Fig. 1A

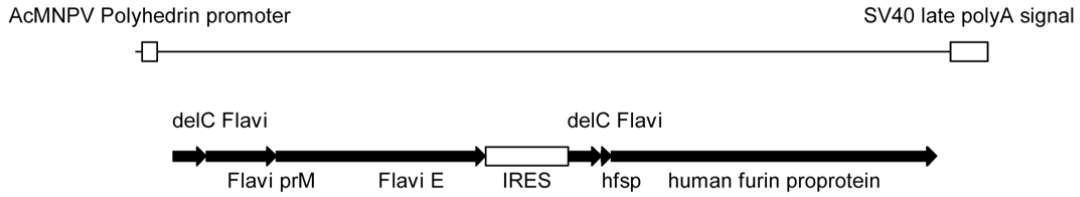


Fig. 1B

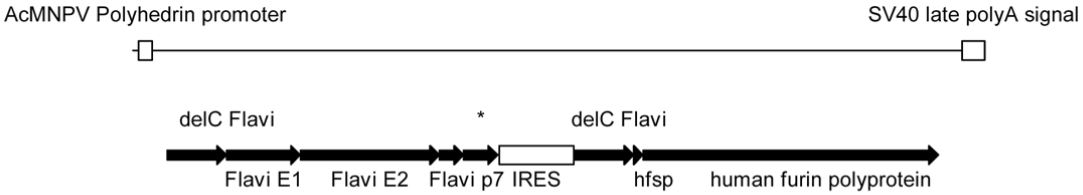


Fig. 1C

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

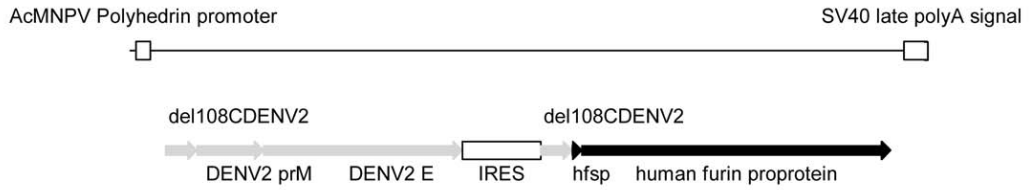


Fig. 2B

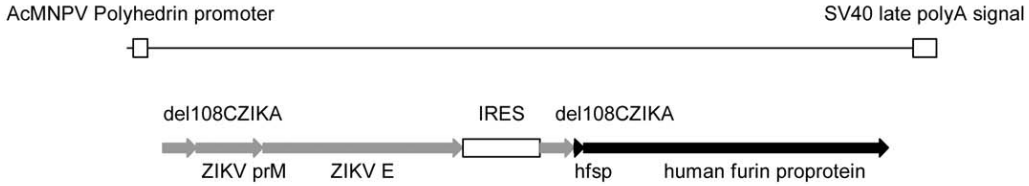


Fig. 2C

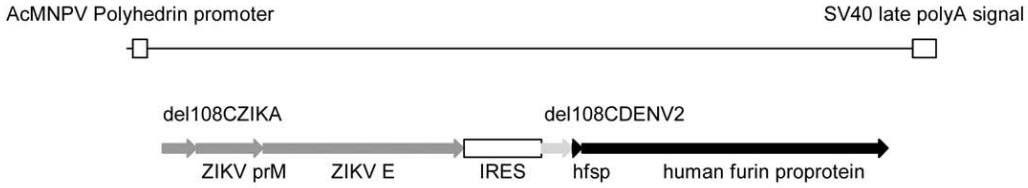


Fig. 2D

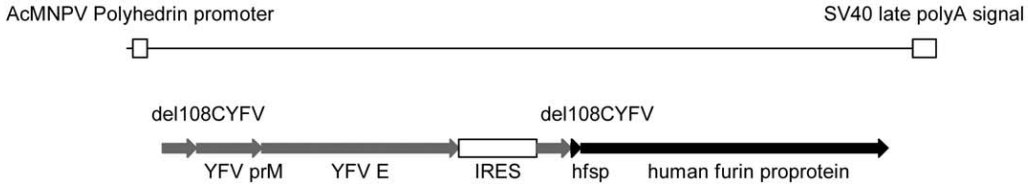


Fig. 2E

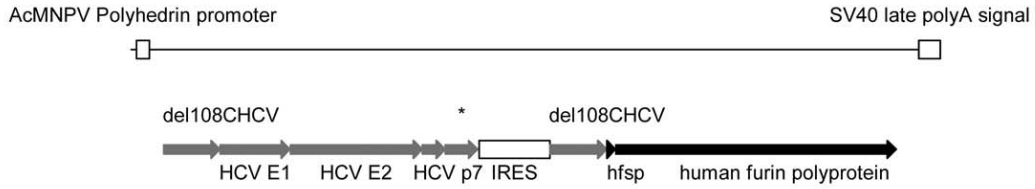


Fig. 2F

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

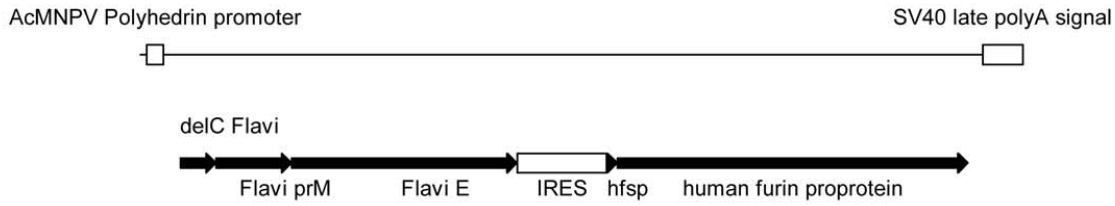


Fig. 3B

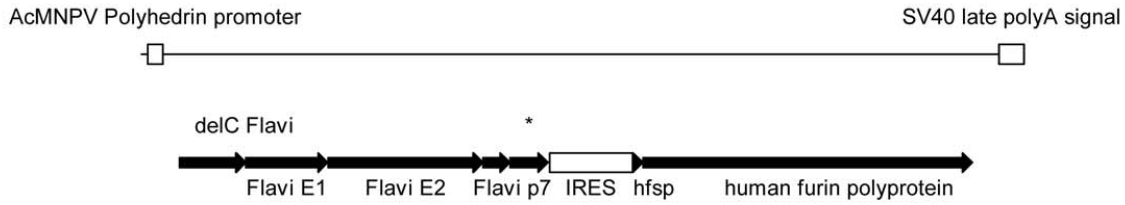


Fig. 3C

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

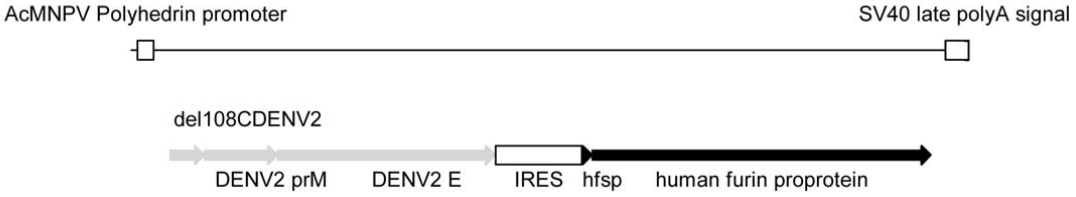


Fig. 4B

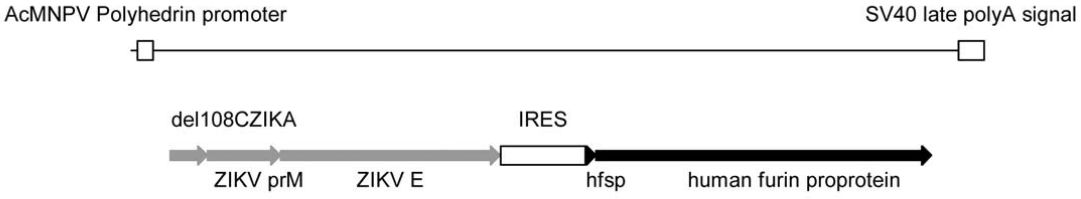


Fig. 4C

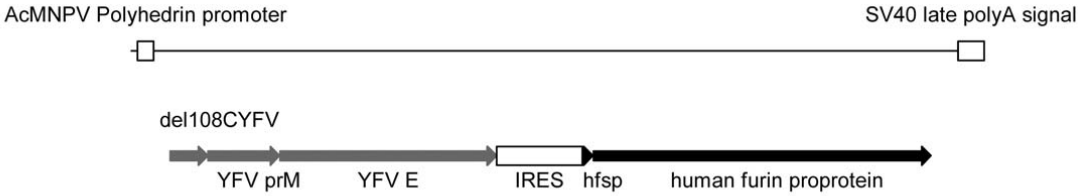


Fig. 4D

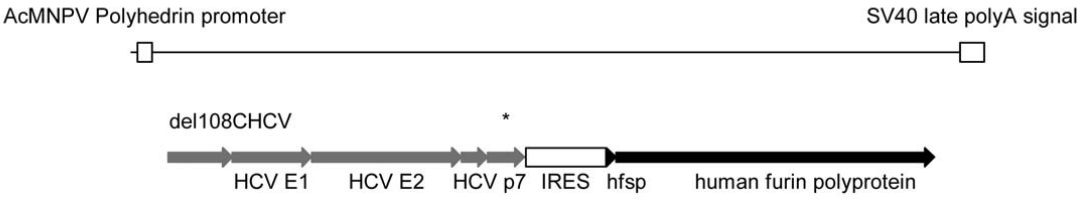


Fig. 4E

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
5696	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
3156	5465	human furin proprotein		Gene
5651	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)**

