UTMB0395WO

SEQUENCE LISTING

<110> Nasar, Farooq
Matassov, Demetrius
Gorchakov, Rodion V.
Hamm, Stefan V.
Nowak, Rebecca V.
Seymour, Robert L.
Eldridge, John H.
Tesh, Robert B.
Clarke, David K.
Latham, Theresa E.
Weaver, Scott C.

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Ser Gly Met Asp Leu Arg Thr Ala Val Cys Ser Gly Leu Lys Gln Arg
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Gly Ile Tyr Asn Arg Ile Arg Ile Gln Tyr Lys Ile Thr Pro Glu Phe
        275                 280                 285

Val
```

<210> 4
<211> 226
<212> PRT
<213> Isfahan Virus

<400> 4

```
Met Lys Ser Leu Lys Arg Leu Ile Lys Ser Asn Lys Lys Lys Gly Asp
1               5                   10                  15

Lys Lys Asn Val Ser Phe Met Asp Trp Asp Glu Pro Pro Ser Tyr Ser
            20                  25                  30

Asp Ser Arg Tyr Gly Cys Tyr Pro Ser Ala Pro Leu Phe Gly Val Asp
        35                  40                  45

Glu Met Met Glu Thr Leu Pro Thr Leu Gly Ile Gln Ser Leu Lys Ile
    50                  55                  60

