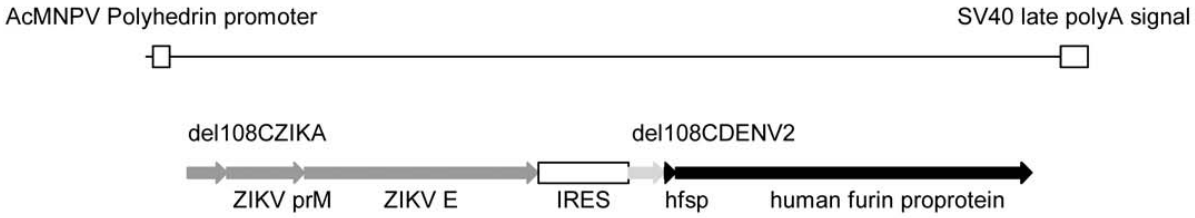


Fig. 2D

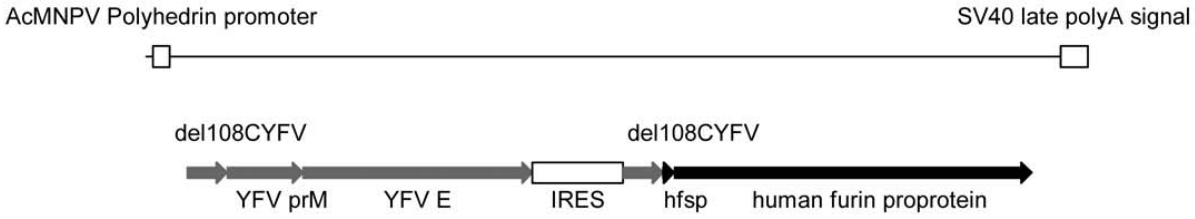


Fig. 2E

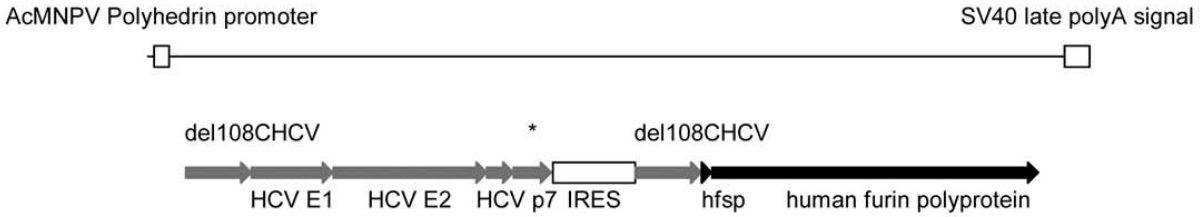


Fig. 2F

Molecule Features: (6051 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
266	499	del108CDENV2		Gene
500	997	DENV2 prM		Gene
998	2482	DENV2 E		Gene
2486	3071	IRES		Gene
3072	3305	del108CDENV2		Gene
3306	3377	hfsp		Gene
3378	5687	human furin proprotein		Gene
5786	6051	SV40 late polyA signal		Region

Fig. 2G

Molecule Features: (6132 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
269	523	del108CZIKA		Gene
524	1027	ZIKV prM		Gene
1028	2539	ZIKV E		Gene
2543	3128	IRES		Gene
3129	3386	del108CZIKA		Gene
3387	3458	hfsp		Gene
3459	5768	human furin proprotein		Gene
5954	6132	SV40 late polyA signal		Region

Fig. 2H

Molecule Features: (6108 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
269	523	del108CZIKA		Gene
524	1027	ZIKV prM		Gene
1028	2539	ZIKV E		Gene
2543	3128	IRES		Gene
3129	3362	del108CDENV2		Gene
3363	3434	hfsp		Gene
3435	5744	human furin proprotein		Gene
5930	6108	SV40 late polyA signal		Region

Primers (0 sites)

Fig. 2I

Molecule Features: (6087 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
266	523	del108CYFV		Gene
524	1015	YFV prM		Gene
1016	2497	YFV E		Gene
2498	3083	IRES		Gene
3084	3341	del108CYFV		Gene
3342	3413	hfsp		Gene
3414	5723	human furin proprotein		Gene
5909	6087	SV40 late polyA signal		Region

Fig. 2J

Molecule Features: (6663 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
269	733	del108CHCV		Gene
734	1309	HCV E1		Gene
1310	2398	HCV E2		Gene
2399	2587	HCV p7		Gene
2588	2854	*		Gene
2864	3449	IRES		Gene
3450	3917	del108CHCV		Gene
3918	3989	hfsp		Gene
3990	6299	human furin polyprotein		Gene
6486	6663	SV40 late polyA signal		Region

Fig. 3A

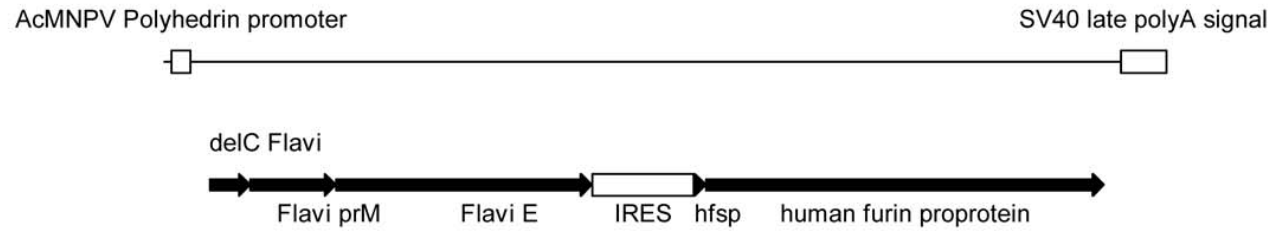


Fig. 3B

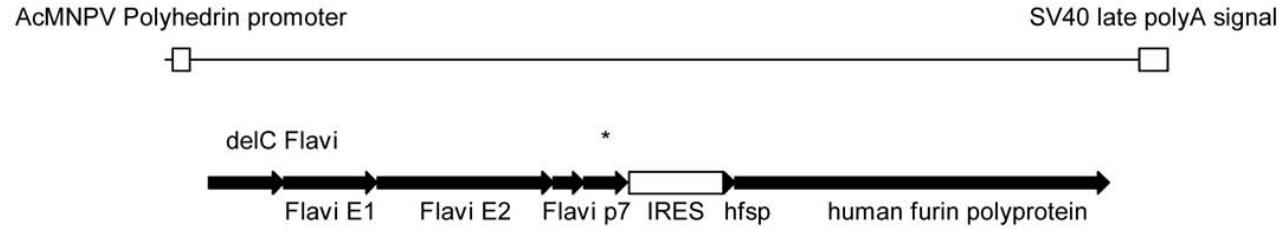


Fig. 3C

Molecule Features: (5817 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
266	499	delC Flavi		Gene
500	997	Flavi prM		Gene
998	2482	Flavi E		Gene
2486	3071	IRES		Gene
3072	3143	hfsp		Gene
3144	5453	human furin proprotein		Gene
5552	5817	SV40 late polyA signal		Region

Primers (0 sites)

Fig. 3D

Molecule Features: (6195 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
269	733	delC Flavi		Gene
734	1309	Flavi E1		Gene
1310	2398	Flavi E2		Gene
2399	2587	Flavi p7		Gene
2588	2854	*		Gene
2864	3449	IRES		Gene
3450	3521	hfsp		Gene
3522	5831	human furin polyprotein		Gene
6018	6195	SV40 late polyA signal		Region

Fig. 4A

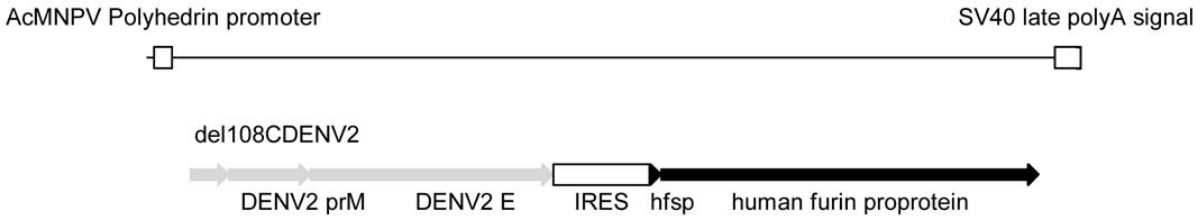


Fig. 4B

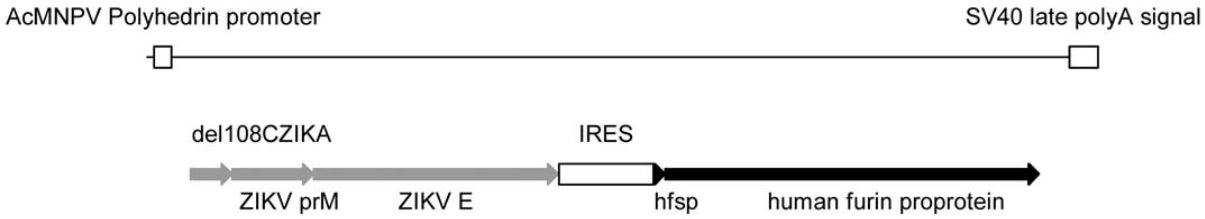


Fig. 4C

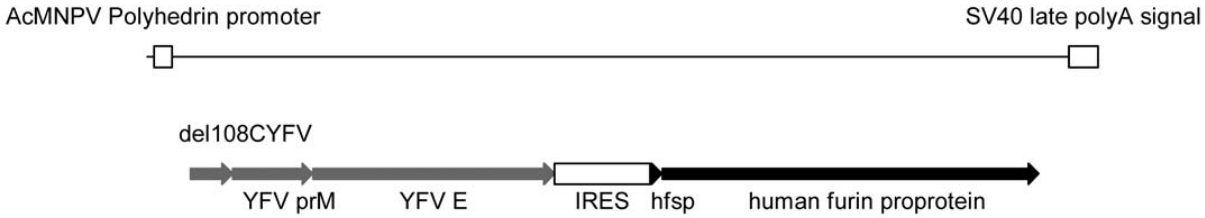


Fig. 4D

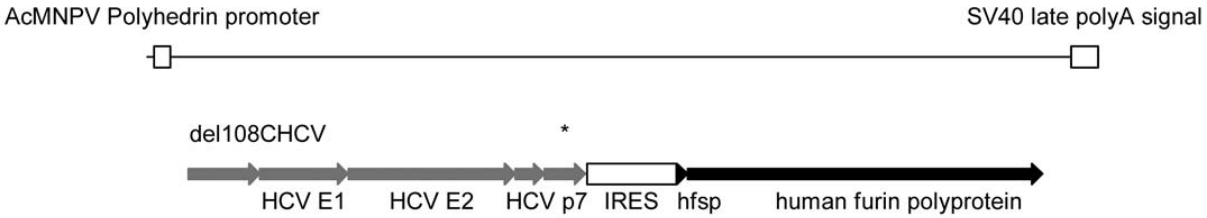


Fig. 4E

Molecule Features: (5817 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
266	499	del108CDENV2		Gene
500	997	DENV2 prM		Gene
998	2482	DENV2 E		Gene
2486	3071	IRES		Gene
3072	3143	hfsp		Gene
3144	5453	human furin proprotein		Gene
5552	5817	SV40 late polyA signal		Region

Fig. 4F

Molecule Features: (5874 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
269	523	del108CZIKA		Gene
524	1027	ZIKV prM		Gene
1028	2539	ZIKV E		Gene
2543	3128	IRES		Gene
3129	3200	hfsp		Gene
3201	5510	human furin proprotein		Gene
[illegible]96	5874	SV40 late polyA signal		Region

Fig. 4G

Molecule Features: (5829 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
266	523	del108CYFV		Gene
524	1015	YFV prM		Gene
1016	2497	YFV E		Gene
2498	3083	IRES		Gene
3084	3155	hfsp		Gene
[illegible]56	5465	human furin proprotein		Gene
1	5829	SV40 late polyA signal		Region

Fig. 4H

Molecule Features: (6195 bps)

Start	End	Name	Feature Key	Draw As
43	152	AcMNPV Polyhedrin promoter		Region
269	733	del108CHCV		Gene
734	1309	HCV E1		Gene
1310	2398	HCV E2		Gene
2399	2587	HCV p7		Gene
2588	2854	*		Gene
2864	3449	IRES		Gene
3450	3521	hfsp		Gene
3522	5831	human furin polyprotein		Gene
6018	6195	SV40 late polyA signal		Region

Fig. 5A Codon Adaptation Index (CAI)

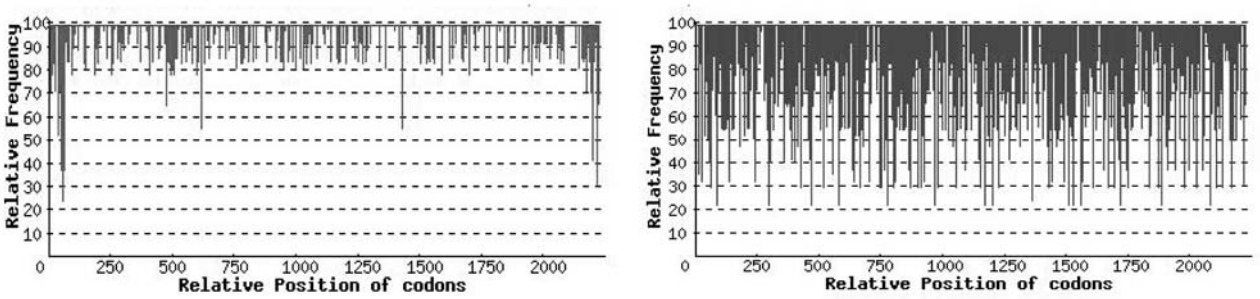


Fig. 5B Frequency of Optimal Codons (FOP)

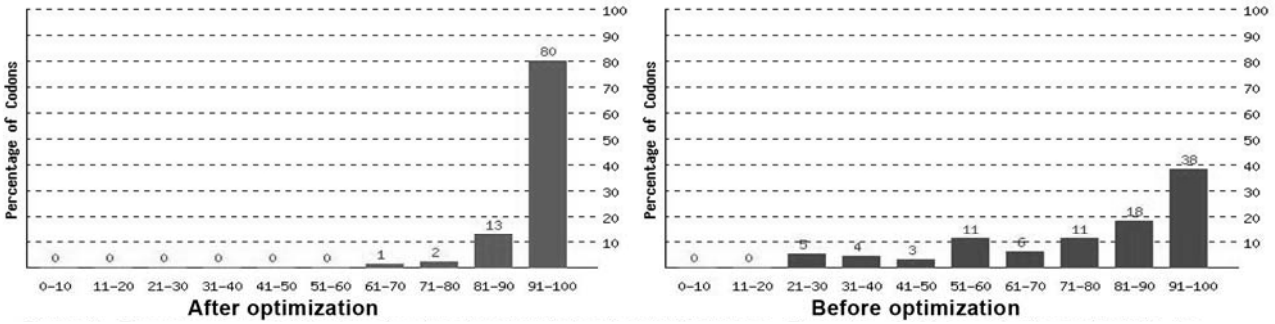


Fig. 5C GC Content Adjustment of DENV 2 del108C-prM-E for insect cells

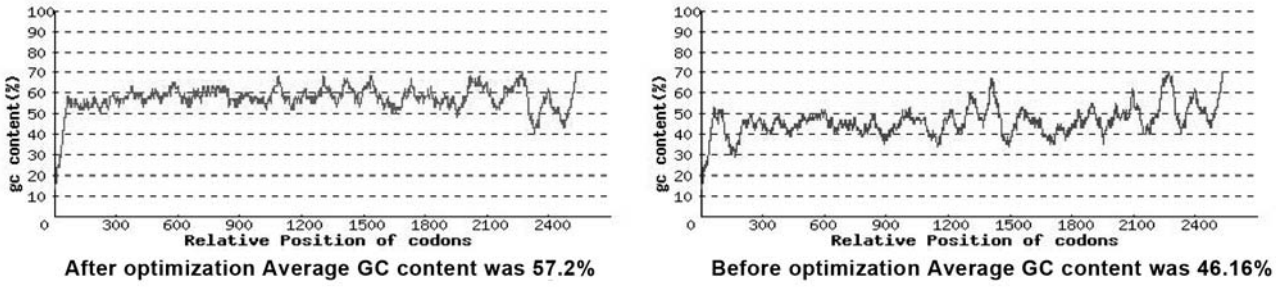


Fig. 6A **Codon Adaptation Index (CAI)**

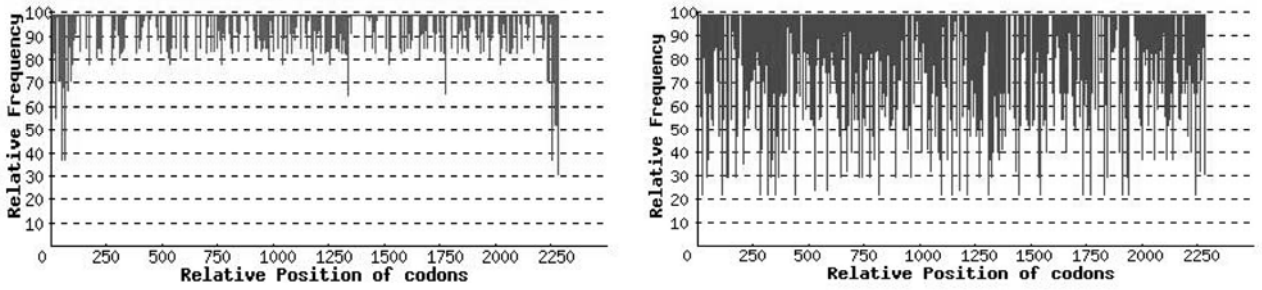


Fig. 6B **Frequency of Optimal Codons (FOP)**

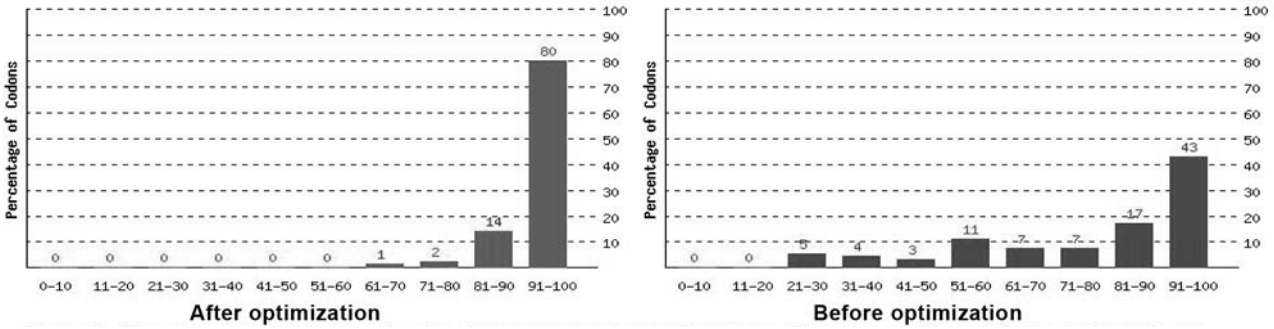


Fig. 6C **GC Content Adjustment of DENV 2 del108C-prM-E for insect cells**

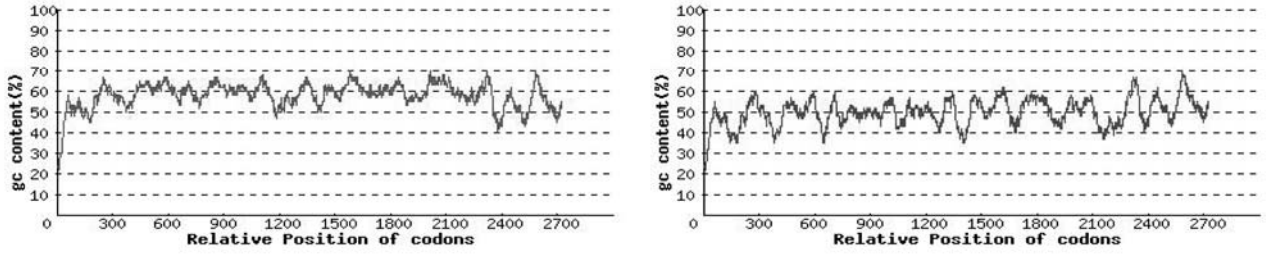


Fig. 7A Codon Adaptation Index (CAI)

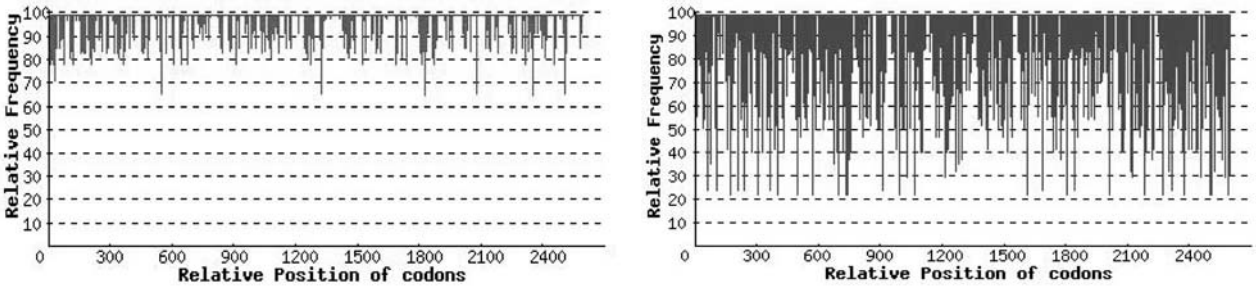


Fig. 7B Frequency of Optimal Codons (FOP)

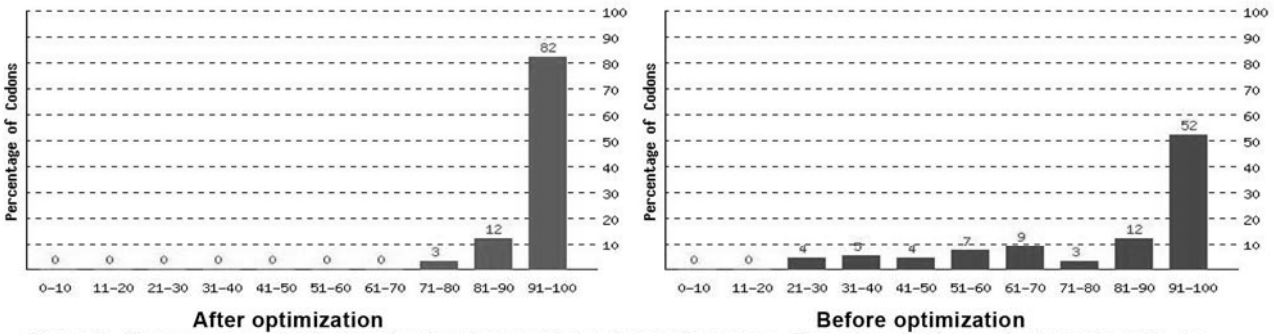


Fig. 7C GC Content Adjustment of HCV del108C-E1-E2-p7-NS2del384 for insect cells

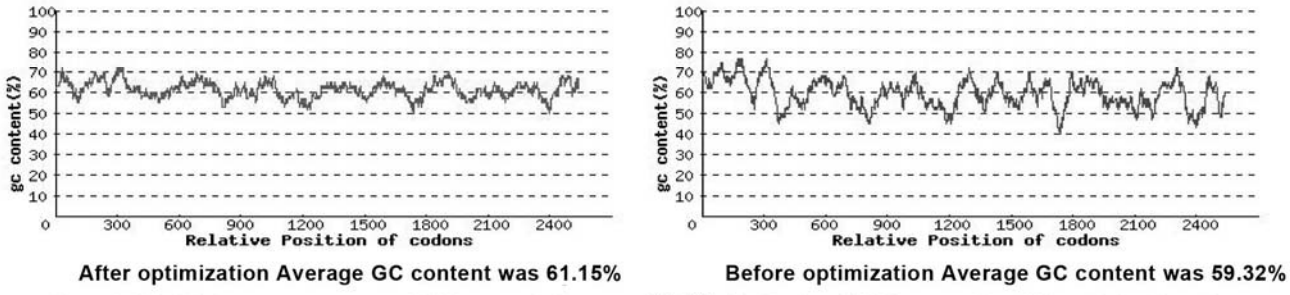


Fig. 8A Codon Adaptation Index (CAI)