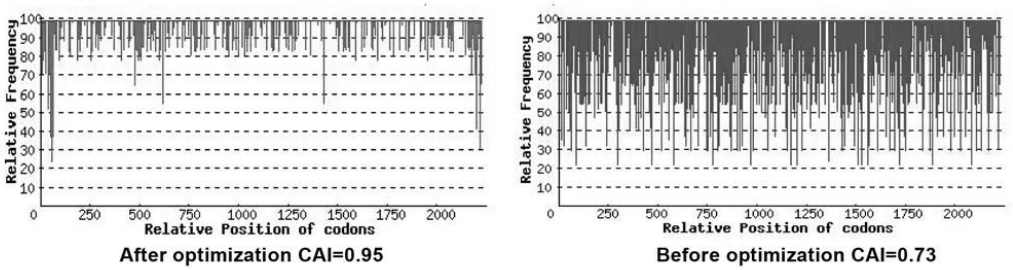


Fig. 5B **Frequency of Optimal Codons (FOP)**

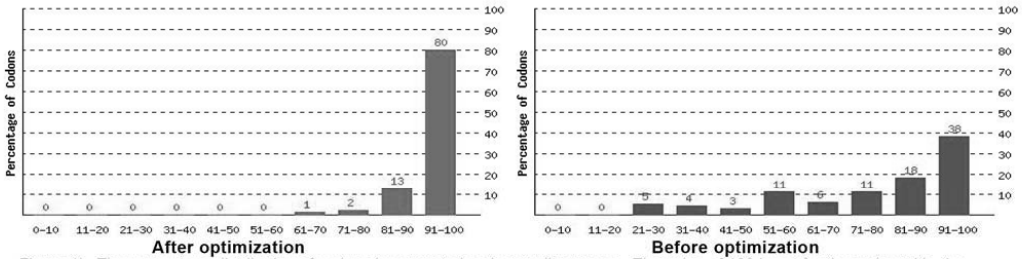


Fig. 5C **GC Content Adjustment of DENV 2 del108C-prM-E for insect cells**

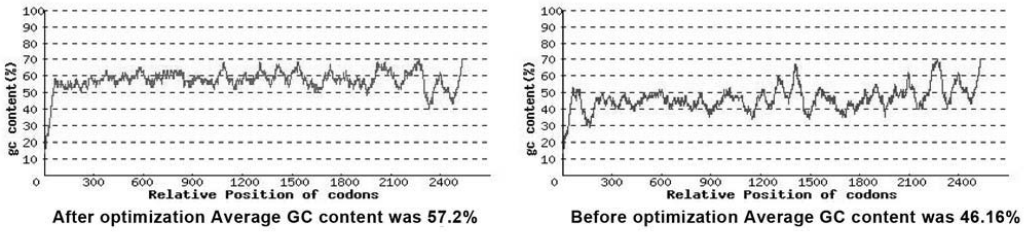


Fig. 6A **Codon Adaptation Index (CAI)**

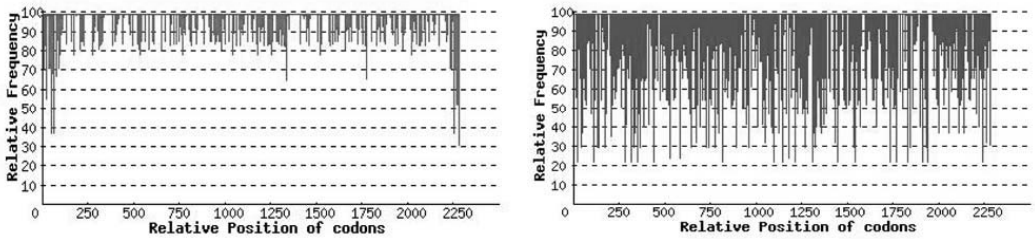


Fig. 6B **Frequency of Optimal Codons (FOP)**

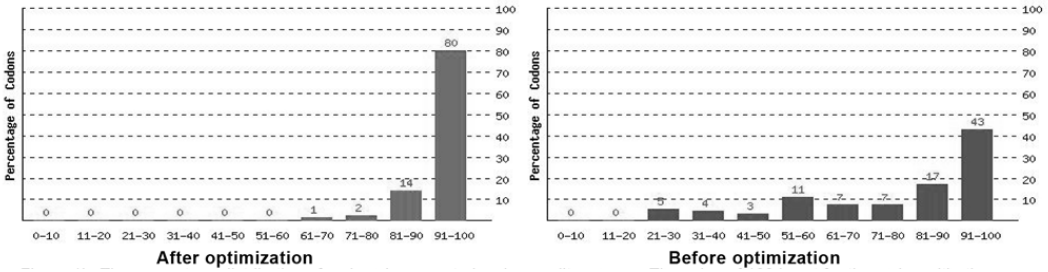


Fig. 6C **GC Content Adjustment of DENV 2 del108C-prM-E for insect cells**

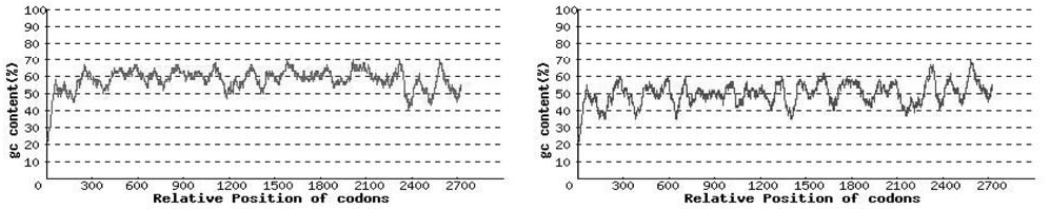
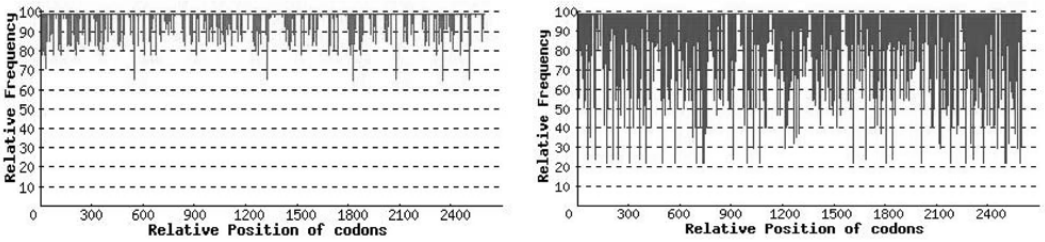


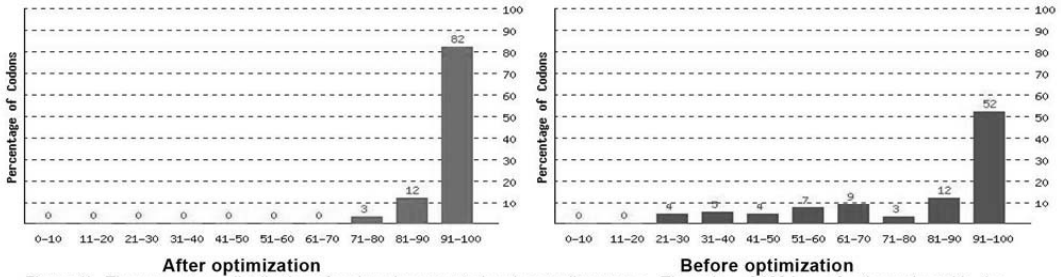
Fig. 7A Codon Adaptation Index (CAI)



After optimization CAI=0.96

Before optimization CAI=0.77

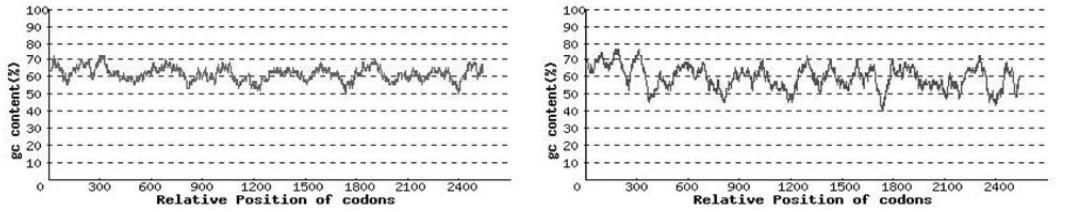
Fig. 7B Frequency of Optimal Codons (FOP)



After optimization

Before optimization

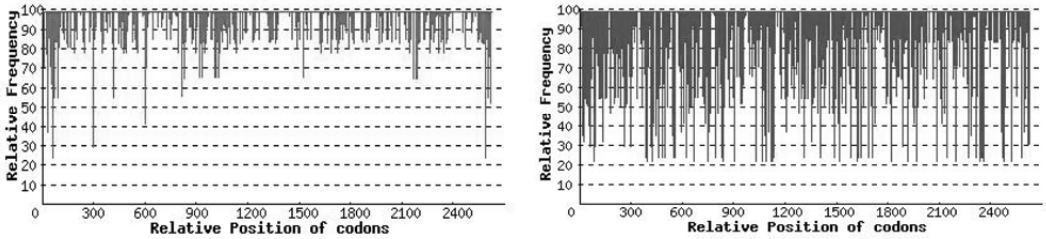
Fig. 7C GC Content Adjustment of HCV del108C-E1-E2-p7-NS2del384 for insect cells



After optimization Average GC content was 61.15%

Before optimization Average GC content was 59.32%

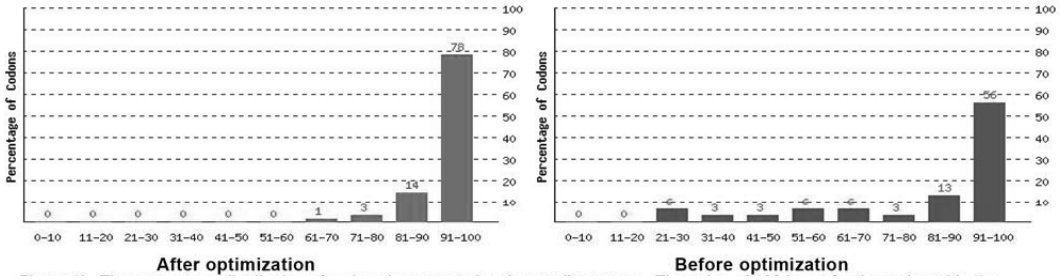
Fig. 8A **Codon Adaptation Index (CAI)**



