

B14236_ST25.txt
SEQUENCE LISTING

<110> INSTITUT PASTEUR
UNIVERSITE DE PARIS
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

<120> A LIVE AND ATTENUATED FLAVIVIRUS COMPRISING A MUTATED M PROTEIN

<130> B14236/AD/DP/KN

<140> PCT/XXXXXX

<141> 2020-03-27

<150> US62/825734

<151> 2019-03-28

<160> 89

<170> PatentIn version 3.5

<210> 1

<211> 225

<212> DNA

<213> Artificial sequence

<220>

<223> cDNA sequence of the endogenous protein M of WNV IS98-ST1

<400> 1

tcactgacag tgcagacaca cggagaaagc actctagcga acaagaaggg ggcttggatg 60

gacagcacca aggccacaag gtatttggta aaaacagaat catggatctt gaggaaccct 120

ggatatgccc tgggtggcagc cgtcattggg tggatgcttg ggagcaacac catgcagaga 180

gttgtgtttg tcgtgctatt gcttttgggtg gccccagctt acagc 225

<210> 2

<211> 75

<212> PRT

<213> Artificial sequence

<220>

<223> Endogenous protein M of WNV IS98-ST1

<400> 2

Ser Leu Thr Val Gln Thr His Gly Glu Ser Thr Leu Ala Asn Lys Lys
1 5 10 15

Gly Ala Trp Met Asp Ser Thr Lys Ala Thr Arg Tyr Leu Val Lys Thr
20 25 30

B14236_ST25.txt

Glu Ser Trp Ile Leu Arg Asn Pro Gly Tyr Ala Leu Val Ala Ala Val
 35 40 45

Ile Gly Trp Met Leu Gly Ser Asn Thr Met Gln Arg Val Val Phe Val
 50 55 60

Val Leu Leu Leu Leu Val Ala Pro Ala Tyr Ser
 65 70 75

<210> 3
 <211> 225
 <212> DNA
 <213> Artificial sequence

<220>
 <223> cDNA sequence coding for a mutated WNV M protein

<220>
 <221> misc_feature
 <222> (106)..(108)
 <223> n is a, c, g, or t; nnn is a codon coding either for phenylalanine (TTT or TTC), or tryptophan (TGG), or tyrosine (TAA, TAG or TGA)

<220>
 <221> misc_feature
 <222> (127)..(129)
 <223> n is a, c, g, or t; nnn is a codon coding for glycine (GGA, GGT, GGC or GGG)

<400> 3
 tcactgacag tgcagacaca cggagaaagc actctagcga acaagaaggg ggcttggatg 60
 gacagcacca aggccacaag gtatttggtg aaaacagaat catggnnntt gaggaaccct 120
 ggatatnnnc tgggtggcagc cgtcattggt tggatgcttg ggagcaacac catgcagaga 180
 gttgtgtttg tcgtgctatt gcttttggtg gccccagctt acagc 225

<210> 4
 <211> 75
 <212> PRT
 <213> Artificial sequence

<220>
 <223> mutated WNV M protein

B14236_ST25.txt

<220>

<221> misc_feature

<222> (36)..(36)

