SEQUENCE LISTING

<110> Oxford University Innovation Limited

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<130> JDM86936P.WOP

<150> GB1705765.4
<151> 2017-04-10

<160> 61

<170> PatentIn version 3.5

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Gly Gly Gly Met Gln Leu Phe His Leu Cys Leu Ile Ile Ser Cys Ser
        35                  40                  45


Cys Pro Thr Val Gln Ala Ser Lys Leu Cys Leu Gly Trp Leu Trp Gly
    50                  55                  60


Met Asp Ile Asp Pro Tyr Lys Glu Phe Gly Ala Ser Val Glu Leu Leu
65                  70                  75                  80


Ser Phe Leu Pro Ser Asp Phe Phe Pro Ser Ile Arg Asp Leu Leu Asp
                85                  90                  95


Thr Ala Ser Ala Leu Tyr Arg Glu Ala Leu Glu Ser Pro Glu His Cys
            100                 105                 110


Ser Pro His His Thr Ala Leu Arg Gln Ala Ile Leu Cys Trp Gly Glu
        115                 120                 125


Leu Met Asn Leu Ala Thr Trp Val Gly Ser Asn Leu Glu Asp Pro Ala
    130                 135                 140


Ser Arg Glu Leu Val Val Ser Tyr Val Asn Val Asn Met Gly Leu Lys
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Ile Arg Gln Leu Leu Trp Phe His Ile Ser Cys Leu Thr Phe Gly Arg
                165                 170                 175
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```
Glu Thr Val Leu Glu Tyr Leu Val Ser Phe Gly Val Trp Ile Arg Thr
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Pro Pro Ala Tyr Arg Pro Pro Asn Ala Pro Ile Leu Ser Thr Leu Pro
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Glu Thr Thr Val Val Arg Arg Arg Gly Arg Ser Pro Arg Arg Arg Thr
    210                 215                 220

Pro Ser Pro Arg Arg Arg Arg Ser Gln Ser Pro Arg Arg Arg Arg Ser
225                 230                 235                 240

Gln Ser Arg Glu Ser Gln Cys Gly Gly Gly Ser Gly Gly Gly Met Pro
                245                 250                 255

Leu Ser Tyr Gln His Phe Arg Lys Leu Leu Leu Leu Asp Asp Glu Ala
            260                 265                 270

Gly Pro Leu Glu Glu Glu Leu Pro Arg Leu Ala Asp Glu Gly Leu Asn
        275                 280                 285

Arg Arg Val Ala Glu Asp Leu Asn Leu Gly Asn Leu Asn Val Ser Ile
    290                 295                 300

Pro Trp Thr His Lys Val Gly Asn Phe Thr Gly Leu Ala Ser Ser Thr
305                 310                 315                 320

Val Pro Val Phe Asn Pro Glu Trp Gln Thr Pro Ser Phe Pro His Ile
                325                 330                 335

His Leu Gln Glu Asp Ile Ile Asn Arg Cys Gln Gln Tyr Val Gly Pro
            340                 345                 350

Leu Thr Val Asn Glu Lys Arg Arg Leu Lys Leu Ile Met Pro Ala Arg
        355                 360                 365
```

```
Phe Tyr Pro Asn Leu Thr Lys Tyr Leu Pro Leu Asp Lys Gly Ile Lys
    370                 375                 380

Pro Tyr Tyr Pro Glu His Ala Val Asn His Tyr Phe Lys Thr Arg His
385                 390                 395                 400

Tyr Leu His Thr Leu Trp Lys Ala Gly Ile Leu Tyr Lys Arg Glu Thr
                405                 410                 415

Thr Arg Ser Ala Ser Phe Cys Gly Ser Pro Tyr Ser Trp Glu Gln Glu
            420                 425                 430

Leu Gln His Gly Arg Leu Val Phe Gln Thr Ser Thr Arg His Gly Asp
        435                 440                 445

Glu Ser Phe Cys Ser Gln Ser Ser Gly Ile Leu Ser Arg Ser Pro Val
    450                 455                 460

Gly Pro Cys Val Arg Ser Gln Leu Lys Gln Ser Arg Leu Gly Leu Gln
465                 470                 475                 480

Pro Gln Gln Gly Ser Leu Ala Arg Gly Lys Ser Gly Arg Ser Gly Ser
                485                 490                 495

Ile Arg Ala Arg Val His Pro Thr Thr Arg Arg Ser Phe Gly Val Glu
            500                 505                 510

Pro Ser Gly Ser Gly His Ile Asp Asn Ser Ala Ser Ser Thr Ser Ser
        515                 520                 525

Cys Leu His Gln Ser Ala Val Arg Lys Thr Ala Tyr Ser His Leu Ser
    530                 535                 540

Thr Ser Lys Arg Gln Ser Ser Ser Gly His Ala Val Glu Leu His Asn
545                 550                 555                 560

Ile Pro Pro Ser Ser Ala Arg Ser Gln Ser Glu Gly Pro Ile Phe Ser
                565                 570                 575
```

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Ala Trp Trp Leu Gln Phe Arg Asn Ser Lys Pro Ala Ser Asp Tyr Ala
            580                 585                 590

Leu Thr His Ile Val Asn Leu Leu Glu Asp Trp Gly Pro Ala Thr Glu
        595                 600                 605

His Gly Glu His Asn Ile Arg Ile Pro Arg Thr Pro Ala Arg Val Thr
    610                 615                 620

Gly Gly Val Phe Leu Val Asp Lys Asn Pro His Asn Thr Thr Glu Ser
625                 630                 635                 640

Arg Leu Val Val Asp Phe Ser Gln Phe Ser Arg Gly Ser Thr His Val
                645                 650                 655

Ser Trp Pro Lys Phe Ala Val Pro Asn Leu Gln Ser Leu Thr Asn Leu
            660                 665                 670

Leu Ser Ser Asn Leu Ser Trp Leu Ser Leu Asp Val Ser Ala Ala Phe
        675                 680                 685

Tyr His Ile Pro Leu His Pro Ala Ala Met Pro His Leu Leu Val Gly
    690                 695                 700

Ser Ser Gly Leu Pro Arg Tyr Val Ala Arg Leu Ser Ser Thr Ser Arg
705                 710                 715                 720

Asn Ile Asn Tyr Gln His Gly Thr Met Gln Asp Leu His Asp Ser Cys
                725                 730                 735

Ser Arg Asn Leu Tyr Val Ser Leu Leu Leu Leu Tyr Lys Thr Phe Gly
            740                 745                 750

Arg Lys Leu His Leu Tyr Ser His Pro Ile Ile Leu Gly Phe Arg Lys
        755                 760                 765
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Ile Pro Met Gly Val Gly Leu Ser Pro Phe Leu Leu Ala Gln Phe Thr
    770                 775                 780

Ser Ala Ile Cys Ser Val Val Arg Arg Ala Phe Pro His Cys Leu Ala
785                 790                 795                 800

Phe Ser Tyr Met Asp Asp Val Val Leu Gly Ala Lys Ser Val Gln His
                805                 810                 815

Leu Glu Ser Leu Phe Thr Ser Ile Thr Asn Phe Leu Leu Ser Leu Gly
            820                 825                 830

Ile His Leu Asn Pro Asn Lys Thr Lys Arg Trp Gly Tyr Ser Leu Asn
        835                 840                 845

Phe Met Gly Tyr Val Ile Gly Ser Trp Gly Thr Leu Pro Gln Glu His
    850                 855                 860

Ile Val Leu Lys Ile Lys Gln Cys Phe Arg Lys Leu Pro Val Asn Arg
865                 870                 875                 880

Pro Ile Asp Trp Lys Val Cys Gln Arg Ile Val Gly Leu Leu Gly Phe
                885                 890                 895

Ala Ala Pro Phe Thr Gln Cys Gly Tyr Pro Ala Leu Met Pro Leu Tyr
            900                 905                 910

Ala Cys Ile Gln Ser Lys Gln Ala Phe Thr Phe Ser Pro Thr Tyr Lys
        915                 920                 925

Ala Phe Leu Cys Lys Gln Tyr Leu Asn Leu Tyr Pro Val Ala Arg Gln
    930                 935                 940

Arg Ser Gly Leu Cys Gln Val Phe Ala Asp Ala Thr Pro Thr Gly Trp
945                 950                 955                 960

Gly Leu Ala Ile Gly His Arg Ala Met Arg Gly Thr Phe Val Ala Pro
                965                 970                 975
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Leu Pro Ile His Thr Ala Glu Leu Leu Ala Ala Cys Phe Ala Arg Ser
            980                 985                 990


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


Arg Lys  Tyr Thr Ser Phe Pro  Trp Leu Leu Gly Cys  Ala Ala Asn
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Trp Ile  Leu Arg Gly Thr Ser  Phe Val Tyr Val Pro  Ser Ala Leu
    1025                1030                1035


Asn Pro  Ala Ala Asp Pro Ser  Ala Gly Arg Leu Gly  Leu Tyr Arg
    1040                1045                1050


Pro Leu  Leu His Leu Pro Phe  Arg Pro Thr Thr Gly  Arg Thr Ser
    1055                1060                1065


Leu Tyr  Ala Val Ser Pro Ser  Val Pro Ser His Leu  Pro Asp Arg
    1070                1075                1080


Val His  Phe Ala Ser Pro Leu  His Val Ala Trp Arg  Pro Pro Arg
    1085                1090                1095


Lys Arg  Arg Ala Pro Val Lys  Gln Thr Leu Asn Phe  Asp Leu Leu
    1100                1105                1110


Lys Leu  Ala Gly Asp Val Glu  Ser Asn Pro Gly Pro  Met Gly Gly
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Trp Ser  Ser Lys Pro Arg Gln  Gly Met Gly Thr Asn  Leu Ser Val
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Pro Asn  Pro Leu Gly Phe Phe  Pro Asp His Gln Leu  Asp Pro Ala
    1145                1150                1155
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Phe Gly  Ala Asn Ser Asn Asn  Pro Asp Trp Asp Phe  Asn Pro Asn
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Lys Asp  His Trp Pro Glu Ala  Asn Gln Val Gly Ala  Gly Ala Phe
    1175                1180                1185

Gly Pro  Gly Phe Thr Pro Pro  His Gly Gly Leu Leu  Gly Trp Ser
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Pro Gln  Ala Gln Gly Ile Leu  Thr Thr Val Pro Ala  Ala Pro Pro
    1205                1210                1215

Pro Ala  Ser Thr Asn Arg Gln  Ser Gly Arg Gln Pro  Thr Pro Ile
    1220                1225                1230

Ser Pro  Pro Leu Arg Asp Ser  His Pro Gln Ala Met  Gln Trp Asn
    1235                1240                1245

Ser Thr  Thr Phe His Gln Ala  Leu Leu Asp Pro Arg  Val Arg Gly
    1250                1255                1260

Leu Tyr  Phe Pro Ala Gly Gly  Ser Ser Ser Gly Thr  Val Asn Pro
    1265                1270                1275

Val Pro  Thr Thr Ala Ser Pro  Ile Ser Ser Ile Phe  Ser Arg Thr
    1280                1285                1290

Gly Asp  Pro Ala Pro Asn Met  Glu Asn Thr Thr Ser  Gly Phe Leu
    1295                1300                1305

Gly Pro  Leu Leu Val Leu Gln  Ala Gly Phe Phe Leu  Leu Thr Arg
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Ile Leu  Thr Ile Pro Gln Ser  Leu Asp Ser Trp Trp  Thr Ser Leu
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Asn Phe  Leu Gly Gly Ala Pro  Thr Cys Pro Gly Gln  Asn Ser Gln
    1340                1345                1350
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Ser Pro  Thr Ser Asn His Ser  Pro Thr Ser Cys Pro  Pro Ile Cys
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Pro Gly  Tyr Arg Trp Met Cys  Leu Arg Arg Phe Ile  Ile Phe Leu
    1370                1375                1380

Phe Ile  Leu Leu Leu Cys Leu  Ile Phe Leu Leu Val  Leu Leu Asp
    1385                1390                1395

Tyr Gln  Gly Met Leu Pro Val  Cys Pro Leu Leu Pro  Gly Thr Ser
    1400                1405                1410

Thr Thr  Ser Thr Gly Pro Cys  Lys Thr Cys Thr Ile  Pro Ala Gln
    1415                1420                1425

Gly Thr  Ser Met Phe Pro Ser  Cys Cys Cys Thr Lys  Pro Ser Asp
    1430                1435                1440

Gly Asn  Cys Thr Cys Ile Pro  Ile Pro Ser Ser Trp  Ala Phe Ala
    1445                1450                1455

Arg Phe  Leu Trp Glu Trp Ala  Ser Val Arg Phe Ser  Trp Leu Ser
    1460                1465                1470

Leu Leu  Val Pro Phe Val Gln  Trp Phe Val Gly Leu  Ser Pro Thr
    1475                1480                1485

Val Trp  Leu Ser Val Ile Trp  Met Met Trp Tyr Trp  Gly Pro Ser
    1490                1495                1500

Leu Tyr  Asn Ile Leu Ser Pro  Phe Leu Pro Leu Leu  Pro Ile Phe
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Phe Cys  Leu Trp Val Tyr Ile
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Lys Gly Gly Gly Pro Gly Gly Gly
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Ser Phe Leu Pro Ser Asp Phe Phe Pro Ser Ile Arg Asp Leu Leu Asp
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Thr Ala Ser Ala Leu Tyr Arg Glu Ala Leu Glu Ser Pro Glu His Cys
        35   40   45

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Ser Pro His His Thr Ala Leu Arg Gln Ala Ile Leu Cys Trp Gly Glu
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Leu Met Asn Leu Ala Thr Trp Val Gly Ser Asn Leu Glu Asp Pro Ala
65                  70                  75                  80

Ser Arg Glu Leu Val Val Ser Tyr Val Asn Val Asn Met Gly Leu Lys
                85                  90                  95

Ile Arg Gln Leu Leu Trp Phe His Ile Ser Cys Leu Thr Phe Gly Arg
            100                 105                 110

Glu Thr Val Leu Glu Tyr Leu Val Ser Phe Gly Val Trp Ile Arg Thr
        115                 120                 125

Pro Pro Ala Tyr Arg Pro Pro Asn Ala Pro Ile Leu Ser Thr Leu Pro
    130                 135                 140

Glu Thr Thr Val Val Arg Arg Arg Gly Arg Ser Pro Arg Arg Arg Thr
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Pro Ser Pro Arg Arg Arg Arg Ser Gln Ser Pro Arg Arg Arg Arg Ser
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Gln Ser Arg Glu Ser Gln Cys
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Leu Asn Arg Arg Val Ala Glu Asp Leu Asn Leu Gly Asn Leu Asn Val
        35                  40                  45


Ser Ile Pro Trp Thr His Lys Val Gly Asn Phe Thr Gly Leu Ala Ser
    50                  55                  60


Ser Thr Val Pro Val Phe Asn Pro Glu Trp Gln Thr Pro Ser Phe Pro
65                  70                  75                  80


His Ile His Leu Gln Glu Asp Ile Ile Asn Arg Cys Gln Gln Tyr Val
                85                  90                  95


Gly Pro Leu Thr Val Asn Glu Lys Arg Arg Leu Lys Leu Ile Met Pro
            100                 105                 110


Ala Arg Phe Tyr Pro Asn Leu Thr Lys Tyr Leu Pro Leu Asp Lys Gly
        115                 120                 125


Ile Lys Pro Tyr Tyr Pro Glu His Ala Val Asn His Tyr Phe Lys Thr
    130                 135                 140


Arg His Tyr Leu His Thr Leu Trp Lys Ala Gly Ile Leu Tyr Lys Arg
145                 150                 155                 160


Glu Thr Thr Arg Ser Ala Ser Phe Cys Gly Ser Pro Tyr Ser Trp Glu
                165                 170                 175
```

```
Gln Glu Leu Gln His Gly Arg Leu Val Phe Gln Thr Ser Thr Arg His
            180                 185                 190

Gly Asp Glu Ser Phe Cys Ser Gln Ser Ser Gly Ile Leu Ser Arg Ser
        195                 200                 205

Pro Val Gly Pro Cys Val Arg Ser Gln Leu Lys Gln Ser Arg Leu Gly
    210                 215                 220

Leu Gln Pro Gln Gln Gly Ser Leu Ala Arg Gly Lys Ser Gly Arg Ser
225                 230                 235                 240

Gly Ser Ile Arg Ala Arg Val His Pro Thr Thr Arg Arg Ser Phe Gly
                245                 250                 255

Val Glu Pro Ser Gly Ser Gly His Ile Asp Asn Ser Ala Ser Ser Thr
            260                 265                 270

Ser Ser Cys Leu His Gln Ser Ala Val Arg Lys Thr Ala Tyr Ser His
        275                 280                 285

Leu Ser Thr Ser Lys Arg Gln Ser Ser Ser Gly His Ala Val Glu Leu
    290                 295                 300

His Asn Ile Pro Pro Ser Ser Ala Arg Ser Gln Ser Glu Gly Pro Ile
305                 310                 315                 320

Phe Ser Ala Trp Trp Leu Gln Phe Arg Asn Ser Lys Pro Ala Ser Asp
                325                 330                 335

Tyr Ala Leu Thr His Ile Val Asn Leu Leu Glu Asp Trp Gly Pro Ala
            340                 345                 350

Thr Glu His Gly Glu His Asn Ile Arg Ile Pro Arg Thr Pro Ala Arg
        355                 360                 365
```

```
Val Thr Gly Gly Val Phe Leu Val Asp Lys Asn Pro His Asn Thr Thr
    370                 375                 380

Glu Ser Arg Leu Val Val Asp Phe Ser Gln Phe Ser Arg Gly Ser Thr
385                 390                 395                 400

His Val Ser Trp Pro Lys Phe Ala Val Pro Asn Leu Gln Ser Leu Thr
                405                 410                 415

Asn Leu Leu Ser Ser Asn Leu Ser Thr Phe Gly Arg Lys Leu His Leu
            420                 425                 430

Tyr Ser His Pro Ile Ile Leu Gly Phe Arg Lys Ile Pro Met Gly Val
        435                 440                 445

Gly Leu Ser Pro Phe Leu Leu Ala Gln Phe Thr Ser Ala Ile Cys Ser
    450                 455                 460

Val Val Arg Arg Ala Phe Pro His Cys Leu Ala Phe Ser Tyr Met Asp
465                 470                 475                 480

Asp Val Val Leu Gly Ala Lys Ser Val Gln His Leu Glu Ser Leu Phe
                485                 490                 495

Thr Ser Ile Thr Asn Phe Leu Leu Ser Leu Gly Ile His Leu Asn Pro
            500                 505                 510

Asn Lys Thr Lys Arg Trp Gly Tyr Ser Leu Asn Phe Met Gly Tyr Val
        515                 520                 525

Ile Gly Ser Trp Gly Thr Leu Pro Gln Glu His Ile Val Leu Lys Ile
    530                 535                 540

Lys Gln Cys Phe Arg Lys Leu Pro Val Asn Arg Pro Ile Asp Trp Lys
545                 550                 555                 560

Val Cys Gln Arg Ile Val Gly Leu Leu Gly Phe Ala Ala Pro Phe Thr
                565                 570                 575
```

```
Gln Cys Gly Tyr Pro Ala Leu Met Pro Leu Tyr Ala Cys Ile Gln Ser
            580                 585                 590

Lys Gln Ala Phe Thr Phe Ser Pro Thr Tyr Lys Ala Phe Leu Cys Lys
        595                 600                 605

Gln Tyr Leu Asn Leu Tyr Pro Val Ala Arg Gln Arg Ser Gly Leu Cys
    610                 615                 620

Gln Val Phe Ala Asp Ala Thr Pro Thr Gly Trp Gly Leu Ala Ile Gly
625                 630                 635                 640

His Arg Ala Met Arg Gly Thr Phe Val Ala Pro Leu Pro Ile His Thr
                645                 650                 655

Ala Glu Leu Leu Ala Ala Cys Phe Ala Arg Ser Arg Ser Gly Ala Lys
            660                 665                 670

Leu Ile Gly Thr Asp Asn Ser Val Val Leu Ser Arg Lys Tyr Thr Ser
        675                 680                 685

Phe Pro Trp Leu Leu Gly Cys Ala Ala Asn Trp Ile Leu Arg Gly Thr
    690                 695                 700

Ser Phe Val Tyr Val Pro Ser Ala Leu Asn Pro Ala Ala Asp Pro Ser
705                 710                 715                 720

Ala Gly Arg Leu Gly Leu Tyr Arg Pro Leu Leu His Leu Pro Phe Arg
                725                 730                 735

Pro Thr Thr Gly Arg Thr Ser Leu Tyr Ala Val Ser Pro Ser Val Pro
            740                 745                 750

Ser His Leu Pro Asp Arg Val His Phe Ala Ser Pro Leu His Val Ala
        755                 760                 765
```