After optimization CAI=0.95

Before optimization CAI=0.77

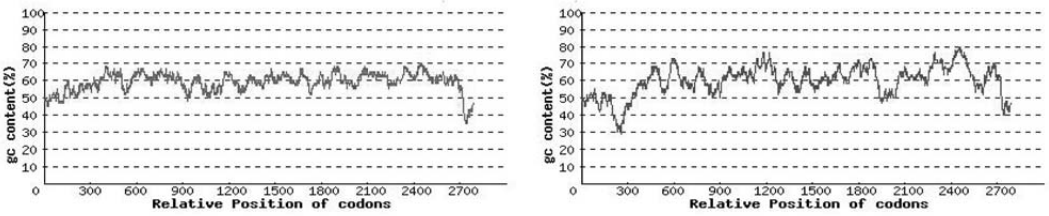
Fig. 8B **Frequency of Optimal Codons (FOP)**



After optimization

Before optimization

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



After optimization Average GC content was 59.02%

Before optimization Average GC content was 59.95%

FIGURE 9

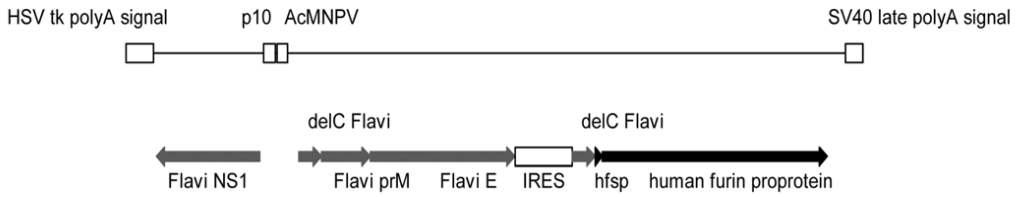

HSV tk polyA signal
p10
AcMNPV
SV40 late polyA signal
delC Flavi
delC Flavi
Flavi NS1
Flavi prM
Flavi E
IRES
hfsp
human furin proprotein

Fig. 10A

DENV VLP & DENV NS-1 Dual Promoter Expression Cassette

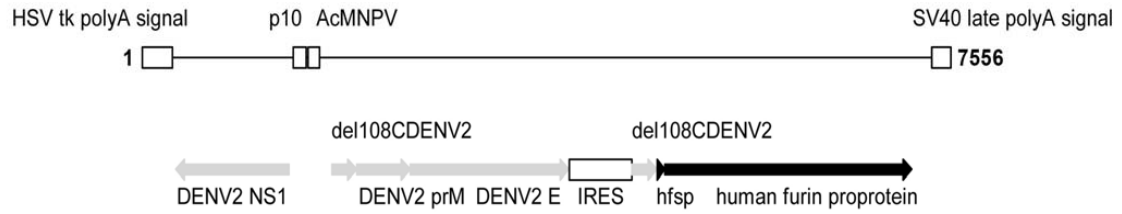


Fig. 10B

ZIKV VLP & ZIKV NS-1 Dual Promoter Expression Cassettes

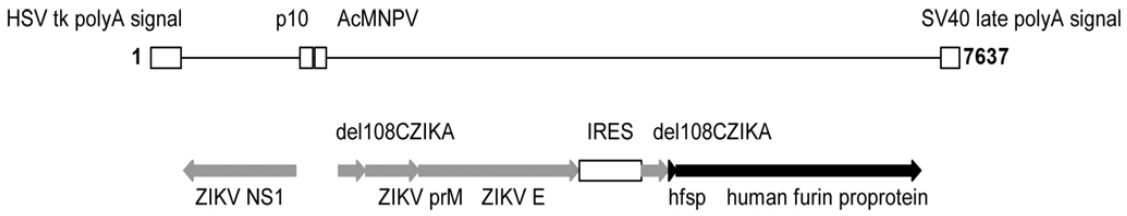


Fig. 10C

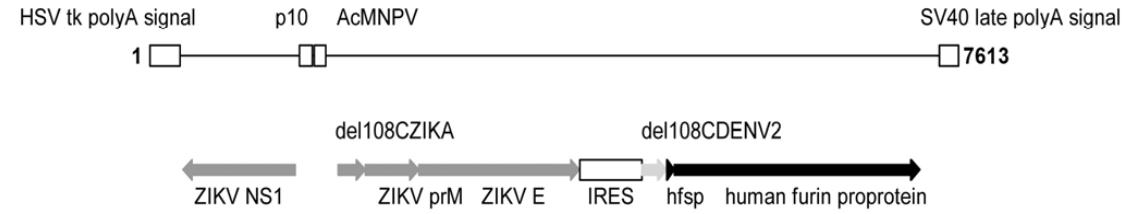


Fig. 10D

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

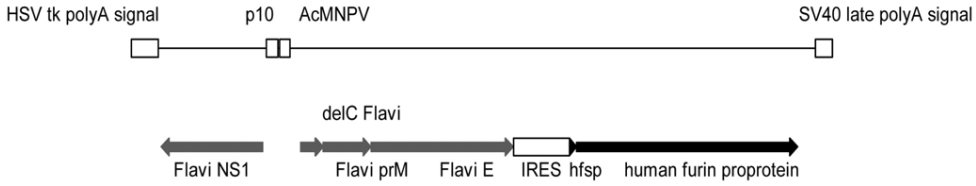

HSV tk polyA signal
p10
AcMNPV
SV40 late polyA signal
delC Flavi
Flavi NS1
Flavi prM
Flavi E
IRES
hfsp
human furin proprotein

FIGURE 12

Fig. 12A

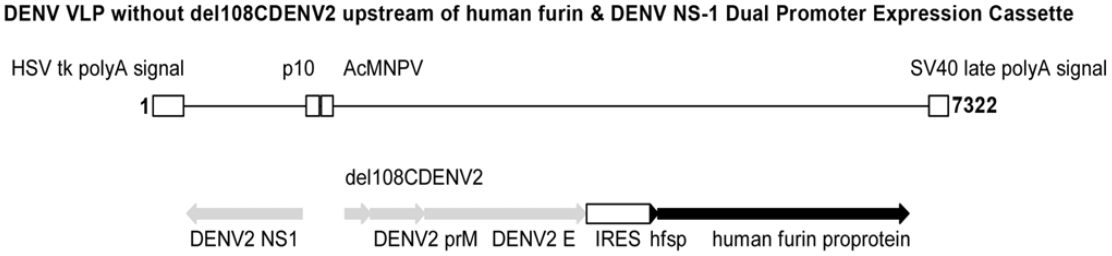


Fig. 12B

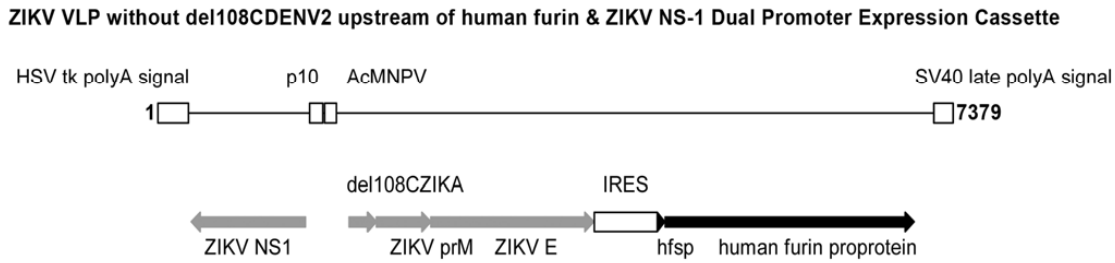


Fig. 12C

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)

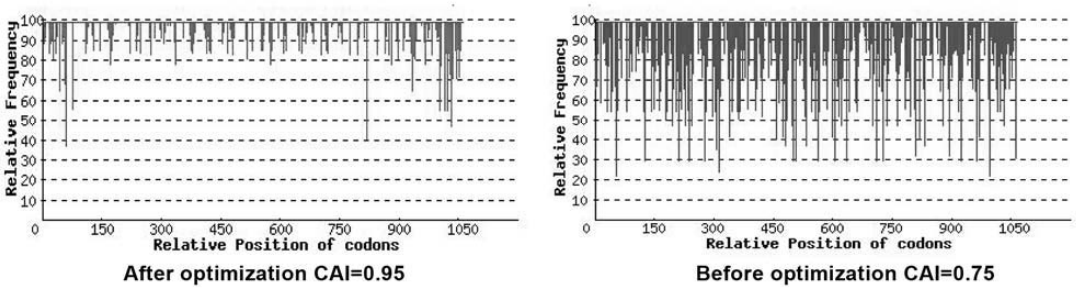


Fig. 13B Frequency of Optimal Codons (FOP)