<223> Xaa is Phe or Trp or Tyr

<400> 4

Ser Leu Thr Val Gln Thr His Gly Glu Ser Thr Leu Ala Asn Lys Lys
1 5 10 15

Gly Ala Trp Met Asp Ser Thr Lys Ala Thr Arg Tyr Leu Val Lys Thr
20 25 30

Glu Ser Trp Xaa Leu Arg Asn Pro Gly Tyr Gly Leu Val Ala Ala Val
35 40 45

Ile Gly Trp Met Leu Gly Ser Asn Thr Met Gln Arg Val Val Phe Val
50 55 60

Val Leu Leu Leu Leu Val Ala Pro Ala Tyr Ser
65 70 75

<210> 5

<211> 225

<212> DNA

<213> Artificial sequence

<220>

<223> cDNA sequence coding for a mutated WNV M protein

<400> 5

tcactgacag tgcagacaca cggagaaagc actctagcga acaagaaggg ggcttggatg 60

gacagcacca aggccacaag gtatttggtg aaaacagaat catggttctt gaggaaccct 120

ggatatggac tgggtggcagc cgtcattggt tggatgcttg ggagcaacac catgcagaga 180

gttgtgtttg tcgtgctatt gcttttggtg gccccagctt acagc 225

<210> 6

<211> 75

<212> PRT

<213> Artificial sequence

<220>

<223> mutated WNV M protein

<400> 6

B14236_ST25.txt

Ser Leu Thr Val Gln Thr His Gly Glu Ser Thr Leu Ala Asn Lys Lys
1 5 10 15

Gly Ala Trp Met Asp Ser Thr Lys Ala Thr Arg Tyr Leu Val Lys Thr
20 25 30

Glu Ser Trp Phe Leu Arg Asn Pro Gly Tyr Gly Leu Val Ala Ala Val
35 40 45

Ile Gly Trp Met Leu Gly Ser Asn Thr Met Gln Arg Val Val Phe Val
50 55 60

Val Leu Leu Leu Leu Val Ala Pro Ala Tyr Ser
65 70 75

<210> 7

<211> 3433

<212> PRT

<213> Artificial sequence

<220>

<223> WN IS98-ST1 polyprotein, wherein protein M is I36F and A43G mutated

<400> 7

Met Ser Lys Lys Pro Gly Gly Pro Gly Lys Ser Arg Ala Val Asn Met
1 5 10 15

Leu Lys Arg Gly Met Pro Arg Val Leu Ser Leu Ile Gly Leu Lys Arg
20 25 30

Ala Met Leu Ser Leu Ile Asp Gly Lys Gly Pro Ile Arg Phe Val Leu
35 40 45

Ala Leu Leu Ala Phe Phe Arg Phe Thr Ala Ile Ala Pro Thr Arg Ala
50 55 60

Val Leu Asp Arg Trp Arg Gly Val Asn Lys Gln Thr Ala Met Lys His
65 70 75 80

Leu Leu Ser Phe Lys Lys Glu Leu Gly Thr Leu Thr Ser Ala Ile Asn
85 90 95

B14236_ST25.txt

Arg Arg Ser Ser Lys Gln Lys Lys Arg Gly Gly Lys Thr Gly Ile Ala
100 105 110

Val Met Ile Gly Leu Ile Ala Ser Val Gly Ala Val Thr Leu Ser Asn
115 120 125

Phe Gln Gly Lys Val Met Met Thr Val Asn Ala Thr Asp Val Thr Asp
130 135 140

Val Ile Thr Ile Pro Thr Ala Ala Gly Lys Asn Leu Cys Ile Val Arg
145 150 155 160

Ala Met Asp Val Gly Tyr Met Cys Asp Asp Thr Ile Thr Tyr Glu Cys
165 170 175

Pro Val Leu Ser Ala Gly Asn Asp Pro Glu Asp Ile Asp Cys Trp Cys
180 185 190

Thr Lys Ser Ala Val Tyr Val Arg Tyr Gly Arg Cys Thr Lys Thr Arg
195 200 205

His Ser Arg Arg Ser Arg Arg Ser Leu Thr Val Gln Thr His Gly Glu
210 215 220

Ser Thr Leu Ala Asn Lys Lys Gly Ala Trp Met Asp Ser Thr Lys Ala
225 230 235 240

Thr Arg Tyr Leu Val Lys Thr Glu Ser Trp Phe Leu Arg Asn Pro Gly
245 250 255

Tyr Gly Leu Val Ala Ala Val Ile Gly Trp Met Leu Gly Ser Asn Thr
260 265 270

Met Gln Arg Val Val Phe Val Val Leu Leu Leu Leu Val Ala Pro Ala
275 280 285

Tyr Ser Phe Asn Cys Leu Gly Met Ser Asn Arg Asp Phe Leu Glu Gly
290 295 300

Val Ser Gly Ala Thr Trp Val Asp Leu Val Leu Glu Gly Asp Ser Cys

305		310		315		320
Val Thr Ile Met Ser Lys Asp Lys Pro Thr Ile Asp Val Lys Met Met						
		325		330		335
Asn Met Glu Ala Ala Asn Leu Ala Glu Val Arg Ser Tyr Cys Tyr Leu						
		340		345		350
Ala Thr Val Ser Asp Leu Ser Thr Lys Ala Ala Cys Pro Thr Met Gly						
		355		360		365
Glu Ala His Asn Asp Lys Arg Ala Asp Pro Ala Phe Val Cys Arg Gln						
		370		375		380
Gly Val Val Asp Arg Gly Trp Gly Asn Gly Cys Gly Leu Phe Gly Lys						
385		390		395		400
Gly Ser Ile Asp Thr Cys Ala Lys Phe Ala Cys Ser Thr Lys Ala Ile						
		405		410		415
Gly Arg Thr Ile Leu Lys Glu Asn Ile Lys Tyr Glu Val Ala Ile Phe						
		420		425		430
Val His Gly Pro Thr Thr Val Glu Ser His Gly Asn Tyr Ser Thr Gln						
		435		440		445
Val Gly Ala Thr Gln Ala Gly Arg Phe Ser Ile Thr Pro Ala Ala Pro						
		450		455		460
Ser Tyr Thr Leu Lys Leu Gly Glu Tyr Gly Glu Val Thr Val Asp Cys						
465		470		475		480
Glu Pro Arg Ser Gly Ile Asp Thr Asn Ala Tyr Tyr Val Met Thr Val						
		485		490		495
Gly Thr Lys Thr Phe Leu Val His Arg Glu Trp Phe Met Asp Leu Asn						
		500		505		510
Leu Pro Trp Ser Ser Ala Gly Ser Thr Val Trp Arg Asn Arg Glu Thr						
		515		520		525