Gln Tyr Lys Cys Ser Leu Gln Val Arg Ala Glu Thr Pro Phe Thr Ser
```

65 70 75 80

Phe Asn Asp Ala Ala Arg Cys Ile Ser Leu Trp Glu Thr Asp Tyr Arg
85 90 95

Gly Tyr Ala Gly Lys Lys Pro Phe Tyr Arg Leu Leu Met Leu Ile Ala
100 105 110

Thr Lys Lys Leu Arg Ala Ala Pro Met Ser Leu Met Asp Gly Asn Arg
115 120 125

Pro Glu Tyr Ser Ser Met Ile Gln Gly Gln Ser Ile Val His His Ser
130 135 140

Leu Gly Val Ile Pro Pro Met Met His Val Pro Glu Thr Phe Thr Arg
145 150 155 160

Glu Trp Asn Leu Leu Thr Asn Lys Gly Met Ile Thr Ala Gln Ile Trp
165 170 175

Leu Gly Ile Thr Asp Val Val Asp Asp Leu Asn Pro Leu Ile Asn Pro
180 185 190

Ala Leu Phe Ser Asp Glu Lys Glu Met Thr Leu Thr Ser Gln Met Phe
195 200 205

Gly Leu Glu Leu Lys Lys Arg Asn Asp Asn Thr Trp Leu Ile Ser Lys
210 215 220

Ser Tyr
225

<210> 5
<211> 523
<212> PRT
<213> Isfahan Virus

<400> 5

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Met Thr Ser Val Leu Phe Met Val Gly Val Leu Leu Gly Ala Phe Gly
1               5                  10                  15

Ser Thr His Cys Ser Ile Gln Ile Val Phe Pro Ser Glu Thr Lys Leu
            20                  25                  30

Val Trp Lys Pro Val Leu Lys Gly Thr Arg Tyr Cys Pro Gln Ser Ala
        35                  40                  45

Glu Leu Asn Leu Glu Pro Asp Leu Lys Thr Met Ala Phe Asp Ser Lys
    50                  55                  60

Val Pro Ile Gly Ile Thr Pro Ser Asn Ser Asp Gly Tyr Leu Cys His
65                  70                  75                  80

Ala Ala Lys Trp Val Thr Thr Cys Asp Phe Arg Trp Tyr Gly Pro Lys
                85                  90                  95

Tyr Ile Thr His Ser Val His Ser Leu Arg Pro Thr Val Ser Asp Cys
            100                 105                 110

Lys Ala Ala Val Glu Ala Tyr Asn Ala Gly Thr Leu Met Tyr Pro Gly
        115                 120                 125

Phe Pro Pro Glu Ser Cys Gly Tyr Ala Ser Ile Thr Asp Ser Glu Phe
    130                 135                 140

Tyr Val Met Leu Val Thr Pro His Pro Val Gly Val Asp Asp Tyr Arg
145                 150                 155                 160

Gly His Trp Val Asp Pro Leu Phe Pro Thr Ser Glu Cys Asn Ser Asn
                165                 170                 175

Phe Cys Glu Thr Val His Asn Ala Thr Met Trp Ile Pro Lys Asp Leu
            180                 185                 190
```

```
Lys Thr His Asp Val Cys Ser Gln Asp Phe Gln Thr Ile Arg Val Ser
        195                 200                 205

Val Met Tyr Pro Gln Thr Lys Pro Thr Lys Gly Ala Asp Leu Thr Leu
    210                 215                 220

Lys Ser Lys Phe His Ala His Met Lys Gly Asp Arg Val Cys Lys Met
225                 230                 235                 240

Lys Phe Cys Asn Lys Asn Gly Leu Arg Leu Gly Asn Gly Glu Trp Ile
                245                 250                 255

Glu Val Gly Asp Glu Val Met Leu Asp Asn Ser Lys Leu Leu Ser Leu
            260                 265                 270

Phe Pro Asp Cys Leu Val Gly Ser Val Val Lys Ser Thr Leu Leu Ser
        275                 280                 285

Glu Gly Val Gln Thr Ala Leu Trp Glu Thr Asp Arg Leu Leu Asp Tyr
    290                 295                 300

Ser Leu Cys Gln Asn Thr Trp Glu Lys Ile Asp Arg Lys Glu Pro Leu
305                 310                 315                 320

Ser Ala Val Asp Leu Ser Tyr Leu Ala Pro Arg Ser Pro Gly Lys Gly
                325                 330                 335

Met Ala Tyr Ile Val Ala Asn Gly Ser Leu Met Ser Ala Pro Ala Arg
            340                 345                 350

Tyr Ile Arg Val Trp Ile Asp Ser Pro Ile Leu Lys Glu Ile Lys Gly
        355                 360                 365

Lys Lys Glu Ser Ala Ser Gly Ile Asp Thr Val Leu Trp Glu Gln Trp
    370                 375                 380
```

```
Leu Pro Phe Asn Gly Met Glu Leu Gly Pro Asn Gly Leu Ile Lys Thr
385                 390                 395                 400


Lys Ser Gly Tyr Lys Phe Pro Leu Tyr Leu Leu Gly Met Gly Ile Val
                405                 410                 415


Asp Gln Asp Leu Gln Glu Leu Ser Ser Val Asn Pro Val Asp His Pro
            420                 425                 430


His Val Pro Ile Ala Gln Ala Phe Val Ser Glu Gly Glu Glu Val Phe
        435                 440                 445


Phe Gly Asp Thr Gly Val Ser Lys Asn Pro Ile Glu Leu Ile Ser Gly
    450                 455                 460


Trp Phe Ser Asp Trp Lys Glu Thr Ala Ala Ala Leu Gly Phe Ala Ala
465                 470                 475                 480


Ile Ser Val Ile Leu Ile Ile Gly Leu Met Arg Leu Leu Pro Leu Leu
                485                 490                 495


Cys Arg Arg Arg Lys Gln Lys Lys Val Ile Tyr Lys Asp Val Glu Leu
            500                 505                 510


Asn Ser Phe Asp Pro Arg Gln Ala Phe His Arg
        515                 520


<210>  6
<211>  2093
<212>  PRT
<213>  Isfahan Virus

<400>  6

Met Asp Glu Tyr Ser Glu Glu Lys Trp Gly Asp Ser Asp Glu Glu Ser
1               5                   10                  15
```

```
Phe Gly Thr Gly Lys Tyr Ser Asp Glu Ser Arg Ile Arg Gly Leu Asn
            20                  25                  30

Ser Val Asp Tyr Asn Leu Asn Ser Pro Leu Ile Gln Asp Asp Leu Tyr
        35                  40                  45

Tyr Leu Met Glu Arg Val Arg Gly Arg Pro Val Pro Pro Ile Trp Lys
    50                  55                  60

Ala Lys Asn Trp Thr Glu Thr Ile His Leu Val Gln Glu Ser Arg Leu
65                  70                  75                  80

Asp Tyr Leu Pro Thr Gln Lys Leu His Ser Trp Tyr Ala Glu Trp Leu
                85                  90                  95

Met Glu Glu Ser His Asp Ser Ser Gln Gly Leu Ala Phe Leu Lys Glu
            100                 105                 110

Val Asp Lys Asp Ser Leu Glu Thr Tyr Glu Val Val Met Ser Phe Leu
        115                 120                 125

Arg Gly Trp Cys Gly Gly Ala Pro Ala Tyr Lys Lys Lys Glu Gly Arg
    130                 135                 140

His Ile Ala Lys Ile Gly Ser Leu Cys Gln Lys Phe Leu Asp Leu His
145                 150                 155                 160

Arg Val Ile Leu Ile Met Asn Ala Ser Thr Gln Met Glu Leu Ser Asn
                165                 170                 175

Leu Ala Glu Thr Phe Gln Ala Ser Ser Val Ser Lys Lys Ile Ile Thr
            180                 185                 190

Thr Pro Ser Met Gly Lys Met Glu Met Ser Gly Gln Phe Ala Leu Ala
        195                 200                 205
```

```
Tyr Gln Gln Lys Val Ile Leu Asp Arg Asn Phe Leu Leu Met Met Lys
    210                 215                 220

Asp Val Val Ile Gly Arg Met Gln Thr Leu Leu Ser Met Val Ser Arg
225                 230                 235                 240

Thr Asp Asp Lys Phe Ser Asp Gly Asp Ile Ser Tyr Leu Ile Lys Ile
                245                 250                 255

Tyr Gln Leu Gly Asp Lys Ile Ile Gln Ser Leu Gly Asn Asp Gly Tyr
            260                 265                 270

Glu Leu Ile Lys Thr Ile Glu Pro Met Cys Asn Leu Arg Leu Ser Asp
        275                 280                 285

Leu Ala Arg Glu Tyr Arg Pro Leu Ile Pro Glu Phe Pro His Phe Arg
    290                 295                 300

Gln His Ile Glu Gly Thr Val Ser Glu Leu Arg Lys Lys Thr Ala Leu
305                 310                 315                 320

Ile Val Asp Met Phe Lys Met Ile Asp Arg Thr Pro Gly Val Asp Ile
                325                 330                 335

Thr Leu Val Ile Tyr Gly Ser Phe Arg His Trp Gly His Pro Phe Ile
            340                 345                 350

Asp Tyr Phe Ala Gly Leu Thr Lys Leu Asn Ser Gln Val Thr Met Gly
        355                 360                 365

Lys Gln Ile Asp Asp Glu Tyr Val Ala Cys Leu Ala Ser Asp Leu Ala
    370                 375                 380

Arg Ile Val Leu Thr Lys Glu Phe Asn Glu Lys Lys Arg Trp Ser Val
385                 390                 395                 400
```

```
Asn Tyr Asn Leu Val Pro Gln Asp His Pro Phe His Glu His Ile Arg
                405                 410                 415

Asp Asn Thr Trp Pro Thr Pro Ala Val Ile Gln Asp Phe Gly Asp Lys
            420                 425                 430

Trp His Glu Leu Pro Leu Thr Gln Cys Phe Glu Ile Pro Asp Leu Ile
        435                 440                 445

Asp Pro Ser Ile Ile Tyr Ser Asp Lys Ser His Ser Met Asn Arg Gln
    450                 455                 460

Asp Val Leu Asn His Val Lys Arg Lys Pro Asp Gln Pro Ile Pro Ser
465                 470                 475                 480

Arg Lys Val Leu Gln Thr Met Ile Asp Thr Pro Ala Thr Asn Trp Leu
                485                 490                 495

Glu Phe Leu Glu Glu Ile Asp Lys Asn Gly Leu Ser Asp Asp Asp Leu
            500                 505                 510

Val Ile Gly Leu Lys Gly Lys Glu Arg Glu Leu Lys Ile Ala Gly Arg
        515                 520                 525

Phe Phe Ser Leu Met Ser Trp Lys Leu Arg Glu Tyr Phe Val Ile Thr
    530                 535                 540

Glu Tyr Leu Ile Lys Thr His Phe Val Pro Leu Phe His Gly Leu Thr
545                 550                 555                 560

Met Ala Asp Asp Met Thr Ala Val Ile Lys Lys Met Leu Glu Ser Ser
                565                 570                 575

Ser Gly Gln Gly Leu Lys Asp Tyr Ser Ala Val Cys Ile Ala Asn His
            580                 585                 590
```

```
Ile Asp Tyr Glu Lys Trp Asn Asn His Gln Arg Lys Arg Ser Asn Glu
        595                 600                 605

Pro Ile Phe Lys Val Met Gly Gln Phe Leu Gly Phe Pro Asn Leu Ile
    610                 615                 620

Ser Arg Thr His Glu Phe Phe Glu Lys Ser Leu Ile Tyr Tyr Asn Gly
625                 630                 635                 640

Arg Pro Asp Leu Met Lys Val Gln Asp Gly Arg Leu Val Asn Thr Thr
                645                 650                 655

Lys Gln Leu Val Cys Trp Glu Gly Gln Ala Gly Gly Leu Glu Gly Leu
            660                 665                 670

Arg Gln Lys Gly Trp Ser Ile Leu Asn Leu Leu Val Ile Gln Arg Glu
        675                 680                 685

Ser Lys Ile Arg Asn Thr Ala Val Lys Val Leu Ala Gln Gly Asp Asn
    690                 695                 700