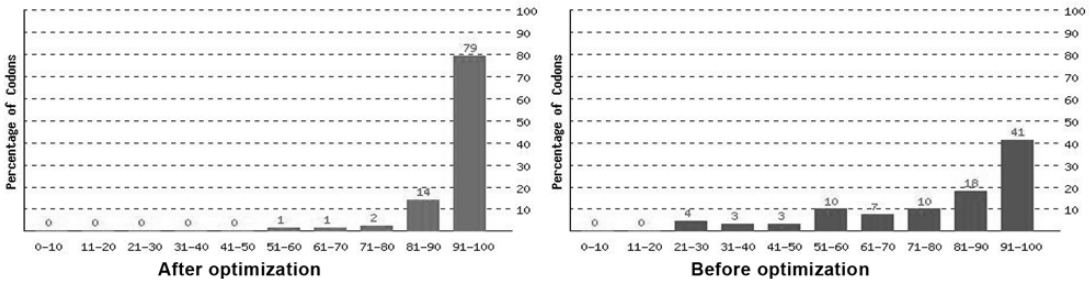


Fig. 13C Content Adjustment of DENV 2 NS1for insect cells

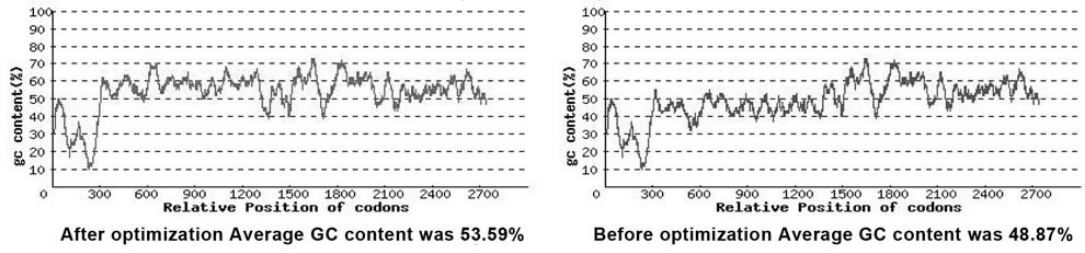


FIGURE 14

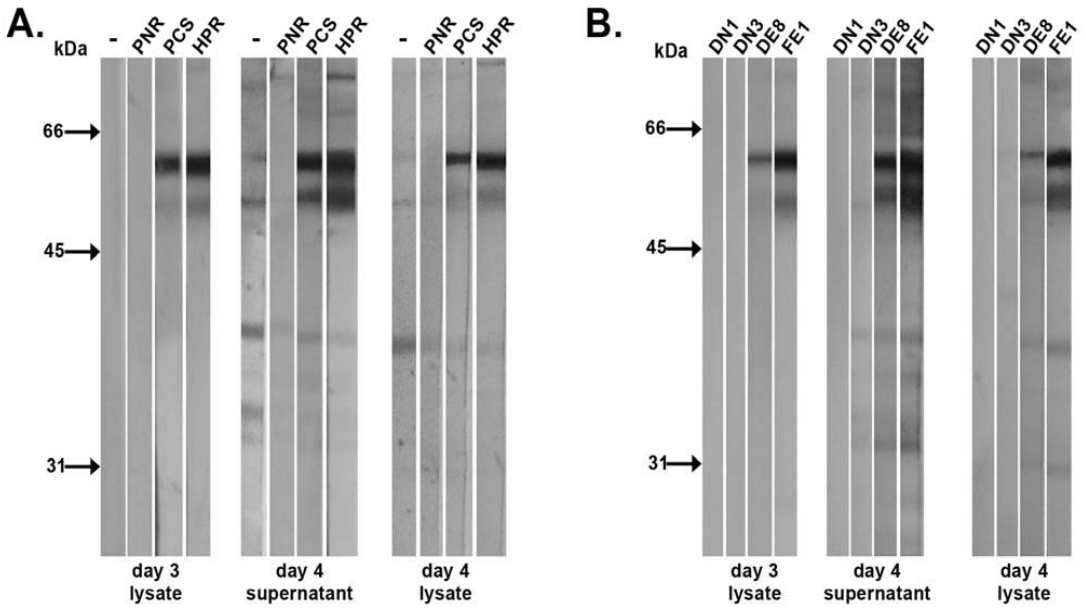

A.
kDa
-
PNR
PCS
HPR
66
45
31
day 3 lysate
day 4 supernatant
day 4 lysate
B.
kDa
DN1
DN3
DE8
FE1
66
45
31
day 3 lysate
day 4 supernatant
day 4 lysate