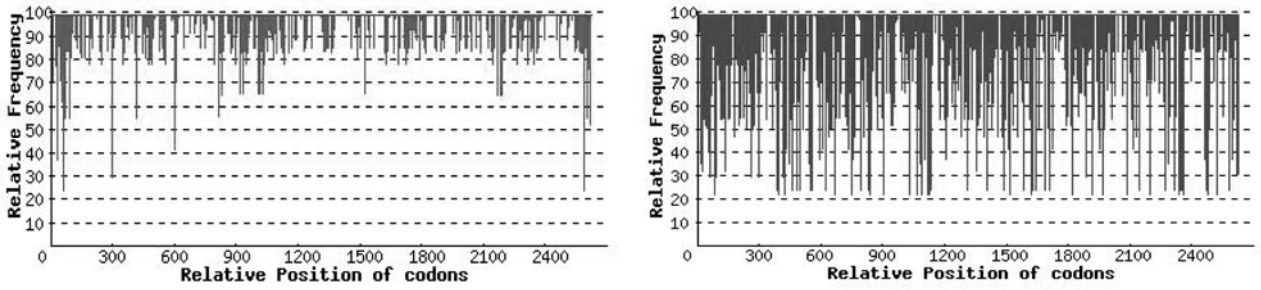


Fig. 8B Frequency of Optimal Codons (FOP)

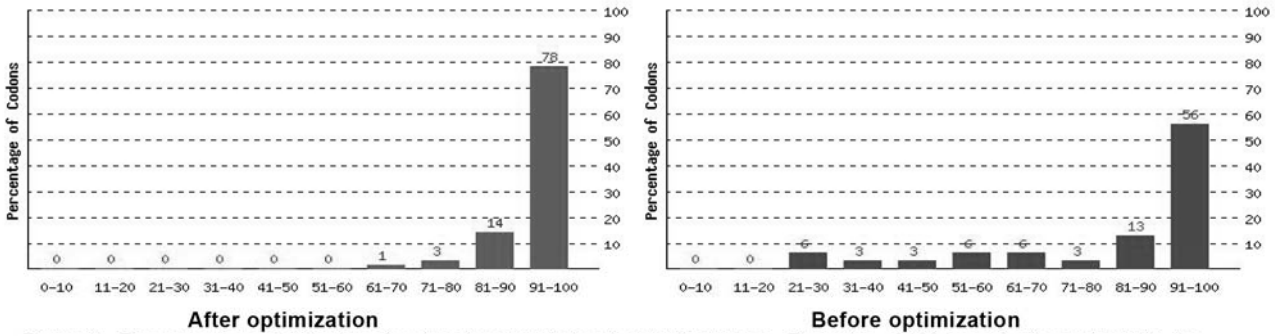


Fig. 8C GC Content Adjustment of del108CDENV 2-human furinfor insect cells

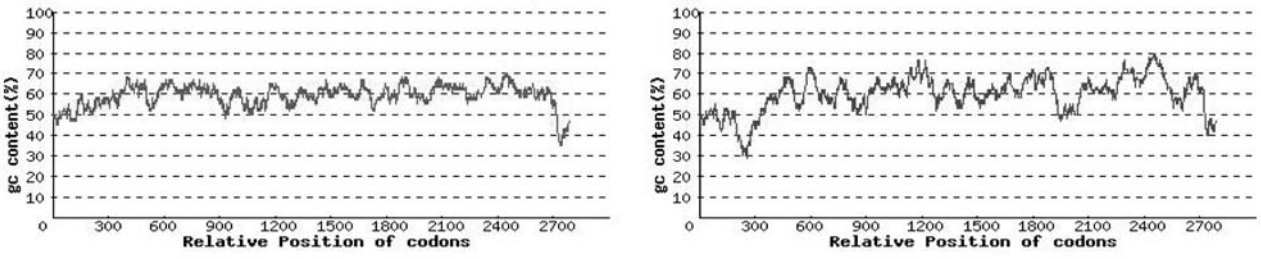


FIGURE 9

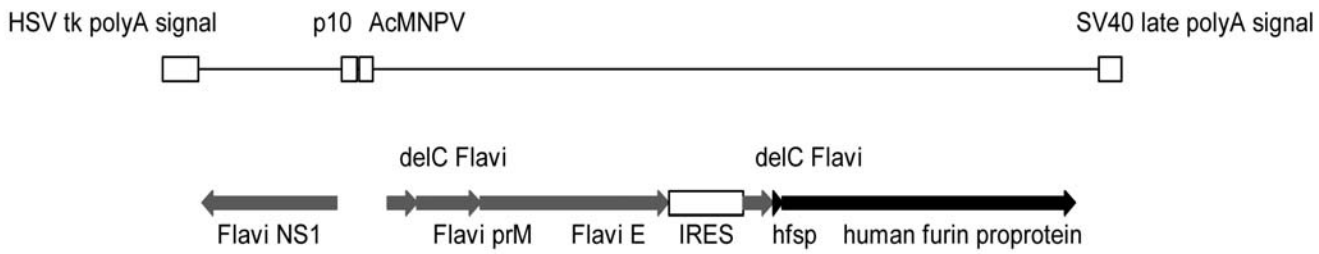

HSV tk polyA signal
p10
AcMNPV
SV40 late polyA signal
delC Flavi
delC Flavi
Flavi NS1
Flavi prM
Flavi E
IRES
hfsp
human furin proprotein

Fig. 10A

DENV VLP & DENV NS-1 Dual Promoter Expression Cassette

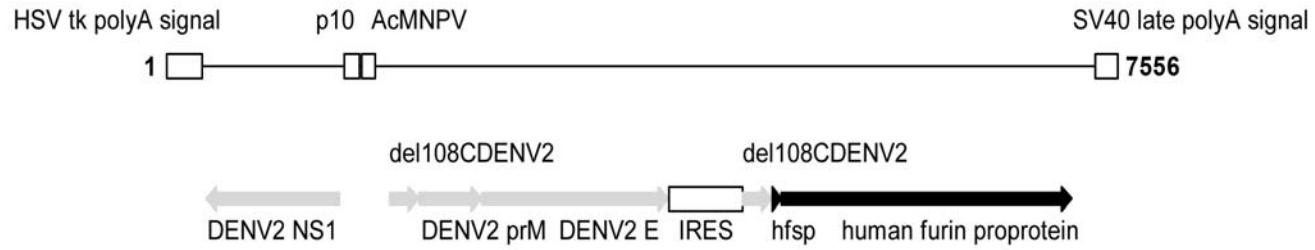


Fig. 10B

ZIKV VLP & ZIKV NS-1 Dual Promoter Expression Cassettes

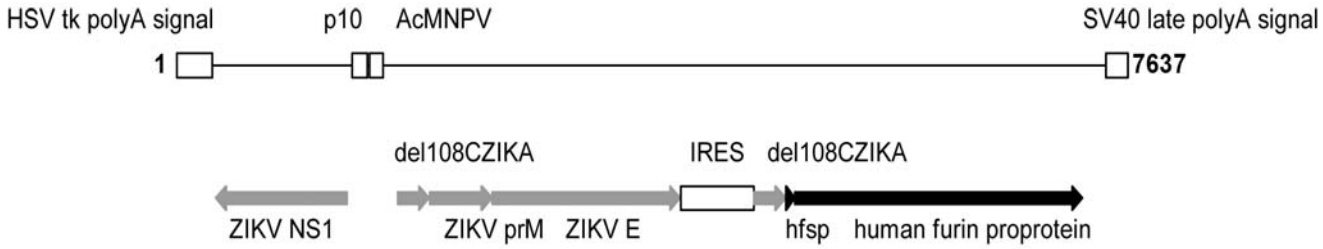


Fig. 10C

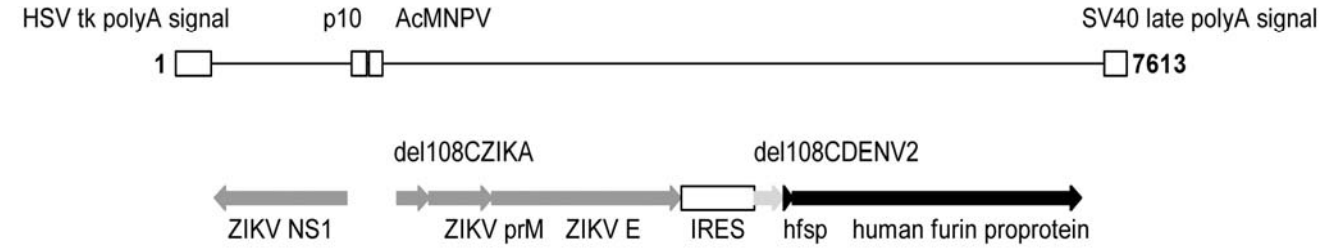


Fig. 10D

Molecule Features:

Start	End		Name	Feature Key	Draw As
283	1	C	HSV tk polyA signal		Region
1370	312	C	DENV2 NS1		Gene
1530	1409	C	p10	promoter	Region
1548	1657		AcMNPV	promoter	Region
1771	2004		del108CDENV2		Gene
2005	2502		DENV2 prM		Gene
2503	3987		DENV2 E		Gene
3991	4576		IRES		Gene
4577	4810		del108CDENV2		Gene
4811	4882		hfsp		Gene
4883	7192		human furin proprotein		Gene
7378	7556		SV40 late polyA signal		Region

Primers (0 sites)

Fig. 10E

Molecule Features:

Start	End		Name	Feature Key	Draw As
283	1	C	HSV tk polyA signal		Region
1370	312	C	ZIKV NS1		Gene
1530	1409	C	p10		Region
1548	1657		AcMNPV	promoter	Region
1774	2028		del108CZIKA		Gene
2029	2532		ZIKV prM		Gene
2533	4044		ZIKV E		Gene
4048	4633		IRES		Gene
4634	4891		del108CZIKA		Gene
4892	4963		hfsp		Gene
4964	7273		human furin proprotein		Gene
7459	7637		SV40 late polyA signal		Gene

Fig. 10F

Molecule Features:

Start	End		Name	Feature Key	Draw As
283	1	C	HSV tk polyA signal		Region
1370	312	C	ZIKV NS1		Gene
1530	1409	C	p10		Region
1548	1657		AcMNPV	promoter	Region
1774	2028		del108CZIKA		Gene
2029	2532		ZIKV prM		Gene
2533	4044		ZIKV E		Gene
4048	4633		IRES		Gene
4634	4867		del108CDENV2		Gene
4868	4939		hfsp		Gene
4940	7249		human furin proprotein		Gene
7435	7613		SV40 late polyA signal		Region

Primers (0 sites)

FIGURE 11

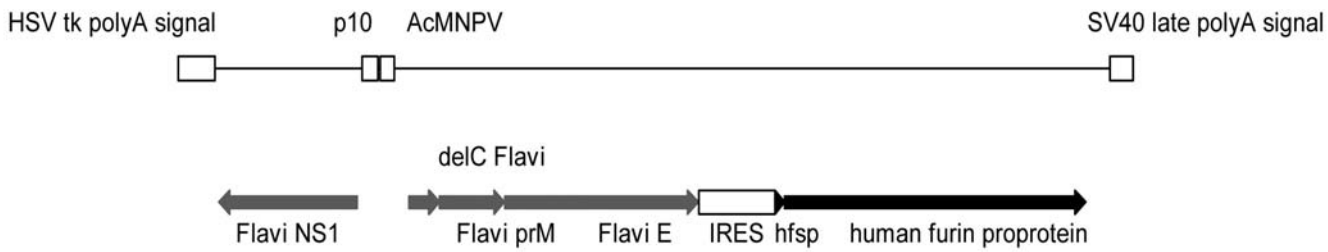

HSV tk polyA signal
p10
AcMNPV
SV40 late polyA signal
delC Flavi
Flavi NS1
Flavi prM
Flavi E
IRES
hfsp
human furin proprotein

FIGURE 12

Fig. 12A

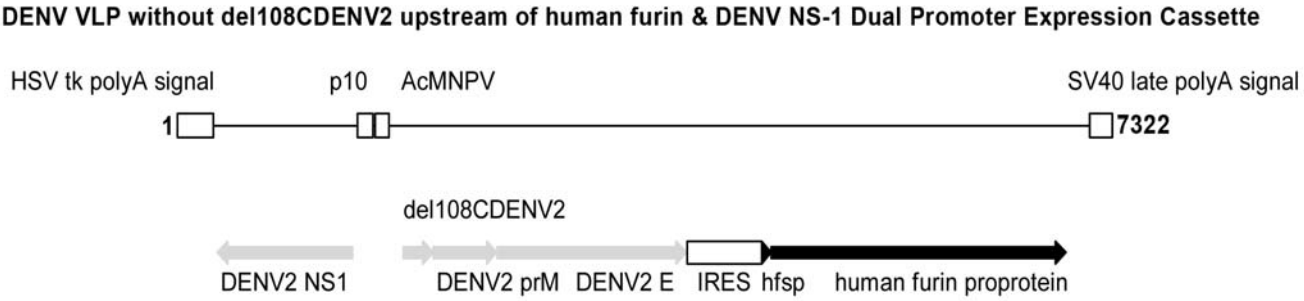


Fig. 12B

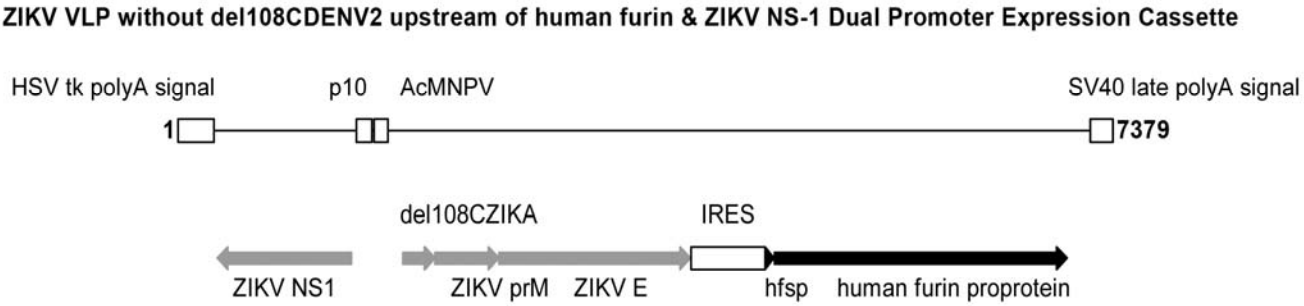


Fig. 12C

Molecule Features:

Start	End		Name	Feature Key	Draw As
283	1	C	HSV tk polyA signal		Region
1370	312	C	DENV2 NS1		Gene
1530	1409	C	p10	promoter	Region
1548	1657		AcMNPV	promoter	Region
1771	2004		del108CDENV2		Gene
2005	2502		DENV2 prM		Gene
2503	3987		DENV2 E		Gene
3991	4576		IRES		Gene
4577	4648		hfsp		Gene
4649	6958		human furin proprotein		Gene
7144	7322		SV40 late polyA signal		Region

Primers (0 sites)

Fig. 12D

Molecule Features:

Start	End		Name	Feature Key	Draw As
283	1	C	HSV tk polyA signal		Region
1370	312	C	ZIKV NS1		Gene
1530	1409	C	p10		Region
1548	1657		AcMNPV	promoter	Region
1774	2028		del108CZIKA		Gene
2029	2532		ZIKV prM		Gene
2533	4044		ZIKV E		Gene
4048	4633		IRES		Gene
4634	4705		hfsp		Gene
4706	7015		human furin proprotein		Gene
7201	7379		SV40 late polyA signal		Region

Primers (0 sites)

Fig. 13A Codon Adaptation Index (CAI)

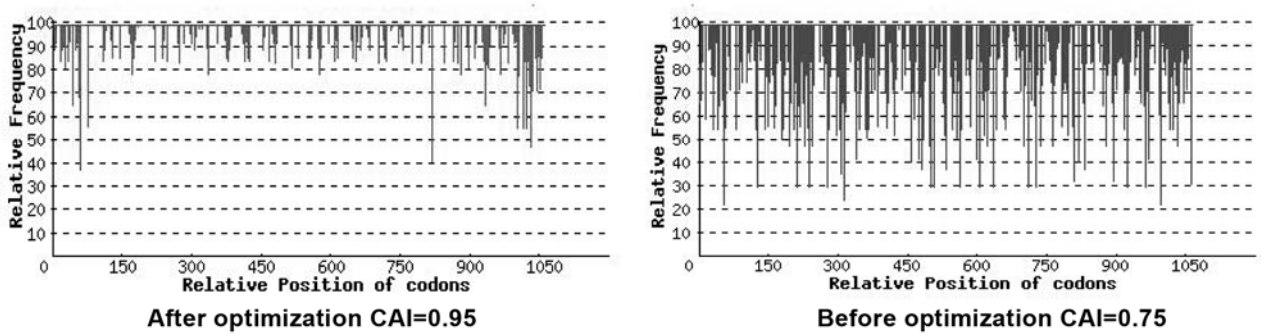


Fig. 13B Frequency of Optimal Codons (FOP)

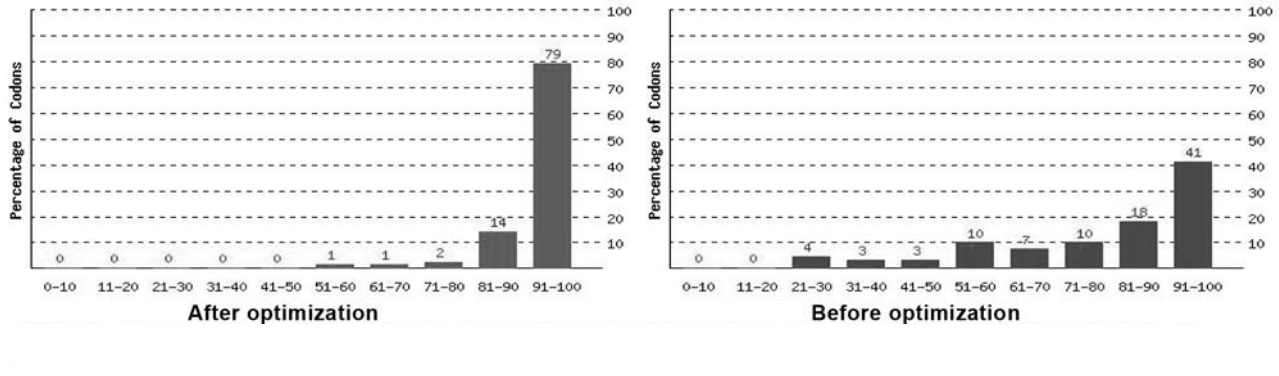
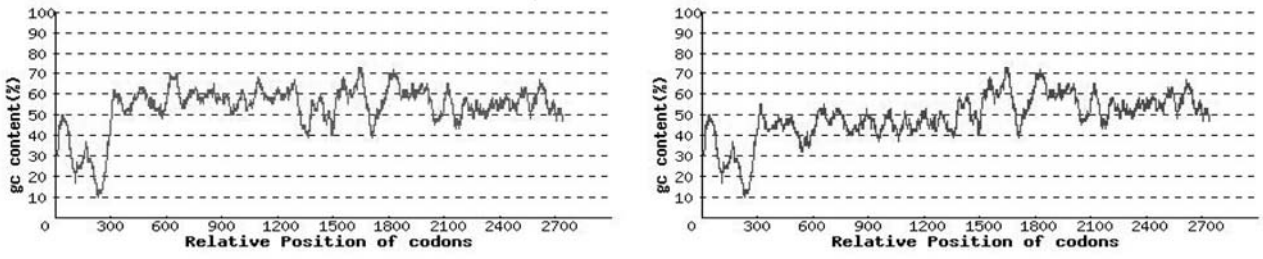


Fig. 13C Content Adjustment of DENV 2 NS1for insect cells



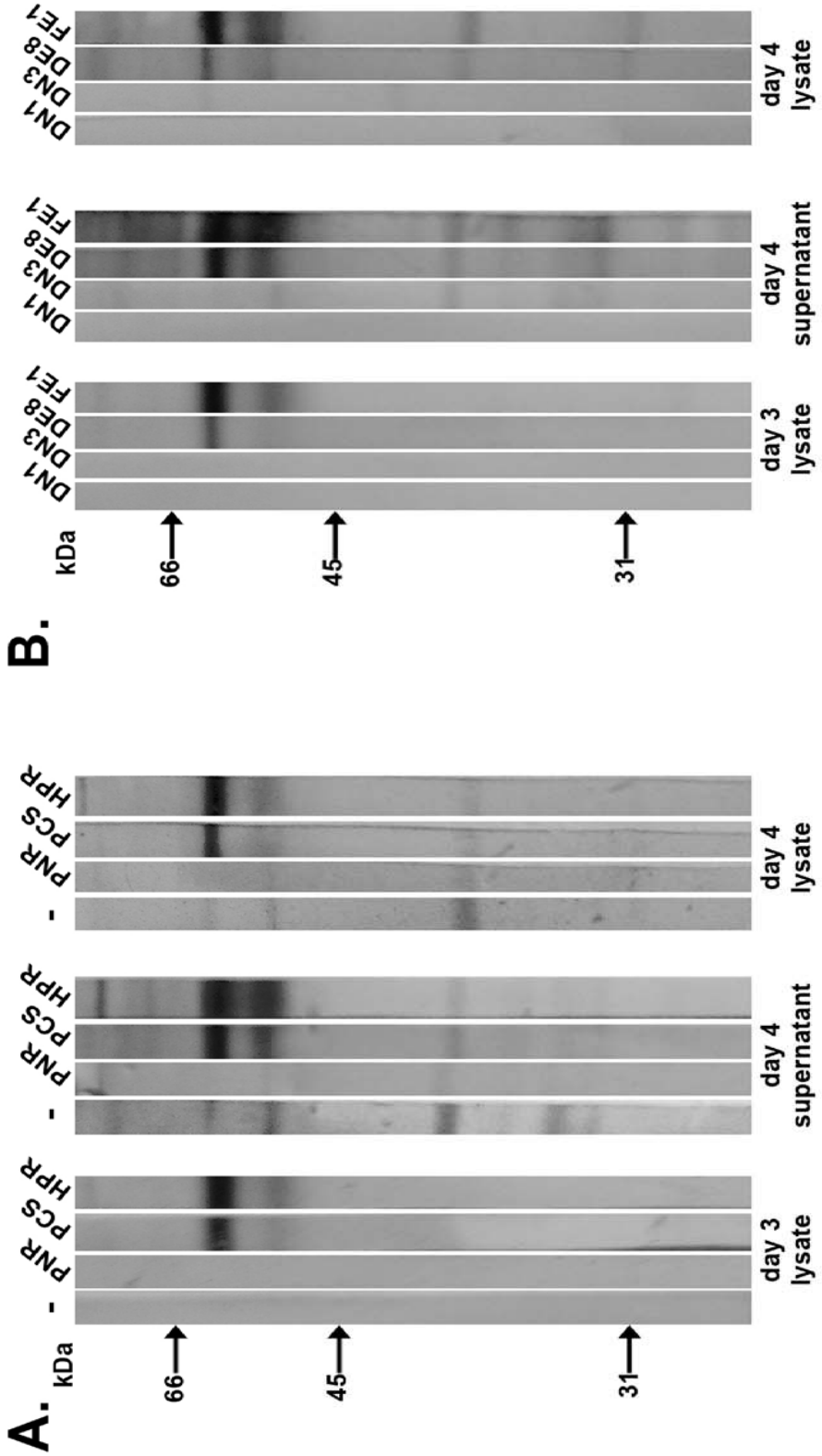

A.
kDa
66
45
31
-
PNR
PCS
HPR
day 3 lysate
day 4 supernatant
day 4 lysate
B.
kDa
66
45
31
DN1
DN3
DE8
FE1
day 3 lysate
day 4 supernatant
day 4 lysate