Gln Val Ile Cys Thr Gln Tyr Lys Thr Lys Gln His Arg Asn Glu Thr
705                 710                 715                 720

Glu Leu Arg Ser Ala Leu Thr Gln Met Lys Leu Asn Asn Asp Ala Val
                725                 730                 735

Met Lys Ala Ile Glu Ser Gly Thr Asn Lys Leu Gly Leu Leu Ile Asn
            740                 745                 750

Gln Asp Glu Thr Met Gln Ser Ala Asp Tyr Leu Asn Tyr Gly Lys Val
        755                 760                 765

Pro Ile Phe Arg Gly Val Ile Arg Gly Leu Glu Thr Lys Arg Trp Ser
    770                 775                 780
```

```
Arg Val Thr Cys Val Thr Asn Asp Gln Leu Pro Thr Cys Ala Asn Leu
785                 790                 795                 800


Met Ser Ser Val Ser Thr Asn Ala Leu Thr Val Ala His Phe Asp Val
                805                 810                 815


Thr Pro Leu Asn Ala Met Ile Gln Tyr Asn Tyr Phe Gly Asn Phe Ser
            820                 825                 830


Arg Leu Leu Leu Asn Met His Asp Pro Ala Val Arg Cys Ser Leu Phe
        835                 840                 845


Gln Leu Ser Gln Lys His Lys Ile Asp Leu Phe Ser Phe Glu Phe Lys
    850                 855                 860


Val Gly Val Leu Tyr Leu Asp Pro Ser Ile Gly Gly Val Cys Gly Thr
865                 870                 875                 880


Ala Leu Ser Arg Phe Leu Ile Arg Gly Phe Pro Asp Pro Val Thr Glu
                885                 890                 895


Ser Ile Ser Phe Trp Lys Val Ile Tyr Asn Asn Thr Gln Asp Asn Arg
            900                 905                 910


Leu Lys Lys Leu Cys Thr Ala Phe Gly Asn Pro Lys Ile Ala Gln Phe
        915                 920                 925


Arg Tyr Ser His Ile Glu Lys Leu Leu Glu Asp Pro Thr Ser Leu Asn
    930                 935                 940


Ile Ser Met Gly Met Ser Ala Ala Asn Leu Leu Lys Ser Glu Ile Lys
945                 950                 955                 960


Lys Asn Leu Leu Arg Lys Arg Arg Thr Ile Gly Asn Ser Ile Val Arg
                965                 970                 975
```

```
Asp Ala Val Thr Tyr Ile His Ser Glu Asp Glu Lys Ile Arg Ser Tyr
            980                 985                 990


Leu Trp Ser Ile Asn Pro Leu Phe  Pro Arg Phe Leu Ser  Glu Phe Lys
        995                 1000                1005


Ser Gly  Thr Phe Met Gly Val  Ala Ser Ser Val Val  Ser Leu Phe
    1010                1015                1020


Gln Asn  Ser Arg Thr Ile Arg  Asn Val Phe Lys Asp  Tyr Met Ser
    1025                1030                1035


Ser Ala  Ile Asp Glu Leu Ile  Thr Lys Ser Glu Val  Asn Ser Leu
    1040                1045                1050


Glu His  Leu Cys Lys Tyr Lys  Gly Val Arg Asn Phe  Asp Gln Val
    1055                1060                1065


Trp Lys  Cys Ser Ala Ser Gln  Ala Asp Tyr Leu Arg  Arg Leu Ser
    1070                1075                1080


Trp Gly  Arg Lys Val Leu Gly  Thr Thr Ile Pro His  Pro Leu Glu
    1085                1090                1095


Met Leu  Gly Ala Gly Thr Ile  Lys Asn Asn Ser Ser  Thr Cys Cys
    1100                1105                1110


Glu His  Ser Gly Gln Asp Tyr  Ile Ser Val Phe Cys  Pro Lys Gly
    1115                1120                1125


Ile Ser  Asn Val Leu Ile Glu  Arg Gly Pro Met Ala  Ala Tyr Leu
    1130                1135                1140


Gly Ser  Lys Thr Ser Glu Ser  Thr Ser Ile Leu Gln  Pro Trp Glu
    1145                1150                1155
```

```
Lys Glu  Ser Lys Ile Pro Ile  Ile Lys Arg Ala Thr  Arg Leu Arg
    1160                1165                1170

Asp Ala  Ile His Trp Phe Val  Glu Pro Ser Ser Asn  Leu Ala Lys
    1175                1180                1185

Ser Ile  Leu Gln Asn Ile Thr  Ala Leu Thr Gly Glu  Glu Trp Gly
    1190                1195                1200

Ser Ser  Leu Glu Gly Phe Lys  Arg Thr Gly Ser Ala  Leu His Arg
    1205                1210                1215

Phe Thr  Thr Ser Arg Met Ser  His Gly Gly Phe Cys  Ala Gln Ser
    1220                1225                1230

Pro Ala  Ala Leu Thr Arg Met  Met Ala Thr Thr Asp  Thr Met Ser
    1235                1240                1245

Asp Tyr  Ala Lys Asp Asn Tyr  Asp Phe Met Phe Gln  Ala Cys Leu
    1250                1255                1260

Leu Phe  Ser Gln Ile Thr Thr  Ser Val Leu Leu Leu  Glu Thr Thr
    1265                1270                1275

Ile Ser  Asn Thr Val His Phe  His Thr Arg Cys Ile  Asn Cys Val
    1280                1285                1290

Arg Lys  Ile Glu Glu Pro Trp  Leu Glu Ser Pro Ser  Val Leu Gln
    1295                1300                1305

Ser Lys  Asp Val Ser Asn Val  Leu Ala Ser Trp Arg  Asn Gly Gly
    1310                1315                1320

Gly Ser  Trp Gly Glu Gln Leu  His Gln Leu Lys Pro  Leu Lys Gly
    1325                1330                1335
```

```
Asp Trp  Glu Ile Leu Thr Pro  Ala Glu Lys Ser Tyr  His Val Gly
    1340                1345                1350

Arg Thr  Leu Gly Phe Leu Phe  Gly Asp Leu Thr Gly  Gln Ser Ser
    1355                1360                1365

Ile Arg  Ala Asp Asp Ser Ser  Leu Phe Pro Leu Ser  Ile Gln Lys
    1370                1375                1380

Arg Leu  Arg Gly Arg Gly Phe  Leu Arg Gly Val Leu  Asp Gly Leu
    1385                1390                1395

Val Arg  Ala Ser Ala Cys Gln  Val Ile His Arg Arg  Ser Leu Thr
    1400                1405                1410

Gln Leu  Lys Arg Pro Ala Asn  Ala Val Tyr Gly Gly  Leu Ile Phe
    1415                1420                1425

Leu Ile  Asp Lys Ile Ser Ala  Ser Ser Thr Phe Ile  Asn Leu Cys
    1430                1435                1440

Arg Asp  Gly Pro Ile Arg Glu  Glu Leu Ser Ser Ile  Pro His Lys
    1445                1450                1455

Ile Pro  Thr Ser Tyr Pro Thr  Ser Asn Ala Asp Leu  Gly Leu His
    1460                1465                1470

Ile Arg  Asn Tyr Phe Lys Phe  Gln Cys Lys Ser Val  Glu Leu Gly
    1475                1480                1485

Lys Tyr  Gln Ser Asp Leu Glu  Asp Leu Trp Leu Phe  Ser Asp Leu
    1490                1495                1500

Leu Ser  Ser Gly Phe Ala Gly  Pro Tyr Ala Leu Ser  Ser Lys Val
    1505                1510                1515
```

```
Leu Lys  Ser Leu Tyr Lys Pro  Ser Leu Ser Arg Arg  Asp Arg Asn
    1520                1525                1530

Asn Ile  Arg Lys Leu Gly Ala  Leu Ser Arg Leu Leu  Arg Ser His
    1535                1540                1545

Glu Asn  Trp Ser Glu Leu His  Lys Glu Phe Leu Thr  Ser Gln Leu
    1550                1555                1560

Leu Leu  Cys Gln Glu Glu Val  Arg His Ala Cys Lys  Phe Gly Ile
    1565                1570                1575

Pro Lys  Asn Val Ser Ala Lys  Ser Ser Met Val Trp  Gly Lys Glu
    1580                1585                1590

Ala Val  Ser Tyr Val Leu Asp  Ile Pro Val Glu Phe  Thr Ser Gln
    1595                1600                1605

Lys Gln  Thr Lys His Leu Asn  Ala Cys Pro Arg Ile  Gln Asp Pro
    1610                1615                1620

Thr Ile  Ser Gly Leu Arg Leu  Gly Gln Leu Pro Thr  Gly Ala His
    1625                1630                1635

Tyr Lys  Ile Arg Thr Ile Leu  Asn Ala Tyr Asn Ile  Lys Cys Arg
    1640                1645                1650

Asp Val  Leu Cys Gly Gly Asp  Gly Ser Gly Gly Met  Thr Ala Ala
    1655                1660                1665

Cys Leu  Arg Tyr Tyr Ser Asn  Ser Arg Ala Ile Phe  Asn Ser Ile
    1670                1675                1680

Leu Glu  Phe Asp Gly Ser Ser  Met Lys Gly Ser Ser  Pro Asp Pro
    1685                1690                1695
```

```
Pro Ser  Ala Leu Glu Thr Val  Asp Gln Gly Met Val  Arg Cys Val
    1700                1705                1710

Asn Ala  Thr Thr Cys Trp Glu  Asn Pro Ser Asp Leu  Ser Gln Glu
    1715                1720                1725

Arg Thr  Trp Asp Tyr Phe Leu  His Leu Lys Lys Ser  Phe Asn Met
    1730                1735                1740

Lys Ile  Asp Leu Ile Ile Leu  Asp Met Glu Val Arg  Asp Phe Gln
    1745                1750                1755

Ile Ser  Lys Leu Ile Glu Gly  Asn Leu Arg Leu Lys  Ile Ser Lys
    1760                1765                1770

Leu Leu  Glu Lys Asn Gly Thr  Leu Ile Tyr Lys Thr  Tyr Gly Thr
    1775                1780                1785

Ile Ile  Cys Ser Glu Thr Ser  Asn Val Leu Thr Thr  Leu Gly Pro
    1790                1795                1800

Leu Phe  His Ser Val Tyr Ile  Val Gln Thr Gly Tyr  Ser Ser Ser
    1805                1810                1815

Phe Thr  Ser Glu Val Tyr Val  Leu Phe Ser Lys Gln  Lys Ser Phe
    1820                1825                1830

Val Asp  Ser Pro Tyr Val Asp  Trp Gly Ser Leu Gln  Tyr Asn Trp
    1835                1840                1845

Glu Lys  Leu Ala Cys Phe Arg  Asn Pro Arg Gln Glu  Phe Lys Arg
    1850                1855                1860

Ala Leu  Arg Ile Arg Ser Ser  Arg Ser Leu Met Gly  Ile Pro Ser
    1865                1870                1875
```

```
Ser Phe  Leu Pro Asp Pro Leu  Val Asn Leu Glu Thr  Leu Leu Gln
    1880                1885                1890

Ile Ser  Gly Val Pro Ser Gly  Val Ser His Gln Leu  Val Thr Asp
    1895                1900                1905

Val Lys  Ser Ser Gly Ala Ser  Gly Leu Ser Ser Ala  Ile Gly Leu
    1910                1915                1920

Leu Gly  Leu Ile Ser His Phe  Thr Leu Asp Val Thr  Lys Leu Tyr
    1925                1930                1935

Val Gln  Glu Tyr Arg Pro Pro  Ser Asp Asn Arg Leu  Ile Lys Met
    1940                1945                1950

Ala Ser  Ala Ile Thr Gly Ile  Ser Tyr Trp Ile Ser  Ile Ala Tyr
    1955                1960                1965

His Asp  Gln Gln Leu Asn Gln  Ala Leu Thr Ser Val  Ile Lys Lys
    1970                1975                1980

Ser Phe  Pro Ile Arg Trp Gly  Leu Ile Asn His Arg  Leu His Trp
    1985                1990                1995

Ser Val  Ser Asp Arg Phe His  Arg Ser Lys Asp Val  Arg Leu Ser
    2000                2005                2010

Asp Cys  Leu Ala Gly Ile Gly  Asn Trp Ile Arg Gly  Met Glu Leu
    2015                2020                2025

Met Lys  Leu Pro Ala Gly Met  Phe Ser His Lys Glu  Val Asn Met
    2030                2035                2040

Ile Leu  Ser Lys Tyr Ile Arg  Gly Leu Asn Tyr His  Thr Ile Ser
    2045                2050                2055
```

