SEQUENCE LISTING

<110> Locana, Inc.

<120> RNA-TARGETING FUSION PROTEIN COMPOSITIONS AND METHODS FOR USE

<130> LOCN-002/001WO 330675-2007

<150> US 62/682,271
<151> 2018-06-08

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<170> PatentIn version 3.5

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Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
20 25 30

Arg Asn Met Thr Gln Gly Leu Cys Lys Pro Val Asn Thr Phe Val His
35 40 45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr

50 55 60

Cys Lys Asn Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65 70 75 80

Ile Thr Asp Cys Arg Leu Thr Asn Gly Ser Arg Tyr Pro Asn Cys Ala
85 90 95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
100 105 110

Ser Pro Tyr Val Pro Val His Phe Asp Ala Ser Val Glu Asp Ser Thr
115 120 125

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Gln Asp Gly Met Tyr Gln Arg Phe Leu Arg Gln His Val His Pro Glu
1 5 10 15

Glu Thr Gly Gly Ser Asp Arg Tyr Cys Asp Leu Met Met Gln Arg Arg
20 25 30

Lys Met Thr Leu Tyr His Cys Lys Arg Phe Asn Thr Phe Ile His Glu
35 40 45

Asp Ile Trp Asn Ile Arg Ser Ile Cys Ser Thr Thr Asn Ile Gln Cys
50 55 60

Lys Asn Gly Lys Met Asn Cys His Glu Gly Val Val Lys Val Thr Asp
65 70 75 80

Cys Arg Asp Thr Gly Ser Ser Arg Ala Pro Asn Cys Arg Tyr Arg Ala
85 90 95

Ile Ala Ser Thr Arg Arg Val Val Ile Ala Cys Glu Gly Asn Pro Gln

```
            100                 105                 110

Val Pro Val His Phe Asp Gly
        115
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Trp Pro Lys Arg Leu Thr Lys Ala His Trp Phe Glu Ile Gln His Ile
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Gln Pro Ser Pro Leu Gln Cys Asn Arg Ala Met Ser Gly Ile Asn Asn
            20                  25                  30

Tyr Thr Gln His Cys Lys His Gln Asn Thr Phe Leu His Asp Ser Phe
        35                  40                  45

Gln Asn Val Ala Ala Val Cys Asp Leu Leu Ser Ile Val Cys Lys Asn
    50                  55                  60

Arg Arg His Asn Cys His Gln Ser Ser Lys Pro Val Asn Met Thr Asp
65                  70                  75                  80

Cys Arg Leu Thr Ser Gly Lys Tyr Pro Gln Cys Arg Tyr Ser Ala Ala
                85                  90                  95

Ala Gln Tyr Lys Phe Phe Ile Val Ala Cys Asp Pro Pro Gln Lys Ser
            100                 105                 110

Asp Pro Pro Tyr Lys Leu Val Pro Val His Leu Asp Ser Ile Leu
        115                 120                 125
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Ala Pro Ala Arg Ala Gly Phe Cys Pro Leu Leu Leu Leu Leu Leu Leu
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Gly Leu Trp Val Ala Glu Ile Pro Val Ser Ala Lys Pro Lys Gly Met
            20   25   30

Thr Ser Ser Gln Trp Phe Lys Ile Gln His Met Gln Pro Ser Pro Gln
        35   40   45

Ala Cys Asn Ser Ala Met Lys Asn Ile Asn Lys His Thr Lys Arg Cys
    50   55   60

Lys Asp Leu Asn Thr Phe Leu His Glu Pro Phe Ser Ser Val Ala Ala
65   70   75   80

Thr Cys Gln Thr Pro Lys Ile Ala Cys Lys Asn Gly Asp Lys Asn Cys
                85   90   95

His Gln Ser His Gly Pro Val Ser Leu Thr Met Cys Lys Leu Thr Ser
            100   105   110

Gly Lys Tyr Pro Asn Cys Arg Tyr Lys Glu Lys Arg Gln Asn Lys Ser
        115   120   125

Tyr Val Val Ala Cys Lys Pro Pro Gln Lys Lys Asp Ser Gln Gln Phe
    130   135   140

His Leu Val Pro Val His Leu Asp Arg Val Leu
145   150   155

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<212> PRT
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<220>
<223> RNAse8

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Thr Ser Ser Gln Trp Phe Lys Thr Gln His Val Gln Pro Ser Pro Gln
1               5                   10                  15


Ala Cys Asn Ser Ala Met Ser Ile Ile Asn Lys Tyr Thr Glu Arg Cys
            20                  25                  30


Lys Asp Leu Asn Thr Phe Leu His Glu Pro Phe Ser Ser Val Ala Ile
        35                  40                  45


Thr Cys Gln Thr Pro Asn Ile Ala Cys Lys Asn Ser Cys Lys Asn Cys
    50                  55                  60


His Gln Ser His Gly Pro Met Ser Leu Thr Met Gly Glu Leu Thr Ser
65                  70                  75                  80


Gly Lys Tyr Pro Asn Cys Arg Tyr Lys Glu Lys His Leu Asn Thr Pro
                85                  90                  95


Tyr Ile Val Ala Cys Asp Pro Pro Gln Gln Gly Asp Pro Gly Tyr Pro
            100                 105                 110


Leu Val Pro Val His Leu Asp Lys Val Val
        115                 120


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Lys Pro Pro Gln Phe Thr Trp Ala Gln Trp Phe Glu Thr Gln His Ile
1               5                   10                  15


Asn Met Thr Ser Gln Gln Cys Thr Asn Ala Met Gln Val Ile Asn Asn
            20                  25                  30


Tyr Gln Arg Arg Cys Lys Asn Gln Asn Thr Phe Leu Leu Thr Thr Phe
        35                  40                  45
```

```
Ala Asn Val Val Asn Val Cys Gly Asn Pro Asn Met Thr Cys Pro Ser
    50                  55                  60

Asn Lys Thr Arg Lys Asn Cys His His Ser Gly Ser Gln Val Pro Leu
65                  70                  75                  80

Ile His Cys Asn Leu Thr Thr Pro Ser Pro Gln Asn Ile Ser Asn Cys
                85                  90                  95

Arg Tyr Ala Gln Thr Pro Ala Asn Met Phe Tyr Ile Val Ala Cys Asp
            100                 105                 110

Asn Arg Asp Gln Arg Arg Asp Pro Pro Gln Tyr Pro Val Val Pro Val
        115                 120                 125

His Leu Asp Arg Ile Ile
    130
```

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Asp Lys Arg Leu Arg Asp Asn His Glu Trp Lys Lys Leu Ile Met Val
1               5                   10                  15

Gln His Trp Pro Glu Thr Val Cys Glu Lys Ile Gln Asn Asp Cys Arg
            20                  25                  30

Asp Pro Pro Asp Tyr Trp Thr Ile His Gly Leu Trp Pro Asp Lys Ser
        35                  40                  45

Glu Gly Cys Asn Arg Ser Trp Pro Phe Asn Leu Glu Glu Ile Lys Lys
    50                  55                  60

Asn Trp Met Glu Ile Thr Asp Ser Ser Leu Pro Ser Pro Ser Met Gly
65                  70                  75                  80
```

```
Pro Ala Pro Pro Arg Trp Met Arg Ser Thr Pro Arg Arg Ser Thr Leu
                85                  90                  95

Ala Glu Ala Trp Asn Ser Thr Gly Ser Trp Thr Ser Thr Gly Gly Cys
            100                 105                 110

Ala Leu Pro Pro Ala Ala Leu Pro Ser Gly Asp Leu Cys Cys Arg Pro
        115                 120                 125

Ser Leu Thr Ala Gly Ser Arg Gly Val Gly Val Asp Leu Thr Ala Leu
    130                 135                 140

His Gln Leu Leu His Val His Tyr Ser Ala Thr Gly Ile Ile Pro Glu
145                 150                 155                 160

Glu Cys Ser Glu Pro Thr Lys Pro Phe Gln Ile Ile Leu His His Asp
                165                 170                 175

His Thr Glu Trp Val Gln Ser Ile Gly Met Pro Ile Trp Gly Thr Ile
            180                 185                 190

Ser Ser Ser Glu Ser Ala Ile Gly Lys Asn Glu Glu Ser Gln Pro Ala
        195                 200                 205

Cys Ala Val Leu Ser His Asp Ser
    210                 215


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Ala Ala Val Glu Asp Asn His Leu Leu Ile Lys Ala Val Gln Asn Glu
1               5                   10                  15

Asp Val Asp Leu Val Gln Gln Leu Leu Glu Gly Gly Ala Asn Val Asn
            20                  25                  30
```

```
Phe Gln Glu Glu Glu Gly Gly Trp Thr Pro Leu His Asn Ala Val Gln
        35                  40                  45

Met Ser Arg Glu Asp Ile Val Glu Leu Leu Leu Arg His Gly Ala Asp
    50                  55                  60

Pro Val Leu Arg Lys Lys Asn Gly Ala Thr Pro Phe Ile Leu Ala Ala
65                  70                  75                  80

Ile Ala Gly Ser Val Lys Asp Leu Leu Lys Leu Phe Leu Ser Lys Gly
                85                  90                  95

Ala Asp Val Asn Glu Cys Asp Phe Tyr Gly Phe Thr Ala Phe Met Glu
            100                 105                 110

Ala Ala Val Tyr Gly Lys Val Lys Ala Leu Lys Phe Leu Tyr Lys Arg
        115                 120                 125

Gly Ala Asn Val Asn Leu Arg Arg Lys Thr Lys Glu Asp Gln Glu Arg
    130                 135                 140

Leu Arg Lys Gly Gly Ala Thr Ala Leu Met Asp Ala Ala Glu Lys Gly
145                 150                 155                 160

His Val Glu Val Leu Lys Ile Leu Leu Asp Glu Met Gly Ala Asp Val
                165                 170                 175

Asn Ala Cys Asp Asn Met Gly Arg Asn Ala Leu Ile His Ala Leu Leu
            180                 185                 190

Ser Ser Asp Asp Ser Asp Val Glu Ala Ile Thr His Leu Leu Leu Asp
        195                 200                 205

His Gly Ala Asp Val Asn Val Arg Gly Glu Arg Gly Lys Thr Pro Leu
    210                 215                 220

Ile Leu Ala Val Glu Lys Lys His Leu Gly Leu Val Gln Arg Leu Leu
225                 230                 235                 240

Glu Gln Glu His Ile Glu Ile Asn Asp Thr Asp Ser Asp Gly Lys Thr
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```
                245                 250                 255

Ala Leu Leu Leu Ala Val Glu Leu Lys Leu Lys Lys Ile Ala Glu Leu
            260                 265                 270

Leu Cys Lys Arg Gly Ala Ser Thr Asp Cys Gly Asp Leu Val Met Thr
        275                 280                 285

Ala Arg Arg Asn Tyr Asp His Ser Leu Val Lys Val Leu Leu Ser His
    290                 295                 300

Gly Ala Lys Glu Asp Phe His Pro Pro Ala Glu Asp Trp Lys Pro Gln
305                 310                 315                 320

Ser Ser His Trp Gly Ala Ala Leu Lys Asp Leu His Arg Ile Tyr Arg
                325                 330                 335

Pro Met Ile Gly Lys Leu Lys Phe Phe Ile Asp Glu Lys Tyr Lys Ile
            340                 345                 350

Ala Asp Thr Ser Glu Gly Gly Ile Tyr Leu Gly Phe Tyr Glu Lys Gln
        355                 360                 365

Glu Val Ala Val Lys Thr Phe Cys Glu Gly Ser Pro Arg Ala Gln Arg
    370                 375                 380

Glu Val Ser Cys Leu Gln Ser Ser Arg Glu Asn Ser His Leu Val Thr
385                 390                 395                 400

Phe Tyr Gly Ser Glu Ser His Arg Gly His Leu Phe Val Cys Val Thr
                405                 410                 415

Leu Cys Glu Gln Thr Leu Glu Ala Cys Leu Asp Val His Arg Gly Glu
            420                 425                 430

Asp Val Glu Asn Glu Glu Asp Glu Phe Ala Arg Asn Val Leu Ser Ser
        435                 440                 445

Ile Phe Lys Ala Val Gln Glu Leu His Leu Ser Cys Gly Tyr Thr His
    450                 455                 460
```

```
Gln Asp Leu Gln Pro Gln Asn Ile Leu Ile Asp Ser Lys Lys Ala Ala
465                 470                 475                 480

His Leu Ala Asp Phe Asp Lys Ser Ile Lys Trp Ala Gly Asp Pro Gln
                485                 490                 495

Glu Val Lys Arg Asp Leu Glu Asp Leu Gly Arg Leu Val Leu Tyr Val
            500                 505                 510

Val Lys Lys Gly Ser Ile Ser Phe Glu Asp Leu Lys Ala Gln Ser Asn
        515                 520                 525

Glu Glu Val Val Gln Leu Ser Pro Asp Glu Glu Thr Lys Asp Leu Ile
    530                 535                 540

His Arg Leu Phe His Pro Gly Glu His Val Arg Asp Cys Leu Ser Asp
545                 550                 555                 560

Leu Leu Gly His Pro Phe Phe Trp Thr Trp Glu Ser Arg Tyr Arg Thr
                565                 570                 575

Leu Arg Asn Val Gly Asn Glu Ser Asp Ile Lys Thr Arg Lys Ser Glu
            580                 585                 590

Ser Glu Ile Leu Arg Leu Leu Gln Pro Gly Pro Ser Glu His Ser Lys
        595                 600                 605

Ser Phe Asp Lys Trp Thr Thr Lys Ile Asn Glu Cys Val Met Lys Lys
    610                 615                 620

Met Asn Lys Phe Tyr Glu Lys Arg Gly Asn Phe Tyr Gln Asn Thr Val
625                 630                 635                 640

Gly Asp Leu Leu Lys Phe Ile Arg Asn Leu Gly Glu His Ile Asp Glu
                645                 650                 655

Glu Lys His Lys Lys Met Lys Leu Lys Ile Gly Asp Pro Ser Leu Tyr
            660                 665                 670

Phe Gln Lys Thr Phe Pro Asp Leu Val Ile Tyr Val Tyr Thr Lys Leu
```

675 680 685

Gln Asn Thr Glu Tyr Arg Lys His Phe Pro Gln Thr His Ser Pro Asn
690 695 700

Lys Pro Gln Cys Asp Gly Ala Gly Gly Ala Ser Gly Leu Ala Ser Pro
705 710 715 720

Gly Cys

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Val Gln His Trp Pro Glu Thr Val Cys Glu Lys Ile Gln Asn Asp Cys
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Arg Asp Pro Pro Asp Tyr Trp Thr Ile His Gly Leu Trp Pro Asp Lys
20 25 30

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

Asp Leu Leu Pro Glu Met Arg Ala Tyr Trp Pro Asp Val Ile His Ser
50 55 60

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

Thr Cys Ala Ala Gln Val Asp Ala Leu Asn Ser Gln Lys Lys Tyr Phe
85 90 95

Gly Arg Ser Leu Glu Leu Tyr Arg Glu Leu Asp Leu Asn Ser Val Leu
100 105 110

Leu Lys Leu Gly Ile Lys Pro Ser Ile Asn Tyr Tyr Gln Val Ala Asp

```
        115                 120                 125

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

Cys Leu Pro Pro Ser Gln Asp Glu Glu Val Gln Thr Ile Gly Gln Ile
145                 150                 155                 160

Glu Leu Cys Leu Thr Lys Gln Asp Gln Gln Leu Gln Asn Cys Thr Glu
                165                 170                 175

Pro Gly Glu Gln Pro Ser Pro Lys Gln Glu Val Trp Leu Ala Asn Gly
            180                 185                 190

Ala Ala Glu Ser Arg Gly Leu Arg Val Cys Glu Asp Gly Pro Val Phe
        195                 200                 205

Tyr Pro Pro Pro Lys Lys Thr Lys His
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Glu Ala Ser Glu Ser Thr Met Lys Ile Ile Lys Glu Glu Phe Thr Asp
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Glu Glu Met Gln Tyr Asp Met Ala Lys Ser Gly Gln Glu Lys Gln Thr
            20                  25                  30

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

Ser Met Ser Lys Asp Asp Met Ser Ser Thr Leu Leu Thr Phe Arg Ser
    50                  55                  60

Leu His Tyr Asn Asp Pro Lys Gly Asn Ser Ser Gly Asn Asp Lys Glu
```

65 70 75 80

Cys Cys Asn Asp Met Thr Val Trp Arg Lys Val Ser Glu Ala Asn Gly
85 90 95

Ser Cys Lys Trp Ser Asn Asn Phe Ile Arg Ser Ser Thr Glu Val Met
100 105 110

Arg Arg Val His Arg Ala Pro Ser Cys Lys Phe Val Gln Asn Pro Gly
115 120 125

Ile Ser Cys Cys Glu Ser Leu Glu Leu Glu Asn Thr Val Cys Gln Phe
130 135 140

Thr Thr Gly Lys Gln Phe Pro Arg Cys Gln Tyr His Ser Val Thr Ser
145 150 155 160

Leu Glu Lys Ile Leu Thr Val Leu Thr Gly His Ser Leu Met Ser Trp
165 170 175

Leu Val Cys Gly Ser Lys Leu
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Xaa Leu Gly Gly Ala Asp Lys Arg Leu Arg Asp Asn His Glu Trp Lys
1 5 10 15

Lys Leu Ile Met Val Gln His Trp Pro Glu Thr Val Cys Glu Lys Ile
20 25 30

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Gln Asn Asp Cys Arg Asp Pro Pro Asp Tyr Trp Thr Ile His Gly Leu
        35                  40                  45

Trp Pro Asp Lys Ser Glu Gly Cys Asn Arg Ser Trp Pro Phe Asn Leu
    50                  55                  60

Glu Glu Ile Lys Asp Leu Leu Pro Glu Met Arg Ala Tyr Trp Pro Asp
65                  70                  75                  80

Val Ile His Ser Phe Pro Asn Arg Ser Arg Phe Trp Lys His Glu Trp
                85                  90                  95

Glu Lys His Gly Thr Cys Ala Ala Gln Val Asp Ala Leu Asn Ser Gln
            100                 105                 110

Lys Lys Tyr Phe Gly Arg Ser Leu Glu Leu Tyr Arg Glu Leu Asp Leu
        115                 120                 125

Asn Ser Val Leu Leu Lys Leu Gly Ile Lys Pro Ser Ile Asn Tyr Tyr
    130                 135                 140

Gln Thr Thr Glu Glu Asp Leu Asn Leu Asp Val Glu Pro Thr Thr Glu
145                 150                 155                 160

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

Phe Gly Glu Ile Gly Pro Arg Arg Trp
            180                 185


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Ala Pro Val Glu His Val Val Ala Asp Ala Gly Ala Phe Leu Arg His
1               5                   10                  15
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```
Ala Ala Leu Gln Asp Ile Gly Lys Asn Ile Tyr Thr Ile Arg Glu Val
            20                  25                  30

Val Thr Glu Ile Arg Asp Lys Ala Thr Arg Arg Arg Leu Ala Val Leu
        35                  40                  45

Pro Tyr Glu Leu Arg Phe Lys Glu Pro Leu Pro Glu Tyr Val Arg Leu
    50                  55                  60

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

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

Val Gly Val Ser His Leu Lys Gln Glu Pro Gln Lys Val Lys Val Ser
            100                 105                 110

Ser Ser Ile Gln His Pro Glu Thr Pro Leu His Ile Ser Gly Phe His
        115                 120                 125

Leu Pro Tyr Lys Pro Lys Pro Pro Gln Glu Thr Glu Lys Gly His Ser
    130                 135                 140

Ala Cys Glu Pro Glu Asn Leu Glu Phe Ser Ser Phe Met Phe Trp Arg
145                 150                 155                 160

Asn Pro Leu Pro Asn Ile Asp His Glu Leu Gln Glu Leu Leu Ile Asp
                165                 170                 175

Arg Gly Glu Asp Val Pro Ser Glu Glu Glu Glu Glu Glu Glu Asn Gly
            180                 185                 190

Phe Glu Asp Arg Lys Asp Asp Ser Asp Asp Asp Gly Gly Gly Trp Ile
        195                 200                 205

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

Val Pro Glu Asp Val Arg Val Gly Cys Leu Thr Thr Asp Phe Ala Met
```

225 230 235 240

Gln Asn Val Leu Leu Gln Met Gly Leu His Val Leu Ala Val Asn Gly
245 250 255

Met Leu Ile Arg Glu Ala Arg Ser Tyr Ile Leu Arg Cys His Gly Cys
260 265 270

Phe Lys Thr Thr Ser Asp Met Ser Arg Val Phe Cys Ser His Cys Gly
275 280 285

Asn Lys Thr Leu Lys Lys Val Ser Val Thr Val
290 295

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Ala Phe Ser Gly Leu Gln Arg Val Gly Gly Val Asp Val Ser Phe Val
1 5 10 15

Lys Gly Asp Ser Val Arg Ala Cys Ala Ser Leu Val Val Leu Ser Phe
20 25 30

Pro Glu Leu Glu Val Val Tyr Glu Glu Ser Arg Met Val Ser Leu Thr
35 40 45

Ala Pro Tyr Val Ser Gly Phe Leu Ala Phe Arg Glu Val Pro Phe Leu
50 55 60

Leu Glu Leu Val Gln Gln Leu Arg Glu Lys Glu Pro Gly Leu Met Pro
65 70 75 80

Gln Val Leu Leu Val Asp Gly Asn Gly Val Leu His His Arg Gly Phe
85 90 95

Gly Val Ala Cys His Leu Gly Val Leu Thr Asp Leu Pro Cys Val Gly

```
            100                 105                 110

Val Ala Lys Lys Leu Leu Gln Val Asp Gly Leu Glu Asn Asn Ala Leu
        115                 120                 125

His Lys Glu Lys Ile Arg Leu Leu Gln Thr Arg Gly Asp Ser Phe Pro
    130                 135                 140

Leu Leu Gly Asp Ser Gly Thr Val Leu Gly Met Ala Leu Arg Ser His
145                 150                 155                 160

Asp Arg Ser Thr Arg Pro Leu Tyr Ile Ser Val Gly His Arg Met Ser
                165                 170                 175

Leu Glu Ala Ala Val Arg Leu Thr Cys Cys Cys Cys Arg Phe Arg Ile
            180                 185                 190

Pro Glu Pro Val Arg Gln Ala Asp Ile Cys Ser Arg Glu His Ile Arg
        195                 200                 205

Lys Ser
    210
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Ala Glu Leu Pro Pro Val Pro Gly Gly Pro Arg Gly Pro Gly Glu Leu
1               5                   10                  15

Ala Lys Tyr Gly Leu Pro Gly Leu Ala Gln Leu Lys Ser Arg Glu Ser
            20                  25                  30

Tyr Val Leu Cys Tyr Asp Pro Arg Thr Arg Gly Ala Leu Trp Val Val
        35                  40                  45

Glu Gln Leu Arg Pro Glu Arg Leu Arg Gly Asp Gly Asp Arg Arg Glu
```

```
    50                  55                  60

Cys Asp Phe Arg Glu Asp Asp Ser Val His Ala Tyr His Arg Ala Thr
65                  70                  75                  80

Asn Ala Asp Tyr Arg Gly Ser Gly Phe Asp Arg Gly His Leu Ala Ala
                85                  90                  95

Ala Ala Asn His Arg Trp Ser Gln Lys Ala Met Asp Asp Thr Phe Tyr
            100                 105                 110

Leu Ser Asn Val Ala Pro Gln Val Pro His Leu Asn Gln Asn Ala Trp
        115                 120                 125

Asn Asn Leu Glu Lys Tyr Ser Arg Ser Leu Thr Arg Ser Tyr Gln Asn
    130                 135                 140

Val Tyr Val Cys Thr Gly Pro Leu Phe Leu Pro Arg Thr Glu Ala Asp
145                 150                 155                 160

Gly Lys Ser Tyr Val Lys Tyr Gln Val Ile Gly Lys Asn His Val Ala
                165                 170                 175

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

Gln Ile Glu Leu Arg Thr Tyr Val Met Pro Asn Ala Pro Val Asp Glu
        195                 200                 205

Ala Ile Pro Leu Glu Arg Phe Leu Val Pro Ile Glu Ser Ile Glu Arg
    210                 215                 220

Ala Ser Gly Leu Leu Phe Val Pro Asn Ile Leu Ala Arg Ala Gly Ser
225                 230                 235                 240

Leu Lys Ala Ile Thr Ala Gly Ser Lys
                245

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Arg Leu Val Gly Glu Glu Glu Ala Gly Phe Gly Glu Cys Asp Lys Phe
1               5                  10                  15


Phe Tyr Ala Gly Thr Pro Pro Ala Gly Leu Ala Ala Asp Ser His Val
            20                  25                  30


Lys Ile Cys Gln Arg Ala Glu Gly Ala Glu Arg Phe Ala Thr Leu Tyr
        35                  40                  45


Ser Thr Arg Asp Arg Ile Pro Val Tyr Ser Ala Phe Arg Ala Pro Arg
    50                  55                  60


Pro Ala Pro Gly Gly Ala Glu Gln Arg Trp Leu Val Glu Pro Gln Ile
65                  70                  75                  80


Asp Asp Pro Asn Ser Asn Leu Glu Glu Ala Ile Asn Glu Ala Glu Ala
                85                  90                  95


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


Tyr Leu Asp Ser Asp Tyr Gln Arg Gly Gln Leu Tyr Pro Phe Ser Leu
        115                 120                 125


Ser Ser Asp Val Gln Val Ala Thr Phe Thr Leu Thr Asn Ser Ala Pro
    130                 135                 140


Met Thr Gln Ser Phe Gln Glu Arg Trp Tyr Val Asn Leu His Ser Leu
145                 150                 155                 160


Met Asp Arg Ala Leu Thr Pro Gln Cys Gly Ser Gly Glu Asp Leu Tyr
                165                 170                 175


Ile Leu Thr Gly Thr Val Pro Ser Asp Tyr Arg Val Lys Asp Lys Val
            180                 185                 190
```

```
Ala Val Pro Glu Phe Val Trp Leu Ala Ala Cys Cys Ala Val Pro Gly
        195                 200                 205

Gly Gly Trp Ala Met Gly Phe Val Lys His Thr Arg Asp Ser Asp Ile
    210                 215                 220

Ile Glu Asp Val Met Val Lys Asp Leu Gln Lys Leu Leu Pro Phe Asn
225                 230                 235                 240

Pro Gln Leu Phe Gln Asn Asn Cys Gly Glu Thr Glu Gln Asp Thr Glu
                245                 250                 255

Lys Met Lys Lys Ile Leu Glu Val Val Asn Gln Ile Gln Asp Glu Glu
            260                 265                 270

Arg Met Val Gln Ser Gln Lys Ser Ser Ser Pro Leu Ser Ser Thr Arg
        275                 280                 285

Ser Lys Arg Ser Thr Leu Leu Pro Pro Glu Ala Ser Glu Gly Ser Ser
    290                 295                 300

Ser Phe Leu Gly Lys Leu Met Gly Phe Ile Ala Thr Pro Phe Ile Lys
305                 310                 315                 320

Leu Phe Gln Leu Ile Tyr Tyr Leu Val Val Ala Ile Leu Lys Asn Ile
                325                 330                 335

Val Tyr Phe Leu Trp Cys Val Thr Lys Gln Val Ile Asn Gly Ile Glu
            340                 345                 350

Ser Cys Leu Tyr Arg Leu Gly Ser Ala Thr Ile Ser Tyr Phe Met Ala
        355                 360                 365

Ile Gly Glu Glu Leu Val Ser Ile Pro Trp Lys Val Leu Lys Val Val
    370                 375                 380

Ala Lys Val Ile Arg Ala Leu Leu Arg Ile Leu Cys Cys Leu Leu Lys
385                 390                 395                 400

Ala Ile Cys Arg Val Leu Ser Ile Pro Val Arg Val Leu Val Asp Val
```

405 410 415

Ala Thr Phe Pro Val Tyr Thr Met Gly Ala Ile Pro Ile Val Cys Lys
420 425 430

Asp Ile Ala Leu Gly Leu Gly Gly Thr Val Ser Leu Leu Phe Asp Thr
435 440 445

Ala Phe Gly Thr Leu Gly Gly Leu Phe Gln Val Val Phe Ser Val Cys
450 455 460

Lys Arg Ile Gly Tyr Lys Val Thr Phe Asp Asn Ser Gly Glu Leu
465 470 475

<210> 35
<211> 380
<212> PRT
<213> Unknown

<220>
<223> hFEN1

<400> 35

Met Gly Ile Gln Gly Leu Ala Lys Leu Ile Ala Asp Val Ala Pro Ser
1 5 10 15

Ala Ile Arg Glu Asn Asp Ile Lys Ser Tyr Phe Gly Arg Lys Val Ala
20 25 30

Ile Asp Ala Ser Met Ser Ile Tyr Gln Phe Leu Ile Ala Val Arg Gln
35 40 45

Gly Gly Asp Val Leu Gln Asn Glu Glu Gly Glu Thr Thr Ser His Leu
50 55 60

Met Gly Met Phe Tyr Arg Thr Ile Arg Met Met Glu Asn Gly Ile Lys
65 70 75 80

Pro Val Tyr Val Phe Asp Gly Lys Pro Pro Gln Leu Lys Ser Gly Glu
85 90 95

Leu Ala Lys Arg Ser Glu Arg Arg Ala Glu Ala Glu Lys Gln Leu Gln

```
            100                 105                 110

Gln Ala Gln Ala Ala Gly Ala Glu Gln Glu Val Glu Lys Phe Thr Lys
        115                 120                 125

Arg Leu Val Lys Val Thr Lys Gln His Asn Asp Glu Cys Lys His Leu
    130                 135                 140

Leu Ser Leu Met Gly Ile Pro Tyr Leu Asp Ala Pro Ser Glu Ala Glu
145                 150                 155                 160

Ala Ser Cys Ala Ala Leu Val Lys Ala Gly Lys Val Tyr Ala Ala Ala
                165                 170                 175

Thr Glu Asp Met Asp Cys Leu Thr Phe Gly Ser Pro Val Leu Met Arg
            180                 185                 190

His Leu Thr Ala Ser Glu Ala Lys Lys Leu Pro Ile Gln Glu Phe His
        195                 200                 205

Leu Ser Arg Ile Leu Gln Glu Leu Gly Leu Asn Gln Glu Gln Phe Val
    210                 215                 220

Asp Leu Cys Ile Leu Leu Gly Ser Asp Tyr Cys Glu Ser Ile Arg Gly
225                 230                 235                 240

Ile Gly Pro Lys Arg Ala Val Asp Leu Ile Gln Lys His Lys Ser Ile
                245                 250                 255

Glu Glu Ile Val Arg Arg Leu Asp Pro Asn Lys Tyr Pro Val Pro Glu
            260                 265                 270

Asn Trp Leu His Lys Glu Ala His Gln Leu Phe Leu Glu Pro Glu Val
        275                 280                 285

Leu Asp Pro Glu Ser Val Glu Leu Lys Trp Ser Glu Pro Asn Glu Glu
    290                 295                 300

Glu Leu Ile Lys Phe Met Cys Gly Glu Lys Gln Phe Ser Glu Glu Arg
305                 310                 315                 320
```

```
Ile Arg Ser Gly Val Lys Arg Leu Ser Lys Ser Arg Gln Gly Ser Thr
                325                 330                 335


Gln Gly Arg Leu Asp Asp Phe Phe Lys Val Thr Gly Ser Leu Ser Ser
            340                 345                 350


Ala Lys Arg Lys Glu Pro Glu Pro Lys Gly Ser Thr Lys Lys Lys Ala
        355                 360                 365


Lys Thr Gly Ala Ala Gly Lys Phe Lys Arg Gly Lys
    370                 375                 380


<210>  36
<211>  186
<212>  PRT
<213>  Homo Sapiens

<400>  36

Glu Ser Thr His Val Glu Phe Lys Arg Phe Thr Thr Lys Lys Val Ile
1               5                   10                  15


Pro Arg Ile Lys Glu Met Leu Pro His Tyr Val Ser Ala Phe Ala Asn
            20                  25                  30


Thr Gln Gly Gly Tyr Val Leu Ile Gly Val Asp Asp Lys Ser Lys Glu
        35                  40                  45


Val Val Gly Cys Lys Trp Glu Lys Val Asn Pro Asp Leu Leu Lys Lys
    50                  55                  60


Glu Ile Glu Asn Cys Ile Glu Lys Leu Pro Thr Phe His Phe Cys Cys
65                  70                  75                  80


Glu Lys Pro Lys Val Asn Phe Thr Thr Lys Ile Leu Asn Val Tyr Gln
                85                  90                  95


Lys Asp Val Leu Asp Gly Tyr Val Cys Val Ile Gln Val Glu Pro Phe
            100                 105                 110


Cys Cys Val Val Phe Ala Glu Ala Pro Asp Ser Trp Ile Met Lys Asp
        115                 120                 125
```

```
Asn Ser Val Thr Arg Leu Thr Ala Glu Gln Trp Val Val Met Met Leu
    130                 135                 140

Asp Thr Gln Ser Ala Pro Pro Ser Leu Val Thr Asp Tyr Asn Ser Cys
145                 150                 155                 160

Leu Ile Ser Ser Ala Ser Ser Ala Arg Lys Ser Pro Gly Tyr Pro Ile
                165                 170                 175

Lys Val His Lys Phe Lys Glu Ala Leu Gln
            180                 185
```

<210> 37
<211> 262
<212> PRT
<213> Homo Sapiens

<400> 37

```
Thr Leu Gln Gly Thr Asn Thr Tyr Leu Val Gly Thr Gly Pro Arg Arg
1               5                   10                  15

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

Leu Lys Gln Ala Leu Thr Glu Phe Asn Thr Ala Ile Gln Glu Ile Val
        35                  40                  45

Val Thr His Trp His Arg Asp His Ser Gly Gly Ile Gly Asp Ile Cys
    50                  55                  60

Lys Ser Ile Asn Asn Asp Thr Thr Tyr Cys Ile Lys Lys Leu Pro Arg
65                  70                  75                  80

Asn Pro Gln Arg Glu Glu Ile Ile Gly Asn Gly Glu Gln Gln Tyr Val
                85                  90                  95

Tyr Leu Lys Asp Gly Asp Val Ile Lys Thr Glu Gly Ala Thr Leu Arg
            100                 105                 110

Val Leu Tyr Thr Pro Gly His Thr Asp Asp His Met Ala Leu Leu Leu
```

```
        115                 120                 125

Glu Glu Glu Asn Ala Ile Phe Ser Gly Asp Cys Ile Leu Gly Glu Gly
    130                 135                 140

Thr Thr Val Phe Glu Asp Leu Tyr Asp Tyr Met Asn Ser Leu Lys Glu
145                 150                 155                 160

Leu Leu Lys Ile Lys Ala Asp Ile Ile Tyr Pro Gly His Gly Pro Val
                165                 170                 175

Ile His Asn Ala Glu Ala Lys Ile Gln Gln Tyr Ile Ser His Arg Asn
            180                 185                 190

Ile Arg Glu Gln Gln Ile Leu Thr Leu Phe Arg Glu Asn Phe Glu Lys
        195                 200                 205

Ser Phe Thr Val Met Glu Leu Val Lys Ile Ile Tyr Lys Asn Thr Pro
    210                 215                 220

Glu Asn Leu His Glu Met Ala Lys His Asn Leu Leu Leu His Leu Lys
225                 230                 235                 240

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

Lys Trp Lys Ala His Leu
            260
```