B14236_ST25.txt

Leu Met Glu Phe Glu Glu Pro His Ala Thr Lys Gln Ser Val Ile Ala
530 535 540

Leu Gly Ser Gln Glu Gly Ala Leu His Gln Ala Leu Ala Gly Ala Ile
545 550 555 560

Pro Val Glu Phe Ser Ser Asn Thr Val Lys Leu Thr Ser Gly His Leu
565 570 575

Lys Cys Arg Val Lys Met Glu Lys Leu Gln Leu Lys Gly Thr Thr Tyr
580 585 590

Gly Val Cys Ser Lys Ala Phe Lys Phe Leu Gly Thr Pro Ala Asp Thr
595 600 605

Gly His Gly Thr Val Val Leu Glu Leu Gln Tyr Thr Gly Thr Asp Gly
610 615 620

Pro Cys Lys Val Pro Ile Ser Ser Val Ala Ser Leu Asn Asp Leu Thr
625 630 635 640

Pro Val Gly Arg Leu Val Thr Val Asn Pro Phe Val Ser Val Ala Thr
645 650 655

Ala Asn Ala Lys Val Leu Ile Glu Leu Glu Pro Pro Phe Gly Asp Ser
660 665 670

Tyr Ile Val Val Gly Arg Gly Glu Gln Gln Ile Asn His His Trp His
675 680 685

Lys Ser Gly Ser Ser Ile Gly Lys Ala Phe Thr Thr Thr Leu Lys Gly
690 695 700

Ala Gln Arg Leu Ala Ala Leu Gly Asp Thr Ala Trp Asp Phe Gly Ser
705 710 715 720

Val Gly Gly Val Phe Thr Ser Val Gly Lys Ala Val His Gln Val Phe
725 730 735

Gly Gly Ala Phe Arg Ser Leu Phe Gly Gly Met Ser Trp Ile Thr Gln
Page 7

740

745

750

Gly Leu Leu Gly Ala Leu Leu Leu Trp Met Gly Ile Asn Ala Arg Asp
 755 760 765

Arg Ser Ile Ala Leu Thr Phe Leu Ala Val Gly Gly Val Leu Leu Phe
 770 775 780

Leu Ser Val Asn Val His Ala Asp Thr Gly Cys Ala Ile Asp Ile Ser
 785 790 795 800

Arg Gln Glu Leu Arg Cys Gly Asn Gly Val Phe Ile His Asn Asp Val
 805 810 815

Glu Ala Trp Met Asp Arg Tyr Lys Tyr Tyr Pro Glu Thr Pro Gln Gly
 820 825 830

Leu Ala Lys Ile Ile Gln Lys Ala His Lys Glu Gly Val Cys Gly Leu
 835 840 845

Arg Ser Val Ser Arg Leu Glu His Gln Met Trp Glu Ala Val Lys Asp
 850 855 860

Glu Leu Asn Thr Leu Leu Lys Glu Asn Gly Val Asp Leu Ser Val Val
 865 870 875 880

Val Glu Lys Gln Glu Gly Met Tyr Lys Ser Ala Pro Lys Arg Leu Thr
 885 890 895

Ala Thr Thr Glu Lys Leu Glu Ile Gly Trp Lys Ala Trp Gly Lys Ser
 900 905 910

Ile Leu Phe Ala Pro Glu Leu Ala Asn Asn Thr Phe Val Val Asp Gly
 915 920 925

Pro Glu Thr Lys Glu Cys Pro Thr Gln Asn Arg Ala Trp Asn Ser Leu
 930 935 940

Glu Val Glu Asp Phe Gly Phe Gly Leu Thr Ser Thr Arg Met Phe Leu
 945 950 955 960

B14236_ST25.txt

Lys Val Arg Glu Ser Asn Thr Thr Glu Cys Asp Ser Lys Ile Ile Gly
 965 970 975

Thr Ala Val Lys Asn Asn Leu Ala Ile His Ser Asp Leu Ser Tyr Trp
 980 985 990

Ile Glu Ser Arg Leu Asn Asp Thr Trp Lys Leu Glu Arg Ala Val Leu
 995 1000 1005

Gly Glu Val Lys Ser Cys Thr Trp Pro Glu Thr His Thr Leu Trp
 1010 1015 1020

Gly Asp Gly Ile Leu Glu Ser Asp Leu Ile Ile Pro Val Thr Leu
 1025 1030 1035

Ala Gly Pro Arg Ser Asn His Asn Arg Arg Pro Gly Tyr Lys Thr
 1040 1045 1050

Gln Asn Gln Gly Pro Trp Asp Glu Gly Arg Val Glu Ile Asp Phe
 1055 1060 1065

Asp Tyr Cys Pro Gly Thr Thr Val Thr Leu Ser Glu Ser Cys Gly
 1070 1075 1080

His Arg Gly Pro Ala Thr Arg Thr Thr Thr Glu Ser Gly Lys Leu
 1085 1090 1095

Ile Thr Asp Trp Cys Cys Arg Ser Cys Thr Leu Pro Pro Leu Arg
 1100 1105 1110

Tyr Gln Thr Asp Ser Gly Cys Trp Tyr Gly Met Glu Ile Arg Pro
 1115 1120 1125

Gln Arg His Asp Glu Lys Thr Leu Val Gln Ser Gln Val Asn Ala
 1130 1135 1140

Tyr Asn Ala Asp Met Ile Asp Pro Phe Gln Leu Gly Leu Leu Val
 1145 1150 1155

Val Phe Leu Ala Thr Gln Glu Val Leu Arg Lys Arg Trp Thr Ala
 Page 9

B14236_ST25.txt

1160						1165						1170			
Lys	Ile	Ser	Met	Pro	Ala	Ile	Leu	Ile	Ala	Leu	Leu	Val	Leu	Val	
1175						1180					1185				
Phe	Gly	Gly	Ile	Thr	Tyr	Thr	Asp	Val	Leu	Arg	Tyr	Val	Ile	Leu	
1190						1195					1200				
Val	Gly	Ala	Ala	Phe	Ala	Glu	Ser	Asn	Ser	Gly	Gly	Asp	Val	Val	
1205						1210					1215				
His	Leu	Ala	Leu	Met	Ala	Thr	Phe	Lys	Ile	Gln	Pro	Val	Phe	Met	
1220						1225					1230				
Val	Ala	Ser	Phe	Leu	Lys	Ala	Arg	Trp	Thr	Asn	Gln	Glu	Asn	Ile	
1235						1240					1245				
Leu	Leu	Met	Leu	Ala	Ala	Val	Phe	Phe	Gln	Met	Ala	Tyr	His	Asp	
1250						1255					1260				
Ala	Arg	Gln	Ile	Leu	Leu	Trp	Glu	Ile	Pro	Asp	Val	Leu	Asn	Ser	
1265						1270					1275				
Leu	Ala	Val	Ala	Trp	Met	Ile	Leu	Arg	Ala	Ile	Thr	Phe	Thr	Thr	
1280						1285					1290				
Thr	Ser	Asn	Val	Val	Val	Pro	Leu	Leu	Ala	Leu	Leu	Thr	Pro	Arg	
1295						1300					1305				
Leu	Arg	Cys	Leu	Asn	Leu	Asp	Val	Tyr	Arg	Ile	Leu	Leu	Leu	Met	
1310						1315					1320				
Val	Gly	Ile	Gly	Ser	Leu	Ile	Arg	Glu	Lys	Arg	Ser	Ala	Ala	Ala	
1325						1330					1335				
Lys	Lys	Lys	Gly	Ala	Ser	Leu	Leu	Cys	Leu	Ala	Leu	Ala	Ser	Thr	
1340						1345					1350				
Gly	Leu	Phe	Asn	Pro	Met	Ile	Leu	Ala	Ala	Gly	Leu	Ile	Ala	Cys	
1355						1360					1365				

B14236_ST25.txt

Asp	Pro	Asn	Arg	Lys	Arg	Gly	Trp	Pro	Ala	Thr	Glu	Val	Met	Thr
1370						1375					1380			
Ala	Val	Gly	Leu	Met	Phe	Ala	Ile	Val	Gly	Gly	Leu	Ala	Glu	Leu
1385						1390					1395			
Asp	Ile	Asp	Ser	Met	Ala	Ile	Pro	Met	Thr	Ile	Ala	Gly	Leu	Met
1400						1405					1410			
Phe	Ala	Ala	Phe	Val	Ile	Ser	Gly	Lys	Ser	Thr	Asp	Met	Trp	Ile
1415						1420					1425			
Glu	Arg	Thr	Ala	Asp	Ile	Ser	Trp	Glu	Ser	Asp	Ala	Glu	Ile	Thr
1430						1435					1440			
Gly	Ser	Ser	Glu	Arg	Val	Asp	Val	Arg	Leu	Asp	Asp	Gly	Glu	Asn
1445						1450					1455			
Phe	Gln	Leu	Met	Asn	Asp	Pro	Gly	Ala	Pro	Trp	Lys	Ile	Trp	Met
1460						1465					1470			
Leu	Arg	Met	Val	Cys	Leu	Ala	Ile	Ser	Ala	Tyr	Thr	Pro	Trp	Ala
1475						1480					1485			
Ile	Leu	Pro	Ser	Val	Val	Gly	Phe	Trp	Ile	Thr	Leu	Gln	Tyr	Thr
1490						1495					1500			
Lys	Arg	Gly	Gly	Val	Leu	Trp	Asp	Thr	Pro	Ser	Pro	Lys	Glu	Tyr
1505						1510					1515			
Lys	Lys	Gly	Asp	Thr	Thr	Thr	Gly	Val	Tyr	Arg	Ile	Met	Thr	Arg
1520						1525					1530			
Gly	Leu	Leu	Gly	Ser	Tyr	Gln	Ala	Gly	Ala	Gly	Val	Met	Val	Glu
1535						1540					1545			
Gly	Val	Phe	His	Thr	Leu	Trp	His	Thr	Thr	Lys	Gly	Ala	Ala	Leu
1550						1555					1560			
Met	Ser	Gly	Glu	Gly	Arg	Leu	Asp	Pro	Tyr	Trp	Gly	Ser	Val	Lys

B14236_ST25.txt

1565

1570

1575

Glu Asp Arg Leu Cys Tyr Gly Gly Pro Trp Lys Leu Gln His Lys
 1580 1585 1590

Trp Asn Gly Gln Asp Glu Val Gln Met Ile Val Val Glu Pro Gly
 1595 1600 1605

Lys Asn Val Lys Asn Val Gln Thr Lys Pro Gly Val Phe Lys Thr
 1610 1615 1620

Pro Glu Gly Glu Ile Gly Ala Val Thr Leu Asp Phe Pro Thr Gly
 1625 1630 1635

Thr Ser Gly Ser Pro Ile Val Asp Lys Asn Gly Asp Val Ile Gly
 1640 1645 1650

Leu Tyr Gly Asn Gly Val Ile Met Pro Asn Gly Ser Tyr Ile Ser
 1655 1660 1665

Ala Ile Val Gln Gly Glu Arg Met Asp Glu Pro Ile Pro Ala Gly
 1670 1675 1680

Phe Glu Pro Glu Met Leu Arg Lys Lys Gln Ile Thr Val Leu Asp
 1685 1690 1695

Leu His Pro Gly Ala Gly Lys Thr Arg Arg Ile Leu Pro Gln Ile
 1700 1705 1710

Ile Lys Glu Ala Ile Asn Arg Arg Leu Arg Thr Ala Val Leu Ala
 1715 1720 1725

Pro Thr Arg Val Val Ala Ala Glu Met Ala Glu Ala Leu Arg Gly
 1730 1735 1740

Leu Pro Ile Arg Tyr Gln Thr Ser Ala Val Pro Arg Glu His Asn
 1745 1750 1755

Gly Asn Glu Ile Val Asp Val Met Cys His Ala Thr Leu Thr His
 1760 1765 1770

B14236_ST25.txt

Arg	Leu	Met	Ser	Pro	His	Arg	Val	Pro	Asn	Tyr	Asn	Leu	Phe	Val
1775						1780					1785			
Met	Asp	Glu	Ala	His	Phe	Thr	Asp	Pro	Ala	Ser	Ile	Ala	Ala	Arg
1790						1795					1800			
Gly	Tyr	Ile	Ser	Thr	Lys	Val	Glu	Leu	Gly	Glu	Ala	Ala	Ala	Ile
1805						1810					1815			
Phe	Met	Thr	Ala	Thr	Pro	Pro	Gly	Thr	Ser	Asp	Pro	Phe	Pro	Glu
1820						1825					1830			
Ser	Asn	Ser	Pro	Ile	Ser	Asp	Leu	Gln	Thr	Glu	Ile	Pro	Asp	Arg
1835						1840					1845			
Ala	Trp	Asn	Ser	Gly	Tyr	Glu	Trp	Ile	Thr	Glu	Tyr	Thr	Gly	Lys
1850						1855					1860			
Thr	Val	Trp	Phe	Val	Pro	Ser	Val	Lys	Met	Gly	Asn	Glu	Ile	Ala
1865						1870					1875			
Leu	Cys	Leu	Gln	Arg	Ala	Gly	Lys	Lys	Val	Val	Gln	Leu	Asn	Arg
1880						1885					1890			
Lys	Ser	Tyr	Glu	Thr	Glu	Tyr	Pro	Lys	Cys	Lys	Asn	Asp	Asp	Trp
1895						1900					1905			
Asp	Phe	Val	Ile	Thr	Thr	Asp	Ile	Ser	Glu	Met	Gly	Ala	Asn	Phe
1910						1915					1920			
Lys	Ala	Ser	Arg	Val	Ile	Asp	Ser	Arg	Lys	Ser	Val	Lys	Pro	Thr
1925						1930					1935			
Ile	Ile	Thr	Glu	Gly	Glu	Gly	Arg	Val	Ile	Leu	Gly	Glu	Pro	Ser
1940						1945					1950			
Ala	Val	Thr	Ala	Ala	Ser	Ala	Ala	Gln	Arg	Arg	Gly	Arg	Ile	Gly
1955						1960					1965			
Arg	Asn	Pro	Ser	Gln	Val	Gly	Asp	Glu	Tyr	Cys	Tyr	Gly	Gly	His