Ser Arg Thr Gly Ile Leu Glu Ile Leu Lys Ser Gln Phe Ser Ile
2060 2065 2070

Ile Asp Arg Ser Leu Met Thr Ile Thr Thr Asp Asn Ile Gln Ser
2075 2080 2085

Ser Asp Trp Thr Asp
2090

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<212> DNA
<213> Vesicular stomatitis virus

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gcaaatgagg atccagtgga atacccggca gattacttca gaaaatcaaa ggagattcct 180

ctttacatca atactacaaa aagtttgtca gatctaagag gatatgtcta ccaaggcctc 240

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atccggggta agttggataa agattggtca agtttcggaa taaacatcgg gaaagcaggg 360

gatacaatcg gaatatttga ccttgtatcc ttgaaagccc tggacggcgt acttccagat 420

ggagtatcgg atgcttccag aaccagcgca gatgacaaat ggttgccttt gtatctactt 480

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<210> 8
<211> 422
<212> PRT
<213> Vesicular stomatitis virus

<400> 8

Met Ser Val Thr Val Lys Arg Ile Ile Asp Asn Thr Val Ile Val Pro
1 5 10 15

Lys Leu Pro Ala Asn Glu Asp Pro Val Glu Tyr Pro Ala Asp Tyr Phe
20 25 30

Arg Lys Ser Lys Glu Ile Pro Leu Tyr Ile Asn Thr Thr Lys Ser Leu
35 40 45

Ser Asp Leu Arg Gly Tyr Val Tyr Gln Gly Leu Lys Ser Gly Asn Val
50 55 60

Ser Ile Ile His Val Asn Ser Tyr Leu Tyr Gly Ala Leu Lys Asp Ile
65 70 75 80

Arg Gly Lys Leu Asp Lys Asp Trp Ser Ser Phe Gly Ile Asn Ile Gly
85 90 95

Lys Ala Gly Asp Thr Ile Gly Ile Phe Asp Leu Val Ser Leu Lys Ala
100 105 110

Leu Asp Gly Val Leu Pro Asp Gly Val Ser Asp Ala Ser Arg Thr Ser
115 120 125

```
Ala Asp Asp Lys Trp Leu Pro Leu Tyr Leu Leu Gly Leu Tyr Arg Val
    130                 135                 140

Gly Arg Thr Gln Met Pro Glu Tyr Arg Lys Lys Leu Met Asp Gly Leu
145                 150                 155                 160

Thr Asn Gln Cys Lys Met Ile Asn Glu Gln Phe Glu Pro Leu Val Pro
                165                 170                 175

Glu Gly Arg Asp Ile Phe Asp Val Trp Gly Asn Asp Ser Asn Tyr Thr
            180                 185                 190

Lys Ile Val Ala Ala Val Asp Met Phe Phe His Met Phe Lys Lys His
        195                 200                 205

Glu Cys Ala Ser Phe Arg Tyr Gly Thr Ile Val Ser Arg Phe Lys Asp
    210                 215                 220

Cys Ala Ala Leu Ala Thr Phe Gly His Leu Cys Lys Ile Thr Gly Met
225                 230                 235                 240

Ser Thr Glu Asp Val Thr Thr Trp Ile Leu Asn Arg Glu Val Ala Asp
                245                 250                 255

Glu Met Val Gln Met Met Leu Pro Gly Gln Glu Ile Asp Lys Ala Asp
            260                 265                 270

Ser Tyr Met Pro Tyr Leu Ile Asp Phe Gly Leu Ser Ser Lys Ser Pro
        275                 280                 285

Tyr Ser Ser Val Lys Asn Pro Ala Phe His Phe Trp Gly Gln Leu Thr
    290                 295                 300

Ala Leu Leu Leu Arg Ser Thr Arg Ala Arg Asn Ala Arg Gln Pro Asp
305                 310                 315                 320
```

```
Asp Ile Glu Tyr Thr Ser Leu Thr Thr Ala Gly Leu Leu Tyr Ala Tyr
                325                 330                 335

Ala Val Gly Ser Ser Ala Asp Leu Ala Gln Gln Phe Cys Val Gly Asp
            340                 345                 350

Asn Lys Tyr Thr Pro Asp Asp Ser Thr Gly Gly Leu Thr Thr Asn Ala
        355                 360                 365

Pro Pro Gln Gly Arg Asp Val Val Glu Trp Leu Gly Trp Phe Glu Asp
    370                 375                 380

Gln Asn Arg Lys Pro Thr Pro Asp Met Met Gln Tyr Ala Lys Arg Ala
385                 390                 395                 400

Val Met Ser Leu Gln Gly Leu Arg Glu Lys Thr Ile Gly Lys Tyr Ala
                405                 410                 415

Lys Ser Glu Phe Asp Lys
            420
```

<210> 9
<211> 265
<212> PRT
<213> Vesicular stomatitis virus

<400> 9

```
Met Asp Asn Leu Thr Lys Val Arg Glu Tyr Leu Lys Ser Tyr Ser Arg
1               5                   10                  15

Leu Asp Gln Ala Val Gly Glu Ile Asp Glu Ile Glu Ala Gln Arg Ala
            20                  25                  30

Glu Lys Ser Asn Tyr Glu Leu Phe Gln Glu Asp Gly Val Glu Glu His
        35                  40                  45
```

```
Thr Lys Pro Ser Tyr Phe Gln Ala Ala Asp Asp Ser Asp Thr Glu Ser
    50                  55                  60

Glu Pro Glu Ile Glu Asp Asn Gln Gly Leu Tyr Ala Gln Asp Pro Glu
65                  70                  75                  80

Ala Glu Gln Val Glu Gly Phe Ile Gln Gly Pro Leu Asp Asp Tyr Ala
                85                  90                  95

Asp Glu Glu Val Asp Val Val Phe Thr Ser Asp Trp Lys Pro Pro Glu
            100                 105                 110

Leu Glu Ser Asp Glu His Gly Lys Thr Leu Arg Leu Thr Ser Pro Glu
        115                 120                 125

Gly Leu Ser Gly Glu Gln Lys Ser Gln Trp Leu Ser Thr Ile Lys Ala
    130                 135                 140

Val Val Gln Ser Ala Lys Tyr Trp Asn Leu Ala Glu Cys Thr Phe Glu
145                 150                 155                 160

Ala Ser Gly Glu Gly Val Ile Met Lys Glu Arg Gln Ile Thr Pro Asp
                165                 170                 175

Val Tyr Lys Val Thr Pro Val Met Asn Thr His Pro Ser Gln Ser Glu
            180                 185                 190

Ala Val Ser Asp Val Trp Ser Leu Ser Lys Thr Ser Met Thr Phe Gln
        195                 200                 205

Pro Lys Lys Ala Ser Leu Gln Pro Leu Thr Ile Ser Leu Asp Glu Leu
    210                 215                 220

Phe Ser Ser Arg Gly Glu Phe Ile Ser Val Gly Gly Asp Gly Arg Met
225                 230                 235                 240
```