<210> 38
<211> 518
<212> PRT
<213> Homo Sapiens

<400> 38

```
Met Leu Arg Val Val Ser Trp Asn Ile Asn Gly Ile Arg Arg Pro Leu
1               5                   10                  15

Gln Gly Val Ala Asn Gln Glu Pro Ser Asn Cys Ala Ala Val Ala Val
            20                  25                  30
```

```
Gly Arg Ile Leu Asp Glu Leu Asp Ala Asp Ile Val Cys Leu Gln Glu
        35                  40                  45

Thr Lys Val Thr Arg Asp Ala Leu Thr Glu Pro Leu Ala Ile Val Glu
    50                  55                  60

Gly Tyr Asn Ser Tyr Phe Ser Phe Ser Arg Asn Arg Ser Gly Tyr Ser
65                  70                  75                  80

Gly Val Ala Thr Phe Cys Lys Asp Asn Ala Thr Pro Val Ala Ala Glu
                85                  90                  95

Glu Gly Leu Ser Gly Leu Phe Ala Thr Gln Asn Gly Asp Val Gly Cys
            100                 105                 110

Tyr Gly Asn Met Asp Glu Phe Thr Gln Glu Glu Leu Arg Ala Leu Asp
        115                 120                 125

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

Gly Lys Glu Lys Thr Leu Thr Leu Ile Asn Val Tyr Cys Pro His Ala
145                 150                 155                 160

Asp Pro Gly Arg Pro Glu Arg Leu Val Phe Lys Met Arg Phe Tyr Arg
                165                 170                 175

Leu Leu Gln Ile Arg Ala Glu Ala Leu Leu Ala Ala Gly Ser His Val
            180                 185                 190

Ile Ile Leu Gly Asp Leu Asn Thr Ala His Arg Pro Ile Asp His Trp
        195                 200                 205

Asp Ala Val Asn Leu Glu Cys Phe Glu Glu Asp Pro Gly Arg Lys Trp
    210                 215                 220

Met Asp Ser Leu Leu Ser Asn Leu Gly Cys Gln Ser Ala Ser His Val
225                 230                 235                 240

Gly Pro Phe Ile Asp Ser Tyr Arg Cys Phe Gln Pro Lys Gln Glu Gly
                245                 250                 255
```

```
Ala Phe Thr Cys Trp Ser Ala Val Thr Gly Ala Arg His Leu Asn Tyr
            260                 265                 270

Gly Ser Arg Leu Asp Tyr Val Leu Gly Asp Arg Thr Leu Val Ile Asp
        275                 280                 285

Thr Phe Gln Ala Ser Phe Leu Leu Pro Glu Val Met Gly Ser Asp His
    290                 295                 300

Cys Pro Val Gly Ala Val Leu Ser Val Ser Ser Val Pro Ala Lys Gln
305                 310                 315                 320

Cys Pro Pro Leu Cys Thr Arg Phe Leu Pro Glu Phe Ala Gly Thr Gln
                325                 330                 335

Leu Lys Ile Leu Arg Phe Leu Val Pro Leu Glu Gln Ser Pro Val Leu
            340                 345                 350

Glu Gln Ser Thr Leu Gln His Asn Asn Gln Thr Arg Val Gln Thr Cys
        355                 360                 365

Gln Asn Lys Ala Gln Val Arg Ser Thr Arg Pro Gln Pro Ser Gln Val
    370                 375                 380

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

Pro Ser Cys Pro Gln Ala Ser Pro Asp Ile Glu Leu Pro Ser Leu Pro
                405                 410                 415

Leu Met Ser Ala Leu Met Thr Pro Lys Thr Pro Glu Glu Lys Ala Val
            420                 425                 430

Ala Lys Val Val Lys Gly Gln Ala Lys Thr Ser Glu Ala Lys Asp Glu
        435                 440                 445

Lys Glu Leu Arg Thr Ser Phe Trp Lys Ser Val Leu Ala Gly Pro Leu
    450                 455                 460
```

```
Arg Thr Pro Leu Cys Gly Gly His Arg Glu Pro Cys Val Met Arg Thr
465                 470                 475                 480


Val Lys Lys Pro Gly Pro Asn Leu Gly Arg Arg Phe Tyr Met Cys Ala
                485                 490                 495


Arg Pro Arg Gly Pro Pro Thr Asp Pro Ser Ser Arg Cys Asn Phe Phe
            500                 505                 510


Leu Trp Ser Arg Pro Ser
        515
```

<210> 39
<211> 350
<212> PRT
<213> Homo Sapiens

<400> 39

```
Met Leu Arg Val Val Ser Trp Asn Ile Asn Gly Ile Arg Arg Pro Leu
1               5                   10                  15


Gln Gly Val Ala Asn Gln Glu Pro Ser Asn Cys Ala Ala Val Ala Val
            20                  25                  30


Gly Arg Ile Leu Asp Glu Leu Asp Ala Asp Ile Val Cys Leu Gln Glu
        35                  40                  45


Thr Lys Val Thr Arg Asp Ala Leu Thr Glu Pro Leu Ala Ile Val Glu
    50                  55                  60


Gly Tyr Asn Ser Tyr Phe Ser Phe Ser Arg Asn Arg Ser Gly Tyr Ser
65                  70                  75                  80


Gly Val Ala Thr Phe Cys Lys Asp Asn Ala Thr Pro Val Ala Ala Glu
                85                  90                  95


Glu Gly Leu Ser Gly Leu Phe Ala Thr Gln Asn Gly Asp Val Gly Cys
            100                 105                 110


Tyr Gly Asn Met Asp Glu Phe Thr Gln Glu Glu Leu Arg Ala Leu Asp
        115                 120                 125
```

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

Gly Lys Glu Lys Thr Leu Thr Leu Ile Asn Val Tyr Cys Pro His Ala
145                 150                 155                 160

Asp Pro Gly Arg Pro Glu Arg Leu Val Phe Lys Met Arg Phe Tyr Arg
                165                 170                 175

Leu Leu Gln Ile Arg Ala Glu Ala Leu Leu Ala Ala Gly Ser His Val
            180                 185                 190

Ile Ile Leu Gly Asp Leu Asn Thr Ala His Arg Pro Ile Asp His Trp
        195                 200                 205

Asp Ala Val Asn Leu Glu Cys Phe Glu Glu Asp Pro Gly Arg Lys Trp
    210                 215                 220

Met Asp Ser Leu Leu Ser Asn Leu Gly Cys Gln Ser Ala Ser His Val
225                 230                 235                 240

Gly Pro Phe Ile Asp Ser Tyr Arg Cys Phe Gln Pro Lys Gln Glu Gly
                245                 250                 255

Ala Phe Thr Cys Trp Ser Ala Val Thr Gly Ala Arg His Leu Asn Tyr
            260                 265                 270

Gly Ser Arg Leu Asp Tyr Val Leu Gly Asp Arg Thr Leu Val Ile Asp
        275                 280                 285

Thr Phe Gln Ala Ser Phe Leu Leu Pro Glu Val Met Gly Ser Asp His
    290                 295                 300

Cys Pro Val Gly Ala Val Leu Ser Val Ser Ser Val Pro Ala Lys Gln
305                 310                 315                 320

Cys Pro Pro Leu Cys Thr Arg Phe Leu Pro Glu Phe Ala Gly Thr Gln
                325                 330                 335

Leu Lys Ile Leu Arg Phe Leu Val Pro Leu Glu Gln Ser Pro
```

340 345 350

<210> 40
<211> 123
<212> PRT
<213> Homo Sapiens

<400> 40

Gln Asp Asn Ser Arg Tyr Thr His Phe Leu Thr Gln His Tyr Asp Ala
1 5 10 15

Lys Pro Gln Gly Arg Asp Asp Arg Tyr Cys Glu Ser Ile Met Arg Arg
20 25 30

Arg Gly Leu Thr Ser Pro Cys Lys Asp Ile Asn Thr Phe Ile His Gly
35 40 45

Asn Lys Arg Ser Ile Lys Ala Ile Cys Glu Asn Lys Asn Gly Asn Pro
50 55 60

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

Cys Lys Leu His Gly Gly Ser Pro Trp Pro Pro Cys Gln Tyr Arg Ala
85 90 95

Thr Ala Gly Phe Arg Asn Val Val Val Ala Cys Glu Asn Gly Leu Pro
100 105 110

Val His Leu Asp Gln Ser Ile Phe Arg Arg Pro
115 120

<210> 41
<211> 136
<212> PRT
<213> Homo Sapiens

<400> 41

Ser Ser Leu Ile Arg Arg Val Ile Ser Thr Ala Lys Ala Pro Gly Ala
1 5 10 15

Ile Gly Pro Tyr Ser Gln Ala Val Leu Val Asp Arg Thr Ile Tyr Ile

```
            20                  25                  30

Ser Gly Gln Ile Gly Met Asp Pro Ser Ser Gly Gln Leu Val Ser Gly
        35                  40                  45

Gly Val Ala Glu Glu Ala Lys Gln Ala Leu Lys Asn Met Gly Glu Ile
    50                  55                  60

Leu Lys Ala Ala Gly Cys Asp Phe Thr Asn Val Val Lys Thr Thr Val
65                  70                  75                  80

Leu Leu Ala Asp Ile Asn Asp Phe Asn Thr Val Asn Glu Ile Tyr Lys
                85                  90                  95

Gln Tyr Phe Lys Ser Asn Phe Pro Ala Arg Ala Ala Tyr Gln Val Ala
            100                 105                 110

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

Gly Pro Leu Thr Thr Ala Ser Leu
    130                 135


<210>  42
<211>  189
<212>  PRT
<213>  Homo Sapiens

<400>  42

Gly Gly Gly Thr Pro Lys Ala Pro Asn Leu Glu Pro Pro Leu Pro Glu
1               5                   10                  15

Glu Glu Lys Glu Gly Ser Asp Leu Arg Pro Val Val Ile Asp Gly Ser
            20                  25                  30

Asn Val Ala Met Ser His Gly Asn Lys Glu Val Phe Ser Cys Arg Gly
        35                  40                  45

Ile Leu Leu Ala Val Asn Trp Phe Leu Glu Arg Gly His Thr Asp Ile
    50                  55                  60
```

```
Thr Val Phe Val Pro Ser Trp Arg Lys Glu Gln Pro Arg Pro Asp Val
65                  70                  75                  80


Pro Ile Thr Asp Gln His Ile Leu Arg Glu Leu Glu Lys Lys Lys Ile
                85                  90                  95


Leu Val Phe Thr Pro Ser Arg Arg Val Gly Gly Lys Arg Val Val Cys
            100                 105                 110


Tyr Asp Asp Arg Phe Ile Val Lys Leu Ala Tyr Glu Ser Asp Gly Ile
        115                 120                 125


Val Val Ser Asn Asp Thr Tyr Arg Asp Leu Gln Gly Glu Arg Gln Glu
    130                 135                 140


Trp Lys Arg Phe Ile Glu Glu Arg Leu Leu Met Tyr Ser Phe Val Asn
145                 150                 155                 160


Asp Lys Phe Met Pro Pro Asp Asp Pro Leu Gly Arg His Gly Pro Ser
                165                 170                 175


Leu Asp Asn Phe Leu Arg Lys Lys Pro Leu Thr Leu Glu
            180                 185


<210>  43
<211>  598
<212>  PRT
<213>  Homo Sapiens

<400>  43

Ser Gly Pro Cys Gly Glu Lys Pro Val Leu Glu Ala Ser Pro Thr Met
1               5                   10                  15


Ser Leu Trp Glu Phe Glu Asp Ser His Ser Arg Gln Gly Thr Pro Arg
            20                  25                  30


Pro Gly Gln Glu Leu Ala Ala Glu Glu Ala Ser Ala Leu Glu Leu Gln
        35                  40                  45


Met Lys Val Asp Phe Phe Arg Lys Leu Gly Tyr Ser Ser Thr Glu Ile
    50                  55                  60
```

```
His Ser Val Leu Gln Lys Leu Gly Val Gln Ala Asp Thr Asn Thr Val
65                  70                  75                  80

Leu Gly Glu Leu Val Lys His Gly Thr Ala Thr Glu Arg Glu Arg Gln
                85                  90                  95

Thr Ser Pro Asp Pro Cys Pro Gln Leu Pro Leu Val Pro Arg Gly Gly
            100                 105                 110

Gly Thr Pro Lys Ala Pro Asn Leu Glu Pro Pro Leu Pro Glu Glu Glu
        115                 120                 125

Lys Glu Gly Ser Asp Leu Arg Pro Val Val Ile Asp Gly Ser Asn Val
    130                 135                 140

Ala Met Ser His Gly Asn Lys Glu Val Phe Ser Cys Arg Gly Ile Leu
145                 150                 155                 160

Leu Ala Val Asn Trp Phe Leu Glu Arg Gly His Thr Asp Ile Thr Val
                165                 170                 175

Phe Val Pro Ser Trp Arg Lys Glu Gln Pro Arg Pro Asp Val Pro Ile
            180                 185                 190

Thr Asp Gln His Ile Leu Arg Glu Leu Glu Lys Lys Lys Ile Leu Val
        195                 200                 205

Phe Thr Pro Ser Arg Arg Val Gly Gly Lys Arg Val Val Cys Tyr Asp
    210                 215                 220

Asp Arg Phe Ile Val Lys Leu Ala Tyr Glu Ser Asp Gly Ile Val Val
225                 230                 235                 240

Ser Asn Asp Thr Tyr Arg Asp Leu Gln Gly Glu Arg Gln Glu Trp Lys
                245                 250                 255

Arg Phe Ile Glu Glu Arg Leu Leu Met Tyr Ser Phe Val Asn Asp Lys
            260                 265                 270

Phe Met Pro Pro Asp Asp Pro Leu Gly Arg His Gly Pro Ser Leu Asp
```

```
        275                 280                 285

Asn Phe Leu Arg Lys Lys Pro Leu Thr Leu Glu His Arg Lys Gln Pro
    290                 295                 300

Cys Pro Tyr Gly Arg Lys Cys Thr Tyr Gly Ile Lys Cys Arg Phe Phe
305                 310                 315                 320

His Pro Glu Arg Pro Ser Cys Pro Gln Arg Ser Val Ala Asp Glu Leu
                325                 330                 335

Arg Ala Asn Ala Leu Leu Ser Pro Pro Arg Ala Pro Ser Lys Asp Lys
            340                 345                 350

Asn Gly Arg Arg Pro Ser Pro Ser Ser Gln Ser Ser Ser Leu Leu Thr
        355                 360                 365

Glu Ser Glu Gln Cys Ser Leu Asp Gly Lys Lys Leu Gly Ala Gln Ala
    370                 375                 380

Ser Pro Gly Ser Arg Gln Glu Gly Leu Thr Gln Thr Tyr Ala Pro Ser
385                 390                 395                 400

Gly Arg Ser Leu Ala Pro Ser Gly Gly Ser Gly Ser Ser Phe Gly Pro
                405                 410                 415

Thr Asp Trp Leu Pro Gln Thr Leu Asp Ser Leu Pro Tyr Val Ser Gln
            420                 425                 430

Asp Cys Leu Asp Ser Gly Ile Gly Ser Leu Glu Ser Gln Met Ser Glu
        435                 440                 445

Leu Trp Gly Val Arg Gly Gly Gly Pro Gly Glu Pro Gly Pro Pro Arg
    450                 455                 460

Ala Pro Tyr Thr Gly Tyr Ser Pro Tyr Gly Ser Glu Leu Pro Ala Thr
465                 470                 475                 480

Ala Ala Phe Ser Ala Phe Gly Arg Ala Met Gly Ala Gly His Phe Ser
                485                 490                 495
```

Val Pro Ala Asp Tyr Pro Pro Ala Pro Pro Ala Phe Pro Pro Arg Glu
500 505 510

Tyr Trp Ser Glu Pro Tyr Pro Leu Pro Pro Pro Thr Ser Val Leu Gln
515 520 525

Glu Pro Pro Val Gln Ser Pro Gly Ala Gly Arg Ser Pro Trp Gly Arg
530 535 540

Ala Gly Ser Leu Ala Lys Glu Gln Ala Ser Val Tyr Thr Lys Leu Cys
545 550 555 560

Gly Val Phe Pro Pro His Leu Val Glu Ala Val Met Gly Arg Phe Pro
565 570 575

Gln Leu Leu Asp Pro Gln Gln Leu Ala Ala Glu Ile Leu Ser Tyr Lys
580 585 590

Ser Gln His Pro Ser Glu
595

<210> 44
<211> 136
<212> PRT
<213> Homo Sapiens

<400> 44

Ser Ser Leu Ile Arg Arg Val Ile Ser Thr Ala Lys Ala Pro Gly Ala
1 5 10 15

Ile Gly Pro Tyr Ser Gln Ala Val Leu Val Asp Arg Thr Ile Tyr Ile
20 25 30

Ser Gly Gln Ile Gly Met Asp Pro Ser Ser Gly Gln Leu Val Ser Gly
35 40 45

Gly Val Ala Glu Glu Ala Lys Gln Ala Leu Lys Asn Met Gly Glu Ile
50 55 60

Leu Lys Ala Ala Gly Cys Asp Phe Thr Asn Val Val Lys Thr Thr Val
65 70 75 80

Leu Leu Ala Asp Ile Asn Asp Phe Asn Thr Val Asn Glu Ile Tyr Lys
85 90 95

Gln Tyr Phe Lys Ser Asn Phe Pro Ala Arg Ala Ala Tyr Gln Val Ala
100 105 110

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

Gly Pro Leu Thr Thr Ala Ser Leu
130 135

<210> 45
<211> 966
<212> PRT
<213> Ruminococcus flavefaciens

<400> 45

Ile Glu Lys Lys Lys Ser Phe Ala Lys Gly Met Gly Val Lys Ser Thr
1 5 10 15

Leu Val Ser Gly Ser Lys Val Tyr Met Thr Thr Phe Ala Glu Gly Ser
20 25 30

Asp Ala Arg Leu Glu Lys Ile Val Glu Gly Asp Ser Ile Arg Ser Val
35 40 45

Asn Glu Gly Glu Ala Phe Ser Ala Glu Met Ala Asp Lys Asn Ala Gly
50 55 60

Tyr Lys Ile Gly Asn Ala Lys Phe Ser His Pro Lys Gly Tyr Ala Val
65 70 75 80

Val Ala Asn Asn Pro Leu Tyr Thr Gly Pro Val Gln Gln Asp Met Leu
85 90 95

Gly Leu Lys Glu Thr Leu Glu Lys Arg Tyr Phe Gly Glu Ser Ala Asp
100 105 110

Gly Asn Asp Asn Ile Cys Ile Gln Val Ile His Asn Ile Leu Asp Ile

```
        115                 120                 125

Glu Lys Ile Leu Ala Glu Tyr Ile Thr Asn Ala Ala Tyr Ala Val Asn
    130                 135                 140

Asn Ile Ser Gly Leu Asp Lys Asp Ile Ile Gly Phe Gly Lys Phe Ser
145                 150                 155                 160

Thr Val Tyr Thr Tyr Asp Glu Phe Lys Asp Pro Glu His His Arg Ala
                165                 170                 175

Ala Phe Asn Asn Asn Asp Lys Leu Ile Asn Ala Ile Lys Ala Gln Tyr
            180                 185                 190

Asp Glu Phe Asp Asn Phe Leu Asp Asn Pro Arg Leu Gly Tyr Phe Gly
        195                 200                 205

Gln Ala Phe Phe Ser Lys Glu Gly Arg Asn Tyr Ile Ile Asn Tyr Gly
    210                 215                 220

Asn Glu Cys Tyr Asp Ile Leu Ala Leu Leu Ser Gly Leu Ala His Trp
225                 230                 235                 240

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

Tyr Asn Leu Asp Lys Asn Leu Asp Asn Glu Tyr Ile Ser Thr Leu Asn
            260                 265                 270

Tyr Leu Tyr Asp Arg Ile Thr Asn Glu Leu Thr Asn Ser Phe Ser Lys
        275                 280                 285

Asn Ser Ala Ala Asn Val Asn Tyr Ile Ala Glu Thr Leu Gly Ile Asn
    290                 295                 300

Pro Ala Glu Phe Ala Glu Gln Tyr Phe Arg Phe Ser Ile Met Lys Glu
305                 310                 315                 320

Gln Lys Asn Leu Gly Phe Asn Ile Thr Lys Leu Arg Glu Val Met Leu
                325                 330                 335
```

```
Asp Arg Lys Asp Met Ser Glu Ile Arg Lys Asn His Lys Val Phe Asp
            340                 345                 350

Ser Ile Arg Thr Lys Val Tyr Thr Met Met Asp Phe Val Ile Tyr Arg
        355                 360                 365

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

Pro Asp Asn Glu Lys Ser Leu Ser Glu Lys Asp Ile Phe Val Ile Asn
385                 390                 395                 400

Leu Arg Gly Ser Phe Asn Asp Asp Gln Lys Asp Ala Leu Tyr Tyr Asp
                405                 410                 415

Glu Ala Asn Arg Ile Trp Arg Lys Leu Glu Asn Ile Met His Asn Ile
            420                 425                 430

Lys Glu Phe Arg Gly Asn Lys Thr Arg Glu Tyr Lys Lys Lys Asp Ala
        435                 440                 445

Pro Arg Leu Pro Arg Ile Leu Pro Ala Gly Arg Asp Val Ser Ala Phe
    450                 455                 460

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

Asn Asp Leu Leu Thr Thr Leu Ile Asn Lys Phe Asp Asn Ile Gln Ser
                485                 490                 495

Phe Leu Lys Val Met Pro Leu Ile Gly Val Asn Ala Lys Phe Val Glu
            500                 505                 510

Glu Tyr Ala Phe Phe Lys Asp Ser Ala Lys Ile Ala Asp Glu Leu Arg
        515                 520                 525

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

Arg Ala Met Tyr Ile Asp Ala Ile Arg Ile Leu Gly Thr Asn Leu Ser
```

```
545                 550                 555                 560

Tyr Asp Glu Leu Lys Ala Leu Ala Asp Thr Phe Ser Leu Asp Glu Asn
                565                 570                 575

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

Asn Asn Val Ile Ser Asn Lys Arg Phe His Tyr Leu Ile Arg Tyr Gly
        595                 600                 605

Asp Pro Ala His Leu His Glu Ile Ala Lys Asn Glu Ala Val Val Lys
    610                 615                 620

Phe Val Leu Gly Arg Ile Ala Asp Ile Gln Lys Lys Gln Gly Gln Asn
625                 630                 635                 640

Gly Lys Asn Gln Ile Asp Arg Tyr Tyr Glu Thr Cys Ile Gly Lys Asp
                645                 650                 655

Lys Gly Lys Ser Val Ser Glu Lys Val Asp Ala Leu Thr Lys Ile Ile
            660                 665                 670

Thr Gly Met Asn Tyr Asp Gln Phe Asp Lys Lys Arg Ser Val Ile Glu
        675                 680                 685

Asp Thr Gly Arg Glu Asn Ala Glu Arg Glu Lys Phe Lys Lys Ile Ile
    690                 695                 700

Ser Leu Tyr Leu Thr Val Ile Tyr His Ile Leu Lys Asn Ile Val Asn
705                 710                 715                 720

Ile Asn Ala Arg Tyr Val Ile Gly Phe His Cys Val Glu Arg Asp Ala
                725                 730                 735

Gln Leu Tyr Lys Glu Lys Gly Tyr Asp Ile Asn Leu Lys Lys Leu Glu
            740                 745                 750

Glu Lys Gly Phe Ser Ser Val Thr Lys Leu Cys Ala Gly Ile Asp Glu
        755                 760                 765
```

```
Thr Ala Pro Asp Lys Arg Lys Asp Val Glu Lys Glu Met Ala Glu Arg
    770                 775                 780

Ala Lys Glu Ser Ile Asp Ser Leu Glu Ser Ala Asn Pro Lys Leu Tyr
785                 790                 795                 800

Ala Asn Tyr Ile Lys Tyr Ser Asp Glu Lys Lys Ala Glu Glu Phe Thr
                805                 810                 815

Arg Gln Ile Asn Arg Glu Lys Ala Lys Thr Ala Leu Asn Ala Tyr Leu
            820                 825                 830

Arg Asn Thr Lys Trp Asn Val Ile Ile Arg Glu Asp Leu Leu Arg Ile
        835                 840                 845

Asp Asn Lys Thr Cys Thr Leu Phe Ala Asn Lys Ala Val Ala Leu Glu
    850                 855                 860

Val Ala Arg Tyr Val His Ala Tyr Ile Asn Asp Ile Ala Glu Val Asn
865                 870                 875                 880

Ser Tyr Phe Gln Leu Tyr His Tyr Ile Met Gln Arg Ile Ile Met Asn
                885                 890                 895

Glu Arg Tyr Glu Lys Ser Ser Gly Lys Val Ser Glu Tyr Phe Asp Ala
            900                 905                 910

Val Asn Asp Glu Lys Lys Tyr Asn Asp Arg Leu Leu Lys Leu Leu Cys
        915                 920                 925

Val Pro Phe Gly Tyr Cys Ile Pro Arg Phe Lys Asn Leu Ser Ile Glu
    930                 935                 940

Ala Leu Phe Asp Arg Asn Glu Ala Ala Lys Phe Asp Lys Glu Lys Lys
945                 950                 955                 960

Lys Val Ser Gly Asn Ser
                965
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<210> 46

<211> 1034
<212> PRT
<213> Unknown

<220>
<223> Cas13d (contig e-k87 11092736)

<400> 46

Met Lys Arg Gln Lys Thr Phe Ala Lys Arg Ile Gly Ile Lys Ser Thr
1 5 10 15

Val Ala Tyr Gly Gln Gly Lys Tyr Ala Ile Thr Thr Phe Gly Lys Gly
20 25 30

Ser Lys Ala Glu Ile Ala Val Arg Ser Ala Asp Pro Pro Glu Glu Thr
35 40 45

Leu Pro Thr Glu Ser Asp Ala Thr Leu Ser Ile His Ala Lys Phe Ala
50 55 60

Lys Ala Gly Arg Asp Gly Arg Glu Phe Lys Cys Gly Asp Val Asp Glu
65 70 75 80

Thr Arg Ile His Thr Ser Arg Ser Glu Tyr Glu Ser Leu Ile Ser Asn
85 90 95

Pro Ala Glu Ser Pro Arg Glu Asp Tyr Leu Gly Leu Lys Gly Thr Leu
100 105 110

Glu Arg Lys Phe Phe Gly Asp Glu Tyr Pro Lys Asp Asn Leu Arg Ile
115 120 125

Gln Ile Ile Tyr Ser Ile Leu Asp Ile Gln Lys Ile Leu Gly Leu Tyr
130 135 140

Val Glu Asp Ile Leu His Phe Val Asp Gly Leu Gln Asp Glu Pro Glu
145 150 155 160

Asp Leu Val Gly Leu Gly Leu Gly Asp Glu Lys Met Gln Lys Leu Leu
165 170 175

Ser Lys Ala Leu Pro Tyr Met Gly Phe Phe Gly Ser Thr Asp Val Phe

```
            180                 185                 190

Lys Val Thr Lys Lys Arg Glu Glu Arg Ala Ala Ala Asp Glu His Asn
        195                 200                 205

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

Phe Lys Trp Lys Glu Ser Leu Ala Ile Phe Gly Ala Asn Ala Asn Met
225                 230                 235                 240

Pro Ile Arg Phe Phe Gln Gly Ala Thr Gly Gly Arg Gln Leu Trp Asn
                245                 250                 255

Asp Val Ile Ala Pro Leu Trp Lys Lys Arg Ile Glu Arg Val Arg Lys
            260                 265                 270

Ser Phe Leu Ser Asn Ser Ala Lys Asn Leu Trp Val Leu Tyr Gln Val
        275                 280                 285

Phe Lys Asp Asp Thr Asp Glu Lys Lys Lys Ala Arg Ala Arg Gln Tyr
    290                 295                 300

Tyr His Phe Ser Val Leu Lys Glu Gly Lys Asn Leu Gly Phe Asn Leu
305                 310                 315                 320

Thr Lys Thr Arg Glu Tyr Phe Leu Asp Lys Phe Phe Pro Ile Phe His
                325                 330                 335

Ser Ser Ala Pro Asp Val Lys Arg Lys Val Asp Thr Phe Arg Ser Lys
            340                 345                 350

Phe Tyr Ala Ile Leu Asp Phe Ile Ile Tyr Glu Ala Ser Val Ser Val
        355                 360                 365

Ala Asn Ser Gly Gln Met Gly Lys Val Ala Pro Trp Lys Gly Ala Ile
    370                 375                 380

Asp Asn Ala Leu Val Lys Leu Arg Glu Ala Pro Asp Glu Glu Ala Lys
385                 390                 395                 400
```

```
Glu Lys Ile Tyr Asn Val Leu Ala Ala Ser Ile Arg Asn Asp Ser Leu
                405                 410                 415

Phe Leu Arg Leu Lys Ser Ala Cys Asp Lys Phe Gly Ala Glu Gln Asn
            420                 425                 430

Arg Pro Val Phe Pro Asn Glu Leu Arg Asn Asn Arg Asp Ile Arg Asn
        435                 440                 445

Val Arg Ser Glu Trp Leu Glu Ala Thr Gln Asp Val Asp Ala Ala Ala
    450                 455                 460

Phe Val Gln Leu Ile Ala Phe Leu Cys Asn Phe Leu Glu Gly Lys Glu
465                 470                 475                 480

Ile Asn Glu Leu Val Thr Ala Leu Ile Lys Lys Phe Glu Gly Ile Gln
                485                 490                 495

Ala Leu Ile Asp Leu Leu Arg Asn Leu Glu Gly Val Asp Ser Ile Arg
            500                 505                 510

Phe Glu Asn Glu Phe Ala Leu Phe Asn Asp Asp Lys Gly Asn Met Ala
        515                 520                 525

Gly Arg Ile Ala Arg Gln Leu Arg Leu Leu Ala Ser Val Gly Lys Met
    530                 535                 540

Lys Pro Asp Met Thr Asp Ala Lys Arg Val Leu Tyr Lys Ser Ala Leu
545                 550                 555                 560

Glu Ile Leu Gly Ala Pro Pro Asp Glu Val Ser Asp Glu Trp Leu Ala
                565                 570                 575

Glu Asn Ile Leu Leu Asp Lys Ser Asn Asn Asp Tyr Gln Lys Ala Lys
            580                 585                 590

Lys Thr Val Asn Pro Phe Arg Asn Tyr Ile Ala Lys Asn Val Ile Thr
        595                 600                 605

Ser Arg Ser Phe Tyr Tyr Leu Val Arg Tyr Ala Lys Pro Thr Ala Val
```

```
    610                 615                 620

Arg Lys Leu Met Ser Asn Pro Lys Ile Val Arg Tyr Val Leu Lys Arg
625                 630                 635                 640

Leu Pro Glu Lys Gln Val Ala Ser Tyr Tyr Ser Ala Ile Trp Thr Gln
                645                 650                 655

Ser Glu Ser Asn Ser Asn Glu Met Val Lys Leu Ile Glu Met Ile Asp
            660                 665                 670

Arg Leu Thr Thr Glu Ile Ala Gly Phe Ser Phe Ala Val Leu Lys Asp
        675                 680                 685

Lys Lys Asp Ser Ile Val Ser Ala Ser Arg Glu Ser Arg Ala Val Asn
    690                 695                 700

Leu Glu Val Glu Arg Leu Lys Lys Leu Thr Thr Leu Tyr Met Ser Ile
705                 710                 715                 720

Ala Tyr Ile Ala Val Lys Ser Leu Val Lys Val Asn Ala Arg Tyr Phe
                725                 730                 735

Ile Ala Tyr Ser Ala Leu Glu Arg Asp Leu Tyr Phe Phe Asn Glu Lys
            740                 745                 750

Tyr Gly Glu Glu Phe Arg Leu His Phe Ile Pro Tyr Glu Leu Asn Gly
        755                 760                 765

Lys Thr Cys Gln Phe Glu Tyr Leu Ala Ile Leu Lys Tyr Tyr Leu Ala
    770                 775                 780

Arg Asp Glu Glu Thr Leu Lys Arg Lys Cys Glu Ile Cys Glu Glu Ile
785                 790                 795                 800

Lys Val Gly Cys Glu Lys His Lys Lys Asn Ala Asn Pro Pro Tyr Glu
                805                 810                 815

Tyr Asp Gln Glu Trp Ile Asp Lys Lys Lys Ala Leu Asn Ser Glu Arg
            820                 825                 830
```

```
Lys Ala Cys Glu Arg Arg Leu His Phe Ser Thr His Trp Ala Gln Tyr
        835                 840                 845

Ala Thr Lys Arg Asp Glu Asn Met Ala Lys His Pro Gln Lys Trp Tyr
    850                 855                 860

Asp Ile Leu Ala Ser His Tyr Asp Glu Leu Leu Ala Leu Gln Ala Thr
865                 870                 875                 880

Gly Trp Leu Ala Thr Gln Ala Arg Asn Asp Ala Glu His Leu Asn Pro
                885                 890                 895

Val Asn Glu Phe Asp Val Tyr Ile Glu Asp Leu Arg Arg Tyr Pro Glu
            900                 905                 910

Gly Thr Pro Lys Asn Lys Asp Tyr His Ile Gly Ser Tyr Phe Glu Ile
        915                 920                 925

Tyr His Tyr Ile Arg Gln Arg Ala Tyr Leu Glu Glu Val Leu Ala Lys
    930                 935                 940

Arg Lys Glu Tyr Arg Asp Ser Gly Ser Phe Thr Asp Glu Gln Leu Asp
945                 950                 955                 960

Lys Leu Gln Lys Ile Leu Asp Asp Ile Arg Ala Arg Gly Ser Tyr Asp
                965                 970                 975

Lys Asn Leu Leu Lys Leu Glu Tyr Leu Pro Phe Ala Tyr Asn Leu Pro
            980                 985                 990

Arg Tyr Lys Asn Leu Thr Thr Glu  Ala Leu Phe Asp Asp  Asp Ser Val
        995                 1000                1005

Ser Gly  Lys Lys Arg Val Ala  Glu Trp Arg Glu Arg  Glu Lys Thr
    1010                1015                1020

Arg Glu  Ala Glu Arg Glu Gln  Arg Arg Gln Arg
    1025                1030
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<210> 47

<211> 30
<212> DNA
<213> Unknown

<220>
<223> contig e-k87 11092736

<400> 47
gtgagaagtc tccttatggg gagatgctac 30

<210> 48
<211> 1022
<212> PRT
<213> Unknown

<220>
<223> Cas13d (160582958 gene49834)

<400> 48

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

Glu Ala Ala Arg Lys Lys Ala Lys Asp Ile Ala Glu Gln Ala Arg Ile
20 25 30

Ala Lys Arg Asn Gly Val Val Lys Lys Glu Glu Asn Arg Ile Asn Arg
35 40 45

Ile Gln Ile Glu Ile Gln Thr Gln Lys Lys Ser Asn Thr Gln Asn Ala
50 55 60

Tyr His Leu Lys Ser Leu Ala Lys Ala Ala Gly Val Lys Ser Val Phe
65 70 75 80

Ala Ile Gly Asn Asp Leu Leu Met Thr Gly Phe Gly Pro Gly Asn Asp
85 90 95

Ala Thr Ile Glu Lys Arg Val Phe Gln Asn Arg Ala Ile Glu Thr Leu
100 105 110

Ser Ser Pro Glu Gln Tyr Ser Ala Glu Phe Gln Asn Lys Gln Phe Lys
115 120 125

Ile Lys Gly Asn Ile Lys Val Leu Asn His Ser Thr Gln Lys Met Glu