B14236_ST25.txt

1970						1975						1980			
Thr	Asn	Glu	Asp	Asp	Ser	Asn	Phe	Ala	His	Trp	Thr	Glu	Ala	Arg	
1985						1990					1995				
Ile	Met	Pro	Asp	Asn	Ile	Asn	Met	Pro	Asn	Gly	Leu	Ile	Ala	Gln	
2000						2005					2010				
Phe	Tyr	Gln	Pro	Glu	Arg	Glu	Lys	Val	Tyr	Thr	Met	Glu	Gly	Glu	
2015						2020					2025				
Tyr	Arg	Leu	Arg	Gly	Glu	Glu	Arg	Lys	Asn	Phe	Leu	Glu	Leu	Leu	
2030						2035					2040				
Arg	Thr	Ala	Asp	Leu	Pro	Val	Trp	Leu	Ala	Tyr	Lys	Val	Ala	Ala	
2045						2050					2055				
Ala	Gly	Val	Ser	Tyr	His	Asp	Arg	Arg	Trp	Cys	Phe	Asp	Gly	Pro	
2060						2065					2070				
Arg	Thr	Asn	Thr	Ile	Leu	Glu	Asp	Asn	Asn	Glu	Val	Glu	Val	Ile	
2075						2080					2085				
Thr	Lys	Leu	Gly	Glu	Arg	Lys	Ile	Leu	Arg	Pro	Arg	Trp	Ile	Asp	
2090						2095					2100				
Ala	Arg	Val	Tyr	Ser	Asp	His	Gln	Ala	Leu	Lys	Ala	Phe	Lys	Asp	
2105						2110					2115				
Phe	Ala	Ser	Gly	Lys	Arg	Ser	Gln	Ile	Gly	Leu	Ile	Glu	Val	Leu	
2120						2125					2130				
Gly	Lys	Met	Pro	Glu	His	Phe	Met	Gly	Lys	Thr	Trp	Glu	Ala	Leu	
2135						2140					2145				
Asp	Thr	Met	Tyr	Val	Val	Ala	Thr	Ala	Glu	Lys	Gly	Gly	Arg	Ala	
2150						2155					2160				
His	Arg	Met	Ala	Leu	Glu	Glu	Leu	Pro	Asp	Ala	Leu	Gln	Thr	Ile	
2165						2170					2175				

B14236_ST25.txt

Ala	Leu	Ile	Ala	Leu	Leu	Ser	Val	Met	Thr	Met	Gly	Val	Phe	Phe
2180						2185					2190			
Leu	Leu	Met	Gln	Arg	Lys	Gly	Ile	Gly	Lys	Ile	Gly	Leu	Gly	Gly
2195						2200					2205			
Ala	Val	Leu	Gly	Val	Ala	Thr	Phe	Phe	Cys	Trp	Met	Ala	Glu	Val
2210						2215					2220			
Pro	Gly	Thr	Lys	Ile	Ala	Gly	Met	Leu	Leu	Leu	Ser	Leu	Leu	Leu
2225						2230					2235			
Met	Ile	Val	Leu	Ile	Pro	Glu	Pro	Glu	Lys	Gln	Arg	Ser	Gln	Thr
2240						2245					2250			
Asp	Asn	Gln	Leu	Ala	Val	Phe	Leu	Ile	Cys	Val	Met	Thr	Leu	Val
2255						2260					2265			
Ser	Ala	Val	Ala	Ala	Asn	Glu	Met	Gly	Trp	Leu	Asp	Lys	Thr	Lys
2270						2275					2280			
Ser	Asp	Ile	Ser	Ser	Leu	Phe	Gly	Gln	Arg	Ile	Glu	Val	Lys	Glu
2285						2290					2295			
Asn	Phe	Ser	Met	Gly	Glu	Phe	Leu	Leu	Asp	Leu	Arg	Pro	Ala	Thr
2300						2305					2310			
Ala	Trp	Ser	Leu	Tyr	Ala	Val	Thr	Thr	Ala	Val	Leu	Thr	Pro	Leu
2315						2320					2325			
Leu	Lys	His	Leu	Ile	Thr	Ser	Asp	Tyr	Ile	Asn	Thr	Ser	Leu	Thr
2330						2335					2340			
Ser	Ile	Asn	Val	Gln	Ala	Ser	Ala	Leu	Phe	Thr	Leu	Ala	Arg	Gly
2345						2350					2355			
Phe	Pro	Phe	Val	Asp	Val	Gly	Val	Ser	Ala	Leu	Leu	Leu	Ala	Ala
2360						2365					2370			
Gly	Cys	Trp	Gly	Gln	Val	Thr	Leu	Thr	Val	Thr	Val	Thr	Ala	Ala

B14236_ST25.txt

2375

2380

2385

Thr Leu Leu Phe Cys His Tyr Ala Tyr Met Val Pro Gly Trp Gln
 2390 2395 2400

Ala Glu Ala Met Arg Ser Ala Gln Arg Arg Thr Ala Ala Gly Ile
 2405 2410 2415

Met Lys Asn Ala Val Val Asp Gly Ile Val Ala Thr Asp Val Pro
 2420 2425 2430

Glu Leu Glu Arg Thr Thr Pro Ile Met Gln Lys Lys Val Gly Gln
 2435 2440 2445

Ile Met Leu Ile Leu Val Ser Leu Ala Ala Val Val Val Asn Pro
 2450 2455 2460

Ser Val Lys Thr Val Arg Glu Ala Gly Ile Leu Ile Thr Ala Ala
 2465 2470 2475

Ala Val Thr Leu Trp Glu Asn Gly Ala Ser Ser Val Trp Asn Ala
 2480 2485 2490

Thr Thr Ala Ile Gly Leu Cys His Ile Met Arg Gly Gly Trp Leu
 2495 2500 2505

Ser Cys Leu Ser Ile Thr Trp Thr Leu Ile Lys Asn Met Glu Lys
 2510 2515 2520

Pro Gly Leu Lys Arg Gly Gly Ala Lys Gly Arg Thr Leu Gly Glu
 2525 2530 2535

Val Trp Lys Glu Arg Leu Asn Gln Met Thr Lys Glu Glu Phe Thr
 2540 2545 2550

Arg Tyr Arg Lys Glu Ala Ile Ile Glu Val Asp Arg Ser Ala Ala
 2555 2560 2565

Lys His Ala Arg Lys Glu Gly Asn Val Thr Gly Gly His Ser Val
 2570 2575 2580

B14236_ST25.txt

Ser	Arg	Gly	Thr	Ala	Lys	Leu	Arg	Trp	Leu	Val	Glu	Arg	Arg	Phe
2585						2590					2595			
Leu	Glu	Pro	Val	Gly	Lys	Val	Ile	Asp	Leu	Gly	Cys	Gly	Arg	Gly
2600						2605					2610			
Gly	Trp	Cys	Tyr	Tyr	Met	Ala	Thr	Gln	Lys	Arg	Val	Gln	Glu	Val
2615						2620					2625			
Arg	Gly	Tyr	Thr	Lys	Gly	Gly	Pro	Gly	His	Glu	Glu	Pro	Gln	Leu
2630						2635					2640			
Val	Gln	Ser	Tyr	Gly	Trp	Asn	Ile	Val	Thr	Met	Lys	Ser	Gly	Val
2645						2650					2655			
Asp	Val	Phe	Tyr	Arg	Pro	Ser	Glu	Cys	Cys	Asp	Thr	Leu	Leu	Cys
2660						2665					2670			
Asp	Ile	Gly	Glu	Ser	Ser	Ser	Ser	Ala	Glu	Val	Glu	Glu	His	Arg
2675						2680					2685			
Thr	Ile	Arg	Val	Leu	Glu	Met	Val	Glu	Asp	Trp	Leu	His	Arg	Gly
2690						2695					2700			
Pro	Arg	Glu	Phe	Cys	Val	Lys	Val	Leu	Cys	Pro	Tyr	Met	Pro	Lys
2705						2710					2715			
Val	Ile	Glu	Lys	Met	Glu	Leu	Leu	Gln	Arg	Arg	Tyr	Gly	Gly	Gly
2720						2725					2730			
Leu	Val	Arg	Asn	Pro	Leu	Ser	Arg	Asn	Ser	Thr	His	Glu	Met	Tyr
2735						2740					2745			
Trp	Val	Ser	Arg	Ala	Ser	Gly	Asn	Val	Val	His	Ser	Val	Asn	Met
2750						2755					2760			
Thr	Ser	Gln	Val	Leu	Leu	Gly	Arg	Met	Glu	Lys	Arg	Thr	Trp	Lys
2765						2770					2775			
Gly	Pro	Gln	Tyr	Glu	Glu	Asp	Val	Asn	Leu	Gly	Ser	Gly	Thr	Arg