Ser His Lys Glu Ala Ile Leu Leu Gly Leu Arg Tyr Lys Lys Leu Tyr
245 250 255

Asn Gln Ala Arg Val Lys Tyr Ser Leu
260 265

<210> 10
<211> 229
<212> PRT
<213> Vesicular stomatitis virus

<400> 10

Met Ser Ser Leu Lys Lys Ile Leu Gly Leu Lys Gly Lys Gly Lys Lys
1 5 10 15

Ser Lys Lys Leu Gly Ile Ala Pro Pro Pro Tyr Glu Glu Asp Thr Ser
20 25 30

Met Glu Tyr Ala Pro Ser Ala Pro Ile Asp Lys Ser Tyr Phe Gly Val
35 40 45

Asp Glu Met Asp Thr Tyr Asp Pro Asn Gln Leu Arg Tyr Glu Lys Phe
50 55 60

Phe Phe Thr Val Lys Met Thr Val Arg Ser Asn Arg Pro Phe Arg Thr
65 70 75 80

Tyr Ser Asp Val Ala Ala Ala Val Ser His Trp Asp His Met Tyr Ile
85 90 95

Gly Met Ala Gly Lys Arg Pro Phe Tyr Lys Ile Leu Ala Phe Leu Gly
100 105 110

Ser Ser Asn Leu Lys Ala Thr Pro Ala Val Leu Ala Asp Gln Gly Gln
115 120 125

Pro Glu Tyr His Thr His Cys Glu Gly Arg Ala Tyr Leu Pro His Arg

130 135 140

Met Gly Lys Thr Pro Pro Met Leu Asn Val Pro Glu His Phe Arg Arg
145 150 155 160

Pro Phe Asn Ile Gly Leu Tyr Lys Gly Thr Ile Glu Leu Thr Met Thr
165 170 175

Ile Tyr Asp Asp Glu Ser Leu Glu Ala Ala Pro Met Ile Trp Asp His
180 185 190

Phe Asn Ser Ser Lys Phe Ser Asp Phe Arg Glu Lys Ala Leu Met Phe
195 200 205

Gly Leu Ile Val Glu Lys Lys Ala Ser Gly Ala Trp Val Leu Asp Ser
210 215 220

Ile Ser His Phe Lys
225

<210> 11
<211> 511
<212> PRT
<213> Vesicular stomatitis virus

<400> 11

Met Lys Cys Leu Leu Tyr Leu Ala Phe Leu Phe Ile Gly Val Asn Cys
1 5 10 15

Lys Phe Thr Ile Val Phe Pro His Asn Gln Lys Gly Asn Trp Lys Asn
20 25 30

Val Pro Ser Asn Tyr His Tyr Cys Pro Ser Ser Ser Asp Leu Asn Trp
35 40 45

His Asn Asp Leu Ile Gly Thr Ala Ile Gln Val Lys Met Pro Lys Ser
50 55 60

```
His Lys Ala Ile Gln Ala Asp Gly Trp Met Cys His Ala Ser Lys Trp
65                  70                  75                  80

Val Thr Thr Cys Asp Phe Arg Trp Tyr Gly Pro Lys Tyr Ile Thr Gln
                85                  90                  95

Ser Ile Arg Ser Phe Thr Pro Ser Val Glu Gln Cys Lys Glu Ser Ile
            100                 105                 110

Glu Gln Thr Lys Gln Gly Thr Trp Leu Asn Pro Gly Phe Pro Pro Gln
        115                 120                 125

Ser Cys Gly Tyr Ala Thr Val Thr Asp Ala Glu Ala Val Ile Val Gln
    130                 135                 140

Val Thr Pro His His Val Leu Val Asp Glu Tyr Thr Gly Glu Trp Val
145                 150                 155                 160

Asp Ser Gln Phe Ile Asn Gly Lys Cys Ser Asn Tyr Ile Cys Pro Thr
                165                 170                 175

Val His Asn Ser Thr Thr Trp His Ser Asp Tyr Lys Val Lys Gly Leu
            180                 185                 190

Cys Asp Ser Asn Leu Ile Ser Met Asp Ile Thr Phe Phe Ser Glu Asp
        195                 200                 205

Gly Glu Leu Ser Ser Leu Gly Lys Glu Gly Thr Gly Phe Arg Ser Asn
    210                 215                 220

Tyr Phe Ala Tyr Glu Thr Gly Gly Lys Ala Cys Lys Met Gln Tyr Cys
225                 230                 235                 240

Lys His Trp Gly Val Arg Leu Pro Ser Gly Val Trp Phe Glu Met Ala
                245                 250                 255
```

```
Asp Lys Asp Leu Phe Ala Ala Ala Arg Phe Pro Glu Cys Pro Glu Gly
            260                 265                 270

Ser Ser Ile Ser Ala Pro Ser Gln Thr Ser Val Asp Val Ser Leu Ile
        275                 280                 285

Gln Asp Val Glu Arg Ile Leu Asp Tyr Ser Leu Cys Gln Glu Thr Trp
    290                 295                 300

Ser Lys Ile Arg Ala Gly Leu Pro Ile Ser Pro Val Asp Leu Ser Tyr
305                 310                 315                 320

Leu Ala Pro Lys Asn Pro Gly Thr Gly Pro Ala Phe Thr Ile Ile Asn
                325                 330                 335

Gly Thr Leu Lys Tyr Phe Glu Thr Arg Tyr Ile Arg Val Asp Ile Ala
            340                 345                 350

Ala Pro Ile Leu Ser Arg Met Val Gly Met Ile Ser Gly Thr Thr Thr
        355                 360                 365

Glu Arg Glu Leu Trp Asp Asp Trp Ala Pro Tyr Glu Asp Val Glu Ile
    370                 375                 380

Gly Pro Asn Gly Val Leu Arg Thr Ser Ser Gly Tyr Lys Phe Pro Leu
385                 390                 395                 400

Tyr Met Ile Gly His Gly Met Leu Asp Ser Asp Leu His Leu Ser Ser
                405                 410                 415

Lys Ala Gln Val Phe Glu His Pro His Ile Gln Asp Ala Ala Ser Gln
            420                 425                 430

Leu Pro Asp Asp Glu Ser Leu Phe Phe Gly Asp Thr Gly Leu Ser Lys
        435                 440                 445
```

```
Asn Pro Ile Glu Leu Val Glu Gly Trp Phe Ser Ser Trp Lys Ser Ser
    450                 455                 460

Ile Ala Ser Phe Phe Phe Ile Ile Gly Leu Ile Ile Gly Leu Phe Leu
465                 470                 475                 480

Val Leu Arg Val Gly Ile His Leu Cys Ile Lys Leu Lys His Thr Lys
                485                 490                 495

Lys Arg Gln Ile Tyr Thr Asp Ile Glu Met Asn Arg Leu Gly Lys
            500                 505                 510
```