```
    130                 135                 140

Glu Ile Gln Thr Glu Leu Gln Asp Asn Tyr Asn Arg Pro His Phe Asp
145                 150                 155                 160

Leu Leu Gly Cys Lys Asn Val Leu Glu Gln Lys Tyr Phe Gly Arg Thr
                165                 170                 175

Phe Ser Asp Asn Ile His Val Gln Ile Ala Tyr Asn Ile Met Asp Ile
            180                 185                 190

Glu Lys Leu Leu Thr Pro Tyr Ile Asn Asn Ile Ile Tyr Thr Leu Asn
        195                 200                 205

Glu Leu Met Arg Asp Asn Ser Lys Asp Asp Phe Phe Gly Cys Asp Ser
    210                 215                 220

His Phe Ser Val Ala Tyr Leu Tyr Asp Glu Leu Lys Ala Gly Tyr Ser
225                 230                 235                 240

Asp Arg Leu Lys Thr Lys Pro Asn Leu Ser Lys Asn Ile Asp Arg Ile
                245                 250                 255

Trp Asn Asn Phe Cys Asn Tyr Met Asn Ser Asp Ser Gly Asn Thr Glu
            260                 265                 270

Ala Arg Leu Ala Tyr Phe Gly Glu Leu Phe Tyr Lys Pro Lys Glu Thr
        275                 280                 285

Gly Asp Ala Lys Ser Asp Tyr Lys Thr His Leu Ser Asn Asn Gln Lys
    290                 295                 300

Glu Glu Trp Glu Leu Lys Ser Asp Lys Glu Val Tyr Asn Ile Phe Ala
305                 310                 315                 320

Ile Leu Cys Asp Leu Arg His Phe Cys Thr His Gly Glu Ser Ile Thr
                325                 330                 335

Pro Ser Gly Lys Pro Phe Pro Tyr Asn Leu Glu Lys Asn Leu Phe Pro
            340                 345                 350
```

```
Glu Ala Lys Gln Val Leu Asn Ser Leu Phe Glu Glu Lys Ala Glu Ser
        355                 360                 365

Leu Gly Ala Glu Ala Phe Gly Lys Thr Ala Gly Lys Thr Asp Val Ser
    370                 375                 380

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

Gln Ala Leu Leu Lys Glu Tyr Tyr Asp Phe Lys Val Gln Lys Thr Tyr
                405                 410                 415

Lys Asn Met Gly Phe Ser Ile Lys Lys Leu Arg Glu Ala Ile Met Glu
            420                 425                 430

Ile Pro Asp Ala Ala Lys Phe Lys Asp Asp Leu Tyr Ser Ser Leu Arg
        435                 440                 445

His Lys Leu Tyr Gly Leu Phe Asp Phe Ile Leu Val Lys His Phe Leu
    450                 455                 460

Asp Thr Ser Asp Ser Glu Asn Leu Gln Asn Asn Asp Ile Phe Arg Gln
465                 470                 475                 480

Leu Arg Ala Cys Arg Cys Glu Glu Glu Lys Asp Gln Val Tyr Arg Ser
                485                 490                 495

Ile Ala Val Lys Val Trp Glu Lys Val Lys Lys Lys Glu Leu Asn Met
            500                 505                 510

Phe Lys Gln Val Val Val Ile Pro Ser Leu Ser Lys Asp Glu Leu Lys
        515                 520                 525

Gln Met Glu Met Thr Lys Asn Thr Glu Leu Leu Ser Ser Ile Glu Thr
    530                 535                 540

Ile Ser Thr Gln Ala Ser Leu Phe Ser Glu Met Ile Phe Met Met Thr
545                 550                 555                 560

Tyr Leu Leu Asp Gly Lys Glu Ile Asn Leu Leu Cys Thr Ser Leu Ile
```

```
                565                 570                 575

Glu Lys Phe Glu Asn Ile Ala Ser Phe Asn Glu Val Leu Lys Ser Pro
            580                 585                 590

Gln Ile Gly Tyr Glu Thr Lys Tyr Thr Glu Gly Tyr Ala Phe Phe Lys
        595                 600                 605

Asn Ala Asp Lys Thr Ala Lys Glu Leu Arg Gln Val Asn Asn Met Ala
    610                 615                 620

Arg Met Thr Lys Pro Leu Gly Gly Val Asn Thr Lys Cys Val Met Tyr
625                 630                 635                 640

Asn Glu Ala Ala Lys Ile Leu Gly Ala Lys Pro Met Ser Lys Ala Glu
                645                 650                 655

Leu Glu Ser Val Phe Asn Leu Asp Asn His Asp Tyr Thr Tyr Ser Pro
            660                 665                 670

Ser Gly Lys Lys Ile Pro Asn Lys Asn Phe Arg Asn Phe Ile Ile Asn
        675                 680                 685

Asn Val Ile Thr Ser Arg Arg Phe Leu Tyr Leu Ile Arg Tyr Gly Asn
    690                 695                 700

Pro Glu Lys Ile Arg Lys Ile Ala Ile Asn Pro Ser Ile Ile Ser Phe
705                 710                 715                 720

Val Leu Lys Gln Ile Pro Asp Glu Gln Ile Lys Arg Tyr Tyr Pro Pro
                725                 730                 735

Cys Ile Gly Lys Arg Thr Asp Asp Val Thr Leu Met Arg Asp Glu Leu
            740                 745                 750

Gly Lys Met Leu Gln Ser Val Asn Phe Glu Gln Phe Ser Arg Val Asn
        755                 760                 765

Asn Lys Gln Asn Ala Lys Gln Asn Pro Asn Gly Glu Lys Ala Arg Leu
    770                 775                 780
```

```
Gln Ala Cys Val Arg Leu Tyr Leu Thr Val Pro Tyr Leu Phe Ile Lys
785                 790                 795                 800


Asn Met Val Asn Ile Asn Ala Arg Tyr Val Leu Ala Phe His Cys Leu
                805                 810                 815


Glu Arg Asp His Ala Leu Cys Phe Asn Ser Arg Lys Leu Asn Asp Asp
            820                 825                 830


Ser Tyr Asn Glu Met Ala Asn Lys Phe Gln Met Val Arg Lys Ala Lys
        835                 840                 845


Lys Glu Gln Tyr Glu Lys Glu Tyr Lys Cys Lys Lys Gln Glu Thr Gly
    850                 855                 860


Thr Ala His Thr Lys Lys Ile Glu Lys Leu Asn Gln Gln Ile Ala Tyr
865                 870                 875                 880


Ile Asp Lys Asp Ile Lys Asn Met His Ser Tyr Thr Cys Arg Asn Tyr
                885                 890                 895


Arg Asn Leu Val Ala His Leu Asn Val Val Ser Lys Leu Gln Asn Tyr
            900                 905                 910


Val Ser Glu Leu Pro Asn Asp Tyr Gln Ile Thr Ser Tyr Phe Ser Phe
        915                 920                 925


Tyr His Tyr Cys Met Gln Leu Gly Leu Met Glu Lys Val Ser Ser Lys
    930                 935                 940


Asn Ile Pro Leu Val Glu Ser Leu Lys Asn Glu Ala Asn Asp Ala Gln
945                 950                 955                 960


Ser Tyr Ser Ala Lys Lys Thr Leu Glu Tyr Phe Asp Leu Ile Glu Lys
                965                 970                 975


Asn Arg Thr Tyr Cys Lys Asp Phe Leu Lys Ala Leu Asn Ala Pro Phe
            980                 985                 990


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

Asp Lys Asn Ile Val Tyr Glu Gln Ala Asp Leu Lys Lys Glu
1010 1015 1020

<210> 49
<211> 36
<212> DNA
<213> Unknown

<220>
<223> Cas13d (160582958 gene49834)

<400> 49
gaactacacc cctctgttct tgtaggggtc taacac 36

<210> 50
<211> 877
<212> PRT
<213> Unknown

<220>
<223> Cas13d (contig tpg DJXD01000002.1)

<400> 50

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

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

Lys Gly Asn Met Ala Asn Leu Ser Tyr Lys Ile Pro Ser Ser Gln Lys
35 40 45

Pro Gln Asn Leu Asn Ser Ser Ala Gly Leu Lys Asn Val Glu Val Ser
50 55 60

Gly Lys Lys Ile Lys Phe Gln Gly Arg His Pro Lys Ile Ala Thr Thr
65 70 75 80

Asp Asn Pro Leu Phe Lys Pro Gln Pro Gly Met Asp Leu Leu Cys Leu
85 90 95

Lys Asp Lys Leu Glu Met His Tyr Phe Gly Lys Thr Phe Asp Asp Asn

```
            100                 105                 110

Ile His Ile Gln Leu Ile Tyr Gln Ile Leu Asp Ile Glu Lys Ile Leu
        115                 120                 125

Ala Val His Val Asn Asn Ile Val Phe Thr Leu Asp Asn Val Leu His
    130                 135                 140

Pro Gln Lys Glu Glu Leu Thr Glu Asp Phe Ile Gly Ala Gly Gly Trp
145                 150                 155                 160

Arg Ile Asn Leu Asp Tyr Gln Thr Leu Arg Gly Gln Thr Asn Lys Tyr
                165                 170                 175

Asp Arg Phe Lys Asn Tyr Ile Lys Arg Lys Glu Leu Leu Tyr Phe Gly
            180                 185                 190

Glu Ala Phe Tyr His Glu Asn Glu Arg Arg Tyr Glu Glu Asp Ile Phe
        195                 200                 205

Ala Ile Leu Thr Leu Leu Ser Ala Leu Arg Gln Phe Cys Phe His Ser
    210                 215                 220

Asp Leu Ser Ser Asp Glu Ser Asp His Val Asn Ser Phe Trp Leu Tyr
225                 230                 235                 240

Gln Leu Glu Asp Gln Leu Ser Asp Glu Phe Lys Glu Thr Leu Ser Ile
                245                 250                 255

Leu Trp Glu Glu Val Thr Glu Arg Ile Asp Ser Glu Phe Leu Lys Thr
            260                 265                 270

Asn Thr Val Asn Leu His Ile Leu Cys His Val Phe Pro Lys Glu Ser
        275                 280                 285

Lys Glu Thr Ile Val Arg Ala Tyr Tyr Glu Phe Leu Ile Lys Lys Ser
    290                 295                 300

Phe Lys Asn Met Gly Phe Ser Ile Lys Lys Leu Arg Glu Ile Met Leu
305                 310                 315                 320
```

```
Glu Gln Ser Asp Leu Lys Ser Phe Lys Glu Asp Lys Tyr Asn Ser Val
                325                 330                 335

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

Asp His His Ala Phe Glu Lys Glu Ala Leu Val Ser Ser Leu Arg Ser
        355                 360                 365

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

Thr Leu Ala Ser Ala Leu Gly Ala Asp Phe Lys Lys Ala Ala Ala Asp
385                 390                 395                 400

Val Asn Ala Lys Asn Ile Arg Asp Tyr Gln Lys Lys Ala Asn Asp Tyr
                405                 410                 415

Arg Ile Ser Phe Glu Asp Ile Lys Ile Gly Asn Thr Gly Ile Gly Tyr
            420                 425                 430

Phe Ser Glu Leu Ile Tyr Met Leu Thr Leu Leu Leu Asp Gly Lys Glu
        435                 440                 445

Ile Asn Asp Leu Leu Thr Thr Leu Ile Asn Lys Phe Asp Asn Ile Ile
    450                 455                 460

Ser Phe Ile Asp Ile Leu Lys Lys Leu Asn Leu Glu Phe Lys Phe Lys
465                 470                 475                 480

Pro Glu Tyr Ala Asp Phe Phe Asn Met Thr Asn Cys Arg Tyr Thr Leu
                485                 490                 495

Glu Glu Leu Arg Val Ile Asn Ser Ile Ala Arg Met Gln Lys Pro Ser
            500                 505                 510

Ala Asp Ala Arg Lys Ile Met Tyr Arg Asp Ala Leu Arg Ile Leu Gly
        515                 520                 525

Met Asp Asn Arg Pro Asp Glu Glu Ile Asp Arg Glu Leu Glu Arg Thr
```

```
    530                 535                 540

Met Pro Val Gly Ala Asp Gly Lys Phe Ile Lys Gly Lys Gln Gly Phe
545                 550                 555                 560

Arg Asn Phe Ile Ala Ser Asn Val Ile Glu Ser Ser Arg Phe His Tyr
                565                 570                 575

Leu Val Arg Tyr Asn Asn Pro His Lys Thr Arg Thr Leu Val Lys Asn
            580                 585                 590

Pro Asn Val Val Lys Phe Val Leu Glu Gly Ile Pro Glu Thr Gln Ile
        595                 600                 605

Lys Arg Tyr Phe Asp Val Cys Lys Gly Gln Glu Ile Pro Pro Thr Ser
    610                 615                 620

Asp Lys Ser Ala Gln Ile Asp Val Leu Ala Arg Ile Ile Ser Ser Val
625                 630                 635                 640

Asp Tyr Lys Ile Phe Glu Asp Val Pro Gln Ser Ala Lys Ile Asn Lys
                645                 650                 655

Asp Asp Pro Ser Arg Asn Phe Ser Asp Ala Leu Lys Lys Gln Arg Tyr
            660                 665                 670

Gln Ala Ile Val Ser Leu Tyr Leu Thr Val Met Tyr Leu Ile Thr Lys
        675                 680                 685

Asn Leu Val Tyr Val Asn Ser Arg Tyr Val Ile Ala Phe His Cys Leu
    690                 695                 700

Glu Arg Asp Ala Phe Leu His Gly Val Thr Leu Pro Lys Met Asn Lys
705                 710                 715                 720

Lys Ile Val Tyr Ser Gln Leu Thr Thr His Leu Leu Thr Asp Lys Asn
                725                 730                 735

Tyr Thr Thr Tyr Gly His Leu Lys Asn Gln Lys Gly His Arg Lys Trp
            740                 745                 750
```

```
Tyr Val Leu Val Lys Asn Asn Leu Gln Asn Ser Asp Ile Thr Ala Val
        755                 760                 765

Ser Ser Phe Arg Asn Ile Val Ala His Ile Ser Val Val Arg Asn Ser
    770                 775                 780

Asn Glu Tyr Ile Ser Gly Ile Gly Glu Leu His Ser Tyr Phe Glu Leu
785                 790                 795                 800

Tyr His Tyr Leu Val Gln Ser Met Ile Ala Lys Asn Asn Trp Tyr Asp
                805                 810                 815

Thr Ser His Gln Pro Lys Thr Ala Glu Tyr Leu Asn Asn Leu Lys Lys
            820                 825                 830

His His Thr Tyr Cys Lys Asp Phe Val Lys Ala Tyr Cys Ile Pro Phe
        835                 840                 845

Gly Tyr Val Val Pro Arg Tyr Lys Asn Leu Thr Ile Asn Glu Leu Phe
    850                 855                 860

Asp Arg Asn Asn Pro Asn Pro Glu Pro Lys Glu Glu Val
865                 870                 875
```

<210> 51
<211> 36
<212> PRT
<213> Homo Sapiens

<400> 51

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Cys Ala Ala Cys Thr Ala Cys Ala Ala Cys Cys Cys Cys Gly Thr Ala
1               5                   10                  15

Ala Ala Ala Ala Thr Ala Cys Gly Gly Gly Gly Thr Thr Cys Thr Gly
            20                  25                  30

Ala Ala Ala Cys
        35
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<210> 52

<400> 52
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<210> 53

<400> 53
000

<210> 54
<211> 124
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig6049000251

<400> 54

Leu Tyr Leu Thr Ser Phe Gly Lys Gly Asn Ala Ala Val Ile Glu Gln
1 5 10 15

Lys Ile Glu Pro Glu Asn Gly Tyr Arg Val Thr Gly Met Gln Ile Thr
20 25 30

Pro Ser Ile Thr Val Asn Lys Ala Thr Asp Glu Ser Val Arg Phe Arg
35 40 45

Val Lys Arg Lys Ile Ala Gln Lys Asp Glu Phe Ile Ala Asp Asn Pro
50 55 60

Met His Glu Gly Arg His Arg Ile Glu Pro Ser Ala Gly Ser Asp Met
65 70 75 80

Leu Gly Leu Lys Thr Lys Leu Glu Lys Tyr Tyr Phe Gly Lys Glu Phe
85 90 95

Asp Asp Asn Leu His Ile Gln Ile Ile Tyr Asn Ile Leu Asp Ile Glu
100 105 110

Lys Ile Leu Ala Val Tyr Ser Thr Asn Ile Thr Ala
115 120

<210> 55

<400> 55
000

<210> 56

<400> 56
000

<210> 57
<211> 358
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig546000275

<400> 57

Met Asp Ser Tyr Arg Pro Lys Leu Tyr Lys Leu Ile Asp Phe Cys Ile
1   5   10   15

Phe Lys His Tyr His Glu Tyr Thr Glu Ile Ser Glu Lys Asn Val Asp
            20   25   30

Thr Leu Arg Ala Ala Val Ser Glu Glu Gln Lys Glu Ser Phe Tyr Ala
        35   40   45

Asp Glu Ala Lys Arg Leu Trp Gly Ile Phe Asp Lys Gln Phe Leu Gly
    50   55   60

Phe Cys Lys Lys Ile Asn Val Trp Val Asn Gly Ser His Glu Lys Glu
65   70   75   80

Ile Leu Gly Tyr Ile Asp Lys Asp Ala Tyr Arg Lys Lys Ser Asp Val
                85   90   95

Ser Tyr Phe Ser Lys Phe Leu Tyr Ala Met Ser Phe Phe Leu Asp Gly
            100   105   110

Lys Glu Ile Asn Asp Leu Leu Thr Thr Leu Ile Asn Lys Phe Asp Asn
        115   120   125

Ile Ala Ser Phe Ile Ser Thr Ala Lys Glu Leu Asp Ala Glu Ile Asp
    130   135   140

Arg Ile Leu Glu Lys Lys Leu Asp Pro Val Thr Gly Lys Pro Leu Lys
145   150   155   160

```
Gly Lys Asn Ser Phe Arg Asn Phe Ile Ala Asn Asn Val Ile Glu Asn
                165                 170                 175

Lys Arg Phe Ile Tyr Val Ile Lys Phe Cys Asn Pro Lys Asn Val Leu
            180                 185                 190

Lys Leu Val Lys Asn Thr Lys Val Thr Glu Phe Val Leu Lys Arg Met
        195                 200                 205

Pro Glu Ser Gln Ile Asp Arg Tyr Tyr Ser Ser Cys Ile Asp Thr Glu
    210                 215                 220

Lys Asn Pro Ser Val Asp Lys Lys Ile Ser Asp Leu Ala Glu Met Ile
225                 230                 235                 240

Lys Lys Ile Ala Phe Asp Asp Phe Arg Asn Val Arg Gln Lys Thr Arg
                245                 250                 255

Thr Arg Glu Glu Ser Leu Glu Lys Glu Arg Phe Lys Ala Val Ile Gly
            260                 265                 270

Leu Tyr Leu Thr Val Val Tyr Leu Leu Ile Lys Asn Leu Val Asn Val
        275                 280                 285

Asn Ser Arg Tyr Val Met Ala Phe His Cys Leu Glu Arg Asp Ala Lys
    290                 295                 300

Leu Tyr Gly Ile Asn Ile Gly Lys Asn Tyr Ile Glu Leu Thr Glu Asp
305                 310                 315                 320

Leu Cys Arg Glu Asn Glu Asn Ser Arg Ser Ala Tyr Leu Ala Arg Asn
                325                 330                 335

Lys Arg Leu Arg Asp Cys Val Lys Gln Asn Ile Asp Asn Ala Lys Asn
            340                 345                 350

Met Lys Ser Lys Glu Lys
        355
```

<210> 58

<400> 58
000

<210> 59

<400> 59
000

<210> 60

<400> 60
000

<210> 61
<211> 149
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig4114000374

<400> 61

Asp Thr Lys Ile Asn Pro Gln Thr Trp Leu Tyr Gln Leu Glu Asn Thr
1   5   10   15

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

Glu Arg Phe Asn Glu Ile Asn Glu His Phe Val Thr Gln Asn Ala Thr
        35   40   45

Asn Leu Cys Ile Met Lys Glu Val Phe Pro Asp Glu Asp Phe Lys Ser
    50   55   60

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

Ile Gly Phe Ser Ile Lys Lys Leu Arg Glu Lys Met Leu Glu Leu Pro
                85   90   95

Glu Ala Lys Arg Val Thr Ser Thr Glu Met Asp Ser Val Arg Ser Lys
            100   105   110

Leu Tyr Lys Leu Ile Asp Phe Cys Ile Phe Lys His Tyr His Glu Lys

115 120 125

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

Glu Asp Met Lys Glu
145

<210> 62

<400> 62
000

<210> 63

<400> 63
000

<210> 64
<211> 372
<212> PRT
<213> Homo Sapiens

<400> 64

Met Glu Ser Gly Gln Pro Ala Arg Arg Ile Ala Met Ala Pro Leu Leu
1 5 10 15

Glu Tyr Glu Arg Gln Leu Val Leu Glu Leu Leu Asp Thr Asp Gly Leu
20 25 30

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

Leu Gln Leu His Cys His Pro Ala Cys Leu Val Leu Val Leu Asn Thr
50 55 60

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

Val Glu His Leu Pro Arg Arg Val Thr Asn Glu Ile Thr Ser Asn Ser
85 90 95

Arg Tyr Glu Val Tyr Thr Gln Gly Gly Val Ile Phe Ala Thr Ser Arg
100 105 110

```
Ile Leu Val Val Asp Phe Leu Thr Asp Arg Ile Pro Ser Asp Leu Ile
        115                 120                 125

Thr Gly Ile Leu Val Tyr Arg Ala His Arg Ile Ile Glu Ser Cys Gln
    130                 135                 140

Glu Ala Phe Ile Leu Arg Leu Phe Arg Gln Lys Asn Lys Arg Gly Phe
145                 150                 155                 160

Ile Lys Ala Phe Thr Asp Asn Ala Val Ala Phe Asp Thr Gly Phe Cys
                165                 170                 175

His Val Glu Arg Val Met Arg Asn Leu Phe Val Arg Lys Leu Tyr Leu
            180                 185                 190

Trp Pro Arg Phe His Val Ala Val Asn Ser Phe Leu Glu Gln His Lys
        195                 200                 205

Pro Glu Val Val Glu Ile His Val Ser Met Thr Pro Thr Met Leu Ala
    210                 215                 220

Ile Gln Thr Ala Ile Leu Asp Ile Leu Asn Ala Cys Leu Lys Glu Leu
225                 230                 235                 240

Lys Cys His Asn Pro Ser Leu Glu Val Glu Asp Leu Ser Leu Glu Asn
                245                 250                 255

Ala Ile Gly Lys Pro Phe Asp Lys Thr Ile Arg His Tyr Leu Asp Pro
            260                 265                 270

Leu Trp His Gln Leu Gly Ala Lys Thr Lys Ser Leu Val Gln Asp Leu
        275                 280                 285

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

Thr Phe Leu Asn Leu Leu Glu Ser Leu Arg Ala Thr Glu Lys Ala Phe
305                 310                 315                 320
```

Gly Gln Asn Ser Gly Trp Leu Phe Leu Asp Ser Ser Thr Ser Met Phe
325 330 335

Ile Asn Ala Arg Ala Arg Val Tyr His Leu Pro Asp Ala Lys Met Ser
340 345 350

Lys Lys Glu Lys Ile Ser Glu Lys Met Glu Ile Lys Glu Gly Glu Gly
355 360 365

Ile Leu Trp Gly
370

<210> 65

<400> 65
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<210> 66

<400> 66
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<210> 67
<211> 320
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig721000619

<400> 67

Lys Glu Gly Ser Thr Met Ala Lys Asn Glu Lys Lys Lys Ser Thr Ala
1 5 10 15

Lys Ala Leu Gly Leu Lys Ser Ser Phe Val Val Asn Asn Asp Ile Tyr
20 25 30

Met Thr Ser Phe Gly Lys Gly Asn Lys Ala Val Leu Glu Lys Lys Ile
35 40 45

Thr Glu Asn Thr Ile Glu Asn Lys Ser Asp Thr Thr Tyr Phe Asp Val
50 55 60

Ile Asn Arg Asp Pro Lys Gly Phe Thr Leu Glu Gly Arg Arg Ile Ala
65 70 75 80

```
Asp Met Thr Ala Phe Ser Asn Asp Pro Lys Tyr His Val Asn Val Val
                85                  90                  95

Asn Gly Lys Phe Leu Glu Asp Gln Leu Gly Ala Arg Ser Glu Leu Glu
            100                 105                 110

Lys Lys Val Phe Gly Arg Thr Phe Asp Asp Asn Val His Ile Gln Leu
        115                 120                 125

Ile His Asn Ile Leu Asp Ile Glu Lys Ile Met Ala Gln Tyr Val Ser
    130                 135                 140

Asp Ile Val Tyr Leu Leu His Asn Thr Ile Lys Arg Asp Met Asn Asp
145                 150                 155                 160

Asp Ile Met Gly Tyr Ile Ser Ile Arg Asn Ser Phe Asp Asp Phe Cys
                165                 170                 175

His Pro Glu Arg Ile Pro Asp Arg Lys Ala Lys Asp Asn Leu Gln Lys
            180                 185                 190

Gln His Asp Ile Phe Phe Asp Glu Ile Leu Lys Cys Gly Arg Leu Ala
        195                 200                 205

Tyr Phe Gly Asn Ala Phe Phe Glu Asp Gly Ser Asp Asn Lys Glu Ile
    210                 215                 220

Ala Lys Leu Lys Arg Tyr Lys Glu Ile Tyr His Ile Ile Ala Leu Met
225                 230                 235                 240

Gly Ser Leu Arg Gln Ser Tyr Phe His Gly Glu Asn Ser Asp Lys Asn
                245                 250                 255

Phe Gln Gly Pro Thr Trp Ala Tyr Thr Leu Glu Ser Asn Leu Thr Gly
            260                 265                 270

Lys Tyr Lys Glu Phe Lys Asp Thr Leu Asp Lys Thr Phe Asp Glu Arg
        275                 280                 285
```

Tyr Glu Met Ile Ser Lys Asp Phe Gly Ser Thr Asn Met Val Asn Leu
290 295 300

Gln Ile Leu Glu Glu Leu Leu Lys Met Leu Tyr Gly Asn Val Ser Pro
305 310 315 320

<210> 68

<400> 68
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<210> 69
<211> 204
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig2002000411

<400> 69

Glu Lys Gln Asn Lys Ala Lys Tyr Gln Ala Ile Ile Ser Leu Tyr Leu
1 5 10 15

Met Val Met Tyr Gln Ile Val Lys Asn Met Ile Tyr Val Asn Ser Arg
20 25 30

Tyr Val Ile Ala Phe His Cys Leu Glu Arg Asp Ser Asn Gln Leu Leu
35 40 45

Gly Arg Phe Asn Ser Arg Asp Ala Ser Met Tyr Asn Lys Leu Thr Gln
50 55 60

Lys Phe Ile Thr Asp Lys Tyr Leu Asn Asp Gly Ala Gln Gly Cys Ser
65 70 75 80

Lys Lys Val Gly Asn Tyr Leu Ser His Asn Ile Thr Cys Cys Ser Asp
85 90 95

Glu Leu Arg Lys Glu Tyr Arg Asn Gln Val Asp His Phe Ala Val Val
100 105 110

Arg Met Ile Gly Lys Tyr Ala Ala Asp Ile Gly Lys Phe Ser Thr Trp
115 120 125

Phe Glu Leu Tyr His Tyr Val Met Gln Arg Ile Ile Phe Asp Lys Arg
    130   135   140

Asn Pro Leu Ser Glu Thr Glu Arg Thr Tyr Lys Gln Leu Ile Ala Lys
145   150   155   160

His His Thr Tyr Cys Lys Asp Leu Val Lys Ala Leu Asn Thr Pro Phe
                165   170   175

Gly Tyr Asn Leu Ala Arg Tyr Lys Asn Leu Ser Ile Gly Glu Leu Phe
            180   185   190

Asp Arg Asn Asn Tyr Asn Ala Lys Thr Lys Glu Thr
        195   200

<210> 70

<400> 70
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<210> 71
<211> 449
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig13552000311

<400> 71

Leu Ile Asp Phe Leu Ile Tyr Asp Leu Tyr Tyr Asn Arg Lys Pro Ala
1   5   10   15

Arg Ile Glu Glu Ile Val Asp Lys Leu Arg Glu Ser Val Asn Asp Glu
            20   25   30

Glu Lys Glu Ser Ile Tyr Ser Ala Glu Thr Lys Tyr Val Tyr Glu Ala
        35   40   45

Leu Gly Lys Val Leu Val Arg Ser Leu Lys Lys Tyr Leu Asn Gly Ala
    50   55   60

Thr Ile Arg Asp Leu Lys Asn Arg Tyr Asp Ala Lys Thr Ala Asn Arg
65   70   75   80

```
Ile Trp Asp Ile Ser Glu His Ser Lys Ser Gly His Val Asn Cys Phe
                85                  90                  95

Cys Lys Leu Ile Tyr Met Met Thr Leu Met Leu Asp Gly Lys Glu Ile
            100                 105                 110

Asn Asp Leu Leu Thr Thr Leu Val Asn Lys Phe Asp Asn Ile Ala Ser
        115                 120                 125

Phe Ile Asp Val Met Asp Glu Leu Gly Leu Glu His Ser Phe Thr Asp
    130                 135                 140

Asn Tyr Lys Met Phe Ala Asp Ser Lys Ala Ile Cys Leu Asp Leu Gln
145                 150                 155                 160

Phe Ile Asn Ser Phe Ala Arg Met Ser Lys Ile Asp Asp Glu Lys Ser
                165                 170                 175

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

Lys Asn Glu Asp Trp Ile Glu Lys Tyr Leu Thr Ser Asp Ile Phe Lys
        195                 200                 205

Arg Asp Glu Asn Gly Asn Lys Ile Asp Gly Glu Lys Arg Asp Phe Arg
    210                 215                 220

Asn Phe Ile Ala Asn Asn Val Ile Lys Ser Ala Arg Phe Lys Tyr Leu
225                 230                 235                 240

Val Lys Tyr Ser Ser Ala Asp Gly Met Ile Lys Leu Lys Lys Asn Glu
                245                 250                 255

Lys Leu Ile Ser Phe Val Leu Glu Gln Leu Pro Glu Thr Gln Ile Asp
            260                 265                 270

Arg Tyr Tyr Glu Ser Cys Gly Leu Asp Cys Ala Val Ala Asp Arg Lys
        275                 280                 285
```

```
Val Arg Ile Glu Lys Leu Thr Gly Leu Ile Arg Asp Met Arg Phe Asp
    290                 295                 300

Asn Phe Arg Gly Val Asn Tyr Ser Asn Asp Ala Cys Lys Lys Asp Lys
305                 310                 315                 320

Gln Ala Lys Ala Lys Tyr Gln Ala Ile Ile Ser Leu Tyr Leu Met Val
                325                 330                 335

Leu Tyr Gln Ile Val Lys Asn Met Ile Tyr Val Asn Ser Arg Tyr Val
            340                 345                 350

Ile Ala Phe His Cys Leu Glu Arg Asp Leu Leu Phe Phe Asn Ile Glu
        355                 360                 365

Leu Asp Asn Ser Tyr Gln Tyr Ser Asn Cys Asn Glu Leu Thr Glu Lys
    370                 375                 380

Phe Ile Lys Asp Lys Tyr Met Lys Glu Gly Ala Leu Gly Phe Asn Met
385                 390                 395                 400

Lys Ala Gly Arg Tyr Leu Thr Lys Asn Ile Gly Asn Cys Ser Asn Glu
                405                 410                 415

Leu Arg Lys Ile Tyr Arg Asn Gln Val Asp His Phe Ala Val Val Arg
            420                 425                 430

Lys Ile Gly Asn Tyr Ala Ala Asp Ile Ala Ser Val Gly Ser Trp Phe
        435                 440                 445

Glu
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<210> 72
<211> 96
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig10037000527

<400> 72

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Tyr Met Asp Gln Asn Phe Ala Asn Ser Asp Ala Trp Ala Ile His Val
1               5                   10                  15


Tyr Arg Asn Lys Ile Gln His Leu Asp Ala Val Arg His Ala Asp Met
            20                  25                  30


Tyr Ile Gly Asp Ile Arg Glu Phe His Ser Trp Phe Glu Leu Tyr His
        35                  40                  45


Tyr Ile Ile Gln Arg Arg Ile Ile Asp Gln Tyr Ala Tyr Glu Ser Thr
    50                  55                  60


Pro Gly Ser Ser Arg Asp Gly Ser Ala Ile Ile Asp Glu Glu Arg Leu
65                  70                  75                  80


Asn Pro Ala Thr Arg Arg Tyr Phe Arg Leu Ile Thr Thr Tyr Lys Thr
                85                  90                  95


<210>  73
<211>  519
<212>  PRT
<213>  Unknown

<220>
<223>  CasRX/Cas13d Gut metagenome contig238000329

<400>  73

Arg Tyr Asp Lys Asp Arg Ser Lys Ile Tyr Thr Met Met Asp Phe Val
1               5                   10                  15


Ile Tyr Arg Tyr Tyr Ile Asp Asn Asn Asn Asp Ser Ile Asp Phe Ile
            20                  25                  30


Asn Lys Leu Arg Ser Ser Ile Asp Glu Lys Ser Lys Glu Lys Leu Tyr
        35                  40                  45


Asn Glu Glu Ala Asn Arg Leu Trp Asn Lys Leu Lys Glu Tyr Met Leu
    50                  55                  60


Tyr Ile Lys Glu Phe Asn Gly Lys Leu Ala Ser Arg Thr Pro Asp Arg
65                  70                  75                  80
```

```
Asp Gly Asn Ile Ser Glu Phe Val Glu Ser Leu Pro Lys Ile His Arg
                85                  90                  95

Leu Leu Pro Arg Gly Gln Lys Ile Ser Asn Phe Ser Lys Leu Met Tyr
            100                 105                 110

Leu Leu Thr Met Phe Leu Asp Gly Lys Glu Ile Asn Asp Leu Leu Thr
        115                 120                 125

Thr Leu Ile Asn Lys Phe Glu Asn Ile Gln Gly Phe Leu Asp Ile Met
    130                 135                 140

Pro Glu Ile Asn Val Asn Ala Lys Phe Glu Pro Glu Tyr Val Phe Phe
145                 150                 155                 160

Asn Lys Ser His Glu Ile Ala Gly Glu Leu Lys Leu Ile Lys Gly Phe
                165                 170                 175

Ala Gln Met Gly Glu Pro Ala Ala Thr Leu Lys Leu Glu Met Thr Ala
            180                 185                 190

Asp Ala Ile Lys Ile Leu Gly Thr Glu Lys Glu Asp Ala Glu Leu Ile
        195                 200                 205

Lys Leu Ala Glu Ser Leu Phe Lys Asp Glu Asn Gly Lys Leu Leu Gly
    210                 215                 220

Asn Lys Gln His Gly Met Arg Asn Phe Ile Gly Asn Asn Val Ile Lys
225                 230                 235                 240

Ser Lys Arg Phe His Tyr Leu Ile Arg Tyr Gly Asp Pro Ala His Leu
                245                 250                 255

His Lys Ile Ala Thr Asn Lys Asn Val Val Arg Phe Val Leu Gly Arg
            260                 265                 270

Ile Ala Asp Met Gln Lys Lys Gln Gly Gln Lys Gly Lys Asn Gln Ile
        275                 280                 285

Asp Arg Tyr Tyr Glu Val Cys Val Gly Asn Lys Asp Ile Lys Lys Thr
    290                 295                 300
```

```
Ile Glu Glu Lys Ile Asp Ala Leu Thr Asp Ile Ile Val Asn Met Asn
305                 310                 315                 320

Tyr Asp Gln Phe Glu Lys Lys Lys Ala Val Ile Glu Asn Gln Asn Arg
                325                 330                 335

Gly Lys Thr Phe Glu Glu Lys Asn Lys Tyr Lys Arg Asp Asn Ala Glu
            340                 345                 350

Arg Glu Lys Phe Lys Lys Ile Ile Ser Leu Tyr Leu Thr Val Ile Tyr
        355                 360                 365

His Ile Leu Lys Asn Ile Val Asn Val Asn Ser Arg Tyr Ile Leu Gly
    370                 375                 380

Phe His Cys Leu Glu Arg Asp Lys Gln Leu Tyr Ile Glu Lys Tyr Asn
385                 390                 395                 400

Lys Asp Lys Leu Asp Gly Phe Val Ala Leu Thr Lys Phe Cys Leu Gly
                405                 410                 415

Asp Glu Glu Arg Tyr Glu Asp Leu Lys Ala Lys Ala Gln Ala Ser Ile
            420                 425                 430

Gln Ala Leu Glu Thr Ala Asn Pro Lys Leu Tyr Ala Lys Tyr Met Asn
        435                 440                 445

Tyr Ser Asp Glu Glu Lys Lys Glu Glu Phe Lys Lys Gln Leu Asn Arg
    450                 455                 460

Glu Arg Val Lys Asn Ala Arg Asn Ala Tyr Leu Lys Asn Ile Lys Asn
465                 470                 475                 480

Tyr Ile Met Ile Arg Leu Gln Leu Arg Asp Gln Thr Asp Ser Ser Gly
                485                 490                 495

Tyr Leu Cys Gly Glu Phe Arg Asp Lys Val Ala His Leu Glu Val Ala
            500                 505                 510
```