B14236_ST25.txt

2780

2785

2790

Ala Val Gly Lys Pro Leu Leu Asn Ser Asp Thr Ser Lys Ile Asn
2795 2800 2805

Asn Arg Ile Glu Arg Leu Arg Arg Glu Tyr Ser Ser Thr Trp His
2810 2815 2820

His Asp Glu Asn His Pro Tyr Arg Thr Trp Asn Tyr His Gly Ser
2825 2830 2835

Tyr Asp Val Lys Pro Thr Gly Ser Ala Ser Ser Leu Val Asn Gly
2840 2845 2850

Val Val Arg Leu Leu Ser Lys Pro Trp Asp Thr Ile Thr Asn Val
2855 2860 2865

Thr Thr Met Ala Met Thr Asp Thr Thr Pro Phe Gly Gln Gln Arg
2870 2875 2880

Val Phe Lys Glu Lys Val Asp Thr Lys Ala Pro Glu Pro Pro Glu
2885 2890 2895

Gly Ala Lys Tyr Val Leu Asn Glu Thr Thr Asn Trp Leu Trp Ala
2900 2905 2910

Phe Leu Ala Arg Glu Lys Arg Pro Arg Met Cys Ser Arg Glu Glu
2915 2920 2925

Phe Ile Arg Lys Val Asn Ser Asn Ala Ala Leu Gly Ala Met Phe
2930 2935 2940

Glu Glu Gln Asn Gln Trp Arg Ser Ala Arg Glu Ala Val Glu Asp
2945 2950 2955

Pro Lys Phe Trp Glu Met Val Asp Glu Glu Arg Glu Ala His Leu
2960 2965 2970

Arg Gly Glu Cys His Thr Cys Ile Tyr Asn Met Met Gly Lys Arg
2975 2980 2985

B14236_ST25.txt

Glu	Lys	Lys	Pro	Gly	Glu	Phe	Gly	Lys	Ala	Lys	Gly	Ser	Arg	Ala
2990						2995					3000			
Ile	Trp	Phe	Met	Trp	Leu	Gly	Ala	Arg	Phe	Leu	Glu	Phe	Glu	Ala
3005						3010					3015			
Leu	Gly	Phe	Leu	Asn	Glu	Asp	His	Trp	Leu	Gly	Arg	Lys	Asn	Ser
3020						3025					3030			
Gly	Gly	Gly	Val	Glu	Gly	Leu	Gly	Leu	Gln	Lys	Leu	Gly	Tyr	Ile
3035						3040					3045			
Leu	Arg	Glu	Val	Gly	Thr	Arg	Pro	Gly	Gly	Lys	Ile	Tyr	Ala	Asp
3050						3055					3060			
Asp	Thr	Ala	Gly	Trp	Asp	Thr	Arg	Ile	Thr	Arg	Ala	Asp	Leu	Glu
3065						3070					3075			
Asn	Glu	Ala	Lys	Val	Leu	Glu	Leu	Leu	Asp	Gly	Glu	His	Arg	Arg
3080						3085					3090			
Leu	Ala	Arg	Ala	Ile	Ile	Glu	Leu	Thr	Tyr	Arg	His	Lys	Val	Val
3095						3100					3105			
Lys	Val	Met	Arg	Pro	Ala	Ala	Asp	Gly	Arg	Thr	Val	Met	Asp	Val
3110						3115					3120			
Ile	Ser	Arg	Glu	Asp	Gln	Arg	Gly	Ser	Gly	Gln	Val	Val	Thr	Tyr
3125						3130					3135			
Ala	Leu	Asn	Thr	Phe	Thr	Asn	Leu	Ala	Val	Gln	Leu	Val	Arg	Met
3140						3145					3150			
Met	Glu	Gly	Glu	Gly	Val	Ile	Gly	Pro	Asp	Asp	Val	Glu	Lys	Leu
3155						3160					3165			
Thr	Lys	Gly	Lys	Gly	Pro	Lys	Val	Arg	Thr	Trp	Leu	Phe	Glu	Asn
3170						3175					3180			
Gly	Glu	Glu	Arg	Leu	Ser	Arg	Met	Ala	Val	Ser	Gly	Asp	Asp	Cys

B14236_ST25.txt

3185

3190

3195

Val Val Lys Pro Leu Asp Asp Arg Phe Ala Thr Ser Leu His Phe
 3200 3205 3210

Leu Asn Ala Met Ser Lys Val Arg Lys Asp Ile Gln Glu Trp Lys
 3215 3220 3225

Pro Ser Thr Gly Trp Tyr Asp Trp Gln Gln Val Pro Phe Cys Ser
 3230 3235 3240

Asn His Phe Thr Glu Leu Ile Met Lys Asp Gly Arg Thr Leu Val
 3245 3250 3255

Val Pro Cys Arg Gly Gln Asp Glu Leu Val Gly Arg Ala Arg Ile
 3260 3265 3270

Ser Pro Gly Ala Gly Trp Asn Val Arg Asp Thr Ala Cys Leu Ala
 3275 3280 3285

Lys Ser Tyr Ala Gln Met Trp Leu Leu Leu Tyr Phe His Arg Arg
 3290 3295 3300

Asp Leu Arg Leu Met Ala Asn Ala Ile Cys Ser Ala Val Pro Val
 3305 3310 3315

Asn Trp Val Pro Thr Gly Arg Thr Thr Trp Ser Ile His Ala Gly
 3320 3325 3330

Gly Glu Trp Met Thr Thr Glu Asp Met Leu Glu Val Trp Asn Arg
 3335 3340 3345

Val Trp Ile Glu Glu Asn Glu Trp Met Glu Asp Lys Thr Pro Val
 3350 3355 3360

Glu Lys Trp Ser Asp Val Pro Tyr Ser Gly Lys Arg Glu Asp Ile
 3365 3370 3375

Trp Cys Gly Ser Leu Ile Gly Thr Arg Ala Arg Ala Thr Trp Ala
 3380 3385 3390

B14236_ST25.txt

Glu Asn Ile Gln Val Ala Ile Asn Gln Val Arg Ala Ile Ile Gly
 3395 3400 3405

Asp Glu Lys Tyr Val Asp Tyr Met Ser Ser Leu Lys Arg Tyr Glu
 3410 3415 3420

Asp Thr Thr Leu Val Glu Asp Thr Val Leu
 3425 3430

<210> 8
 <211> 31
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Forward primer (M-I36F WNV)

<400> 8
 aaaacagaat catggttctt gaggaaccct g 31

<210> 9
 <211> 32
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Reverse primer (M-I36F WNV)

<400> 9
 ccagggttcc tcaagaacca tgattctggtt tt 32

<210> 10
 <211> 25
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Forward primer (M-A43G WNV)

<400> 10
 accctggata tggactggtg gcagc 25

<210> 11
 <211> 25
 <212> DNA
 <213> Artificial sequence

<220>

<223> Reverse primer (M-A43G WNV)