Trp Arg Pro Pro
770

<210> 9
<211> 28
<212> PRT
<213> Unknown

<220>
<223> Furin 2A

<400> 9

Arg Lys Arg Arg Ala Pro Val Lys Gln Thr Leu Asn Phe Asp Leu Leu
1 5 10 15

Lys Leu Ala Gly Asp Val Glu Ser Asn Pro Gly Pro
20 25

<210> 10
<211> 226
<212> PRT
<213> Hepatitis B virus

<400> 10

Met Glu Asn Thr Thr Ser Gly Phe Leu Gly Pro Leu Leu Val Leu Gln
1 5 10 15

Ala Gly Phe Phe Leu Leu Thr Arg Ile Leu Thr Ile Pro Gln Ser Leu
20 25 30

Asp Ser Trp Trp Thr Ser Leu Asn Phe Leu Gly Gly Ala Pro Thr Cys
35 40 45

Pro Gly Gln Asn Ser Gln Ser Pro Thr Ser Asn His Ser Pro Thr Ser
50 55 60

Cys Pro Pro Ile Cys Pro Gly Tyr Arg Trp Met Cys Leu Arg Arg Phe
65 70 75 80

Ile Ile Phe Leu Phe Ile Leu Leu Leu Cys Leu Ile Phe Leu Leu Val

```
                85                  90                  95

Leu Leu Asp Tyr Gln Gly Met Leu Pro Val Cys Pro Leu Leu Pro Gly
            100                 105                 110

Thr Ser Thr Thr Ser Thr Gly Pro Cys Lys Thr Cys Thr Ile Pro Ala
        115                 120                 125

Gln Gly Thr Ser Met Phe Pro Ser Cys Cys Cys Thr Lys Pro Ser Asp
    130                 135                 140

Gly Asn Cys Thr Cys Ile Pro Ile Pro Ser Ser Trp Ala Phe Ala Arg
145                 150                 155                 160

Phe Leu Trp Glu Trp Ala Ser Val Arg Phe Ser Trp Leu Ser Leu Leu
                165                 170                 175

Val Pro Phe Val Gln Trp Phe Val Gly Leu Ser Pro Thr Val Trp Leu
            180                 185                 190

Ser Val Ile Trp Met Met Trp Tyr Trp Gly Pro Ser Leu Tyr Asn Ile
        195                 200                 205

Leu Ser Pro Phe Leu Pro Leu Leu Pro Ile Phe Phe Cys Leu Trp Val
    210                 215                 220

Tyr Ile
225
```