Arg His Ala His Glu Tyr Ile
515

<210> 74
<211> 20
<212> RNA
<213> Artificial Sequence

<220>
<223> Space Sequence

<400> 74
ggggccgggg ccggggccgg 20

<210> 75
<211> 20
<212> RNA
<213> Artificial Sequence

<220>
<223> Space Sequence

<400> 75
gggccggggc cggggccggg 20

<210> 76
<211> 20
<212> RNA
<213> Artificial Sequence

<220>
<223> Space Sequence

<400> 76
ggccggggcc ggggccgggg 20

<210> 77
<211> 20
<212> RNA
<213> Artificial Sequence

<220>
<223> Space Sequence

<400> 77
gccggggccg gggccggggc 20

<210> 78
<211> 20

<212> RNA
<213> Artificial Sequence

<220>
<223> Space Sequence

<400> 78
ccggggccgg ggccggggcc 20

<210> 79
<211> 20
<212> RNA
<213> Artificial Sequence

<220>
<223> Space Sequence

<400> 79
cggggccggg gccggggccg 20

<210> 80
<211> 3
<212> RNA
<213> Artificial Sequence

<220>
<223> Space Sequence

<400> 80
cag 3

<210> 81
<211> 6
<212> RNA
<213> Artificial Sequence

<220>
<223> Space Sequence

<400> 81
ggggcc 6

<210> 82
<211> 93
<212> RNA
<213> Artificial Sequence

<220>
<223> Scaffold Sequence

<400> 82
guuuaagagc uaugcuggaa acagcauagc aaguuuaaau aaggcuaguc cguuaucaac 60

uugaaaaagu ggcaccgagu cggugcuuuu uuu 93

<210> 83
<211> 83
<212> RNA
<213> Artificial Sequence

<220>
<223> Scaffold Sequence

<400> 83
guuuuagagc uagaaauagc aaguuaaaau aaggcuaguc cguuaucaac uugaaaaagu 60

ggcaccgagu cggugcuuuu uuu 83

<210> 84
<211> 181
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig2643000492

<400> 84

Asn Gly Glu Ile Val Ser Leu Ala Glu Lys Glu Ala Phe Ser Ala Lys
1 5 10 15

Ile Ala Asp Lys Asn Ile Gly Cys Lys Ile Glu Asn Lys Gln Phe Arg
20 25 30

His Pro Lys Gly Tyr Asp Val Ile Ala Asp Asn Pro Ile Tyr Lys Gly
35 40 45

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

Tyr Phe Ser Pro Ser Asp Ser Ile Asp Asn Val Arg Val Gln Val Ala
65 70 75 80

His Asn Ile Leu Asp Ile Glu Lys Ile Leu Ala Glu Tyr Ile Thr Asn
85 90 95

Ala Val Tyr Ser Phe Asp Asn Ile Ala Gly Phe Gly Lys Asp Ile Ile
100 105 110

Gly Asp Asp Phe Ser Pro Val Tyr Thr Tyr Asp Lys Phe Glu Lys Ser
115 120 125

Asp Arg Tyr Glu Tyr Phe Lys Asn Leu Leu Asn Asn Ser Arg Leu Gly
130 135 140

Tyr Tyr Gly Gln Ala Phe Phe Glu Cys Asp Asp Ser Lys Glu Asn Lys
145 150 155 160

Lys Lys Lys Asp Ala Ile Lys Cys Tyr Asn Ile Ile Ala Leu Leu Ser
165 170 175

Gly Leu Arg His Trp
180

<210> 85
<211> 440
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig874000057

<400> 85

Met Ser Lys Asn Lys Glu Ser Tyr Ala Lys Gly Met Gly Leu Lys Ser
1 5 10 15

Ala Leu Val Ser Gly Ser Lys Val Tyr Met Thr Ser Phe Glu Gly Gly
20 25 30

Asn Asp Ala Lys Leu Glu Lys Val Val Glu Asn Ser Glu Ile Val Ser
35 40 45

Leu Ala Glu Lys Glu Ser Phe Ser Ala Glu Ile Phe Lys Lys Asn Ile
50 55 60

Gly Cys Lys Ile Glu Asn Lys Lys Phe Lys His Pro Lys Arg Tyr Asp
65 70 75 80

```
Val Ile Ala Asp Asn Pro Leu Tyr Lys Gly Ser Val Arg Gln Asp Met
                85                  90                  95

Leu Gly Leu Lys Glu Thr Leu Glu Lys Arg Tyr Phe Asn Ser Ala Asp
            100                 105                 110

Gly Thr Asp Asn Val Cys Ile Gln Val Ile His Asn Ile Leu Asp Ile
        115                 120                 125

Glu Lys Ile Leu Ala Glu Tyr Ile Thr Asn Ala Val Tyr Ser Phe Asp
    130                 135                 140

Asn Ile Ala Gly Phe Gly Glu Asp Ile Ile Gly Met Gly Gly Phe Lys
145                 150                 155                 160

Pro Ile Tyr Thr Tyr Lys Gln Phe Lys Glu Pro Asp Lys Tyr Asn Lys
                165                 170                 175

Lys Phe Asp Asp Ile Leu Asn Asn Ser Arg Leu Gly Tyr Tyr Gly Lys
            180                 185                 190

Ala Phe Phe Glu Lys Asn Asp Leu Lys His Asn Pro Asn Lys Lys Lys
        195                 200                 205

Arg Asp Lys Asn Pro Tyr Ile Leu Lys Tyr Asp Asn Glu Cys Tyr Tyr
    210                 215                 220

Ile Ile Ala Leu Leu Ser Gly Leu Arg His Trp Asn Ile His Ser His
225                 230                 235                 240

Ala Lys Asp Asp Leu Val Ser Tyr Arg Trp Leu Tyr Asn Leu Asp Ser
                245                 250                 255

Ile Leu Asn Arg Glu Tyr Ile Ser Thr Leu Asn Tyr Leu Tyr Asp Asp
            260                 265                 270

Ile Ala Asp Glu Leu Thr Glu Ser Phe Ser Lys Asn Ser Ser Ala Asn
        275                 280                 285

Val Asn Tyr Ile Ala Glu Thr Leu Asn Ile Asp Pro Ser Glu Phe Ala
    290                 295                 300
```

```
Gln Gln Tyr Phe Arg Phe Ser Ile Met Lys Glu Gln Lys Asn Met Gly
305                 310                 315                 320


Phe Asn Val Ser Lys Leu Arg Glu Ile Met Leu Asp Arg Lys Glu Leu
                325                 330                 335


Ser Asp Ile Arg Asp Asn His Arg Val Phe Asp Ser Ile Arg Ser Lys
            340                 345                 350


Leu Tyr Thr Met Met Asp Phe Val Ile Tyr Arg Tyr Tyr Ile Glu Glu
        355                 360                 365


Ala Ala Lys Thr Glu Ala Glu Asn Arg Asn Leu Pro Glu Asn Glu Lys
    370                 375                 380


Lys Ile Ser Glu Lys Asp Phe Phe Val Ile Asn Leu Arg Gly Ser Phe
385                 390                 395                 400


Asp Glu Asn Gln Lys Glu Lys Leu Tyr Ile Glu Glu Ala Lys Arg Leu
                405                 410                 415


Trp Glu Lys Leu Lys Asp Ile Met Leu Lys Ile Lys Glu Phe Arg Gly
            420                 425                 430


Glu Lys Val Lys Glu Tyr Lys Lys
        435                 440


<210>  86
<211>  137
<212>  PRT
<213>  Unknown

<220>
<223>  CasRX/Cas13d Gut metagenome contig4781000489

<400>  86

Leu Asp Lys Gln Leu Asp Tyr Glu Tyr Ile Arg Thr Leu Asn Tyr Met
1               5                   10                  15


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

```
Ala Ala Asn Val Asn Tyr Ile Ala Glu Thr Leu Asn Ile Asp Pro Asn
        35                  40                  45

Lys Phe Ala Glu Gln Tyr Phe Arg Phe Ser Ile Met Lys Glu Gln Lys
    50                  55                  60

Asn Leu Gly Phe Asn Leu Thr Lys Leu Arg Glu Ser Met Leu Asp Arg
65                  70                  75                  80

Arg Glu Leu Ser Asp Ile Arg Asp Asn His Asn Val Phe Asp Ser Ile
                85                  90                  95

Arg Pro Lys Leu Tyr Thr Met Met Asp Phe Val Ile Tyr Lys His Tyr
            100                 105                 110

Ile Asp Glu Ala Lys Lys Thr Glu Ala Glu Asn Lys Ser Leu Pro Asp
        115                 120                 125

Asp Arg Lys Asn Leu Ser Glu Lys Asp
    130                 135
```

<210> 87
<211> 87
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig12144000352

<400> 87

```
Arg Met Gly Glu Pro Val Ala Asn Thr Lys Arg Val Met Met Ile Asp
1               5                   10                  15

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

Met Ala Asp Ser Phe Phe Lys Asp Ser Asp Gly Asn Leu Leu Lys Lys
        35                  40                  45

Gly Lys His Gly Met Arg Asn Phe Ile Thr Asn Asn Val Ile Lys Asn
    50                  55                  60
```

Lys Arg Phe His Tyr Leu Ile Arg Tyr Gly Asp Pro Ala His Leu His
65 70 75 80

Glu Ile Ala Lys Asn Glu Ala
85

<210> 88
<211> 414
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig5590000448

<400> 88

Val His Asn Asn Glu Glu Lys Asp Leu Ile Lys Tyr Thr Trp Leu Tyr
1 5 10 15

Asn Leu Asp Lys Tyr Leu Asp Ala Glu Tyr Ile Thr Thr Leu Asn Tyr
20 25 30

Met Tyr Asn Asp Ile Gly Asp Glu Leu Thr Asp Ser Phe Ser Lys Asn
35 40 45

Ser Ala Ala Asn Ile Asn Tyr Ile Ala Glu Thr Leu Gly Ile Asp Pro
50 55 60

Lys Thr Phe Ala Glu Gln Tyr Phe Arg Phe Ser Ile Met Lys Glu Gln
65 70 75 80

Lys Asn Leu Gly Phe Asn Leu Thr Lys Leu Arg Glu Val Met Leu Asp
85 90 95

Arg Lys Asp Met Ser Glu Ile Arg Glu Asn His Asn Asp Phe Asp Ser
100 105 110

Ile Arg Ala Lys Val Tyr Thr Met Met Asp Phe Val Ile Tyr Arg Tyr
115 120 125

Tyr Ile Glu Glu Ala Ala Lys Val Asn Ala Ala Asn Lys Ser Leu Pro
130 135 140

```
Asp Asn Glu Lys Ser Leu Ser Glu Lys Asp Ile Phe Val Ile Ser Leu
145                 150                 155                 160


Arg Gly Ser Phe Asn Glu Asp Gln Lys Asp Arg Leu Tyr Tyr Asp Glu
                165                 170                 175


Ala Gln Arg Leu Trp Ser Lys Val Gly Lys Leu Met Leu Lys Ile Lys
            180                 185                 190


Lys Phe Arg Gly Lys Asp Thr Arg Lys Tyr Lys Asn Met Gly Thr Pro
        195                 200                 205


Arg Ile Arg Arg Leu Ile Pro Glu Gly Arg Asp Ile Ser Thr Phe Ser
    210                 215                 220


Lys Leu Met Tyr Ala Leu Thr Met Phe Leu Asp Gly Lys Glu Ile Asn
225                 230                 235                 240


Asp Leu Leu Thr Thr Leu Ile Asn Lys Phe Asp Asn Ile Gln Ser Phe
                245                 250                 255


Leu Lys Val Met Pro Leu Ile Gly Val Asn Ala Lys Phe Ala Glu Glu
            260                 265                 270


Tyr Ser Phe Phe Asn Asn Ser Glu Lys Ile Ala Asp Glu Leu Arg Leu
        275                 280                 285


Ile Lys Ser Phe Ala Arg Met Gly Glu Pro Val Ala Asp Ala Arg Arg
    290                 295                 300


Ala Met Tyr Ile Asp Ala Ile Arg Ile Leu Gly Thr Asp Leu Ser Asp
305                 310                 315                 320


Asp Glu Leu Lys Ala Leu Ala Asp Ser Phe Ser Leu Asp Glu Asn Gly
                325                 330                 335


Asn Lys Leu Gly Lys Gly Lys His Gly Met Arg Asn Phe Ile Ile Asn
            340                 345                 350
```

```
Asn Val Ile Thr Asn Lys Arg Phe His Tyr Leu Ile Arg Tyr Gly Asn
        355                 360                 365


Pro Val His Leu His Glu Ile Ala Lys Asn Glu Ala Val Val Lys Phe
    370                 375                 380


Val Leu Gly Arg Ile Ala Asp Ile Gln Lys Lys Gln Gly Gln Asn Gly
385                 390                 395                 400


Lys Asn Gln Ile Asp Arg Tyr Tyr Glu Thr Cys Ile Gly Lys
                405                 410


<210>  89
<211>  345
<212>  PRT
<213>  Unknown

<220>
<223>  CasRX/Cas13d Gut metagenome contig525000349

<400>  89

Met Ser Lys Lys Glu Asn Arg Lys Ser Tyr Val Lys Gly Leu Gly Leu
1               5                   10                  15


Lys Ser Thr Leu Val Ser Asp Ser Lys Val Tyr Leu Thr Thr Phe Ala
            20                  25                  30


Asp Gly Ser Asn Ala Lys Leu Glu Lys Cys Val Glu Asn Asn Lys Ile
        35                  40                  45


Ile Cys Ile Ser Asn Asp Lys Glu Ala Phe Ala Ala Ser Ile Ala Asn
    50                  55                  60


Lys Asn Val Gly Tyr Lys Ile Lys Asn Asp Glu Lys Phe Arg His Pro
65                  70                  75                  80


Lys Gly Tyr Asp Ile Ile Ser Asn Asn Pro Leu Leu His Asn Asn Ser
                85                  90                  95


Val Gln Gln Asp Met Leu Gly Leu Lys Asn Val Leu Glu Lys Arg Tyr
            100                 105                 110
```

```
Phe Gly Lys Ser Ser Gly Gly Asp Asn Asn Leu Cys Ile Gln Ile Ile
        115                 120                 125

His Asn Ile Ile Asp Ile Glu Lys Ile Leu Ser Glu Tyr Ile Pro Asn
    130                 135                 140

Val Val Tyr Ala Phe Asn Asn Ile Ala Gly Phe Lys Asp Glu His Asn
145                 150                 155                 160

Asn Ile Ile Asp Ile Ile Gly Thr Gln Thr Tyr Asn Ser Ser Tyr Thr
                165                 170                 175

Tyr Ala Asp Phe Ser Lys Asp Lys Ser Asp Lys Lys Tyr Ile Glu Phe
            180                 185                 190

Gln Lys Leu Leu Lys Asn Lys Arg Leu Gly Tyr Trp Gly Lys Ala Phe
        195                 200                 205

Phe Thr Gly Gln Gly Asn Asn Ala Lys Val Arg Gln Glu Asn Gln Cys
    210                 215                 220

Phe His Ile Ile Ala Leu Leu Ile Ser Leu Arg Asn Trp Ala Thr His
225                 230                 235                 240

Ser Asn Glu Leu Asp Lys His Thr Lys Arg Thr Trp Leu Tyr Lys Leu
                245                 250                 255

Asp Asp Thr Asn Ile Leu Asn Ala Glu Tyr Val Lys Thr Leu Asn Tyr
            260                 265                 270

Leu Tyr Asp Thr Ile Ala Asp Glu Leu Thr Lys Ser Phe Ser Lys Asn
        275                 280                 285

Gly Ala Val Asn Val Asn Tyr Leu Ala Lys Lys Tyr Asn Ile Lys Asp
    290                 295                 300

Asp Leu Pro Gly Phe Ser Glu Gln Tyr Phe Arg Phe Ser Ile Met Lys
305                 310                 315                 320

Glu Gln Lys Asn Leu Gly Phe Asn Ile Ser Lys Leu Arg Glu Asn Met
                325                 330                 335
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Leu Asp Phe Lys Asp Met Ser Val Ile
340 345

<210> 90
<211> 206
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig7229000302

<400> 90

Lys Lys Ile Ser Ser Leu Thr Lys Phe Cys Leu Gly Glu Ser Asp Glu
1 5 10 15

Lys Lys Leu Lys Ala Leu Ala Lys Lys Ser Leu Glu Glu Leu Lys Thr
20 25 30

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

Lys Ala Glu Glu Ala Lys Arg Gln Ile Asn Arg Glu Arg Ala Lys Thr
50 55 60

Ala Met Asn Ala His Leu Arg Asn Thr Lys Trp Asn Asp Ile Met Tyr
65 70 75 80

Gly Gln Leu Lys Asp Leu Ala Asp Ser Lys Ser Arg Ile Cys Ser Glu
85 90 95

Phe Arg Asn Lys Ala Ala His Leu Glu Val Ala Arg Tyr Ala His Met
100 105 110

Tyr Ile Asn Asp Ile Ser Glu Val Lys Ser Tyr Phe Arg Leu Tyr His
115 120 125

Tyr Ile Met Gln Arg Arg Ile Ile Asp Val Ile Glu Asn Asn Pro Lys
130 135 140

Ala Lys Tyr Glu Gly Lys Val Lys Val Tyr Phe Glu Asp Val Lys Lys
145 150 155 160

Asn Lys Lys Tyr Asn Lys Asn Leu Leu Lys Leu Met Cys Val Pro Phe
165 170 175

Gly Tyr Cys Ile Pro Arg Phe Lys Asn Leu Ser Ile Glu Gln Met Phe
180 185 190

Asp Met Asn Glu Thr Asp Asn Ser Asp Lys Lys Lys Glu Lys
195 200 205

<210> 91
<211> 95
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d Gut metagenome contig3227000343

<400> 91

Ile Gly Asp Ile Ser Glu Val Asn Ser Tyr Phe Gln Leu Tyr His Tyr
1 5 10 15

Ile Met Gln Arg Ile Leu Ile Asp Lys Ile Gly Ser Lys Thr Thr Gly
20 25 30

Lys Ala Lys Glu Tyr Phe Asp Ser Val Ile Val Asn Lys Lys Tyr Asp
35 40 45

Asp Arg Leu Leu Lys Leu Leu Cys Ser Pro Leu Gly Tyr Cys Leu Thr
50 55 60

Arg Tyr Lys Asp Leu Ser Ile Glu Ala Leu Phe Asp Met Asn Glu Ala
65 70 75 80

Ala Lys Tyr Asp Lys Leu Asn Lys Glu Arg Lys Asn Lys Lys Lys
85 90 95

<210> 92
<211> 115
<212> PRT
<213> Unknown

<220>

<223> CasRX/Cas13d Gut metagenome contig7030000469

<400> 92

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Ser Ile Arg Ser Lys Leu Tyr Thr Met Met Asp Phe Val Ile Tyr Arg
1               5                  10                  15


Tyr Tyr Ile Glu Glu Ser Ala Lys Ala Ala Ala Glu Asn Lys Pro Ser
            20                  25                  30


Glu Ser Asp Ser Phe Val Ile Arg Leu Arg Gly Ser Phe Asn Glu Asn
        35                  40                  45


Gln Lys Glu Glu Leu Tyr Ile Glu Glu Ala Glu Arg Leu Trp Lys Lys
    50                  55                  60


Phe Gly Glu Ile Met Leu Lys Ile Lys Glu Phe Arg Gly Glu Lys Val
65                  70                  75                  80


Lys Glu Tyr Lys Lys Glu Val Pro Arg Ile Glu Arg Ile Leu Pro His
                85                  90                  95


Gly Lys Asp Ile Ser Ala Phe Ser Lys Leu Met Tyr Met Leu Ser Met
            100                 105                 110


Phe Leu Asp
        115
```

<210> 93
<211> 234
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d gut metagenome P17E0k2120140920, c87000043

<400> 93

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Met Tyr Phe Ser Lys Met Ile Tyr Met Leu Thr Tyr Phe Leu Asp Gly
1               5                  10                  15


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

```
Ile Lys Glu Phe Leu Lys Ile Met Lys Ser Ser Ala Val Asp Val Glu
        35                  40                  45

Cys Glu Leu Thr Ala Gly Tyr Lys Leu Phe Asn Asp Ser Gln Arg Ile
    50                  55                  60

Thr Asn Glu Leu Phe Ile Val Lys Asn Ile Ala Ser Met Arg Lys Pro
65                  70                  75                  80

Ala Ala Ser Ala Lys Leu Thr Met Phe Arg Asp Ala Leu Thr Ile Leu
                85                  90                  95

Gly Ile Asp Asp Lys Ile Thr Asp Asp Arg Ile Ser Glu Ile Leu Lys
            100                 105                 110

Leu Lys Glu Lys Gly Lys Gly Ile His Gly Leu Arg Asn Phe Ile Thr
        115                 120                 125

Asn Asn Val Ile Glu Ser Ser Arg Phe Val Tyr Leu Ile Lys Tyr Ala
    130                 135                 140

Asn Ala Gln Lys Ile Arg Glu Val Ala Lys Asn Glu Lys Val Val Met
145                 150                 155                 160

Phe Val Leu Gly Gly Ile Pro Asp Thr Gln Ile Glu Arg Tyr Tyr Lys
                165                 170                 175

Ser Cys Val Glu Phe Pro Asp Met Asn Ser Ser Leu Glu Ala Lys Arg
            180                 185                 190

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

Asn Val Lys Gln Gln Ala Lys Gly Arg Glu Asn Val Ala Lys Glu Arg
    210                 215                 220

Ala Lys Ala Val Ile Gly Leu Tyr Leu Thr
225                 230
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<210> 94
<211> 939

<212> PRT
<213> Unknown

<220>
<223> contig emb OBVH01003037.1, human gut metagenome sequence

<400> 94

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Met Ala Lys Lys Lys Arg Ile Thr Ala Lys Glu Arg Lys Gln Asn His
1               5                  10                  15


Arg Glu Leu Leu Met Lys Lys Ala Asp Ser Asn Ala Glu Lys Glu Lys
            20                  25                  30


Ala Lys Lys Pro Val Val Glu Asn Lys Pro Asp Thr Ala Ile Ser Lys
        35                  40                  45


Asp Asn Thr Pro Lys Pro Asn Lys Glu Ile Lys Lys Ser Lys Ala Lys
    50                  55                  60


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


Ile Ser Ser Phe Gly Lys Gly Asn Asn Ser Val Leu Glu Lys Arg Ile
                85                  90                  95


Met Gly Asp Val Ser Ser Asn Val Asn Lys Asp Ser His Met Tyr Val
            100                 105                 110


Asn Pro Lys Tyr Thr Lys Lys Asn Tyr Glu Ile Lys Asn Gly Phe Ser
        115                 120                 125


Ser Gly Ser Ser Leu Val Thr Tyr Pro Asn Lys Pro Asp Lys Asn Ser
    130                 135                 140


Gly Met Asp Ala Leu Cys Leu Lys Pro Tyr Phe Glu Lys Asp Phe Phe
145                 150                 155                 160


Gly His Ile Phe Thr Asp Asn Met His Ile Gln Ala Ile Tyr Asn Ile
                165                 170                 175


Phe Asp Ile Glu Lys Ile Leu Ala Lys His Ile Thr Asn Ile Ile Tyr
            180                 185                 190
```

```
Thr Val Asn Ser Phe Asp Arg Asn Tyr Asn Gln Ser Gly Asn Asp Thr
        195                 200                 205

Ile Gly Phe Gly Leu Asn Tyr Arg Val Pro Tyr Ser Glu Tyr Gly Gly
    210                 215                 220

Gly Lys Asp Ser Asn Gly Glu Pro Lys Asn Gln Ser Lys Trp Glu Lys
225                 230                 235                 240

Arg Asp Asn Phe Ile Lys Phe Tyr Asn Glu Ser Lys Pro His Leu Gly
                245                 250                 255

Tyr Tyr Glu Asn Ile Phe Tyr Asp His Gly Glu Pro Ile Ser Glu Glu
            260                 265                 270

Lys Phe Tyr Asn Tyr Leu Asn Ile Leu Asn Phe Ile Arg Asn Asn Thr
        275                 280                 285

Phe His Tyr Lys Asp Asp Asp Ile Glu Leu Tyr Ser Glu Asn Tyr Ser
    290                 295                 300

Glu Glu Phe Val Phe Ile Asn Cys Leu Asn Lys Phe Val Lys Asn Lys
305                 310                 315                 320

Phe Lys Asn Val Asn Lys Asn Phe Ile Ser Asn Glu Lys Asn Asn Leu
                325                 330                 335

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

Val Lys Lys Tyr Ser Lys Glu Leu Tyr Lys Leu Ser Val Leu Lys Thr
        355                 360                 365

Asn Lys Asn Leu Gly Val Asn Val Lys Lys Leu Arg Glu Ser Ala Ile
    370                 375                 380

Glu Tyr Gly Tyr Cys Pro Leu Pro Tyr Asp Lys Glu Lys Glu Val Ala
385                 390                 395                 400
```

```
Lys Leu Ser Ser Val Lys His Lys Leu Tyr Lys Thr Tyr Asp Phe Val
                405                 410                 415

Ile Thr His Tyr Leu Asn Ser Asn Asp Lys Leu Leu Leu Glu Ile Val
            420                 425                 430

Glu Thr Leu Arg Leu Ser Lys Asn Asp Asp Glu Lys Glu Asn Val Tyr
        435                 440                 445

Lys Lys Tyr Ala Glu Lys Leu Phe Lys Ala Asp Asp Val Ile Asn Pro
    450                 455                 460

Ile Lys Ala Ile Ser Lys Leu Phe Ala Arg Lys Gly Asn Lys Leu Phe
465                 470                 475                 480

Lys Glu Lys Ile Ile Ile Lys Lys Glu Tyr Ile Glu Asp Val Ser Ile
                485                 490                 495

Asp Lys Asn Ile Tyr Asp Phe Thr Lys Val Ile Phe Phe Met Thr Cys
            500                 505                 510

Phe Leu Asp Gly Lys Glu Ile Asn Asp Leu Leu Thr Asn Ile Ile Ser
        515                 520                 525

Lys Leu Gln Val Ile Glu Asp His Asn Asn Val Ile Lys Phe Ile Ser
    530                 535                 540

Asn Asn Lys Asp Ala Val Tyr Lys Asp Tyr Ser Asp Lys Tyr Ala Ile
545                 550                 555                 560

Phe Arg Asn Ala Gly Lys Ile Ala Thr Glu Leu Glu Ala Ile Lys Ser
                565                 570                 575

Ile Ala Arg Met Glu Asn Lys Ile Glu Asn Ala Pro Gln Glu Pro Leu
            580                 585                 590

Leu Lys Asp Ala Leu Leu Ser Leu Gly Val Ser Asp Asp Thr Lys Val
        595                 600                 605

Leu Glu Asn Thr Tyr Asn Lys Tyr Phe Asp Ser Lys Glu Lys Thr Asp
    610                 615                 620
```

```
Lys Gln Ser Gln Lys Val Ser Thr Phe Leu Met Asn Asn Val Ile Asn
625                 630                 635                 640


Asn Asn Arg Phe Lys Tyr Val Ile Lys Tyr Ile Asn Pro Ala Asp Ile
                645                 650                 655


Asn Gly Leu Ala Lys Asn Arg Tyr Leu Val Lys Phe Val Leu Ser Lys
            660                 665                 670


Ile Pro Glu Glu Gln Ile Asp Ser Tyr Tyr Lys Leu Phe Ser Asn Glu
        675                 680                 685


Glu Glu Pro Gly Cys Glu Glu Lys Ile Lys Leu Leu Thr Lys Lys Ile
    690                 695                 700


Ser Lys Leu Asn Phe Gln Thr Leu Phe Glu Asn Asn Lys Ile Pro Asn
705                 710                 715                 720


Val Glu Lys Glu Lys Lys Lys Ala Ile Ile Thr Leu Tyr Phe Thr Ile
                725                 730                 735


Val Tyr Ile Leu Val Lys Asn Leu Val Asn Ile Asn Gly Leu Tyr Thr
            740                 745                 750


Leu Ala Leu Tyr Phe Val Glu Arg Asp Gly Tyr Phe Tyr Lys Asp Ile
        755                 760                 765


Cys Gly Lys Lys Asp Lys Lys Lys Ser Tyr Asn Asp Val Asp Tyr Leu
    770                 775                 780


Leu Leu Pro Glu Ile Phe Ser Gly Ser Lys Tyr Arg Glu Glu Thr Lys
785                 790                 795                 800


Asn Leu Lys Leu Pro Lys Glu Lys Asp Arg Asp Ile Met Lys Lys Tyr
                805                 810                 815


Leu Pro Asn Asp Lys Asp Arg Glu Lys Tyr Asn Lys Phe Phe Thr Ala
            820                 825                 830
```

```
Tyr Arg Asn Asn Ile Val His Leu Asn Ile Ile Ala Lys Leu Ser Glu
        835                 840                 845


Leu Thr Lys Asn Ile Asp Lys Asp Ile Asn Ser Tyr Phe Asp Ile Tyr
    850                 855                 860


His Tyr Cys Thr Gln Arg Val Met Phe Asn Tyr Cys Lys Glu Lys Asn
865                 870                 875                 880


Asp Val Val Leu Ala Lys Met Lys Asp Leu Ala His Ile Lys Ser Asp
                885                 890                 895


Cys Asn Glu Phe Ser Ser Lys His Thr Tyr Pro Phe Ser Ser Ala Val
            900                 905                 910


Leu Arg Phe Met Asn Leu Pro Phe Ala Tyr Asn Val Pro Arg Phe Lys
        915                 920                 925


Asn Leu Ser Tyr Lys Lys Phe Phe Asp Lys Gln
    930                 935


<210>  95
<211>  877
<212>  PRT
<213>  Unknown

<220>
<223>  contig  tpg DJXD01000002.1

<400>  95

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


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


Lys Gly Asn Met Ala Asn Leu Ser Tyr Lys Ile Pro Ser Ser Gln Lys
        35                  40                  45


Pro Gln Asn Leu Asn Ser Ser Ala Gly Leu Lys Asn Val Glu Val Ser
    50                  55                  60
```

```
Gly Lys Lys Ile Lys Phe Gln Gly Arg His Pro Lys Ile Ala Thr Thr
65                  70                  75                  80

Asp Asn Pro Leu Phe Lys Pro Gln Pro Gly Met Asp Leu Leu Cys Leu
                85                  90                  95

Lys Asp Lys Leu Glu Met His Tyr Phe Gly Lys Thr Phe Asp Asp Asn
            100                 105                 110

Ile His Ile Gln Leu Ile Tyr Gln Ile Leu Asp Ile Glu Lys Ile Leu
        115                 120                 125

Ala Val His Val Asn Asn Ile Val Phe Thr Leu Asp Asn Val Leu His
    130                 135                 140

Pro Gln Lys Glu Glu Leu Thr Glu Asp Phe Ile Gly Ala Gly Gly Trp
145                 150                 155                 160

Arg Ile Asn Leu Asp Tyr Gln Thr Leu Arg Gly Gln Thr Asn Lys Tyr
                165                 170                 175

Asp Arg Phe Lys Asn Tyr Ile Lys Arg Lys Glu Leu Leu Tyr Phe Gly
            180                 185                 190

Glu Ala Phe Tyr His Glu Asn Glu Arg Arg Tyr Glu Glu Asp Ile Phe
        195                 200                 205

Ala Ile Leu Thr Leu Leu Ser Ala Leu Arg Gln Phe Cys Phe His Ser
    210                 215                 220

Asp Leu Ser Ser Asp Glu Ser Asp His Val Asn Ser Phe Trp Leu Tyr
225                 230                 235                 240

Gln Leu Glu Asp Gln Leu Ser Asp Glu Phe Lys Glu Thr Leu Ser Ile
                245                 250                 255

Leu Trp Glu Glu Val Thr Glu Arg Ile Asp Ser Glu Phe Leu Lys Thr
            260                 265                 270

Asn Thr Val Asn Leu His Ile Leu Cys His Val Phe Pro Lys Glu Ser
        275                 280                 285
```

```
Lys Glu Thr Ile Val Arg Ala Tyr Tyr Glu Phe Leu Ile Lys Lys Ser
    290                 295                 300

Phe Lys Asn Met Gly Phe Ser Ile Lys Lys Leu Arg Glu Ile Met Leu
305                 310                 315                 320

