SEQUENCE LISTING

<110> Bavarian Nordic A/S c/o Bavarian Nordic Inc.
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THE UNITED STATES OF AMERICA, AS REPRESENTED BY THE
SECRETARY, DEPARTMENT OF HEALTH AND HUMAN SERVICES

<120> METHODS AND COMPOSITIONS FOR INDUCING PROTECTIVE IMMUNITY AGAINST
FILOVIRUS INFECTION

<130> BN0088PCT-I

<150> US 62/045,522
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<151> 2015-07-06

<160> 5

<170> PatentIn version 3.5

<210> 1
<211> 676
<212> PRT
<213> Artificial Sequence

<220>
<223> Glycoprotein Ebola virus Zaire, strain Mayinga

<400> 1

Met Gly Val Thr Gly Ile Leu Gln Leu Pro Arg Asp Arg Phe Lys Arg
1 5 10 15

Thr Ser Phe Phe Leu Trp Val Ile Ile Leu Phe Gln Arg Thr Phe Ser
20 25 30

Ile Pro Leu Gly Val Ile His Asn Ser Thr Leu Gln Val Ser Asp Val
35 40 45

Asp Lys Leu Val Cys Arg Asp Lys Leu Ser Ser Thr Asn Gln Leu Arg
50 55 60

Ser Val Gly Leu Asn Leu Glu Gly Asn Gly Val Ala Thr Asp Val Pro
65 70 75 80

Ser Ala Thr Lys Arg Trp Gly Phe Arg Ser Gly Val Pro Pro Lys Val
85 90 95

Val Asn Tyr Glu Ala Gly Glu Trp Ala Glu Asn Cys Tyr Asn Leu Glu
100 105 110

```
Ile Lys Lys Pro Asp Gly Ser Glu Cys Leu Pro Ala Ala Pro Asp Gly
        115                 120                 125

Ile Arg Gly Phe Pro Arg Cys Arg Tyr Val His Lys Val Ser Gly Thr
    130                 135                 140

Gly Pro Cys Ala Gly Asp Phe Ala Phe His Lys Glu Gly Ala Phe Phe
145                 150                 155                 160

Leu Tyr Asp Arg Leu Ala Ser Thr Val Ile Tyr Arg Gly Thr Thr Phe
                165                 170                 175

Ala Glu Gly Val Val Ala Phe Leu Ile Leu Pro Gln Ala Lys Lys Asp
            180                 185                 190

Phe Phe Ser Ser His Pro Leu Arg Glu Pro Val Asn Ala Thr Glu Asp
        195                 200                 205

Pro Ser Ser Gly Tyr Tyr Ser Thr Thr Ile Arg Tyr Gln Ala Thr Gly
    210                 215                 220

Phe Gly Thr Asn Glu Thr Glu Tyr Leu Phe Glu Val Asp Asn Leu Thr
225                 230                 235                 240

Tyr Val Gln Leu Glu Ser Arg Phe Thr Pro Gln Phe Leu Leu Gln Leu
                245                 250                 255

Asn Glu Thr Ile Tyr Thr Ser Gly Lys Arg Ser Asn Thr Thr Gly Lys
            260                 265                 270

Leu Ile Trp Lys Val Asn Pro Glu Ile Asp Thr Thr Ile Gly Glu Trp
        275                 280                 285

Ala Phe Trp Glu Thr Lys Lys Asn Leu Thr Arg Lys Ile Arg Ser Glu
    290                 295                 300

Glu Leu Ser Phe Thr Val Val Ser Asn Gly Ala Lys Asn Ile Ser Gly
305                 310                 315                 320

Gln Ser Pro Ala Arg Thr Ser Ser Asp Pro Gly Thr Asn Thr Thr Thr
                325                 330                 335

Glu Asp His Lys Ile Met Ala Ser Glu Asn Ser Ser Ala Met Val Gln
            340                 345                 350

Val His Ser Gln Gly Arg Glu Ala Ala Val Ser His Leu Thr Thr Leu
        355                 360                 365
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Ala Thr Ile Ser Thr Ser Pro Gln Ser Leu Thr Thr Lys Pro Gly Pro
    370                 375                 380

Asp Asn Ser Thr His Asn Thr Pro Val Tyr Lys Leu Asp Ile Ser Glu
385                 390                 395                 400

Ala Thr Gln Val Glu Gln His His Arg Arg Thr Asp Asn Asp Ser Thr
                405                 410                 415

Ala Ser Asp Thr Pro Ser Ala Thr Thr Ala Ala Gly Pro Pro Lys Ala
            420                 425                 430

Glu Asn Thr Asn Thr Ser Lys Ser Thr Asp Phe Leu Asp Pro Ala Thr
        435                 440                 445

Thr Thr Ser Pro Gln Asn His Ser Glu Thr Ala Gly Asn Asn Asn Thr
    450                 455                 460

His His Gln Asp Thr Gly Glu Glu Ser Ala Ser Ser Gly Lys Leu Gly
465                 470                 475                 480

Leu Ile Thr Asn Thr Ile Ala Gly Val Ala Gly Leu Ile Thr Gly Gly
                485                 490                 495

Arg Arg Thr Arg Arg Glu Ala Ile Val Asn Ala Gln Pro Lys Cys Asn
            500                 505                 510

Pro Asn Leu His Tyr Trp Thr Thr Gln Asp Glu Gly Ala Ala Ile Gly
        515                 520                 525

Leu Ala Trp Ile Pro Tyr Phe Gly Pro Ala Ala Glu Gly Ile Tyr Ile
    530                 535                 540

Glu Gly Leu Met His Asn Gln Asp Gly Leu Ile Cys Gly Leu Arg Gln
545                 550                 555                 560

Leu Ala Asn Glu Thr Thr Gln Ala Leu Gln Leu Phe Leu Arg Ala Thr
                565                 570                 575

Thr Glu Leu Arg Thr Phe Ser Ile Leu Asn Arg Lys Ala Ile Asp Phe
            580                 585                 590

Leu Leu Gln Arg Trp Gly Gly Thr Cys His Ile Leu Gly Pro Asp Cys
        595                 600                 605

Cys Ile Glu Pro His Asp Trp Thr Lys Asn Ile Thr Asp Lys Ile Asp
    610                 615                 620

Gln Ile Ile His Asp Phe Val Asp Lys Thr Leu Pro Asp Gln Gly Asp
```