FIGURE 14

FIGURE 15

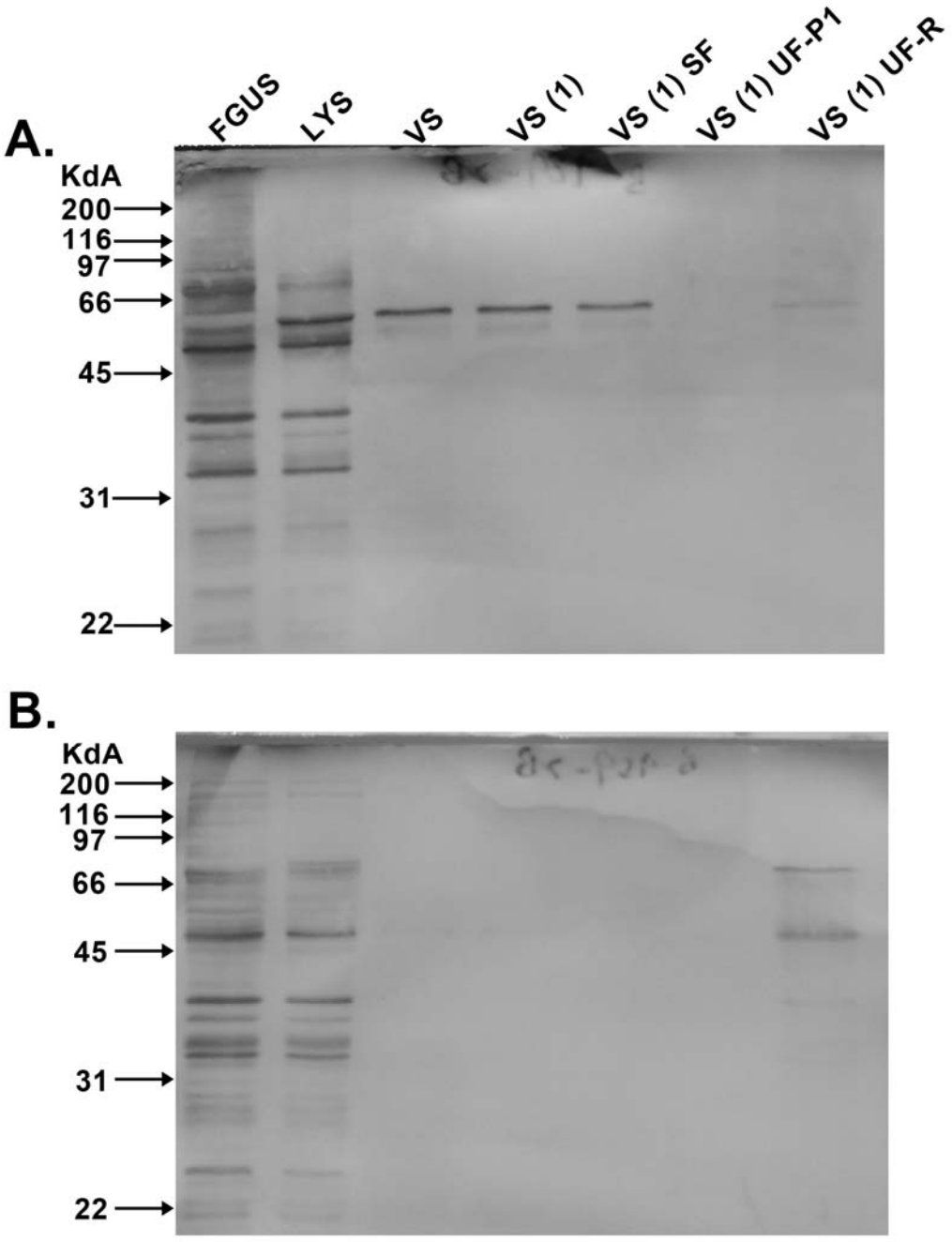

A.
FGUS
LYS
VS
VS (1)
VS (1) SF
VS (1) UF-P1
VS (1) UF-R
KdA
200
116
97
66
45
31
22
B.
KdA
200
116
97
66
45
31
22

FIGURE 16

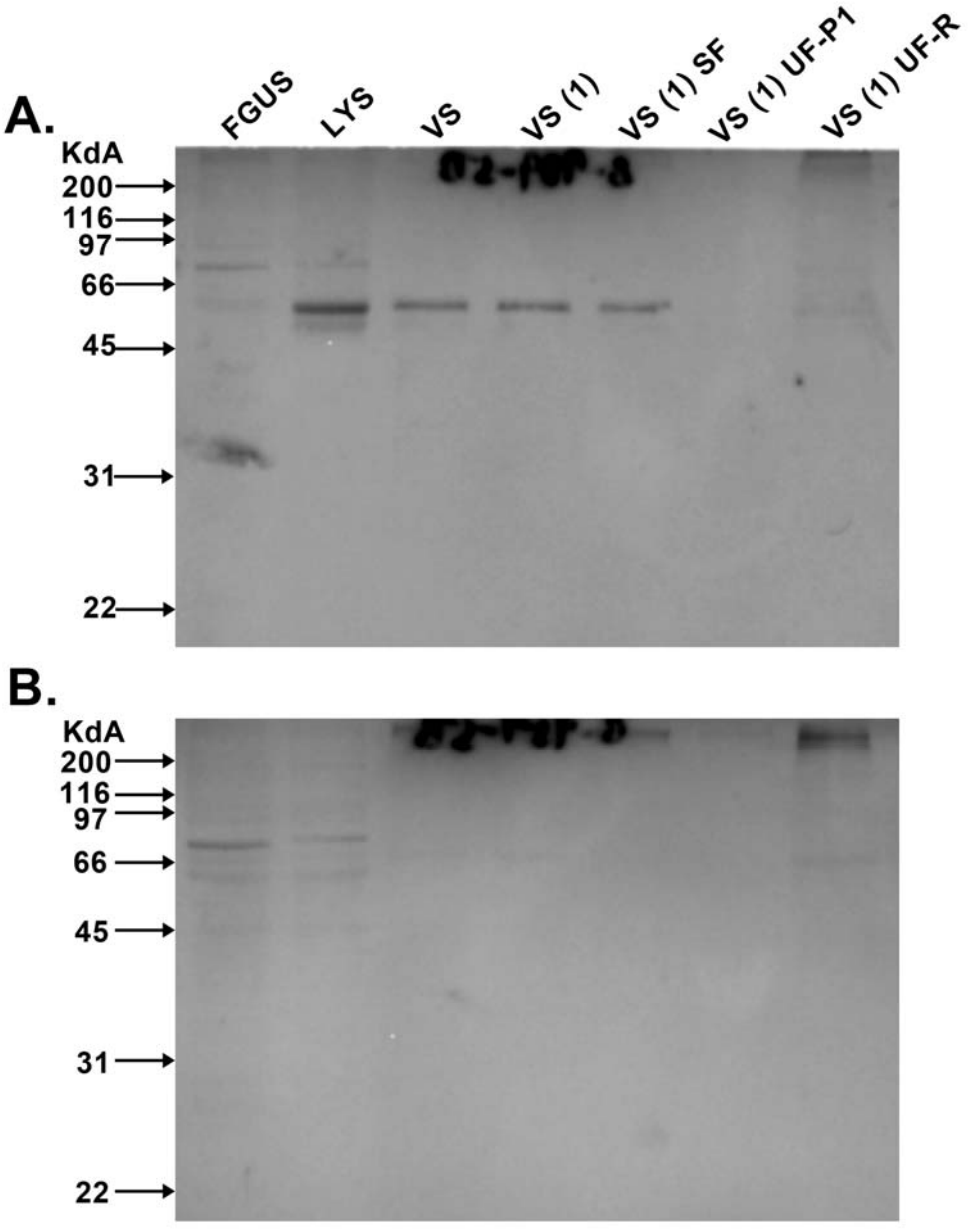

A.
FGUS
LYS
VS
VS (1)
VS (1) SF
VS (1) UF-P1
VS (1) UF-R
KdA
200
116
97
66
45
31
22
B.
KdA
200
116
97
66
45
31
22

FIGURE 17

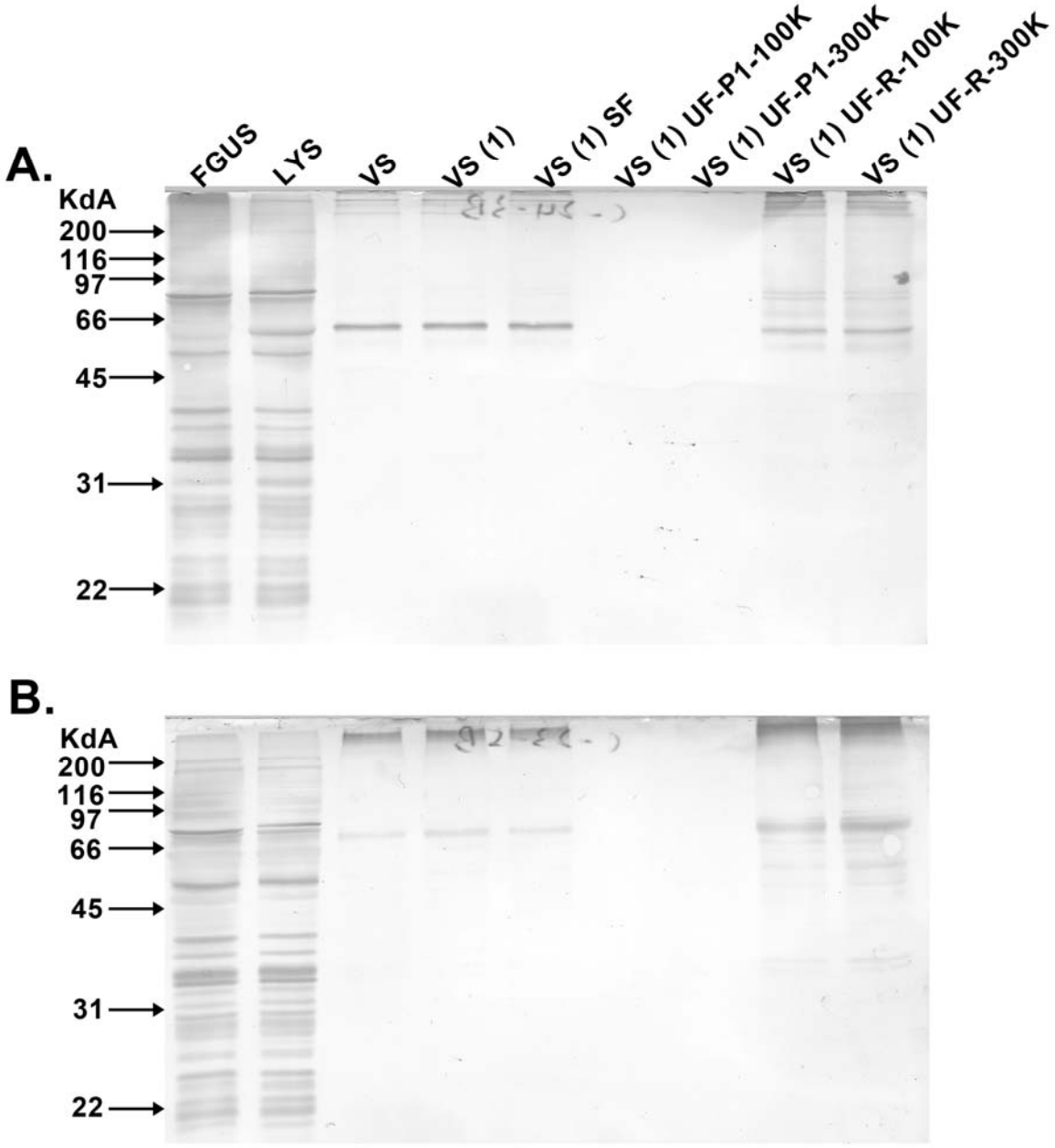

A.
FGUS
LYS
VS
VS (1)
VS (1) SF
VS (1) UF-P1-100K
VS (1) UF-P1-300K
VS (1) UF-R-100K
VS (1) UF-R-300K
KdA
200
116
97
66
45
31
22
B.
KdA
200
116
97
66
45
31
22

FIGURE 18

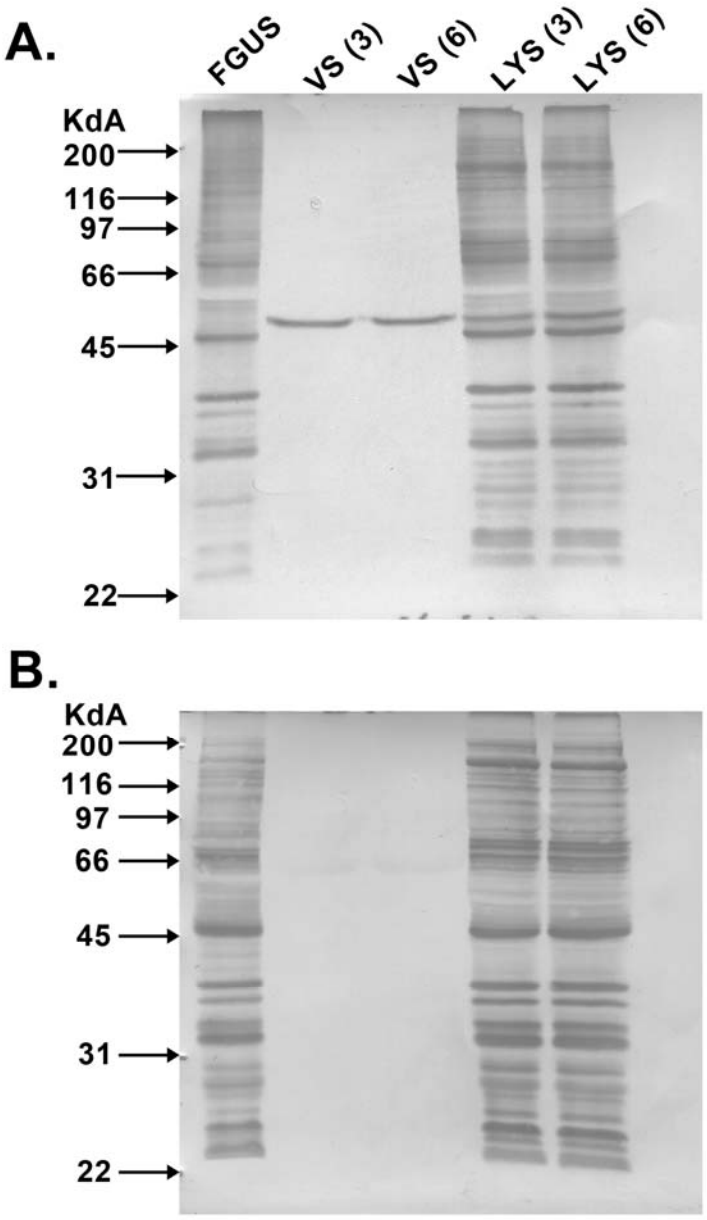

A.
FGUS
VS (3)
VS (6)
LYS (3)
LYS (6)
KdA
200
116
97
66
45
31
22
B.
KdA
200
116
97
66
45
31
22

FIGURE 19

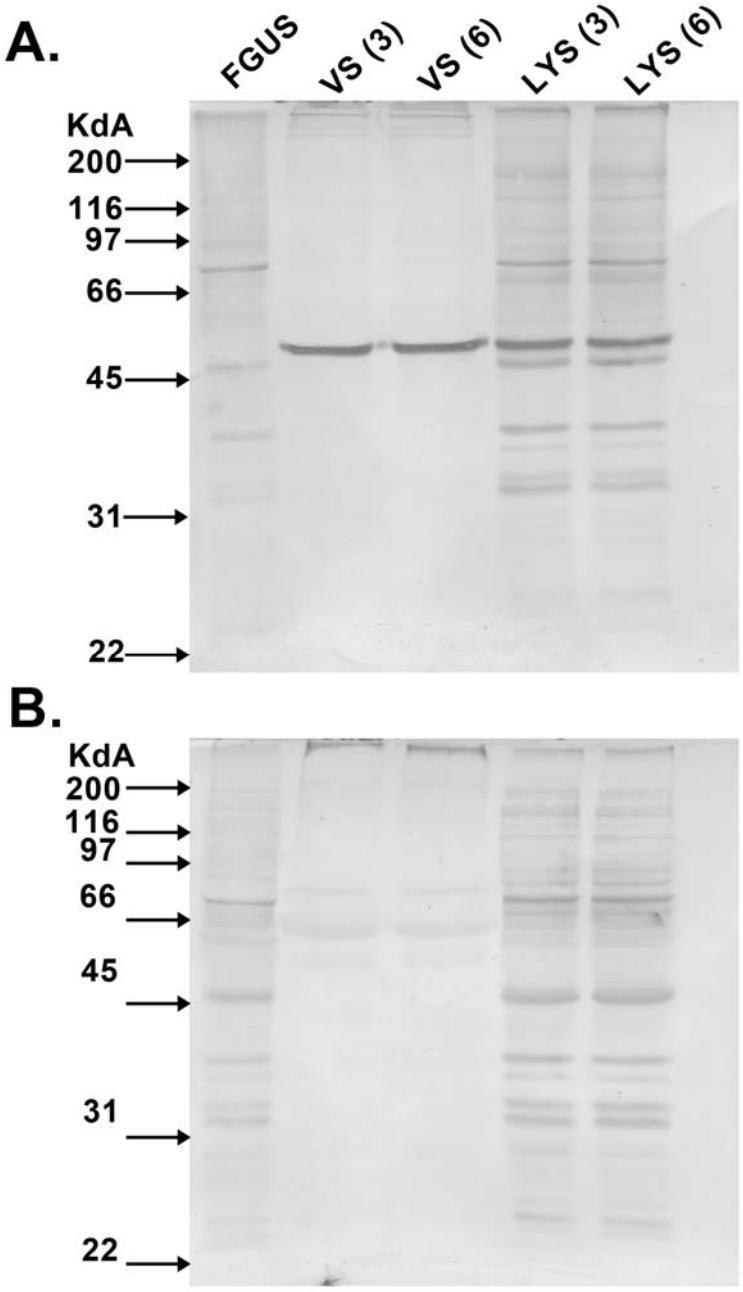

A.
FGUS
VS (3)
VS (6)
LYS (3)
LYS (6)
KdA
200
116
97
66
45
31
22
B.
KdA
200
116
97
66
45
31
22

FIGURE 20

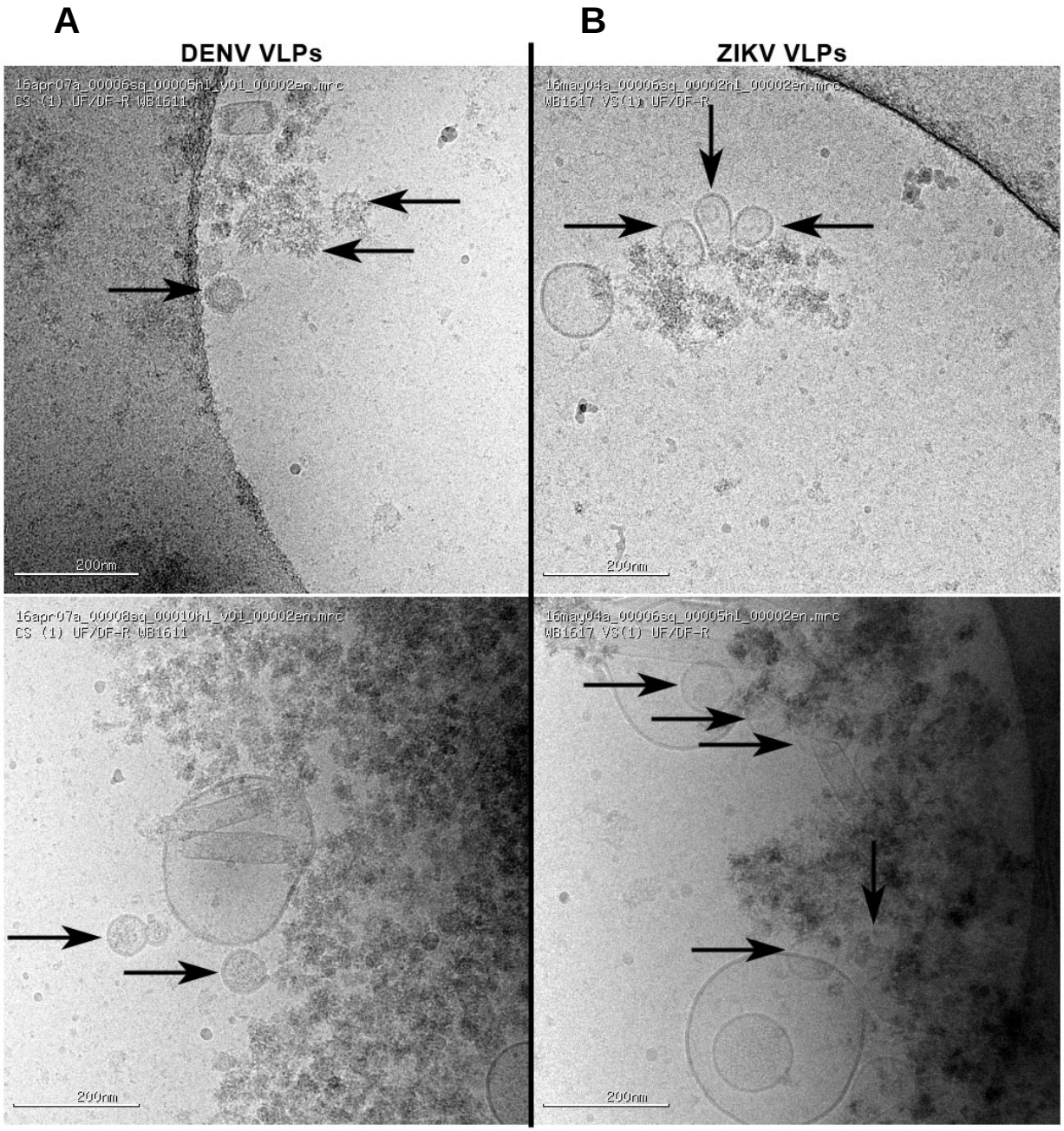

A
DENV VLPs
B
ZIKV VLPs
16apr07a_00006sq_00005hl_v01_00002en.mrc
CS (1) UF/DF-R WB1611
200nm
16may04a_00006sq_00002hl_00002en.mrc
WB1617 VS(1) UF/DF-R
200nm
16apr07a_00006sq_00010hl_v01_00002en.mrc
CS (1) UF/DF-R WB1611
200nm
16may04a_00006sq_00005hl_00002en.mrc
WB1617 VS(1) UF/DF-R
200nm