Glu Gln Ser Asp Leu Lys Ser Phe Lys Glu Asp Lys Tyr Asn Ser Val
                325                 330                 335

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

Asp His His Ala Phe Glu Lys Glu Ala Leu Val Ser Ser Leu Arg Ser
        355                 360                 365

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

Thr Leu Ala Ser Ala Leu Gly Ala Asp Phe Lys Lys Ala Ala Ala Asp
385                 390                 395                 400

Val Asn Ala Lys Asn Ile Arg Asp Tyr Gln Lys Lys Ala Asn Asp Tyr
                405                 410                 415

Arg Ile Ser Phe Glu Asp Ile Lys Ile Gly Asn Thr Gly Ile Gly Tyr
            420                 425                 430

Phe Ser Glu Leu Ile Tyr Met Leu Thr Leu Leu Leu Asp Gly Lys Glu
        435                 440                 445

Ile Asn Asp Leu Leu Thr Thr Leu Ile Asn Lys Phe Asp Asn Ile Ile
    450                 455                 460

Ser Phe Ile Asp Ile Leu Lys Lys Leu Asn Leu Glu Phe Lys Phe Lys
465                 470                 475                 480

Pro Glu Tyr Ala Asp Phe Phe Asn Met Thr Asn Cys Arg Tyr Thr Leu
                485                 490                 495
```

```
Glu Glu Leu Arg Val Ile Asn Ser Ile Ala Arg Met Gln Lys Pro Ser
            500                 505                 510

Ala Asp Ala Arg Lys Ile Met Tyr Arg Asp Ala Leu Arg Ile Leu Gly
        515                 520                 525

Met Asp Asn Arg Pro Asp Glu Glu Ile Asp Arg Glu Leu Glu Arg Thr
    530                 535                 540

Met Pro Val Gly Ala Asp Gly Lys Phe Ile Lys Gly Lys Gln Gly Phe
545                 550                 555                 560

Arg Asn Phe Ile Ala Ser Asn Val Ile Glu Ser Ser Arg Phe His Tyr
                565                 570                 575

Leu Val Arg Tyr Asn Asn Pro His Lys Thr Arg Thr Leu Val Lys Asn
            580                 585                 590

Pro Asn Val Val Lys Phe Val Leu Glu Gly Ile Pro Glu Thr Gln Ile
        595                 600                 605

Lys Arg Tyr Phe Asp Val Cys Lys Gly Gln Glu Ile Pro Pro Thr Ser
    610                 615                 620

Asp Lys Ser Ala Gln Ile Asp Val Leu Ala Arg Ile Ile Ser Ser Val
625                 630                 635                 640

Asp Tyr Lys Ile Phe Glu Asp Val Pro Gln Ser Ala Lys Ile Asn Lys
                645                 650                 655

Asp Asp Pro Ser Arg Asn Phe Ser Asp Ala Leu Lys Lys Gln Arg Tyr
            660                 665                 670

Gln Ala Ile Val Ser Leu Tyr Leu Thr Val Met Tyr Leu Ile Thr Lys
        675                 680                 685

Asn Leu Val Tyr Val Asn Ser Arg Tyr Val Ile Ala Phe His Cys Leu
    690                 695                 700

Glu Arg Asp Ala Phe Leu His Gly Val Thr Leu Pro Lys Met Asn Lys
705                 710                 715                 720
```

```
Lys Ile Val Tyr Ser Gln Leu Thr Thr His Leu Leu Thr Asp Lys Asn
                725                 730                 735

Tyr Thr Thr Tyr Gly His Leu Lys Asn Gln Lys Gly His Arg Lys Trp
            740                 745                 750

Tyr Val Leu Val Lys Asn Asn Leu Gln Asn Ser Asp Ile Thr Ala Val
        755                 760                 765

Ser Ser Phe Arg Asn Ile Val Ala His Ile Ser Val Val Arg Asn Ser
    770                 775                 780

Asn Glu Tyr Ile Ser Gly Ile Gly Glu Leu His Ser Tyr Phe Glu Leu
785                 790                 795                 800

Tyr His Tyr Leu Val Gln Ser Met Ile Ala Lys Asn Asn Trp Tyr Asp
                805                 810                 815

Thr Ser His Gln Pro Lys Thr Ala Glu Tyr Leu Asn Asn Leu Lys Lys
            820                 825                 830

His His Thr Tyr Cys Lys Asp Phe Val Lys Ala Tyr Cys Ile Pro Phe
        835                 840                 845

Gly Tyr Val Val Pro Arg Tyr Lys Asn Leu Thr Ile Asn Glu Leu Phe
    850                 855                 860

Asp Arg Asn Asn Pro Asn Pro Glu Pro Lys Glu Glu Val
865                 870                 875
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<210> 96
<211> 36
<212> DNA
<213> Unknown

<220>
<223> CasRX/Cas13d DR

<400> 96
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<210> 97
<211> 984
<212> PRT
<213> Unknown

<220>
<223> contig OGZC01000639.1

<400> 97

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Met Lys Lys Lys Asn Ile Arg Ala Thr Arg Glu Ala Leu Lys Ala Gln
1               5                   10                  15


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


Ala Glu Glu Ala Ala Gln Lys Arg Arg Glu Glu Leu Glu Lys Lys Asn
        35                  40                  45


Leu Ala Gln Trp Glu Glu Thr Ser Ala Glu Gly Arg Arg Ser Arg Val
    50                  55                  60


Lys Ala Val Gly Val Lys Ser Val Phe Val Val Gly Asp Asp Leu Tyr
65                  70                  75                  80


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


Thr Pro Asp Gly Lys Ile Thr Thr Phe Pro Glu Glu Glu Thr Phe Thr
            100                 105                 110


Ala Lys Leu Lys Phe Ala Gln Thr Glu Pro Thr Val Ala Thr Ser Ile
        115                 120                 125


Gly Ile Ser Asn Gly Arg Ile Val Leu Pro Glu Ile Ser Val Asp Asn
    130                 135                 140


Pro Leu His Thr Thr Met Gln Lys Asn Thr Ile Lys Arg Ser Ala Gly
145                 150                 155                 160


Glu Asp Ile Leu Gln Leu Lys Asp Val Leu Glu Asn Arg Tyr Phe Asp
                165                 170                 175
```

```
Arg Ser Phe Asn Asp Asp Leu His Ile Arg Leu Ile Tyr Asn Ile Leu
            180                 185                 190

Asp Ile Glu Lys Ile Leu Ala Glu Tyr Thr Thr Asn Ala Val Phe Ala
        195                 200                 205

Ile Asp Asn Val Ser Gly Cys Ser Asp Asp Phe Leu Ser Asn Phe Ser
    210                 215                 220

Thr Arg Asn Gln Trp Asp Glu Phe Gln Asn Pro Glu Gln His Arg Glu
225                 230                 235                 240

His Phe Gly Asn Lys Asp Asn Val Ile Cys Ser Val Lys Lys Gln Gln
                245                 250                 255

Asp Leu Phe Phe Asn Phe Phe Lys Asn Asn Arg Ile Gly Tyr Phe Gly
            260                 265                 270

Lys Ala Phe Phe His Ala Glu Ser Glu Arg Lys Ile Val Lys Lys Thr
        275                 280                 285

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

Trp Ile Thr His Ser Thr Glu Gly Gly Ile Ser Arg Leu Trp Leu Tyr
305                 310                 315                 320

Gln Leu Glu Asp Ala Leu Ser Arg Glu Tyr Gln Glu Thr Met Asn Asn
                325                 330                 335

Cys Tyr Asn Ser Thr Ile Tyr Gly Leu Gln Lys Asp Phe Glu Lys Thr
            340                 345                 350

Asn Ala Pro Asn Leu Asn Phe Leu Ala Glu Ile Leu Gly Lys Asn Ala
        355                 360                 365

Ser Glu Leu Ala Glu Pro Tyr Phe Arg Phe Ile Ile Thr Lys Glu Tyr
    370                 375                 380

Lys Asn Leu Gly Phe Ser Ile Lys Thr Leu Arg Glu Met Leu Leu Asp
385                 390                 395                 400
```

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

Ile Arg Ser Lys Leu Tyr Lys Met Ile Asp Phe Val Leu Val Tyr Ala
            420                 425                 430

Tyr Ser Asn Glu Arg Lys Ser Lys Ala Asp Ala Leu Ala Ser Asn Leu
        435                 440                 445

Arg Ser Ala Ile Thr Glu Asp Ala Lys Lys Arg Ile Tyr Gln Asn Glu
    450                 455                 460

Ala Asp Gln Leu Trp Thr Ser Tyr Gln Glu Leu Phe Lys Arg Ile Arg
465                 470                 475                 480

Gly Phe Lys Gly Ala Gln Val Lys Glu Tyr Ser Ser Lys Asn Met Pro
               485                 490                 495

Ile Pro Ile Gln Lys Gln Ile Gln Asn Ile Leu Lys Pro Ala Glu Gln
            500                 505                 510

Val Thr Tyr Phe Thr Lys Leu Met Tyr Leu Leu Thr Met Phe Leu Asp
        515                 520                 525

Gly Lys Glu Ile Asn Asp Leu Leu Thr Thr Leu Ile Asn Lys Phe Asp
    530                 535                 540

Asn Ile Ser Ser Leu Leu Lys Thr Met Glu Gln Leu Glu Leu Gln Thr
545                 550                 555                 560

Thr Phe Lys Glu Asp Tyr Thr Phe Phe Gln Gln Ser Ser Arg Leu Cys
               565                 570                 575

Lys Glu Ile Thr Gln Leu Lys Ser Phe Ala Arg Met Gly Asn Pro Ile
            580                 585                 590

Ser Asn Leu Lys Glu Val Met Met Val Asp Ala Ile Gln Ile Leu Gly
        595                 600                 605
```

```
Thr Glu Lys Ser Glu Gln Glu Leu Gln Ser Met Ala Cys Phe Phe Phe
    610                 615                 620

Arg Asp Lys Asn Gly Lys Lys Leu Asn Thr Gly Glu His Gly Met Arg
625                 630                 635                 640

Asn Phe Ile Gly Asn Asn Val Ile Ser Asn Thr Arg Phe Gln Tyr Leu
                645                 650                 655

Ile Arg Tyr Gly Asn Pro Gln Lys Leu His Thr Leu Ser Gln Asn Glu
            660                 665                 670

Thr Val Val Arg Phe Val Leu Ser Arg Ile Ala Lys Asn Gln Arg Val
        675                 680                 685

Gln Gly Met Asn Gly Lys Asn Gln Ile Asp Arg Tyr Tyr Glu Thr Cys
    690                 695                 700

Gly Gly Thr Asn Ser Trp Ser Val Ser Glu Glu Glu Lys Ile Asn Phe
705                 710                 715                 720

Leu Cys Lys Ile Leu Thr Asn Met Ser Tyr Asp Gln Phe Gln Asp Val
                725                 730                 735

Lys Gln Ser Gly Ala Glu Ile Thr Ala Glu Glu Lys Arg Lys Lys Glu
            740                 745                 750

Arg Tyr Lys Ala Ile Ile Ser Leu Tyr Leu Thr Val Leu Tyr Gln Leu
        755                 760                 765

Ile Lys Asn Leu Val Asn Ile Asn Ala Arg Tyr Ile Ile Ala Phe His
    770                 775                 780

Cys Leu Glu Arg Asp Ala Ile Leu Tyr Ser Ser Lys Phe Asn Thr Ser
785                 790                 795                 800

Ile Asn Leu Lys Lys Arg Tyr Thr Ala Leu Thr Glu Met Ile Leu Gly
                805                 810                 815

Tyr Glu Thr Asp Glu Lys Ala Arg Arg Lys Asp Thr Arg Thr Val Tyr
            820                 825                 830
```

```
Glu Lys Ala Glu Ala Ala Lys Asn Arg His Leu Lys Asn Val Lys Trp
        835                 840                 845

Asn Cys Lys Thr Arg Glu Asn Leu Glu Asn Ala Asp Lys Asn Ala Ile
    850                 855                 860

Val Ala Phe Arg Asn Ile Val Ala His Leu Trp Ile Ile Arg Asp Ala
865                 870                 875                 880

Asp Arg Phe Ile Thr Gly Met Gly Ala Met Lys Arg Tyr Phe Asp Cys
                885                 890                 895

Tyr His Tyr Leu Leu Gln Arg Glu Leu Gly Tyr Ile Leu Glu Lys Ser
            900                 905                 910

Asn Gln Gly Ser Glu Tyr Thr Lys Lys Ser Leu Glu Lys Val Gln Gln
        915                 920                 925

Tyr His Ser Tyr Cys Lys Asp Phe Leu His Met Leu Cys Leu Pro Phe
    930                 935                 940

Ala Tyr Cys Ile Pro Arg Tyr Lys Asn Leu Ser Ile Ala Glu Leu Phe
945                 950                 955                 960

Asp Arg His Glu Pro Glu Ala Glu Pro Lys Glu Glu Ala Ser Ser Val
                965                 970                 975

Asn Asn Ser Gln Phe Ile Thr Thr
            980
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<210> 98
<211> 978
<212> PRT
<213> Unknown

<220>
<223> contig emb OHBM01000764.1

<220>
<221> misc_feature
<222> (1)..(222)

<223> Xaa can be any naturally occurring amino acid

<400> 98

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
1   5   10   15

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
            20   25   30

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
        35   40   45

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
    50   55   60

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
65   70   75   80

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
                85   90   95

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
            100   105   110

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
        115   120   125

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
    130   135   140

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
145   150   155   160

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
                165   170   175

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
            180   185   190

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa
        195   200   205

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Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa His Pro
    210                 215                 220

Leu Gln Lys Arg Tyr Arg Tyr Leu Thr Ser Thr Asn Leu Lys Ser Phe
225                 230                 235                 240

Glu Thr Tyr Lys Asn Asn Leu Val Asn Lys Lys Lys Phe Asp Leu Asp
                245                 250                 255

Arg Val Lys Lys Ile Pro Gln Leu Ala Tyr Phe Gly Ser Ala Phe Tyr
            260                 265                 270

Asn Thr Pro Glu Asp Thr Ser Ala Lys Ile Thr Lys Thr Lys Ile Lys
        275                 280                 285

Ser Asn Glu Glu Ile Tyr Tyr Thr Phe Met Leu Leu Ser Thr Ala Arg
    290                 295                 300

Asn Phe Ser Ala His Tyr Leu Asp Arg Asn Arg Ala Lys Ser Ser Asp
305                 310                 315                 320

Ala Glu Asp Phe Asp Gly Thr Ser Val Ile Met Tyr Asn Leu Asp Asn
                325                 330                 335

Glu Glu Leu Tyr Lys Lys Leu Tyr Asn Lys Lys Val His Met Ala Leu
            340                 345                 350

Thr Gly Met Lys Lys Val Leu Asp Ala Asn Phe Asn Lys Lys Val Glu
        355                 360                 365

His Leu Asn Asn Ser Phe Ile Lys Asn Ser Ala Lys Asp Phe Val Ile
    370                 375                 380

Leu Cys Glu Val Leu Gly Ile Lys Ser Arg Asp Glu Lys Thr Lys Phe
385                 390                 395                 400

Val Lys Asp Tyr Tyr Asp Phe Val Val Arg Lys Asn Tyr Lys His Leu
                405                 410                 415
```

```
Gly Phe Ser Val Lys Glu Leu Arg Glu Leu Leu Phe Ala Asn His Asp
            420                 425                 430

Ser Asn Lys Tyr Ile Lys Glu Phe Asp Lys Ile Ser Asn Lys Lys Phe
        435                 440                 445

Asp Ser Val Arg Ser Arg Leu Asn Arg Leu Ala Asp Tyr Ile Ile Tyr
    450                 455                 460

Asp Tyr Tyr Asn Lys Asn Asn Ala Lys Val Ser Asp Leu Val Lys Tyr
465                 470                 475                 480

Leu Arg Ala Ala Ala Asp Asp Glu Gln Lys Lys Lys Ile Tyr Leu Asn
                485                 490                 495

Glu Ser Ile Asn Leu Val Lys Ser Gly Ile Leu Glu Arg Ile Lys Lys
            500                 505                 510

Ile Leu Pro Lys Leu Asn Gly Lys Ile Ile Gly Asn Met Gln Pro Asp
        515                 520                 525

Ser Thr Ile Thr Ala Ser Met Leu His Asn Thr Gly Lys Asp Trp His
    530                 535                 540

Pro Ile Ser Glu Asn Ala His Tyr Phe Thr Lys Trp Ile Tyr Thr Leu
545                 550                 555                 560

Thr Leu Phe Met Asp Gly Lys Glu Ile Asn Asp Leu Val Thr Thr Leu
                565                 570                 575

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

Gln Ser Val Cys Thr His Phe Ser Glu Glu Arg Lys Met Phe Ile Asp
        595                 600                 605

Ser Ala Glu Ile Cys Ser Glu Leu Ser Ala Met Asn Ser Phe Ala Arg
    610                 615                 620

Met Glu Ala Pro Gly Ala Ser Ser Lys Arg Ala Met Phe Val Glu Ala
625                 630                 635                 640
```

```
Ala Arg Ile Leu Gly Asp Asn Arg Ser Lys Glu Glu Leu Glu Glu Tyr
                645                 650                 655

Phe Asp Thr Leu Phe Asp Lys Ser Ala Ser Lys Lys Glu Lys Gly Phe
            660                 665                 670

Arg Asn Phe Ile Arg Asn Asn Val Val Asp Ser Asn Arg Phe Lys Tyr
        675                 680                 685

Leu Thr Arg Tyr Thr Asp Thr Ser Ser Val Lys Ala Phe Ser Asn Asn
    690                 695                 700

Lys Ala Leu Val Lys Phe Ala Ile Lys Asp Ile Pro Gln Glu Gln Ile
705                 710                 715                 720

Leu Arg Tyr Tyr Asn Ser Cys Phe Gly Ala Ser Glu Arg Tyr Tyr Asn
                725                 730                 735

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

Met Gln Phe Asn Gly Val Ile Gln Gln Ala Asp Arg Asn Met Leu Pro
        755                 760                 765

Glu Glu Lys Lys Lys Ala Asn Ala Gln Lys Glu Lys Tyr Lys Ser Ile
    770                 775                 780

Ile Arg Leu Tyr Leu Thr Val Cys Tyr Leu Phe Phe Lys Asn Leu Val
785                 790                 795                 800

Tyr Val Asn Ser Arg Tyr Tyr Ser Ala Phe Tyr Asn Leu Glu Lys Asp
                805                 810                 815

Arg Ser Leu Phe Glu Ile Asn Gly Glu Leu Lys Pro Thr Gly Lys Phe
            820                 825                 830

Asp Glu Gly His Tyr Thr Gly Leu Val Lys Leu Phe Ile Asp Asn Gly
        835                 840                 845
```

```
Trp Ile Asn Pro Arg Ala Ser Ala Tyr Leu Thr Val Asn Leu Ala Asn
    850                 855                 860

Ser Asp Glu Thr Ala Ile Arg Thr Phe Arg Asn Thr Ala Glu His Leu
865                 870                 875                 880

Glu Ala Leu Arg Asn Ala Asp Lys Tyr Leu Asn Asp Leu Lys Gln Phe
                885                 890                 895

Asp Ser Tyr Phe Glu Ile Tyr His Tyr Ile Thr Gln Arg Asn Ile Lys
            900                 905                 910

Glu Lys Cys Glu Met Leu Lys Glu Gln Thr Val Lys Tyr Asn Asn Asp
        915                 920                 925

Leu Leu Lys Tyr His Gly Tyr Ser Lys Asp Phe Val Lys Ala Leu Cys
    930                 935                 940

Val Pro Phe Gly Tyr Asn Leu Pro Arg Phe Lys Asn Leu Ser Ile Asp
945                 950                 955                 960

Ala Leu Phe Asp Lys Asn Asp Lys Arg Glu Lys Leu Lys Lys Gly Phe
                965                 970                 975

Glu Asp
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Leu Asn Lys Gln Lys Trp Ala Lys Asn Asp Ser Val Ile Ile Val Pro
            20                  25                  30
```

```
Glu Thr Lys Glu Glu Ile Lys Thr Gly Glu Ile Gln Asp Asn Asn Arg
        35                  40                  45

Lys Arg Ser Arg Gln Lys Ser Gln Ala Lys Ala Met Gly Leu Lys Ala
    50                  55                  60

Val Leu Ser Phe Asp Asn Lys Ile Ala Ile Ala Ser Phe Val Ser Ser
65                  70                  75                  80

Lys Asn Ala Lys Ser Ser His Ile Glu Arg Ile Thr Asp Lys Glu Gly
                85                  90                  95

Thr Thr Ile Ser Val Asn Ser Lys Met Phe Glu Ser Ser Val Asn Lys
            100                 105                 110

Arg Asp Ile Asn Ile Glu Lys Arg Ile Thr Ile Glu Glu Pro Gln Gln
        115                 120                 125

Asp Gly Thr Ile Lys Lys Glu Glu Lys Gly Val Lys Ser Thr Thr Cys
    130                 135                 140

Asn Pro Tyr Phe Lys Val Gly Gly Lys Asp Tyr Ile Gly Ile Lys Glu
145                 150                 155                 160

Ile Ala Glu Glu His Phe Phe Gly Arg Ala Phe Pro Asn Glu Asn Leu
                165                 170                 175

Arg Val Gln Ile Ala Tyr Asn Ile Phe Asp Val Gln Lys Ile Leu Gly
            180                 185                 190

Thr Phe Val Asn Asn Ile Ile Tyr Ser Phe Tyr Asn Leu Ser Arg Asp
        195                 200                 205

Glu Val Gln Ser Asp Asn Asp Val Ile Gly Met Leu Tyr Ser Ile Ser
    210                 215                 220

Asp Tyr Asp Arg Gln Lys Glu Thr Glu Thr Phe Leu Gln Ala Lys Ser
225                 230                 235                 240

Leu Leu Lys Gln Thr Glu Ala Tyr Tyr Ala Tyr Phe Asp Asp Val Phe
                245                 250                 255
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```
Lys Lys Asn Lys Lys Pro Asp Lys Asn Lys Glu Gly Asp Asn Ser Lys
            260                 265                 270

Gln Tyr Gln Glu Asn Leu Arg His Asn Phe Asn Ile Leu Arg Val Leu
        275                 280                 285

Ser Phe Leu Arg Gln Ile Cys Met His Ala Glu Val His Val Ser Asp
    290                 295                 300

Asp Glu Gly Cys Thr Arg Thr Gln Asn Tyr Thr Asp Ser Leu Glu Ala
305                 310                 315                 320

Leu Phe Asn Ile Ser Lys Ala Phe Gly Lys Lys Met Pro Glu Leu Lys
                325                 330                 335

Thr Leu Ile Asp Asn Ile Tyr Ser Lys Gly Ile Asn Ala Ile Asn Asp
            340                 345                 350

Glu Phe Val Lys Asn Gly Lys Asn Asn Leu Tyr Ile Leu Ser Lys Val
        355                 360                 365

Tyr Pro Asn Glu Lys Arg Glu Val Leu Leu Arg Glu Tyr Tyr Asn Phe
    370                 375                 380

Val Val Cys Lys Glu Gly Ser Asn Ile Gly Ile Ser Thr Arg Lys Leu
385                 390                 395                 400

Lys Glu Thr Met Ile Ala Gln Asn Met Pro Ser Leu Lys Glu Glu Asn
                405                 410                 415

Thr Tyr Arg Asn Lys Leu Tyr Thr Val Met Asn Phe Ile Leu Val Arg
            420                 425                 430

Glu Leu Lys Asn Cys Ala Thr Ile Arg Glu Gln Met Ile Lys Glu Leu
        435                 440                 445

Arg Ala Asn Met Asp Glu Glu Glu Gly Arg Asp Arg Ile Tyr Ser Lys
    450                 455                 460
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```
Tyr Ala Lys Glu Ile Tyr Leu Tyr Val Lys Asp Lys Leu Lys Leu Met
465                 470                 475                 480


Leu Asn Val Phe Lys Glu Glu Ala Glu Gly Ile Ile Ile Pro Gly Lys
                485                 490                 495


Glu Asp Pro Val Lys Phe Ser His Gly Lys Leu Asp Lys Lys Glu Ile
            500                 505                 510


Glu Ser Phe Cys Leu Thr Thr Lys Asn Thr Glu Asp Ile Thr Lys Val
        515                 520                 525


Ile Tyr Phe Leu Cys Lys Phe Leu Asp Gly Lys Glu Ile Asn Glu Leu
    530                 535                 540


Cys Cys Ala Met Met Asn Lys Leu Asp Gly Ile Ser Asp Leu Ile Glu
545                 550                 555                 560


Thr Ala Lys Gln Cys Gly Glu Asp Val Glu Phe Val Asp Gln Phe Lys
                565                 570                 575


Cys Leu Ser Lys Cys Ala Thr Met Ser Asn Gln Ile Arg Ile Val Lys
            580                 585                 590


Asn Ile Ser Arg Met Lys Lys Glu Met Thr Ile Asp Asn Asp Thr Ile
        595                 600                 605


Phe Leu Asp Ala Leu Glu Leu Leu Gly Arg Lys Ile Glu Lys Tyr Gln
    610                 615                 620


Lys Asp Lys Asn Gly Asp Tyr Val Lys Asp Glu Lys Gly Lys Lys Val
625                 630                 635                 640


Tyr Thr Lys Asp Tyr Asn Asn Phe Gln Asp Met Phe Phe Glu Gly Lys
                645                 650                 655


Asn His Arg Val Arg Asn Phe Val Ser Asn Asn Val Ile Lys Ser Lys
            660                 665                 670


Trp Phe Ser Tyr Val Val Arg Tyr Asn Lys Pro Ala Glu Cys Gln Ala
        675                 680                 685
```

```
Leu Met Arg Asn Ser Lys Leu Val Lys Phe Ala Leu Asp Glu Leu Pro
    690                 695                 700

Asp Ser Gln Ile Glu Lys Tyr Tyr Ile Ser Val Phe Gly Glu Lys Ser
705                 710                 715                 720

Ser Ser Ser Asn Glu Glu Met Arg Arg Glu Leu Leu Lys Lys Leu Cys
                725                 730                 735

Asp Phe Ser Val Arg Gly Phe Leu Asp Glu Ile Val Leu Leu Ser Glu
            740                 745                 750

Asp Glu Met Lys Gln Lys Asp Lys Phe Ser Glu Lys Glu Lys Lys Lys
        755                 760                 765

Ser Leu Ile Arg Leu Tyr Leu Thr Ile Val Tyr Leu Ile Thr Lys Ser
    770                 775                 780

Met Val Lys Ile Asn Thr Arg Phe Ser Ile Ala Cys Ala Thr Tyr Glu
785                 790                 795                 800

Arg Asp Tyr Ile Leu Leu Cys Gln Ser Glu Lys Ala Glu Arg Ala Trp
                805                 810                 815

Glu Lys Gly Ala Thr Ala Phe Ala Leu Thr Arg Lys Phe Leu Asn His
            820                 825                 830

Asp Lys Pro Thr Phe Glu Gln Tyr Tyr Thr Arg Glu Arg Glu Ile Ser
        835                 840                 845

Ala Met Pro Gln Glu Lys Arg Lys Glu Leu Arg Lys Glu Asn Asp Gln
    850                 855                 860

Leu Leu Lys Lys Thr His Tyr Ser Lys His Ala Tyr Cys Tyr Ile Val
865                 870                 875                 880

Asp Asn Val Asn Asn Leu Thr Gly Ala Val Ala Asn Asp Asn Gly Arg
                885                 890                 895
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Gly Leu Pro Cys Leu Ser Glu Lys Asn Asp Asn Ala Asn Leu Phe Leu
900 905 910

Glu Met Arg Asn Lys Ile Val His Leu Asn Val Val His Asp Met Val
915 920 925

Lys Tyr Ile Asn Glu Ile Lys Asn Ile Thr Ser Tyr Tyr Ala Phe Phe
930 935 940

Cys Tyr Val Leu Gln Arg Met Ile Ile Gly Asn Asn Ser Asn Glu Gln
945 950 955 960

Asn Lys Phe Lys Ala Lys Tyr Ser Lys Thr Leu Gln Glu Phe Gly Thr
965 970 975

Tyr Ser Lys Asp Leu Met Trp Val Leu Asn Leu Pro Phe Ala Tyr Asn
980 985 990

Leu Pro Arg Tyr Lys Asn Leu Ser Asn Glu Gln Leu Phe Tyr Asp Glu
995 1000 1005

Glu Glu Arg Met Glu Lys Ile Val Gly Arg Lys Asn Asp Ser Arg
1010 1015 1020

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Ala Lys Ser Arg Ser Lys Ala Ala Gly Leu Lys Ser Thr Phe Ala Val
20 25 30

Asn Gly Ser Val Leu Leu Thr Ser Phe Gly Arg Gly Asn Asp Ala Val
35 40 45

```
Pro Glu Lys Leu Ile Thr Glu Lys Ala Val Ser Glu Ile Asn Thr Val
    50                  55                  60

Lys Pro Arg Phe Ser Val Glu Lys Pro Ala Thr Ser Tyr Ser Ser Ser
65                  70                  75                  80

Phe Gly Ile Lys Ser His Ile Ser Ala Thr Ala Asp Asn Pro Leu Ala
                85                  90                  95

Gly Arg Ala Pro Val Gly Glu Asp Ala Ile His Ala Lys Glu Val Leu
            100                 105                 110

Glu Gln Arg Val Phe Gly Lys Thr Phe Ser Asp Asp Asn Ile His Ile
        115                 120                 125

Gln Leu Ile Tyr Asn Ile Leu Asp Ile Arg Lys Ile Leu Ser Thr Tyr
    130                 135                 140

Ala Asn Asn Val Val Phe Thr Ile Asn Ser Met Arg Arg Leu Asp Glu
145                 150                 155                 160

Tyr Asp Arg Glu Gln Asp Tyr Leu Gly Tyr Leu Tyr Thr Gly Asn Ser
                165                 170                 175

Tyr Glu Arg Leu Leu Asp Ile Ala Asp Lys Tyr Ala Val Asp Gly Glu
            180                 185                 190

Asp Trp Arg Asn Thr Ala Ala Gly Ile Ser Asn Asp Phe Glu Lys Lys
        195                 200                 205

Gln Phe Gln Thr Ile Asn Gly Phe Trp Asp Leu Leu Asp Met Ile Glu
    210                 215                 220

Pro Tyr Met Cys Tyr Phe Ser Glu Ala Phe Phe Cys Glu Thr Thr Val
225                 230                 235                 240

Lys Asp Pro Asp Ser Gly Arg Ile Val Pro Cys Leu Glu Gln Arg Ser
                245                 250                 255

Asp Gly Asp Ile Tyr Asn Ile Leu Arg Ile Leu Ser Ile Val Arg Gln
            260                 265                 270
```

```
Thr Cys Met His Asp Asn Ala Ser Met Arg Thr Val Met Phe Thr Leu
        275                 280                 285

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

Glu Leu Leu Asp Tyr Leu Tyr Asp Glu Lys Ile Asp Ile Val Asn Arg
305                 310                 315                 320

Asp Phe Leu Arg Asn Gln Lys Asn Asn Ile Glu Leu Leu Ser Arg Ile
                325                 330                 335

Tyr Gly Ser Ser Ala Asp Ser Pro Glu Arg Asp Arg Leu Val Gln Asn
            340                 345                 350

Phe Tyr Asp Phe Arg Val Leu Ser Gln Asp Lys Asn Leu Gly Phe Ser
        355                 360                 365

Ile Lys Lys Leu Arg Glu Lys Leu Leu Asp Ser Pro Ala Leu Ser Val
    370                 375                 380

Val Arg Ser Lys Lys Tyr Asp Thr Met Arg Ser Lys Ile Tyr Ser Leu
385                 390                 395                 400

Ile Asp Phe Met Ile Tyr Arg Lys Phe Ser Glu Asn His Val Ala Val
                405                 410                 415

Asp Asp Phe Val Glu Glu Leu Arg Ser Leu Leu Thr Glu Asp Glu Lys
            420                 425                 430

Glu Ser Ala Tyr Ser Arg Trp Ala Glu Thr Leu Ile Asn Asp Gly Phe
        435                 440                 445

Ala Gln Glu Ile Leu Val Lys Leu Leu Pro Gln Thr Asp Pro Ala Val
    450                 455                 460

Ile Gly Lys Ile Lys Gly Lys Lys Leu Leu Asn Asp Ser Ile Ala Gly
465                 470                 475                 480
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```
Ile Lys Leu Lys Lys Asp Ala Ser Phe Phe Thr Lys Ile Ile Asn Val
                485                 490                 495

Leu Cys Met Phe Gln Asp Gly Lys Glu Ile Asn Glu Leu Val Ser Ser
            500                 505                 510

Leu Val Asn Lys Phe Ala Asn Ile Gln Ser Phe Val Asp Val Met Arg
        515                 520                 525

Ser Gln Gly Ile Asp Ser Gly Phe Thr Ala Asp Tyr Ala Met Phe Ala
    530                 535                 540

Glu Ser Gly Arg Ile Ser Arg Glu Leu His Ile Leu Lys Gly Ile Ala
545                 550                 555                 560

Arg Met Gln His Ser Ile Ala Gly Leu Gly Asp Val Lys Ile Tyr Gly
                565                 570                 575

Ser Asp Asp Lys Phe His Gly Val Ser Arg Arg Val Tyr Thr Asp Ala
            580                 585                 590

Ala Tyr Ile Leu Gly Phe Gly Glu Arg Ser Glu Asp Asn Asp Gly Tyr
        595                 600                 605

Val Asp Asp Tyr Val Ser Ser Lys Leu Leu Gly Gly Ala Asp Lys Asn
    610                 615                 620

Leu Arg Asn Phe Ile Thr Asn Asn Val Ile Lys Asn Arg Arg Phe Leu
625                 630                 635                 640

Tyr Thr Val Arg Tyr Met Asn Pro Lys Arg Ala Lys Lys Leu Val Gln
                645                 650                 655

Asn Asp Ala Leu Val Val Leu Ala Leu Ser Gly Ile Pro Glu Thr Gln
            660                 665                 670

Ile Asp Arg Tyr Tyr Lys Ser Cys Ile Glu Lys Arg Ser Phe Asn Pro
        675                 680                 685

Asp Leu Asn Glu Lys Ile Ala Ala Leu Ser Glu Met Ile Thr Thr Leu
    690                 695                 700
```

```
Lys Ile Asp Asp Phe Glu Asp Val Lys Gln Asn Pro Glu Lys Asn Ala
705                 710                 715                 720


Asn Tyr Glu Ala Lys Lys Asn Gln Arg Ile Ser Lys Glu Arg Tyr Lys
                725                 730                 735


Ala Cys Ile Gly Leu Tyr Leu Thr Val Leu Tyr Leu Ile Cys Lys Asn
            740                 745                 750


Leu Val Lys Ile Asn Ala Arg Tyr Ser Ile Ala Ile Gly Cys Leu Glu
        755                 760                 765


Arg Asp Thr Gln Leu His Gly Val Asp Phe Lys Gly Ala Ala Tyr Met
    770                 775                 780


Thr Arg Asp Val Phe Ile Ala Lys Gly Trp Ile Asn Pro Lys Lys Pro
785                 790                 795                 800