625 630 635 640

Asn Asp Asn Trp Trp Thr Gly Trp Arg Gln Trp Ile Pro Ala Gly Ile
645 650 655

Gly Val Thr Gly Val Ile Ile Ala Val Ile Ala Leu Phe Cys Ile Cys
660 665 670

Lys Phe Val Phe
675

<210> 2
<211> 676
<212> PRT
<213> Artificial Sequence

<220>
<223> Glycoprotein Ebola virus Sudan, strain Gulu

<400> 2

Met Gly Gly Leu Ser Leu Leu Gln Leu Pro Arg Asp Lys Phe Arg Lys
1 5 10 15

Ser Ser Phe Phe Val Trp Val Ile Ile Leu Phe Gln Lys Ala Phe Ser
20 25 30

Met Pro Leu Gly Val Val Thr Asn Ser Thr Leu Glu Val Thr Glu Ile
35 40 45

Asp Gln Leu Val Cys Lys Asp His Leu Ala Ser Thr Asp Gln Leu Lys
50 55 60

Ser Val Gly Leu Asn Leu Glu Gly Ser Gly Val Ser Thr Asp Ile Pro
65 70 75 80

Ser Ala Thr Lys Arg Trp Gly Phe Arg Ser Gly Val Pro Pro Lys Val
85 90 95

Val Ser Tyr Glu Ala Gly Glu Trp Ala Glu Asn Cys Tyr Asn Leu Glu
100 105 110

Ile Lys Lys Pro Asp Gly Ser Glu Cys Leu Pro Pro Pro Pro Asp Gly
115 120 125

Val Arg Gly Phe Pro Arg Cys Arg Tyr Val His Lys Ala Gln Gly Thr
130 135 140

Gly Pro Cys Pro Gly Asp Tyr Ala Phe His Lys Asp Gly Ala Phe Phe
145 150 155 160

```
Leu Tyr Asp Arg Leu Ala Ser Thr Val Ile Tyr Arg Gly Val Asn Phe
                165                 170                 175

Ala Glu Gly Val Ile Ala Phe Leu Ile Leu Ala Lys Pro Lys Glu Thr
            180                 185                 190

Phe Leu Gln Ser Pro Pro Ile Arg Glu Ala Val Asn Tyr Thr Glu Asn
        195                 200                 205

Thr Ser Ser Tyr Tyr Ala Thr Ser Tyr Leu Glu Tyr Glu Ile Glu Asn
    210                 215                 220

Phe Gly Ala Gln His Ser Thr Thr Leu Phe Lys Ile Asp Asn Asn Thr
225                 230                 235                 240

Phe Val Arg Leu Asp Arg Pro His Thr Pro Gln Phe Leu Phe Gln Leu
                245                 250                 255

Asn Asp Thr Ile His Leu His Gln Gln Leu Ser Asn Thr Thr Gly Arg
            260                 265                 270

Leu Ile Trp Thr Leu Asp Ala Asn Ile Asn Ala Asp Ile Gly Glu Trp
        275                 280                 285

Ala Phe Trp Glu Asn Lys Lys Asn Leu Ser Glu Gln Leu Arg Gly Glu
    290                 295                 300

Glu Leu Ser Phe Glu Ala Leu Ser Leu Asn Glu Thr Glu Asp Asp Asp
305                 310                 315                 320

Ala Ala Ser Ser Arg Ile Thr Lys Gly Arg Ile Ser Asp Arg Ala Thr
                325                 330                 335

Arg Lys Tyr Ser Asp Leu Val Pro Lys Asn Ser Pro Gly Met Val Pro