FIGURE 21

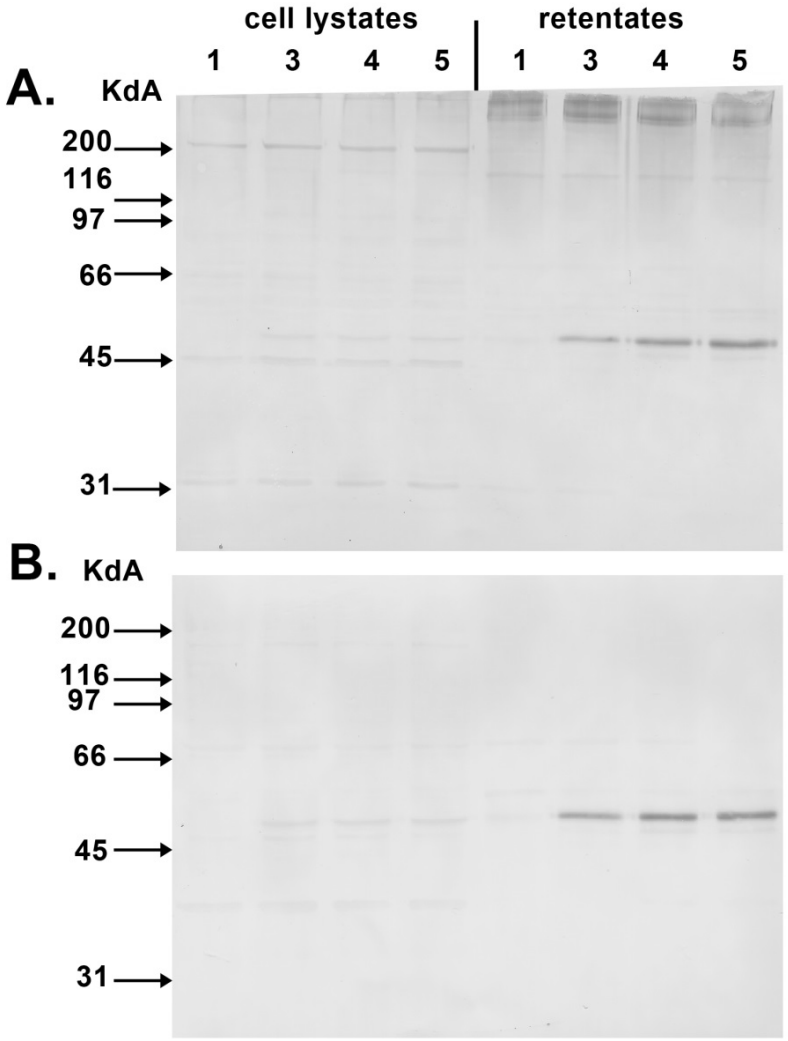

cell lystates
retentates
1
3
4
5
1
3
4
5
A.
KdA
200
116
97
66
45
31
B.
KdA
200
116
97
66
45
31

FIGURE 22

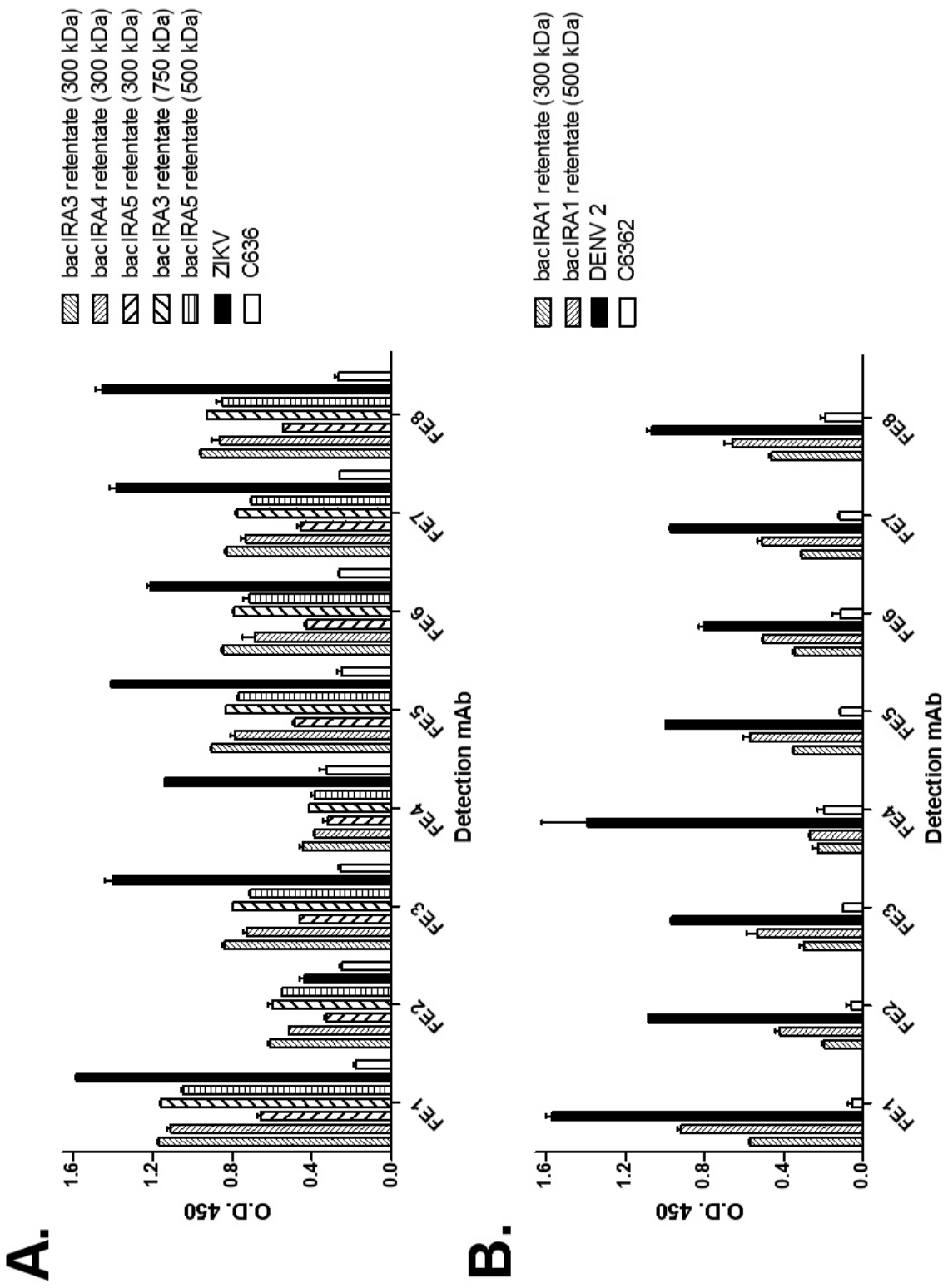

A.
bacIRA3 retentate (300 kDa)
bacIRA4 retentate (300 kDa)
bacIRA5 retentate (300 kDa)
bacIRA3 retentate (750 kDa)
bacIRA5 retentate (500 kDa)
ZIKV
C636
O.D. 450
1.6
1.2
0.8
0.4
0.0
FE1
FE2
FE3
FE4
FE5
FE6
FE7
FE8
Detection mAb
B.
bacIRA1 retentate (300 kDa)
bacIRA1 retentate (500 kDa)
DENV 2
C6362
O.D. 450
1.6
1.2
0.8
0.4
0.0
FE1
FE2
FE3
FE4
FE5
FE6
FE7
FE8
Detection mAb

FIGURE 23

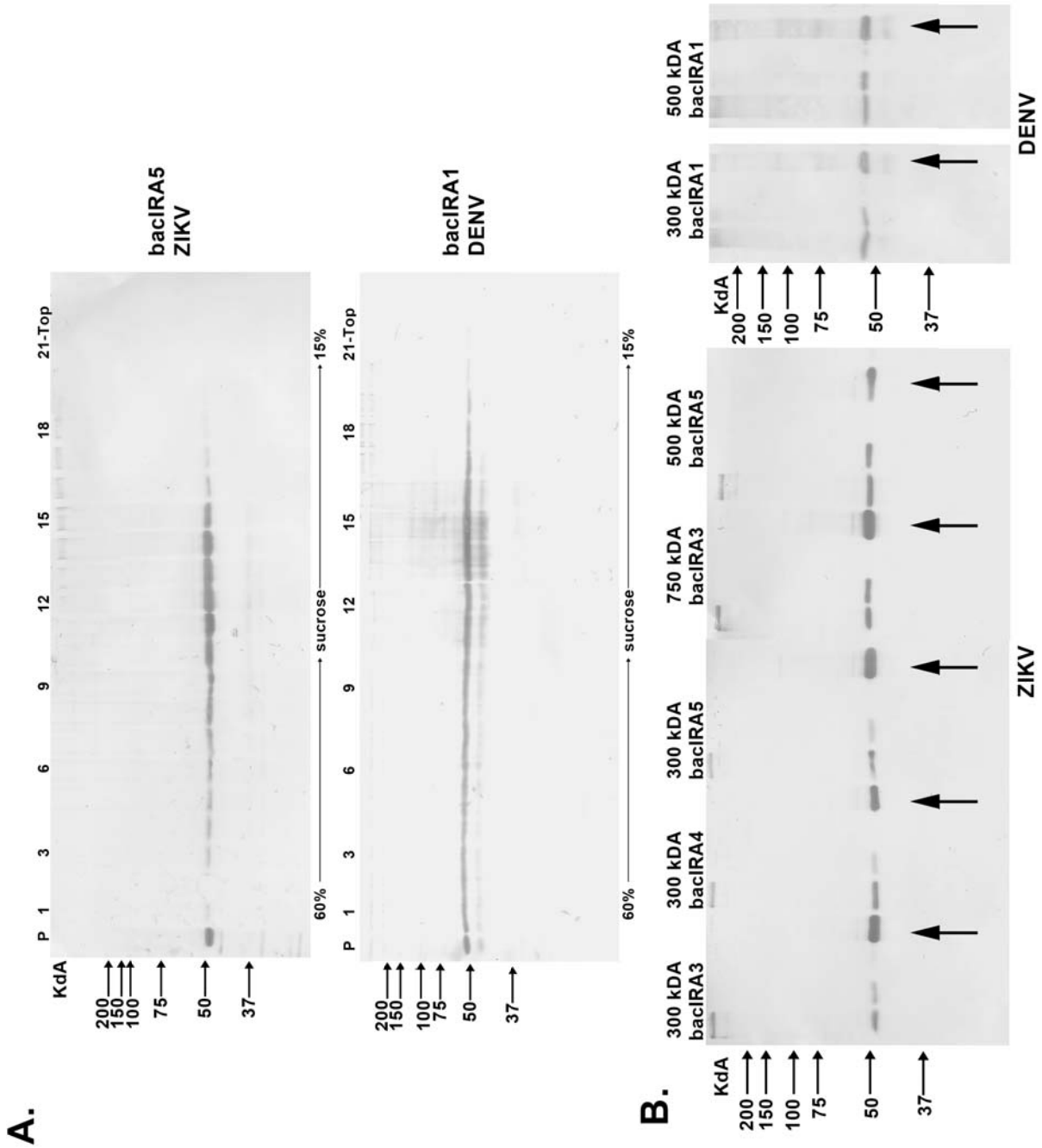

A.
bacIRA5
ZIKV
bacIRA1
DENV
KdA
200
150
100
75
50
37
P 1 3 6 9 12 15 18 21-Top
60%
sucrose
15%
B.
300 kDA
bacIRA3
300 kDA
bacIRA4
300 kDA
bacIRA5
750 kDA
bacIRA3
500 kDA
bacIRA5
300 kDA
bacIRA1
500 kDA
bacIRA1
ZIKV
DENV

FIGURE 24

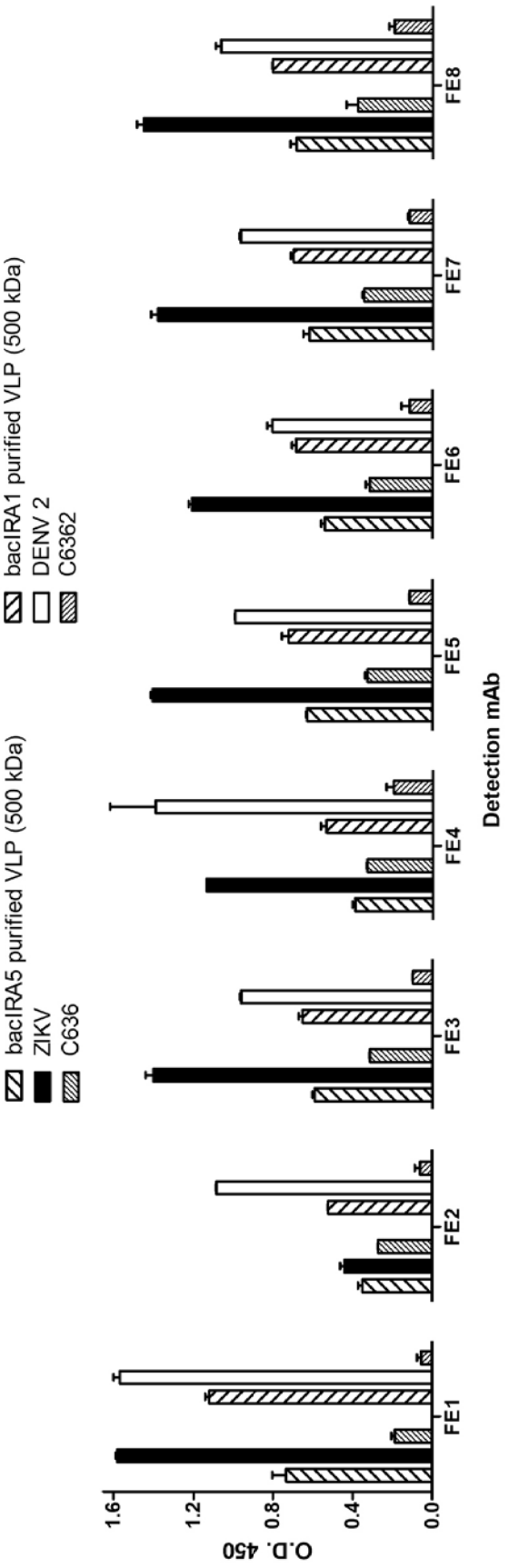

bacIRA5 purified VLP (500 kDa)
ZIKV
C636
bacIRA1 purified VLP (500 kDa)
DENV 2
C6362
O.D. 450
0.0
0.4
0.8
1.2
1.6
FE1
FE2
FE3
FE4
FE5
FE6
FE7
FE8
Detection mAb

FIGURE 25

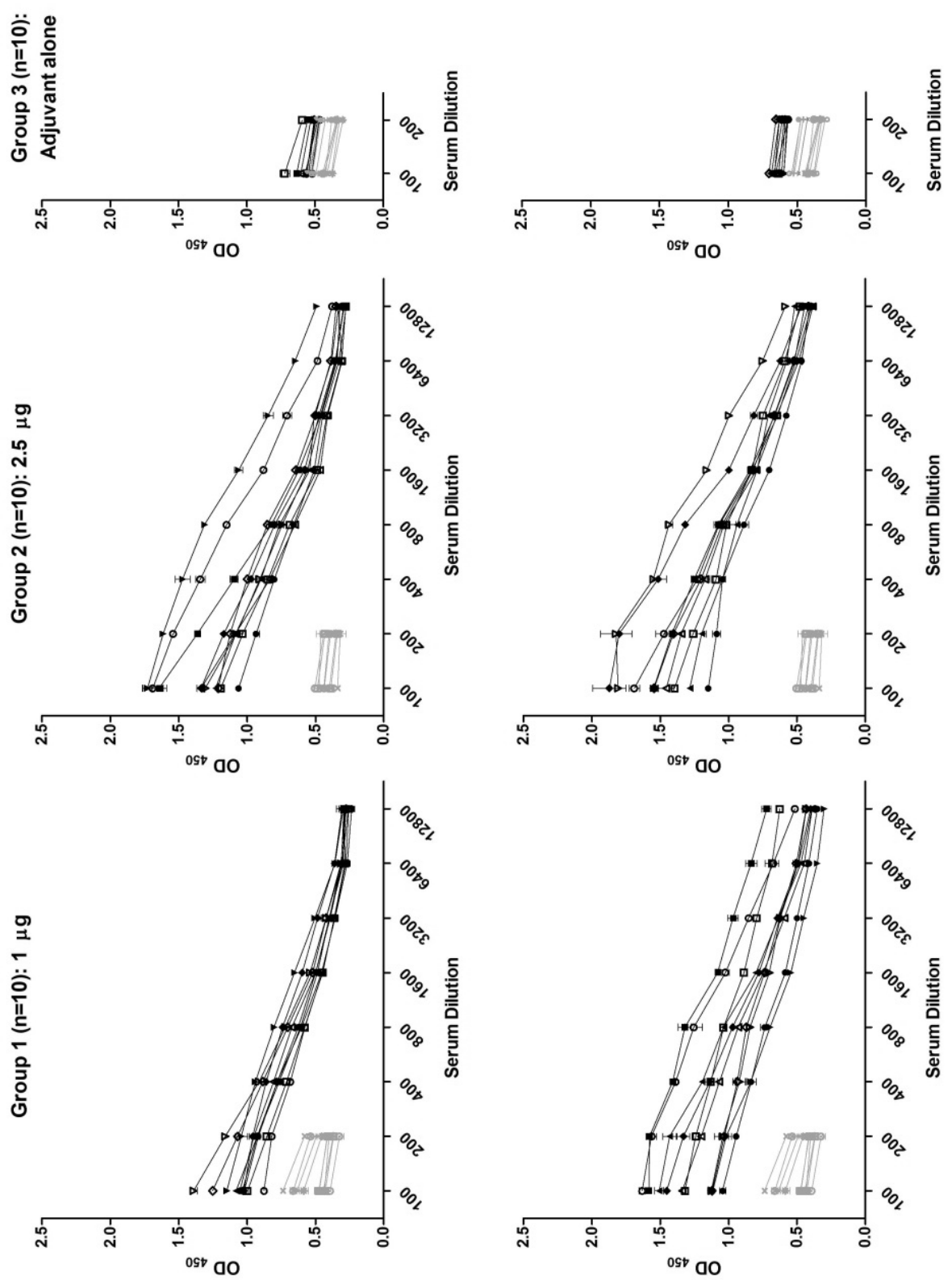

Group 1 (n=10): 1 µg
Group 2 (n=10): 2.5 µg
Group 3 (n=10): Adjuvant alone
day 21
day 42
OD 450
Serum Dilution
100
200
400
800
1600
3200
6400
12800
0.0
0.5
1.0
1.5
2.0
2.5

FIGURE 26

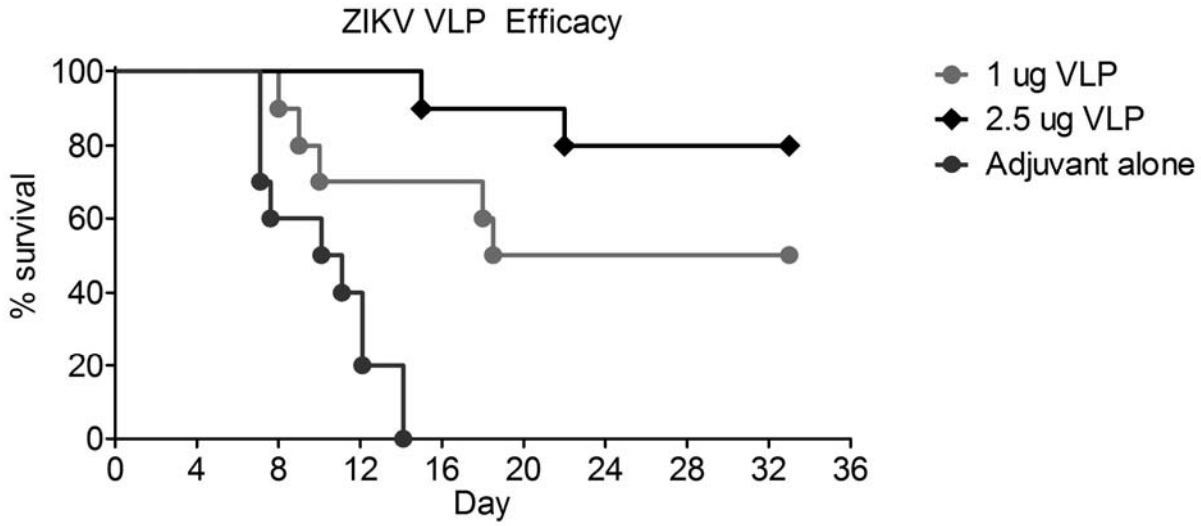

ZIKV VLP Efficacy
% survival
100
80
60
40
20
0
0
4
8
12
16
20
24
28
32
36
Day
1 ug VLP
2.5 ug VLP
Adjuvant alone