Thr Val Lys Ser Ile Lys Glu Gln Tyr Ala Phe Leu Thr Pro Tyr Ile
                805                 810                 815


Phe Thr Thr Tyr Arg Asn Met Ile Ala His Leu Ala Ala Val Thr Asn
            820                 825                 830


Ala Tyr Lys Tyr Ile Pro Gln Met Asp Arg Phe Lys Ser Trp Phe His
        835                 840                 845


Leu Tyr His Thr Val Ile Gln His Ser Leu Ile Gln Gln Tyr Glu Tyr
    850                 855                 860


Asp Arg Asp Tyr Gly Arg Lys Gly Ala Pro Val Val Ser Glu Arg Val
865                 870                 875                 880


Leu Gln Leu Leu Glu Gln Cys Arg Glu His Ser Asn Tyr Ser Arg Asp
                885                 890                 895


Leu Leu His Ile Leu Asn Leu Pro Phe Gly Tyr Asn Leu Pro Arg Tyr
            900                 905                 910
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Leu Asn Leu Ser Ser Glu Lys Tyr Phe Asp Ala Asn Ala Ile
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Leu Asn Lys Gln Lys Trp Ala Lys Gln Asp Thr Pro Val Val Pro Lys
20 25 30

Ser Lys Thr Glu Glu Lys Pro Val Ala Ala Ser Asp Asp Lys Leu Leu
35 40 45

Lys Thr Thr Gln Val Lys Lys Val Gln Thr Lys Ser Lys Ala Lys Ala
50 55 60

Met Gly Leu Lys Thr Val Leu Ser Phe Asp Asp Lys Ile Ala Ile Ala
65 70 75 80

Ser Phe Val Asn Asp Lys Lys Thr Lys Leu Pro His Ile Glu Arg Ile
85 90 95

Thr Asp Lys Ser Gly Thr Thr Ile His Glu Asn Ala Arg Met Phe Asp
100 105 110

Ser Ser Val Asp Glu Gln Asn Val Asn Ile Glu Lys Arg Met Thr Ile
115 120 125

Glu Glu Lys Gln Asn Asp Gly Thr Phe Lys Lys Asp Glu Lys Asp Val
130 135 140

Lys Ala Thr Ile Cys Asn Pro Tyr Phe Lys Thr Cys Gly Lys Asp Tyr
145 150 155 160

```
Ile Gly Ile Lys Asp Val Ala Glu Lys Tyr Phe Phe Gly Lys Thr Phe
                165                 170                 175

Pro Asn Glu Asn Leu Arg Val Gln Ile Ala Tyr Asn Val Phe Asp Ile
            180                 185                 190

Gln Lys Ile Leu Gly Thr Tyr Val Asn Asn Ile Ile Tyr Ser Phe Tyr
        195                 200                 205

Asn Leu Arg Arg Asp Gly Lys Ser Asp Val Asp Ile Ile Gly Ser Leu
    210                 215                 220

Tyr Ala Phe Ala Asp Phe Asp Asn Gln Leu Lys Asp Lys Pro Ala Phe
225                 230                 235                 240

Arg Glu Ala Lys Asp Leu Leu Lys Asn Thr Glu Ala Tyr Phe Ser Tyr
                245                 250                 255

Phe Gly Asp Val Phe Lys Lys Ser Lys Lys Gly Lys Lys Asp Glu Asn
            260                 265                 270

Asn Glu Asp Tyr Glu Lys Asn Leu Arg His Asn Phe Asn Val Leu Arg
        275                 280                 285

Val Leu Ser Phe Leu Arg Gln Ile Cys Thr His Ala Tyr Val Lys Cys
    290                 295                 300

Thr Gly Gly Ala Lys Asn Asn Gly Asp Ser Thr Lys Val Glu Ala Glu
305                 310                 315                 320

Ser Leu Asp Ala Leu Phe Asn Ile Thr Glu Tyr Phe Ala Lys Thr Ala
                325                 330                 335

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

Arg Ile Asn Asn Asp Phe Val Thr Asn Gly Lys Asn Asn Leu Tyr Ile
        355                 360                 365

Leu Ser Lys Val Tyr Pro Asp Met Gln Arg Asn Glu Leu Val Lys Lys
    370                 375                 380
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```
Tyr Tyr Gln Phe Val Val Cys Lys Glu Gly Asn Asn Val Gly Ile Asn
385                 390                 395                 400

Thr Arg Lys Leu Lys Glu Ser Ile Ile Ser Gln His Pro Trp Ile Thr
                405                 410                 415

Thr Pro Gln Asp Asn Asn Lys Ala Asn Asp Tyr Glu Ser Cys Arg His
            420                 425                 430

Lys Leu Tyr Thr Ile Met Cys Phe Ile Leu Val Ala Glu Leu Asp Ala
        435                 440                 445

His Glu Ser Ile Arg Asp Asn Met Val Ala Glu Leu Arg Ala Asn Met
    450                 455                 460

Asp Gly Asp Asp Gly Arg Asp Ala Ile Tyr Glu Lys Tyr Ala Lys Asp
465                 470                 475                 480

Ile Tyr His Ile Val Lys Asp Lys Leu Leu Ala Met Gln Lys Val Phe
                485                 490                 495

Asp Glu Glu Leu Val Pro Val Lys Val Glu Gly Lys Asn Asp Pro Gln
            500                 505                 510

Gln Phe Thr His Gly Lys Leu Gly Lys Lys Glu Ile Glu Ser Phe Cys
        515                 520                 525

Leu Ser Asp Lys Asn Thr Ser Asp Ile Ala Lys Val Val Tyr Phe Leu
    530                 535                 540

Cys Asn Phe Leu Asp Gly Lys Glu Ile Asn Glu Leu Cys Cys Ala Met
545                 550                 555                 560

Met Asn Lys Phe Asp Gly Ile Gly Asp Leu Ile Asp Thr Ala Lys Gln
                565                 570                 575

Cys Gly Glu Glu Val Lys Phe Ile Glu Glu Phe Ala Cys Leu Ser Asn
            580                 585                 590
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```
Cys Arg Lys Ile Thr Asn Asp Ile Arg Val Ala Lys Ser Ile Ser Lys
        595                 600                 605

Met Lys Asn Lys Val Asn Ile Asp Asn Asp Ile Ile Tyr Leu Asp Ala
    610                 615                 620

Ile Glu Leu Leu Gly Arg Lys Ile Glu Lys Tyr Gln Lys Asp Glu Asn
625                 630                 635                 640

Gly Lys Ile Leu Leu Gly Thr Asp Gly Lys Arg Leu Tyr Thr Gln Glu
                645                 650                 655

Tyr Lys Tyr Phe Asn Asp Met Phe Phe Asn Ala Gly Asn His Lys Val
            660                 665                 670

Arg Asn Phe Ile Ala Asn Asn Val Met Gln Ser Lys Trp Phe Phe Tyr
        675                 680                 685

Val Val Arg Tyr Asn Lys Pro Ala Glu Cys Gln Ile Ile Met Arg Asn
    690                 695                 700

Lys Thr Leu Val Lys Phe Thr Leu Asp Asp Leu Pro Asp Met Gln Ile
705                 710                 715                 720

Gln Arg Tyr Tyr Ser Ser Val Phe Gly Asp Asn Asn Met Pro Ala Val
                725                 730                 735

Asp Glu Met Arg Lys Arg Leu Leu Asp Lys Ile Asn Gln Phe Ser Val
            740                 745                 750

Arg Gly Phe Leu Asp Glu Leu Asp Glu Ile Val Leu Met Ser Asp Glu
        755                 760                 765

Glu Ser Lys Arg Asn Lys Ser Ser Glu Lys Glu Gln Lys Lys Ser Leu
    770                 775                 780

Ile Arg Leu Tyr Leu Thr Ile Ala Tyr Leu Ile Thr Lys Ser Met Val
785                 790                 795                 800

Lys Ile Asn Thr Arg Phe Ser Ile Ala Cys Ala Met Tyr Glu Arg Asp
                805                 810                 815
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Tyr Ala Leu Leu Cys Gln Ser Glu Met Lys Gly Gly Pro Trp Asp Gly
            820                 825                 830

Gly Ala Gln Ala Leu Ala Val Thr Arg Lys Phe Leu Asn His Asp Arg
        835                 840                 845

Glu Val Phe Asp Arg Tyr Cys Ala Arg Glu Ala Glu Ile Ala Arg Leu
    850                 855                 860

Pro Ser Glu Glu Arg Lys Pro Leu Arg Lys Ala Asn Asp Lys Leu Leu
865                 870                 875                 880

Lys Gln Thr His Tyr Thr Asn His Ser Tyr Thr Tyr Ile Val Asn Asn
                885                 890                 895

Leu Asn Ser Phe Thr Asp Ile Asp Tyr Cys Ala Lys Asp Val Gly Leu
            900                 905                 910

Pro Ala Pro Asn Asp Lys Asn Asp Asn Ala Ser Ile Leu Gly Glu Met
        915                 920                 925

Arg Asn Asp Ile Ala His Leu Asn Ile Val His Asp Met Val Lys Tyr
    930                 935                 940

Ile Glu Glu Leu Lys Asp Ile Ser Ser Tyr Tyr Ala Phe Tyr Cys Tyr
945                 950                 955                 960

Val Leu Gln Arg Arg Leu Val Gly Lys Asp Pro Asn Cys Gln Asn Lys
                965                 970                 975

Phe Lys Ala Lys Tyr Ala Lys Glu Leu Asn Asp Tyr Gly Thr Tyr Asn
            980                 985                 990

Lys Asn Leu Met Trp Met Leu Asn  Leu Pro Phe Ala Tyr  Asn Leu Pro
        995                 1000                1005

Arg Tyr  Lys Asn Leu Ser Ser  Glu Phe Leu Phe Tyr  Asp Met Glu
    1010                1015                1020
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Tyr Asn Lys Lys Asp Asp Glu
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Gln Asn Lys Gln Lys Trp Ala Lys Lys Gln Ala Asp Ala Thr Ala Val
            20   25   30

Phe Glu Cys Glu Ala Asp Ile Lys Pro Ala Asp Ser Lys Asp Glu Asp
        35   40   45

Cys Thr Asn Ile Tyr Ile Lys Arg Glu Lys Lys Lys Thr Gln Ala Lys
    50   55   60

Ala Met Gly Leu Lys Thr Val Leu Gly Phe Asp Asn Lys Ile Ala Ile
65   70   75   80

Ala Ser Phe Met Ser Ser Lys Asp Ser Lys Ser Ser His Ile Glu Arg
                85   90   95

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

Asp Ser Asn Val Asp Glu Cys Ser Ile Asn Leu Glu Lys Arg Met Thr
        115   120   125

Val Glu Glu Arg Gln Lys Asp Gly Thr Ile Lys Lys Asp Glu Lys Asp
    130   135   140

Val Lys Ser Thr Ile Cys Asn Pro Tyr Ser Asn Glu Cys Gly Lys Asp
145   150   155   160

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

Phe Pro Asn Asp Asn Leu Arg Val Gln Ile Ala Tyr Asn Ile Phe Asp
            180                 185                 190

Ile Gln Lys Ile Leu Gly Thr Tyr Ile Asn Asn Ile Ile Tyr Ser Phe
        195                 200                 205

Tyr Asn Leu Ser Arg Asp Glu Ser Gln Ser Asp Asn Asp Val Ile Gly
    210                 215                 220

Thr Leu Tyr Met Leu Lys Asp Phe Asp Gly Gln Lys Glu Thr Asp Thr
225                 230                 235                 240

Phe Arg Gln Ala Arg Ala Leu Leu Glu Arg Thr Glu Ala Tyr Tyr Ser
                245                 250                 255

Tyr Phe Asp Asn Val Phe Lys Lys Ile Asp Lys Asn Lys Lys Lys Ser
            260                 265                 270

Asp Asp Cys Lys Arg Glu Arg Asn Glu Ile Leu Arg Tyr Asn Phe Asn
        275                 280                 285

Val Leu Arg Val Leu Ser Phe Leu Arg Gln Ile Cys Ala His Ala Gln
    290                 295                 300

Val Lys Ile Ser Asn Glu His Asp Arg Glu Lys Gly Gly Gly Leu Val
305                 310                 315                 320

Asp Ser Leu Asp Ala Leu Phe Asn Ile Ser Arg Phe Phe Asp Ala Val
                325                 330                 335

Ala Pro Glu Leu Asn Glu Val Ile Asn Ser Val Tyr Ser Lys Gly Ile
            340                 345                 350

Asp Asp Ile Asn Asp Asn Phe Val Lys Asn Gly Lys Asn Asn Phe Tyr
        355                 360                 365

Ile Leu Ser Lys Ile Tyr Pro Glu Val Ala Arg Glu Asp Leu Leu Arg
    370                 375                 380
```

```
Glu Tyr Tyr Tyr Phe Val Val Ser Lys Glu Gly Asn Asn Ile Gly Ile
385                 390                 395                 400

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

Ile Lys Ser Glu Asp Tyr Asp Thr Tyr Arg Asn Lys Leu Tyr Thr Val
            420                 425                 430

Leu Cys Phe Ile Leu Val Lys Glu Leu Asn Glu Arg Thr Thr Ile Arg
        435                 440                 445

Glu Gln Met Val Ala Asp Leu Arg Ala Asn Met Asn Gly Asp Ile Gly
    450                 455                 460

Arg Glu Asp Ile Tyr Ser Lys Tyr Ala Lys Ile Ile Tyr Ala Gln Val
465                 470                 475                 480

Lys Pro Arg Phe Asp Thr Met Lys Ser Ala Phe Glu Glu Glu Ala Lys
                485                 490                 495

Asp Val Ile Val Pro Asp Lys Lys Lys Pro Val Lys Phe Ser His Gly
            500                 505                 510

Lys Leu Asp Lys Asn Glu Ile Glu Arg Phe Cys Ile Thr Ser Ala Asn
        515                 520                 525

Thr Asp Ser Val Ala Lys Ile Ile Tyr Phe Leu Cys Lys Phe Leu Asp
    530                 535                 540

Gly Lys Glu Ile Asn Glu Leu Cys Cys Ala Met Met Asn Lys Leu Asp
545                 550                 555                 560

Gly Ile Asn Asp Leu Ile Glu Thr Ala Glu Gln Cys Gly Ala Lys Val
                565                 570                 575

Glu Phe Val Asp Lys Phe Ser Val Leu Ser Asn Cys Glu Thr Ile Ser
            580                 585                 590
```

```
Asp Gln Ile Arg Ile Val Lys Ser Ile Ser Lys Met Lys Lys Glu Ile
        595                 600                 605

Ala Ile Asp Asn Asp Thr Ile Phe Leu Asp Ala Leu Glu Leu Leu Gly
    610                 615                 620

Arg Lys Ile Asp Lys Tyr Lys Lys Asp Ala Thr Gly Lys Tyr Leu Lys
625                 630                 635                 640

Asp Glu Asn Gly Lys Tyr Leu Tyr Ser Lys Glu Tyr Asp Asp Phe Gln
                645                 650                 655

Tyr Met Phe Phe Lys Asp Ser His Arg Val Arg Asn Phe Ile Ser Asn
            660                 665                 670

Ser Val Ile Lys Ser Lys Trp Phe Ser Tyr Ile Val Arg Tyr Asn Gln
        675                 680                 685

Pro Ser Glu Cys Arg Ala Ile Met Lys Asn Lys Thr Leu Val Lys Phe
    690                 695                 700

Ala Leu Asp Glu Leu Pro Asp Leu Gln Ile Gln Arg Tyr Phe Val Ala
705                 710                 715                 720

Leu Tyr Gly Asp Glu Asp Leu Pro Ser Tyr Gly Glu Met Arg Lys Ile
                725                 730                 735

Leu Leu Lys Lys Leu His Asp Phe Ser Ile Lys Gly Phe Leu Asp Glu
            740                 745                 750

Ile Val Leu Leu Ser Asp Leu Asp Met Glu Ser Gln Asp Lys Tyr Cys
        755                 760                 765

Glu Lys Glu Gln Lys Lys Ser Leu Phe Arg Leu Tyr Leu Thr Ile Ala
    770                 775                 780

Tyr Leu Ile Thr Lys Ser Met Val Lys Ile Asn Thr Arg Phe Ser Ile
785                 790                 795                 800

Ala Cys Ala Thr Tyr Glu Arg Asp Tyr Ala Leu Leu Cys Ala Ser Asn
                805                 810                 815
```

```
Lys Gln Glu Arg Ala Trp Ser Ser Gly Ala Thr Ala Leu Ala Leu Thr
            820                 825                 830

Arg Arg Phe Leu Asn Gln Asp Lys Leu Ile Phe Glu Lys His Tyr Ala
        835                 840                 845

Arg Glu Gly Glu Ile Ser Lys Leu Pro Lys Glu Glu Arg Lys Ala Met
    850                 855                 860

Arg Lys Val Asn Asp Gln Leu Leu Lys Arg Thr His Phe Ser Lys His
865                 870                 875                 880

Ser Tyr Cys Tyr Ile Val Asp Asn Val Asn Arg Leu Thr Gly Gly Glu
                885                 890                 895

Cys Arg Thr Asp Lys Arg Val Leu Pro Val Leu Asn Glu Lys Asn Asp
            900                 905                 910

Asn Ala Gly Ile Leu Leu Asp Phe Arg Lys Thr Ile Ala His Leu Asn
        915                 920                 925

Val Val His Lys Met Val Asp Tyr Val Asp Glu Ile Lys Gly Ile Thr
    930                 935                 940

Ser Tyr Tyr Ala Phe Phe Cys Tyr Val Leu Gln Arg Met Leu Val Gly
945                 950                 955                 960

Asn Asn Leu Asn Glu Lys Asn Ala Ile Lys Glu Lys Tyr Ser Ala Thr
                965                 970                 975

Val Lys Ser Phe Gly Thr Tyr Ser Lys Asp Phe Met Trp Leu Ile Asn
            980                 985                 990

Leu Pro Phe Ala Tyr Asn Leu Pro  Arg Tyr Lys Asn Leu  Ser Asn Glu
        995                 1000                1005

Gln Leu  Phe Tyr Asp Glu Glu  Glu Arg Asn Glu Thr  Glu Glu Gln
    1010                1015                1020
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Ile Asp Arg Leu
    1025

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Met Ala Lys Lys Lys Lys Thr Ala Arg Gln Leu Arg Glu Glu Met Gln
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Gln Gln Arg Lys Gln Ala Ile Gln Lys Gln Gln Glu Gln Arg Gln Glu
            20   25   30

Lys Ala Ala Ala Ala Arg Glu Thr Ala Ala Pro Glu Gln Pro Ala Ala
        35   40   45

Ala Pro Val Pro Lys Arg Gln Arg Lys Ser Leu Ala Lys Ala Ala Gly
    50   55   60

Leu Lys Ser Asn Phe Ile Leu Asp Pro Gln Arg Arg Thr Thr Val Met
65   70   75   80

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

Asp Arg Ala Ile Ser Asp Leu Gln Pro Val Gln Gln Phe Gln Val Glu
            100   105   110

Pro Ala Ser Ala Ala Lys Tyr Arg Leu Lys Asn Ser Arg Val Arg Phe
        115   120   125

Pro Asn Val Thr Ala Asp Asp Pro Leu Tyr Arg Arg Lys Asp Gly Gly
    130   135   140

Phe Val Pro Gly Met Asp Ala Leu Arg Arg Lys Asn Val Leu Glu Gln
145   150   155   160

```
Arg Phe Phe Gly Lys Ser Phe Ala Asp Asn Ile His Ile Gln Met Ile
                165                 170                 175

Tyr Ser Ile Leu Asp Ile His Lys Ile Leu Ala Ala Ala Ser Gly His
            180                 185                 190

Ile Val His Leu Leu Asn Ile Val Asn Gly Ser Lys Asp Arg Asp Phe
        195                 200                 205

Ile Gly Met Leu Ala Ala His Val Leu Tyr Asn Glu Leu Asn Glu Glu
    210                 215                 220

Ala Lys Arg Ser Ile Ala Asp Phe Cys Lys Ser Pro Arg Leu Ile Tyr
225                 230                 235                 240

Tyr Ser Ala Ala Phe Tyr Glu Thr Leu Asp Asn Gly Lys Ser Glu Arg
                245                 250                 255

Arg Ser Asn Glu Asp Ile Phe Asn Ile Leu Ala Leu Met Thr Cys Leu
            260                 265                 270

Arg Asn Phe Ser Ser His His Ser Ile Ala Ile Lys Val Lys Asp Tyr
        275                 280                 285

Ser Ala Ala Gly Leu Tyr Asn Leu Arg Arg Leu Gly Pro Asp Met Lys
    290                 295                 300

Lys Met Leu Asp Thr Phe Tyr Thr Glu Ala Phe Ile Gln Leu Asn Gln
305                 310                 315                 320

Ser Phe Gln Asp His Asn Thr Thr Asn Leu Thr Cys Leu Phe Asp Ile
                325                 330                 335

Leu Asn Ile Ser Asp Ser Ala Arg Gln Lys Gln Leu Ala Glu Glu Phe
            340                 345                 350

Tyr Arg Tyr Val Val Phe Lys Glu Gln Lys Asn Leu Gly Phe Ser Val
        355                 360                 365

Arg Lys Leu Arg Glu Glu Met Leu Leu Leu Pro Asp Ala Ala Val Ile
    370                 375                 380
```

```
Ala Asp Lys Arg Tyr Asp Thr Cys Arg Ser Lys Leu Tyr Asn Leu Met
385                 390                 395                 400

Asp Phe Leu Ile Leu Arg Val Tyr Arg Thr Gly Arg Ala Asp Arg Cys
                405                 410                 415

Asp Lys Leu Pro Glu Ala Leu Arg Ala Ala Leu Thr Asp Glu Glu Lys
            420                 425                 430

Ala Val Val Tyr His Lys Glu Ala Leu Ser Leu Trp Asn Glu Met Arg
        435                 440                 445

Thr Leu Ile Leu Asp Gly Leu Leu Pro Gln Met Thr Pro Glu Asn Leu
    450                 455                 460

Ser Arg Leu Ser Gly Gln Lys Arg Lys Gly Glu Leu Ser Leu Asp Asp
465                 470                 475                 480

Ala Met Leu Lys Glu Cys Leu Tyr Glu Pro Gly Pro Val Pro Glu Asp
                485                 490                 495

Ala Ala Pro Glu Glu Ala Asn Ala Glu Tyr Phe Cys Arg Met Ile Tyr
            500                 505                 510

Leu Ala Thr Leu Phe Met Asp Gly Lys Glu Ile Asn Thr Leu Leu Thr
        515                 520                 525

Thr Leu Ile Ser Lys Phe Glu Asn Ile Ala Ala Phe Leu Gln Thr Met
    530                 535                 540

Glu Gln Leu Asn Ile Glu Ala Glu Leu Gly Pro Glu Tyr Ala Met Phe
545                 550                 555                 560

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

Ala Leu Met Lys Lys Pro Gln Val Asn Ala Lys Gln Gln Leu Tyr Arg
            580                 585                 590
```

```
Ala Ala Val Thr Leu Leu Gly Thr Glu Asp Pro Asp Gly Val Thr Asp
        595                 600                 605

Glu Met Leu Cys Ile Asp Pro Val Thr Gly Lys Met Leu Pro Pro Asn
    610                 615                 620

Gln Arg His His Gly Asp Thr Gly Leu Arg Asn Phe Ile Ala Asn Asn
625                 630                 635                 640

Val Val Glu Ser Arg Arg Phe Gln Tyr Leu Ile Arg Tyr Ser Asp Pro
                645                 650                 655

Ala Gln Leu His Gln Leu Ala Ser Asn Lys Lys Leu Val Arg Phe Val
            660                 665                 670

Leu Ser Ser Ile Pro Asp Thr Gln Ile Asn Arg Tyr Tyr Glu Thr Cys
        675                 680                 685

Gly Gln Thr Arg Leu Ala Gly Arg Ala Ala Lys Val Glu Phe Leu Thr
    690                 695                 700

Asp Met Ile Ala Ala Ile Arg Phe Asp Gln Phe Arg Asp Val Asn Gln
705                 710                 715                 720

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

Gly Leu Tyr Gln Thr Val Leu Tyr Leu Ala Val Lys Asn Leu Val Asn
            740                 745                 750

Ile Asn Ala Arg Tyr Val Met Ala Phe His Cys Val Glu Arg Asp Met
        755                 760                 765

Phe Leu Tyr Asp Gly Glu Leu Thr Asp Pro Lys Gly Glu Ser Val Ser
    770                 775                 780

Ala Phe Leu Ala Val Asn Gly Lys Lys Gly Val Gln Pro Gln Tyr Leu
785                 790                 795                 800

Leu Leu Thr Gln Leu Phe Ile Arg Arg Asp Tyr Leu Lys Arg Ser Ala
                805                 810                 815
```

```
Cys Glu Gln Ile Gln His Asn Met Glu Asn Ile Ser Asp Arg Leu Leu
            820                 825                 830

Arg Glu Tyr Arg Asn Ala Val Ala His Leu Asn Val Ile Ala His Leu
        835                 840                 845

Ala Asp Tyr Ser Ala Asp Met Arg Glu Ile Thr Ser Tyr Tyr Gly Leu
    850                 855                 860

Tyr His Tyr Leu Met Gln Arg His Leu Phe Lys Arg His Ala Trp Gln
865                 870                 875                 880

Ile Arg Gln Pro Glu Arg Pro Thr Glu Glu Glu Gln Lys Leu Ile Glu
                885                 890                 895

Gln Glu Gln Lys Gln Leu Ala Trp Glu Lys Ala Leu Phe Asp Lys Thr
            900                 905                 910

Leu Gln Tyr His Ser Tyr Asn Lys Asp Leu Val Lys Ala Leu Asn Ala
        915                 920                 925

Pro Phe Gly Tyr Asn Leu Ala Arg Tyr Lys Asn Leu Ser Ile Glu Pro
    930                 935                 940

Leu Phe Ser Lys Glu Ala Ala Pro Ala Ala Glu Ile Lys Ala Thr His
945                 950                 955                 960

Ala
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Met Lys Gln Asn Asp Arg Glu Asn Asn Asn Lys Ile Lys Lys Ser Ala
1               5                   10                  15
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Ala Lys Ala Val Gly Val Lys Ser Leu Ala Arg Leu Ser Asp Gly Ser
            20                  25                  30

Thr Val Val Ser Ser Phe Gly Lys Gly Ala Ala Ala Glu Leu Glu Ser
        35                  40                  45

Leu Ile Thr Gly Gly Glu Ile Arg Lys Leu Ser Asp Lys Ala Ile Leu
    50                  55                  60

Glu Ile Thr Asp Asp Thr Gln Asn Lys Asn Ala Tyr Asn Val Lys Ser
65                  70                  75                  80

Ser Arg Ile Pro Asn Leu Thr Ala Arg Thr Asp Lys Leu Ser Asp Lys
                85                  90                  95

Ser Gly Met Asp Asp Leu Gly Phe Lys Arg Glu Leu Glu Leu Glu Val
            100                 105                 110

Phe Gly Gln Cys Phe Asp Asp Ser Ile His Ile Gln Ile Ala His Ala
        115                 120                 125

Val Phe Asp Ile Gln Lys Ser Leu Ala Ala Val Ile Pro Asn Val Leu
    130                 135                 140

Tyr Thr Leu Asn Asn Leu Asp Arg Ser Tyr Ser Thr Asp Asn Thr Ser
145                 150                 155                 160

Asp Lys Lys Asp Ile Ile Gly Asn Thr Leu Asn Tyr Gln His Ser Tyr
                165                 170                 175

Glu Ser Phe Asn Val Glu Lys Arg Gly Glu Phe Thr Glu Tyr Tyr Asn
            180                 185                 190

Ala Ala Lys Asp Arg Phe Ser Tyr Phe Pro Asp Ile Leu Cys Val Leu
        195                 200                 205

Glu Lys Val Asn Gly Lys Asp Arg Tyr Gln Pro Lys Ser Glu Lys Asp
    210                 215                 220
```

```
Ala Phe Asn Val Leu Ser Ser Val Asn Met Leu Arg Asn Ser Leu Phe
225                 230                 235                 240


His Phe Ala Pro Lys Ser Asn Asp Gly Lys Ala Arg Ile Ala Val Phe
                245                 250                 255


Lys Asn Gln Phe Asp Ser Asp Phe Ser His Ile Thr Ser Thr Val Asn
            260                 265                 270


Lys Ile Tyr Ser Ala Lys Ile Ala Gly Val Asn Glu Asn Phe Leu Asn
        275                 280                 285


Asn Glu Gly Asn Asn Leu Tyr Ile Ile Leu Lys Ala Thr Asn Trp Asp
    290                 295                 300


Ile Lys Lys Ile Val Pro Gln Leu Tyr Arg Phe Ser Val Leu Lys Ser
305                 310                 315                 320


Asp Lys Asn Met Gly Phe Asn Met Arg Lys Leu Arg Glu Phe Ala Val
                325                 330                 335


Glu Ser Lys Asn Ile Asp Leu Ser Arg Leu Asn Asp Lys Phe Leu Thr
            340                 345                 350


Asn Asn Arg Lys Lys Leu Tyr Lys Val Ile Asp Phe Ile Ile Tyr Tyr
        355                 360                 365


His Leu Asn Lys Val Leu Lys Asp Ser Phe Val Asp Asp Phe Val Ala
    370                 375                 380


Ala Leu Arg Ala Ser Gln Ser Glu Glu Glu Lys Glu Lys Leu Tyr Ala
385                 390                 395                 400


Gln Tyr Ser Glu Arg Leu Phe Ala Asp Glu Gly Leu Lys Ser Ala Ile
                405                 410                 415


Lys Lys Ala Val Asp Met Ile Ser Asp Thr Lys Ser Asn Ile Phe Lys
            420                 425                 430


Met Lys Thr Pro Leu Asp Lys Ala Leu Ile Glu Asn Ile Lys Val Asn
        435                 440                 445
```

```
Ser Asp Ala Ser Asp Phe Cys Lys Leu Ile Tyr Val Phe Thr Arg Phe
    450                 455                 460

Leu Asp Gly Lys Glu Ile Asn Ile Leu Leu Asn Ser Leu Ile Lys Lys
465                 470                 475                 480

Phe Gln Asp Ile His Ser Phe Asn Thr Thr Val Lys Lys Leu Ser Glu
                485                 490                 495

Asn Asn Leu Ile Ile Asn Ala Asp Tyr Val Asp Asp Tyr Ser Leu Phe
            500                 505                 510

Glu Gln Ser Gly Thr Val Ala Arg Glu Leu Met Leu Ile Lys Ser Ile
        515                 520                 525

Ser Lys Met Asp Phe Gly Leu Asp Asn Ile Asn Leu Ser Phe Met Tyr
    530                 535                 540

Asp Asp Ala Leu Arg Thr Leu Gly Val Ser Asp Glu Asn Leu Pro Glu
545                 550                 555                 560

Val Lys Arg Glu Tyr Phe Gly Lys Thr Lys Asn Leu Ser Ala Tyr Ile
                565                 570                 575

Arg Asn Asn Val Leu Glu Asn Arg Arg Phe Lys Tyr Val Ile Lys Tyr
            580                 585                 590

Ile His Pro Ser Asp Val Gln Lys Ile Ala Cys Asn Lys Ala Ile Ala
        595                 600                 605

Gly Phe Val Leu Asn Arg Met Pro Asp Thr Gln Ile Lys Arg Tyr Tyr
    610                 615                 620

Asp Ser Leu Ile Asn Lys Gly Ala Thr Asp Ile Gln Ala Gln Ala Lys
625                 630                 635                 640

Ala Leu Leu Asp Cys Ile Thr Gly Ile Ser Phe Asp Ala Ile Lys Asp
                645                 650                 655
```

```
Asp Lys His Leu His Lys Ser Lys Glu Lys Ser Pro Gln Arg Ser Ala
            660                 665                 670

Asp Arg Glu Arg Lys Lys Ala Met Leu Thr Leu Tyr Tyr Thr Ile Val
        675                 680                 685

Tyr Ile Phe Val Lys Gln Met Leu His Ile Asn Ser Leu Tyr Thr Ile
    690                 695                 700

Gly Phe Phe Tyr Leu Glu Arg Asp Gln Arg Phe Ile Tyr Ser Arg Ala
705                 710                 715                 720

Lys Lys Glu Asn Lys Asn Pro Ser Lys Asn Ser Tyr Leu Asn Asp Phe
                725                 730                 735

Arg Ser Val Thr Ala Tyr Phe Ile Pro Ser Glu Ile Met Lys Arg Ile
            740                 745                 750

Glu Lys Asn Glu Asn Lys Gly Phe Leu Glu Asp Phe Glu Ala Leu Trp
        755                 760                 765

Asn Ser Cys Gly Lys Thr Ser Arg Leu Arg Lys Glu Asp Val Leu Leu
    770                 775                 780

Tyr Ala Arg Tyr Ile Ser Pro Asp His Ala Leu Lys Asn Tyr Lys Met
785                 790                 795                 800

Ile Leu Asn Ser Tyr Arg Asn Lys Ile Ala His Ile Asn Val Ile Met
                805                 810                 815

Ser Ala Gly Lys Tyr Thr Gly Gly Ile Lys Arg Met Asp Ser Tyr Phe
            820                 825                 830

Ser Val Phe Gln His Leu Val Gln Cys Asp Ile Leu Ser Asn Pro Asn
        835                 840                 845

Asn Lys Gly Lys Cys Phe Glu Ser Glu Ser Leu Lys Pro Leu Leu Leu
    850                 855                 860

Asp Met Lys Phe Asp Gly Thr Asp Glu Lys Leu Tyr Ser Lys Arg Leu
865                 870                 875                 880
```

Thr Arg Ala Leu Asn Ile Pro Phe Gly Tyr Asn Val Pro Arg Tyr Lys
885 890 895

Asn Leu Thr Phe Glu Lys Ile Tyr Leu Lys Ser Ser Ile Asn Glu
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Lys Ser Thr Phe Val Leu Glu Asn Asn Lys Leu Leu Met Thr Ser Phe
20 25 30

Gly Asn Gly Asn Lys Ala Val Ile Glu Lys Ile Ile Asp Glu Lys Val
35 40 45

Asp Ser Ile Asn Glu Pro Glu Val Phe Ser Val Thr Pro Cys Asp Lys
50 55 60

Lys Phe Glu Leu Gln Pro Ala Lys Arg Gly Leu Ala Ala Asp Ser Leu
65 70 75 80

Val Asp Asn Pro Leu Lys Ser Lys Lys Thr Ala Gly Asp Asp Ala Ile
85 90 95

His Ser Arg Lys Phe Leu Glu Arg Gln Phe Phe Asp Gly Asn Thr Phe
100 105 110

Asn Asp Asn Ile His Ile Gln Leu Ile Tyr Asn Ile Leu Asp Ile Glu
115 120 125

Lys Ile Leu Ser Val His Val Asn Asp Ile Val Tyr Ser Val Asn Asn
130 135 140

```
Ile Leu Ser Arg Gly Glu Gly Met Glu Tyr Asn Asp Tyr Ile Gly Thr
145                 150                 155                 160