<210> 12
<211> 2109
<212> PRT
<213> Vesicular stomatitis virus

<400> 12

```
Met Glu Val His Asp Phe Glu Thr Asp Glu Phe Asn Asp Phe Asn Glu
1               5                   10                  15

Asp Asp Tyr Ala Thr Arg Glu Phe Leu Asn Pro Asp Glu Arg Met Thr
            20                  25                  30

Tyr Leu Asn His Ala Asp Tyr Asn Leu Asn Ser Pro Leu Ile Ser Asp
        35                  40                  45

Asp Ile Asp Asn Leu Ile Arg Lys Phe Asn Ser Leu Pro Ile Pro Ser
    50                  55                  60

Met Trp Asp Ser Lys Asn Trp Asp Gly Val Leu Glu Met Leu Thr Ser
65                  70                  75                  80

Cys Gln Ala Asn Pro Ile Ser Thr Ser Gln Met His Lys Trp Met Gly
                85                  90                  95
```

```
Ser Trp Leu Met Ser Asp Asn His Asp Ala Ser Gln Gly Tyr Ser Phe
            100                 105                 110

Leu His Glu Val Asp Lys Glu Ala Glu Ile Thr Phe Asp Val Val Glu
        115                 120                 125

Thr Phe Ile Arg Gly Trp Gly Asn Lys Pro Ile Glu Tyr Ile Lys Lys
    130                 135                 140

Glu Arg Trp Thr Asp Ser Phe Lys Ile Leu Ala Tyr Leu Cys Gln Lys
145                 150                 155                 160

Phe Leu Asp Leu His Lys Leu Thr Leu Ile Leu Asn Ala Val Ser Glu
                165                 170                 175

Val Glu Leu Leu Asn Leu Ala Arg Thr Phe Lys Gly Lys Val Arg Arg
            180                 185                 190

Ser Ser His Gly Thr Asn Ile Cys Arg Ile Arg Val Pro Ser Leu Gly
        195                 200                 205

Pro Thr Phe Ile Ser Glu Gly Trp Ala Tyr Phe Lys Lys Leu Asp Ile
    210                 215                 220

Leu Met Asp Arg Asn Phe Leu Leu Met Val Lys Asp Val Ile Ile Gly
225                 230                 235                 240

Arg Met Gln Thr Val Leu Ser Met Val Cys Arg Ile Asp Asn Leu Phe
                245                 250                 255

Ser Glu Gln Asp Ile Phe Ser Leu Leu Asn Ile Tyr Arg Ile Gly Asp
            260                 265                 270

Lys Ile Val Glu Arg Gln Gly Asn Phe Ser Tyr Asp Leu Ile Lys Met
        275                 280                 285
```

```
Val Glu Pro Ile Cys Asn Leu Lys Leu Met Lys Leu Ala Arg Glu Ser
    290                 295                 300

Arg Pro Leu Val Pro Gln Phe Pro His Phe Glu Asn His Ile Lys Thr
305                 310                 315                 320

Ser Val Asp Glu Gly Ala Lys Ile Asp Arg Gly Ile Arg Phe Leu His
                325                 330                 335

Asp Gln Ile Met Ser Val Lys Thr Val Asp Leu Thr Leu Val Ile Tyr
            340                 345                 350

Gly Ser Phe Arg His Trp Gly His Pro Phe Ile Asp Tyr Tyr Thr Gly
        355                 360                 365

Leu Glu Lys Leu His Ser Gln Val Thr Met Lys Lys Asp Ile Asp Val
    370                 375                 380

Ser Tyr Ala Lys Ala Leu Ala Ser Asp Leu Ala Arg Ile Val Leu Phe
385                 390                 395                 400

Gln Gln Phe Asn Asp His Lys Lys Trp Phe Val Asn Gly Asp Leu Leu
                405                 410                 415

Pro His Asp His Pro Phe Lys Ser His Val Lys Glu Asn Thr Trp Pro
            420                 425                 430

Thr Ala Ala Gln Val Gln Asp Phe Gly Asp Lys Trp His Glu Leu Pro
        435                 440                 445

Leu Ile Lys Cys Phe Glu Ile Pro Asp Leu Leu Asp Pro Ser Ile Ile
    450                 455                 460

Tyr Ser Asp Lys Ser His Ser Met Asn Arg Ser Glu Val Leu Lys His
465                 470                 475                 480
```

```
Val Arg Met Asn Pro Asn Thr Pro Ile Pro Ser Lys Lys Val Leu Gln
                485                 490                 495

Thr Met Leu Asp Thr Lys Ala Thr Asn Trp Lys Glu Phe Leu Lys Glu
            500                 505                 510

Ile Asp Glu Lys Gly Leu Asp Asp Asp Asp Leu Ile Ile Gly Leu Lys
        515                 520                 525

Gly Lys Glu Arg Glu Leu Lys Leu Ala Gly Arg Phe Phe Ser Leu Met
    530                 535                 540

Ser Trp Lys Leu Arg Glu Tyr Phe Val Ile Thr Glu Tyr Leu Ile Lys
545                 550                 555                 560

Thr His Phe Val Pro Met Phe Lys Gly Leu Thr Met Ala Asp Asp Leu
                565                 570                 575

Thr Ala Val Ile Lys Lys Met Leu Asp Ser Ser Ser Gly Gln Gly Leu
            580                 585                 590

Lys Ser Tyr Glu Ala Ile Cys Ile Ala Asn His Ile Asp Tyr Glu Lys
        595                 600                 605

Trp Asn Asn His Gln Arg Lys Leu Ser Asn Gly Pro Val Phe Arg Val
    610                 615                 620

Met Gly Gln Phe Leu Gly Tyr Pro Ser Leu Ile Glu Arg Thr His Glu
625                 630                 635                 640

Phe Phe Glu Lys Ser Leu Ile Tyr Tyr Asn Gly Arg Pro Asp Leu Met
                645                 650                 655

Arg Val His Asn Asn Thr Leu Ile Asn Ser Thr Ser Gln Arg Val Cys
            660                 665                 670
```

```
Trp Gln Gly Gln Glu Gly Gly Leu Glu Gly Leu Arg Gln Lys Gly Trp
        675                 680                 685

Thr Ile Leu Asn Leu Leu Val Ile Gln Arg Glu Ala Lys Ile Arg Asn
    690                 695                 700

Thr Ala Val Lys Val Leu Ala Gln Gly Asp Asn Gln Val Ile Cys Thr
705                 710                 715                 720

Gln Tyr Lys Thr Lys Lys Ser Arg Asn Val Val Glu Leu Gln Gly Ala
                725                 730                 735

Leu Asn Gln Met Val Ser Asn Asn Glu Lys Ile Met Thr Ala Ile Lys
            740                 745                 750

Ile Gly Thr Gly Lys Leu Gly Leu Leu Ile Asn Asp Asp Glu Thr Met
        755                 760                 765

Gln Ser Ala Asp Tyr Leu Asn Tyr Gly Lys Ile Pro Ile Phe Arg Gly
    770                 775                 780

Val Ile Arg Gly Leu Glu Thr Lys Arg Trp Ser Arg Val Thr Cys Val
785                 790                 795                 800

Thr Asn Asp Gln Ile Pro Thr Cys Ala Asn Ile Met Ser Ser Val Ser
                805                 810                 815

Thr Asn Ala Leu Thr Val Ala His Phe Ala Glu Asn Pro Ile Asn Ala
            820                 825                 830

Met Ile Gln Tyr Asn Tyr Phe Gly Thr Phe Ala Arg Leu Leu Leu Met
        835                 840                 845

Met His Asp Pro Ala Leu Arg Gln Ser Leu Tyr Glu Val Gln Asp Lys
    850                 855                 860
```

```
Ile Pro Gly Leu His Ser Ser Thr Phe Lys Tyr Ala Met Leu Tyr Leu
865                 870                 875                 880


Asp Pro Ser Ile Gly Gly Val Ser Gly Met Ser Leu Ser Arg Phe Leu
                885                 890                 895


Ile Arg Ala Phe Pro Asp Pro Val Thr Glu Ser Leu Ser Phe Trp Arg
            900                 905                 910


Phe Ile His Val His Ala Arg Ser Glu His Leu Lys Glu Met Ser Ala
        915                 920                 925


Val Phe Gly Asn Pro Glu Ile Ala Lys Phe Arg Ile Thr His Ile Asp
    930                 935                 940


Lys Leu Val Glu Asp Pro Thr Ser Leu Asn Ile Ala Met Gly Met Ser
945                 950                 955                 960


Pro Ala Asn Leu Leu Lys Thr Glu Val Lys Lys Cys Leu Ile Glu Ser
                965                 970                 975


Arg Gln Thr Ile Arg Asn Gln Val Ile Lys Asp Ala Thr Ile Tyr Leu
            980                 985                 990


Tyr His Glu Glu Asp Arg Leu Arg  Ser Phe Leu Trp Ser  Ile Asn Pro
        995                 1000                1005


Leu Phe  Pro Arg Phe Leu Ser  Glu Phe Lys Ser Gly  Thr Phe Leu
    1010                1015                1020


Gly Val  Ala Asp Gly Leu Ile  Ser Leu Phe Gln Asn  Ser Arg Thr
    1025                1030                1035


Ile Arg  Asn Ser Phe Lys Lys  Lys Tyr His Arg Glu  Leu Asp Asp
    1040                1045                1050
```

```
Leu Ile  Val Arg Ser Glu Val  Ser Ser Leu Thr His  Leu Gly Lys
    1055                1060                1065

Leu His  Leu Arg Arg Gly Ser  Cys Lys Met Trp Thr  Cys Ser Ala
    1070                1075                1080