            340                 345                 350

Leu His Ile Pro Glu Gly Glu Thr Thr Leu Pro Ser Gln Asn Ser Thr
        355                 360                 365

Glu Gly Arg Arg Val Gly Val Asn Thr Gln Glu Thr Ile Thr Glu Thr
    370                 375                 380

Ala Ala Thr Ile Ile Gly Thr Asn Gly Asn His Met Gln Ile Ser Thr
385                 390                 395                 400

Ile Gly Ile Arg Pro Ser Ser Ser Gln Ile Pro Ser Ser Ser Pro Thr
                405                 410                 415

Thr Ala Pro Ser Pro Glu Ala Gln Thr Pro Thr Thr His Thr Ser Gly
```

```
            420                 425                 430

Pro Ser Val Met Ala Thr Glu Glu Pro Thr Thr Pro Pro Gly Ser Ser
        435                 440                 445

Pro Gly Pro Thr Thr Glu Ala Pro Thr Leu Thr Thr Pro Glu Asn Ile
    450                 455                 460

Thr Thr Ala Val Lys Thr Val Leu Pro Gln Glu Ser Thr Ser Asn Gly
465                 470                 475                 480

Leu Ile Thr Ser Thr Val Thr Gly Ile Leu Gly Ser Leu Gly Leu Arg
                485                 490                 495

Lys Arg Ser Arg Arg Gln Thr Asn Thr Lys Ala Thr Gly Lys Cys Asn
            500                 505                 510

Pro Asn Leu His Tyr Trp Thr Ala Gln Glu Gln His Asn Ala Ala Gly
        515                 520                 525

Ile Ala Trp Ile Pro Tyr Phe Gly Pro Gly Ala Glu Gly Ile Tyr Thr
    530                 535                 540

Glu Gly Leu Met His Asn Gln Asn Ala Leu Val Cys Gly Leu Arg Gln
545                 550                 555                 560

Leu Ala Asn Glu Thr Thr Gln Ala Leu Gln Leu Phe Leu Arg Ala Thr
                565                 570                 575

Thr Glu Leu Arg Thr Tyr Thr Ile Leu Asn Arg Lys Ala Ile Asp Phe
            580                 585                 590

Leu Leu Arg Arg Trp Gly Gly Thr Cys Arg Ile Leu Gly Pro Asp Cys
        595                 600                 605

Cys Ile Glu Pro His Asp Trp Thr Lys Asn Ile Thr Asp Lys Ile Asn
    610                 615                 620

Gln Ile Ile His Asp Phe Ile Asp Asn Pro Leu Pro Asn Gln Asp Asn
625                 630                 635                 640

Asp Asp Asn Trp Trp Thr Gly Trp Arg Gln Trp Ile Pro Ala Gly Ile
                645                 650                 655

Gly Ile Thr Gly Ile Ile Ile Ala Ile Ile Ala Leu Leu Cys Val Cys
            660                 665                 670

Lys Leu Leu Cys
        675
```