<400> 11

gctgccacca gtccatatcc agggc

25

<210> 12

<211> 21

<212> DNA

<213> Artificial sequence

<220>

<223> Primer

<400> 12

gcggcaatat tcatgacagc c

21

<210> 13

<211> 21

<212> DNA

<213> Artificial sequence

<220>

<223> Primer

<400> 13

cgggatctca gtctgtaagt c

21

<210> 14

<211> 20

<212> DNA

<213> Artificial sequence

<220>

<223> Primer

<400> 14

ggtcggagtc aacggatttg

20

<210> 15

<211> 20

<212> DNA

<213> Artificial sequence

<220>

<223> Primer

<400> 15

actccacgac gtactcagcg

20

B14236_ST25.txt

<210> 16
 <211> 49
 <212> PRT
 <213> Artificial sequence

<220>
 <223> ectoM and part of TM1 of Dengue Virus 1 (DV1)

<400> 16

Ser Val Ala Leu Ala Pro His Val Gly Leu Gly Leu Glu Thr Arg Thr
 1 5 10 15

Glu Thr Trp Met Ser Ser Glu Gly Ala Trp Lys Gln Ile Gln Lys Val
 20 25 30

Glu Thr Trp Ala Leu Arg His Pro Gly Phe Thr Val Ile Ala Leu Phe
 35 40 45

Leu

<210> 17
 <211> 49
 <212> PRT
 <213> Artificial sequence

<220>
 <223> ectoM and part of TM1 of Dengue Virus 2 (DV2)

<400> 17

Ser Val Ala Leu Val Pro His Val Gly Met Gly Leu Glu Thr Arg Thr
 1 5 10 15

Glu Thr Trp Met Ser Ser Glu Gly Ala Trp Lys His Ala Gln Arg Ile
 20 25 30

Glu Thr Trp Ile Leu Arg His Pro Gly Phe Thr Ile Met Ala Ala Ile
 35 40 45

Leu

<210> 18

B14236_ST25.txt

<211> 49
 <212> PRT
 <213> Artificial sequence

<220>

<223> ectoM and part oof TM1 f Dengue Virus 3 (DV3)

<400> 18

Ser	Val	Ala	Leu	Ala	Pro	His	Val	Gly	Met	Gly	Leu	Asp	Thr	Arg	Ala
1				5					10					15	

Gln	Thr	Trp	Met	Ser	Ala	Glu	Gly	Ala	Trp	Arg	Gln	Val	Glu	Lys	Val
			20					25					30		

Glu	Thr	Trp	Ala	Phe	Arg	His	Pro	Gly	Phe	Thr	Ile	Leu	Ala	Leu	Phe
			35					40				45			

Leu

<210> 19
 <211> 75
 <212> PRT
 <213> Artificial sequence

<220>

<223> endogenous M protein of Dengue Virus 4 (DV4)

<400> 19

Ser	Val	Ala	Leu	Thr	Pro	His	Ser	Gly	Met	Gly	Leu	Glu	Thr	Arg	Ala
1				5					10					15	

Glu	Thr	Trp	Met	Ser	Ser	Glu	Gly	Ala	Trp	Lys	His	Ala	Gln	Arg	Val
			20					25					30		

Glu	Ser	Trp	Ile	Leu	Arg	Asn	Pro	Gly	Phe	Ala	Leu	Leu	Ala	Gly	Phe
			35					40				45			

Met	Ala	Tyr	Met	Ile	Gly	Gln	Thr	Gly	Ile	Gln	Arg	Thr	Val	Phe	Phe
	50					55					60				

Val	Leu	Met	Met	Leu	Val	Ala	Pro	Ser	Tyr	Gly
65					70					75

B14236_ST25.txt

<210> 20
 <211> 75
 <212> PRT
 <213> Artificial sequence

<220>
 <223> endogenous M protein of Japanese Encephalitis Virus (JEV)

<400> 20

Ser Val Ser Val Gln Thr His Gly Glu Ser Ser Leu Val Asn Lys Lys
 1 5 10 15

Glu Ala Trp Leu Asp Ser Thr Lys Ala Thr Arg Tyr Leu Met Lys Thr
 20 25 30

Glu Asn Trp Ile Ile Arg Asn Pro Gly Tyr Ala Phe Leu Ala Ala Val
 35 40 45

Leu Gly Trp Met Leu Gly Ser Asn Asn Gly Gln Arg Val Val Phe Thr
 50 55 60

Ile Leu Leu Leu Leu Val Ala Pro Ala Tyr Ser
 65 70 75

<210> 21
 <211> 75
 <212> PRT
 <213> Artificial sequence

<220>
 <223> truncated endogenous M protein of West Nile Virus (WNV)

<400> 21

Ser Leu Thr Val Gln Thr His Gly Glu Ser Thr Leu Ala Asn Lys Lys
 1 5 10 15

Gly Ala Trp Met Asp Ser Thr Lys Ala Thr Arg Tyr Leu Val Lys Thr
 20 25 30

Glu Ser Trp Ile Leu Arg Asn Pro Gly Tyr Ala Leu Val Ala Ala Val
 35 40 45

Ile Gly Trp Met Leu Gly Ser Asn Thr Met Gln Arg Val Val Phe Val
 Page 25

50

55

60

Val Leu Leu Leu Leu Val Ala Pro Ala Tyr Ser
 65 70 75

<210> 22

<211> 75

<212> PRT

<213> Artificial sequence

<220>

<223> endogenous M protein of Zika Virus (ZIKV), PF-13 strain

<400> 22

Ala Val Thr Leu Pro Ser His Ser Thr Arg Lys Leu Gln Thr Arg Ser
 1 5 10 15

Gln Thr Trp Leu Glu Ser Arg Glu Tyr Thr Lys His Leu Ile Arg Val
 20 25 30

Glu Asn Trp Ile Phe Arg Asn Pro Gly Leu Ala Leu Ala Ala Ala Ala
 35 40 45

Ile Ala Trp Leu Leu Gly Ser Ser Thr Ser Gln Lys Val Ile Tyr Leu
 50 55 60

Val Met Ile Leu Leu Ile Ala Pro Ala Tyr Ser
 65 70 75

<210> 23

<211> 49

<212> PRT

<213> Artificial sequence

<220>

<223> ectoM and part of TM1 of Yellow Fever Virus (YFV)

<400> 23

Ala Ile Asp Leu Pro Thr His Glu Asn His Gly Leu Lys Thr Arg Gln
 1 5 10 15

Glu Lys Trp Met Thr Gly Arg Met Gly Glu Arg Gln Leu Gln Lys Ile
 20 25 30

B14236_ST25.txt

Glu Arg Trp Leu Val Arg Asn Pro Phe Phe Ala Val Thr Ala Leu Thr
35 40 45

Ile

<210> 24
<211> 49
<212> PRT
<213> Artificial sequence

<220>
<223> ectoM and part of TM1 of Yellow Fever Virus-17D vaccine strain (YFV-17D)

<400> 24

Ala Ile Asp Leu Pro Thr His Glu Asn His Gly Leu Lys Thr Arg Gln
1 5 10 15

Glu Lys Trp Met Thr Gly Arg Met Gly Glu Arg Gln Leu Gln Lys Ile
20 25 30

Glu Arg Trp Phe Val Arg Asn Pro Phe Phe Ala Val Thr Ala Leu Thr
35 40 45

Ile

<210> 25
<211> 49
<212> PRT
<213> Artificial sequence

<220>
<223> ectoM and part of TM1 of Yellow Fever Virus-French Neurotropic Virus
(YFV-FNV)

<400> 25

Ala Ile Asp Leu Pro Thr His Glu Asn His Gly Leu Lys Thr Arg Gln
1 5 10 15

Glu Lys Trp Met Thr Gly Arg Met Gly Glu Arg Gln Leu Gln Lys Ile
20 25 30

B14236_ST25.txt

Glu Arg Trp Phe Val Arg Asn Pro Phe Phe Ala Val Thr Ala Leu Thr
 35 40 45

Ile

<210> 26
 <211> 49
 <212> PRT
 <213> Artificial sequence

<220>
 <223> ectoM and part of TM1 of Dengue Virus 4 (DV4)