Leu Asn Leu Lys Ser Phe Glu Thr Tyr Lys Asn Asn Leu Val Asn Lys
                165                 170                 175


Lys Lys Phe Asp Leu Asp Arg Val Lys Lys Ile Pro Gln Leu Ala Tyr
            180                 185                 190


Phe Gly Ser Ala Phe Tyr Asn Thr Pro Glu Asp Thr Ser Ala Lys Ile
        195                 200                 205


Thr Lys Thr Lys Ile Lys Ser Asn Glu Glu Ile Tyr Tyr Thr Phe Met
    210                 215                 220


Leu Leu Ser Thr Ala Arg Asn Phe Ser Ala His Tyr Leu Asp Arg Asn
225                 230                 235                 240


Arg Ala Lys Ser Ser Asp Ala Glu Asp Phe Asp Gly Thr Ser Val Ile
                245                 250                 255


Met Tyr Asn Leu Asp Asn Glu Glu Leu Tyr Lys Lys Leu Tyr Asn Lys
            260                 265                 270


Lys Val His Met Ala Leu Thr Gly Met Lys Lys Val Leu Asp Ala Asn
        275                 280                 285


Phe Asn Lys Lys Val Glu His Leu Asn Asn Ser Phe Ile Lys Asn Ser
    290                 295                 300


Ala Lys Asp Phe Val Ile Leu Cys Glu Val Leu Gly Ile Lys Ser Arg
305                 310                 315                 320


Asp Glu Lys Thr Lys Phe Val Lys Asp Tyr Tyr Asp Phe Val Val Arg
                325                 330                 335


Lys Asn Tyr Lys His Leu Gly Phe Ser Val Lys Glu Leu Arg Glu Leu
            340                 345                 350
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```
Leu Phe Ala Asn His Asp Ser Asn Lys Tyr Ile Lys Glu Phe Asp Lys
        355                 360                 365

Ile Ser Asn Lys Lys Phe Asp Ser Val Arg Ser Arg Leu Asn Arg Leu
    370                 375                 380

Ala Asp Tyr Ile Ile Tyr Asp Tyr Tyr Asn Lys Asn Asn Ala Lys Val
385                 390                 395                 400

Ser Asp Leu Val Lys Tyr Leu Arg Ala Ala Ala Asp Asp Glu Gln Lys
                405                 410                 415

Lys Lys Ile Tyr Leu Asn Glu Ser Ile Asn Leu Val Lys Ser Gly Ile
            420                 425                 430

Leu Glu Arg Ile Lys Lys Ile Leu Pro Lys Leu Asn Gly Lys Ile Ile
        435                 440                 445

Gly Asn Met Gln Pro Asp Ser Thr Ile Thr Ala Ser Met Leu His Asn
    450                 455                 460

Thr Gly Lys Asp Trp His Pro Ile Ser Glu Asn Ala His Tyr Phe Thr
465                 470                 475                 480

Lys Trp Ile Tyr Thr Leu Thr Leu Phe Met Asp Gly Lys Glu Ile Asn
                485                 490                 495

Asp Leu Val Thr Thr Leu Ile Asn Lys Phe Asp Asn Ile Ala Ser Phe
            500                 505                 510

Ile Glu Val Leu Lys Ser Gln Ser Val Cys Thr His Phe Ser Glu Glu
        515                 520                 525

Arg Lys Met Phe Ile Asp Ser Ala Glu Ile Cys Ser Glu Leu Ser Ala
    530                 535                 540

Met Asn Ser Phe Ala Arg Met Glu Ala Pro Gly Ala Ser Ser Lys Arg
545                 550                 555                 560

Ala Met Phe Val Glu Ala Ala Arg Ile Leu Gly Asp Asn Arg Ser Lys
                565                 570                 575
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```
Glu Glu Leu Glu Glu Tyr Phe Asp Thr Leu Phe Asp Lys Ser Ala Ser
            580                 585                 590

Lys Lys Glu Lys Gly Phe Arg Asn Phe Ile Arg Asn Asn Val Val Asp
        595                 600                 605

Ser Asn Arg Phe Lys Tyr Leu Thr Arg Tyr Thr Asp Thr Ser Ser Val
    610                 615                 620

Lys Ala Phe Ser Asn Asn Lys Ala Leu Val Lys Phe Ala Ile Lys Asp
625                 630                 635                 640

Ile Pro Gln Glu Gln Ile Leu Arg Tyr Tyr Asn Ser Cys Phe Gly Ala
                645                 650                 655

Ser Glu Arg Tyr Tyr Asn Asp Gly Met Ser Asp Lys Leu Val Glu Ala
            660                 665                 670

Ile Gly Lys Ile Asn Leu Met Gln Phe Asn Gly Val Ile Gln Gln Ala
        675                 680                 685

Asp Arg Asn Met Leu Pro Glu Glu Lys Lys Lys Ala Asn Ala Gln Lys
    690                 695                 700

Glu Lys Tyr Lys Ser Ile Ile Arg Leu Tyr Leu Thr Val Cys Tyr Leu
705                 710                 715                 720

Phe Phe Lys Asn Leu Val Tyr Val Asn Ser Arg Tyr Tyr Ser Ala Phe
                725                 730                 735

Tyr Asn Leu Glu Lys Asp Arg Ser Leu Phe Glu Ile Asn Gly Glu Leu
            740                 745                 750

Lys Pro Thr Gly Lys Phe Asp Glu Gly His Tyr Thr Gly Leu Val Lys
        755                 760                 765

Leu Phe Ile Asp Asn Gly Trp Ile Asn Pro Arg Ala Ser Ala Tyr Leu
    770                 775                 780
```

```
Thr Val Asn Leu Ala Asn Ser Asp Glu Thr Ala Ile Arg Thr Phe Arg
785                 790                 795                 800


Asn Thr Ala Glu His Leu Glu Ala Leu Arg Asn Ala Asp Lys Tyr Leu
                805                 810                 815


Asn Asp Leu Lys Gln Phe Asp Ser Tyr Phe Glu Ile Tyr His Tyr Ile
            820                 825                 830


Thr Gln Arg Asn Ile Lys Glu Lys Cys Glu Met Leu Lys Glu Gln Thr
        835                 840                 845


Val Lys Tyr Asn Asn Asp Leu Leu Lys Tyr His Gly Tyr Ser Lys Asp
    850                 855                 860


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


Lys Asn Leu Ser Ile Asp Ala Leu Phe Asp Lys Asn Asp Lys Arg Glu
                885                 890                 895


Lys Leu Lys Lys Gly Phe Glu Asp
            900


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Met Glu Arg Gln Lys Arg Lys Met Lys Ser Lys Ser Lys Met Ala Gly
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Val Lys Ser Val Phe Val Ile Gly Asp Glu Leu Leu Met Thr Ser Phe
            20                  25                  30


Gly Asp Gly Asp Asp Ala Val Leu Glu Lys Asp Ile Asp Glu Asn Gly
        35                  40                  45
```

```
Val Val Asn Asp Cys Arg Asn Pro Ala Ala Tyr Asp Ala Val Tyr Gly
    50                  55                  60

Thr Asp Ser Ile Arg Val Lys Lys Thr Asn Asn Asn Ile Arg Ala Lys
65                  70                  75                  80

Val Asn Asn Pro Leu Ala Lys Ser Asn Ile Arg Ser Glu Glu Ser Ala
                85                  90                  95

Leu Phe Arg Thr Arg Val Asn Glu Tyr Lys Arg Glu Gln Lys Asp Lys
            100                 105                 110

Tyr Glu Thr Leu Phe Phe Gly Lys Thr Phe Asp Asp Asn Ile His Ile
        115                 120                 125

Gln Leu Ile Ser Lys Ile Leu Asp Ile Glu Lys Thr Phe Ser Val Val
    130                 135                 140

Ile Gly Asn Ile Val Tyr Ala Ile Asn Asn Leu Ser Leu Glu Gln Ser
145                 150                 155                 160

Ile Asp Arg Pro Ile Asp Ile Phe Gly Asp Lys Asn Thr Gln Gly Ile
                165                 170                 175

Ser Leu Arg Glu Asp Asn Asp Tyr Leu Lys Thr Met Leu Pro Arg Cys
            180                 185                 190

Glu Tyr Leu Phe His Asn Ile Leu Asn Ser Asp Ser Asp Asn Asn Ser
        195                 200                 205

Lys Met Asn Tyr Asn Lys Val Asn Lys Gly Lys Glu Glu Lys Asp Asn
    210                 215                 220

Arg Asn Asn Glu Asn Ile Glu Lys Leu Lys Lys Ala Leu Glu Val Ile
225                 230                 235                 240

Lys Ile Ile Arg Val Asp Ser Phe His Gly Val Asp Gly Ile Lys Gly
                245                 250                 255

Asp Gln Lys Phe Pro Arg Ser Lys Tyr Asn Leu Ala Val Asn Tyr Asn
            260                 265                 270
```

```
Glu Glu Ile Gln Lys Thr Ile Ser Glu Pro Phe Asn Arg Lys Val Glu
        275                 280                 285

Glu Val Gln Gln Asp Phe Tyr Arg Asn Ser Cys Val Asn Ile Asp Phe
    290                 295                 300

Leu Lys Glu Ile Met Tyr Gly Ser Asn Tyr Thr Asp Arg Gly Ser Asp
305                 310                 315                 320

Ser Leu Glu Cys Ser Tyr Phe Asn Phe Ala Ile Leu Lys Gln Asn Lys
                325                 330                 335

Asn Met Gly Phe Ser Ile Thr Ser Ile Arg Glu Cys Leu Leu Asp Leu
            340                 345                 350

Tyr Glu Leu Asn Phe Glu Ser Met Gln Asn Leu Arg Pro Arg Ala Asn
        355                 360                 365

Ser Phe Cys Asp Phe Leu Ile Tyr Asp Tyr Tyr Cys Lys Asn Glu Ser
    370                 375                 380

Glu Arg Ala Asn Leu Val Asp Cys Leu Arg Ser Ala Ala Ser Glu Glu
385                 390                 395                 400

Glu Lys Lys Asn Ile Tyr Phe Gln Thr Ala Glu Arg Val Lys Glu Lys
                405                 410                 415

Phe Arg Asn Ala Phe Asn Arg Ile Ser Arg Phe Asp Ala Ser Tyr Ile
            420                 425                 430

Lys Asn Ser Arg Glu Lys Asn Leu Ser Gly Gly Ser Ser Leu Pro Lys
        435                 440                 445

Tyr Ser Phe Ile Glu Gly Phe Thr Lys Arg Ser Lys Lys Ile Asn Asp
    450                 455                 460

Asn Asp Glu Lys Asn Ala Asp Leu Phe Cys Asn Met Leu Tyr Tyr Leu
465                 470                 475                 480
```

```
Ala Gln Phe Leu Asp Gly Lys Glu Ile Asn Ile Phe Leu Thr Ser Ile
                485                 490                 495

His Asn Ile Phe Gln Asn Ile Asp Ser Phe Leu Lys Val Met Lys Glu
            500                 505                 510

Lys Gly Met Glu Cys Lys Phe Gln Lys Asp Phe Lys Met Phe Ser His
        515                 520                 525

Ala Gly His Val Ala Lys Lys Ile Glu Ile Val Ile Ser Leu Ala Lys
    530                 535                 540

Met Lys Lys Thr Leu Asp Phe Tyr Asn Ala Gln Ala Leu Lys Asp Ala
545                 550                 555                 560

Val Thr Ile Leu Gly Val Ser Lys Lys His Gln Tyr Leu Asp Met Asn
                565                 570                 575

Ser Tyr Leu Asp Phe Tyr Met Phe Asp Asn Arg Ser Gly Ala Thr Gly
            580                 585                 590

Lys Asn Ala Gly Lys Asp His Asn Leu Arg Asn Phe Leu Val Ser Asn
        595                 600                 605

Val Ile Arg Ser Arg Lys Phe Asn Tyr Leu Ser Arg Tyr Ser Asn Leu
    610                 615                 620

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

Leu Ser Arg Ile Glu Pro Ser Leu Ile Cys Arg Tyr Tyr Glu Ser Ser
                645                 650                 655

Gln Gly Ile Ser Ser Glu Gly Ile Thr Ile Asp Glu Gln Ile Lys Lys
            660                 665                 670

Leu Thr Gly Ile Ile Val Asp Met Asn Ile Asp Ser Phe Glu Asn Ile
        675                 680                 685

Asn Asn Gly Glu Ile Gly Met Arg Tyr Ser Lys Ala Thr Pro Gln Ser
    690                 695                 700
```

```
Ile Glu Arg Arg Asn Gln Met Arg Val Cys Val Gly Leu Tyr Leu Asn
705                 710                 715                 720


Val Leu Tyr Gln Ile Glu Lys Asn Leu Met Asn Val Asn Ala Arg Tyr
                725                 730                 735


Val Leu Ala Phe Ala Phe Ala Glu Arg Asp Ala Leu Met Leu Asn Phe
            740                 745                 750


Thr Leu Glu Glu Cys Lys Lys Asn Lys Lys Arg Ser Ser Gly Gly Phe
        755                 760                 765


Ser Phe Ile Glu Met Thr Gln Phe Phe Ile Asp Lys Lys Leu Phe Lys
    770                 775                 780


Val Ala Thr Glu Ala Ile Lys Lys Asn Val Leu Lys Tyr Asn Gly Asn
785                 790                 795                 800


Pro Glu Ser Leu Asn His Ile Pro Gly Glu Tyr Ile Cys Lys Asn Met
                805                 810                 815


Glu Gly Tyr His Glu Asn Thr Val Arg Asn Phe Arg Asn Met Val Ala
            820                 825                 830


His Leu Thr Ala Val Ala Arg Val Pro Leu Tyr Ile Ser Glu Val Thr
        835                 840                 845


Gln Ile Asp Ser Tyr Tyr Ala Leu Tyr His Tyr Cys Met Gln Met Asn
    850                 855                 860


Ile Leu Gln Gly Ile Glu Gln Ser Gly Lys Ile Leu Asp Asn Ile Lys
865                 870                 875                 880


Leu Lys Asn Ala Leu Glu Asn Ala Arg Val His Arg Thr Tyr Ser Lys
                885                 890                 895


Asp Ala Val Lys Tyr Leu Cys Leu Pro Phe Ala Tyr Asn Ile Ser Arg
            900                 905                 910
```

Tyr Lys Ala Leu Thr Ile Lys Asp Leu Phe Asp Trp Thr Glu Tyr Ser
915 920 925

Cys Lys Lys Asp Glu
930

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<400> 107

Met Lys Arg Gln Lys Thr Phe Ala Lys Arg Ile Gly Ile Lys Ser Thr
1 5 10 15

Val Ala Tyr Gly Gln Gly Lys Tyr Ala Ile Thr Thr Phe Gly Lys Gly
20 25 30

Ser Lys Ala Glu Ile Ala Val Arg Ser Ala Asp Pro Pro Glu Glu Thr
35 40 45

Leu Pro Thr Glu Ser Asp Ala Thr Leu Ser Ile His Ala Lys Phe Ala
50 55 60

Lys Ala Gly Arg Asp Gly Arg Glu Phe Lys Cys Gly Asp Val Asp Glu
65 70 75 80

Thr Arg Ile His Thr Ser Arg Ser Glu Tyr Glu Ser Leu Ile Ser Asn
85 90 95

Pro Ala Glu Ser Pro Arg Glu Asp Tyr Leu Gly Leu Lys Gly Thr Leu
100 105 110

Glu Arg Lys Phe Phe Gly Asp Glu Tyr Pro Lys Asp Asn Leu Arg Ile
115 120 125

Gln Ile Ile Tyr Ser Ile Leu Asp Ile Gln Lys Ile Leu Gly Leu Tyr
130 135 140

```
Val Glu Asp Ile Leu His Phe Val Asp Gly Leu Gln Asp Glu Pro Glu
145                 150                 155                 160


Asp Leu Val Gly Leu Gly Leu Gly Asp Glu Lys Met Gln Lys Leu Leu
                165                 170                 175


Ser Lys Ala Leu Pro Tyr Met Gly Phe Phe Gly Ser Thr Asp Val Phe
            180                 185                 190


Lys Val Thr Lys Lys Arg Glu Glu Arg Ala Ala Ala Asp Glu His Asn
        195                 200                 205


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


Phe Lys Trp Lys Glu Ser Leu Ala Ile Phe Gly Ala Asn Ala Asn Met
225                 230                 235                 240


Pro Ile Arg Phe Phe Gln Gly Ala Thr Gly Gly Arg Gln Leu Trp Asn
                245                 250                 255


Asp Val Ile Ala Pro Leu Trp Lys Lys Arg Ile Glu Arg Val Arg Lys
            260                 265                 270


Ser Phe Leu Ser Asn Ser Ala Lys Asn Leu Trp Val Leu Tyr Gln Val
        275                 280                 285


Phe Lys Asp Asp Thr Asp Glu Lys Lys Lys Ala Arg Ala Arg Gln Tyr
    290                 295                 300


Tyr His Phe Ser Val Leu Lys Glu Gly Lys Asn Leu Gly Phe Asn Leu
305                 310                 315                 320


Thr Lys Thr Arg Glu Tyr Phe Leu Asp Lys Phe Phe Pro Ile Phe His
                325                 330                 335


Ser Ser Ala Pro Asp Val Lys Arg Lys Val Asp Thr Phe Arg Ser Lys
            340                 345                 350


Phe Tyr Ala Ile Leu Asp Phe Ile Ile Tyr Glu Ala Ser Val Ser Val
        355                 360                 365
```

```
Ala Asn Ser Gly Gln Met Gly Lys Val Ala Pro Trp Lys Gly Ala Ile
    370                 375                 380

Asp Asn Ala Leu Val Lys Leu Arg Glu Ala Pro Asp Glu Glu Ala Lys
385                 390                 395                 400

Glu Lys Ile Tyr Asn Val Leu Ala Ala Ser Ile Arg Asn Asp Ser Leu
                405                 410                 415

Phe Leu Arg Leu Lys Ser Ala Cys Asp Lys Phe Gly Ala Glu Gln Asn
            420                 425                 430

Arg Pro Val Phe Pro Asn Glu Leu Arg Asn Asn Arg Asp Ile Arg Asn
        435                 440                 445

Val Arg Ser Glu Trp Leu Glu Ala Thr Gln Asp Val Asp Ala Ala Ala
    450                 455                 460

Phe Val Gln Leu Ile Ala Phe Leu Cys Asn Phe Leu Glu Gly Lys Glu
465                 470                 475                 480

Ile Asn Glu Leu Val Thr Ala Leu Ile Lys Lys Phe Glu Gly Ile Gln
                485                 490                 495

Ala Leu Ile Asp Leu Leu Arg Asn Leu Glu Gly Val Asp Ser Ile Arg
            500                 505                 510

Phe Glu Asn Glu Phe Ala Leu Phe Asn Asp Asp Lys Gly Asn Met Ala
        515                 520                 525

Gly Arg Ile Ala Arg Gln Leu Arg Leu Leu Ala Ser Val Gly Lys Met
    530                 535                 540

Lys Pro Asp Met Thr Asp Ala Lys Arg Val Leu Tyr Lys Ser Ala Leu
545                 550                 555                 560

Glu Ile Leu Gly Ala Pro Pro Asp Glu Val Ser Asp Glu Trp Leu Ala
                565                 570                 575
```

```
Glu Asn Ile Leu Leu Asp Lys Ser Asn Asn Asp Tyr Gln Lys Ala Lys
            580                 585                 590

Lys Thr Val Asn Pro Phe Arg Asn Tyr Ile Ala Lys Asn Val Ile Thr
        595                 600                 605

Ser Arg Ser Phe Tyr Tyr Leu Val Arg Tyr Ala Lys Pro Thr Ala Val
    610                 615                 620

Arg Lys Leu Met Ser Asn Pro Lys Ile Val Arg Tyr Val Leu Lys Arg
625                 630                 635                 640

Leu Pro Glu Lys Gln Val Ala Ser Tyr Tyr Ser Ala Ile Trp Thr Gln
                645                 650                 655

Ser Glu Ser Asn Ser Asn Glu Met Val Lys Leu Ile Glu Met Ile Asp
            660                 665                 670

Arg Leu Thr Thr Glu Ile Ala Gly Phe Ser Phe Ala Val Leu Lys Asp
        675                 680                 685

Lys Lys Asp Ser Ile Val Ser Ala Ser Arg Glu Ser Arg Ala Val Asn
    690                 695                 700

Leu Glu Val Glu Arg Leu Lys Lys Leu Thr Thr Leu Tyr Met Ser Ile
705                 710                 715                 720

Ala Tyr Ile Ala Val Lys Ser Leu Val Lys Val Asn Ala Arg Tyr Phe
                725                 730                 735

Ile Ala Tyr Ser Ala Leu Glu Arg Asp Leu Tyr Phe Phe Asn Glu Lys
            740                 745                 750

Tyr Gly Glu Glu Phe Arg Leu His Phe Ile Pro Tyr Glu Leu Asn Gly
        755                 760                 765

Lys Thr Cys Gln Phe Glu Tyr Leu Ala Ile Leu Lys Tyr Tyr Leu Ala
    770                 775                 780

Arg Asp Glu Glu Thr Leu Lys Arg Lys Cys Glu Ile Cys Glu Glu Ile
785                 790                 795                 800
```

```
Lys Val Gly Cys Glu Lys His Lys Lys Asn Ala Asn Pro Pro Tyr Glu
                805                 810                 815

Tyr Asp Gln Glu Trp Ile Asp Lys Lys Lys Ala Leu Asn Ser Glu Arg
            820                 825                 830

Lys Ala Cys Glu Arg Arg Leu His Phe Ser Thr His Trp Ala Gln Tyr
        835                 840                 845

Ala Thr Lys Arg Asp Glu Asn Met Ala Lys His Pro Gln Lys Trp Tyr
    850                 855                 860

Asp Ile Leu Ala Ser His Tyr Asp Glu Leu Leu Ala Leu Gln Ala Thr
865                 870                 875                 880

Gly Trp Leu Ala Thr Gln Ala Arg Asn Asp Ala Glu His Leu Asn Pro
                885                 890                 895

Val Asn Glu Phe Asp Val Tyr Ile Glu Asp Leu Arg Arg Tyr Pro Glu
            900                 905                 910

Gly Thr Pro Lys Asn Lys Asp Tyr His Ile Gly Ser Tyr Phe Glu Ile
        915                 920                 925

Tyr His Tyr Ile Arg Gln Arg Ala Tyr Leu Glu Glu Val Leu Ala Lys
    930                 935                 940

Arg Lys Glu Tyr Arg Asp Ser Gly Ser Phe Thr Asp Glu Gln Leu Asp
945                 950                 955                 960

Lys Leu Gln Lys Ile Leu Asp Asp Ile Arg Ala Arg Gly Ser Tyr Asp
                965                 970                 975

Lys Asn Leu Leu Lys Leu Glu Tyr Leu Pro Phe Ala Tyr Asn Leu Pro
            980                 985                 990

Arg Tyr Lys Asn Leu Thr Thr Glu  Ala Leu Phe Asp Asp  Asp Ser Val
        995                 1000                1005
```

Ser Gly Lys Lys Arg Val Ala Glu Trp Arg Glu Arg Glu Lys Thr
    1010   1015   1020

Arg Glu Ala Glu Arg Glu Gln Arg Arg Gln Arg
    1025   1030

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<210> 109
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<400> 109

Met Gln Lys Gln Arg Glu Gln Gln Thr Val Thr Asp Glu Ser Glu Arg
1   5   10   15

Lys Lys Lys Pro Leu Lys Ser Gly Ala Lys Ala Ala Gly Leu Lys Ser
            20   25   30

Val Phe Val Leu Ser Glu Gly Lys Glu Leu Leu Thr Ser Phe Gly Arg
        35   40   45

Gly Asn Glu Ala Val Pro Glu Lys Arg Val Thr Gly Gly Thr Ile Ala
    50   55   60

Asn Ala Arg Thr Asp Asn Lys Glu Ala Phe Ser Ala Ala Leu Gln Asn
65   70   75   80

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

```
Leu Ala Val Ser Arg Ala Pro Gly Gln Asp Leu Ile Gly Ala Lys Thr
            100                 105                 110

Ala Leu Glu Glu Arg Tyr Phe Gly Arg Ala Phe Ala Asp Asn Ile His
        115                 120                 125

Met Gln Val Ile Tyr Ala Ile Gln Asp Ile Asn Lys Ile Leu Ala Val
    130                 135                 140

His Ala Asn Asn Ile Val Tyr Thr Leu Asn Asn Leu Asp Arg Glu Ala
145                 150                 155                 160

Asp Pro Glu Thr Asp Asp Phe Ile Gly Ser Gly Tyr Leu Thr Leu Lys
                165                 170                 175

Asn Thr Phe Glu Thr Tyr Cys Asp Pro Ala Ala Leu Asn Glu Arg Glu
            180                 185                 190

Arg Glu Lys Val Thr Val Ser Lys Gln His Phe Asp Ala Phe Met Gln
        195                 200                 205

Asn Pro Arg Leu Ala Tyr Tyr Gly Asn Ala Phe Phe Arg Lys Leu Ser
    210                 215                 220

Lys Ala Glu Arg Leu Ala Arg Gly Arg Glu Ile Phe Asp Lys Glu Ser
225                 230                 235                 240

Pro Glu Arg Arg Gln Glu Ile Leu Gly Ser Arg Gly Lys Asn Lys Ser
                245                 250                 255

Val Asp Asp Glu Ile Arg Ala Leu Ala Pro Glu Trp Val Lys Arg Glu
            260                 265                 270

Glu Arg Asp Val Tyr Ser Glu Leu Val Leu Met Ser Glu Leu Arg Gln
        275                 280                 285

Ser Cys Phe His Gly Gln Gln Lys Asn Ser Ala Arg Ile Phe Arg Leu
    290                 295                 300

Asp Asn Asp Leu Gly Pro Gly Val Asp Gly Ala Arg Glu Leu Leu Asp
305                 310                 315                 320
```

```
Arg Leu Tyr Ala Glu Lys Ile Asn Asp Leu Arg Ser Phe Asp Lys Thr
                325                 330                 335

Ser Ala Ser Ser Asn Phe Arg Leu Leu Phe Asn Ala Tyr His Ala Asp
            340                 345                 350

Asn Glu Lys Lys Lys Glu Leu Ala Gln Glu Phe Tyr Arg Phe Ser Val
        355                 360                 365

Leu Lys Val Ser Lys Asn Thr Gly Phe Ser Ile Arg Thr Leu Arg Glu
    370                 375                 380

Lys Ile Ile Glu Asp His Ala Ala Gln Tyr Arg Asp Lys Ile Tyr Asp
385                 390                 395                 400

Ser Met Arg Lys Lys Leu Phe Ser Thr Phe Asp Phe Phe Leu Trp Arg
                405                 410                 415

Phe Tyr Glu Glu Arg Glu Asp Glu Ala Glu Glu Leu Arg Ala Cys Leu
            420                 425                 430

Arg Ala Ala Arg Ser Asp Glu Glu Lys Glu Gln Ile Tyr Ala Glu Ala
        435                 440                 445

Ala Ala Ser Cys Trp Pro Ser Val Lys Pro Phe Val Glu Ser Val Ala
    450                 455                 460

Ala Thr Leu Cys Asp Val Val Lys Gly Arg Thr Lys Leu Asn Lys Leu
465                 470                 475                 480

Lys Leu Ser Ala Asp Glu Ser Thr Leu Val Arg Asn Ala Ile Asp Gly
                485                 490                 495

Val Arg Ile Ser Pro Arg Ala Ser Tyr Phe Thr Lys Leu Ile Tyr Leu
            500                 505                 510

Met Thr Leu Phe Leu Asp Gly Lys Glu Ile Asn Asp Leu Leu Thr Thr
        515                 520                 525
```

```
Leu Ile His Ala Phe Glu Asn Ile Asp Ser Phe Leu Ser Val Leu Gly
    530                 535                 540

Ser Glu Arg Leu Glu Arg Thr Phe Asp Ala Asn Tyr Arg Ile Phe Ala
545                 550                 555                 560

Asp Ser Gly Val Ile Ala Gln Glu Leu Arg Ala Val Asn Ser Phe Ala
                565                 570                 575

Arg Met Thr Thr Glu Pro Phe Asn Ser Lys Leu Val Met Phe Glu Asp
            580                 585                 590

Ala Ala Gln Leu Phe Gly Met Ser Gly Gly Leu Val Glu His Ala Glu
        595                 600                 605

Glu Leu Arg Glu Tyr Leu Asp Asn Lys Met Leu Asp Lys Thr Lys Leu
    610                 615                 620

Arg Leu Leu Pro Asp Gly Lys Val Asp Thr Gly Phe Arg Asn Phe Ile
625                 630                 635                 640

Ile Ser Asn Val Thr Glu Ser Arg Arg Phe Arg Tyr Leu Val Arg Tyr
                645                 650                 655

Cys Glu Pro Arg Ala Val Arg Asp Tyr Met Ser Cys Arg Pro Leu Ile
            660                 665                 670

Arg Leu Thr Leu Arg Asp Met Pro Asp Thr Ile Leu Arg Arg Tyr Tyr
        675                 680                 685

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

Thr Leu Ala Asp Lys Leu Leu Ser Leu Arg Phe Thr Asp Phe Glu Asn
705                 710                 715                 720

Val Asn Gln Arg Ala Asn Ala Glu Arg Asn Arg Glu Lys Gln Lys Met
                725                 730                 735

Met Gly Ile Ile Ser Leu Tyr Leu Asn Val Ala Tyr Gln Ile Val Lys
            740                 745                 750
```

```
Asn Leu Val Tyr Val Asn Ala Arg Tyr Thr Met Ala Tyr His Cys Ala
        755                 760                 765

Glu Arg Asp Thr Glu Leu Leu Leu Asn Ala Ala Gly Glu Gly Asn Leu
    770                 775                 780

Leu Arg Arg Asp Arg Ser Trp Pro Ala Arg Leu His Leu Pro Arg Arg
785                 790                 795                 800

Ala Leu Ala Arg Arg Arg Asp Arg Val Glu Val Met Glu Arg Asp Val
                805                 810                 815

Ala Arg Gly Pro Glu Ala Tyr Asn Arg Asp Glu Trp Leu Gly Leu Val
            820                 825                 830

Arg Thr Leu Arg Arg Glu Lys Arg Val Cys Asp Asn Leu His Asn Asn
        835                 840                 845

Tyr Ala Tyr Leu Cys Gly Ala Asp Ala Glu Pro Gly Asp Ala Ser Leu
    850                 855                 860

Ser Leu Leu Phe Val Tyr Arg Asn Lys Ala Ala His Leu Ser Val Leu
865                 870                 875                 880

Asn Lys Gly Gly Arg Leu Ser Gly Asp Leu Lys Glu Ala Lys Ser Trp
                885                 890                 895

Phe Tyr Val Tyr His Phe Leu Met Gln Arg Val Leu Glu Glu Glu Phe
            900                 905                 910

Arg Asn Thr Gln Ala Leu Pro Glu Arg Leu Arg Glu Leu Leu Met Met
        915                 920                 925

Ala Glu Arg Tyr Arg Gly Cys Ser Lys Asp Leu Ile Lys Val Leu Asn
    930                 935                 940

Leu Thr Phe Ala Tyr Asn Leu Pro Arg Tyr Lys Asn Leu Ser Ile Asp
945                 950                 955                 960
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Gly Arg Phe Asp Lys Asn His Pro Asp Pro Ser Asp Glu
965 970

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<400> 110

Met Lys Lys Gln Lys Lys Ser Leu Val Lys Ala Ala Gly Leu Lys Ser
1 5 10 15

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

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

Arg Tyr Val Ser Asp Ser Glu Lys His Thr Leu Lys Ile Asn Ser Ile
50 55 60

Thr Asp Thr Glu Leu Arg Leu Ser Gly Pro Phe Pro Lys Gln Ala Glu
65 70 75 80

Ala Lys Asn Pro Thr His Lys Lys Asp Asn Glu Gln Lys Asn Thr Arg
85 90 95

Gln Asp Met Leu Gly Leu Lys Ser Thr Leu Glu Lys Phe Tyr Phe Gly
100 105 110

Ser Thr Phe Asp Asp Asn Ile His Ile Gln Ile Ile His Asn Ile Gln
115 120 125

Asp Ile Ala Lys Ile Leu Ala Ala His Ser Asn Asn Ala Gly Tyr Ala
130 135 140

Leu Asp Asn Met Leu Ala Tyr Gln Gly Val Glu Phe Ser Asp Met Ile
145 150 155 160

```
Gly Tyr Met Gly Thr Ser Arg Thr Phe Asp Asn Tyr Asp Pro Asn His
                165                 170                 175

Lys Asn Asn Lys Asp Phe Phe Arg Phe Leu Lys Leu Pro Arg Leu Gly
            180                 185                 190

Tyr Phe Gly Ser Ala Phe Tyr Ser Gln Lys Gly Lys Asp Phe Glu Lys
        195                 200                 205

Arg Ser Asp Glu Glu Val Tyr Asn Ile Cys Ala Leu Met Gly Gln Ile
    210                 215                 220

Arg Gln Cys Cys Phe His Gly Lys Gln Glu Lys Tyr Gln Leu Lys Trp
225                 230                 235                 240

Leu Tyr Asn Phe His Asn Phe Lys Ser Asn Lys Pro Phe Leu Asp Thr
                245                 250                 255

Leu Asp Lys His Phe Asp Glu Met Ile Asp Arg Ile Asn Lys Asn Phe
            260                 265                 270

Ile Lys Asn Asn Thr Pro Asp Leu Ile Ile Leu Ser Gly Leu Tyr Pro
        275                 280                 285

Asp Met Ala Lys Lys Glu Leu Val Arg Leu Phe Tyr Asp Phe Thr Thr
    290                 295                 300

Val Lys Glu Tyr Lys Asn Met Gly Phe Ser Val Lys Lys Leu Arg Glu
305                 310                 315                 320

Lys Met Leu Glu Ser Glu Glu Ala Ser Asp Phe Arg Asp Lys Asp Tyr
                325                 330                 335

Asp Ser Val Arg Arg Lys Leu Tyr Lys Leu Met Asp Phe Cys Ile Tyr
            340                 345                 350

Tyr Leu Tyr Tyr Ser Asp Ser Glu Arg Asn Glu Asn Leu Val Ser Arg
        355                 360                 365

Leu Arg Glu Ser Leu Thr Asp Glu Asn Lys Asp Ile Ile Tyr Ser Lys
    370                 375                 380
```

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


Leu Asp Asn Val Lys Gly Ser Asn Ile Lys Lys Leu Glu Asn Val Lys
                405                 410                 415


Glu Lys Phe Ile Ser Glu Asp Glu Phe Asp Asp Ile Lys Leu Asp Ile
            420                 425                 430


Asp Ile Ser Tyr Phe Ser Lys Leu Met Tyr Val Met Cys Tyr Phe Leu
        435                 440                 445


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


Asp Asn Ile Gly Ser Ile Ile Glu Ala Ala Thr Gln Ile Gly Ile Asn
465                 470                 475                 480


Ile Glu Phe Ile Asp Asp Phe Lys Phe Phe Asp Arg Ser Lys Asp Ile
                485                 490                 495