<210> 11
<211> 1521
<212> PRT
<213> Artificial Sequence

<220>
<223> Vaccine construct

<400> 11

```
Met Ser Leu Leu Trp Gly Gly Val Thr Val Leu Ala Ala Met Leu Ile
```

```
1               5                   10                  15

Ala Gly Gln Val Ala Ser Val Val Phe Leu Val Lys Gly Gly Ser Met
            20                  25                  30

Gly Gly Trp Ser Ser Lys Pro Arg Gln Gly Met Gly Thr Asn Leu Ser
        35                  40                  45

Val Pro Asn Pro Leu Gly Phe Phe Pro Asp His Gln Leu Asp Pro Ala
    50                  55                  60

Phe Gly Ala Asn Ser Asn Asn Pro Asp Trp Asp Phe Asn Pro Asn Lys
65                  70                  75                  80

Asp His Trp Pro Glu Ala Asn Gln Val Gly Ala Gly Ala Phe Gly Pro
                85                  90                  95

Gly Phe Thr Pro Pro His Gly Gly Leu Leu Gly Trp Ser Pro Gln Ala
            100                 105                 110

Gln Gly Ile Leu Thr Thr Val Pro Ala Ala Pro Pro Pro Ala Ser Thr
        115                 120                 125

Asn Arg Gln Ser Gly Arg Gln Pro Thr Pro Ile Ser Pro Pro Leu Arg
    130                 135                 140

Asp Ser His Pro Gln Ala Met Gln Trp Asn Ser Thr Thr Phe His Gln
145                 150                 155                 160

Ala Leu Leu Asp Pro Arg Val Arg Gly Leu Tyr Phe Pro Ala Gly Gly
                165                 170                 175

Ser Ser Ser Gly Thr Val Asn Pro Val Pro Thr Thr Ala Ser Pro Ile
            180                 185                 190

Ser Ser Ile Phe Ser Arg Thr Gly Asp Pro Ala Pro Asn Met Glu Asn
        195                 200                 205
```

```
Thr Thr Ser Gly Phe Leu Gly Pro Leu Leu Val Leu Gln Ala Gly Phe
    210                 215                 220

Phe Leu Leu Thr Arg Ile Leu Thr Ile Pro Gln Ser Leu Asp Ser Trp
225                 230                 235                 240

Trp Thr Ser Leu Asn Phe Leu Gly Gly Ala Pro Thr Cys Pro Gly Gln
                245                 250                 255

Asn Ser Gln Ser Pro Thr Ser Asn His Ser Pro Thr Ser Cys Pro Pro
            260                 265                 270

Ile Cys Pro Gly Tyr Arg Trp Met Cys Leu Arg Arg Phe Ile Ile Phe
        275                 280                 285

Leu Phe Ile Leu Leu Leu Cys Leu Ile Phe Leu Leu Val Leu Leu Asp
    290                 295                 300

Tyr Gln Gly Met Leu Pro Val Cys Pro Leu Leu Pro Gly Thr Ser Thr
305                 310                 315                 320

Thr Ser Thr Gly Pro Cys Lys Thr Cys Thr Ile Pro Ala Gln Gly Thr
                325                 330                 335

Ser Met Phe Pro Ser Cys Cys Cys Thr Lys Pro Ser Asp Gly Asn Cys
            340                 345                 350

Thr Cys Ile Pro Ile Pro Ser Ser Trp Ala Phe Ala Arg Phe Leu Trp
        355                 360                 365

Glu Trp Ala Ser Val Arg Phe Ser Trp Leu Ser Leu Leu Val Pro Phe
    370                 375                 380

Val Gln Trp Phe Val Gly Leu Ser Pro Thr Val Trp Leu Ser Val Ile
385                 390                 395                 400

Trp Met Met Trp Tyr Trp Gly Pro Ser Leu Tyr Asn Ile Leu Ser Pro
```

```
                405                 410                 415

Phe Leu Pro Leu Leu Pro Ile Phe Phe Cys Leu Trp Val Tyr Ile Arg
            420                 425                 430

Lys Arg Arg Ala Pro Val Lys Gln Thr Leu Asn Phe Asp Leu Leu Lys
        435                 440                 445

Leu Ala Gly Asp Val Glu Ser Asn Pro Gly Pro Met Gln Leu Phe His
    450                 455                 460

Leu Cys Leu Ile Ile Ser Cys Ser Cys Pro Thr Val Gln Ala Ser Lys
465                 470                 475                 480

Leu Cys Leu Gly Trp Leu Trp Gly Met Asp Ile Asp Pro Tyr Lys Glu
                485                 490                 495

Phe Gly Ala Ser Val Glu Leu Leu Ser Phe Leu Pro Ser Asp Phe Phe
            500                 505                 510

Pro Ser Ile Arg Asp Leu Leu Asp Thr Ala Ser Ala Leu Tyr Arg Glu
        515                 520                 525

Ala Leu Glu Ser Pro Glu His Cys Ser Pro His His Thr Ala Leu Arg
    530                 535                 540

Gln Ala Ile Leu Cys Trp Gly Glu Leu Met Asn Leu Ala Thr Trp Val
545                 550                 555                 560

Gly Ser Asn Leu Glu Asp Pro Ala Ser Arg Glu Leu Val Val Ser Tyr
                565                 570                 575

Val Asn Val Asn Met Gly Leu Lys Ile Arg Gln Leu Leu Trp Phe His
            580                 585                 590

Ile Ser Cys Leu Thr Phe Gly Arg Glu Thr Val Leu Glu Tyr Leu Val
        595                 600                 605
```

```
Ser Phe Gly Val Trp Ile Arg Thr Pro Pro Ala Tyr Arg Pro Pro Asn
    610                 615                 620

Ala Pro Ile Leu Ser Thr Leu Pro Glu Thr Thr Val Val Arg Arg Arg
625                 630                 635                 640

Gly Arg Ser Pro Arg Arg Arg Thr Pro Ser Pro Arg Arg Arg Arg Ser
                645                 650                 655

Gln Ser Pro Arg Arg Arg Arg Ser Gln Ser Arg Glu Ser Gln Cys Gly
            660                 665                 670

Gly Gly Ser Gly Gly Gly Met Pro Leu Ser Tyr Gln His Phe Arg Lys
        675                 680                 685

Leu Leu Leu Leu Asp Asp Glu Ala Gly Pro Leu Glu Glu Glu Leu Pro
    690                 695                 700

Arg Leu Ala Asp Glu Gly Leu Asn Arg Arg Val Ala Glu Asp Leu Asn
705                 710                 715                 720

Leu Gly Asn Leu Asn Val Ser Ile Pro Trp Thr His Lys Val Gly Asn
                725                 730                 735

Phe Thr Gly Leu Ala Ser Ser Thr Val Pro Val Phe Asn Pro Glu Trp
            740                 745                 750

Gln Thr Pro Ser Phe Pro His Ile His Leu Gln Glu Asp Ile Ile Asn
        755                 760                 765

Arg Cys Gln Gln Tyr Val Gly Pro Leu Thr Val Asn Glu Lys Arg Arg
    770                 775                 780

Leu Lys Leu Ile Met Pro Ala Arg Phe Tyr Pro Asn Leu Thr Lys Tyr
785                 790                 795                 800

Leu Pro Leu Asp Lys Gly Ile Lys Pro Tyr Tyr Pro Glu His Ala Val
```

```
                805                 810                 815

Asn His Tyr Phe Lys Thr Arg His Tyr Leu His Thr Leu Trp Lys Ala
            820                 825                 830

Gly Ile Leu Tyr Lys Arg Glu Thr Thr Arg Ser Ala Ser Phe Cys Gly
        835                 840                 845

Ser Pro Tyr Ser Trp Glu Gln Glu Leu Gln His Gly Arg Leu Val Phe
    850                 855                 860

Gln Thr Ser Thr Arg His Gly Asp Glu Ser Phe Cys Ser Gln Ser Ser
865                 870                 875                 880

Gly Ile Leu Ser Arg Ser Pro Val Gly Pro Cys Val Arg Ser Gln Leu
                885                 890                 895

Lys Gln Ser Arg Leu Gly Leu Gln Pro Gln Gln Gly Ser Leu Ala Arg
            900                 905                 910

Gly Lys Ser Gly Arg Ser Gly Ser Ile Arg Ala Arg Val His Pro Thr
        915                 920                 925

Thr Arg Arg Ser Phe Gly Val Glu Pro Ser Gly Ser Gly His Ile Asp
    930                 935                 940

Asn Ser Ala Ser Ser Thr Ser Ser Cys Leu His Gln Ser Ala Val Arg
945                 950                 955                 960

Lys Thr Ala Tyr Ser His Leu Ser Thr Ser Lys Arg Gln Ser Ser Ser
                965                 970                 975

Gly His Ala Val Glu Leu His Asn Ile Pro Pro Ser Ser Ala Arg Ser
            980                 985                 990

Gln Ser Glu Gly Pro Ile Phe Ser  Ala Trp Trp Leu Gln  Phe Arg Asn
        995                 1000                1005
```

```
Ser Lys  Pro Ala Ser Asp Tyr  Ala Leu Thr His Ile  Val Asn Leu
    1010                1015                1020

Leu Glu  Asp Trp Gly Pro Ala  Thr Glu His Gly Glu  His Asn Ile
    1025                1030                1035

Arg Ile  Pro Arg Thr Pro Ala  Arg Val Thr Gly Gly  Val Phe Leu
    1040                1045                1050

Val Asp  Lys Asn Pro His Asn  Thr Thr Glu Ser Arg  Leu Val Val
    1055                1060                1065

Asp Phe  Ser Gln Phe Ser Arg  Gly Ser Thr His Val  Ser Trp Pro
    1070                1075                1080

Lys Phe  Ala Val Pro Asn Leu  Gln Ser Leu Thr Asn  Leu Leu Ser
    1085                1090                1095

Ser Asn  Leu Ser Trp Leu Ser  Leu Asp Val Ser Ala  Ala Phe Tyr
    1100                1105                1110

His Ile  Pro Leu His Pro Ala  Ala Met Pro His Leu  Leu Val Gly
    1115                1120                1125

Ser Ser  Gly Leu Pro Arg Tyr  Val Ala Arg Leu Ser  Ser Thr Ser
    1130                1135                1140

Arg Asn  Ile Asn Tyr Gln His  Gly Thr Met Gln Asp  Leu His Asp
    1145                1150                1155

Ser Cys  Ser Arg Asn Leu Tyr  Val Ser Leu Leu Leu  Leu Tyr Lys
    1160                1165                1170

Thr Phe  Gly Arg Lys Leu His  Leu Tyr Ser His Pro  Ile Ile Leu
    1175                1180                1185

Gly Phe  Arg Lys Ile Pro Met  Gly Val Gly Leu Ser  Pro Phe Leu
```

```
    1190                1195                1200

Leu Ala  Gln Phe Thr Ser Ala  Ile Cys Ser Val Val  Arg Arg Ala
    1205                1210                1215

Phe Pro  His Cys Leu Ala Phe  Ser Tyr Met Asp Asp  Val Val Leu
    1220                1225                1230

Gly Ala  Lys Ser Val Gln His  Leu Glu Ser Leu Phe  Thr Ser Ile
    1235                1240                1245

Thr Asn  Phe Leu Leu Ser Leu  Gly Ile His Leu Asn  Pro Asn Lys
    1250                1255                1260

Thr Lys  Arg Trp Gly Tyr Ser  Leu Asn Phe Met Gly  Tyr Val Ile
    1265                1270                1275

Gly Ser  Trp Gly Thr Leu Pro  Gln Glu His Ile Val  Leu Lys Ile
    1280                1285                1290

Lys Gln  Cys Phe Arg Lys Leu  Pro Val Asn Arg Pro  Ile Asp Trp
    1295                1300                1305

Lys Val  Cys Gln Arg Ile Val  Gly Leu Leu Gly Phe  Ala Ala Pro
    1310                1315                1320

Phe Thr  Gln Cys Gly Tyr Pro  Ala Leu Met Pro Leu  Tyr Ala Cys
    1325                1330                1335

Ile Gln  Ser Lys Gln Ala Phe  Thr Phe Ser Pro Thr  Tyr Lys Ala
    1340                1345                1350

Phe Leu  Cys Lys Gln Tyr Leu  Asn Leu Tyr Pro Val  Ala Arg Gln
    1355                1360                1365

Arg Ser  Gly Leu Cys Gln Val  Phe Ala Asp Ala Thr  Pro Thr Gly
    1370                1375                1380
```

```
Trp Gly  Leu Ala Ile Gly His  Arg Ala Met Arg Gly  Thr Phe Val
    1385                1390                1395


Ala Pro  Leu Pro Ile His Thr  Ala Glu Leu Leu Ala  Ala Cys Phe
    1400                1405                1410


Ala Arg  Ser Arg Ser Gly Ala  Lys Leu Ile Gly Thr  Asp Asn Ser
    1415                1420                1425


Val Val  Leu Ser Arg Lys Tyr  Thr Ser Phe Pro Trp  Leu Leu Gly
    1430                1435                1440


Cys Ala  Ala Asn Trp Ile Leu  Arg Gly Thr Ser Phe  Val Tyr Val
    1445                1450                1455


Pro Ser  Ala Leu Asn Pro Ala  Ala Asp Pro Ser Ala  Gly Arg Leu
    1460                1465                1470


Gly Leu  Tyr Arg Pro Leu Leu  His Leu Pro Phe Arg  Pro Thr Thr
    1475                1480                1485


Gly Arg  Thr Ser Leu Tyr Ala  Val Ser Pro Ser Val  Pro Ser His
    1490                1495                1500


Leu Pro  Asp Arg Val His Phe  Ala Ser Pro Leu His  Val Ala Trp
    1505                1510                1515


Arg Pro  Pro
    1520
```

<210> 12
<211> 1490
<212> PRT
<213> Artificial Sequence

<220>
<223> Vaccine construct

<400> 12

```
Met Gln Leu Phe His Leu Cys Leu Ile Ile Ser Cys Ser Cys Pro Thr
1               5                  10                  15

Val Gln Ala Ser Lys Leu Cys Leu Gly Trp Leu Trp Gly Met Asp Ile
            20                  25                  30

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

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

Ala Leu Tyr Arg Glu Ala Leu Glu Ser Pro Glu His Cys Ser Pro His
65                  70                  75                  80

His Thr Ala Leu Arg Gln Ala Ile Leu Cys Trp Gly Glu Leu Met Asn
                85                  90                  95

Leu Ala Thr Trp Val Gly Ser Asn Leu Glu Asp Pro Ala Ser Arg Glu
            100                 105                 110

Leu Val Val Ser Tyr Val Asn Val Asn Met Gly Leu Lys Ile Arg Gln
        115                 120                 125

Leu Leu Trp Phe His Ile Ser Cys Leu Thr Phe Gly Arg Glu Thr Val
    130                 135                 140

Leu Glu Tyr Leu Val Ser Phe Gly Val Trp Ile Arg Thr Pro Pro Ala
145                 150                 155                 160

Tyr Arg Pro Pro Asn Ala Pro Ile Leu Ser Thr Leu Pro Glu Thr Thr
                165                 170                 175

Val Val Arg Arg Arg Gly Arg Ser Pro Arg Arg Arg Thr Pro Ser Pro
            180                 185                 190

Arg Arg Arg Arg Ser Gln Ser Pro Arg Arg Arg Arg Ser Gln Ser Arg
```

```
        195                 200                 205

Glu Ser Gln Cys Gly Gly Gly Ser Gly Gly Gly Met Pro Leu Ser Tyr
    210                 215                 220

Gln His Phe Arg Lys Leu Leu Leu Leu Asp Asp Glu Ala Gly Pro Leu
225                 230                 235                 240

Glu Glu Glu Leu Pro Arg Leu Ala Asp Glu Gly Leu Asn Arg Arg Val
                245                 250                 255

Ala Glu Asp Leu Asn Leu Gly Asn Leu Asn Val Ser Ile Pro Trp Thr
            260                 265                 270

His Lys Val Gly Asn Phe Thr Gly Leu Ala Ser Ser Thr Val Pro Val
        275                 280                 285

Phe Asn Pro Glu Trp Gln Thr Pro Ser Phe Pro His Ile His Leu Gln
    290                 295                 300

Glu Asp Ile Ile Asn Arg Cys Gln Gln Tyr Val Gly Pro Leu Thr Val
305                 310                 315                 320

Asn Glu Lys Arg Arg Leu Lys Leu Ile Met Pro Ala Arg Phe Tyr Pro
                325                 330                 335

Asn Leu Thr Lys Tyr Leu Pro Leu Asp Lys Gly Ile Lys Pro Tyr Tyr
            340                 345                 350

Pro Glu His Ala Val Asn His Tyr Phe Lys Thr Arg His Tyr Leu His
        355                 360                 365

Thr Leu Trp Lys Ala Gly Ile Leu Tyr Lys Arg Glu Thr Thr Arg Ser
    370                 375                 380

Ala Ser Phe Cys Gly Ser Pro Tyr Ser Trp Glu Gln Glu Leu Gln His
385                 390                 395                 400
```

```
Gly Arg Leu Val Phe Gln Thr Ser Thr Arg His Gly Asp Glu Ser Phe
                405                 410                 415

Cys Ser Gln Ser Ser Gly Ile Leu Ser Arg Ser Pro Val Gly Pro Cys
            420                 425                 430

Val Arg Ser Gln Leu Lys Gln Ser Arg Leu Gly Leu Gln Pro Gln Gln
        435                 440                 445

Gly Ser Leu Ala Arg Gly Lys Ser Gly Arg Ser Gly Ser Ile Arg Ala
    450                 455                 460

Arg Val His Pro Thr Thr Arg Arg Ser Phe Gly Val Glu Pro Ser Gly
465                 470                 475                 480

Ser Gly His Ile Asp Asn Ser Ala Ser Ser Thr Ser Ser Cys Leu His
                485                 490                 495

Gln Ser Ala Val Arg Lys Thr Ala Tyr Ser His Leu Ser Thr Ser Lys
            500                 505                 510

Arg Gln Ser Ser Ser Gly His Ala Val Glu Leu His Asn Ile Pro Pro
        515                 520                 525

Ser Ser Ala Arg Ser Gln Ser Glu Gly Pro Ile Phe Ser Ala Trp Trp
    530                 535                 540

Leu Gln Phe Arg Asn Ser Lys Pro Ala Ser Asp Tyr Ala Leu Thr His
545                 550                 555                 560

Ile Val Asn Leu Leu Glu Asp Trp Gly Pro Ala Thr Glu His Gly Glu
                565                 570                 575

His Asn Ile Arg Ile Pro Arg Thr Pro Ala Arg Val Thr Gly Gly Val
            580                 585                 590

Phe Leu Val Asp Lys Asn Pro His Asn Thr Thr Glu Ser Arg Leu Val
```

```
        595                 600                 605

Val Asp Phe Ser Gln Phe Ser Arg Gly Ser Thr His Val Ser Trp Pro
    610                 615                 620

Lys Phe Ala Val Pro Asn Leu Gln Ser Leu Thr Asn Leu Leu Ser Ser
625                 630                 635                 640

Asn Leu Ser Trp Leu Ser Leu Asp Val Ser Ala Ala Phe Tyr His Ile
                645                 650                 655

Pro Leu His Pro Ala Ala Met Pro His Leu Leu Val Gly Ser Ser Gly
            660                 665                 670

Leu Pro Arg Tyr Val Ala Arg Leu Ser Ser Thr Ser Arg Asn Ile Asn
        675                 680                 685

Tyr Gln His Gly Thr Met Gln Asp Leu His Asp Ser Cys Ser Arg Asn
    690                 695                 700

Leu Tyr Val Ser Leu Leu Leu Leu Tyr Lys Thr Phe Gly Arg Lys Leu
705                 710                 715                 720

His Leu Tyr Ser His Pro Ile Ile Leu Gly Phe Arg Lys Ile Pro Met
                725                 730                 735

Gly Val Gly Leu Ser Pro Phe Leu Leu Ala Gln Phe Thr Ser Ala Ile
            740                 745                 750

Cys Ser Val Val Arg Arg Ala Phe Pro His Cys Leu Ala Phe Ser Tyr
        755                 760                 765

Met Asp Asp Val Val Leu Gly Ala Lys Ser Val Gln His Leu Glu Ser
    770                 775                 780

Leu Phe Thr Ser Ile Thr Asn Phe Leu Leu Ser Leu Gly Ile His Leu
785                 790                 795                 800
```

```
Asn Pro Asn Lys Thr Lys Arg Trp Gly Tyr Ser Leu Asn Phe Met Gly
               805                 810                 815

Tyr Val Ile Gly Ser Trp Gly Thr Leu Pro Gln Glu His Ile Val Leu
            820                 825                 830

Lys Ile Lys Gln Cys Phe Arg Lys Leu Pro Val Asn Arg Pro Ile Asp
        835                 840                 845

Trp Lys Val Cys Gln Arg Ile Val Gly Leu Leu Gly Phe Ala Ala Pro
    850                 855                 860

Phe Thr Gln Cys Gly Tyr Pro Ala Leu Met Pro Leu Tyr Ala Cys Ile
865                 870                 875                 880

Gln Ser Lys Gln Ala Phe Thr Phe Ser Pro Thr Tyr Lys Ala Phe Leu
               885                 890                 895

Cys Lys Gln Tyr Leu Asn Leu Tyr Pro Val Ala Arg Gln Arg Ser Gly
            900                 905                 910

Leu Cys Gln Val Phe Ala Asp Ala Thr Pro Thr Gly Trp Gly Leu Ala
        915                 920                 925

Ile Gly His Arg Ala Met Arg Gly Thr Phe Val Ala Pro Leu Pro Ile
    930                 935                 940

His Thr Ala Glu Leu Leu Ala Ala Cys Phe Ala Arg Ser Arg Ser Gly
945                 950                 955                 960

Ala Lys Leu Ile Gly Thr Asp Asn Ser Val Val Leu Ser Arg Lys Tyr
               965                 970                 975

Thr Ser Phe Pro Trp Leu Leu Gly Cys Ala Ala Asn Trp Ile Leu Arg
            980                 985                 990

Gly Thr Ser Phe Val Tyr Val Pro  Ser Ala Leu Asn Pro  Ala Ala Asp
```

```
        995                 1000                1005

Pro Ser  Ala Gly Arg Leu Gly  Leu Tyr Arg Pro Leu  Leu His Leu
    1010                1015                1020

Pro Phe  Arg Pro Thr Thr Gly  Arg Thr Ser Leu Tyr  Ala Val Ser
    1025                1030                1035

Pro Ser  Val Pro Ser His Leu  Pro Asp Arg Val His  Phe Ala Ser
    1040                1045                1050

Pro Leu  His Val Ala Trp Arg  Pro Pro Arg Lys Arg  Arg Ala Pro
    1055                1060                1065

Val Lys  Gln Thr Leu Asn Phe  Asp Leu Leu Lys Leu  Ala Gly Asp
    1070                1075                1080

Val Glu  Ser Asn Pro Gly Pro  Met Gly Gly Trp Ser  Ser Lys Pro
    1085                1090                1095

Arg Gln  Gly Met Gly Thr Asn  Leu Ser Val Pro Asn  Pro Leu Gly
    1100                1105                1110

Phe Phe  Pro Asp His Gln Leu  Asp Pro Ala Phe Gly  Ala Asn Ser
    1115                1120                1125

Asn Asn  Pro Asp Trp Asp Phe  Asn Pro Asn Lys Asp  His Trp Pro
    1130                1135                1140

Glu Ala  Asn Gln Val Gly Ala  Gly Ala Phe Gly Pro  Gly Phe Thr
    1145                1150                1155

Pro Pro  His Gly Gly Leu Leu  Gly Trp Ser Pro Gln  Ala Gln Gly
    1160                1165                1170

Ile Leu  Thr Thr Val Pro Ala  Ala Pro Pro Pro Ala  Ser Thr Asn
    1175                1180                1185
```

```
Arg Gln  Ser Gly Arg Gln Pro  Thr Pro Ile Ser Pro  Pro Leu Arg
    1190                1195                1200

Asp Ser  His Pro Gln Ala Met  Gln Trp Asn Ser Thr  Thr Phe His
    1205                1210                1215

Gln Ala  Leu Leu Asp Pro Arg  Val Arg Gly Leu Tyr  Phe Pro Ala
    1220                1225                1230

Gly Gly  Ser Ser Ser Gly Thr  Val Asn Pro Val Pro  Thr Thr Ala
    1235                1240                1245

Ser Pro  Ile Ser Ser Ile Phe  Ser Arg Thr Gly Asp  Pro Ala Pro
    1250                1255                1260

Asn Met  Glu Asn Thr Thr Ser  Gly Phe Leu Gly Pro  Leu Leu Val
    1265                1270                1275

Leu Gln  Ala Gly Phe Phe Leu  Leu Thr Arg Ile Leu  Thr Ile Pro
    1280                1285                1290

Gln Ser  Leu Asp Ser Trp Trp  Thr Ser Leu Asn Phe  Leu Gly Gly
    1295                1300                1305

Ala Pro  Thr Cys Pro Gly Gln  Asn Ser Gln Ser Pro  Thr Ser Asn
    1310                1315                1320

His Ser  Pro Thr Ser Cys Pro  Pro Ile Cys Pro Gly  Tyr Arg Trp
    1325                1330                1335

Met Cys  Leu Arg Arg Phe Ile  Ile Phe Leu Phe Ile  Leu Leu Leu
    1340                1345                1350

Cys Leu  Ile Phe Leu Leu Val  Leu Leu Asp Tyr Gln  Gly Met Leu
    1355                1360                1365

Pro Val  Cys Pro Leu Leu Pro  Gly Thr Ser Thr Thr  Ser Thr Gly
```