FIGURE 15

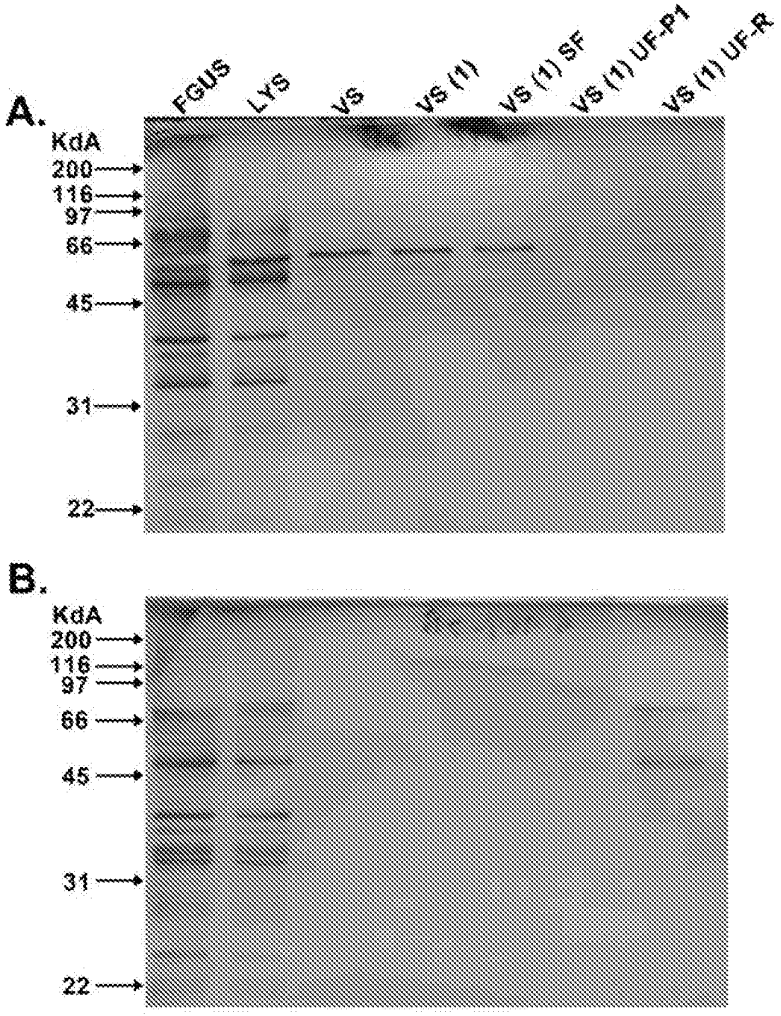

A.
KdA
200
116
97
66
45
31
22
FGUS
LYS
VS
VS (1)
VS (1) SF
VS (1) UF-P1
VS (1) UF-R
B.
KdA
200
116
97
66
45
31
22

FIGURE 16

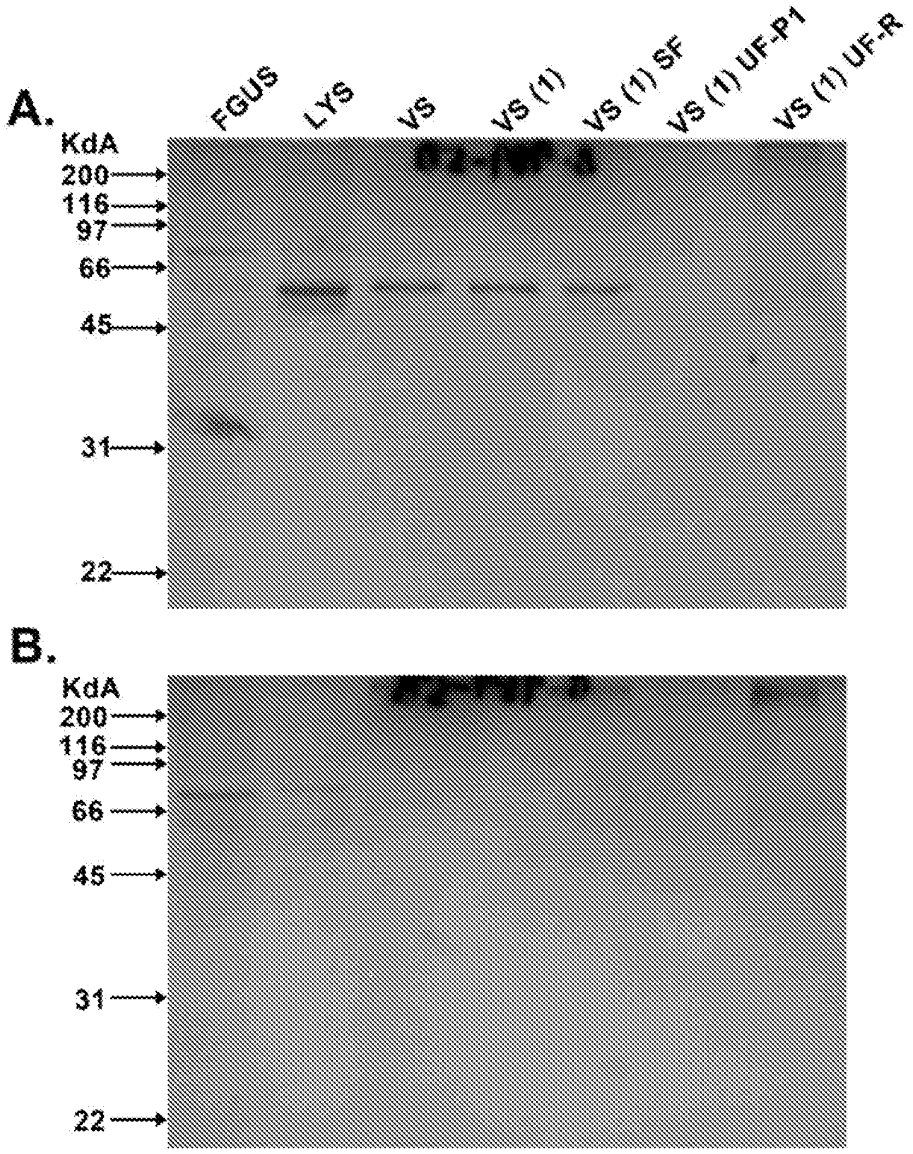

A.
FGUS
LYS
VS
VS (1)
VS (1) SF
VS (1) UF-P1
VS (1) UF-R
KdA
200
116
97
66
45
31
22
B.
KdA
200
116
97
66
45
31
22

FIGURE 17

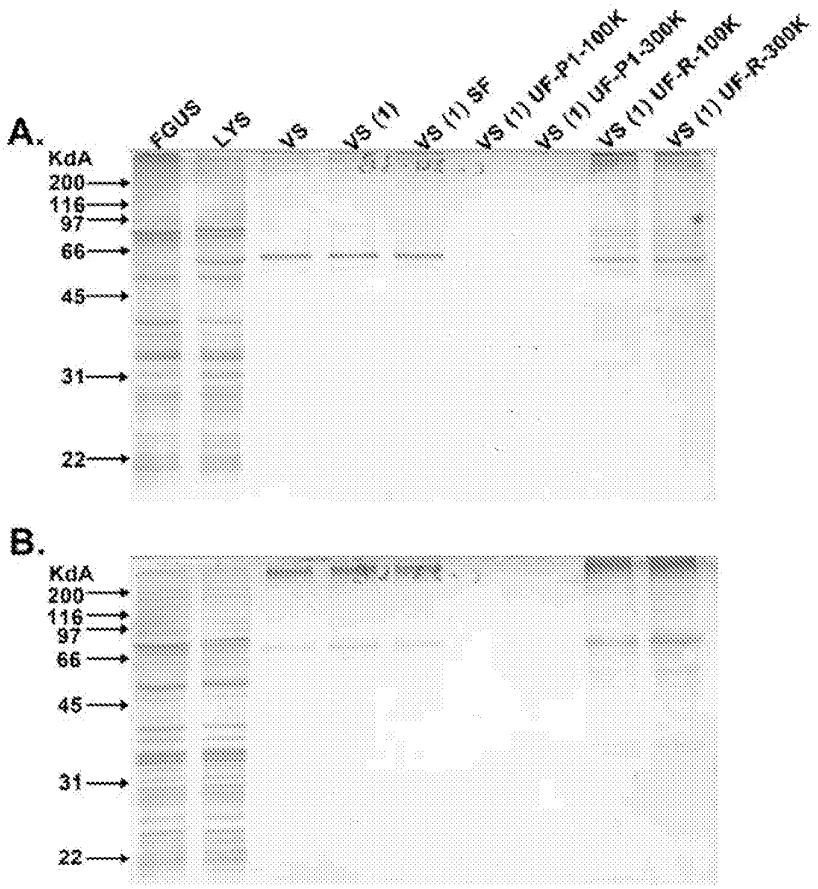

A.
KdA
200
116
97
66
45
31
22
FGUS
LYS
VS
VS (1)
VS (1) SF
VS (1) UF-P1-100K
VS (1) UF-P1-300K
VS (1) UF-R-100K
VS (1) UF-R-300K
B.
KdA
200
116
97
66
45
31
22