Thr His  Ala Asp Thr Leu Arg  Tyr Lys Ser Trp Gly  Arg Thr Val
    1085                1090                1095

Ile Gly  Thr Thr Val Pro His  Pro Leu Glu Met Leu  Gly Pro Gln
    1100                1105                1110

His Arg  Lys Glu Thr Pro Cys  Ala Pro Cys Asn Thr  Ser Gly Phe
    1115                1120                1125

Asn Tyr  Val Ser Val His Cys  Pro Asp Gly Ile His  Asp Val Phe
    1130                1135                1140

Ser Ser  Arg Gly Pro Leu Pro  Ala Tyr Leu Gly Ser  Lys Thr Ser
    1145                1150                1155

Glu Ser  Thr Ser Ile Leu Gln  Pro Trp Glu Arg Glu  Ser Lys Val
    1160                1165                1170

Pro Leu  Ile Lys Arg Ala Thr  Arg Leu Arg Asp Ala  Ile Ser Trp
    1175                1180                1185

Phe Val  Glu Pro Asp Ser Lys  Leu Ala Met Thr Ile  Leu Ser Asn
    1190                1195                1200

Ile His  Ser Leu Thr Gly Glu  Glu Trp Thr Lys Arg  Gln His Gly
    1205                1210                1215

Phe Lys  Arg Thr Gly Ser Ala  Leu His Arg Phe Ser  Thr Ser Arg
    1220                1225                1230
```

```
Met Ser  His Gly Gly Phe Ala  Ser Gln Ser Thr Ala  Ala Leu Thr
    1235                1240                1245

Arg Leu  Met Ala Thr Thr Asp  Thr Met Arg Asp Leu  Gly Asp Gln
    1250                1255                1260

Asn Phe  Asp Phe Leu Phe Gln  Ala Thr Leu Leu Tyr  Ala Gln Ile
    1265                1270                1275

Thr Thr  Thr Val Ala Arg Asp  Gly Trp Ile Thr Ser  Cys Thr Asp
    1280                1285                1290

His Tyr  His Ile Ala Cys Lys  Ser Cys Leu Arg Pro  Ile Glu Glu
    1295                1300                1305

Ile Thr  Leu Asp Ser Ser Met  Asp Tyr Thr Pro Pro  Asp Val Ser
    1310                1315                1320

His Val  Leu Lys Thr Trp Arg  Asn Gly Glu Gly Ser  Trp Gly Gln
    1325                1330                1335

Glu Ile  Lys Gln Ile Tyr Pro  Leu Glu Gly Asn Trp  Lys Asn Leu
    1340                1345                1350

Ala Pro  Ala Glu Gln Ser Tyr  Gln Val Gly Arg Cys  Ile Gly Phe
    1355                1360                1365

Leu Tyr  Gly Asp Leu Ala Tyr  Arg Lys Ser Thr His  Ala Glu Asp
    1370                1375                1380

Ser Ser  Leu Phe Pro Leu Ser  Ile Gln Gly Arg Ile  Arg Gly Arg
    1385                1390                1395

Gly Phe  Leu Lys Gly Leu Leu  Asp Gly Leu Met Arg  Ala Ser Cys
    1400                1405                1410
```

```
Cys Gln  Val Ile His Arg Arg  Ser Leu Ala His Leu  Lys Arg Pro
    1415                 1420                 1425

Ala Asn  Ala Val Tyr Gly Gly  Leu Ile Tyr Leu Ile  Asp Lys Leu
    1430                 1435                 1440

Ser Val  Ser Pro Pro Phe Leu  Ser Leu Thr Arg Ser  Gly Pro Ile
    1445                 1450                 1455

Arg Asp  Glu Leu Glu Thr Ile  Pro His Lys Ile Pro  Thr Ser Tyr
    1460                 1465                 1470

Pro Thr  Ser Asn Arg Asp Met  Gly Val Ile Val Arg  Asn Tyr Phe
    1475                 1480                 1485

Lys Tyr  Gln Cys Arg Leu Ile  Glu Lys Gly Lys Tyr  Arg Ser His
    1490                 1495                 1500

Tyr Ser  Gln Leu Trp Leu Phe  Ser Asp Val Leu Ser  Ile Asp Phe
    1505                 1510                 1515

Ile Gly  Pro Phe Ser Ile Ser  Thr Thr Leu Leu Gln  Ile Leu Tyr
    1520                 1525                 1530

Lys Pro  Phe Leu Ser Gly Lys  Asp Lys Asn Glu Leu  Arg Glu Leu
    1535                 1540                 1545

Ala Asn  Leu Ser Ser Leu Leu  Arg Ser Gly Glu Gly  Trp Glu Asp
    1550                 1555                 1560

Ile His  Val Lys Phe Phe Thr  Lys Asp Ile Leu Leu  Cys Pro Glu
    1565                 1570                 1575

Glu Ile  Arg His Ala Cys Lys  Phe Gly Ile Ala Lys  Asp Asn Asn
    1580                 1585                 1590
```

```
Lys Asp  Met Ser Tyr Pro Pro  Trp Gly Arg Glu Ser  Arg Gly Thr
    1595                1600                1605

Ile Thr  Thr Ile Pro Val Tyr  Tyr Thr Thr Thr Pro  Tyr Pro Lys
    1610                1615                1620

Met Leu  Glu Met Pro Pro Arg  Ile Gln Asn Pro Leu  Leu Ser Gly
    1625                1630                1635

Ile Arg  Leu Gly Gln Leu Pro  Thr Gly Ala His Tyr  Lys Ile Arg
    1640                1645                1650

Ser Ile  Leu His Gly Met Gly  Ile His Tyr Arg Asp  Phe Leu Ser
    1655                1660                1665

Cys Gly  Asp Gly Ser Gly Gly  Met Thr Ala Ala Leu  Leu Arg Glu
    1670                1675                1680

Asn Val  His Ser Arg Gly Ile  Phe Asn Ser Leu Leu  Glu Leu Ser
    1685                1690                1695

Gly Ser  Val Met Arg Gly Ala  Ser Pro Glu Pro Pro  Ser Ala Leu
    1700                1705                1710

Glu Thr  Leu Gly Gly Asp Lys  Ser Arg Cys Val Asn  Gly Glu Thr
    1715                1720                1725

Cys Trp  Glu Tyr Pro Ser Asp  Leu Cys Asp Pro Arg  Thr Trp Asp
    1730                1735                1740

Tyr Phe  Leu Arg Leu Lys Ala  Gly Leu Gly Leu Gln  Ile Asp Leu
    1745                1750                1755

Ile Val  Met Asp Met Glu Val  Arg Asp Ser Ser Thr  Ser Leu Lys
    1760                1765                1770
```

```
Ile Glu  Thr Asn Val Arg Asn  Tyr Val His Arg Ile  Leu Asp Glu
    1775                1780                1785

Gln Gly  Val Leu Ile Tyr Lys  Thr Tyr Gly Thr Tyr  Ile Cys Glu
    1790                1795                1800

Ser Glu  Lys Asn Ala Val Thr  Ile Leu Gly Pro Met  Phe Lys Thr
    1805                1810                1815

Val Asp  Leu Val Gln Thr Glu  Phe Ser Ser Ser Gln  Thr Ser Glu
    1820                1825                1830

Val Tyr  Met Val Cys Lys Gly  Leu Lys Lys Leu Ile  Asp Glu Pro
    1835                1840                1845

Asn Pro  Asp Trp Ser Ser Ile  Asn Glu Ser Trp Lys  Asn Leu Tyr
    1850                1855                1860

Ala Phe  Gln Ser Ser Glu Gln  Glu Phe Ala Arg Ala  Lys Lys Val
    1865                1870                1875

Ser Thr  Tyr Phe Thr Leu Thr  Gly Ile Pro Ser Gln  Phe Ile Pro
    1880                1885                1890

Asp Pro  Phe Val Asn Ile Glu  Thr Met Leu Gln Ile  Phe Gly Val
    1895                1900                1905

Pro Thr  Gly Val Ser His Ala  Ala Ala Leu Lys Ser  Ser Asp Arg
    1910                1915                1920

Pro Ala  Asp Leu Leu Thr Ile  Ser Leu Phe Tyr Met  Ala Ile Ile
    1925                1930                1935

Ser Tyr  Tyr Asn Ile Asn His  Ile Arg Val Gly Pro  Ile Pro Pro
    1940                1945                1950
```

```
Asn Pro  Pro Ser Asp Gly Ile  Ala Gln Asn Val Gly  Ile Ala Ile
    1955                1960                1965

Thr Gly  Ile Ser Phe Trp Leu  Ser Leu Met Glu Lys  Asp Ile Pro
    1970                1975                1980

Leu Tyr  Gln Gln Cys Leu Ala  Val Ile Gln Gln Ser  Phe Pro Ile
    1985                1990                1995

Arg Trp  Glu Ala Val Ser Val  Lys Gly Gly Tyr Lys  Gln Lys Trp
    2000                2005                2010

Ser Thr  Arg Gly Asp Gly Leu  Pro Lys Asp Thr Arg  Thr Ser Asp
    2015                2020                2025

Ser Leu  Ala Pro Ile Gly Asn  Trp Ile Arg Ser Leu  Glu Leu Val
    2030                2035                2040

Arg Asn  Gln Val Arg Leu Asn  Pro Phe Asn Glu Ile  Leu Phe Asn
    2045                2050                2055

Gln Leu  Cys Arg Thr Val Asp  Asn His Leu Lys Trp  Ser Asn Leu
    2060                2065                2070

Arg Arg  Asn Thr Gly Met Ile  Glu Trp Ile Asn Arg  Arg Ile Ser
    2075                2080                2085

Lys Glu  Asp Arg Ser Ile Leu  Met Leu Lys Ser Asp  Leu His Glu
    2090                2095                2100

Glu Asn  Ser Trp Arg Asp
    2105
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<210> 13
<211> 30
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<213> Artificial Sequence

<220>
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<400> 13
gtgcgtggaa gaccggtacc tcccatttgg 30

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<400> 14
taatgttatt gccggcgaat tcgaaactga ataaatc 37

<210> 15
<211> 35
<212> DNA
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<400> 15
aataacatta ctcgagttcg gtacctccca tttgg 35

<210> 16