1370 1375 1380

Pro Cys Lys Thr Cys Thr Ile Pro Ala Gln Gly Thr Ser Met Phe
1385 1390 1395

Pro Ser Cys Cys Cys Thr Lys Pro Ser Asp Gly Asn Cys Thr Cys
1400 1405 1410

Ile Pro Ile Pro Ser Ser Trp Ala Phe Ala Arg Phe Leu Trp Glu
1415 1420 1425

Trp Ala Ser Val Arg Phe Ser Trp Leu Ser Leu Leu Val Pro Phe
1430 1435 1440

Val Gln Trp Phe Val Gly Leu Ser Pro Thr Val Trp Leu Ser Val
1445 1450 1455

Ile Trp Met Met Trp Tyr Trp Gly Pro Ser Leu Tyr Asn Ile Leu
1460 1465 1470

Ser Pro Phe Leu Pro Leu Leu Pro Ile Phe Phe Cys Leu Trp Val
1475 1480 1485

Tyr Ile
1490

<210> 13
<211> 1492
<212> PRT
<213> Artificial Sequence

<220>
<223> Vaccine construct

<400> 13

Met Ser Leu Leu Trp Gly Gly Val Thr Val Leu Ala Ala Met Leu Ile
1 5 10 15

Ala Gly Gln Val Ala Ser Val Val Phe Leu Val Lys Gly Gly Gly Pro

```
            20                  25                  30

Gly Gly Gly Met Gln Leu Phe His Leu Cys Leu Ile Ile Ser Cys Ser
        35                  40                  45

Cys Pro Thr Val Gln Ala Ser Lys Leu Cys Leu Gly Trp Leu Trp Gly
    50                  55                  60

Met Asp Ile Asp Pro Tyr Lys Glu Phe Gly Ala Ser Val Glu Leu Leu
65                  70                  75                  80

Ser Phe Leu Pro Ser Asp Phe Phe Pro Ser Ile Arg Asp Leu Leu Asp
                85                  90                  95

Thr Ala Ser Ala Leu Tyr Arg Glu Ala Leu Glu Ser Pro Glu His Cys
            100                 105                 110

Ser Pro His His Thr Ala Leu Arg Gln Ala Ile Leu Cys Trp Gly Glu
        115                 120                 125

Leu Met Asn Leu Ala Thr Trp Val Gly Ser Asn Leu Glu Asp Pro Ala
    130                 135                 140

Ser Arg Glu Leu Val Val Ser Tyr Val Asn Val Asn Met Gly Leu Lys
145                 150                 155                 160

Ile Arg Gln Leu Leu Trp Phe His Ile Ser Cys Leu Thr Phe Gly Arg
                165                 170                 175

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

Pro Pro Ala Tyr Arg Pro Pro Asn Ala Pro Ile Leu Ser Thr Leu Pro
        195                 200                 205

Glu Thr Thr Val Val Arg Arg Arg Gly Arg Ser Pro Arg Arg Arg Thr
    210                 215                 220
```

```
Pro Ser Pro Arg Arg Arg Arg Ser Gln Ser Pro Arg Arg Arg Arg Ser
225                 230                 235                 240

Gln Ser Arg Glu Ser Gln Cys Gly Gly Gly Ser Gly Gly Gly Met Pro
                245                 250                 255

Leu Ser Tyr Gln His Phe Arg Lys Leu Leu Leu Leu Asp Asp Glu Ala
            260                 265                 270

Gly Pro Leu Glu Glu Glu Leu Pro Arg Leu Ala Asp Glu Gly Leu Asn
        275                 280                 285

Arg Arg Val Ala Glu Asp Leu Asn Leu Gly Asn Leu Asn Val Ser Ile
    290                 295                 300

Pro Trp Thr His Lys Val Gly Asn Phe Thr Gly Leu Ala Ser Ser Thr
305                 310                 315                 320

Val Pro Val Phe Asn Pro Glu Trp Gln Thr Pro Ser Phe Pro His Ile
                325                 330                 335

His Leu Gln Glu Asp Ile Ile Asn Arg Cys Gln Gln Tyr Val Gly Pro
            340                 345                 350

Leu Thr Val Asn Glu Lys Arg Arg Leu Lys Leu Ile Met Pro Ala Arg
        355                 360                 365

Phe Tyr Pro Asn Leu Thr Lys Tyr Leu Pro Leu Asp Lys Gly Ile Lys
    370                 375                 380

Pro Tyr Tyr Pro Glu His Ala Val Asn His Tyr Phe Lys Thr Arg His
385                 390                 395                 400

Tyr Leu His Thr Leu Trp Lys Ala Gly Ile Leu Tyr Lys Arg Glu Thr
                405                 410                 415

Thr Arg Ser Ala Ser Phe Cys Gly Ser Pro Tyr Ser Trp Glu Gln Glu
```

```
            420                 425                 430

Leu Gln His Gly Arg Leu Val Phe Gln Thr Ser Thr Arg His Gly Asp
        435                 440                 445

Glu Ser Phe Cys Ser Gln Ser Ser Gly Ile Leu Ser Arg Ser Pro Val
    450                 455                 460

Gly Pro Cys Val Arg Ser Gln Leu Lys Gln Ser Arg Leu Gly Leu Gln
465                 470                 475                 480

Pro Gln Gln Gly Ser Leu Ala Arg Gly Lys Ser Gly Arg Ser Gly Ser
                485                 490                 495

Ile Arg Ala Arg Val His Pro Thr Thr Arg Arg Ser Phe Gly Val Glu
            500                 505                 510

Pro Ser Gly Ser Gly His Ile Asp Asn Ser Ala Ser Ser Thr Ser Ser
        515                 520                 525

Cys Leu His Gln Ser Ala Val Arg Lys Thr Ala Tyr Ser His Leu Ser
    530                 535                 540

Thr Ser Lys Arg Gln Ser Ser Ser Gly His Ala Val Glu Leu His Asn
545                 550                 555                 560

Ile Pro Pro Ser Ser Ala Arg Ser Gln Ser Glu Gly Pro Ile Phe Ser
                565                 570                 575

Ala Trp Trp Leu Gln Phe Arg Asn Ser Lys Pro Ala Ser Asp Tyr Ala
            580                 585                 590

Leu Thr His Ile Val Asn Leu Leu Glu Asp Trp Gly Pro Ala Thr Glu
        595                 600                 605

His Gly Glu His Asn Ile Arg Ile Pro Arg Thr Pro Ala Arg Val Thr
    610                 615                 620
```

```
Gly Gly Val Phe Leu Val Asp Lys Asn Pro His Asn Thr Thr Glu Ser
625                 630                 635                 640

Arg Leu Val Val Asp Phe Ser Gln Phe Ser Arg Gly Ser Thr His Val
                645                 650                 655

Ser Trp Pro Lys Phe Ala Val Pro Asn Leu Gln Ser Leu Thr Asn Leu
            660                 665                 670

Leu Ser Ser Asn Leu Ser Thr Phe Gly Arg Lys Leu His Leu Tyr Ser
        675                 680                 685

His Pro Ile Ile Leu Gly Phe Arg Lys Ile Pro Met Gly Val Gly Leu
    690                 695                 700

Ser Pro Phe Leu Leu Ala Gln Phe Thr Ser Ala Ile Cys Ser Val Val
705                 710                 715                 720

Arg Arg Ala Phe Pro His Cys Leu Ala Phe Ser Tyr Met Asp Asp Val
                725                 730                 735

Val Leu Gly Ala Lys Ser Val Gln His Leu Glu Ser Leu Phe Thr Ser
            740                 745                 750

Ile Thr Asn Phe Leu Leu Ser Leu Gly Ile His Leu Asn Pro Asn Lys
        755                 760                 765

Thr Lys Arg Trp Gly Tyr Ser Leu Asn Phe Met Gly Tyr Val Ile Gly
    770                 775                 780

Ser Trp Gly Thr Leu Pro Gln Glu His Ile Val Leu Lys Ile Lys Gln
785                 790                 795                 800

Cys Phe Arg Lys Leu Pro Val Asn Arg Pro Ile Asp Trp Lys Val Cys
                805                 810                 815

Gln Arg Ile Val Gly Leu Leu Gly Phe Ala Ala Pro Phe Thr Gln Cys
```

```
            820                 825                 830

Gly Tyr Pro Ala Leu Met Pro Leu Tyr Ala Cys Ile Gln Ser Lys Gln
        835                 840                 845

Ala Phe Thr Phe Ser Pro Thr Tyr Lys Ala Phe Leu Cys Lys Gln Tyr
    850                 855                 860

Leu Asn Leu Tyr Pro Val Ala Arg Gln Arg Ser Gly Leu Cys Gln Val
865                 870                 875                 880

Phe Ala Asp Ala Thr Pro Thr Gly Trp Gly Leu Ala Ile Gly His Arg
                885                 890                 895

Ala Met Arg Gly Thr Phe Val Ala Pro Leu Pro Ile His Thr Ala Glu
            900                 905                 910

Leu Leu Ala Ala Cys Phe Ala Arg Ser Arg Ser Gly Ala Lys Leu Ile
        915                 920                 925

Gly Thr Asp Asn Ser Val Val Leu Ser Arg Lys Tyr Thr Ser Phe Pro
    930                 935                 940

Trp Leu Leu Gly Cys Ala Ala Asn Trp Ile Leu Arg Gly Thr Ser Phe
945                 950                 955                 960

Val Tyr Val Pro Ser Ala Leu Asn Pro Ala Ala Asp Pro Ser Ala Gly
                965                 970                 975

Arg Leu Gly Leu Tyr Arg Pro Leu Leu His Leu Pro Phe Arg Pro Thr
            980                 985                 990

Thr Gly Arg Thr Ser Leu Tyr Ala  Val Ser Pro Ser Val  Pro Ser His
        995                 1000                1005

Leu Pro  Asp Arg Val His Phe  Ala Ser Pro Leu His  Val Ala Trp
    1010                1015                1020
```

```
Arg Pro  Pro Lys Ser Pro Asn  Ser Asn Asn Pro Asp  Trp Asp Phe
    1025                1030                1035

Asn Pro  Asn Lys Asp His Trp  Pro Glu Ala Asn Gln  Val Gly Ala
    1040                1045                1050

Gly Ala  Phe Gly Pro Gly Phe  Thr Pro Pro His Gly  Gly Leu Leu
    1055                1060                1065

Gly Trp  Ser Pro Gln Ala Gln  Gly Ile Leu Thr Thr  Val Pro Ala
    1070                1075                1080

Ala Pro  Pro Pro Ala Ser Thr  Asn Arg Gln Ser Gly  Arg Gln Pro
    1085                1090                1095

Thr Pro  Ile Ser Pro Pro Leu  Arg Asp Ser His Pro  Gln Ala Met
    1100                1105                1110

Gln Trp  Asn Ser Thr Thr Phe  His Gln Ala Leu Leu  Asp Pro Arg
    1115                1120                1125

Val Arg  Gly Leu Tyr Phe Pro  Ala Gly Gly Ser Ser  Ser Gly Thr
    1130                1135                1140

Val Asn  Pro Val Pro Thr Thr  Ala Ser Pro Ile Ser  Ser Ile Phe
    1145                1150                1155

Ser Arg  Thr Gly Asp Pro Ala  Pro Asn Gly Ser Lys  Gly Lys Arg
    1160                1165                1170

Lys Arg  Arg Ala Pro Val Lys  Gln Thr Leu Asn Phe  Asp Leu Leu
    1175                1180                1185

Lys Leu  Ala Gly Asp Val Glu  Ser Asn Pro Gly Pro  Met Gly Gly
    1190                1195                1200

Trp Ser  Ser Lys Pro Arg Gln  Gly Met Gly Thr Asn  Leu Ser Val
```

```
    1205                1210                1215

Pro Asn  Pro Leu Gly Phe Phe  Pro Asp His Gln Leu  Asp Pro Ala
    1220                1225                1230

Phe Gly  Ala Asn Ser Asn Asn  Pro Asp Trp Asp Phe  Asn Pro Asn
    1235                1240                1245

Lys Asp  His Trp Pro Glu Ala  Asn Gln Val Gly Leu  Glu Gly Gly
    1250                1255                1260

Ser Gly  Gly Met Glu Asn Thr  Thr Ser Gly Phe Leu  Gly Pro Leu
    1265                1270                1275

Leu Val  Leu Gln Ala Gly Phe  Phe Leu Leu Thr Arg  Ile Leu Thr
    1280                1285                1290

Ile Pro  Gln Ser Leu Asp Ser  Trp Trp Thr Ser Leu  Asn Phe Leu
    1295                1300                1305

Gly Gly  Ala Pro Thr Cys Pro  Gly Gln Asn Ser Gln  Ser Pro Thr
    1310                1315                1320

Ser Asn  His Ser Pro Thr Ser  Cys Pro Pro Ile Cys  Pro Gly Tyr
    1325                1330                1335

Arg Trp  Met Cys Leu Arg Arg  Phe Ile Ile Phe Leu  Phe Ile Leu
    1340                1345                1350

Leu Leu  Cys Leu Ile Phe Leu  Leu Val Leu Leu Asp  Tyr Gln Gly
    1355                1360                1365

Met Leu  Pro Val Cys Pro Leu  Leu Pro Gly Thr Ser  Thr Thr Ser
    1370                1375                1380

Thr Gly  Pro Cys Lys Thr Cys  Thr Ile Pro Ala Gln  Gly Thr Ser
    1385                1390                1395
```

```
Met Phe  Pro Ser Cys Cys Cys  Thr Lys Pro Ser Asp  Gly Asn Cys
    1400                1405                1410


Thr Cys  Ile Pro Ile Pro Ser  Ser Trp Ala Phe Ala  Arg Phe Leu
    1415                1420                1425


Trp Glu  Trp Ala Ser Val Arg  Phe Ser Trp Leu Ser  Leu Leu Val
    1430                1435                1440


Pro Phe  Val Gln Trp Phe Val  Gly Leu Ser Pro Thr  Val Trp Leu
    1445                1450                1455


Ser Val  Ile Trp Met Met Trp  Tyr Trp Gly Pro Ser  Leu Tyr Asn
    1460                1465                1470


Ile Leu  Ser Pro Phe Leu Pro  Leu Leu Pro Ile Phe  Phe Cys Leu
    1475                1480                1485


Trp Val  Tyr Ile
    1490


<210>  14
<211>  4
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Linker peptide

<400>  14

Lys Gly Gly Ser
1


<210>  15
<211>  138
<212>  PRT
<213>  Hepatitis B virus

<400>  15
```

```
Asn Ser Asn Asn Pro Asp Trp Asp Phe Asn Pro Asn Lys Asp His Trp
1               5                   10                  15


Pro Glu Ala Asn Gln Val Gly Ala Gly Ala Phe Gly Pro Gly Phe Thr
            20                  25                  30


Pro Pro His Gly Gly Leu Leu Gly Trp Ser Pro Gln Ala Gln Gly Ile
        35                  40                  45


Leu Thr Thr Val Pro Ala Ala Pro Pro Pro Ala Ser Thr Asn Arg Gln
    50                  55                  60


Ser Gly Arg Gln Pro Thr Pro Ile Ser Pro Pro Leu Arg Asp Ser His
65                  70                  75                  80


Pro Gln Ala Met Gln Trp Asn Ser Thr Thr Phe His Gln Ala Leu Leu
                85                  90                  95


Asp Pro Arg Val Arg Gly Leu Tyr Phe Pro Ala Gly Gly Ser Ser Ser
            100                 105                 110


Gly Thr Val Asn Pro Val Pro Thr Thr Ala Ser Pro Ile Ser Ser Ile
        115                 120                 125


Phe Ser Arg Thr Gly Asp Pro Ala Pro Asn
    130                 135


<210>  16
<211>  29
<212>  PRT
<213>  Hepatitis B virus

<400>  16

Met Gln Leu Phe His Leu Cys Leu Ile Ile Ser Cys Ser Cys Pro Thr
1               5                   10                  15


Val Gln Ala Ser Lys Leu Cys Leu Gly Trp Leu Trp Gly
            20                  25
```