FIGURE 18

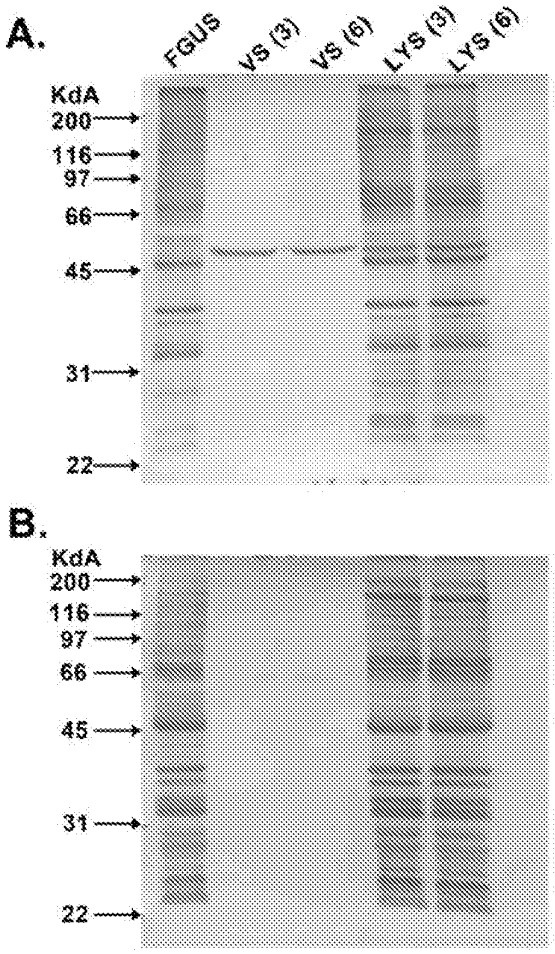

A.
FGUS
VS (3)
VS (6)
LYS (3)
LYS (6)
KdA
200
116
97
66
45
31
22
B.
KdA
200
116
97
66
45
31
22

FIGURE 19

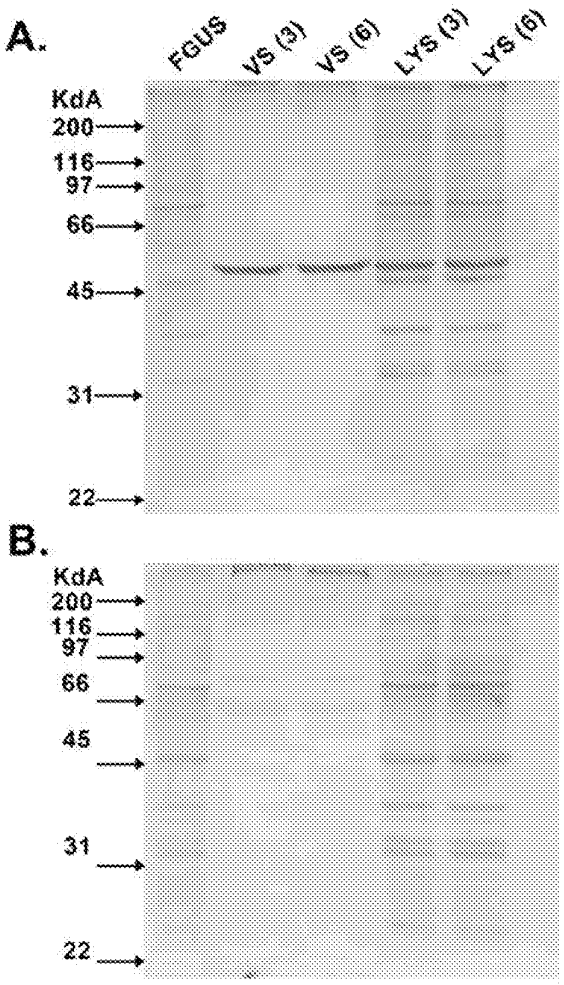

A.
FGUS
VS (3)
VS (6)
LYS (3)
LYS (6)
KdA
200
116
97
66
45
31
22
B.
KdA
200
116
97
66
45
31
22

FIGURE 20

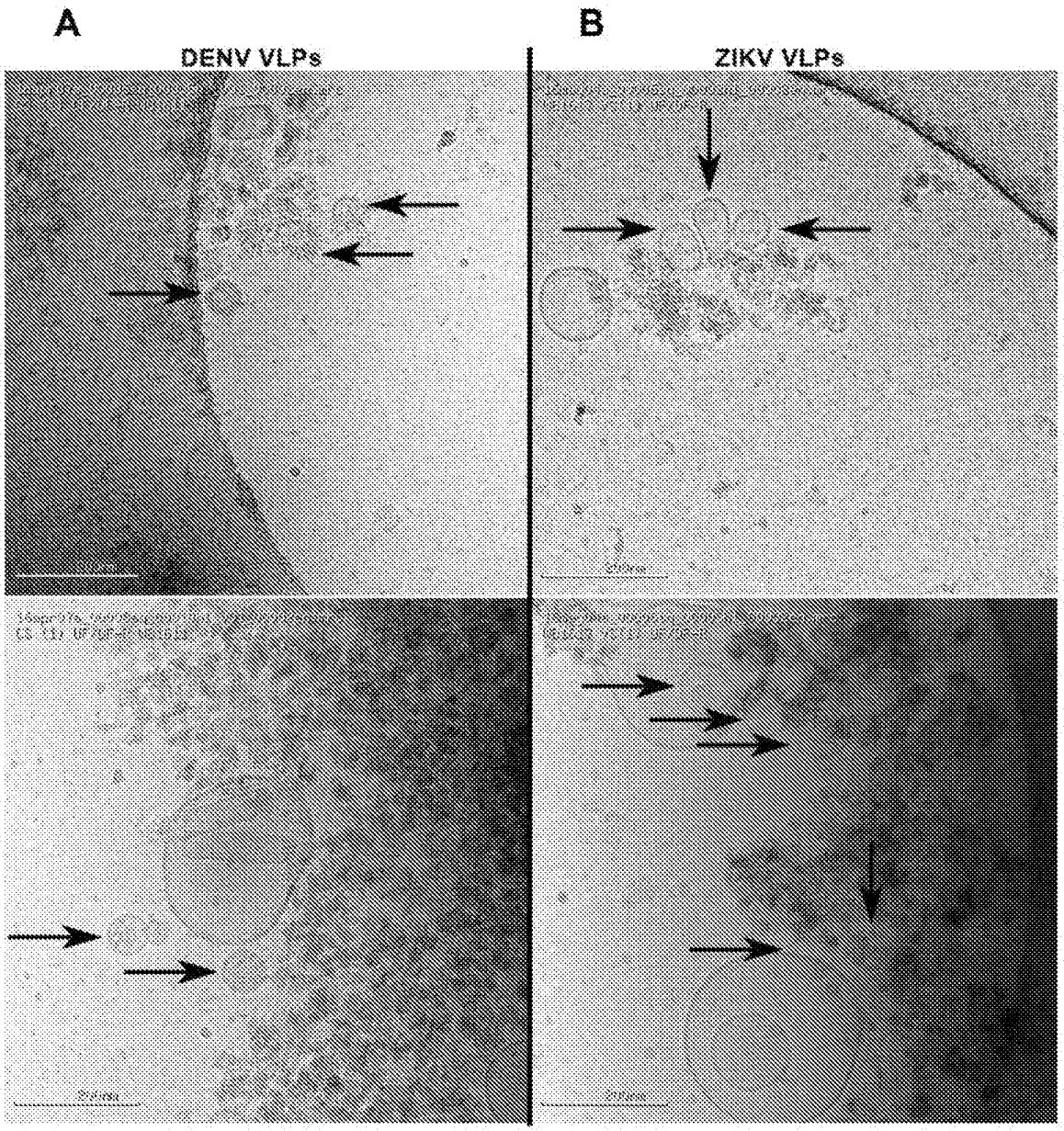


FIGURE 21

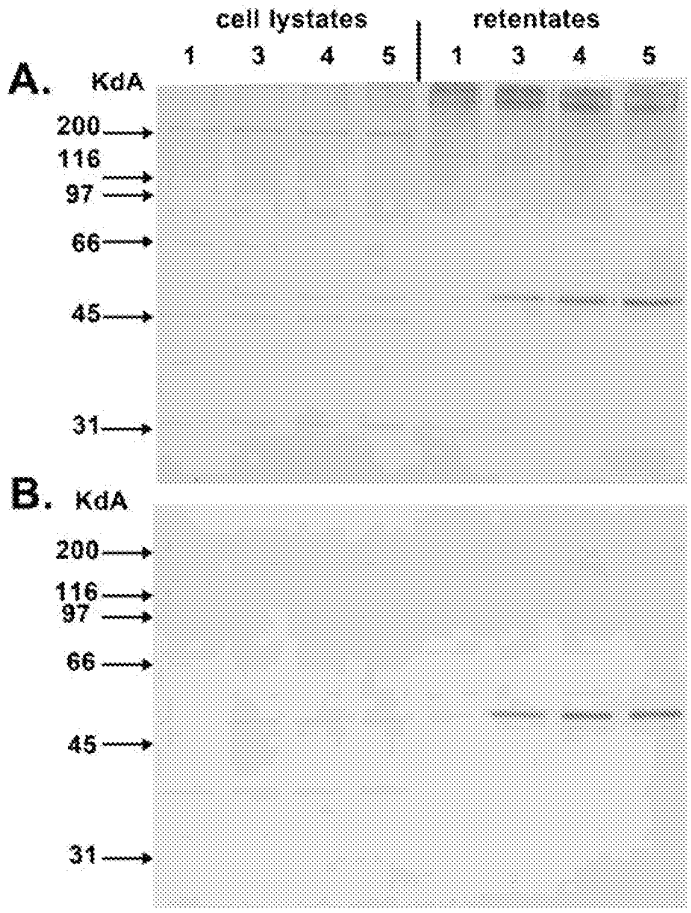

cell lystates
retentates
1 3 4 5 1 3 4 5
A.
KdA
200
116
97
66
45
31
B.
KdA
200
116
97
66
45
31

FIGURE 22

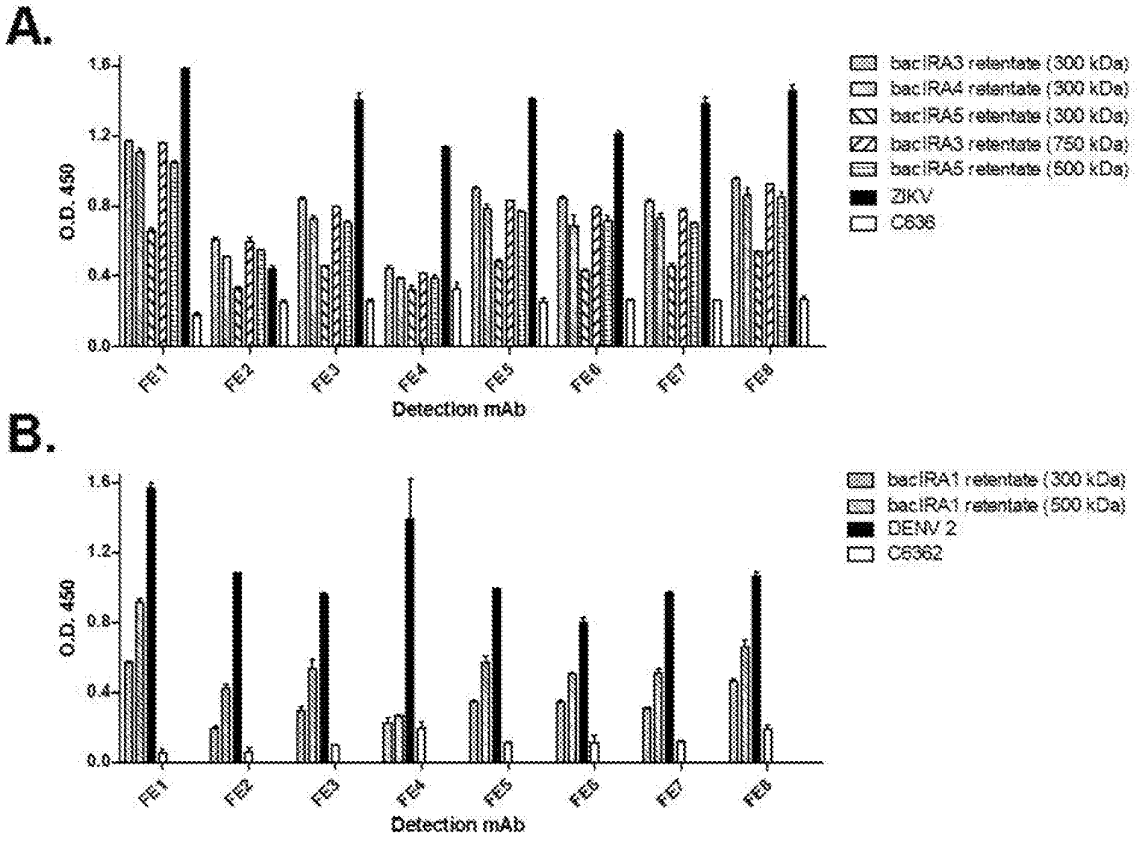

A.
O.D. 450
1.6
1.2
0.8
0.4
0.0
FE1
FE2
FE3
FE4
FE5
FE6
FE7
FE8
Detection mAb
bacIRA3 retentate (300 kDa)
bacIRA4 retentate (300 kDa)
bacIRA5 retentate (300 kDa)
bacIRA3 retentate (750 kDa)
bacIRA5 retentate (500 kDa)
ZIKV
C636
B.
O.D. 450
1.6
1.2
0.8
0.4
0.0
FE1
FE2
FE3
FE4
FE5
FE6
FE7
FE8
Detection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

FIGURE 23

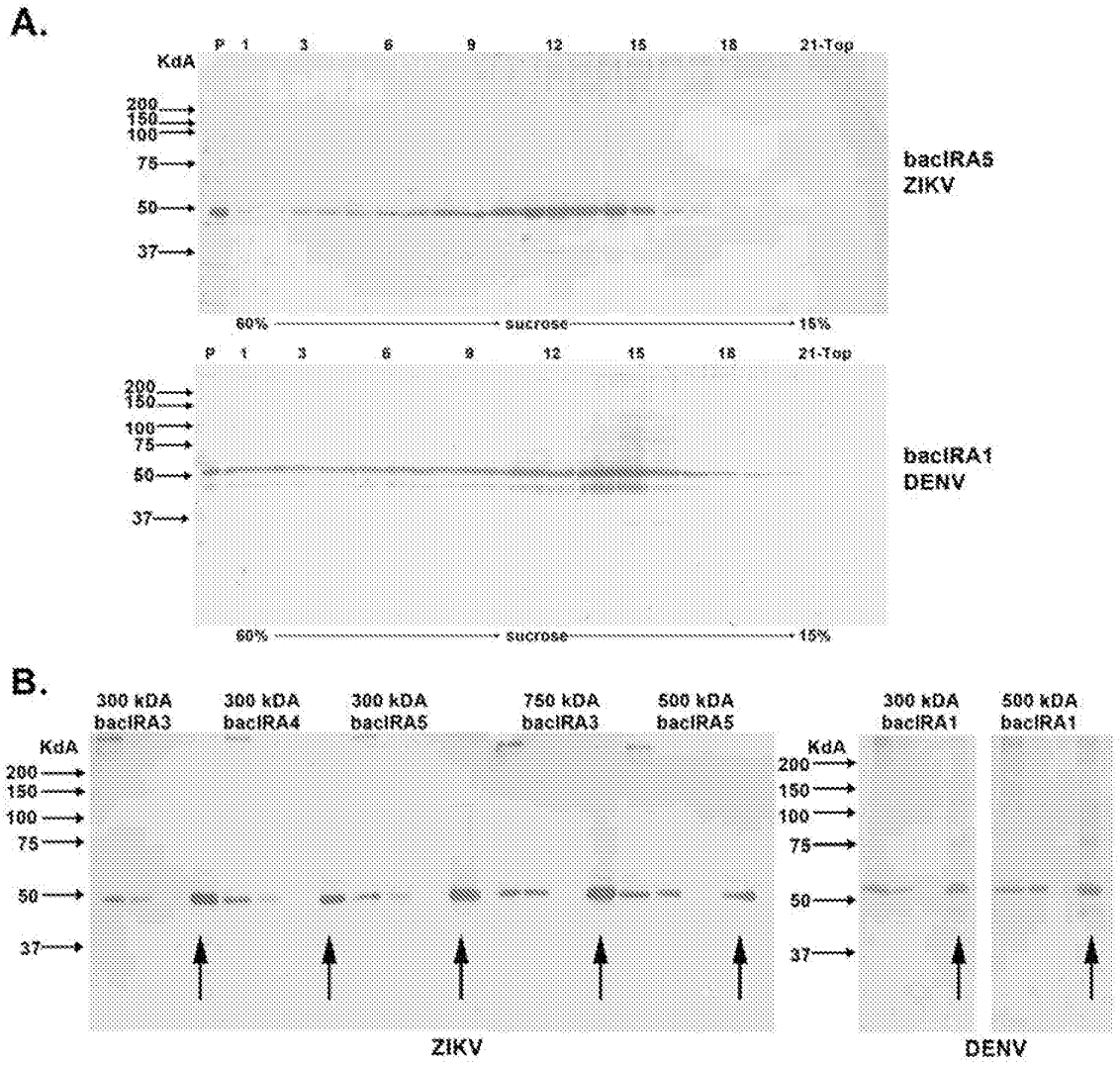

A.
P 1 3 6 9 12 15 18 21-Top
KdA
200
150
100
75
50
37
60% sucrose 15%
bacIRA5
ZIKV
bacIRA1
DENV
B.
300 kDA bacIRA3
300 kDA bacIRA4
300 kDA bacIRA5
750 kDA bacIRA3
500 kDA bacIRA5
300 kDA bacIRA1
500 kDA bacIRA1
ZIKV
DENV