<400> 26

Ser Val Ala Leu Thr Pro His Ser Gly Met Gly Leu Glu Thr Arg Ala
 1 5 10 15

Glu Thr Trp Met Ser Ser Glu Gly Ala Trp Lys His Ala Gln Arg Val
 20 25 30

Glu Ser Trp Ile Leu Arg Asn Pro Gly Phe Ala Leu Leu Ala Gly Phe
 35 40 45

Met

<210> 27
 <211> 49
 <212> PRT
 <213> Artificial sequence

<220>
 <223> ectoM and part of TM1 of Japanese Encephalitis Virus (JEV)

<400> 27

Ser Val Ser Val Gln Thr His Gly Glu Ser Ser Leu Val Asn Lys Lys
 1 5 10 15

Glu Ala Trp Leu Asp Ser Thr Lys Ala Thr Arg Tyr Leu Met Lys Thr
 20 25 30

Glu Asn Trp Ile Ile Arg Asn Pro Gly Tyr Ala Phe Leu Ala Ala Val
 35 40 45

Leu

<210> 28
 <211> 49
 <212> PRT
 <213> Artificial sequence

<220>
 <223> ectoM and part of TM1 of West Nile Virus (WNV)
 <400> 28

Ser Leu Thr Val Gln Thr His Gly Glu Ser Thr Leu Ala Asn Lys Lys
 1 5 10 15

Gly Ala Trp Met Asp Ser Thr Lys Ala Thr Arg Tyr Leu Val Lys Thr
 20 25 30

Glu Ser Trp Ile Leu Arg Asn Pro Gly Tyr Ala Leu Val Ala Ala Val
 35 40 45

Ile

<210> 29
 <211> 49
 <212> PRT
 <213> Artificial sequence

<220>
 <223> ectoM and part of TM1 of Zika Virus (ZIKV)
 <400> 29

Ala Val Thr Leu Pro Ser His Ser Thr Arg Lys Leu Gln Thr Arg Ser
 1 5 10 15

Gln Thr Trp Leu Glu Ser Arg Glu Tyr Thr Lys His Leu Ile Arg Val
 20 25 30

Glu Asn Trp Ile Phe Arg Asn Pro Gly Leu Ala Leu Ala Ala Ala Ala
 35 40 45

Ile

<210> 30
 <211> 43
 <212> PRT
 <213> Artificial sequence

<220>
 <223> ectoM and part of TM1 of WNV (from 1 to 43)

<400> 30

Ser Leu Thr Val Gln Thr His Gly Glu Ser Thr Leu Ala Asn Lys Lys
 1 5 10 15

Gly Ala Trp Leu Asp Ser Thr Lys Ala Thr Arg Tyr Leu Val Lys Thr
 20 25 30

Glu Ser Trp Ile Leu Arg Asn Pro Gly Phe Ala
 35 40

<210> 31
 <211> 60
 <212> PRT
 <213> Artificial sequence

<220>
 <223> M protein of WNV

<400> 31

Ser Leu Thr Val Gln Thr His Gly Glu Ser Thr Leu Ala Asn Lys Lys
 1 5 10 15

Gly Ala Trp Met Asp Ser Thr Lys Ala Thr Arg Tyr Leu Val Lys Thr
 20 25 30

Glu Ser Trp Ile Leu Arg Asn Pro Gly Tyr Ala Leu Val Ala Ala Val
 35 40 45

Ile Gly Trp Met Leu Gly Ser Asn Thr Met Gln Arg
 50 55 60

<210> 32
 <211> 60

<212> PRT

<213> Artificial sequence

<220>

<223> M protein of ZIKV

<400> 32

Ala Val Thr Leu Pro Ser His Ser Thr Arg Lys Leu Gln Thr Arg Ser
 1 5 10 15

Gln Thr Trp Leu Glu Ser Arg Glu Tyr Thr Lys His Leu Ile Lys Val
 20 25 30

Glu Asn Trp Ile Phe Arg Asn Pro Gly Phe Ala Leu Val Ala Val Ala
 35 40 45

Ile Ala Trp Leu Leu Gly Ser Ser Thr Ser Gln Lys
 50 55 60

<210> 33

<211> 28

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer (M-I36F ZIKV)

<400> 33

ggttgaaaac tggtttttca ggaacccc

28

<210> 34

<211> 28

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer (M-I36F ZIKV)

<400> 34

ggggttcctg aaaaaccagt tttcaacc

28

<210> 35

<211> 27

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer (M-A43G ZIKV)

<400> 35

aaccccgggt ttggactagt ggccgtt

27

<210> 36

<211> 26

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer (M-A43G ZIKV)

<400> 36

aacgccacta gtccaaaccc ggggtt

26

<210> 37

<211> 20

<212> DNA

<213> Artificial sequence

<220>

<223> Primer

<400> 37

atggaagacg gctgtggaag

20

<210> 38

<211> 20

<212> DNA

<213> Artificial sequence

<220>

<223> Primer

<400> 38

gctcccaacc acatgtacca

20

<210> 39

<211> 22

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer

<400> 39

ctgtgtgagc tgacaaactt ag

22

<210> 40
 <211> 20
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Forward primer

<400> 40
 gacggtaaatt gctactgacg 20

<210> 41
 <211> 19
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Forward primer

<400> 41
 ttggaaggag tgtctggag 19

<210> 42
 <211> 21
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Forward primer

<400> 42
 aaagcttgga gaatatggag a 21

<210> 43
 <211> 18
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Forward primer

<400> 43
 cattgaacga cctaacgc 18

<210> 44
 <211> 20
 <212> DNA
 <213> Artificial sequence

<220>

<223> Forward primer

<400> 44

caagagctga gatgtggaag

20

<210> 45

<211> 22

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer

<400> 45

gaatgtgact cgaagatcat tg

22

<210> 46

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer

<400> 46

cctcgtgcag tcacaagt

18

<210> 47

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer

<400> 47

ctagccctgc taacaccc

18

<210> 48

<211> 20

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer

<400> 48

ttggaagata tggatgctca

20

<210> 49
<211> 18
<212> DNA
<213> Artificial sequence

<220>

<223> Forward primer

<400> 49

ccactggaac atcaggct

18

<210> 50
<211> 21
<212> DNA
<213> Artificial sequence

<220>

<223> Forward primer

<400> 50

gcaagagggtt acatttccac a

21

<210> 51
<211> 18
<212> DNA
<213> Artificial sequence

<220>

<223> Forward primer

<400> 51

agaaatccgt cgcaagtt

18

<210> 52
<211> 18
<212> DNA
<213> Artificial sequence

<220>

<223> Forward primer

<400> 52

tgcttgagca cttcatgg

18

<210> 53
<211> 19
<212> DNA
<213> Artificial sequence

<220>

<223> Forward primer

<400> 53

caacagcctg gtcactgta

19

<210> 54

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer

<400> 54

acgagaagcc ggaatttt

18

<210> 55

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer

<400> 55

gtcccggaaca tgaagagc

18

<210> 56

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer

<400> 56

ggaaaacccc tgctcaac

18

<210> 57

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Forward primer

<400> 57

ggggggaatg tcacactt

18

<210> 58
<211> 18
<212> DNA
<213> Artificial sequence

<220>

<223> Forward primer

<400> 58

ttgtcaccta cgccctaa

18

<210> 59
<211> 18
<212> DNA
<213> Artificial sequence

<220>

<223> Forward primer

<400> 59

aagagacctg cggctcat

18

<210> 60
<211> 18
<212> DNA
<213> Artificial sequence

<220>

<223> Forward primer

<400> 60

aaagtcaggc cgggaagt

18

<210> 61
<211> 18
<212> DNA
<213> Artificial sequence

<220>

<223> Reverse primer

<400> 61

caagccccct tcttggtc

18

<210> 62
<211> 19
<212> DNA
<213> Artificial sequence

<220>

<223> Reverse primer

<400> 62

ttcctttgcc aaatagtcc

19

<210> 63

<211> 20

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 63

agtgttgctt gaaaattcca

20

<210> 64

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 64

atggacagcc ttcccaac

18

<210> 65

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 65

gtgaggcggt taggtgct

18

<210> 66

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 66

agtcaatctc tacccggc

18

<210> 67
 <211> 23
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Reverse primer