<210> 3
<211> 681
<212> PRT
<213> Artificial Sequence

<220>
<223> Glycoprotein Marburg virus Angola

<400> 3

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Met Lys Thr Thr Cys Leu Leu Ile Ser Leu Ile Leu Ile Gln Gly Val
1               5                   10                  15


Lys Thr Leu Pro Ile Leu Glu Ile Ala Ser Asn Ile Gln Pro Gln Asn
            20                  25                  30


Val Asp Ser Val Cys Ser Gly Thr Leu Gln Lys Thr Glu Asp Val His
        35                  40                  45


Leu Met Gly Phe Thr Leu Ser Gly Gln Lys Val Ala Asp Ser Pro Leu
    50                  55                  60


Glu Ala Ser Lys Arg Trp Ala Phe Arg Ala Gly Val Pro Pro Lys Asn
65                  70                  75                  80


Val Glu Tyr Thr Glu Gly Glu Glu Ala Lys Thr Cys Tyr Asn Ile Ser
                85                  90                  95


Val Thr Asp Pro Ser Gly Lys Ser Leu Leu Leu Asp Pro Pro Thr Asn
            100                 105                 110


Ile Arg Asp Tyr Pro Lys Cys Lys Thr Ile His His Ile Gln Gly Gln
        115                 120                 125


Asn Pro His Ala Gln Gly Ile Ala Leu His Leu Trp Gly Ala Phe Phe
    130                 135                 140


Leu Tyr Asp Arg Ile Ala Ser Thr Thr Met Tyr Arg Gly Lys Val Phe
145                 150                 155                 160


Thr Glu Gly Asn Ile Ala Ala Met Ile Val Asn Lys Thr Val His Lys
                165                 170                 175


Met Ile Phe Ser Arg Gln Gly Gln Gly Tyr Arg His Met Asn Leu Thr
            180                 185                 190


Ser Thr Asn Lys Tyr Trp Thr Ser Ser Asn Gly Thr Gln Thr Asn Asp
        195                 200                 205


Thr Gly Cys Phe Gly Thr Leu Gln Glu Tyr Asn Ser Thr Lys Asn Gln
```

```
    210                 215                 220

Thr Cys Ala Pro Ser Lys Lys Pro Leu Pro Leu Pro Thr Ala His Pro
225                 230                 235                 240

Glu Val Lys Leu Thr Ser Thr Ser Thr Asp Ala Thr Lys Leu Asn Thr
                245                 250                 255

Thr Asp Pro Asn Ser Asp Asp Glu Asp Leu Thr Thr Ser Gly Ser Gly
            260                 265                 270

Ser Gly Glu Gln Glu Pro Tyr Thr Thr Ser Asp Ala Ala Thr Lys Gln
        275                 280                 285

Gly Leu Ser Ser Thr Met Pro Pro Thr Pro Ser Pro Gln Pro Ser Thr
    290                 295                 300

Pro Gln Gln Gly Gly Asn Asn Thr Asn His Ser Gln Gly Val Val Thr
305                 310                 315                 320