<210> 17
<211> 159
<212> PRT
<213> Hepatitis B virus

<400> 17

```
Ser Lys Leu Cys Leu Gly Trp Leu Trp Gly Met Asp Ile Asp Pro Tyr
1               5                   10                  15


Lys Glu Phe Gly Ala Ser Val Glu Leu Leu Ser Phe Leu Pro Ser Asp
            20                  25                  30


Phe Phe Pro Ser Ile Arg Asp Leu Leu Asp Thr Ala Ser Ala Leu Tyr
        35                  40                  45


Arg Glu Ala Leu Glu Ser Pro Glu His Cys Ser Pro His His Thr Ala
    50                  55                  60


Leu Arg Gln Ala Ile Leu Cys Trp Gly Glu Leu Met Asn Leu Ala Thr
65                  70                  75                  80


Trp Val Gly Ser Asn Leu Glu Asp Pro Ala Ser Arg Glu Leu Val Val
                85                  90                  95


Ser Tyr Val Asn Val Asn Met Gly Leu Lys Ile Arg Gln Leu Leu Trp
            100                 105                 110


Phe His Ile Ser Cys Leu Thr Phe Gly Arg Glu Thr Val Leu Glu Tyr
        115                 120                 125


Leu Val Ser Phe Gly Val Trp Ile Arg Thr Pro Pro Ala Tyr Arg Pro
    130                 135                 140


Pro Asn Ala Pro Ile Leu Ser Thr Leu Pro Glu Thr Thr Val Val
145                 150                 155
```

<210> 18
<211> 226

<212> PRT
<213> Hepatitis B virus

<400> 18

```
Met Glu Asn Thr Thr Ser Gly Phe Leu Gly Pro Leu Leu Val Leu Gln
1               5                   10                  15


Ala Gly Phe Phe Leu Leu Thr Arg Ile Leu Thr Ile Pro Gln Ser Leu
            20                  25                  30


Asp Ser Trp Trp Thr Ser Leu Asn Phe Leu Gly Gly Ala Pro Thr Cys
        35                  40                  45


Pro Gly Gln Asn Ser Gln Ser Pro Thr Ser Asn His Ser Pro Thr Ser
    50                  55                  60


Cys Pro Pro Ile Cys Pro Gly Tyr Arg Trp Met Cys Leu Arg Arg Phe
65                  70                  75                  80


Ile Ile Phe Leu Phe Ile Leu Leu Leu Cys Leu Ile Phe Leu Leu Val
                85                  90                  95


Leu Leu Asp Tyr Gln Gly Met Leu Pro Val Cys Pro Leu Leu Pro Gly
            100                 105                 110


Thr Ser Thr Thr Ser Thr Gly Pro Cys Lys Thr Cys Thr Ile Pro Ala
        115                 120                 125


Gln Gly Thr Ser Met Phe Pro Ser Cys Cys Cys Thr Lys Pro Ser Asp
    130                 135                 140


Gly Asn Cys Thr Cys Ile Pro Ile Pro Ser Ser Trp Ala Phe Ala Arg
145                 150                 155                 160


Phe Leu Trp Glu Trp Ala Ser Val Arg Phe Ser Trp Leu Ser Leu Leu
                165                 170                 175


Val Pro Phe Val Gln Trp Phe Val Gly Leu Ser Pro Thr Val Trp Leu
```

```
            180                 185                 190

Ser Val Ile Trp Met Met Trp Tyr Trp Gly Pro Ser Leu Tyr Asn Ile
        195                 200                 205

Leu Ser Pro Phe Leu Pro Leu Leu Pro Ile Phe Phe Cys Leu Trp Val
    210                 215                 220

Tyr Ile
225
```

<210> 19
<211> 843
<212> PRT
<213> Hepatitis B virus

<400> 19

```
Met Pro Leu Ser Tyr Gln His Phe Arg Lys Leu Leu Leu Leu Asp Asp
1               5                   10                  15

Glu Ala Gly Pro Leu Glu Glu Glu Leu Pro Arg Leu Ala Asp Glu Gly
            20                  25                  30

Leu Asn Arg Arg Val Ala Glu Asp Leu Asn Leu Gly Asn Leu Asn Val
        35                  40                  45

Ser Ile Pro Trp Thr His Lys Val Gly Asn Phe Thr Gly Leu Tyr Ser
    50                  55                  60

Ser Thr Val Pro Val Phe Asn Pro Glu Trp Gln Thr Pro Ser Phe Pro
65                  70                  75                  80

His Ile His Leu Gln Glu Asp Ile Ile Asn Arg Cys Gln Gln Tyr Val
                85                  90                  95

Gly Pro Leu Thr Val Asn Glu Lys Arg Arg Leu Lys Leu Ile Met Pro
            100                 105                 110
```

```
Ala Arg Phe Tyr Pro Asn Leu Thr Lys Tyr Leu Pro Leu Asp Lys Gly
        115                 120                 125

Ile Lys Pro Tyr Tyr Pro Glu His Ala Val Asn His Tyr Phe Lys Thr
    130                 135                 140

Arg His Tyr Leu His Thr Leu Trp Lys Ala Gly Ile Leu Tyr Lys Arg
145                 150                 155                 160

Glu Thr Thr Arg Ser Ala Ser Phe Cys Gly Ser Pro Tyr Ser Trp Glu
                165                 170                 175

Gln Glu Leu Gln His Gly Arg Leu Val Phe Gln Thr Ser Thr Arg His
            180                 185                 190

Gly Asp Glu Ser Phe Cys Ser Gln Ser Ser Gly Ile Leu Ser Arg Ser
        195                 200                 205

Pro Val Gly Pro Cys Val Arg Ser Gln Leu Lys Gln Ser Arg Leu Gly
    210                 215                 220

Leu Gln Pro Gln Gln Gly Ser Leu Ala Arg Gly Lys Ser Gly Arg Ser
225                 230                 235                 240

Gly Ser Ile Arg Ala Arg Val His Pro Thr Thr Arg Arg Ser Phe Gly
                245                 250                 255

Val Glu Pro Ser Gly Ser Gly His Ile Asp Asn Ser Ala Ser Ser Thr
            260                 265                 270

Ser Ser Cys Leu His Gln Ser Ala Val Arg Lys Thr Ala Tyr Ser His
        275                 280                 285

Leu Ser Thr Ser Lys Arg Gln Ser Ser Ser Gly His Ala Val Glu Leu
    290                 295                 300

His Asn Ile Pro Pro Ser Ser Ala Arg Ser Gln Ser Glu Gly Pro Ile
305                 310                 315                 320
```

```
Phe Ser Cys Trp Trp Leu Gln Phe Arg Asn Ser Lys Pro Cys Ser Asp
                325                 330                 335

Tyr Cys Leu Thr His Ile Val Asn Leu Leu Glu Asp Trp Gly Pro Cys
            340                 345                 350

Thr Glu His Gly Glu His Asn Ile Arg Ile Pro Arg Thr Pro Ala Arg
        355                 360                 365

Val Thr Gly Gly Val Phe Leu Val Asp Lys Asn Pro His Asn Thr Thr
    370                 375                 380

Glu Ser Arg Leu Val Val Asp Phe Ser Gln Phe Ser Arg Gly Ser Thr
385                 390                 395                 400

His Val Ser Trp Pro Lys Phe Ala Val Pro Asn Leu Gln Ser Leu Thr
                405                 410                 415

Asn Leu Leu Ser Ser Asn Leu Ser Trp Leu Ser Leu Asp Val Ser Ala
            420                 425                 430

Ala Phe Tyr His Ile Pro Leu His Pro Ala Ala Met Pro His Leu Leu
        435                 440                 445

Val Gly Ser Ser Gly Leu Pro Arg Tyr Val Ala Arg Leu Ser Ser Thr
    450                 455                 460

Ser Arg Asn Ile Asn Tyr Gln His Gly Thr Met Gln Asp Leu His Asp
465                 470                 475                 480

Ser Cys Ser Arg Asn Leu Tyr Val Ser Leu Leu Leu Leu Tyr Lys Thr
                485                 490                 495

Phe Gly Arg Lys Leu His Leu Tyr Ser His Pro Ile Ile Leu Gly Phe
            500                 505                 510
```

```
Arg Lys Ile Pro Met Gly Val Gly Leu Ser Pro Phe Leu Leu Ala Gln
        515                 520                 525

Phe Thr Ser Ala Ile Cys Ser Val Val Arg Arg Ala Phe Pro His Cys
    530                 535                 540

Leu Ala Phe Ser Tyr Met Asp Asp Val Val Leu Gly Ala Lys Ser Val
545                 550                 555                 560

Gln His Leu Glu Ser Leu Phe Thr Ser Ile Thr Asn Phe Leu Leu Ser
                565                 570                 575

Leu Gly Ile His Leu Asn Pro Asn Lys Thr Lys Arg Trp Gly Tyr Ser
            580                 585                 590

Leu Asn Phe Met Gly Tyr Val Ile Gly Ser Trp Gly Thr Leu Pro Gln
        595                 600                 605

Glu His Ile Val Leu Lys Ile Lys Gln Cys Phe Arg Lys Leu Pro Val
    610                 615                 620

Asn Arg Pro Ile Asp Trp Lys Val Cys Gln Arg Ile Val Gly Leu Leu
625                 630                 635                 640

Gly Phe Ala Ala Pro Phe Thr Gln Cys Gly Tyr Pro Ala Leu Met Pro
                645                 650                 655

Leu Tyr Ala Cys Ile Gln Ser Lys Gln Ala Phe Thr Phe Ser Pro Thr
            660                 665                 670

Tyr Lys Ala Phe Leu Cys Lys Gln Tyr Leu Asn Leu Tyr Pro Val Ala
        675                 680                 685

Arg Gln Arg Ser Gly Leu Cys Gln Val Phe Ala Asp Ala Thr Pro Thr
    690                 695                 700

Gly Trp Gly Leu Ala Ile Gly His Arg Arg Met Arg Gly Thr Phe Val
705                 710                 715                 720
```

```
Ala Pro Leu Pro Ile His Thr Ala Glu Leu Leu Ala Ala Cys Phe Ala
                725                 730                 735

Arg Ser Arg Ser Gly Ala Lys Leu Ile Gly Thr Asp Asn Ser Val Val
            740                 745                 750

Leu Ser Arg Lys Tyr Thr Ser Phe Pro Trp Leu Leu Gly Cys Ala Ala
        755                 760                 765

Asn Trp Ile Leu Arg Gly Thr Ser Phe Val Tyr Val Pro Ser Ala Leu
    770                 775                 780

Asn Pro Ala Asp Asp Pro Ser Arg Gly Arg Leu Gly Leu Tyr Arg Pro
785                 790                 795                 800

Leu Leu His Leu Pro Phe Arg Pro Thr Thr Gly Arg Thr Ser Leu Tyr
                805                 810                 815

Ala Val Ser Pro Ser Val Pro Ser His Leu Pro Asp Arg Val His Phe
            820                 825                 830

Ala Ser Pro Leu His Val Ala Trp Arg Pro Pro
        835                 840
```