FIGURE 24

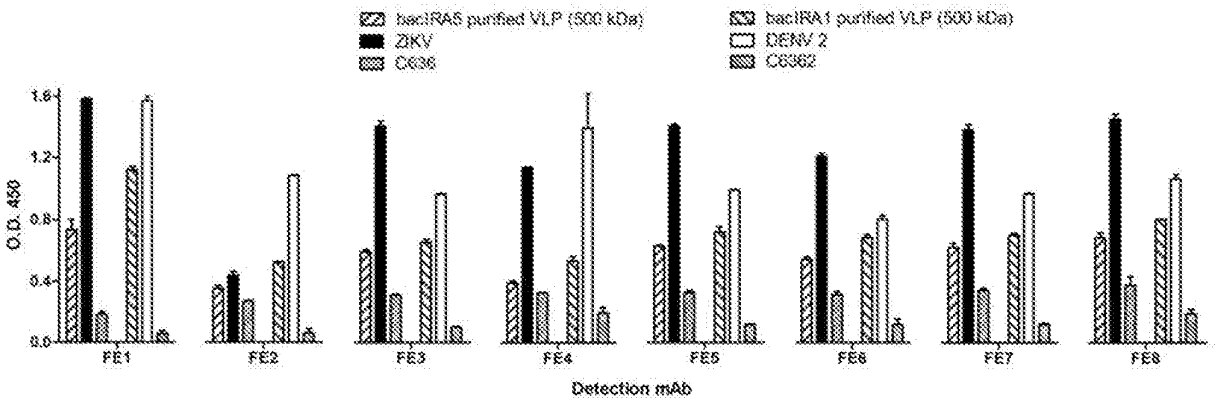

bacIRA5 purified VLP (500 kDa)
ZIKV
C6/36
bacIRA1 purified VLP (500 kDa)
DENV 2
C6/36
O.D. 450
1.6
1.2
0.8
0.4
0.0
FE1
FE2
FE3
FE4
FE5
FE6
FE7
FE8
Detection mAb

FIGURE 25

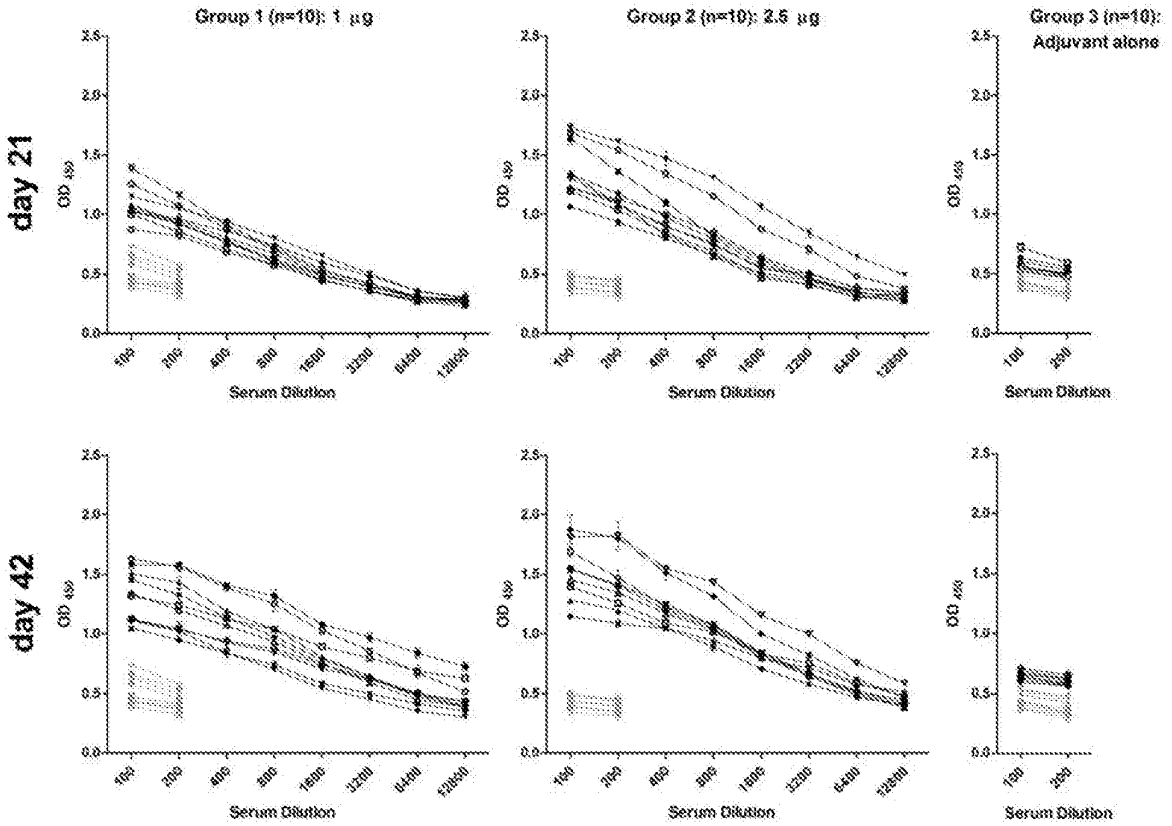


FIGURE 26

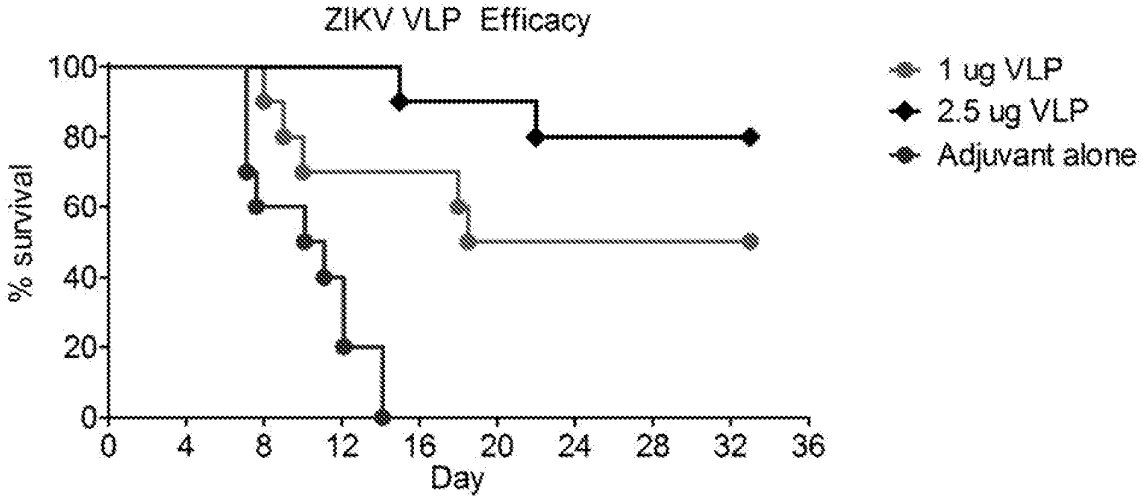


FIGURE 27

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 cagggttgg 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

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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 cgacccttg caggcagcgg 2760

aaccccccac 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

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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 aagcatttttt 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

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

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cgaaatccag atgtcctctg gaaacctgct gttcaccggt cacctgaagt gcagactgcg 1860

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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

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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

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tataatggtt acaaataaag caatagcatc acaaatttca caaataaagc attttttttca 5760

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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

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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

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ccctgaacct gaaacataaa atgaatgcaa ttgttgttgt taacttgttt attgcagctt 7440

taatggtta caaataaagc aatagcatca caaatttcac aaataaagca tttttttcac 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

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ccaacacccg tgcgttttat tctgtctttt tattgccgtc atagcgcggg ttccttccgg 240

tattgtctcc ttccgtgttt cagttagcct cccccatctc ccggtagcgc atgctctaga 300

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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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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

agatgggccc tcttcagcct ccatgtgtca ttcttctcac tctcaatcca gtagcctaga 780

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aatgaataat cttctctaac cttgagccag acactagtgt gaaatacccc gaacccatga 900

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ccatccacga caaagctgtt atttgtcttt gctgctctga cgaagtacga tttcccccaa 1020

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

tcaggatggt acttgtacct gtccctccag gcttcaacgt cgttatagac gaacacccct 1320

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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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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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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gtatgggaat ctgatctggg gcctcggtgc acatgcttta catgtgttta gtcgaggtta 4560

aaaaagctct aggcccccccg aaccacgggg acgtggtttt cctttgaaaa acacgatgat 4620

aagcttgcca caaatgctgc tcggacacgg ccctattcgt atggtgctcg ctatcctcgc 4680

ctttctcagg tttaccgcta tcaagcctag tctgggtctc atcaacagat ggggtagcgt 4740

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gagaatcatc aacgctcgta aggagaagaa gcgcaggggt gccgacacct ctgtgggaat 4860

cgtgggtctg ctgctgacca ccgctatggc tatggaactg agaccttggc tgctgtgggt 4920

ggtggctgct actggcaccc tggtgctgct agcagctgac gcccagggcc agaaggtgtt 4980

caccaacacc tgggctgtga gaatccccgg cggacctgct gtggctaaca gcgtggctcg 5040

taagcacggc ttcctgaacc tgggacagat tttcggtgac tactaccact tctggcaccg 5100

cggagtgacc aagaggagcc tgtccccaca cagaccaagg cactccagac tgcagcgtga 5160

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cgacaacaga catggaacca gatgtgctgg tgaagtggct gctgtggcta acaacggcgt 5520

gtgcggagtg ggtgtggcct acaacgctag aatcggtggc gtgcgtatgc tggatggaga 5580

agtgactgat gctgtggaag ctagaagcct gggactgaac ccaaaccaca tccacatcta 5640

ctctgccagc tggggtccag aggatgatgg aaagactgtg gatggtcctg ctagactggc 5700

tgaggaagcc ttcttccgcg gcgtgagcca gggaagggga ggtctgggaa gcatcttcgt 5760

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ctctatctac accctgagca tcagctccgc tacccagttc ggtaacgtgc cctggtactc 5880

cgaagcctgc tctagcaccc tggctaccac ctactcctct ggcaaccaga acgagaagca 5940

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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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gggtcttgag gggtttttg gaattcaccc agctttcttg tacaaagtgg tgatagcttg 7380

tcgagaagta ctagaggatc ataatcagcc ataccacatt tgtagaggtt ttacttgctt 7440

taaaaaacct cccacacctc cccctgaacc tgaaacataa aatgaatgca attgttgttg 7500

ttaacttgtt tattgcagct tataatggtt acaaataaag caatagcatc acaaatttca 7560

caaataaagc attttttca 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

ggccttatct ccattccata ccaacagcca tctttagccc ggaacgacag tgggggcatt 420

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tcaggatggt acttgtacct gtccctccag gcttcaacgt cgttatagac gaacacccct 1320