Glu Pro Gly Lys Thr Asn Thr Thr Ala Gln Pro Ser Met Pro Pro His
                325                 330                 335

Asn Thr Thr Thr Ile Ser Thr Asn Asn Thr Ser Lys His Asn Leu Ser
            340                 345                 350

Thr Pro Ser Val Pro Ile Gln Asn Ala Thr Asn Tyr Asn Thr Gln Ser
        355                 360                 365

Thr Ala Pro Glu Asn Glu Gln Thr Ser Ala Pro Ser Lys Thr Thr Leu
    370                 375                 380

Leu Pro Thr Glu Asn Pro Thr Thr Ala Lys Ser Thr Asn Ser Thr Lys
385                 390                 395                 400

Ser Pro Thr Thr Thr Val Pro Asn Thr Thr Asn Lys Tyr Ser Thr Ser
                405                 410                 415

Pro Ser Pro Thr Pro Asn Ser Thr Ala Gln His Leu Val Tyr Phe Arg
            420                 425                 430

Arg Lys Arg Asn Ile Leu Trp Arg Glu Gly Asp Met Phe Pro Phe Leu
        435                 440                 445

Asp Gly Leu Ile Asn Ala Pro Ile Asp Phe Asp Pro Val Pro Asn Thr
    450                 455                 460

Lys Thr Ile Phe Asp Glu Ser Ser Ser Ser Gly Ala Ser Ala Glu Glu
465                 470                 475                 480
```

```
Asp Gln His Ala Ser Pro Asn Ile Ser Leu Thr Leu Ser Tyr Phe Pro
                485                 490                 495

Lys Val Asn Glu Asn Thr Ala His Ser Gly Glu Asn Glu Asn Asp Cys
            500                 505                 510

Asp Ala Glu Leu Arg Ile Trp Ser Val Gln Glu Asp Asp Leu Ala Ala
        515                 520                 525

Gly Leu Ser Trp Ile Pro Phe Phe Gly Pro Gly Ile Glu Gly Leu Tyr
    530                 535                 540

Thr Ala Gly Leu Ile Lys Asn Gln Asn Asn Leu Val Cys Arg Leu Arg
545                 550                 555                 560

Arg Leu Ala Asn Gln Thr Ala Lys Ser Leu Glu Leu Leu Leu Arg Val
                565                 570                 575

Thr Thr Glu Glu Arg Thr Phe Ser Leu Ile Asn Arg His Ala Ile Asp
            580                 585                 590

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

Cys Cys Ile Gly Ile Glu Asp Leu Ser Arg Asn Ile Ser Glu Gln Ile
    610                 615                 620

Asp Gln Ile Lys Lys Asp Glu Gln Lys Glu Gly Thr Gly Trp Gly Leu
625                 630                 635                 640

Gly Gly Lys Trp Trp Thr Ser Asp Trp Gly Val Leu Thr Asn Leu Gly
                645                 650                 655

Ile Leu Leu Leu Leu Ser Ile Ala Val Leu Ile Ala Leu Ser Cys Ile
            660                 665                 670

Cys Arg Ile Phe Thr Lys Tyr Ile Gly
        675                 680


<210>  4
<211>  681
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Glycoprotein Marburg virus Musoke

<400>  4

Met Lys Thr Thr Cys Phe Leu Ile Ser Leu Ile Leu Ile Gln Gly Thr
```

```
1               5                   10                  15

Lys Asn Leu Pro Ile Leu Glu Ile Ala Ser Asn Asn Gln Pro Gln Asn
            20                  25                  30

Val Asp Ser Val Cys Ser Gly Thr Leu Gln Lys Thr Glu Asp Val His
        35                  40                  45

Leu Met Gly Phe Thr Leu Ser Gly Gln Lys Val Ala Asp Ser Pro Leu
    50                  55                  60

Glu Ala Ser Lys Arg Trp Ala Phe Arg Thr Gly Val Pro Pro Lys Asn
65                  70                  75                  80