<210> 20
<211> 5
<212> PRT
<213> Artificial Sequence

<220>
<223> Linker peptide

<400> 20

```
Gly Ser Lys Gly Lys
1               5
```

<210> 21
<211> 59

<212> PRT
<213> Hepatitis B virus

<400> 21

Met Gly Gly Trp Ser Ser Lys Pro Arg Gln Gly Met Gly Thr Asn Leu
1   5   10   15

Ser Val Pro Asn Pro Leu Gly Phe Phe Pro Asp His Gln Leu Asp Pro
            20   25   30

Ala Phe Gly Ala Asn Ser Asn Asn Pro Asp Trp Asp Phe Asn Pro Asn
        35   40   45

Lys Asp His Trp Pro Glu Ala Asn Gln Val Gly
    50   55

<210> 22
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Linker peptide

<400> 22

Leu Glu Gly Gly Ser Gly Gly
1   5

<210> 23
<211> 1539
<212> PRT
<213> Hepatitis B virus

<400> 23

Met Ser Leu Leu Trp Gly Gly Val Thr Val Leu Ala Ala Met Leu Ile
1   5   10   15

Ala Gly Gln Val Ala Ser Val Val Phe Leu Val Ser Lys Ser Gly Pro
            20   25   30

```
Pro Ser Gly Lys Ser Asn Ser Asn Asn Pro Asp Trp Asp Phe Asn Pro
        35                  40                  45

Asn Lys Asp His Trp Pro Glu Ala Asn Gln Val Gly Ala Gly Ala Phe
    50                  55                  60

Gly Pro Gly Phe Thr Pro Pro His Gly Gly Leu Leu Gly Trp Ser Pro
65                  70                  75                  80

Gln Ala Gln Gly Ile Leu Thr Thr Val Pro Ala Ala Pro Pro Pro Ala
                85                  90                  95

Ser Thr Asn Arg Gln Ser Gly Arg Gln Pro Thr Pro Ile Ser Pro Pro
            100                 105                 110

Leu Arg Asp Ser His Pro Gln Ala Met Gln Trp Asn Ser Thr Thr Phe
        115                 120                 125

His Gln Ala Leu Leu Asp Pro Arg Val Arg Gly Leu Tyr Phe Pro Ala
    130                 135                 140

Gly Gly Ser Ser Ser Gly Thr Val Asn Pro Val Pro Thr Thr Ala Ser
145                 150                 155                 160

Pro Ile Ser Ser Ile Phe Ser Arg Thr Gly Asp Pro Ala Pro Asn Gly
                165                 170                 175

Ser Lys Ser Gly Ser Lys Met Pro Leu Ser Tyr Gln His Phe Arg Lys
            180                 185                 190

Leu Leu Leu Leu Asp Asp Glu Ala Gly Pro Leu Glu Glu Glu Leu Pro
        195                 200                 205

Arg Leu Ala Asp Glu Gly Leu Asn Arg Arg Val Ala Glu Asp Leu Asn
    210                 215                 220

Leu Gly Asn Leu Asn Val Ser Ile Pro Trp Thr His Lys Val Gly Asn
225                 230                 235                 240
```

```
Phe Thr Gly Leu Ala Ser Ser Thr Val Pro Val Phe Asn Pro Glu Trp
                245                 250                 255

Gln Thr Pro Ser Phe Pro His Ile His Leu Gln Glu Asp Ile Ile Asn
            260                 265                 270

Arg Cys Gln Gln Tyr Val Gly Pro Leu Thr Val Asn Glu Lys Arg Arg
        275                 280                 285

Leu Lys Leu Ile Met Pro Ala Arg Phe Tyr Pro Asn Leu Thr Lys Tyr
    290                 295                 300

Leu Pro Leu Asp Lys Gly Ile Lys Pro Tyr Tyr Pro Glu His Ala Val
305                 310                 315                 320

Asn His Tyr Phe Lys Thr Arg His Tyr Leu His Thr Leu Trp Lys Ala
                325                 330                 335

Gly Ile Leu Tyr Lys Arg Glu Thr Thr Arg Ser Ala Ser Phe Cys Gly
            340                 345                 350

Ser Pro Tyr Ser Trp Glu Gln Glu Leu Gln His Gly Arg Leu Val Phe
        355                 360                 365

Gln Thr Ser Thr Arg His Gly Asp Glu Ser Phe Cys Ser Gln Ser Ser
    370                 375                 380

Gly Ile Leu Ser Arg Ser Pro Val Gly Pro Cys Val Arg Ser Gln Leu
385                 390                 395                 400

Lys Gln Ser Arg Leu Gly Leu Gln Pro Gln Gln Gly Ser Leu Ala Arg
                405                 410                 415

Gly Lys Ser Gly Arg Ser Gly Ser Ile Arg Ala Arg Val His Pro Thr
            420                 425                 430
```

```
Thr Arg Arg Ser Phe Gly Val Glu Pro Ser Gly Ser Gly His Ile Asp
        435                 440                 445

Asn Ser Ala Ser Ser Thr Ser Ser Cys Leu His Gln Ser Ala Val Arg
    450                 455                 460

Lys Thr Ala Tyr Ser His Leu Ser Thr Ser Lys Arg Gln Ser Ser Ser
465                 470                 475                 480

Gly His Ala Val Glu Leu His Asn Ile Pro Pro Ser Ser Ala Arg Ser
                485                 490                 495

Gln Ser Glu Gly Pro Ile Phe Ser Ala Trp Trp Leu Gln Phe Arg Asn
            500                 505                 510

Ser Lys Pro Ala Ser Asp Tyr Ala Leu Thr His Ile Val Asn Leu Leu
        515                 520                 525

Glu Asp Trp Gly Pro Ala Thr Glu His Gly Glu His Asn Ile Arg Ile
    530                 535                 540

Pro Arg Thr Pro Ala Arg Val Thr Gly Gly Val Phe Leu Val Asp Lys
545                 550                 555                 560

Asn Pro His Asn Thr Thr Glu Ser Arg Leu Val Val Asp Phe Ser Gln
                565                 570                 575

Phe Ser Arg Gly Ser Thr His Val Ser Trp Pro Lys Phe Ala Val Pro
            580                 585                 590

Asn Leu Gln Ser Leu Thr Asn Leu Leu Ser Ser Asn Leu Ser Trp Leu
        595                 600                 605

Ser Leu Asp Val Ser Ala Ala Phe Tyr His Ile Pro Leu His Pro Ala
    610                 615                 620

Ala Met Pro His Leu Leu Val Gly Ser Ser Gly Leu Pro Arg Tyr Val
625                 630                 635                 640
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```
Ala Arg Leu Ser Ser Thr Ser Arg Asn Ile Asn Tyr Gln His Gly Thr
                645                 650                 655

Met Gln Asp Leu His Asp Ser Cys Ser Arg Asn Leu Tyr Val Ser Leu
            660                 665                 670

Leu Leu Leu Tyr Lys Thr Phe Gly Arg Lys Leu His Leu Tyr Ser His
        675                 680                 685

Pro Ile Ile Leu Gly Phe Arg Lys Ile Pro Met Gly Val Gly Leu Ser
    690                 695                 700

Pro Phe Leu Leu Ala Gln Phe Thr Ser Ala Ile Cys Ser Val Val Arg
705                 710                 715                 720

Arg Ala Phe Pro His Cys Leu Ala Phe Ser Tyr Met Asp Asp Val Val
                725                 730                 735

Leu Gly Ala Lys Ser Val Gln His Leu Glu Ser Leu Phe Thr Ser Ile
            740                 745                 750

Thr Asn Phe Leu Leu Ser Leu Gly Ile His Leu Asn Pro Asn Lys Thr
        755                 760                 765

Lys Arg Trp Gly Tyr Ser Leu Asn Phe Met Gly Tyr Val Ile Gly Ser
    770                 775                 780

Trp Gly Thr Leu Pro Gln Glu His Ile Val Leu Lys Ile Lys Gln Cys
785                 790                 795                 800

Phe Arg Lys Leu Pro Val Asn Arg Pro Ile Asp Trp Lys Val Cys Gln
                805                 810                 815

Arg Ile Val Gly Leu Leu Gly Phe Ala Ala Pro Phe Thr Gln Cys Gly
            820                 825                 830
```

```
Tyr Pro Ala Leu Met Pro Leu Tyr Ala Cys Ile Gln Ser Lys Gln Ala
        835                 840                 845

Phe Thr Phe Ser Pro Thr Tyr Lys Ala Phe Leu Cys Lys Gln Tyr Leu
    850                 855                 860

Asn Leu Tyr Pro Val Ala Arg Gln Arg Ser Gly Leu Cys Gln Val Phe
865                 870                 875                 880

Ala Asp Ala Thr Pro Thr Gly Trp Gly Leu Ala Ile Gly His Arg Ala
                885                 890                 895

Met Arg Gly Thr Phe Val Ala Pro Leu Pro Ile His Thr Ala Glu Leu
            900                 905                 910

Leu Ala Ala Cys Phe Ala Arg Ser Arg Ser Gly Ala Lys Leu Ile Gly
        915                 920                 925

Thr Asp Asn Ser Val Val Leu Ser Arg Lys Tyr Thr Ser Phe Pro Trp
    930                 935                 940

Leu Leu Gly Cys Ala Ala Asn Trp Ile Leu Arg Gly Thr Ser Phe Val
945                 950                 955                 960

Tyr Val Pro Ser Ala Leu Asn Pro Ala Ala Asp Pro Ser Ala Gly Arg
                965                 970                 975

Leu Gly Leu Tyr Arg Pro Leu Leu His Leu Pro Phe Arg Pro Thr Thr
            980                 985                 990

Gly Arg Thr Ser Leu Tyr Ala Val  Ser Pro Ser Val Pro  Ser His Leu
        995                 1000                1005

Pro Asp  Arg Val His Phe Ala  Ser Pro Leu His Val  Ala Trp Arg
    1010                1015                1020

Pro Pro  Ser Lys Ser Pro Gly  Ser Gly Pro Pro Met  Gln Leu Phe
    1025                1030                1035
```

```
His Leu  Cys Leu Ile Ile Ser  Cys Ser Cys Pro Thr  Val Gln Ala
    1040                1045                1050

Ser Lys  Leu Cys Leu Gly Trp  Leu Trp Gly Met Asp  Ile Asp Pro
    1055                1060                1065

Tyr Lys  Glu Phe Gly Ala Ser  Val Glu Leu Leu Ser  Phe Leu Pro
    1070                1075                1080

Ser Asp  Phe Phe Pro Ser Ile  Arg Asp Leu Leu Asp  Thr Ala Ser
    1085                1090                1095

Ala Leu  Tyr Arg Glu Ala Leu  Glu Ser Pro Glu His  Cys Ser Pro
    1100                1105                1110

His His  Thr Ala Leu Arg Gln  Ala Ile Leu Cys Trp  Gly Glu Leu
    1115                1120                1125

Met Asn  Leu Ala Thr Trp Val  Gly Ser Asn Leu Glu  Asp Pro Ala
    1130                1135                1140

Ser Arg  Glu Leu Val Val Ser  Tyr Val Asn Val Asn  Met Gly Leu
    1145                1150                1155

Lys Ile  Arg Gln Leu Leu Trp  Phe His Ile Ser Cys  Leu Thr Phe
    1160                1165                1170

Gly Arg  Glu Thr Val Leu Glu  Tyr Leu Val Ser Phe  Gly Val Trp
    1175                1180                1185

Ile Arg  Thr Pro Pro Ala Tyr  Arg Pro Pro Asn Ala  Pro Ile Leu
    1190                1195                1200

Ser Thr  Leu Pro Glu Thr Thr  Val Val Arg Arg Arg  Gly Arg Ser
    1205                1210                1215
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```
Pro Arg  Arg Arg Thr Pro Ser  Pro Arg Arg Arg Arg  Ser Gln Ser
    1220                1225                1230

Pro Arg  Arg Arg Arg Ser Gln  Ser Arg Glu Ser Gln  Cys Met Gly
    1235                1240                1245

Gly Trp  Ser Ser Lys Pro Arg  Gln Gly Met Gly Thr  Asn Leu Ser
    1250                1255                1260

Val Pro  Asn Pro Leu Gly Phe  Phe Pro Asp His Gln  Leu Asp Pro
    1265                1270                1275

Ala Phe  Gly Ala Asn Ser Asn  Asn Pro Asp Trp Asp  Phe Asn Pro
    1280                1285                1290

Asn Lys  Asp His Trp Pro Glu  Ala Asn Gln Val Gly  Ala Ser Lys
    1295                1300                1305

Gly Gly  Lys Ser Gly Met Glu  Asn Thr Thr Ser Gly  Phe Leu Gly
    1310                1315                1320

Pro Leu  Leu Val Leu Gln Ala  Gly Phe Phe Leu Leu  Thr Arg Ile
    1325                1330                1335

Leu Thr  Ile Pro Gln Ser Leu  Asp Ser Trp Trp Thr  Ser Leu Asn
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Phe Leu  Gly Gly Ala Pro Thr  Cys Pro Gly Gln Asn  Ser Gln Ser
    1355                1360                1365

Pro Thr  Ser Asn His Ser Pro  Thr Ser Cys Pro Pro  Ile Cys Pro
    1370                1375                1380

Gly Tyr  Arg Trp Met Cys Leu  Arg Arg Phe Ile Ile  Phe Leu Phe
    1385                1390                1395

Ile Leu  Leu Leu Cys Leu Ile  Phe Leu Leu Val Leu  Leu Asp Tyr
    1400                1405                1410
```