FIGURE 27

SEQ ID NO: 1. DENV2 del108C-prM-E & del108CDENV-human furin proprotein bicistronic cassette

cgtatactcc ggaatattaa tagatcatgg agataattaa aatgataacc atctcgcaaa 60

taaataagta ttttactgtt ttcgtaacag ttttgtaata aaaaaaccta taaatattcc 120

ggattattca taccgtccca ccatcgggcg cggatcatca caagtttgta caaaaaagca 180

ggctagatct taatacgact cactatatta attaaggatc ccaaaaaatt gaaattttat 240

ttttttttt tggaatataa ataatatgct ccagggcaga ggaccactca agctgttcat 300

ggcactcgtc gcctttctcc ggtttctcac tatcccaccc actgtcggta tcctgaagag 360

atggggcacc atcaagaaga gcaaggctat caacgtgctg cgcggattca ggaaggagat 420

cggtcgtatg ctgaacatcc tgaaccgcag gagacgtacc gctggaatga tcatcatgct 480

gatcccaacc gtgatggcct tccacctgac caccagaaac ggagagcccc acatgatcgt 540

gtctcgtcag gaaaagggca agagcctgct gttcaagacc gaggacggcg tgaacatgtg 600

caccctgatg gctatggacc tgggcgagct gtgcgaagac accatcacct acaagtgccc 660

actgctgaga cagaacgagc ccgaagacat cgactgctgg tgcaactcta ccagcacctg 720

ggtgacctac ggcacctgta ccaccactgg agagcacaga agggaaaaga gatctgtggc 780

cctggtgccc cacgtgggta tgggactgga gacccgtacc gaaacctgga tgagctccga 840

gggagcctgg aagcacgctc agagaatcga aacctggatt ctgcgtcacc ctggattcac 900

cctgatggcc gctatcctgg cttacaccat cggcaccacc aacttccagc gtgccctgat 960

cttcatcctg ctgaccgccg tggctccaag catgaccatg cgctgcatcg gcatctccaa 1020

cagggacttc gtggagggag tgtccggcgg atcttgggtg gacatcgtgc tggaacacgg 1080

ttcctgcgtg actaccatgg ccaagaacaa gcctaccctg gacttcgagc tgatcaagac 1140

cgaagccaag cagccagcta ccctgcgcaa gtactgcatc gaggccaagc tgaccaacac 1200

cactactgag tctaggtgcc caacccaggg tgaacctagc ctgaacgagg aacaggacaa 1260

gaggttcgtg tgcaagcact ctatggtgga caggggttgg ggcaacggat gcggcctgtt 1320

cggaaagggc ggcatcgtga cctgcgccat gttcacctgc aagaagaaca tggagggcaa 1380

gatcgtgcag cccgagaacc tggaatacac catcgtgatc acccctcact ctggagagga 1440

acacgctgtg ggcaacgaca ccggaaagca cggcaaggag atcaagatca cccctcagtc 1500

tagcatcacc gaggccgaac tgaccggcta cggaaccgtg accatggaat gcagccctcg 1560

caccggcctg gacttcaacg agatggtgct gctgcagatg gaaaacaagg cttggctggt 1620

gcacaggcag tggttcctgg acctgcctct gccttggctg ccaggtgctg acacccaggg 1680

cagcaactgg attcagaagg agaccctggt gaccttcaag aacccccacg ctaagaagca 1740

ggacgtggtg gtgctgggct cccaggaggg agctatgcac accgctctga ccggagccac 1800

cgaaatccag atgtcctctg gaaacctgct gttcaccggt cacctgaagt gcagactgcg 1860

tatggacaag ctgcagctga agggaatgtc ctactctatg tgcaccggca agttcaaggt 1920

ggtgaaggag atcgccgaaa cccagcacgg caccatcgtg gtgagagtgc agtacgaggg 1980

tgacggcagc ccttgcaaga tcccattcga gatcatggac ctggaaaagc gccacgtgct 2040

gggcaggctg atcaccgtga accctatcgt gaccgaaaag gactccccag tgaacatcga 2100

ggctgaaccc cctttcggag actcttacgt gatcatcggt gtggagcctg gccagctgaa 2160

gctgaactgg ttcaagaagg gaagctccat cggtcagatg ttcgaaacca ccatgagagg 2220

cgctaagcgt atggccatcc tgggcgacac tgcttgggac ttcggctccc tgggcggcgt 2280

gttcacctct atcggcaagg ctctgcacca ggtgttcggc gccatctacg gagccgcttt 2340

cagcggagtg tcctggacca tgaagatcct gatcggtgtg atcatcacct ggatcggcat 2400

gaacagcagg tccacctctc tgagcgtctc tctggtcctc gtgggcgtcg tgactctcta 2460

tctcggtgtg gtcgtgcagg catgagcccc tctccctccc ccccccctaa cgttactggc 2520

cgaagccgct tggaataagg ccggtgtgtg tttgtctata tgtgattttc caccatattg 2580

ccgtcttttg gcaatgtgag ggcccggaaa cctggccctg tcttcttgac gagcattcct 2640

aggggtcttt cccctctcgc caaaggaatg caaggtctgt tgaatgtcgt gaaggaagca 2700

gttcctctgg aagcttcttg aagacaaaca acgtctgtag cgacccttttg caggcagcgg 2760

aacccccccac ctggcgacag gtgcctctgc ggccaaaagc cacgtgtata agatacacct 2820

gcaaaggcgg cacaacccca gtgccacgtt gtgagttgga tagttgtgga aagagtcaaa 2880

tggctctcct caagcgtagt caacaagggg ctgaaggatg cccagaaggt accccattgt 2940

atgggaatct gatctggggc ctcggtgcac atgctttaca tgtgtttagt cgaggttaaa 3000

aaagctctag gcccccccgaa ccacggggac gtggttttcc tttgaaaaac acgatgataa 3060

gcttgccaca aatgctccag ggtcgcggtc cactgaaact ctttatggct ctcgtcgcct 3120

tcctgcggtt cctcactatt cctcctactg tcggtattct gaagaggtgg ggcaccatca 3180

agaagagcaa ggccatcaac gtgctgcgcg gattcaggaa ggagatcggt aggatgctga 3240

acatcctgaa ccgcaggaga cgtaccgccg gcatgatcat catgctgatc cccaccgtga 3300

tggctatgga actgagacct tggctgctgt gggtggtggc tgctactggc accctggtgc 3360

tgctagcagc tgacgcccag ggccagaagg tgttcaccaa cacctgggct gtgagaatcc 3420

ccggcggacc tgctgtggct aacagcgtgg ctcgtaagca cggcttcctg aacctgggac 3480

agattttcgg tgactactac cacttctggc accgcggagt gaccaagagg agcctgtccc 3540

cacacagacc aaggcactcc agactgcagc gtgagcccca ggtgcagtgg ctggaacagc 3600

aggtggccaa gcgcaggacc aagagagacg tgtaccagga gcctaccgac ccaaagttcc 3660

cccagcagtg gtatctgtcc ggcgtgaccc agcgtgacct gaacgtgaag gccgcttggg 3720

ctcagggtta caccggtcac ggcatcgtgg tgtccatcct ggacgacggc atcgagaaga 3780

accaccctga cctggccggt aactacgacc caggcgcttc tttcgacgtg aacgaccagg 3840

accccgaccc tcagccaaga tacacccaga tgaacgacaa cagacatgga accagatgtg 3900

ctggtgaagt ggctgctgtg gctaacaacg gcgtgtgcgg agtgggtgtg gcctacaacg 3960

ctagaatcgg tggcgtgcgt atgctggatg gagaagtgac tgatgctgtg gaagctagaa 4020

gcctgggact gaacccaaac cacatccaca tctactctgc cagctggggt ccagaggatg 4080

atggaaagac tgtggatggt cctgctagac tggctgagga agccttcttc cgcggcgtga 4140

gccagggaag gggaggtctg ggaagcatct tcgtgtgggc ttctggtaac ggcggaagag 4200

agcacgactc ctgcaactgc gacggataca ccaactctat ctacaccctg agcatcagct 4260

ccgctaccca gttcggtaac gtgccctggt actccgaagc ctgctctagc accctggcta 4320

ccacctactc ctctggcaac cagaacgaga agcagatcgt gaccaccgac ctgcgtcaga 4380

agtgcaccga atctcacact ggcacctccg cctctgctcc tctggctgct ggaatcatcg 4440

ccctgaccct ggaggctaac aagaacctga cctggcgcga catgcagcac ctggtggtgc 4500

agacctccaa gccagctcac ctgaacgcca acgactgggc taccaacggc gtgggaagga 4560

aggtgagcca ctcttacggt tacggtctgc tggatgctgg tgctatggtg gccctggctc 4620

agaactggac caccgtggcc cctcagcgca agtgcatcat cgacatcctg accgagccta 4680

aggacatcgg aaagagactg gaagtgcgta agaccgtgac cgcttgcctg ggagagccca 4740

accacatcac cagactggaa cacgcccagg ctcgtctgac cctgtcttac aacagacgtg 4800

gagacctggc catccacctg gtgtctccaa tgggcacccg cagcaccctg ctggctgcta 4860

ggccacacga ctacagcgcc gacggattca acgactgggc tttcatgacc acccactcct 4920

gggacgagga cccttctggt gaatgggtgc tggagatcga aaacaccagc gaggccaaca 4980

actacggcac cctgaccaag ttcaccctgg tgctgtacgg caccgctcct gagggactgc 5040

cagtgccccc tgaaagctcc ggttgcaaga ccctgacctc tagccaggcc tgcgtggtgt 5100

gcgaggaagg cttctccctg caccagaagt cttgcgtgca gcactgccca cccggattcg 5160

ctcctcaggt gctggacacc cactactcta ccgagaacga cgtggaaacc atcagagcca 5220

gcgtgtgcgc tccttgtcac gcttcctgtg ctacttgtca gggaccagcc ctgactgact 5280

gcctgtcctg cccatctcac gccagcctgg accccgtgga gcagacctgc tccagacagt 5340

ctcagtcctc tcgtgaaagc cctccacagc agcagccccc tagactgcca cccgaggtgg 5400

aagccggcca gagactgcgt gctggactgc tgccttctca cctgccagag gtggtggctg 5460

gtctgagctg cgctttcatc gtgctggtgt tcgtgaccgt gttcctggtg ctgcagctgc 5520

gcagcggttt ctccttcagg ggcgtgaagg tgtacaccat ggaccgcggt ctgatcagct 5580

acaagggtct gcctccagag gcttggcagg aggaatgccc atctgacagc gaagaggacg 5640

agggacgtgg agaacggact gccttcatca aagatcagag cgcactgtaa taaatcgatt 5700

taattaatag cataacccct tggggcctct aaacgggtct tgaggggttt tttggaattc 5760

acccagcttt cttgtacaaa gtggtgatag cttgtcgaga agtactagag gatcataatc 5820

agccatacca catttgtaga ggttttactt gctttaaaaa acctcccaca cctccccctg 5880

aacctgaaac ataaaatgaa tgcaattgtt gttgttaact tgtttattgc agcttataat 5940

ggttacaaat aaagcaatag catcacaaat ttcacaaata aagcattttt ttcactgcat 6000

tctagttgtg gtttgtccaa actcatcaat gtatcttatc atgtctggat c 6051

FIGURE 28

SEQ ID NO: 2. DENV2 del108C-prM-E & human furin proprotein bicistronic cassette

cgtatactcc ggaatattaa tagatcatgg agataattaa aatgataacc atctcgcaaa 60

taaataagta ttttactgtt ttcgtaacag ttttgtaata aaaaaaccta taaatattcc 120

ggattattca taccgtccca ccatcgggcg cggatcatca caagtttgta caaaaaagca 180

ggctagatct taatacgact cactatatta attaaggatc ccaaaaaatt gaaatttttat 240

ttttttttt tggaatataa ataatatgct ccagggcaga ggaccactca agctgttcat 300

ggcactcgtc gcctttctcc ggtttctcac tatcccaccc actgtcggta tcctgaagag 360

atggggcacc atcaagaaga gcaaggctat caacgtgctg cgcggattca ggaaggagat 420

cggtcgtatg ctgaacatcc tgaaccgcag gagacgtacc gctggaatga tcatcatgct 480

gatcccaacc gtgatggcct tccacctgac caccagaaac ggagagcccc acatgatcgt 540

gtctcgtcag gaaaagggca agagcctgct gttcaagacc gaggacggcg tgaacatgtg 600

caccctgatg gctatggacc tgggcgagct gtgcgaagac accatcacct acaagtgccc 660

actgctgaga cagaacgagc ccgaagacat cgactgctgg tgcaactcta ccagcacctg 720

ggtgacctac ggcacctgta ccaccactgg agagcacaga agggaaaaga gatctgtggc 780

cctggtgccc cacgtgggta tgggactgga gacccgtacc gaaacctgga tgagctccga 840

gggagcctgg aagcacgctc agagaatcga aacctggatt ctgcgtcacc ctggattcac 900

cctgatggcc gctatcctgg cttacaccat cggcaccacc aacttccagc gtgccctgat 960

cttcatcctg ctgaccgccg tggctccaag catgaccatg cgctgcatcg gcatctccaa 1020

cagggacttc gtggagggag tgtccggcgg atcttgggtg gacatcgtgc tggaacacgg 1080

ttcctgcgtg actaccatgg ccaagaacaa gcctaccctg gacttcgagc tgatcaagac 1140

cgaagccaag cagccagcta ccctgcgcaa gtactgcatc gaggccaagc tgaccaacac 1200

cactactgag tctaggtgcc caacccaggg tgaacctagc ctgaacgagg aacaggacaa 1260

gaggttcgtg tgcaagcact ctatggtgga caggggttgg ggcaacggat gcggcctgtt 1320

cggaaagggc ggcatcgtga cctgcgccat gttcacctgc aagaagaaca tggagggcaa 1380

gatcgtgcag cccgagaacc tggaatacac catcgtgatc acccctcact ctggagagga 1440

acacgctgtg ggcaacgaca ccggaaagca cggcaaggag atcaagatca cccctcagtc 1500

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aacccccac ctggcgacag gtgcctctgc ggccaaaagc cacgtgtata agatacacct 2820

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tggtgctgct agcagctgac gcccagggcc agaaggtgtt caccaacacc tgggctgtga 3180

gaatccccgg cggacctgct gtggctaaca gcgtggctcg taagcacggc ttcctgaacc 3240

tgggacagat tttcggtgac tactaccact tctggcaccg cggagtgacc aagaggagcc 3300

tgtccccaca cagaccaagg cactccagac tgcagcgtga gccccaggtg cagtggctgg 3360

aacagcaggt ggccaagcgc aggaccaaga gagacgtgta ccaggagcct accgacccaa 3420

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accaggaccc cgaccctcag ccaagataca cccagatgaa cgacaacaga catggaacca 3660

gatgtgctgg tgaagtggct gctgtggcta acaacggcgt gtgcggagtg ggtgtggcct 3720

acaacgctag aatcggtggc gtgcgtatgc tggatggaga agtgactgat gctgtggaag 3780

ctagaagcct gggactgaac ccaaaccaca tccacatcta ctctgccagc tggggtccag 3840

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gcgtgagcca gggaagggga ggtctgggaa gcatcttcgt gtgggcttct ggtaacggcg 3960

gaagagagca cgactcctgc aactgcgacg gatacaccaa ctctatctac accctgagca 4020

tcagctccgc tacccagttc ggtaacgtgc cctggtactc cgaagcctgc tctagcaccc 4080

tggctaccac ctactcctct ggcaaccaga acgagaagca gatcgtgacc accgacctgc 4140

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gaattcaccc agctttcttg tacaaagtgg tgatagcttg tcgagaagta ctagaggatc 5580

ataatcagcc ataccacatt tgtagaggtt ttacttgctt taaaaaacct cccacacctc 5640

cccctgaacc tgaaacataa aatgaatgca attgttgttg ttaacttgtt tattgcagct 5700

tataatggtt acaaataaag caatagcatc acaaatttca caaataaagc attttttttca 5760

ctgcattcta gttgtggttt gtccaaactc atcaatgtat cttatcatgt ctggatc 5817

FIGURE 29

SEQ ID NO: 3. Dual Promoter-DENV2 del108C-prM-E & del108CDENV-human furin proprotein bicistronic cassette + DENV2 NS1

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cttgggggtt ggggtgggga aaaggaagaa acgcgggcgt attggtccca atggggtctc 120

ggtggggtat cgacagagtg ccagccctgg gaccgaaccc cgcgtttatg aacaaacgac 180

ccaacacccg tgcgttttat tctgtctttt tattgccgtc atagcgcggg ttccttccgg 240

tattgtctcc ttccgtgttt cagttagcct cccccatctc ccggtagcgc atgctctaga 300

ggcgcgcctt attaggctgt cacgagagag gacacgagat tttcttcttt ttctttcaga 360

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gaaggacctc tgtttccgca gtcttcggtc accaccacgg tggttccctt gcagaagtcg 540

aagtccatct caagcttgcc caggtgccat ggtccagcgg tctgggtgtg gtatccaggg 600

cggtagttgt gctggctcac ggggccagcg aagttctttg ggatgatcat ttcagactcc 660

agcactccgt tggaccacag ggtgtggctc ttgggccagt ggcagctctt cacttcgatg 720

aaagaagcct tctcgatctt ccaggtgtcg ttcagggcgg attcgatcca gtagcccatg 780

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aattcaccca gctttcttgt acaaagtggt gatagcttgt cgagaagtac tagaggatca 7320

taatcagcca taccacattt gtagaggttt tacttgcttt aaaaaacctc ccacacctcc 7380

ccctgaacct gaaacataaa atgaatgcaa ttgttgttgt taacttgttt attgcagctt 7440

taatggtta caaataaagc aatagcatca caaatttcac aaataaagca ttttttcac 7500

tgcattctag ttgtggtttg tccaaactca tcaatgtatc ttatcatgtc tggatc 7556

FIGURE 30

SEQ ID NO: 4. Dual Promoter-DENV2 del108C-prM-E & human furin proprotein bicistronic cassette + DENV2 NS1

gtggctatgg cagggcttgc cgccccgacg ttggctgcga gccctgggcc ttcacccgaa 60

cttgggggtt ggggtgggga aaaggaagaa acgcgggcgt attggtccca atggggtctc 120

ggtggggtat cgacagagtg ccagccctgg gaccgaaccc cgcgtttatg aacaaacgac 180

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tattgtctcc ttccgtgttt cagttagcct cccccatctc ccggtagcgc atgctctaga 300

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ggacgaattt ccatgccgta ccagcatccg tcctcgccac ggtatctcag agggggcagg 420

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cggtagttgt gctggctcac ggggccagcg aagttctttg ggatgatcat ttcagactcc 660

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aaagaagcct tctcgatctt ccaggtgtcg ttcagggcgg attcgatcca gtagcccatg 780

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tc 7322

FIGURE 31

SEQ ID NO: 5. Dual Promoter-Heterologous ZIKV del108C-prM-E & del108CDENV2-human furin proprotein bicistronic cassette + ZIKV NS1

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cagcgtgtgc gctccttgtc acgcttcctg tgctacttgt cagggaccag ccctgactga 6840

ctgcctgtcc tgcccatctc acgccagcct ggaccccgtg gagcagacct gctccagaca 6900

gtctcagtcc tctcgtgaaa gccctccaca gcagcagccc cctagactgc cacccgaggt 6960

ggaagccggc cagagactgc gtgctggact gctgccttct cacctgccag aggtggtggc 7020

tggtctgagc tgcgctttca tcgtgctggt gttcgtgacc gtgttcctgg tgctgcagct 7080

gcgcagcggt ttctccttca ggggcgtgaa ggtgtacacc atggaccgcg gtctgatcag 7140

ctacaagggt ctgcctccag aggcttggca ggaggaatgc ccatctgaca gcgaagagga 7200

cgagggacgt ggagaacgga ctgccttcat caaagatcag agcgcactgt aataaatcga 7260

tttaattaat agcataaccc cttggggcct ctaaacgggt cttgaggggt tttttggaat 7320

tcacccagct ttcttgtaca aagtggtgat agcttgtcga gaagtactag aggatcataa 7380

tcagccatac cacatttgta gaggttttac ttgctttaaa aaacctccca cacctccccc 7440

tgaacctgaa acataaaatg aatgcaattg ttgttgttaa cttgtttatt gcagcttata 7500

atggttacaa ataaagcaat agcatcacaa atttcacaaa taaagcattt ttttcactgc 7560

attctagttg tggtttgtcc aaactcatca atgtatctta tcatgtctgg atc 7613

FIGURE 32

SEQ ID NO: 6. Dual Promoter-Homologous ZIKV del108C-prM-E & del108CZIKV-human furin proprotein bicistronic cassette + ZIKV NS1

gtggctatgg cagggcttgc cgccccgacg ttggctgcga gccctgggcc ttcacccgaa 60

cttgggggtt ggggtgggga aaaggaagaa acgcgggcgt attggtccca atggggtctc 120

ggtggggtat cgacagagtg ccagccctgg gaccgaaccc cgcgtttatg aacaaacgac 180

ccaacacccg tgcgttttat tctgtctttt tattgccgtc atagcgcggg ttccttccgg 240

tattgtctcc ttccgtgttt cagttagcct cccccatctc ccggtagcgc atgctctaga 300

ggcgcgcctt attatgcagt caccattgac cttactaagt tactttctgg ttctttcctg 360

ggccttatct ccattccata ccaacagcca tctttagccc ggaacgacag tgggggcatt 420

gtgcactccc tgcagcacca ttcctcgatc acccttccgc ttgcagtggt tgatctcaga 480

gatggtcctc ttgttccaca tgtttcctcc acgtggacct tagtgcctgg gcattcctca 540

aaccgaattt caagctcttc actgtgccat ggccctttca tttgggtcct gtagccctct 600

ctggtattgt gatggctgag tggcccagct aaagacttgg gtatgatcag atcactctct 660

tctattccat ctgtccacaa tgtgtgggac tttggccatt cacatgtttt catctcgatc 720

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tcactgtgta cagcctcctt tcccttaaca gctgttccaa taacggctgg atcacactct 840

aatgaataat cttctctaac cttgagccag acactagtgt gaaatacccc gaacccatga 900

tcctccacaa gaaagctgtt ccatgctcta tgtttgagtg ggcattcctt cagtgtgtca 960

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gccttccagc cgtggggcag ctcgttcaca ggcacgggca atctctgtgg acctctccac 1080

atggggtttt ttacagatcc cacaacgacc gtcagttgaa ctccattctc ttccaggatt 1140

gcgttgagct ccccttctac tgatctccac atgatgtttt ccattcttga aacagaggag 1200

atcccacaga taccatcttc ccaggcttgc ttgactgctg ctgccaatct acgggggggag 1260

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gtaccgcatc tcgtctcctt ctttgagaag tccaccgagc accccacatc catgcggccg 1380

cctcgagatc ccgggtgatc aagtcttcgt cgagtgattg taaataaaat gtaatttaca 1440

gtatagtatt ttaattaata tacaaatgat ttgataataa ttcttattta actataatat 1500

attgtgttgg gttgaattaa aggtccgtat catggagata attaaaatga taaccatctc 1560

gcaaataaat aagtatttta ctgttttcgt aacagttttg taataaaaaa acctataaat 1620

attccggatt attcataccg tcccaccatc gggcgcggat catcacaagt ttgtacaaaa 1680

aagcaggcta gatcttaata cgactcacta tattaattaa ggatcccaaa aaattgaaat 1740

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aacagatggg gtagcgtggg caagaaggag gctatggaaa tcatcaagaa gttcaagaag 1920

gacctggccg ctatgctgag aatcatcaac gctcgtaagg agaagaagcg caggggtgcc 1980

gacacctctg tgggaatcgt gggtctgctg ctgaccaccg ctatggctgc tgaggtgacc 2040

agaagaggct ccgcctacta catgtacctg gacaggaacg acgctggaga agccatctct 2100

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aagggtgaag ctcgcaggtc cagacgtgcc gtgaccctgc cttcccactc tacccgcaag 2340