Val Glu Tyr Thr Glu Gly Glu Glu Ala Lys Thr Cys Tyr Asn Ile Ser
                85                  90                  95

Val Thr Asp Pro Ser Gly Lys Ser Leu Leu Leu Asp Pro Pro Thr Asn
            100                 105                 110

Ile Arg Asp Tyr Pro Lys Cys Lys Thr Ile His His Ile Gln Gly Gln
        115                 120                 125

Asn Pro His Ala Gln Gly Ile Ala Leu His Leu Trp Gly Ala Phe Phe
    130                 135                 140

Leu Tyr Asp Arg Ile Ala Ser Thr Thr Met Tyr Arg Gly Lys Val Phe
145                 150                 155                 160

Thr Glu Gly Asn Ile Ala Ala Met Ile Val Asn Lys Thr Val His Lys
                165                 170                 175

Met Ile Phe Ser Arg Gln Gly Gln Gly Tyr Arg His Met Asn Leu Thr
            180                 185                 190

Ser Thr Asn Lys Tyr Trp Thr Ser Ser Asn Gly Thr Gln Thr Asn Asp
        195                 200                 205

Thr Gly Cys Phe Gly Ala Leu Gln Glu Tyr Asn Ser Thr Lys Asn Gln
    210                 215                 220

Thr Cys Ala Pro Ser Lys Ile Pro Pro Pro Leu Pro Thr Ala Arg Pro
225                 230                 235                 240

Glu Ile Lys Leu Thr Ser Thr Pro Thr Asp Ala Thr Lys Leu Asn Thr
                245                 250                 255

Thr Asp Pro Ser Ser Asp Asp Glu Asp Leu Ala Thr Ser Gly Ser Gly
            260                 265                 270
```

```
Ser Gly Glu Arg Glu Pro His Thr Thr Ser Asp Ala Val Thr Lys Gln
        275                 280                 285

Gly Leu Ser Ser Thr Met Pro Pro Thr Pro Ser Pro Gln Pro Ser Thr
    290                 295                 300

Pro Gln Gln Gly Gly Asn Asn Thr Asn His Ser Gln Asp Ala Val Thr
305                 310                 315                 320

Glu Leu Asp Lys Asn Asn Thr Thr Ala Gln Pro Ser Met Pro Pro His
                325                 330                 335

Asn Thr Thr Thr Ile Ser Thr Asn Asn Thr Ser Lys His Asn Phe Ser
            340                 345                 350

Thr Leu Ser Ala Pro Leu Gln Asn Thr Thr Asn Asp Asn Thr Gln Ser
        355                 360                 365

Thr Ile Thr Glu Asn Glu Gln Thr Ser Ala Pro Ser Ile Thr Thr Leu
    370                 375                 380

Pro Pro Thr Gly Asn Pro Thr Thr Ala Lys Ser Thr Ser Ser Lys Lys
385                 390                 395                 400

Gly Pro Ala Thr Thr Ala Pro Asn Thr Thr Asn Glu His Phe Thr Ser
                405                 410                 415

Pro Pro Pro Thr Pro Ser Ser Thr Ala Gln His Leu Val Tyr Phe Arg
            420                 425                 430

Arg Lys Arg Ser Ile Leu Trp Arg Glu Gly Asp Met Phe Pro Phe Leu
        435                 440                 445

Asp Gly Leu Ile Asn Ala Pro Ile Asp Phe Asp Pro Val Pro Asn Thr
    450                 455                 460

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

Asp Gln His Ala Ser Pro Asn Ile Ser Leu Thr Leu Ser Tyr Phe Pro
                485                 490                 495

Asn Ile Asn Glu Asn Thr Ala Tyr Ser Gly Glu Asn Glu Asn Asp Cys
            500                 505                 510

Asp Ala Glu Leu Arg Ile Trp Ser Val Gln Glu Asp Asp Leu Ala Ala
        515                 520                 525
```

```
Gly Leu Ser Trp Ile Pro Phe Phe Gly Pro Gly Ile Glu Gly Leu Tyr
    530                 535                 540