Gln Gly Met Leu Pro Val Cys Pro Leu Leu Pro Gly Thr Ser Thr
    1415   1420   1425

Thr Ser Thr Gly Pro Cys Lys Thr Cys Thr Ile Pro Ala Gln Gly
    1430   1435   1440

Thr Ser Met Phe Pro Ser Cys Cys Cys Thr Lys Pro Ser Asp Gly
    1445   1450   1455

Asn Cys Thr Cys Ile Pro Ile Pro Ser Ser Trp Ala Phe Ala Arg
    1460   1465   1470

Phe Leu Trp Glu Trp Ala Ser Val Arg Phe Ser Trp Leu Ser Leu
    1475   1480   1485

Leu Val Pro Phe Val Gln Trp Phe Val Gly Leu Ser Pro Thr Val
    1490   1495   1500

Trp Leu Ser Val Ile Trp Met Met Trp Tyr Trp Gly Pro Ser Leu
    1505   1510   1515

Tyr Asn Ile Leu Ser Pro Phe Leu Pro Leu Leu Pro Ile Phe Phe
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Cys Leu Trp Val Tyr Ile
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Gly Gly Gly Met Gln Leu Phe His Leu Cys Leu Ile Ile Ser Cys Ser
        35                  40                  45

Cys Pro Thr Val Gln Ala Ser Lys Leu Cys Leu Gly Trp Leu Trp Gly
    50                  55                  60

Met Asp Ile Asp Pro Tyr Lys Glu Phe Gly Ala Ser Val Glu Leu Leu
65                  70                  75                  80

Ser Phe Leu Pro Ser Asp Phe Phe Pro Ser Ile Arg Asp Leu Leu Asp
                85                  90                  95

Thr Ala Ser Ala Leu Tyr Arg Glu Ala Leu Glu Ser Pro Glu His Cys
            100                 105                 110

Ser Pro His His Thr Ala Leu Arg Gln Ala Ile Leu Cys Trp Gly Glu
        115                 120                 125

Leu Met Asn Leu Ala Thr Trp Val Gly Ser Asn Leu Glu Asp Pro Ala
    130                 135                 140

Ser Arg Glu Leu Val Val Ser Tyr Val Asn Val Asn Met Gly Leu Lys
145                 150                 155                 160

Ile Arg Gln Leu Leu Trp Phe His Ile Ser Cys Leu Thr Phe Gly Arg
                165                 170                 175

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

Pro Pro Ala Tyr Arg Pro Pro Asn Ala Pro Ile Leu Ser Thr Leu Pro
        195                 200                 205
```

```
Glu Thr Thr Val Val Arg Arg Arg Gly Arg Ser Pro Arg Arg Arg Thr
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Pro Ser Pro Arg Arg Arg Arg Ser Gln Ser Pro Arg Arg Arg Arg Ser
225                 230                 235                 240

Gln Ser Arg Glu Ser Gln Cys Gly Gly Gly Ser Gly Gly Gly Met Pro
                245                 250                 255

Leu Ser Tyr Gln His Phe Arg Lys Leu Leu Leu Leu Asp Asp Glu Ala
            260                 265                 270

Gly Pro Leu Glu Glu Glu Leu Pro Arg Leu Ala Asp Glu Gly Leu Asn
        275                 280                 285

Arg Arg Val Ala Glu Asp Leu Asn Leu Gly Asn Leu Asn Val Ser Ile
    290                 295                 300

Pro Trp Thr His Lys Val Gly Asn Phe Thr Gly Leu Ala Ser Ser Thr
305                 310                 315                 320

Val Pro Val Phe Asn Pro Glu Trp Gln Thr Pro Ser Phe Pro His Ile
                325                 330                 335

His Leu Gln Glu Asp Ile Ile Asn Arg Cys Gln Gln Tyr Val Gly Pro
            340                 345                 350

Leu Thr Val Asn Glu Lys Arg Arg Leu Lys Leu Ile Met Pro Ala Arg
        355                 360                 365

Phe Tyr Pro Asn Leu Thr Lys Tyr Leu Pro Leu Asp Lys Gly Ile Lys
    370                 375                 380

Pro Tyr Tyr Pro Glu His Ala Val Asn His Tyr Phe Lys Thr Arg His
385                 390                 395                 400

Tyr Leu His Thr Leu Trp Lys Ala Gly Ile Leu Tyr Lys Arg Glu Thr
                405                 410                 415
```

```
Thr Arg Ser Ala Ser Phe Cys Gly Ser Pro Tyr Ser Trp Glu Gln Glu
            420                 425                 430

Leu Gln His Gly Arg Leu Val Phe Gln Thr Ser Thr Arg His Gly Asp
        435                 440                 445

Glu Ser Phe Cys Ser Gln Ser Ser Gly Ile Leu Ser Arg Ser Pro Val
    450                 455                 460

Gly Pro Cys Val Arg Ser Gln Leu Lys Gln Ser Arg Leu Gly Leu Gln
465                 470                 475                 480

Pro Gln Gln Gly Ser Leu Ala Arg Gly Lys Ser Gly Arg Ser Gly Ser
                485                 490                 495

Ile Arg Ala Arg Val His Pro Thr Thr Arg Arg Ser Phe Gly Val Glu
            500                 505                 510

Pro Ser Gly Ser Gly His Ile Asp Asn Ser Ala Ser Ser Thr Ser Ser
        515                 520                 525

Cys Leu His Gln Ser Ala Val Arg Lys Thr Ala Tyr Ser His Leu Ser
    530                 535                 540

Thr Ser Lys Arg Gln Ser Ser Ser Gly His Ala Val Glu Leu His Asn
545                 550                 555                 560

Ile Pro Pro Ser Ser Ala Arg Ser Gln Ser Glu Gly Pro Ile Phe Ser
                565                 570                 575

Ala Trp Trp Leu Gln Phe Arg Asn Ser Lys Pro Ala Ser Asp Tyr Ala
            580                 585                 590

Leu Thr His Ile Val Asn Leu Leu Glu Asp Trp Gly Pro Ala Thr Glu
        595                 600                 605
```

```
His Gly Glu His Asn Ile Arg Ile Pro Arg Thr Pro Ala Arg Val Thr
    610                 615                 620

Gly Gly Val Phe Leu Val Asp Lys Asn Pro His Asn Thr Thr Glu Ser
625                 630                 635                 640

Arg Leu Val Val Asp Phe Ser Gln Phe Ser Arg Gly Ser Thr His Val
                645                 650                 655

Ser Trp Pro Lys Phe Ala Val Pro Asn Leu Gln Ser Leu Thr Asn Leu
            660                 665                 670

Leu Ser Ser Asn Leu Ser Thr Phe Gly Arg Lys Leu His Leu Tyr Ser
        675                 680                 685

His Pro Ile Ile Leu Gly Phe Arg Lys Ile Pro Met Gly Val Gly Leu
    690                 695                 700

Ser Pro Phe Leu Leu Ala Gln Phe Thr Ser Ala Ile Cys Ser Val Val
705                 710                 715                 720

Arg Arg Ala Phe Pro His Cys Leu Ala Phe Ser Tyr Met Asp Asp Val
                725                 730                 735

Val Leu Gly Ala Lys Ser Val Gln His Leu Glu Ser Leu Phe Thr Ser
            740                 745                 750

Ile Thr Asn Phe Leu Leu Ser Leu Gly Ile His Leu Asn Pro Asn Lys
        755                 760                 765

Thr Lys Arg Trp Gly Tyr Ser Leu Asn Phe Met Gly Tyr Val Ile Gly
    770                 775                 780

Ser Trp Gly Thr Leu Pro Gln Glu His Ile Val Leu Lys Ile Lys Gln
785                 790                 795                 800

Cys Phe Arg Lys Leu Pro Val Asn Arg Pro Ile Asp Trp Lys Val Cys
                805                 810                 815
```

```
Gln Arg Ile Val Gly Leu Leu Gly Phe Ala Ala Pro Phe Thr Gln Cys
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Gly Tyr Pro Ala Leu Met Pro Leu Tyr Ala Cys Ile Gln Ser Lys Gln
        835                 840                 845

Ala Phe Thr Phe Ser Pro Thr Tyr Lys Ala Phe Leu Cys Lys Gln Tyr
    850                 855                 860

Leu Asn Leu Tyr Pro Val Ala Arg Gln Arg Ser Gly Leu Cys Gln Val
865                 870                 875                 880

Phe Ala Asp Ala Thr Pro Thr Gly Trp Gly Leu Ala Ile Gly His Arg
                885                 890                 895

Ala Met Arg Gly Thr Phe Val Ala Pro Leu Pro Ile His Thr Ala Glu
            900                 905                 910

Leu Leu Ala Ala Cys Phe Ala Arg Ser Arg Ser Gly Ala Lys Leu Ile
        915                 920                 925

Gly Thr Asp Asn Ser Val Val Leu Ser Arg Lys Tyr Thr Ser Phe Pro
    930                 935                 940

Trp Leu Leu Gly Cys Ala Ala Asn Trp Ile Leu Arg Gly Thr Ser Phe
945                 950                 955                 960

Val Tyr Val Pro Ser Ala Leu Asn Pro Ala Ala Asp Pro Ser Ala Gly
                965                 970                 975

Arg Leu Gly Leu Tyr Arg Pro Leu Leu His Leu Pro Phe Arg Pro Thr
            980                 985                 990

Thr Gly Arg Thr Ser Leu Tyr Ala  Val Ser Pro Ser Val  Pro Ser His
        995                 1000                1005
```

```
Leu Pro  Asp Arg Val His Phe  Ala Ser Pro Leu His  Val Ala Trp
    1010                1015                1020

Arg Pro  Pro Lys Ser Pro Asn  Ser Asn Asn Pro Asp  Trp Asp Phe
    1025                1030                1035

Asn Pro  Asn Lys Asp His Trp  Pro Glu Ala Asn Gln  Val Gly Ala
    1040                1045                1050

Gly Ala  Phe Gly Pro Gly Phe  Thr Pro Pro His Gly  Gly Leu Leu
    1055                1060                1065

Gly Trp  Ser Pro Gln Ala Gln  Gly Ile Leu Thr Thr  Val Pro Ala
    1070                1075                1080

Ala Pro  Pro Pro Ala Ser Thr  Asn Arg Gln Ser Gly  Arg Gln Pro
    1085                1090                1095

Thr Pro  Ile Ser Pro Pro Leu  Arg Asp Ser His Pro  Gln Ala Met
    1100                1105                1110

Gln Trp  Asn Ser Thr Thr Phe  His Gln Ala Leu Leu  Asp Pro Arg
    1115                1120                1125

Val Arg  Gly Leu Tyr Phe Pro  Ala Gly Gly Ser Ser  Ser Gly Thr
    1130                1135                1140

Val Asn  Pro Val Pro Thr Thr  Ala Ser Pro Ile Ser  Ser Ile Phe
    1145                1150                1155

Ser Arg  Thr Gly Asp Pro Ala  Pro Asn Gly Ser Lys  Gly Lys Arg
    1160                1165                1170

Lys Arg  Arg Ala Pro Val Lys  Gln Thr Leu Asn Phe  Asp Leu Leu
    1175                1180                1185

Lys Leu  Ala Gly Asp Val Glu  Ser Asn Pro Gly Pro  Met Asp Ala
    1190                1195                1200
```

```
Met Lys  Arg Gly Leu Cys Cys  Val Leu Leu Leu Cys  Gly Ala Val
    1205                 1210                 1215

Phe Val  Ser Pro Ser Gln Glu  Ile His Ala Arg Phe  Arg Arg Met
    1220                 1225                 1230

Gly Gly  Trp Ser Ser Lys Pro  Arg Gln Gly Met Gly  Thr Asn Leu
    1235                 1240                 1245

Ser Val  Pro Asn Pro Leu Gly  Phe Phe Pro Asp His  Gln Leu Asp
    1250                 1255                 1260

Pro Ala  Phe Gly Ala Asn Ser  Asn Asn Pro Asp Trp  Asp Phe Asn
    1265                 1270                 1275

Pro Asn  Lys Asp His Trp Pro  Glu Ala Asn Gln Val  Gly Leu Glu
    1280                 1285                 1290

Gly Gly  Ser Gly Gly Met Glu  Asn Thr Thr Ser Gly  Phe Leu Gly
    1295                 1300                 1305

Pro Leu  Leu Val Leu Gln Ala  Gly Phe Phe Leu Leu  Thr Arg Ile
    1310                 1315                 1320

Leu Thr  Ile Pro Gln Ser Leu  Asp Ser Trp Trp Thr  Ser Leu Asn
    1325                 1330                 1335

Phe Leu  Gly Gly Ala Pro Thr  Cys Pro Gly Gln Asn  Ser Gln Ser
    1340                 1345                 1350

Pro Thr  Ser Asn His Ser Pro  Thr Ser Cys Pro Pro  Ile Cys Pro
    1355                 1360                 1365

Gly Tyr  Arg Trp Met Cys Leu  Arg Arg Phe Ile Ile  Phe Leu Phe
    1370                 1375                 1380
```

```
Ile Leu  Leu Leu Cys Leu Ile  Phe Leu Leu Val Leu  Leu Asp Tyr
    1385                1390                1395


Gln Gly  Met Leu Pro Val Cys  Pro Leu Leu Pro Gly  Thr Ser Thr
    1400                1405                1410


Thr Ser  Thr Gly Pro Cys Lys  Thr Cys Thr Ile Pro  Ala Gln Gly
    1415                1420                1425


Thr Ser  Met Phe Pro Ser Cys  Cys Cys Thr Lys Pro  Ser Asp Gly
    1430                1435                1440


Asn Cys  Thr Cys Ile Pro Ile  Pro Ser Ser Trp Ala  Phe Ala Arg
    1445                1450                1455


Phe Leu  Trp Glu Trp Ala Ser  Val Arg Phe Ser Trp  Leu Ser Leu
    1460                1465                1470


Leu Val  Pro Phe Val Gln Trp  Phe Val Gly Leu Ser  Pro Thr Val
    1475                1480                1485


Trp Leu  Ser Val Ile Trp Met  Met Trp Tyr Trp Gly  Pro Ser Leu
    1490                1495                1500


Tyr Asn  Ile Leu Ser Pro Phe  Leu Pro Leu Leu Pro  Ile Phe Phe
    1505                1510                1515