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caactttaaa ttcgaaactg aataaatcta tc 32

<210> 17
<211> 19
<212> DNA

<213> Artificial Sequence

<220>
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<400> 17
taatacgact cactatagg 19

<210> 18
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<220>
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<400> 18
acggagaaaa acaaaccaat tcacgc 26

<210> 19
<211> 36
<212> DNA
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ttgagcacct ggtacaggta tgaattgatg tgacac 36

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gcgtgaattg gtttgttttt ctccgtccta tagtgagtcg tattagccgg cctcgagtaa 60

attaatt 67

<210> 21

<211> 36
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<400> 21
ttgagcacct ggtacaggta tgaattgatg tgacac 36

<210> 22
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<400> 22
cgtattagcc ggcctcgagt aaattaatt 29

<210> 23
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<212> DNA
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<220>
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<400> 23
aatctggacg cgtctcgcta gtcaggctga ttatttgagg 40

<210> 24
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<220>
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<400> 24
ttgatatttc cccaactcta c 21

<210> 25

<211> 26
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<220>
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<400> 25
cgcatgccgt ctccttatgt tgattg 26

<210> 26
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<220>
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<400> 26
agcattcatt ataagtatga c 21

<210> 27
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<212> DNA
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<400> 27
gcttttcaca gatgaagcta gctgaaagta tgaaaaaaac g 41

<210> 28
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<400> 28
gtttttttca tactttcagc tagcttcatc tgtgaaaagc ttg 43

<210> 29

<211> 45
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<220>
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<400> 29
aacagaggtc aaacgcgtgt caaaatgact tcagttttat tcatg 45

<210> 30
<211> 45
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<220>
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<400> 30
gaataaaact gaagtcattt tgacacgcgt ttgacctctg ttaat 45

<210> 31
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caatg 65

<210> 32
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<220>
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<400> 32
acatagtggc attgtgaaca g 21

<210> 33
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<220>
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<400> 33
cgcatgccgt ctccttatgt tgattg 26

<210> 34
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<400> 34
agtcataccg gtctcgttaa ttttttttcat atctttcttc tgcatgttat aattc 55

<210> 35
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<400> 35
tcgagaacgc gtttgacctc tgttaatttt tttcatatat gttgatttga attc 54

<210> 36
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<400> 36
attccaacgc gtctcgttaa cagggatcaa aatgacttct gtagtaaag 49

<210> 37
<211> 53
<212> DNA
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<400> 37
gcttttcaca gatgaagcta gcgcatgcgg ccgctgaaag tatgaaaaaa acg 53

<210> 38
<211> 55
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<400> 38
gtttttttca tactttcagc ggccgcatgc gctagcttca tctgtgaaaa gcttg 55

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<212> DNA
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<400> 39
ctagctgaaa gtatgaaaaa aattaacaga ggtcaaactc gaggatatcg gtaccgaagg 60

cgcgcccagc tgtgcggcc 79

<210> 40
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<220>
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<400> 40

ggccgcacag ctgggcgcgc cttcggtacc gatatcctcg agtttgacct ctgttaattt 60

ttttcatact ttcag 75

<210> 41
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<400> 41
gaattcctcg agttgacctc tgttaatttt tttcatatat gttgatttga attc 54

<210> 42
<211> 57
<212> DNA
<213> Artificial Sequence

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<400> 42
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<210> 43
<211> 21
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<400> 43
atcattcctt tatttgtcag c 21

<210> 44
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<400> 44
tatatggcta gcgaagacag agggatcaaa atgtctcgac tcaaccaaat 50

<210> 45
<211> 44
<212> DNA
<213> Artificial Sequence

<220>
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<400> 45
ctagcccggc taatacgact cactatagga cggagaaaaa caaa 44

<210> 46
<211> 45
<212> DNA
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<220>
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<400> 46
ttggtttgtt tttctccgtc ctatagtgag tcgtattagc cggcg 45

<210> 47
<211> 40
<212> DNA
<213> Artificial Sequence

<220>
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<400> 47
ccaattcacg cattagaaga ttccagagga aagtgctaac 40

<210> 48
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<400> 48
ccctgttagc actttcctct ggaatcttct aatgcgtgaa 40

<210> 49
<211> 71
<212> DNA
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<220>
<223> Synthetic oligonucleotide

<400> 49
gaaagacaag aagtggacca gagcgattcc tacatgcctt acatgattga tatggggatc 60

tcaaccaaat c 71

<210> 50
<211> 70
<212> DNA
<213> Artificial Sequence

<220>
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<400> 50
ggttgagatc cccatatcaa tcatgtaagg catgtaggaa tcgctctggt ccacttcttg 60

tctttctttc 70

<210> 51
<211> 117
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic polypeptide

<400> 51

Met Val Ala Arg Ala Ser Val Leu Gly Gly Glu Leu Asp Arg Trp Glu
1 5 10 15

Lys Glu Glu Glu Arg Pro Gly Gly Lys Lys Lys Tyr Lys Leu Lys Glu

20 25 30

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

Leu Glu Thr Ser Glu Gly Cys Arg Gln Ile Gly Gly His Gln Ala Ala
50 55 60

Met Gln Met Leu Lys Glu Thr Ile Asn Glu Glu Ala Ala Ile Leu Lys
65 70 75 80

Ala Leu Gly Pro Ala Ala Thr Leu Glu Glu Met Met Thr Ala Cys Gln
85 90 95

Gly Val Gly Gly Tyr Pro Tyr Asp Val Pro Asp Tyr Ala Pro Gly His
100 105 110

Lys Ala Arg Val Leu
115

<210> 52
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic polypeptide

<400> 52

Ala Met Gln Met Leu Lys Glu Thr Ile
1 5

<210> 53
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide

<400> 53
tttttgcta gcttcacctg cataatagtg gcaac 35

<210> 54
<211> 45
<212> DNA
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<220>
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<400> 54
aacagaggtc aaacgcgtgt caaaatgact tcagttttat tcatg 45

<210> 55
<211> 70
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide

<400> 55
gtgcgtatga aaaaaacgaa tcaacagagt tcatcatgga tgagtactct gaagaaaagt 60

ggggcgattc 70

<210> 56
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<212> PRT
<213> Artificial Sequence

<220>
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<400> 56

Met Asp Glu Tyr Ser Glu Glu Lys Trp Gly Asp
1 5 10

<210> 57
<211> 137
<212> DNA

<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide

<400> 57
gtgcaggtga gctagccgcc tagccagatt ctatgtttgg accaaatcaa cttgtgatac 60

catgctcaaa gaggcctcat tatatttgag tttttaattt ttatgaaaaa aacgaatcaa 120

cagagttcat catggat 137

<210> 58
<211> 52
<212> DNA
<213> Artificial Sequence

<220>
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<400> 58
ctattatgcg tatgcgagac gcgtctcgta tgaaaaaaac gaatcaacag ag 52

<210> 59
<211> 52
<212> DNA
<213> Artificial Sequence

<220>
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<400> 59
ctgttgattc gttttttca tacgagacgc gtctcgcata cgcataatag tg 52

<210> 60
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<400> 60
aattaacgtc tcagagattg cagcgaaccc cagtgcggct gctgtttctt tc 52

<210> 61
<211> 45
<212> DNA
<213> Artificial Sequence

<220>
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<400> 61
aacagaggtc aaacgcgtgt caaaatgact tcagttttat tcatg 45

<210> 62
<211> 57
<212> DNA
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<220>
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<400> 62
tctctgtgat cctgatcatc ggactgatga ggctgctgcc actactgtgc aggtgag 57

<210> 63
<211> 57
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide

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Gly Pro

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