Thr Ala Val Leu Ile Lys Asn Gln Asn Asn Leu Val Cys Arg Leu Arg
545                 550                 555                 560

Arg Leu Ala Asn Gln Thr Ala Lys Ser Leu Glu Leu Leu Leu Arg Val
                565                 570                 575

Thr Thr Glu Glu Arg Thr Phe Ser Leu Ile Asn Arg His Ala Ile Asp
            580                 585                 590

Phe Leu Leu Thr Arg Trp Gly Gly Thr Cys Lys Val Leu Gly Pro Asp
        595                 600                 605

Cys Cys Ile Gly Ile Glu Asp Leu Ser Lys Asn Ile Ser Glu Gln Ile
    610                 615                 620

Asp Gln Ile Lys Lys Asp Glu Gln Lys Glu Gly Thr Gly Trp Gly Leu
625                 630                 635                 640

Gly Gly Lys Trp Trp Thr Ser Asp Trp Gly Val Leu Thr Asn Leu Gly
                645                 650                 655

Ile Leu Leu Leu Leu Ser Ile Ala Val Leu Ile Ala Leu Ser Cys Ile
            660                 665                 670

Cys Arg Ile Phe Thr Lys Tyr Ile Gly
        675                 680


<210>  5
<211>  739
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Nucleoprotein Ebola virus Tai Forest / Ivory coast

<400>  5

Met Glu Ser Arg Ala His Lys Ala Trp Met Thr His Thr Ala Ser Gly
1               5                   10                  15

Phe Glu Thr Asp Tyr His Lys Ile Leu Thr Ala Gly Leu Ser Val Gln
            20                  25                  30

Gln Gly Ile Val Arg Gln Arg Val Ile Gln Val His Gln Val Thr Asn
        35                  40                  45

Leu Glu Glu Ile Cys Gln Leu Ile Ile Gln Ala Phe Glu Ala Gly Val
    50                  55                  60
```

```
Asp Phe Gln Glu Ser Ala Asp Ser Phe Leu Leu Met Leu Cys Leu His
65                  70                  75                  80

His Ala Tyr Gln Gly Asp Tyr Lys Gln Phe Leu Glu Ser Asn Ala Val
                85                  90                  95

Lys Tyr Leu Glu Gly His Gly Phe Arg Phe Glu Val Arg Lys Lys Glu
            100                 105                 110

Gly Val Lys Arg Leu Glu Glu Leu Leu Pro Ala Ala Ser Ser Gly Lys
        115                 120                 125

Ser Ile Arg Arg Thr Leu Ala Ala Met Pro Glu Glu Glu Thr Thr Glu
    130                 135                 140

Ala Asn Ala Gly Gln Phe Leu Ser Phe Ala Ser Leu Phe Leu Pro Lys
145                 150                 155                 160

Leu Val Val Gly Glu Lys Ala Cys Leu Glu Lys Val Gln Arg Gln Ile
                165                 170                 175

Gln Val His Ser Glu Gln Gly Leu Ile Gln Tyr Pro Thr Ala Trp Gln
            180                 185                 190

Ser Val Gly His Met Met Val Ile Phe Arg Leu Met Arg Thr Asn Phe
        195                 200                 205

Leu Ile Lys Phe Leu Leu Ile His Gln Gly Met His Met Val Ala Gly
    210                 215                 220

His Asp Ala Asn Asp Ala Val Ile Ala Asn Ser Val Ala Gln Ala Arg
225                 230                 235                 240

Phe Ser Gly Leu Leu Ile Val Lys Thr Val Leu Asp His Ile Leu Gln
                245                 250                 255

Lys Thr Glu His Gly Val Arg Leu His Pro Leu Ala Arg Thr Ala Lys
            260                 265                 270

Val Lys Asn Glu Val Asn Ser Phe Lys Ala Ala Leu Ser Ser Leu Ala
        275                 280                 285

Gln His Gly Glu Tyr Ala Pro Phe Ala Arg Leu Leu Asn Leu Ser Gly
    290                 295                 300