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gaagctaccc tgggaggttt cggcagcctg ggactggact gtgagcctcg taccggcctg 3120

gacttctccg acctgtacta cctgaccatg aacaacaagc actggctggt gcacaaggaa 3180

tggttccacg acatcccact gccatggcac gccggtgctg acactggaac cccacactgg 3240

aacaacaagg aggctctggt ggagttcaag gacgcccacg ctaagagaca gactgtggtg 3300

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atggacggtg ccaagggccg tctgtctagc ggtcacctga agtgccgcct gaagatggac 3420

aagctgaggc tgaagggcgt gtcctactct ctgtgcaccg ccgctttcac cttcaccaag 3480

atccctgctg aaaccctgca cggcaccgtg accgtggaag tgcagtacgc tggaaccgat 3540

ggtccatgca aggtgcctgc tcagatggcc gtggacatgc agaccctgac ccctgtggga 3600

cgcctgatca ccgccaaccc agtgatcacc gagtctaccg aaaacagcaa gatgatgctg 3660

gagctggacc ctcccttcgg cgacagctac atcgtgatcg gagtgggtga aaagaagatc 3720

acccaccact ggcacaggag cggcagcacc atcggcaagg ctttcgaggc taccgtgcgc 3780

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tttctctcta ccgcagtctc cgcatgagcc cctctccctc ccccccccct aacgttactg 4080

gccgaagccg cttggaataa ggccggtgtg tgtttgtcta tatgtgattt tccaccatat 4140

tgccgtcttt tggcaatgtg agggcccgga aacctggccc tgtcttcttg acgagcattc 4200

taggggtct ttcccctctc gccaaaggaa tgcaaggtct gttgaatgtc gtgaaggaag 4260

cagttcctct ggaagcttct tgaagacaaa caacgtctgt agcgaccctt tgcaggcagc 4320

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caccaacacc tgggctgtga gaatccccgg cggacctgct gtggctaaca gcgtggctcg 5040

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cggagtgacc aagaggagcc tgtccccaca cagaccaagg cactccagac tgcagcgtga 5160

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cgacaacaga catggaacca gatgtgctgg tgaagtggct gctgtggcta acaacggcgt 5520

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ctctgccagc tggggtccag aggatgatgg aaagactgtg gatggtcctg ctagactggc 5700

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gcgcgacatg cagcacctgg tggtgcagac ctccaagcca gctcacctga acgccaacga 6120

ctgggctacc aacggcgtgg gaaggaaggt gagccactct tacggttacg gtctgctgga 6180

tgctggtgct atggtggccc tggctcagaa ctggaccacc gtggcccctc agcgcaagtg 6240

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cgtgaccgct tgcctgggag agcccaacca catcaccaga ctggaacacg cccaggctcg 6360

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tcgagaagta ctagaggatc ataatcagcc ataccacatt tgtagaggtt ttacttgctt 7440

taaaaaacct cccacacctc cccctgaacc tgaaacataa aatgaatgca attgttgttg 7500

ttaacttgtt tattgcagct tataatggtt acaaataaag caatagcatc acaaatttca 7560

caaataaagc attttttttca ctgcattcta gttgtggttt gtccaaactc atcaatgtat 7620

cttatcatgt ctggatc 7637

FIGURE 33

SEQ ID NO: 7. Dual Promoter-ZIKV del108C-prM-E & human furin proprotein bicistronic cassette + ZIKV NS1

gtggctatgg cagggcttgc cgccccgacg ttggctgcga gccctgggcc ttcacccgaa 60

cttgggggtt ggggtgggga aaaggaagaa acgcgggcgt attggtccca atggggtctc 120

ggtggggtat cgacagagtg ccagccctgg gaccgaaccc cgcgtttatg aacaaacgac 180

ccaacacccg tgcgttttat tctgtctttt tattgccgtc atagcgcggg ttccttccgg 240

tattgtctcc ttccgtgttt cagttagcct cccccatctc ccggtagcgc atgctctaga 300

ggcgcgcctt attatgcagt caccattgac cttactaagt tactttctgg ttctttcctg 360

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gcgttgagct ccccttctac tgatctccac atgatgtttt ccattcttga aacagaggag 1200

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tcaggatggt acttgtacct gtccctccag gcttcaacgt cgttatagac gaacacccct 1320

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cctcgagatc ccgggtgatc aagtcttcgt cgagtgattg taaataaaat gtaatttaca 1440

gtatagtatt ttaattaata tacaaatgat ttgataataa ttcttattta actataatat 1500

attgtgttgg gttgaattaa aggtccgtat catggagata attaaaatga taaccatctc 1560

gcaaataaat aagtatttta ctgttttcgt aacagttttg taataaaaaa acctataaat 1620

attccggatt attcataccg tcccaccatc gggcgcggat catcacaagt ttgtacaaaa 1680

aagcaggcta gatcttaata cgactcacta tattaattaa ggatcccaaa aaattgaaat 1740

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aacagatggg gtagcgtggg caagaaggag gctatggaaa tcatcaagaa gttcaagaag 1920

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agaagaggct ccgcctacta catgtacctg gacaggaacg acgctggaga agccatctct 2100

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cctgggacag attttcggtg actactacca cttctggcac cgcggagtga ccaagaggag 4860

cctgtcccca cacagaccaa ggcactccag actgcagcgt gagccccagg tgcagtggct 4920

ggaacagcag gtggccaagc gcaggaccaa gagagacgtg taccaggagc ctaccgaccc 4980

aaagttcccc cagcagtggt atctgtccgg cgtgacccag cgtgacctga acgtgaaggc 5040

cgcttgggct cagggttaca ccggtcacgg catcgtggtg tccatcctgg acgacggcat 5100

cgagaagaac caccctgacc tggccggtaa ctacgaccca ggcgcttctt tcgacgtgaa 5160

cgaccaggac cccgaccctc agccaagata cacccagatg aacgacaaca gacatggaac 5220

cagatgtgct ggtgaagtgg ctgctgtggc taacaacggc gtgtgcggag tgggtgtggc 5280

ctacaacgct agaatcggtg gcgtgcgtat gctggatgga gaagtgactg atgctgtgga 5340

agctagaagc ctgggactga acccaaacca catccacatc tactctgcca gctggggtcc 5400

agaggatgat ggaaagactg tggatggtcc tgctagactg gctgaggaag ccttcttccg 5460

cggcgtgagc cagggaaggg gaggtctggg aagcatcttc gtgtgggctt ctggtaacgg 5520

cggaagagag cacgactcct gcaactgcga cggatacacc aactctatct acaccctgag 5580

catcagctcc gctacccagt tcggtaacgt gccctggtac tccgaagcct gctctagcac 5640

cctggctacc acctactcct ctggcaacca gaacgagaag cagatcgtga ccaccgacct 5700

gcgtcagaag tgcaccgaat ctcacactgg cacctccgcc tctgctcctc tggctgctgg 5760

aatcatcgcc ctgaccctgg aggctaacaa gaacctgacc tggcgcgaca tgcagcacct 5820

ggtggtgcag acctccaagc cagctcacct gaacgccaac gactgggcta ccaacggcgt 5880

gggaaggaag gtgagccact cttacggtta cggtctgctg gatgctggtg ctatggtggc 5940

cctggctcag aactggacca ccgtggcccc tcagcgcaag tgcatcatcg acatcctgac 6000

cgagcctaag gacatcggaa agagactgga agtgcgtaag accgtgaccg cttgcctggg 6060

agagcccaac cacatcacca gactggaaca cgcccaggct cgtctgaccc tgtcttacaa 6120

cagacgtgga gacctggcca tccacctggt gtctccaatg ggcacccgca gcaccctgct 6180

ggctgctagg ccacacgact acagcgccga cggattcaac gactgggctt tcatgaccac 6240

ccactcctgg gacgaggacc cttctggtga atgggtgctg gagatcgaaa acaccagcga 6300

ggccaacaac tacggcaccc tgaccaagtt caccctggtg ctgtacggca ccgctcctga 6360

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cgtggtgtgc gaggaaggct tctccctgca ccagaagtct tgcgtgcagc actgcccacc 6480

cggattcgct cctcaggtgc tggacaccca ctactctacc gagaacgacg tggaaaccat 6540

cagagccagc gtgtgcgctc cttgtcacgc ttcctgtgct acttgtcagg gaccagccct 6600

gactgactgc ctgtcctgcc catctcacgc cagcctggac cccgtggagc agacctgctc 6660

cagacagtct cagtcctctc gtgaaagccc tccacagcag cagcccccta gactgccacc 6720

cgaggtggaa gccggccaga gactgcgtgc tggactgctg ccttctcacc tgccagaggt 6780

ggtggctggt ctgagctgcg ctttcatcgt gctggtgttc gtgaccgtgt tcctggtgct 6840

gcagctgcgc agcggtttct ccttcagggg cgtgaaggtg tacaccatgg accgcggtct 6900

gatcagctac aagggtctgc ctccagaggc ttggcaggag gaatgcccat ctgacagcga 6960

agaggacgag ggacgtggag aacggactgc cttcatcaaa gatcagagcg cactgtaata 7020

aatcgattta attaatagca taacccccttg gggcctctaa acgggtcttg aggggttttt 7080

tggaattcac ccagctttct tgtacaaagt ggtgatagct tgtcgagaag tactagagga 7140

tcataatcag ccataccaca tttgtagagg ttttacttgc tttaaaaaac ctcccacacc 7200

tccccctgaa cctgaaacat aaaatgaatg caattgttgt tgttaacttg tttattgcag 7260

cttataatgg ttacaaataa agcaatagca tcacaaattt cacaaataaa gcatttttttt 7320

cactgcattc tagttgtggt ttgtccaaac tcatcaatgt atcttatcat gtctggatc 7379

FIGURE 34

SEQ ID NO: 8. Heterologous ZIKV del108C-prM-E & del108CDENV2-human furin proprotein bicistronic cassette

cgtatactcc ggaatattaa tagatcatgg agataattaa aatgataacc atctcgcaaa 60

taaataagta ttttactgtt ttcgtaacag ttttgtaata aaaaaaccta taaatattcc 120

ggattattca taccgtccca ccatcgggcg cggatcatca caagtttgta caaaaaagca 180

ggctagatct taatacgact cactatatta attaaggatc ccaaaaaatt gaaattttat 240

ttttttttt tggaatataa ataatatgct gctcggacac ggccctattc gtatggtgct 300

cgctatcctc gcctttctca ggtttaccgc tatcaagcct agtctgggtc tcatcaacag 360

atggggtagc gtgggcaaga aggaggctat ggaaatcatc aagaagttca agaaggacct 420

ggccgctatg ctgagaatca tcaacgctcg taaggagaag aagcgcaggg gtgccgacac 480

ctctgtggga atcgtgggtc tgctgctgac caccgctatg gctgctgagg tgaccagaag 540

aggctccgcc tactacatgt acctggacag gaacgacgct ggagaagcca tctctttccc 600

caccaccctg ggtatgaaca agtgctacat ccagatcatg gacctgggac acatgtgcga 660

cgccaccatg agctacgagt gcccaatgct ggacgagggt gtggaacccg acgacgtgga 720

ctgctggtgc aacaccacca gcacctgggt ggtgtacgga acctgccacc acaagaaggg 780

tgaagctcgc aggtccagac gtgccgtgac cctgccttcc cactctaccc gcaagctgca 840

gaccaggtcc cagacctggc tggagtctcg cgaatacacc aagcacctga tccgcgtgga 900

gaactggatc ttcaggaacc ctggtttcgc tctggccgct gctgctatcg cttggctgct 960

gggaagctcc acctcccaga aggtcatcta cctggtcatg atcctgctga tcgcccctgc 1020

ttacagcatc agatgcatcg gcgtgagcaa ccgtgacttc gtggagggca tgtctggcgg 1080

aacctgggtg gacgtggtgc tggaacacgg tggctgcgtg accgtgatgg ctcaggacaa 1140

gccaaccgtc gacatcgagc tggtgaccac caccgtgtct aacatggccg aggtgcgcag 1200

ctactgctac gaagccagca tcagcgacat ggcctctgac agcaggtgcc caacccaggg 1260

cgaagcttac ctggacaagc agtctgacac ccagtacgtg tgcaagagaa ccctggtgga 1320

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aatcatgctg tctgtgcacg gctcccagca ctctggaatg atcgtgaacg acaccggaca 1500

cgaaaccgac gaaaacagag ccaaggtgga gatcacccct aactctccac gtgccgaagc 1560

taccctggga ggtttcggca gcctgggact ggactgtgag cctcgtaccg gcctggactt 1620

ctccgacctg tactacctga ccatgaacaa caagcactgg ctggtgcaca aggaatggtt 1680

ccacgacatc ccactgccat ggcacgccgg tgctgacact ggaaccccac actggaacaa 1740

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gggttcccag gagggtgctg tgcacaccgc cctggctgga gctctggagg ctgaaatgga 1860

cggtgccaag ggccgtctgt ctagcggtca cctgaagtgc cgcctgaaga tggacaagct 1920

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tgctgaaacc ctgcacggca ccgtgaccgt ggaagtgcag tacgctggaa ccgatggtcc 2040

atgcaaggtg cctgctcaga tggccgtgga catgcagacc ctgacccctg tgggacgcct 2100

gatcaccgcc aacccagtga tcaccgagtc taccgaaaac agcaagatga tgctggagct 2160

ggaccctccc ttcggcgaca gctacatcgt gatcggagtg ggtgaaaaga agatcaccca 2220

ccactggcac aggagcggca gcaccatcgg caaggctttc gaggctaccg tgcgcggcgc 2280

taagagaatg gccgtgctgg gcgacactgc ttgggacttc ggaagcgtgg gcggagccct 2340

gaactccctg ggcaagggaa tccaccagat cttcggcgcc gctttcaagt ccctgttcgg 2400

tggcatgagc tggttctccc agatcctgat cggaaccctg ctgatgtggc tgggtctgaa 2460

caccaagaac ggctctatca gcctgatgtg cctcgctctc ggtggcgtgc tgatttttct 2520

ctctaccgca gtctccgcat gagcccctct ccctcccccc cccctaacgt tactggccga 2580

agccgcttgg aataaggccg gtgtgtgttt gtctatatgt gattttccac catattgccg 2640

tcttttggca atgtgagggc ccggaaacct ggccctgtct tcttgacgag cattcctagg 2700

ggtctttccc ctctcgccaa aggaatgcaa ggtctgttga atgtcgtgaa ggaagcagtt 2760

cctctggaag cttcttgaag acaaacaacg tctgtagcga ccctttgcag gcagcggaac 2820

cccccacctg gcgacaggtg cctctgcggc caaaagccac gtgtataaga tacacctgca 2880

aaggcggcac aaccccagtg ccacgttgtg agttggatag ttgtggaaag agtcaaatgg 2940

ctctcctcaa gcgtagtcaa caaggggctg aaggatgccc agaaggtacc ccattgtatg 3000

ggaatctgat ctggggcctc ggtgcacatg ctttacatgt gtttagtcga ggttaaaaaa 3060

gctctaggcc ccccgaacca cggggacgtg gttttccttt gaaaaacacg atgataagct 3120

tgccacaaat gctccagggt cgcggtccac tgaaactctt tatggctctc gtcgccttcc 3180

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acagaccaag gcactccaga ctgcagcgtg agccccaggt gcagtggctg gaacagcagg 3660

tggccaagcg caggaccaag agagacgtgt accaggagcc taccgaccca aagttccccc 3720

agcagtggta tctgtccggc gtgacccagc gtgacctgaa cgtgaaggcc gcttgggctc 3780

agggttacac cggtcacggc atcgtggtgt ccatcctgga cgacggcatc gagaagaacc 3840

accctgacct ggccggtaac tacgacccag gcgcttcttt cgacgtgaac gaccaggacc 3900

ccgaccctca gccaagatac acccagatga acgacaacag acatggaacc agatgtgctg 3960

gtgaagtggc tgctgtggct aacaacggcg tgtgcggagt gggtgtggcc tacaacgcta 4020

gaatcggtgg cgtgcgtatg ctggatggag aagtgactga tgctgtggaa gctagaagcc 4080

tgggactgaa cccaaaccac atccacatct actctgccag ctggggtcca gaggatgatg 4140

gaaagactgt ggatggtcct gctagactgg ctgaggaagc cttcttccgc ggcgtgagcc 4200

agggaagggg aggtctggga agcatcttcg tgtgggcttc tggtaacggc ggaagagagc 4260

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cctactcctc tggcaaccag aacgagaagc agatcgtgac caccgacctg cgtcagaagt 4440

gcaccgaatc tcacactggc acctccgcct ctgctcctct ggctgctgga atcatcgccc 4500

tgaccctgga ggctaacaag aacctgacct ggcgcgacat gcagcacctg gtggtgcaga 4560

cctccaagcc agctcacctg aacgccaacg actgggctac caacggcgtg ggaaggaagg 4620

tgagccactc ttacggttac ggtctgctgg atgctggtgc tatggtggcc ctggctcaga 4680

actggaccac cgtggcccct cagcgcaagt gcatcatcga catcctgacc gagcctaagg 4740

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acggcaccct gaccaagttc accctggtgc tgtacggcac cgctcctgag ggactgccag 5100

tgccccctga aagctccggt tgcaagaccc tgacctctag ccaggcctgc gtggtgtgcg 5160

aggaaggctt ctccctgcac cagaagtctt gcgtgcagca ctgcccaccc ggattcgctc 5220

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gcggtttctc cttcaggggc gtgaaggtgt acaccatgga ccgcggtctg atcagctaca 5640

agggtctgcc tccagaggct tggcaggagg aatgcccatc tgacagcgaa gaggacgagg 5700

gacgtggaga acggactgcc ttcatcaaag atcagagcgc actgtaataa atcgatttaa 5760

ttaatagcat aacccccttgg ggcctctaaa cgggtcttga ggggtttttt ggaattcacc 5820

cagctttctt gtacaaagtg gtgatagctt gtcgagaagt actagaggat cataatcagc 5880

cataccacat ttgtagaggt tttacttgct ttaaaaaacc tcccacacct ccccctgaac 5940

ctgaaacata aaatgaatgc aattgttgtt gttaacttgt ttattgcagc ttataatggt 6000

tacaaataaa gcaatagcat cacaaatttc acaaataaag catttttttc actgcattct 6060

agttgtggtt tgtccaaact catcaatgta tcttatcatg tctggatc 6108

FIGURE 35

SEQ ID NO: 9. Homologous ZIKV del108C-prM-E & del108CZIKV-human furin proprotein bicistronic cassette

cgtatactcc ggaatattaa tagatcatgg agataattaa aatgataacc atctcgcaaa 60

taaataagta ttttactgtt ttcgtaacag ttttgtaata aaaaaaccta taaatattcc 120

ggattattca taccgtccca ccatcgggcg cggatcatca caagtttgta caaaaaagca 180

ggctagatct taatacgact cactatatta attaaggatc ccaaaaaatt gaaattttat 240

ttttttttt tggaatataa ataatatgct gctcggacac ggccctattc gtatggtgct 300

cgctatcctc gcctttctca ggtttaccgc tatcaagcct agtctgggtc tcatcaacag 360

atggggtagc gtgggcaaga aggaggctat ggaaatcatc aagaagttca agaaggacct 420

ggccgctatg ctgagaatca tcaacgctcg taaggagaag aagcgcaggg gtgccgacac 480

ctctgtggga atcgtgggtc tgctgctgac caccgctatg gctgctgagg tgaccagaag 540

aggctccgcc tactacatgt acctggacag gaacgacgct ggagaagcca tctctttccc 600

caccaccctg ggtatgaaca agtgctacat ccagatcatg gacctgggac acatgtgcga 660

cgccaccatg agctacgagt gcccaatgct ggacgagggt gtggaacccg acgacgtgga 720

ctgctggtgc aacaccacca gcacctgggt ggtgtacgga acctgccacc acaagaaggg 780

tgaagctcgc aggtccagac gtgccgtgac cctgccttcc cactctaccc gcaagctgca 840

gaccaggtcc cagacctggc tggagtctcg cgaatacacc aagcacctga tccgcgtgga 900

gaactggatc ttcaggaacc ctggtttcgc tctggccgct gctgctatcg cttggctgct 960

gggaagctcc acctcccaga aggtcatcta cctggtcatg atcctgctga tcgcccctgc 1020

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aacctgggtg gacgtggtgc tggaacacgg tggctgcgtg accgtgatgg ctcaggacaa 1140

gccaaccgtc gacatcgagc tggtgaccac caccgtgtct aacatggccg aggtgcgcag 1200

ctactgctac gaagccagca tcagcgacat ggcctctgac agcaggtgcc caacccaggg 1260

cgaagcttac ctggacaagc agtctgacac ccagtacgtg tgcaagagaa ccctggtgga 1320

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aatcatgctg tctgtgcacg gctcccagca ctctggaatg atcgtgaacg acaccggaca 1500

cgaaaccgac gaaaacagag ccaaggtgga gatcacccct aactctccac gtgccgaagc 1560

taccctggga ggtttcggca gcctgggact ggactgtgag cctcgtaccg gcctggactt 1620

ctccgacctg tactacctga ccatgaacaa caagcactgg ctggtgcaca aggaatggtt 1680

ccacgacatc ccactgccat ggcacgccgg tgctgacact ggaaccccac actggaacaa 1740

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gggttcccag gagggtgctg tgcacaccgc cctggctgga gctctggagg ctgaaatgga 1860

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atgcaaggtg cctgctcaga tggccgtgga catgcagacc ctgacccctg tgggacgcct 2100

gatcaccgcc aacccagtga tcaccgagtc taccgaaaac agcaagatga tgctggagct 2160

ggaccctccc ttcggcgaca gctacatcgt gatcggagtg ggtgaaaaga agatcaccca 2220

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tggcatgagc tggttctccc agatcctgat cggaaccctg ctgatgtggc tgggtctgaa 2460

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cccccacctg gcgacaggtg cctctgcggc caaaagccac gtgtataaga tacacctgca 2880

aaggcggcac aaccccagtg ccacgttgtg agttggatag ttgtggaaag agtcaaatgg 2940

ctctcctcaa gcgtagtcaa caaggggctg aaggatgccc agaaggtacc ccattgtatg 3000

ggaatctgat ctggggcctc ggtgcacatg ctttacatgt gtttagtcga ggttaaaaaa 3060

gctctaggcc ccccgaacca cggggacgtg gttttccttt gaaaaacacg atgataagct 3120

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agaaggaggc tatggaaatc atcaagaagt tcaagaagga cctggccgct atgctgagaa 3300

tcatcaacgc tcgtaaggag aagaagcgca ggggtgccga cacctctgtg ggaatcgtgg 3360

gtctgctgct gaccaccgct atggctatgg aactgagacc ttggctgctg tgggtggtgg 3420

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acacctgggc tgtgagaatc cccggcggac ctgctgtggc taacagcgtg gctcgtaagc 3540