Cys Leu  Trp Val Tyr Ile
    1520
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<211> 1571
<212> PRT
<213> Artificial Sequence

<220>
<223> Vaccine construct

<400> 26

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Ala Gly Gln Val Ala Ser Val Val Phe Leu Val Ser Lys Ser Gly Pro
            20                  25                  30

Pro Ser Gly Lys Ser Asn Ser Asn Asn Pro Asp Trp Asp Phe Asn Pro
        35                  40                  45

Asn Lys Asp His Trp Pro Glu Ala Asn Gln Val Gly Ala Gly Ala Phe
    50                  55                  60

Gly Pro Gly Phe Thr Pro Pro His Gly Gly Leu Leu Gly Trp Ser Pro
65                  70                  75                  80

Gln Ala Gln Gly Ile Leu Thr Thr Val Pro Ala Ala Pro Pro Pro Ala
                85                  90                  95

Ser Thr Asn Arg Gln Ser Gly Arg Gln Pro Thr Pro Ile Ser Pro Pro
            100                 105                 110

Leu Arg Asp Ser His Pro Gln Ala Met Gln Trp Asn Ser Thr Thr Phe
        115                 120                 125

His Gln Ala Leu Leu Asp Pro Arg Val Arg Gly Leu Tyr Phe Pro Ala
    130                 135                 140

Gly Gly Ser Ser Ser Gly Thr Val Asn Pro Val Pro Thr Thr Ala Ser
145                 150                 155                 160

Pro Ile Ser Ser Ile Phe Ser Arg Thr Gly Asp Pro Ala Pro Asn Gly
                165                 170                 175

Ser Lys Ser Gly Ser Lys Met Pro Leu Ser Tyr Gln His Phe Arg Lys
            180                 185                 190

Leu Leu Leu Leu Asp Asp Glu Ala Gly Pro Leu Glu Glu Glu Leu Pro
        195                 200                 205
```

```
Arg Leu Ala Asp Glu Gly Leu Asn Arg Arg Val Ala Glu Asp Leu Asn
    210                 215                 220

Leu Gly Asn Leu Asn Val Ser Ile Pro Trp Thr His Lys Val Gly Asn
225                 230                 235                 240

Phe Thr Gly Leu Ala Ser Ser Thr Val Pro Val Phe Asn Pro Glu Trp
                245                 250                 255

Gln Thr Pro Ser Phe Pro His Ile His Leu Gln Glu Asp Ile Ile Asn
            260                 265                 270

Arg Cys Gln Gln Tyr Val Gly Pro Leu Thr Val Asn Glu Lys Arg Arg
        275                 280                 285

Leu Lys Leu Ile Met Pro Ala Arg Phe Tyr Pro Asn Leu Thr Lys Tyr
    290                 295                 300

Leu Pro Leu Asp Lys Gly Ile Lys Pro Tyr Tyr Pro Glu His Ala Val
305                 310                 315                 320

Asn His Tyr Phe Lys Thr Arg His Tyr Leu His Thr Leu Trp Lys Ala
                325                 330                 335

Gly Ile Leu Tyr Lys Arg Glu Thr Thr Arg Ser Ala Ser Phe Cys Gly
            340                 345                 350

Ser Pro Tyr Ser Trp Glu Gln Glu Leu Gln His Gly Arg Leu Val Phe
        355                 360                 365

Gln Thr Ser Thr Arg His Gly Asp Glu Ser Phe Cys Ser Gln Ser Ser
    370                 375                 380

Gly Ile Leu Ser Arg Ser Pro Val Gly Pro Cys Val Arg Ser Gln Leu
385                 390                 395                 400
```

```
Lys Gln Ser Arg Leu Gly Leu Gln Pro Gln Gln Gly Ser Leu Ala Arg
                405                 410                 415

Gly Lys Ser Gly Arg Ser Gly Ser Ile Arg Ala Arg Val His Pro Thr
            420                 425                 430

Thr Arg Arg Ser Phe Gly Val Glu Pro Ser Gly Ser Gly His Ile Asp
        435                 440                 445

Asn Ser Ala Ser Ser Thr Ser Ser Cys Leu His Gln Ser Ala Val Arg
    450                 455                 460

Lys Thr Ala Tyr Ser His Leu Ser Thr Ser Lys Arg Gln Ser Ser Ser
465                 470                 475                 480

Gly His Ala Val Glu Leu His Asn Ile Pro Pro Ser Ser Ala Arg Ser
                485                 490                 495

Gln Ser Glu Gly Pro Ile Phe Ser Ala Trp Trp Leu Gln Phe Arg Asn
            500                 505                 510

Ser Lys Pro Ala Ser Asp Tyr Ala Leu Thr His Ile Val Asn Leu Leu
        515                 520                 525

Glu Asp Trp Gly Pro Ala Thr Glu His Gly Glu His Asn Ile Arg Ile
    530                 535                 540

Pro Arg Thr Pro Ala Arg Val Thr Gly Gly Val Phe Leu Val Asp Lys
545                 550                 555                 560

Asn Pro His Asn Thr Thr Glu Ser Arg Leu Val Val Asp Phe Ser Gln
                565                 570                 575

Phe Ser Arg Gly Ser Thr His Val Ser Trp Pro Lys Phe Ala Val Pro
            580                 585                 590

Asn Leu Gln Ser Leu Thr Asn Leu Leu Ser Ser Asn Leu Ser Trp Leu
        595                 600                 605
```

```
Ser Leu Asp Val Ser Ala Ala Phe Tyr His Ile Pro Leu His Pro Ala
    610                 615                 620

Ala Met Pro His Leu Leu Val Gly Ser Ser Gly Leu Pro Arg Tyr Val
625                 630                 635                 640

Ala Arg Leu Ser Ser Thr Ser Arg Asn Ile Asn Tyr Gln His Gly Thr
                645                 650                 655

Met Gln Asp Leu His Asp Ser Cys Ser Arg Asn Leu Tyr Val Ser Leu
            660                 665                 670

Leu Leu Leu Tyr Lys Thr Phe Gly Arg Lys Leu His Leu Tyr Ser His
        675                 680                 685

Pro Ile Ile Leu Gly Phe Arg Lys Ile Pro Met Gly Val Gly Leu Ser
    690                 695                 700

Pro Phe Leu Leu Ala Gln Phe Thr Ser Ala Ile Cys Ser Val Val Arg
705                 710                 715                 720

Arg Ala Phe Pro His Cys Leu Ala Phe Ser Tyr Met Asp Asp Val Val
                725                 730                 735

Leu Gly Ala Lys Ser Val Gln His Leu Glu Ser Leu Phe Thr Ser Ile
            740                 745                 750

Thr Asn Phe Leu Leu Ser Leu Gly Ile His Leu Asn Pro Asn Lys Thr
        755                 760                 765

Lys Arg Trp Gly Tyr Ser Leu Asn Phe Met Gly Tyr Val Ile Gly Ser
    770                 775                 780

Trp Gly Thr Leu Pro Gln Glu His Ile Val Leu Lys Ile Lys Gln Cys
785                 790                 795                 800
```

```
Phe Arg Lys Leu Pro Val Asn Arg Pro Ile Asp Trp Lys Val Cys Gln
                805                 810                 815

Arg Ile Val Gly Leu Leu Gly Phe Ala Ala Pro Phe Thr Gln Cys Gly
            820                 825                 830

Tyr Pro Ala Leu Met Pro Leu Tyr Ala Cys Ile Gln Ser Lys Gln Ala
        835                 840                 845

Phe Thr Phe Ser Pro Thr Tyr Lys Ala Phe Leu Cys Lys Gln Tyr Leu
    850                 855                 860

Asn Leu Tyr Pro Val Ala Arg Gln Arg Ser Gly Leu Cys Gln Val Phe
865                 870                 875                 880

Ala Asp Ala Thr Pro Thr Gly Trp Gly Leu Ala Ile Gly His Arg Ala
                885                 890                 895

Met Arg Gly Thr Phe Val Ala Pro Leu Pro Ile His Thr Ala Glu Leu
            900                 905                 910

Leu Ala Ala Cys Phe Ala Arg Ser Arg Ser Gly Ala Lys Leu Ile Gly
        915                 920                 925

Thr Asp Asn Ser Val Val Leu Ser Arg Lys Tyr Thr Ser Phe Pro Trp
    930                 935                 940

Leu Leu Gly Cys Ala Ala Asn Trp Ile Leu Arg Gly Thr Ser Phe Val
945                 950                 955                 960

Tyr Val Pro Ser Ala Leu Asn Pro Ala Ala Asp Pro Ser Ala Gly Arg
                965                 970                 975

Leu Gly Leu Tyr Arg Pro Leu Leu His Leu Pro Phe Arg Pro Thr Thr
            980                 985                 990

Gly Arg Thr Ser Leu Tyr Ala Val  Ser Pro Ser Val Pro  Ser His Leu
        995                 1000                1005
```

```
Pro Asp  Arg Val His Phe Ala  Ser Pro Leu His Val  Ala Trp Arg
    1010                1015                1020

Pro Pro  Ser Lys Ser Pro Gly  Ser Gly Pro Pro Met  Gln Leu Phe
    1025                1030                1035

His Leu  Cys Leu Ile Ile Ser  Cys Ser Cys Pro Thr  Val Gln Ala
    1040                1045                1050

Ser Lys  Leu Cys Leu Gly Trp  Leu Trp Gly Met Asp  Ile Asp Pro
    1055                1060                1065

Tyr Lys  Glu Phe Gly Ala Ser  Val Glu Leu Leu Ser  Phe Leu Pro
    1070                1075                1080

Ser Asp  Phe Phe Pro Ser Ile  Arg Asp Leu Leu Asp  Thr Ala Ser
    1085                1090                1095

Ala Leu  Tyr Arg Glu Ala Leu  Glu Ser Pro Glu His  Cys Ser Pro
    1100                1105                1110

His His  Thr Ala Leu Arg Gln  Ala Ile Leu Cys Trp  Gly Glu Leu
    1115                1120                1125

Met Asn  Leu Ala Thr Trp Val  Gly Ser Asn Leu Glu  Asp Pro Ala
    1130                1135                1140

Ser Arg  Glu Leu Val Val Ser  Tyr Val Asn Val Asn  Met Gly Leu
    1145                1150                1155

Lys Ile  Arg Gln Leu Leu Trp  Phe His Ile Ser Cys  Leu Thr Phe
    1160                1165                1170

Gly Arg  Glu Thr Val Leu Glu  Tyr Leu Val Ser Phe  Gly Val Trp
    1175                1180                1185
```

```
Ile Arg  Thr Pro Pro Ala Tyr  Arg Pro Pro Asn Ala  Pro Ile Leu
    1190                1195                1200

Ser Thr  Leu Pro Glu Thr Thr  Val Val Arg Arg Arg  Gly Arg Ser
    1205                1210                1215

Pro Arg  Arg Arg Thr Pro Ser  Pro Arg Arg Arg Arg  Ser Gln Ser
    1220                1225                1230

Pro Arg  Arg Arg Arg Ser Gln  Ser Arg Glu Ser Gln  Cys Met Asp
    1235                1240                1245

Ala Met  Lys Arg Gly Leu Cys  Cys Val Leu Leu Leu  Cys Gly Ala
    1250                1255                1260

Val Phe  Val Ser Pro Ser Gln  Glu Ile His Ala Arg  Phe Arg Arg
    1265                1270                1275

Met Gly  Gly Trp Ser Ser Lys  Pro Arg Gln Gly Met  Gly Thr Asn
    1280                1285                1290

Leu Ser  Val Pro Asn Pro Leu  Gly Phe Phe Pro Asp  His Gln Leu
    1295                1300                1305

Asp Pro  Ala Phe Gly Ala Asn  Ser Asn Asn Pro Asp  Trp Asp Phe
    1310                1315                1320

Asn Pro  Asn Lys Asp His Trp  Pro Glu Ala Asn Gln  Val Gly Ala
    1325                1330                1335

Ser Lys  Gly Gly Lys Ser Gly  Met Glu Asn Thr Thr  Ser Gly Phe
    1340                1345                1350

Leu Gly  Pro Leu Leu Val Leu  Gln Ala Gly Phe Phe  Leu Leu Thr
    1355                1360                1365

Arg Ile  Leu Thr Ile Pro Gln  Ser Leu Asp Ser Trp  Trp Thr Ser
    1370                1375                1380
```

```
Leu Asn  Phe Leu Gly Gly Ala  Pro Thr Cys Pro Gly  Gln Asn Ser
    1385                1390                1395

Gln Ser  Pro Thr Ser Asn His  Ser Pro Thr Ser Cys  Pro Pro Ile
    1400                1405                1410

Cys Pro  Gly Tyr Arg Trp Met  Cys Leu Arg Arg Phe  Ile Ile Phe
    1415                1420                1425

Leu Phe  Ile Leu Leu Leu Cys  Leu Ile Phe Leu Leu  Val Leu Leu
    1430                1435                1440

Asp Tyr  Gln Gly Met Leu Pro  Val Cys Pro Leu Leu  Pro Gly Thr
    1445                1450                1455

Ser Thr  Thr Ser Thr Gly Pro  Cys Lys Thr Cys Thr  Ile Pro Ala
    1460                1465                1470

Gln Gly  Thr Ser Met Phe Pro  Ser Cys Cys Cys Thr  Lys Pro Ser
    1475                1480                1485

Asp Gly  Asn Cys Thr Cys Ile  Pro Ile Pro Ser Ser  Trp Ala Phe
    1490                1495                1500

Ala Arg  Phe Leu Trp Glu Trp  Ala Ser Val Arg Phe  Ser Trp Leu
    1505                1510                1515

Ser Leu  Leu Val Pro Phe Val  Gln Trp Phe Val Gly  Leu Ser Pro
    1520                1525                1530

Thr Val  Trp Leu Ser Val Ile  Trp Met Met Trp Tyr  Trp Gly Pro
    1535                1540                1545

Ser Leu  Tyr Asn Ile Leu Ser  Pro Phe Leu Pro Leu  Leu Pro Ile
    1550                1555                1560
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Phe Phe Cys Leu Trp Val Tyr Ile
    1565   1570

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gccgaccatt cgatttaata aaaaaatcag atgctaaacg caattctaaa tcgttggtca   240

aagaatctat ggcatccttg aaatccttgt acgaggcatt cgagacacaa tcaggagcgt   300

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accaaagaaa ttaaaaacag agacaaaata gttaatagtt tgtctctatc aaacctggac 240

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Lys Asp His Trp Pro Glu Ala Asn Gln Val Gly Ala Gly Ala Phe Gly
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Pro Gly Phe Thr Pro Pro His Gly Gly Leu Leu Gly Trp Ser Pro Gln
65                  70                  75                  80

Ala Gln Gly Ile Leu Thr Thr Val Pro Ala Ala Pro Pro Pro Ala Ser
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