Val Asn Asn Leu Glu His Gly Leu Phe Pro Gln Leu Ser Ala Ile Ala
305                 310                 315                 320
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```
Leu Gly Val Ala Thr Ala His Gly Ser Thr Leu Ala Gly Val Asn Val
                325                 330                 335

Gly Glu Gln Tyr Gln Gln Leu Arg Glu Ala Ala Thr Glu Ala Glu Lys
            340                 345                 350

Gln Leu Gln Lys Tyr Ala Glu Ser Arg Glu Leu Asp His Leu Gly Leu
        355                 360                 365

Asp Asp Gln Glu Lys Lys Ile Leu Lys Asp Phe His Gln Lys Lys Asn
    370                 375                 380

Glu Ile Ser Phe Gln Gln Thr Thr Ala Met Val Thr Leu Arg Lys Glu
385                 390                 395                 400

Arg Leu Ala Lys Leu Thr Glu Ala Ile Thr Ser Thr Ser Leu Leu Lys
                405                 410                 415

Thr Gly Lys Gln Tyr Asp Asp Asp Asn Asp Ile Pro Phe Pro Gly Pro
            420                 425                 430

Ile Asn Asp Asn Glu Asn Ser Glu Gln Gln Asp Asp Asp Pro Thr Asp
        435                 440                 445

Ser Gln Asp Thr Thr Ile Pro Asp Ile Ile Val Asp Pro Asp Asp Gly
    450                 455                 460

Arg Tyr Asn Asn Tyr Gly Asp Tyr Pro Ser Glu Thr Ala Asn Ala Pro
465                 470                 475                 480

Glu Asp Leu Val Leu Phe Asp Leu Glu Asp Gly Asp Glu Asp Asp His
                485                 490                 495

Arg Pro Ser Ser Ser Ser Glu Asn Asn Asn Lys His Ser Leu Thr Gly
            500                 505                 510

Thr Asp Ser Asn Lys Thr Ser Asn Trp Asn Arg Asn Pro Thr Asn Met
        515                 520                 525

Pro Lys Lys Asp Ser Thr Gln Asn Asn Asp Asn Pro Ala Gln Arg Ala
    530                 535                 540

Gln Glu Tyr Ala Arg Asp Asn Ile Gln Asp Thr Pro Thr Pro His Arg
545                 550                 555                 560

Ala Leu Thr Pro Ile Ser Glu Glu Thr Gly Ser Asn Gly His Asn Glu
                565                 570                 575
```

```
Asp Asp Ile Asp Ser Ile Pro Pro Leu Glu Ser Asp Glu Glu Asn Asn
            580                 585                 590

Thr Glu Thr Thr Ile Thr Thr Thr Lys Asn Thr Thr Ala Pro Pro Ala
        595                 600                 605

Pro Val Tyr Arg Ser Asn Ser Glu Lys Glu Pro Leu Pro Gln Glu Lys
    610                 615                 620

Ser Gln Lys Gln Pro Asn Gln Val Ser Gly Ser Glu Asn Thr Asp Asn
625                 630                 635                 640

Lys Pro His Ser Glu Gln Ser Val Glu Glu Met Tyr Arg His Ile Leu
                645                 650                 655

Gln Thr Gln Gly Pro Phe Asp Ala Ile Leu Tyr Tyr Tyr Met Met Thr
            660                 665                 670

Glu Glu Pro Ile Val Phe Ser Thr Ser Asp Gly Lys Glu Tyr Val Tyr
        675                 680                 685

Pro Asp Ser Leu Glu Gly Glu His Pro Pro Trp Leu Ser Glu Lys Glu
    690                 695                 700

Ala Leu Asn Glu Asp Asn Arg Phe Ile Thr Met Asp Asp Gln Gln Phe
705                 710                 715                 720

Tyr Trp Pro Val Met Asn His Arg Asn Lys Phe Met Ala Ile Leu Gln
                725                 730                 735

His His Lys
```