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ctttcgacgt gaacgaccag gaccccgacc ctcagccaag atacacccag atgaacgaca 3960

acagacatgg aaccagatgt gctggtgaag tggctgctgt ggctaacaac ggcgtgtgcg 4020

gagtgggtgt ggcctacaac gctagaatcg gtggcgtgcg tatgctggat ggagaagtga 4080

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aagccttctt ccgcggcgtg agccagggaa ggggaggtct gggaagcatc ttcgtgtggg 4260

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cctgctctag caccctggct accacctact cctctggcaa ccagaacgag aagcagatcg 4440

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ctctggctgc tggaatcatc gccctgaccc tggaggctaa caagaacctg acctggcgcg 4560

acatgcagca cctggtggtg cagacctcca agccagctca cctgaacgcc aacgactggg 4620

ctaccaacgg cgtgggaagg aaggtgagcc actcttacgg ttacggtctg ctggatgctg 4680

gtgctatggt ggccctggct cagaactgga ccaccgtggc ccctcagcgc aagtgcatca 4740

tcgacatcct gaccgagcct aaggacatcg gaaagagact ggaagtgcgt aagaccgtga 4800

ccgcttgcct gggagagccc aaccacatca ccagactgga acacgcccag gctcgtctga 4860

ccctgtctta caacagacgt ggagacctgg ccatccacct ggtgtctcca atgggcaccc 4920

gcagcaccct gctggctgct aggccacacg actacagcgc cgacggattc aacgactggg 4980

ctttcatgac cacccactcc tgggacgagg acccttctgg tgaatgggtg ctggagatcg 5040

aaaacaccag cgaggccaac aactacggca ccctgaccaa gttcaccctg gtgctgtacg 5100

gcaccgctcc tgagggactg ccagtgcccc ctgaaagctc cggttgcaag accctgacct 5160

ctagccaggc ctgcgtggtg tgcgaggaag gcttctccct gcaccagaag tcttgcgtgc 5220

agcactgccc acccggattc gctcctcagg tgctggacac ccactactct accgagaacg 5280

acgtggaaac catcagagcc agcgtgtgcg ctccttgtca cgcttcctgt gctacttgtc 5340

agggaccagc cctgactgac tgcctgtcct gcccatctca cgccagcctg gaccccgtgg 5400

agcagacctg ctccagacag tctcagtcct ctcgtgaaag ccctccacag cagcagcccc 5460

ctagactgcc acccgaggtg gaagccggcc agagactgcg tgctggactg ctgccttctc 5520

acctgccaga ggtggtggct ggtctgagct gcgctttcat cgtgctggtg ttcgtgaccg 5580

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tggaccgcgg tctgatcagc tacaagggtc tgcctccaga ggcttggcag gaggaatgcc 5700

catctgacag cgaagaggac gagggacgtg gagaacggac tgccttcatc aaagatcaga 5760

gcgcactgta ataaatcgat ttaattaata gcataacccc ttggggcctc taaacgggtc 5820

ttgaggggtt ttttggaatt cacccagctt tcttgtacaa agtggtgata gcttgtcgag 5880

aagtactaga ggatcataat cagccatacc acatttgtag aggttttact tgctttaaaa 5940

aacctcccac acctcccccc gaacctgaaa cataaaatga atgcaattgt tgttgttaac 6000

ttgtttattg cagcttataa tggttacaaa taaagcaata gcatcacaaa tttcacaaat 6060

aaagcatttt tttcactgca ttctagttgt ggtttgtcca aactcatcaa tgtatcttat 6120

catgtctgga tc 6132

FIGURE 36

SEQ ID NO: 10. ZIKV del108C-prM-E & human furin proprotein bicistronic cassette

cgtatactcc ggaatattaa tagatcatgg agataattaa aatgataacc atctcgcaaa 60

taaataagta ttttactgtt ttcgtaacag ttttgtaata aaaaaaccta taaatattcc 120

ggattattca taccgtccca ccatcgggcg cggatcatca caagtttgta caaaaaagca 180

ggctagatct taatacgact cactatatta attaaggatc ccaaaaaatt gaaatttttat 240

ttttttttt tggaatataa ataatatgct gctcggacac ggccctattc gtatggtgct 300

cgctatcctc gcctttctca ggtttaccgc tatcaagcct agtctgggtc tcatcaacag 360

atggggtagc gtgggcaaga aggaggctat ggaaatcatc aagaagttca agaaggacct 420

ggccgctatg ctgagaatca tcaacgctcg taaggagaag aagcgcaggg gtgccgacac 480

ctctgtggga atcgtgggtc tgctgctgac caccgctatg gctgctgagg tgaccagaag 540

aggctccgcc tactacatgt acctggacag gaacgacgct ggagaagcca tctctttccc 600

caccaccctg ggtatgaaca agtgctacat ccagatcatg gacctgggac acatgtgcga 660

cgccaccatg agctacgagt gcccaatgct ggacgagggt gtggaacccg acgacgtgga 720

ctgctggtgc aacaccacca gcacctgggt ggtgtacgga acctgccacc acaagaaggg 780

tgaagctcgc aggtccagac gtgccgtgac cctgccttcc cactctaccc gcaagctgca 840

gaccaggtcc cagacctggc tggagtctcg cgaatacacc aagcacctga tccgcgtgga 900

gaactggatc ttcaggaacc ctggtttcgc tctggccgct gctgctatcg cttggctgct 960

gggaagctcc acctcccaga aggtcatcta cctggtcatg atcctgctga tcgcccctgc 1020

ttacagcatc agatgcatcg gcgtgagcaa ccgtgacttc gtggagggca tgtctggcgg 1080

aacctgggtg gacgtggtgc tggaacacgg tggctgcgtg accgtgatgg ctcaggacaa 1140

gccaaccgtc gacatcgagc tggtgaccac caccgtgtct aacatggccg aggtgcgcag 1200

ctactgctac gaagccagca tcagcgacat ggcctctgac agcaggtgcc caacccaggg 1260

cgaagcttac ctggacaagc agtctgacac ccagtacgtg tgcaagagaa ccctggtgga 1320

ccgtggatgg ggtaacggct gcggactgtt cggcaagggc agcctggtga cctgcgctaa 1380

gttcgcctgc tccaagaaga tgaccggcaa gtctatccag ccagagaacc tggaatacag 1440

aatcatgctg tctgtgcacg gctcccagca ctctggaatg atcgtgaacg acaccggaca 1500

cgaaaccgac gaaaacagag ccaaggtgga gatcacccct aactctccac gtgccgaagc 1560

taccctggga ggtttcggca gcctgggact ggactgtgag cctcgtaccg gcctggactt 1620

ctccgacctg tactacctga ccatgaacaa caagcactgg ctggtgcaca aggaatggtt 1680

ccacgacatc ccactgccat ggcacgccgg tgctgacact ggaaccccac actggaacaa 1740

caaggaggct ctggtggagt tcaaggacgc ccacgctaag agacagactg tggtggtgct 1800

gggttcccag gagggtgctg tgcacaccgc cctggctgga gctctggagg ctgaaatgga 1860

cggtgccaag ggccgtctgt ctagcggtca cctgaagtgc cgcctgaaga tggacaagct 1920

gaggctgaag ggcgtgtcct actctctgtg caccgccgct ttcaccttca ccaagatccc 1980

tgctgaaacc ctgcacggca ccgtgaccgt ggaagtgcag tacgctggaa ccgatggtcc 2040

atgcaaggtg cctgctcaga tggccgtgga catgcagacc ctgacccctg tgggacgcct 2100

gatcaccgcc aacccagtga tcaccgagtc taccgaaaac agcaagatga tgctggagct 2160

ggaccctccc ttcggcgaca gctacatcgt gatcggagtg ggtgaaaaga agatcaccca 2220

ccactggcac aggagcggca gcaccatcgg caaggctttc gaggctaccg tgcgcggcgc 2280

taagagaatg gccgtgctgg gcgacactgc ttgggacttc ggaagcgtgg gcggagccct 2340

gaactccctg ggcaagggaa tccaccagat cttcggcgcc gctttcaagt ccctgttcgg 2400

tggcatgagc tggttctccc agatcctgat cggaaccctg ctgatgtggc tgggtctgaa 2460

caccaagaac ggctctatca gcctgatgtg cctcgctctc ggtggcgtgc tgatttttct 2520

ctctaccgca gtctccgcat gagcccctct ccctcccccc cccctaacgt tactggccga 2580

agccgcttgg aataaggccg gtgtgtgttt gtctatatgt gattttccac catattgccg 2640

tcttttggca atgtgagggc ccggaaacct ggccctgtct tcttgacgag cattcctagg 2700

ggtctttccc ctctcgccaa aggaatgcaa ggtctgttga atgtcgtgaa ggaagcagtt 2760

cctctggaag cttcttgaag acaaacaacg tctgtagcga ccctttgcag gcagcggaac 2820

cccccacctg gcgacaggtg cctctgcggc caaaagccac gtgtataaga tacacctgca 2880

aaggcggcac aaccccagtg ccacgttgtg agttggatag ttgtggaaag agtcaaatgg 2940

ctctcctcaa gcgtagtcaa caaggggctg aaggatgccc agaaggtacc ccattgtatg 3000

ggaatctgat ctggggcctc ggtgcacatg ctttacatgt gtttagtcga ggttaaaaaa 3060

gctctaggcc ccccgaacca cggggacgtg gttttccttt gaaaaacacg atgataagct 3120

tgccacaaat ggaactgaga ccttggctgc tgtgggtggt ggctgctact ggcaccctgg 3180

tgctgctagc agctgacgcc cagggccaga aggtgttcac caacacctgg gctgtgagaa 3240

tccccggcgg acctgctgtg gctaacagcg tggctcgtaa gcacggcttc ctgaacctgg 3300

gacagatttt cggtgactac taccacttct ggcaccgcgg agtgaccaag aggagcctgt 3360

ccccacacag accaaggcac tccagactgc agcgtgagcc ccaggtgcag tggctggaac 3420

agcaggtggc caagcgcagg accaagagag acgtgtacca ggagcctacc gacccaaagt 3480

tcccccagca gtggtatctg tccggcgtga cccagcgtga cctgaacgtg aaggccgctt 3540

gggctcaggg ttacaccggt cacggcatcg tggtgtccat cctggacgac ggcatcgaga 3600

agaaccaccc tgacctggcc ggtaactacg acccaggcgc ttctttcgac gtgaacgacc 3660

aggaccccga ccctcagcca agatacaccc agatgaacga caacagacat ggaaccagat 3720

gtgctggtga agtggctgct gtggctaaca acggcgtgtg cggagtgggt gtggcctaca 3780

acgctagaat cggtggcgtg cgtatgctgg atggagaagt gactgatgct gtggaagcta 3840

gaagcctggg actgaaccca aaccacatcc acatctactc tgccagctgg ggtccagagg 3900

atgatggaaa gactgtggat ggtcctgcta gactggctga ggaagccttc ttccgcggcg 3960

tgagccaggg aaggggaggt ctgggaagca tcttcgtgtg ggcttctggt aacggcggaa 4020

gagagcacga ctcctgcaac tgcgacggat acaccaactc tatctacacc ctgagcatca 4080

gctccgctac ccagttcggt aacgtgccct ggtactccga agcctgctct agcaccctgg 4140

ctaccaccta ctcctctggc aaccagaacg agaagcagat cgtgaccacc gacctgcgtc 4200

agaagtgcac cgaatctcac actggcacct ccgcctctgc tcctctggct gctggaatca 4260

tcgccctgac cctggaggct aacaagaacc tgacctggcg cgacatgcag cacctggtgg 4320

tgcagacctc caagccagct cacctgaacg ccaacgactg ggctaccaac ggcgtgggaa 4380

ggaaggtgag ccactcttac ggttacggtc tgctggatgc tggtgctatg gtggccctgg 4440

ctcagaactg gaccaccgtg gcccctcagc gcaagtgcat catcgacatc ctgaccgagc 4500

ctaaggacat cggaaagaga ctggaagtgc gtaagaccgt gaccgcttgc ctgggagagc 4560

ccaaccacat caccagactg gaacacgccc aggctcgtct gaccctgtct tacaacagac 4620

gtggagacct ggccatccac ctggtgtctc caatgggcac ccgcagcacc ctgctggctg 4680

ctaggccaca cgactacagc gccgacggat tcaacgactg ggctttcatg accacccact 4740

cctgggacga ggacccttct ggtgaatggg tgctggagat cgaaaacacc agcgaggcca 4800

acaactacgg caccctgacc aagttcaccc tggtgctgta cggcaccgct cctgagggac 4860

tgccagtgcc ccctgaaagc tccggttgca agaccctgac ctctagccag gcctgcgtgg 4920

tgtgcgagga aggcttctcc ctgcaccaga agtcttgcgt gcagcactgc ccacccggat 4980

tcgctcctca ggtgctggac acccactact ctaccgagaa cgacgtggaa accatcagag 5040

ccagcgtgtg cgctccttgt cacgcttcct gtgctacttg tcagggacca gccctgactg 5100

actgcctgtc ctgcccatct cacgccagcc tggaccccgt ggagcagacc tgctccagac 5160

agtctcagtc ctctcgtgaa agccctccac agcagcagcc ccctagactg ccacccgagg 5220

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gctacaaggg tctgcctcca gaggcttggc aggaggaatg cccatctgac agcgaagagg 5460

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atcagccata ccacatttgt agaggtttta cttgctttaa aaaacctccc acacctcccc 5700

ctgaacctga aacataaaat gaatgcaatt gttgttgtta acttgtttat tgcagcttat 5760

aatggttaca ataaaagcaa tagcatcaca aatttcacaa ataaagcatt tttttcactg 5820

cattctagtt gtggtttgtc caaactcatc aatgtatctt atcatgtctg gatc 5874

FIGURE 37

SEQ ID NO: 11. YFV del108C-prM-E & del108CYFV-human furin proprotein bicistronic cassette

cgtatactcc ggaatattaa tagatcatgg agataattaa aatgataacc atctcgcaaa 60

taaataagta ttttactgtt ttcgtaacag ttttgtaata aaaaaaccta taaatattcc 120

ggattattca taccgtccca ccatcgggcg cggatcatca caagtttgta caaaaaagca 180

ggctagatct taatacgact cactatatta attaaggatc ccaaaaaatt gaaattttat 240

ttttttttt tggaatataa ataatatgag acctggacct tcaagaggtg ttcaaggatt 300

tatctttttc tttttgttca acattttgac tggaaaaaag atcacggccc acctaaagag 360

gttgtggaaa atgctggacc caagacaagg cttggctgtt ctaaggaaag ttaagagagt 420

ggtggccagt ttgatgagag gattgtcctc aaggaaacgc cgttcccatg atgttctgac 480

tgtgcaattc ctaattttgg gaatgctgtt gatgacgggt ggagtgacct tggtgcggaa 540

aaacagatgg ttgctcctaa atgtgacatc tgaggacctc gggaaaacat tctctgtggg 600

cacaggcaac tgcacaacaa acattttgga agccaagtac tggtgcccag actcaatgga 660

atacaactgt cccaatctca gtccaagaga ggagccagat gacattgatt gctggtgcta 720

tggggtggaa aacgttagag tcgcatatgg taagtgtgac tcagcaggca ggtctaggag 780

gtcaagaagg gccattgact tgcctacgca tgaaaaccat ggtttgaaga cccggcaaga 840

aaaatggatg actggaagaa tgggtgaaag gcaactccaa aagattgaga gatggctcgt 900

gaggaacccc ttttttgcag tgacagctct gaccattgcc taccttgtgg gaagcaacat 960

gacgcaacga gtcgtgattg ccctactggt cttggctgtt ggtccggcct actcagctca 1020

ctgcattgga attactgaca gggatttcat tgaggggtg catggaggaa cttgggtttc 1080

agctaccctg gagcaagaca agtgtgtcac tgttatggcc cctgacaagc cttcattgga 1140

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tgcagttctc actcatgtga agattaatga caagtgcccc agcactggag aggcccacct 1260

agctgaagag aacgaagggg acaatgcgtg caagcgcact tattctgata gaggctgggg 1320

caatggctgt ggcctatttg ggaaagggag cattgtggca tgcgccaaat tcacttgtgc 1380

caaatccatg agtttgtttg aggttgatca gaccaaaatt cagtatgtca tcagagcaca 1440

attgcatgta ggggccaagc aggaaaattg gaataccgac attaagactc tcaagtttga 1500

tgccctgtca ggctcccagg aagccgagtt cactgggtat ggaaaagcta cactggaatg 1560

ccaggtgcaa actgcggtgg actttggtaa cagttacatc gctgagatgg aaaaagagag 1620

ctggatagtg gacagacagt gggcccagga cttgaccctg ccatggcaga gtggaagtgg 1680

cggggtgtgg agagagatgc atcatcttgt cgaatttgaa cctccgcatg ccgccactat 1740

cagagtactg gccctgggaa accaggaagg ctccttgaaa acagctctta ccggcgcaat 1800

gagggttaca aaggacacaa atgacaacaa cctttacaaa ctacatggtg gacatgtttc 1860

ctgcagagtg aaattgtcag ctttgacact caaggggaca tcctacaaaa tgtgcactga 1920

caaaatgtct tttgtcaaga acccaactga cactggccat ggcactgttg tgatgcaggt 1980

gaaagtgcca aaaggagccc cctgcaggat tccagtgata gtagctgatg atcttacagc 2040

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cgctggaggg ttcttcactt cggttgggaa aggtattcat acggtgtttg gctctgcctt 2340

tcaggggcta tttggcggct tgaactggat aacaaaggtc atcatggggg cggtactcat 2400

atgggttggc atcaacacaa gaaacatgac aatgtccatg agcatgatct tggtaggagt 2460

gatcatgatg tttttgtctc taggagttgg ggcgtgagcc cctctccctc ccccccccct 2520

aacgttactg gccgaagccg cttggaataa ggccggtgtg tgtttgtcta tatgtgattt 2580

tccaccatat tgccgtcttt tggcaatgtg agggcccgga aacctggccc tgtcttcttg 2640

acgagcattc ctaggggtct ttcccctctc gccaaaggaa tgcaaggtct gttgaatgtc 2700

gtgaaggaag cagttcctct ggaagcttct tgaagacaaa caacgtctgt agcgaccctt 2760

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taagatacac ctgcaaaggc ggcacaaccc cagtgccacg ttgtgagttg gatagttgtg 2880

gaaagagtca aatggctctc ctcaagcgta gtcaacaagg ggctgaagga tgcccagaag 2940

gtaccccatt gtatgggaat ctgatctggg gcctcggtgc acatgcttta catgtgttta 3000

gtcgaggtta aaaaagctct aggccccccg aaccacgggg acgtggtttt cctttgaaaa 3060

acacgatgat aagcttgcca caaatgagac ctggaccttc aagaggtgtt caaggattta 3120

tctttttctt tttgttcaac attttgactg gaaaaaagat cacggcccac ctaaagaggt 3180

tgtggaaaat gctggaccca agacaaggct tggctgttct aaggaaagtt aagagagtgg 3240

tggccagttt gatgagagga ttgtcctcaa ggaaacgccg ttcccatgat gttctgactg 3300

tgcaattcct aattttggga atgctgttga tgacgggtgg aatggaactg agaccttggc 3360

tgctgtgggt ggtggctgct actggcaccc tggtgctgct agcagctgac gcccagggcc 3420

agaaggtgtt caccaacacc tgggctgtga gaatccccgg cggacctgct gtggctaaca 3480

gcgtggctcg taagcacggc ttcctgaacc tgggacagat tttcggtgac tactaccact 3540

tctggcaccg cggagtgacc aagaggagcc tgtccccaca cagaccaagg cactccagac 3600

tgcagcgtga gccccaggtg cagtggctgg aacagcaggt ggccaagcgc aggaccaaga 3660

gagacgtgta ccaggagcct accgacccaa agttccccca gcagtggtat ctgtccggcg 3720

tgacccagcg tgacctgaac gtgaaggccg cttgggctca gggttacacc ggtcacggca 3780

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cccagatgaa cgacaacaga catggaacca gatgtgctgg tgaagtggct gctgtggcta 3960

acaacggcgt gtgcggagtg ggtgtggcct acaacgctag aatcggtggc gtgcgtatgc 4020

tggatggaga agtgactgat gctgtggaag ctagaagcct gggactgaac ccaaaccaca 4080

tccacatcta ctctgccagc tggggtccag aggatgatgg aaagactgtg gatggtcctg 4140

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gcatcttcgt gtgggcttct ggtaacggcg gaagagagca cgactcctgc aactgcgacg 4260

gatacaccaa ctctatctac accctgagca tcagctccgc tacccagttc ggtaacgtgc 4320

cctggtactc cgaagcctgc tctagcaccc tggctaccac ctactcctct ggcaaccaga 4380

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acctgacctg gcgcgacatg cagcacctgg tggtgcagac ctccaagcca gctcacctga 4560

acgccaacga ctgggctacc aacggcgtgg gaaggaaggt gagccactct tacggttacg 4620

gtctgctgga tgctggtgct atggtggccc tggctcagaa ctggaccacc gtggcccctc 4680

agcgcaagtg catcatcgac atcctgaccg agcctaagga catcggaaag agactggaag 4740

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cccaggctcg tctgaccctg tcttacaaca gacgtggaga cctggccatc cacctggtgt 4860