<400> 67
 ccaccataaa cactggttgt atc 23

<210> 68
 <211> 18
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Reverse primer

<400> 68
 caatgtcaag ctctgcca 18

<210> 69
 <211> 18
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Reverse primer

<400> 69
 cctctccgct catcaaag 18

<210> 70
 <211> 18
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Reverse primer

<400> 70
 acaaccctgg ttggtgct 18

<210> 71
 <211> 18
 <212> DNA
 <213> Artificial sequence

<220>

<223> Reverse primer

<400> 71

ttgggtactc cgtctcgt

18

<210> 72

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 72

cacctccggt cgtggtat

18

<210> 73

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 73

gagagcagca acattccg

18

<210> 74

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 74

aaccgggaac catgtagg

18

<210> 75

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 75

agcgatcgac ttcgatga

18

<210> 76
 <211> 21
 <212> DNA
 <213> Artificial sequence

<220>

<223> Reverse primer

<400> 76

ggagcagctc catcttctct a

21

<210> 77
 <211> 19
 <212> DNA
 <213> Artificial sequence

<220>

<223> Reverse primer

<400> 77

catggttttg agaggagcc

19

<210> 78
 <211> 18
 <212> DNA
 <213> Artificial sequence

<220>

<223> Reverse primer

<400> 78

ccagccagct gtgtcatc

18

<210> 79
 <211> 19
 <212> DNA
 <213> Artificial sequence

<220>

<223> Reverse primer

<400> 79

tcataccatc cagttgacg

19

<210> 80
 <211> 19
 <212> DNA
 <213> Artificial sequence

<220>

<223> Reverse primer

<400> 80

ggttgatagc cacctggat

19

<210> 81

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 81

tttcgccctg gttaacac

18

<210> 82

<211> 18

<212> DNA

<213> Artificial sequence

<220>

<223> Reverse primer

<400> 82

atcctgtgtt ctgcacc

18

<210> 83

<211> 75

<212> PRT

<213> Artificial sequence

<220>

<223> mutated ZIKV M protein, MR766 strain

<220>

<221> misc_feature

<222> (36)..(36)

<223> Xaa is Phe or Trp or Tyr

<400> 83

Ala Val Thr Leu Pro Ser His Ser Thr Arg Lys Leu Gln Thr Arg Ser
1 5 10 15

Gln Thr Trp Leu Glu Ser Arg Glu Tyr Thr Lys His Leu Ile Lys Val
20 25 30

B14236_ST25.txt

Glu Asn Trp Xaa Phe Arg Asn Pro Gly Phe Gly Leu Val Ala Val Ala
35 40 45

Ile Ala Trp Leu Leu Gly Ser Ser Thr Ser Gln Lys Val Ile Tyr Leu
50 55 60

Val Met Ile Leu Leu Ile Ala Pro Ala Tyr Ser
65 70 75

<210> 84
<211> 75
<212> PRT
<213> Artificial sequence

<220>
<223> endogenous M protein of Zika Virus (ZIKV), MR766 strain

<400> 84

Ala Val Thr Leu Pro Ser His Ser Thr Arg Lys Leu Gln Thr Arg Ser
1 5 10 15

Gln Thr Trp Leu Glu Ser Arg Glu Tyr Thr Lys His Leu Ile Lys Val
20 25 30

Glu Asn Trp Ile Phe Arg Asn Pro Gly Phe Ala Leu Val Ala Val Ala
35 40 45

Ile Ala Trp Leu Leu Gly Ser Ser Thr Ser Gln Lys Val Ile Tyr Leu
50 55 60

Val Met Ile Leu Leu Ile Ala Pro Ala Tyr Ser
65 70 75

<210> 85
<211> 225
<212> DNA
<213> Artificial sequence

<220>
<223> cDNA sequence of the endogenous protein M of USUV bologna 2009 strain

<400> 85

tcgatcgag tgacagcgca cggggagagt atgctggcta acaagaagga tgcttgcta 60

gactcaacca aggcttcgag atacctgatg aagactgaga attggattat caggaatcct 120

B14236_ST25.txt

gggtatgctt ttgtagctgt cctcttgggc tggatgctgg gaagcaacaa tggacaaagg 180
gtcgttttcg tcgttctctt acttctcgtg gcgcctgctt atagc 225

<210> 86
<211> 75
<212> PRT
<213> Artificial sequence

<220>
<223> Endogenous protein M of USUV bologna 2009 strain

<400> 86

Ser Ile Ala Val Gln Thr His Gly Glu Ser Met Leu Ala Asn Lys Lys
1 5 10 15

Asp Ala Trp Leu Asp Ser Thr Lys Ala Ser Arg Tyr Leu Met Lys Thr
20 25 30

Glu Asn Trp Ile Ile Arg Asn Pro Gly Tyr Ala Phe Val Ala Val Leu
35 40 45

Leu Gly Trp Met Leu Gly Ser Asn Asn Gly Gln Arg Val Val Phe Val
50 55 60

Val Leu Leu Leu Leu Val Ala Pro Ala Tyr Ser
65 70 75

<210> 87
<211> 75
<212> PRT
<213> Artificial sequence

<220>
<223> mutated USUV M protein, bologna 2009 strain

<220>
<221> misc_feature
<222> (36)..(36)
<223> Xaa is Phe or Trp or Tyr

<400> 87

Ser Ile Ala Val Gln Thr His Gly Glu Ser Met Leu Ala Asn Lys Lys
1 5 10 15

B14236_ST25.txt

Asp Ala Trp Leu Asp Ser Thr Lys Ala Ser Arg Tyr Leu Met Lys Thr
20 25 30

Glu Asn Trp Xaa Ile Arg Asn Pro Gly Tyr Gly Phe Val Ala Val Leu
35 40 45

Leu Gly Trp Met Leu Gly Ser Asn Asn Gly Gln Arg Val Val Phe Val
50 55 60

Val Leu Leu Leu Leu Val Ala Pro Ala Tyr Ser
65 70 75

<210> 88
<211> 223
<212> DNA
<213> Artificial sequence

<220>
<223> cDNA sequence of the endogenous M protein of Zika Virus (ZIKV), MR766 strain

<400> 88
ccgtgacgct cccttctcac tctacaagga agttgcaaac gcggtcgcag acctggtttag 60
aatcaagaga atacacgaag cacttgatca aggttgaaaa ctggatattc aggaaccccg 120
ggtttgcgct agtggccggt gccattgcct ggcttttggg aagctcgacg agccaaaaag 180
tcatatactt ggtcatgata ctgctgattg ccccggcata cag 223

<210> 89
<211> 223
<212> DNA
<213> Artificial sequence

<220>
<223> cDNA sequence coding for a mutated ZIKV MR766 strain M protein

<220>
<221> misc_feature
<222> (105)..(107)
<223> n is a, c, g, or t; nnn is a codon coding either for phenylalanine (TTT or TTC), or tryptophan (TGG), or tyrosine (TAA, TAG or TGA)

<220>
<221> misc_feature

B14236_ST25.txt

<222> (126)..(128)

<223> n is a, c, g, or t; nnn is a codon coding for glycine (GGA, GGT, GGC or GGG)

<400> 89

ccgtgacgct cccttctcac tctacaagga agttgcaaac gcggtcgag acctggtttag 60

aatcaagaga atacacgaag cacttgatca aggttgaaaa ctggnnnttc aggaaccccg 120

ggtttnnnct agtggccgtt gccattgcct ggcttttggg aagctcgacg agccaaaaag 180

tcataactt ggtcatgata ctgctgattg ccccggcata cag 223