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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gacctggccg ctatgctgag aatcatcaac gctcgtaagg agaagaagcg caggggtgcc 1980

gacacctctg tgggaatcgt gggtctgctg ctgaccaccg ctatggctgc tgaggtgacc 2040

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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

gggactgcca gtgccccctg aaagctccgg ttgcaagacc ctgacctcta gccaggcctg 6420

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

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

ccccacctg 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

tgcggttcct cactattcct cctactgtcg gtattctgaa gaggtggggc accatcaaga 3240

agagcaaggc catcaacgtg ctgcgcggat tcaggaagga gatcggtagg atgctgaaca 3300

tcctgaaccg caggagacgt accgccggca tgatcatcat gctgatcccc accgtgatgg 3360

ctatggaact gagaccttgg ctgctgtggg tggtggctgc tactggcacc ctggtgctgc 3420

tagcagctga cgcccagggc cagaaggtgt tcaccaacac ctgggctgtg agaatccccg 3480

gcggacctgc tgtggctaac agcgtggctc gtaagcacgg cttcctgaac ctgggacaga 3540

ttttcggtga ctactaccac ttctggcacc gcggagtgac caagaggagc ctgtccccac 3600

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

acgactcctg caactgcgac ggatacacca actctatcta caccctgagc atcagctccg 4320

ctacccagtt cggtaacgtg ccctggtact ccgaagcctg ctctagcacc ctggctacca 4380

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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acatcaccag actggaacac gcccaggctc gtctgaccct gtcttacaac agacgtggag 4860

acctggccat ccacctggtg tctccaatgg gcacccgcag caccctgctg gctgctaggc 4920

cacacgacta cagcgccgac ggattcaacg actgggcttt catgaccacc cactcctggg 4980

acgaggaccc ttctggtgaa tgggtgctgg agatcgaaaa caccagcgag gccaacaact 5040

acggcaccct gaccaagttc accctggtgc tgtacggcac cgctcctgag ggactgccag 5100

tgccccctga aagctccggt tgcaagaccc tgacctctag ccaggcctgc gtggtgtgcg 5160

aggaaggctt ctccctgcac cagaagtctt gcgtgcagca ctgcccaccc ggattcgctc 5220

ctcaggtgct ggacacccac tactctaccg agaacgacgt ggaaaccatc agagccagcg 5280

tgtgcgctcc ttgtcacgct tcctgtgcta cttgtcaggg accagccctg actgactgcc 5340

tgtcctgccc atctcacgcc agcctggacc ccgtggagca gacctgctcc agacagtctc 5400

agtcctctcg tgaaagccct ccacagcagc agccccctag actgccaccc gaggtggaag 5460

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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

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

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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

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

ccccacctg 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 gctgctcgga cacggcccta ttcgtatggt gctcgctatc ctcgcctttc 3180

tcaggtttac cgctatcaag cctagtctgg gtctcatcaa cagatggggt agcgtgggca 3240

agaaggaggc tatggaaatc atcaagaagt tcaagaagga cctggccgct atgctgagaa 3300

tcatcaacgc tcgtaaggag aagaagcgca ggggtgccga cacctctgtg ggaatcgtgg 3360

gtctgctgct gaccaccgct atggctatgg aactgagacc ttggctgctg tgggtggtgg 3420

ctgctactgg caccctggtg ctgctagcag ctgacgccca gggccagaag gtgttcacca 3480

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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ccagctgggg tccagaggat gatggaaaga ctgtggatgg tcctgctaga ctggctgagg 4200

aagccttctt ccgcggcgtg agccagggaa ggggaggtct gggaagcatc ttcgtgtggg 4260

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tctacaccct gagcatcagc tccgctaccc agttcggtaa cgtgccctgg tactccgaag 4380

cctgctctag caccctggct accacctact cctctggcaa ccagaacgag aagcagatcg 4440

tgaccaccga cctgcgtcag aagtgcaccg aatctcacac tggcacctcc gcctctgctc 4500

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

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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

tgttcctggt gctgcagctg cgcagcggtt tctccttcag gggcgtgaag gtgtacacca 5640

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 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

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

ccccacctg 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

tccccccagca 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

tggaagccgg ccagagactg cgtgctggac tgctgccttc tcacctgcca gaggtggtgg 5280

ctggtctgag ctgcgctttc atcgtgctgg tgttcgtgac cgtgttcctg gtgctgcagc 5340

tgcgcagcgg tttctccttc aggggcgtga aggtgtacac catggaccgc ggtctgatca 5400

gctacaaggg tctgcctcca gaggcttggc aggaggaatg cccatctgac agcgaagagg 5460

acgagggacg tggagaacgg actgccttca tcaaagatca gagcgcactg taataaatcg 5520

atttaattaa tagcataacc ccttggggcc tctaaacggg tcttgagggg ttttttggaa 5580

ttcacccagc tttcttgtac aaagtggtga tagcttgtcg agaagtacta gaggatcata 5640

atcagccata ccacatttgt agaggtttta cttgctttaa aaaacctccc acacctcccc 5700

ctgaacctga aacataaaat gaatgcaatt gttgttgtta acttgtttat tgcagcttat 5760

aatggttaca aataaagcaa 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 tgagggggtg 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 cacctttttgg agacagctac attatcgttg ggacaggaga 2160

ttcacgtctc acttaccagt ggcacaaaga gggaagctca ataggaaagt tgttcactca 2220

gaccatgaaa ggcgcggaac gcctggccgt catgggagac gccgcctggg atttcagctc 2280

cgctggaggg ttcttcactt cggttgggaa aggtattcat acggtgtttg gctctgcctt 2340

tcaggggcta tttggcggct tgaactggat aacaaaggtc atcatggggg cggtactcat 2400

atgggttggc atcaacacaa gaaacatgac aatgtccatg agcatgatct tggtaggagt 2460

gatcatgatg ttttgtctc 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 agcgacccct 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 aggcccccccg 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

tcgtggtgtc catcctggac gacggcatcg agaagaacca ccctgacctg gccggtaact 3840

acgacccagg cgcttctttc gacgtgaacg accaggaccc cgaccctcag ccaagataca 3900

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

ctagactggc tgaggaagcc ttcttccgcg gcgtgagcca gggaagggga ggtctgggaa 4200

gcatcttcgt gtgggcttct ggtaacggcg gaagagagca cgactcctgc aactgcgacg 4260

gatacaccaa ctctatctac accctgagca tcagctccgc tacccagttc ggtaacgtgc 4320

cctggtactc cgaagcctgc tctagcaccc tggctaccac ctactcctct ggcaaccaga 4380

acgagaagca gatcgtgacc accgacctgc gtcagaagtg caccgaatct cacactggca 4440

cctccgcctc tgctcctctg gctgctggaa tcatcgccct gaccctggag gctaacaaga 4500

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

tgcgtaagac cgtgaccgct tgcctgggag agcccaacca catcaccaga ctggaacacg 4800

cccaggctcg tctgaccctg tcttacaaca gacgtggaga cctggccatc cacctggtgt 4860

ctccaatggg cacccgcagc accctgctgg ctgctaggcc acacgactac agcgccgacg 4920

gattcaacga ctgggctttc atgaccaccc actcctggga cgaggaccct tctggtgaat 4980

gggtgctgga gatcgaaaac accagcgagg ccaacaacta cggcaccctg accaagttca 5040

ccctggtgct gtacggcacc gctcctgagg gactgccagt gccccctgaa agctccggtt 5100

gcaagaccct gacctctagc caggcctgcg tggtgtgcga ggaaggcttc tccctgcacc 5160

agaagtcttg cgtgcagcac tgcccacccg gattcgctcc tcaggtgctg gacacccact 5220

actctaccga gaacgacgtg gaaaccatca gagccagcgt gtgcgctcct tgtcacgctt 5280

cctgtgctac ttgtcaggga ccagccctga ctgactgcct gtcctgccca tctcacgcca 5340

gcctggaccc cgtggagcag acctgctcca gacagtctca gtcctctcgt gaaagccctc 5400

cacagcagca gccccctaga ctgccacccg aggtggaagc cggccagaga ctgcgtgctg 5460

gactgctgcc ttctcacctg ccagaggtgg tggctggtct gagctgcgct ttcatcgtgc 5520

tggtgttcgt gaccgtgttc ctggtgctgc agctgcgcag cggtttctcc ttcaggggcg 5580

tgaaggtgta caccatggac cgcggtctga tcagctacaa gggtctgcct ccagaggctt 5640

ggcaggagga atgcccatct gacagcgaag aggacgaggg acgtggagaa cggactgcct 5700

tcatcaaaga tcagagcgca ctgtaataaa tcgatttaat taatagcata acccccttggg 5760

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 taccccttggc cactgtacgg 420

aaacgaaggc tgcggatggg ctggatggct gctgagcccc aggggttcca gaccttcttg 480

gggtccaact gacccacgcc gccgcagccg caacctgggc aaggtcatcg acaccctgac 540

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atc 6663

FIGURE 39

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

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gtctggatc 5829

FIGURE 40

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

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