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gcctggaccc cgtggagcag acctgctcca gacagtctca gtcctctcgt gaaagccctc 5400

cacagcagca gccccctaga ctgccacccg aggtggaagc cggccagaga ctgcgtgctg 5460

gactgctgcc ttctcacctg ccagaggtgg tggctggtct gagctgcgct ttcatcgtgc 5520

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gcctctaaac gggtcttgag gggtttttg gaattcaccc agctttcttg tacaaagtgg 5820

tgatagcttg tcgagaagta ctagaggatc ataatcagcc ataccacatt tgtagaggtt 5880

ttacttgctt taaaaaacct cccacacctc cccctgaacc tgaaacataa aatgaatgca 5940

attgttgttg ttaacttgtt tattgcagct tataatggtt acaaataaag caatagcatc 6000

acaaatttca caaataaagc attttttca ctgcattcta gttgtggttt gtccaaactc 6060

atcaatgtat cttatcatgt ctggatc 6087

FIGURE 38

SEQ ID NO: 12. HCV del108C-E1-E2 & del108CHCV-human furin proprotein bicistronic cassette

cgtatactcc ggaatattaa tagatcatgg agataattaa aatgataacc atctcgcaaa 60

taaataagta ttttactgtt ttcgtaacag ttttgtaata aaaaaaccta taaatattcc 120

ggattattca taccgtccca ccatcgggcg cggatcatca caagtttgta caaaaaagca 180

ggctagatct taatacgact cactatatta attaaggatc ccaaaaaatt gaaattttat 240

ttttttttt tggaatataa ataatatgct gccaagaagg ggtccaagac tcggagtgcg 300

tgccacccgc aagacctctg agcgtagcca gccaagaggc cgccgccagc caatccctaa 360

ggctcgcagg cctgaaggta gaacttgggc tcagccaggt tacccttggc cactgtacgg 420

aaacgaaggc tgcggatggg ctggatggct gctgagcccc aggggttcca gaccttcttg 480

gggtccaact gacccacgcc gccgcagccg caacctgggc aaggtcatcg acaccctgac 540

ctgcggattc gccgacctga tgggttacat cccactggtg ggagctcccc tgggcggagc 600

tgctagggcc ctggctcacg gtgtgagagt gctggaagac ggcgtgaact acgccaccgg 660

taacctgcca ggctgcagct tctccatctt cctgctggct ctgctgtcct gcctgactgg 720

accagcttct gcttaccagg tgaggaacag caccggtctg taccacgtga ccaacgactg 780

ccccaacagc tccatcgtgt tcgaagctgc tgatgctatc ctgcacaccc caggatgcgt 840

gccttgcgtg cgtgagggta acgcttccag atgctgggtg gctgtgaccc ctaccgtggc 900

caccagagac ggcaagctgc caaccaccca gctgaggaga cacatcgacc tgctggtggg 960

tagcgccacc ctgtgctccg ctctgtacgt gggcgacctg tgcggtagcg tgttcctggt 1020

gggccagctg ttcaccttca gccctcgtcg ccactggacc acccaggact gcaactgctc 1080

catctaccca ggccacatct ctggacaccg tatggcttgg gacatgatga tgaactggag 1140

cccaactgcc gctctgctgg tggctcagct gctgagaatc ccacaggcca tcctggacat 1200

gatcgctggt gctcactggg gcgtgctggc tggaatggct tacttctcta tggtgggcaa 1260

ctgggccaag gtgctggtgg tgctgctgct gttcgccgga gtggacgctg aaacctacgt 1320

gaccggtggc agcgccgcta ggactactgc tggcctggct agtctgttct cccctggagc 1380

taagcagaac atccagctgg tgaacaccaa cggctcttgg cacatcaaca gcaccgccct 1440

gaactgcaac gactccctga acaccggttg gatcgctggc ctgttctacc accacaagtt 1500

caactctagc ggatgctccg aaaggctggc ttcttgcaga cctctgactg acttcgctca 1560

gggttggggt cctatcagcc acgctgatgg atctggtcca gaccagcgcc cctactgctg 1620

gcactaccct cccaagcctt gcggtatcgt gcctgctaag tccgtgtgcg gtcccgtgta 1680

ctgcttcacc ccctctcctg tggtggtggg aaccaccgac aggtctggtg ctccaaccta 1740

cagctgggga gccaacgaca ccgacgtgtt cgtgctgaac aacaccagac cacccctggg 1800

aaactggttc ggttgcacct ggatgaacag caccggcttc accaaggtgt gcggagcccc 1860

tccatgcgtg atcggaggtg tgggcaacaa caccctgcgt tgccccaccg actgcttccg 1920

caagcaccct gaggctacct actccagatg cggctctgga ccttggatca ccccaaggtg 1980

cctggtggac taccctaca gactgtggca ctacccttgc accatcaact acaccgtgtt 2040

caaggtgcgt atgtacgtgg gcggagtgga gcacagactg gaagctgctt gtaactggac 2100

tcgcggcgac cgctgcaacc tggacgacag ggacagatct gagctgagcc ccctgctgct 2160

gtccaccacc cagtggcagg tgctgccatg cagcttcacc accctgcccg ccctgtccac 2220

tggcctgatc cacctgcacc agaacatcgt ggacgtgcag tacctgtacg gtgtgggctc 2280

ctctatcgca tcttgggcta tcaagtggga atacgtggtg ctgctgttcc tgctgctggc 2340

tgatgctcgc gtgtgctcct gcctgtggat gatgctgctg atctctcagg tggaggccgc 2400

tctggaaaac ctggtggtgc tgaacgctgc aagcctggct ggaacccacg gtctggtgtc 2460

cttcctggtg ttcttctgct tcgcttggta cctgaagggc aagtgggtgc ctggagccgt 2520

gtacgctctg tacggaatgt ggcctctgct gctgctgctg ctggccctgc cacagagagc 2580

ttacgctctg gacactgagg tggctgcttc ttgtggtggc gtggtgctgg tgggcctgat 2640

ggctctgacc ctgtctcctt actacaagag gtacatcagc tggtgcctgt ggtggctgca 2700

gtacttcctg accagaatcg aagcccagct gcacgtgtgg attcctcccc tgaacgtgcg 2760

cggcggcaga gatgccgtga tcctgctgat gtgcgtggtg caccccgctc tggtgttcga 2820

catcaccaag ctgctgctgg ccgctttcgg cccttaatct agagcccctc tccctccccc 2880

ccccctaacg ttactggccg aagccgcttg gaataaggcc ggtgtgtgtt tgtctatatg 2940

tgattttcca ccatattgcc gtcttttggc aatgtgaggg cccggaaacc tggccctgtc 3000

ttcttgacga gcattcctag gggtctttcc cctctcgcca aaggaatgca aggtctgttg 3060

aatgtcgtga aggaagcagt tcctctggaa gcttcttgaa gacaaacaac gtctgtagcg 3120

acccttttgca ggcagcggaa ccccccacct ggcgacaggt gcctctgcgg ccaaaagcca 3180

cgtgtataag atacacctgc aaaggcggca caaccccagt gccacgttgt gagttggata 3240

gttgtggaaa gagtcaaatg gctctcctca agcgtagtca acaaggggct gaaggatgcc 3300

cagaaggtac cccattgtat gggaatctga tctggggcct cggtgcacat gctttacatg 3360

tgtttagtcg aggttaaaaa agctctaggc cccccgaacc acggggacgt ggttttcctt 3420

tgaaaaacac gatgataagc ttgccacaaa tgctgcctag aaggggacct aggctgggtg 3480

tgagggccac cagaaagacc tctgagagga gccagcctag aggccgccgc cagccaatcc 3540

ctaaggctcg caggcccgag ggaagaacct gggctcagcc tggttaccca tggcccctgt 3600

acggcaacga aggttgcggc tgggctggtt ggctgctgtc tccacgtggt tcccgcccct 3660

cttggggtcc tactgaccca cgccgccgca gccgcaacct gggcaaggtc atcgacaccc 3720

tgacctgcgg attcgccgac ctgatgggtt acatccctct ggtgggagct ccactgggcg 3780

gagccgctcg tgccctggct cacggagtgc gcgtgctgga ggacggtgtg aactacgcca 3840

ccggcaacct gcccggatgc agcttctcca tcttcctgct ggctctgctg tcttgtctga 3900

ctggtccagc ttccgctatg gaactgcgcc cctggctgct gtgggtggtg gctgctactg 3960

gaaccctggt gctgctagca gctgacgccc agggccagaa ggtgttcacc aacacctggg 4020

ctgtgagaat ccccggcgga cctgctgtgg ctaacagcgt ggctcgtaag cacggcttcc 4080

tgaacctggg acagattttc ggtgactact accacttctg gcaccgcgga gtgaccaaga 4140

ggagcctgtc cccacacaga ccaaggcact ccagactgca gcgtgagccc caggtgcagt 4200

ggctggaaca gcaggtggcc aagcgcagga ccaagagaga cgtgtaccag gagcctaccg 4260

acccaaagtt cccccagcag tggtatctgt ccggcgtgac ccagcgtgac ctgaacgtga 4320

aggccgcttg ggctcagggt tacaccggtc acggcatcgt ggtgtccatc ctggacgacg 4380

gcatcgagaa gaaccaccct gacctggccg gtaactacga cccaggcgct tctttcgacg 4440

tgaacgacca ggaccccgac cctcagccaa gatacaccca gatgaacgac aacagacatg 4500

gaaccagatg tgctggtgaa gtggctgctg tggctaacaa cggcgtgtgc ggagtgggtg 4560

tggcctacaa cgctagaatc ggtggcgtgc gtatgctgga tggagaagtg actgatgctg 4620

tggaagctag aagcctggga ctgaacccaa accacatcca catctactct gccagctggg 4680

gtccagagga tgatggaaag actgtggatg gtcctgctag actggctgag gaagccttct 4740

tccgcggcgt gagccaggga aggggaggtc tgggaagcat cttcgtgtgg gcttctggta 4800

acggcggaag agagcacgac tcctgcaact gcgacggata caccaactct atctacaccc 4860

tgagcatcag ctccgctacc cagttcggta acgtgccctg gtactccgaa gcctgctcta 4920

gcaccctggc taccacctac tcctctggca accagaacga gaagcagatc gtgaccaccg 4980

acctgcgtca gaagtgcacc gaatctcaca ctggcacctc cgcctctgct cctctggctg 5040

ctggaatcat cgccctgacc ctggaggcta acaagaacct gacctggcgc gacatgcagc 5100

acctggtggt gcagacctcc aagccagctc acctgaacgc caacgactgg gctaccaacg 5160

gcgtgggaag gaaggtgagc cactcttacg gttacggtct gctggatgct ggtgctatgg 5220

tggccctggc tcagaactgg accaccgtgg cccctcagcg caagtgcatc atcgacatcc 5280

tgaccgagcc taaggacatc ggaaagagac tggaagtgcg taagaccgtg accgcttgcc 5340

tgggagagcc caaccacatc accagactgg aacacgccca ggctcgtctg accctgtctt 5400

acaacagacg tggagacctg gccatccacc tggtgtctcc aatgggcacc cgcagcaccc 5460

tgctggctgc taggccacac gactacagcg ccgacggatt caacgactgg gctttcatga 5520

ccacccactc ctgggacgag gacccttctg gtgaatgggt gctggagatc gaaaacacca 5580

gcgaggccaa caactacggc accctgacca agttcaccct ggtgctgtac ggcaccgctc 5640

ctgagggact gccagtgccc cctgaaagct ccggttgcaa gaccctgacc tctagccagg 5700

cctgcgtggt gtgcgaggaa ggcttctccc tgcaccagaa gtcttgcgtg cagcactgcc 5760

cacccggatt cgctcctcag gtgctggaca cccactactc taccgagaac gacgtggaaa 5820

ccatcagagc cagcgtgtgc gctccttgtc acgcttcctg tgctacttgt cagggaccag 5880

ccctgactga ctgcctgtcc tgcccatctc acgccagcct ggaccccgtg gagcagacct 5940

gctccagaca gtctcagtcc tctcgtgaaa gccctccaca gcagcagccc cctagactgc 6000

cacccgaggt ggaagccggc cagagactgc gtgctggact gctgccttct cacctgccag 6060

aggtggtggc tggtctgagc tgcgctttca tcgtgctggt gttcgtgacc gtgttcctgg 6120

tgctgcagct gcgcagcggt ttctccttca ggggcgtgaa ggtgtacacc atggaccgcg 6180

gtctgatcag ctacaagggt ctgcctccag aggcttggca ggaggaatgc ccatctgaca 6240

gcgaagagga cgagggacgt ggagaacgga ctgccttcat caaagatcag agcgcactgt 6300

aataaatcga tttaattaat agcataaccc cttggggcct ctaaacgggt cttgaggggt 6360

tttttggaat tcacccagct ttcttgtaca aagtggtgat agcttgtcga gaagtactag 6420

aggatcataa tcagccatac cacatttgta gaggttttac ttgctttaaa aaacctccca 6480

cacctccccc tgaacctgaa acataaaatg aatgcaattg ttgttgttaa cttgtttatt 6540

gcagcttata atggttacaa ataaagcaat agcatcacaa atttcacaaa taaagcattt 6600

ttttcactgc attctagttg tggtttgtcc aaactcatca atgtatctta tcatgtctgg 6660

atc 6663

FIGURE 39

SEQ ID NO: 13. YFV del108C-prM-E & human furin proprotein bicistronic cassette

cgtatactcc ggaatattaa tagatcatgg agataattaa aatgataacc atctcgcaaa 60

taaataagta ttttactgtt ttcgtaacag ttttgtaata aaaaaaccta taaatattcc 120

ggattattca taccgtccca ccatcgggcg cggatcatca caagtttgta caaaaaagca 180

ggctagatct taatacgact cactatatta attaaggatc ccaaaaaatt gaaatttttat 240

ttttttttt tggaatataa ataatatgag acctggacct tcaagaggtg ttcaaggatt 300

tatctttttc tttttgttca acattttgac tggaaaaaag atcacggccc acctaaagag 360

gttgtggaaa atgctggacc caagacaagg cttggctgtt ctaaggaaag ttaagagagt 420

ggtggccagt ttgatgagag gattgtcctc aaggaaacgc cgttcccatg atgttctgac 480

tgtgcaattc ctaattttgg gaatgctgtt gatgacgggt ggagtgacct tggtgcggaa 540

aaacagatgg ttgctcctaa atgtgacatc tgaggacctc gggaaaacat tctctgtggg 600

cacaggcaac tgcacaacaa acattttgga agccaagtac tggtgcccag actcaatgga 660

atacaactgt cccaatctca gtccaagaga ggagccagat gacattgatt gctggtgcta 720

tggggtggaa aacgttagag tcgcatatgg taagtgtgac tcagcaggca ggtctaggag 780

gtcaagaagg gccattgact tgcctacgca tgaaaaccat ggtttgaaga cccggcaaga 840

aaaatggatg actggaagaa tgggtgaaag gcaactccaa aagattgaga gatggctcgt 900

gaggaacccc ttttttgcag tgacagctct gaccattgcc taccttgtgg gaagcaacat 960

gacgcaacga gtcgtgattg ccctactggt cttggctgtt ggtccggcct actcagctca 1020

ctgcattgga attactgaca gggatttcat tgaggggtg catggaggaa cttgggtttc 1080

agctaccctg gagcaagaca agtgtgtcac tgttatggcc cctgacaagc cttcattgga 1140

catctcacta gagacagtag ccattgatgg acctgctgag gcgaggaaag tgtgttacaa 1200

tgcagttctc actcatgtga agattaatga caagtgcccc agcactggag aggcccacct 1260

agctgaagag aacgaagggg acaatgcgtg caagcgcact tattctgata gaggctgggg 1320

caatggctgt ggcctatttg ggaaagggag cattgtggca tgcgccaaat tcacttgtgc 1380

caaatccatg agtttgtttg aggttgatca gaccaaaatt cagtatgtca tcagagcaca 1440

attgcatgta ggggccaagc aggaaaattg gaataccgac attaagactc tcaagtttga 1500

tgccctgtca ggctcccagg aagccgagtt cactgggtat ggaaaagcta cactggaatg 1560

ccaggtgcaa actgcggtgg actttggtaa cagttacatc gctgagatgg aaaaagagag 1620

ctggatagtg gacagacagt gggcccagga cttgaccctg ccatggcaga gtggaagtgg 1680

cggggtgtgg agagagatgc atcatcttgt cgaatttgaa cctccgcatg ccgccactat 1740

cagagtactg gccctgggaa accaggaagg ctccttgaaa acagctctta ccggcgcaat 1800

gagggttaca aaggacacaa atgacaacaa cctttacaaa ctacatggtg gacatgtttc 1860

ctgcagagtg aaattgtcag ctttgacact caaggggaca tcctacaaaa tgtgcactga 1920

caaaatgtct tttgtcaaga acccaactga cactggccat ggcactgttg tgatgcaggt 1980

gaaagtgcca aaaggagccc cctgcaggat tccagtgata gtagctgatg atcttacagc 2040

ggcaatcaat aaaggcattt tggttacagt taaccccatc gcctcaacca atgatgatga 2100

agtgctgatt gaggtgaacc cacctttgg agacagctac attatcgttg ggacaggaga 2160

ttcacgtctc acttaccagt ggcacaaaga gggaagctca ataggaaagt tgttcactca 2220

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cgctggaggg ttcttcactt cggttgggaa aggtattcat acggtgtttg gctctgcctt 2340

tcaggggcta tttggcggct tgaactggat aacaaaggtc atcatggggg cggtactcat 2400

atgggttggc atcaacacaa gaaacatgac aatgtccatg agcatgatct tggtaggagt 2460

gatcatgatg tttttgtctc taggagttgg ggcgtgagcc cctctccctc ccccccccct 2520

aacgttactg gccgaagccg cttggaataa ggccggtgtg tgtttgtcta tatgtgattt 2580

tccaccatat tgccgtcttt tggcaatgtg agggcccgga aacctggccc tgtcttcttg 2640

acgagcattc ctaggggtct ttcccctctc gccaaaggaa tgcaaggtct gttgaatgtc 2700

gtgaaggaag cagttcctct ggaagcttct tgaagacaaa caacgtctgt agcgaccctt 2760

tgcaggcagc ggaacccccc acctggcgac aggtgcctct gcggccaaaa gccacgtgta 2820

taagatacac ctgcaaaggc ggcacaaccc cagtgccacg ttgtgagttg gatagttgtg 2880

gaaagagtca aatggctctc ctcaagcgta gtcaacaagg ggctgaagga tgcccagaag 2940

gtaccccatt gtatgggaat ctgatctggg gcctcggtgc acatgcttta catgtgttta 3000

gtcgaggtta aaaaagctct aggcccccg aaccacgggg acgtggtttt cctttgaaaa 3060

acacgatgat aagcttgcca caaatggaac tgagaccttg gctgctgtgg gtggtggctg 3120

ctactggcac cctggtgctg ctagcagctg acgcccaggg ccagaaggtg ttcaccaaca 3180

cctgggctgt gagaatcccc ggcggacctg ctgtggctaa cagcgtggct cgtaagcacg 3240

gcttcctgaa cctgggacag attttcggtg actactacca cttctggcac cgcggagtga 3300

ccaagaggag cctgtcccca cacagaccaa ggcactccag actgcagcgt gagccccagg 3360

tgcagtggct ggaacagcag gtggccaagc gcaggaccaa gagagacgtg taccaggagc 3420

ctaccgaccc aaagttcccc cagcagtggt atctgtccgg cgtgacccag cgtgacctga 3480

acgtgaaggc cgcttgggct cagggttaca ccggtcacgg catcgtggtg tccatcctgg 3540

acgacggcat cgagaagaac caccctgacc tggccggtaa ctacgaccca ggcgcttctt 3600

tcgacgtgaa cgaccaggac cccgaccctc agccaagata cacccagatg aacgacaaca 3660

gacatggaac cagatgtgct ggtgaagtgg ctgctgtggc taacaacggc gtgtgcggag 3720

tgggtgtggc ctacaacgct agaatcggtg gcgtgcgtat gctggatgga gaagtgactg 3780

atgctgtgga agctagaagc ctgggactga acccaaacca catccacatc tactctgcca 3840

gctggggtcc agaggatgat ggaaagactg tggatggtcc tgctagactg gctgaggaag 3900

ccttcttccg cggcgtgagc cagggaaggg gaggtctggg aagcatcttc gtgtgggctt 3960

ctggtaacgg cggaagagag cacgactcct gcaactgcga cggatacacc aactctatct 4020

acaccctgag catcagctcc gctacccagt tcggtaacgt gccctggtac tccgaagcct 4080

gctctagcac cctggctacc acctactcct ctggcaacca gaacgagaag cagatcgtga 4140

ccaccgacct gcgtcagaag tgcaccgaat ctcacactgg cacctccgcc tctgctcctc 4200

tggctgctgg aatcatcgcc ctgaccctgg aggctaacaa gaacctgacc tggcgcgaca 4260

tgcagcacct ggtggtgcag acctccaagc cagctcacct gaacgccaac gactgggcta 4320

ccaacggcgt gggaaggaag gtgagccact cttacggtta cggtctgctg gatgctggtg 4380

ctatggtggc cctggctcag aactggacca ccgtggcccc tcagcgcaag tgcatcatcg 4440

acatcctgac cgagcctaag gacatcggaa agagactgga agtgcgtaag accgtgaccg 4500

cttgcctggg agagcccaac cacatcacca gactggaaca cgcccaggct cgtctgaccc 4560

tgtcttacaa cagacgtgga gacctggcca tccacctggt gtctccaatg ggcacccgca 4620

gcaccctgct ggctgctagg ccacacgact acagcgccga cggattcaac gactgggctt 4680

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acaccagcga ggccaacaac tacggcaccc tgaccaagtt caccctggtg ctgtacggca 4800

ccgctcctga gggactgcca gtgccccctg aaagctccgg ttgcaagacc ctgacctcta 4860

gccaggcctg cgtggtgtgc gaggaaggct tctccctgca ccagaagtct tgcgtgcagc 4920

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gaccagccct gactgactgc ctgtcctgcc catctcacgc cagcctggac cccgtggagc 5100

agacctgctc cagacagtct cagtcctctc gtgaaagccc tccacagcag cagcccccta 5160

gactgccacc cgaggtggaa gccggccaga gactgcgtgc tggactgctg ccttctcacc 5220

tgccagaggt ggtggctggt ctgagctgcg ctttcatcgt gctggtgttc gtgaccgtgt 5280

tcctggtgct gcagctgcgc agcggtttct ccttcagggg cgtgaaggtg tacaccatgg 5340

accgcggtct gatcagctac aagggtctgc ctccagaggc ttggcaggag gaatgcccat 5400

ctgacagcga agaggacgag ggacgtggag aacggactgc cttcatcaaa gatcagagcg 5460

cactgtaata aatcgattta attaatagca taacccccttg gggcctctaa acgggtcttg 5520

aggggttttt tggaattcac ccagctttct tgtacaaagt ggtgatagct tgtcgagaag 5580

tactagagga tcataatcag ccataccaca tttgtagagg ttttacttgc tttaaaaaac 5640

ctcccacacc tccccctgaa cctgaaacat aaaatgaatg caattgttgt tgttaacttg 5700

tttattgcag cttataatgg ttacaaataa agcaatagca tcacaaattt cacaaataaa 5760

gcatttttt cactgcattc tagttgtggt ttgtccaaac tcatcaatgt atcttatcat 5820

gtctggatc 5829

FIGURE 40

SEQ ID NO: 14. HCV del108C-E1-E2-p7 & human furin proprotein bicistronic cassette

cgtatactcc ggaatattaa tagatcatgg agataattaa aatgataacc atctcgcaaa 60

taaataagta ttttactgtt ttcgtaacag ttttgtaata aaaaaaccta taaatattcc 120

ggattattca taccgtccca ccatcgggcg cggatcatca caagtttgta caaaaaagca 180

ggctagatct taatacgact cactatatta attaaggatc ccaaaaaatt gaaatttttat 240

ttttttttt tggaatataa ataatatgct gccaagaagg ggtccaagac tcggagtgcg 300

tgccacccgc aagacctctg agcgtagcca gccaagaggc cgccgccagc caatccctaa 360

ggctcgcagg cctgaaggta gaacttgggc tcagccaggt taccttggc cactgtacgg 420

aaacgaaggc tgcggatggg ctggatggct gctgagcccc aggggttcca gaccttcttg 480

gggtccaact gacccacgcc gccgcagccg caacctgggc aaggtcatcg acaccctgac 540

ctgcggattc gccgacctga tgggttacat cccactggtg ggagctcccc tgggcggagc 600

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