Ser Val Glu Leu Asn Ile Ile Arg Asn Phe Ala Arg Met Gln Ala Pro
            500                 505                 510


Val Pro Asn Ala Lys Arg Ala Met Gln Glu Asp Ala Ile Arg Ile Leu
        515                 520                 525


Gly Gly Ser Glu Glu Asp Ile Phe Ser Ile Leu Asp Asp Met Thr Gly
    530                 535                 540


Tyr Asp Lys Ser Gly Lys Lys Leu Ala Gln Ser Lys Lys Gly Phe Arg
545                 550                 555                 560


Asn Phe Ile Ile Asn Asn Val Val Glu Ser Ser Arg Phe Lys Tyr Ile
                565                 570                 575


Val Arg Tyr Ser Asn Pro Gln Lys Ile Arg Lys Leu Ala Asn Asn Ser
            580                 585                 590
```

```
Val Val Val Gly Phe Val Leu Gly Lys Leu Pro Asp Ala Gln Ile Glu
        595                 600                 605

Ser Tyr Phe Asn Ser Cys Leu Pro Asn Arg Val Tyr Ser Thr Pro Asp
    610                 615                 620

Lys Ala Arg Glu Ser Leu Arg Asp Met Leu His Asn Ile Ser Phe Asn
625                 630                 635                 640

Asp Phe Ala Asp Val Lys Gln Asp Asp Arg Arg Ala Thr Pro Glu Glu
                645                 650                 655

Lys Val Glu Lys Glu Arg Tyr Lys Ala Ile Ile Gly Leu Tyr Leu Thr
            660                 665                 670

Val Met Tyr His Leu Val Lys Asn Leu Val Tyr Val Asn Ser Arg Tyr
        675                 680                 685

Val Met Ala Phe His Cys Leu Glu Arg Asp Ala Met His Tyr Asp Val
    690                 695                 700

Ser Leu Asp Asn Tyr Arg Asp Leu Ile Arg His Leu Ile Ser Glu Gly
705                 710                 715                 720

Asp Ser Ser Cys Asn His Phe Ile Ser His Asn Arg Arg Met Arg Asp
                725                 730                 735

Cys Ile Glu Glu Asn Val Lys Asn Ser Glu Gln Leu Ile Phe Gly Lys
            740                 745                 750

Glu Asp Ala Val Ile Arg Phe Arg Asn Asn Val Ala His Leu Ser Ala
        755                 760                 765

Ile Arg Asn Ala Asn Glu Tyr Ile Gly Asp Ile Arg Glu Ile Thr Ser
    770                 775                 780

Tyr Phe Ala Leu Tyr His Tyr Leu Met Gln Arg Lys Leu Ile Asp Asp
785                 790                 795                 800

Cys Lys Val Asn Asp Thr Ala His Lys Tyr Phe Glu Gln Leu Thr Lys
                805                 810                 815
```

Tyr Lys Thr Tyr Val Met Asp Met Val Lys Ala Leu Cys Ser Pro Phe
            820   825   830

Gly Tyr Asn Leu Pro Arg Phe Lys Asn Leu Ser Ile Glu Gly Lys Phe
        835   840   845

Asp Met His Glu Ser Lys
    850

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<400> 111

Met Ser Lys Lys Glu Asn Arg Lys Ser Tyr Val Lys Gly Leu Gly Leu
1   5   10   15

Lys Ser Thr Leu Val Ser Asp Ser Lys Val Tyr Leu Thr Thr Phe Ala
            20   25   30

Asp Gly Ser Asn Ala Lys Leu Glu Lys Cys Val Glu Asn Asn Lys Ile
        35   40   45

Ile Cys Ile Ser Asn Asp Lys Glu Ala Phe Ala Ala Ser Ile Ala Asn
    50   55   60

Lys Asn Val Gly Tyr Lys Ile Lys Asn Asp Glu Lys Phe Arg His Pro
65   70   75   80

Lys Gly Tyr Asp Ile Ile Ser Asn Asn Pro Leu Leu His Asn Asn Ser
                85   90   95

Val Gln Gln Asp Met Leu Gly Leu Lys Asn Val Leu Glu Lys Arg Tyr
            100   105   110

Phe Gly Lys Ser Ser Gly Gly Asp Asn Asn Leu Cys Ile Gln Ile Ile
        115   120   125

```
His Asn Ile Ile Asp Ile Glu Lys Ile Leu Ser Glu Tyr Ile Pro Asn
    130                 135                 140

Val Val Tyr Ala Phe Asn Asn Ile Ala Gly Phe Lys Asp Glu His Asn
145                 150                 155                 160

Asn Ile Ile Asp Ile Ile Gly Thr Gln Thr Tyr Asn Ser Ser Tyr Thr
                165                 170                 175

Tyr Ala Asp Phe Ser Lys Asp Lys Ser Asp Lys Lys Tyr Ile Glu Phe
            180                 185                 190

Gln Lys Leu Leu Lys Asn Lys Arg Leu Gly Tyr Trp Gly Lys Ala Phe
        195                 200                 205

Phe Thr Gly Gln Gly Asn Asn Ala Lys Val Arg Gln Glu Asn Gln Cys
    210                 215                 220

Phe His Ile Ile Ala Leu Leu Ile Ser Leu Arg Asn Trp Ala Thr His
225                 230                 235                 240

Ser Asn Glu Leu Asp Lys His Thr Lys Arg Thr Trp Leu Tyr Lys Leu
                245                 250                 255

Asp Asp Thr Asn Ile Leu Asn Ala Glu Tyr Val Lys Thr Leu Asn Tyr
            260                 265                 270

Leu Tyr Asp Thr Ile Ala Asp Glu Leu Thr Lys Ser Phe Ser Lys Asn
        275                 280                 285

Gly Ala Val Asn Val Asn Tyr Leu Ala Lys Lys Tyr Asn Ile Lys Asp
    290                 295                 300

Asp Leu Pro Gly Phe Ser Glu Gln Tyr Phe Arg Phe Ser Ile Met Lys
305                 310                 315                 320

Glu Gln Lys Asn Leu Gly Phe Asn Ile Ser Lys Leu Arg Glu Asn Met
                325                 330                 335
```

```
Leu Asp Phe Lys Asp Met Ser Val Ile Arg Asp Asp His Asn Arg Tyr
            340                 345                 350

Asp Lys Asp Arg Ser Lys Ile Tyr Thr Met Met Asp Phe Val Ile Tyr
        355                 360                 365

Arg Tyr Tyr Ile Asp Asn Asn Asn Asp Ser Ile Asp Phe Ile Asn Lys
    370                 375                 380

Leu Arg Ser Ser Ile Asp Glu Lys Ser Lys Glu Lys Leu Tyr Asn Glu
385                 390                 395                 400

Glu Ala Asn Arg Leu Trp Asn Lys Leu Lys Glu Tyr Met Leu Tyr Ile
                405                 410                 415

Lys Glu Phe Asn Gly Lys Leu Ala Ser Arg Thr Pro Asp Arg Asp Gly
            420                 425                 430

Asn Ile Ser Glu Phe Val Glu Ser Leu Pro Lys Ile His Arg Leu Leu
        435                 440                 445

Pro Arg Gly Gln Lys Ile Ser Asn Phe Ser Lys Leu Met Tyr Leu Leu
    450                 455                 460

Thr Met Phe Leu Asp Gly Lys Glu Ile Asn Asp Leu Leu Thr Thr Leu
465                 470                 475                 480

Ile Asn Lys Phe Glu Asn Ile Gln Gly Phe Leu Asp Ile Met Pro Glu
                485                 490                 495

Ile Asn Val Asn Ala Lys Phe Glu Pro Glu Tyr Val Phe Phe Asn Lys
            500                 505                 510

Ser His Glu Ile Ala Gly Glu Leu Lys Leu Ile Lys Gly Phe Ala Gln
        515                 520                 525

Met Gly Glu Pro Ala Ala Thr Leu Lys Leu Glu Met Thr Ala Asp Ala
    530                 535                 540

Ile Lys Ile Leu Gly Thr Glu Lys Glu Asp Ala Glu Leu Ile Lys Leu
545                 550                 555                 560
```

```
Ala Glu Ser Leu Phe Lys Asp Glu Asn Gly Lys Leu Leu Gly Asn Lys
                565                 570                 575

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

Arg Phe His Tyr Leu Ile Arg Tyr Gly Asp Pro Ala His Leu His Lys
        595                 600                 605

Ile Ala Thr Asn Lys Asn Val Val Arg Phe Val Leu Gly Arg Ile Ala
    610                 615                 620

Asp Met Gln Lys Lys Gln Gly Gln Lys Gly Lys Asn Gln Ile Asp Arg
625                 630                 635                 640

Tyr Tyr Glu Val Cys Val Gly Asn Lys Asp Ile Lys Lys Thr Ile Glu
                645                 650                 655

Glu Lys Ile Asp Ala Leu Thr Asp Ile Ile Val Asn Met Asn Tyr Asp
            660                 665                 670

Gln Phe Glu Lys Lys Lys Ala Val Ile Glu Asn Gln Asn Arg Gly Lys
        675                 680                 685

Thr Phe Glu Glu Lys Asn Lys Tyr Lys Arg Asp Asn Ala Glu Arg Glu
    690                 695                 700

Lys Phe Lys Lys Ile Ile Ser Leu Tyr Leu Thr Val Ile Tyr His Ile
705                 710                 715                 720

Leu Lys Asn Ile Val Asn Val Asn Ser Arg Tyr Ile Leu Gly Phe His
                725                 730                 735

Cys Leu Glu Arg Asp Lys Gln Leu Tyr Ile Glu Lys Tyr Asn Lys Asp
            740                 745                 750

Lys Leu Asp Gly Phe Val Ala Leu Thr Lys Phe Cys Leu Gly Asp Glu
        755                 760                 765
```

```
Glu Arg Phe Glu Asp Leu Lys Ala Lys Ala Gln Ala Ser Ile Gln Ala
    770                 775                 780

Leu Glu Thr Ala Asn Pro Lys Leu Tyr Ala Lys Tyr Met Asn Tyr Ser
785                 790                 795                 800

Asp Glu Glu Lys Lys Glu Glu Phe Lys Lys Gln Leu Asn Arg Glu Arg
                805                 810                 815

Val Lys Asn Ala Arg Asn Ala Tyr Leu Lys Asn Ile Lys Asn Tyr Ile
            820                 825                 830

Met Ile Arg Leu Gln Leu Arg Asp Gln Thr Asp Ser Ser Gly Tyr Leu
        835                 840                 845

Cys Gly Glu Phe Arg Asp Lys Val Ala His Leu Glu Val Ala Arg His
    850                 855                 860

Ala His Glu Tyr Ile Gly Asn Ile Lys Glu Val Asn Ser Tyr Phe Gln
865                 870                 875                 880

Leu Tyr His Tyr Ile Met Gln Cys Arg Leu Tyr Asp Val Leu Lys Asn
                885                 890                 895

Asn Thr Lys Ala Glu Ala Met Val Lys Gly Lys Ala Lys Glu Tyr Phe
            900                 905                 910

Glu Ala Leu Glu Lys Glu Gly Thr Tyr Asn Asp Lys Leu Leu Lys Ile
        915                 920                 925

Ala Cys Val Pro Phe Gly Tyr Cys Ile Pro Arg Tyr Lys Asn Leu Ser
    930                 935                 940

Met Glu Glu Leu Phe Asp Met Asn Glu Glu Lys Lys Phe Lys Lys Lys
945                 950                 955                 960

Ala Pro Glu Asn Thr
                965
```

<210> 112
<211> 1022

<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d 160582958 gene49834

<400> 112

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

Glu Ala Ala Arg Lys Lys Ala Lys Asp Ile Ala Glu Gln Ala Arg Ile
20 25 30

Ala Lys Arg Asn Gly Val Val Lys Lys Glu Glu Asn Arg Ile Asn Arg
35 40 45

Ile Gln Ile Glu Ile Gln Thr Gln Lys Lys Ser Asn Thr Gln Asn Ala
50 55 60

Tyr His Leu Lys Ser Leu Ala Lys Ala Ala Gly Val Lys Ser Val Phe
65 70 75 80

Ala Ile Gly Asn Asp Leu Leu Met Thr Gly Phe Gly Pro Gly Asn Asp
85 90 95

Ala Thr Ile Glu Lys Arg Val Phe Gln Asn Arg Ala Ile Glu Thr Leu
100 105 110

Ser Ser Pro Glu Gln Tyr Ser Ala Glu Phe Gln Asn Lys Gln Phe Lys
115 120 125

Ile Lys Gly Asn Ile Lys Val Leu Asn His Ser Thr Gln Lys Met Glu
130 135 140

Glu Ile Gln Thr Glu Leu Gln Asp Asn Tyr Asn Arg Pro His Phe Asp
145 150 155 160

Leu Leu Gly Cys Lys Asn Val Leu Glu Gln Lys Tyr Phe Gly Arg Thr
165 170 175

Phe Ser Asp Asn Ile His Val Gln Ile Ala Tyr Asn Ile Met Asp Ile
180 185 190

```
Glu Lys Leu Leu Thr Pro Tyr Ile Asn Asn Ile Ile Tyr Thr Leu Asn
        195                 200                 205

Glu Leu Met Arg Asp Asn Ser Lys Asp Asp Phe Phe Gly Cys Asp Ser
    210                 215                 220

His Phe Ser Val Ala Tyr Leu Tyr Asp Glu Leu Lys Ala Gly Tyr Ser
225                 230                 235                 240

Asp Arg Leu Lys Thr Lys Pro Asn Leu Ser Lys Asn Ile Asp Arg Ile
                245                 250                 255

Trp Asn Asn Phe Cys Asn Tyr Met Asn Ser Asp Ser Gly Asn Thr Glu
            260                 265                 270

Ala Arg Leu Ala Tyr Phe Gly Glu Leu Phe Tyr Lys Pro Lys Glu Thr
        275                 280                 285

Gly Asp Ala Lys Ser Asp Tyr Lys Thr His Leu Ser Asn Asn Gln Lys
    290                 295                 300

Glu Glu Trp Glu Leu Lys Ser Asp Lys Glu Val Tyr Asn Ile Phe Ala
305                 310                 315                 320

Ile Leu Cys Asp Leu Arg His Phe Cys Thr His Gly Glu Ser Ile Thr
                325                 330                 335

Pro Ser Gly Lys Pro Phe Pro Tyr Asn Leu Glu Lys Asn Leu Phe Pro
            340                 345                 350

Glu Ala Lys Gln Val Leu Asn Ser Leu Phe Glu Glu Lys Ala Glu Ser
        355                 360                 365

Leu Gly Ala Glu Ala Phe Gly Lys Thr Ala Gly Lys Thr Asp Val Ser
    370                 375                 380

Ile Leu Leu Lys Val Phe Glu Lys Glu Gln Ala Ser Gln Lys Glu Gln
385                 390                 395                 400
```

```
Gln Ala Leu Leu Lys Glu Tyr Tyr Asp Phe Lys Val Gln Lys Thr Tyr
                405                 410                 415

Lys Asn Met Gly Phe Ser Ile Lys Lys Leu Arg Glu Ala Ile Met Glu
            420                 425                 430

Ile Pro Asp Ala Ala Lys Phe Lys Asp Asp Leu Tyr Ser Ser Leu Arg
        435                 440                 445

His Lys Leu Tyr Gly Leu Phe Asp Phe Ile Leu Val Lys His Phe Leu
    450                 455                 460

Asp Thr Ser Asp Ser Glu Asn Leu Gln Asn Asn Asp Ile Phe Arg Gln
465                 470                 475                 480

Leu Arg Ala Cys Arg Cys Glu Glu Glu Lys Asp Gln Val Tyr Arg Ser
                485                 490                 495

Ile Ala Val Lys Val Trp Glu Lys Val Lys Lys Lys Glu Leu Asn Met
            500                 505                 510

Phe Lys Gln Val Val Val Ile Pro Ser Leu Ser Lys Asp Glu Leu Lys
        515                 520                 525

Gln Met Glu Met Thr Lys Asn Thr Glu Leu Leu Ser Ser Ile Glu Thr
    530                 535                 540

Ile Ser Thr Gln Ala Ser Leu Phe Ser Glu Met Ile Phe Met Met Thr
545                 550                 555                 560

Tyr Leu Leu Asp Gly Lys Glu Ile Asn Leu Leu Cys Thr Ser Leu Ile
                565                 570                 575

Glu Lys Phe Glu Asn Ile Ala Ser Phe Asn Glu Val Leu Lys Ser Pro
            580                 585                 590

Gln Ile Gly Tyr Glu Thr Lys Tyr Thr Glu Gly Tyr Ala Phe Phe Lys
        595                 600                 605

Asn Ala Asp Lys Thr Ala Lys Glu Leu Arg Gln Val Asn Asn Met Ala
    610                 615                 620
```

```
Arg Met Thr Lys Pro Leu Gly Gly Val Asn Thr Lys Cys Val Met Tyr
625                 630                 635                 640

Asn Glu Ala Ala Lys Ile Leu Gly Ala Lys Pro Met Ser Lys Ala Glu
                645                 650                 655

Leu Glu Ser Val Phe Asn Leu Asp Asn His Asp Tyr Thr Tyr Ser Pro
            660                 665                 670

Ser Gly Lys Lys Ile Pro Asn Lys Asn Phe Arg Asn Phe Ile Ile Asn
        675                 680                 685

Asn Val Ile Thr Ser Arg Arg Phe Leu Tyr Leu Ile Arg Tyr Gly Asn
    690                 695                 700

Pro Glu Lys Ile Arg Lys Ile Ala Ile Asn Pro Ser Ile Ile Ser Phe
705                 710                 715                 720

Val Leu Lys Gln Ile Pro Asp Glu Gln Ile Lys Arg Tyr Tyr Pro Pro
                725                 730                 735

Cys Ile Gly Lys Arg Thr Asp Asp Val Thr Leu Met Arg Asp Glu Leu
            740                 745                 750

Gly Lys Met Leu Gln Ser Val Asn Phe Glu Gln Phe Ser Arg Val Asn
        755                 760                 765

Asn Lys Gln Asn Ala Lys Gln Asn Pro Asn Gly Glu Lys Ala Arg Leu
    770                 775                 780

Gln Ala Cys Val Arg Leu Tyr Leu Thr Val Pro Tyr Leu Phe Ile Lys
785                 790                 795                 800

Asn Met Val Asn Ile Asn Ala Arg Tyr Val Leu Ala Phe His Cys Leu
                805                 810                 815

Glu Arg Asp His Ala Leu Cys Phe Asn Ser Arg Lys Leu Asn Asp Asp
            820                 825                 830
```

```
Ser Tyr Asn Glu Met Ala Asn Lys Phe Gln Met Val Arg Lys Ala Lys
        835                 840                 845

Lys Glu Gln Tyr Glu Lys Glu Tyr Lys Cys Lys Lys Gln Glu Thr Gly
    850                 855                 860

Thr Ala His Thr Lys Lys Ile Glu Lys Leu Asn Gln Gln Ile Ala Tyr
865                 870                 875                 880

Ile Asp Lys Asp Ile Lys Asn Met His Ser Tyr Thr Cys Arg Asn Tyr
                885                 890                 895

Arg Asn Leu Val Ala His Leu Asn Val Val Ser Lys Leu Gln Asn Tyr
            900                 905                 910

Val Ser Glu Leu Pro Asn Asp Tyr Gln Ile Thr Ser Tyr Phe Ser Phe
        915                 920                 925

Tyr His Tyr Cys Met Gln Leu Gly Leu Met Glu Lys Val Ser Ser Lys
    930                 935                 940

Asn Ile Pro Leu Val Glu Ser Leu Lys Asn Glu Ala Asn Asp Ala Gln
945                 950                 955                 960

Ser Tyr Ser Ala Lys Lys Thr Leu Glu Tyr Phe Asp Leu Ile Glu Lys
                965                 970                 975

Asn Arg Thr Tyr Cys Lys Asp Phe Leu Lys Ala Leu Asn Ala Pro Phe
            980                 985                 990

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

Asp Lys  Asn Ile Val Tyr Glu  Gln Ala Asp Leu Lys  Lys Glu
    1010                1015                1020
```

<210> 113
<211> 36
<212> PRT
<213> Unknown

<220>

<223> CasRX/Cas13d DR

<400> 113

Gly Ala Ala Cys Thr Ala Cys Ala Cys Cys Cys Cys Thr Cys Thr Gly
1   5   10   15

Thr Thr Cys Thr Thr Gly Thr Ala Gly Gly Gly Gly Thr Cys Thr Ala
            20   25   30

Ala Cys Ala Cys
        35

<210> 114
<211> 998
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d 250twins 35838 GL0110300

<400> 114

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

Lys Leu Cys Asn Gln Gln Lys Ala Arg Gln Ala Glu Ser Gln Arg Asp
            20   25   30

Lys Ile Lys Asn Met Asn Val Glu Lys Met Lys Asn Ile Asn Thr Asn
        35   40   45

Asp Ile Lys His Thr Lys Thr Thr Ala Lys Lys Leu Gly Leu Lys Ser
    50   55   60

Thr Ile Ile Ala Asp Lys Lys Ile Ile Leu Thr Ser Phe Ile Asn Glu
65   70   75   80

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

Asp Thr Ile Asp Thr Ile Ser Tyr Thr Pro Arg Met Phe Arg Ser Glu
            100   105   110

```
Ile Asn Pro Gly Glu Ile Val Ile Ser Lys Gly Asp Asp Leu Ser Glu
        115                 120                 125

Phe Ala Asn Pro Ala Asn Phe Pro Ile Gly Arg Asp Tyr Val Lys Ile
    130                 135                 140

Arg Ser Ala Leu Glu Lys Gln Tyr Phe Gly Lys Glu Phe Pro Glu Asp
145                 150                 155                 160

Asn Leu His Val Gln Ile Ala Tyr Asn Val Ala Asp Ile Lys Lys Ile
                165                 170                 175

Leu Ser Val Tyr Ile Asn Asn Ile Ile Tyr Met Phe Tyr Asn Leu Ala
            180                 185                 190

Arg Ser Glu Glu Tyr Asp Ile Phe Tyr Asn Ser Gln Ser Glu Asn Ser
        195                 200                 205

Gly Arg Asp Cys Asp Val Ile Gly Ser Leu Tyr Tyr Gln Ala Ser Tyr
    210                 215                 220

Arg Asn Gln Asp Ala Asn Arg Phe Glu Lys Asp Gly Lys Lys Lys Ala
225                 230                 235                 240

Ile Asp Ser Leu Leu Asp Asp Thr Arg Ala Tyr Tyr Thr Tyr Phe Asp
                245                 250                 255

Gly Leu Phe Ser Val Pro Lys Arg Glu Asp Asp Gly Lys Ile Lys Glu
            260                 265                 270

Ser Glu Lys Glu Lys Ala Lys Asp Gln Asn Phe Asp Val Leu Arg Leu
        275                 280                 285

Leu Ser Val Gly Arg Gln Leu Thr Phe His Ser Asp Lys Ser Asn Asn
    290                 295                 300

Glu Ala Tyr Leu Phe Asp Leu Ser Lys Leu Thr Arg Ala Ala Gln Asp
305                 310                 315                 320

Glu Asn Arg Arg Gln Asp Ile Gln Ser Leu Leu Asn Ile Leu Asn Ser
                325                 330                 335
```

```
Thr Cys Arg Ser Asn Leu Glu Gly Val Asn Gly Asp Phe Val Lys His
            340                 345                 350

Ala Lys Asn Asn Leu Tyr Val Leu Asn Gln Leu Tyr Pro Ser Leu Lys
        355                 360                 365

Ala Asn Asp Leu Ile Gly Glu Tyr Tyr Asn Phe Ile Val Lys Lys Glu
    370                 375                 380

Asn Arg Asn Ile Gly Ile Arg Leu Ile Thr Val Arg Glu Leu Ile Ile
385                 390                 395                 400

Glu His Asn Tyr Thr Asn Leu Lys Asp Ser Lys Tyr Asp Thr Tyr Arg
                405                 410                 415

Asn Lys Ile Tyr Thr Val Leu Asn Phe Ile Leu Phe Arg Glu Ile Gln
            420                 425                 430

Glu Asn Ser Ile Ala Ile Lys Asn Phe Arg Glu Lys Leu Arg Ser Thr
        435                 440                 445

Glu Lys Ala Glu Gln Pro Ala Leu Tyr Gln Ala Phe Ala Asn Lys Ile
    450                 455                 460

Tyr Pro Met Val Gln Ala Lys Phe Ala Lys Ala Ile Asp Leu Phe Glu
465                 470                 475                 480

Glu Gln Tyr Lys Thr Lys Phe Lys Ser Glu Phe Lys Gly Gly Ile Ser
                485                 490                 495

Ile Glu Asn Met Gln Gln Gln Asn Ile Leu Leu Gln Thr Glu Asn Ile
            500                 505                 510

Asp Tyr Phe Ser Lys Tyr Val Leu Phe Leu Thr Lys Phe Leu Asp Gly
        515                 520                 525

Lys Glu Ile Asn Glu Leu Leu Cys Ala Leu Ile Asn Lys Phe Asp Asn
    530                 535                 540
```

```
Ile Ala Asp Leu Leu Asp Ile Ser Lys Gln Ile Gly Thr Pro Val Val
545                 550                 555                 560


Phe Cys Ala Asp Tyr Glu Ser Leu Asn Asp Ala Ala Lys Ile Ala Glu
                565                 570                 575


Asn Ile Arg Leu Ile Lys Asn Ile Ala His Leu Arg Pro Ala Ile Gln
            580                 585                 590


Glu Ala Gln Ser Ser Lys Asp Asn Ala Asp Ala Ala Gly Thr Pro Ala
        595                 600                 605


Thr Leu Leu Ile Asp Ala Tyr Asn Met Leu Asn Thr Asp Ile Gln Leu
    610                 615                 620


Val Tyr Gly Glu Ala Ala Tyr Glu Glu Leu Arg Lys Asp Leu Phe Glu
625                 630                 635                 640


Arg Lys Asn Gly Thr Lys Tyr Asn Lys Lys Gly Lys Lys Val Asp Val
                645                 650                 655


Tyr Asp His Lys Phe Arg Asn Phe Leu Ile Asn Asn Val Ile Lys Ser
            660                 665                 670


Lys Trp Phe Phe Tyr Ile Ala Lys Tyr Val Lys Pro Ala Asp Cys Ala
        675                 680                 685


Lys Met Met Ser Asn Lys Lys Met Ile Glu Phe Ala Leu Arg Asp Leu
    690                 695                 700


Pro Glu Thr Gln Ile Lys Arg Tyr Tyr Tyr Thr Ile Thr Gly Asn Glu
705                 710                 715                 720


Ala Leu Gly Asp Ala Glu Ser Leu Lys Gly Val Ile Ile Glu Gln Leu
                725                 730                 735


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


Glu Gly Glu Tyr Lys Ile Gln Gln Ile Gly Ser Ser Lys Glu Lys Leu
        755                 760                 765
```

```
Lys Ala Ile Val Asn Leu Tyr Leu Thr Val Ala Tyr Leu Leu Thr Lys
    770                 775                 780

Ser Leu Val Lys Val Asn Ile Arg Phe Ser Ile Ala Phe Gly Cys Leu
785                 790                 795                 800

Glu Arg Asp Leu Val Leu Gln Lys Lys Ser Glu Lys Lys Phe Asp Ala
                805                 810                 815

Ile Ile Asn Glu Ile Leu Leu Glu Asp Asp Lys Ile Arg Lys Glu Cys
            820                 825                 830

Asp Lys Glu Arg Ala Gln Ala Lys Thr Leu Pro Arg Glu Leu Ala Gln
        835                 840                 845

Glu Arg Phe Ala Gln Ile Lys Arg Arg Glu Ser Gly Cys Tyr Phe Lys
    850                 855                 860

Ser Tyr His Val Tyr Asp Tyr Leu Ser Lys Asn Ser Asn Glu Phe Lys
865                 870                 875                 880

Gln Asn His Ile Asp Phe Ala Val Thr Ser Tyr Arg Asn Asn Val Glu
                885                 890                 895

His Leu Asn Val Val His Cys Met Thr Lys Tyr Phe Ser Glu Val Lys
            900                 905                 910

Asp Val Lys Ser Tyr Tyr Gly Val Tyr Cys Tyr Ile Met Gln Arg Met
        915                 920                 925

Leu Cys Asp Glu Leu Ile Ile Lys Asn Gln Asp Lys Pro Asp Val Arg
    930                 935                 940

Gln Thr Phe Glu Glu Tyr Asn Arg Leu Leu Lys Asp His Gly Thr Tyr
945                 950                 955                 960

Ser Lys Asn Leu Met Trp Leu Leu Asn Phe Pro Phe Ala Tyr Asn Leu
                965                 970                 975
```

Ala Arg Tyr Lys Asn Leu Ser Asn Glu Asp Leu Phe Asn Ala Lys Asn
980 985 990

Asn Asp Gln Lys Ser Lys
995

<210> 115
<211> 1020
<212> PRT
<213> Unknown

<220>
<223> CasRX/Cas13d 250twins 36050 GL0158985

<400> 115

Met Lys Lys Lys His Gln Ser Ala Ala Glu Lys Arg Gln Val Lys Lys
1 5 10 15

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

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

Val Ser His Ile Ala Ser Ser Lys Thr Leu Ala Lys Ala Met Gly Leu
50 55 60

Lys Ser Thr Leu Val Met Gly Asp Lys Leu Val Ile Thr Ser Phe Ala
65 70 75 80

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

Lys Ile Thr Asp Leu Gln Gly Arg Val Ile Glu Glu His Glu Arg Met
100 105 110

Phe Ser Ala Asp Val Gly Glu Lys Asn Ile Glu Leu Ser Lys Asn Asp
115 120 125

Cys His Thr Asn Val Asn Asn Pro Val Val Thr Asn Ile Gly Lys Asp
130 135 140

```
Tyr Ile Gly Leu Lys Ser Arg Leu Glu Gln Glu Phe Phe Gly Lys Thr
145                 150                 155                 160

Phe Glu Asn Asp Asn Leu His Val Gln Leu Ala Tyr Asn Ile Leu Asp
                165                 170                 175

Ile Lys Lys Ile Leu Gly Thr Tyr Val Asn Asn Ile Ile Tyr Ile Phe
            180                 185                 190

Tyr Asn Leu Asn Arg Ala Gly Thr Gly Arg Asp Glu Arg Met Tyr Asp
        195                 200                 205

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

Thr Tyr Leu Leu Lys Gly Asp Lys Asp Met Arg Arg Phe Glu Glu Val
225                 230                 235                 240

Lys Gln Leu Leu Gln Asn Thr Ser Ala Tyr Tyr Val Tyr Tyr Gly Thr
                245                 250                 255

Leu Phe Glu Lys Val Lys Ala Lys Ser Lys Lys Glu Gln Arg Ala Lys
            260                 265                 270

Glu Ala Glu Ile Asp Ala Cys Thr Ala His Asn Tyr Asp Val Leu Arg
        275                 280                 285

Leu Leu Ser Leu Met Arg Gln Leu Cys Met His Ser Val Ala Gly Thr
    290                 295                 300

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

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

Asn Lys Leu Asn Asp Gly Phe Val Gln His Ser Gly Asn Asn Leu Tyr
            340                 345                 350

Val Leu Gln Gln Leu Tyr Pro Asn Glu Thr Ile Glu Arg Ile Ala Glu
        355                 360                 365
```

```
Lys Tyr Tyr Arg Leu Thr Val Arg Lys Glu Asp Leu Asn Met Gly Val
    370                 375                 380

Asn Ile Lys Lys Leu Arg Glu Leu Ile Val Gly Gln Tyr Phe Pro Glu
385                 390                 395                 400

Val Leu Asp Lys Glu Tyr Asp Leu Ser Lys Asn Gly Asp Ser Val Val
                405                 410                 415

Thr Tyr Arg Ser Lys Ile Tyr Thr Val Met Asn Tyr Ile Leu Leu Tyr
            420                 425                 430

Tyr Leu Glu Asp His Asp Ser Ser Arg Glu Ser Met Val Glu Ala Leu
        435                 440                 445

Arg Gln Asn Arg Glu Gly Asp Glu Gly Lys Glu Glu Ile Tyr Arg Gln
    450                 455                 460

Phe Ala Lys Lys Val Trp Asn Gly Val Ser Gly Leu Phe Gly Val Cys
465                 470                 475                 480

Leu Asn Leu Phe Lys Thr Glu Lys Arg Asn Lys Phe Arg Ser Lys Val
                485                 490                 495

Ala Leu Pro Asp Val Ser Gly Ala Ala Tyr Met Leu Ser Ser Glu Asn
            500                 505                 510

Ile Asp Tyr Phe Val Lys Met Leu Phe Phe Val Cys Lys Phe Leu Asp
        515                 520                 525

Gly Lys Glu Ile Asn Glu Leu Leu Cys Ala Leu Ile Asn Lys Phe Asp
    530                 535                 540

Asn Ile Ala Asp Ile Leu Asp Ala Ala Ala Gln Cys Gly Ser Ser Val
545                 550                 555                 560

Trp Phe Val Asp Ser Tyr Arg Phe Phe Glu Arg Ser Arg Arg Ile Ser
                565                 570                 575
```

```
Ala Gln Ile Arg Ile Val Lys Asn Ile Ala Ser Lys Asp Phe Lys Lys
            580                 585                 590

Ser Lys Lys Asp Ser Asp Glu Ser Tyr Pro Glu Gln Leu Tyr Leu Asp
        595                 600                 605

Ala Leu Ala Leu Leu Gly Asp Val Ile Ser Lys Tyr Lys Gln Asn Arg
    610                 615                 620

Asp Gly Ser Val Val Ile Asp Asp Gln Gly Asn Ala Val Leu Thr Glu
625                 630                 635                 640

Gln Tyr Lys Arg Phe Arg Tyr Glu Phe Phe Glu Glu Ile Lys Arg Asp
                645                 650                 655

Glu Ser Gly Gly Ile Lys Tyr Lys Lys Ser Gly Lys Pro Glu Tyr Asn
            660                 665                 670

His Gln Arg Arg Asn Phe Ile Leu Asn Asn Val Leu Lys Ser Lys Trp
        675                 680                 685

Phe Phe Tyr Val Val Lys Tyr Asn Arg Pro Ser Ser Cys Arg Glu Leu
    690                 695                 700

Met Lys Asn Lys Glu Ile Leu Arg Phe Val Leu Arg Asp Ile Pro Asp
705                 710                 715                 720

Ser Gln Val Arg Arg Tyr Phe Lys Ala Val Gln Gly Glu Glu Ala Tyr
                725                 730                 735

Ala Ser Ala Glu Ala Met Arg Thr Arg Leu Val Asp Ala Leu Ser Gln
            740                 745                 750

Phe Ser Val Thr Ala Cys Leu Asp Glu Val Gly Gly Met Thr Asp Lys
        755                 760                 765

Glu Phe Ala Ser Gln Arg Ala Val Asp Ser Lys Glu Lys Leu Arg Ala
    770                 775                 780

Ile Ile Arg Leu Tyr Leu Thr Val Ala Tyr Leu Ile Thr Lys Ser Met
785                 790                 795                 800
```

```
Val Lys Val Asn Thr Arg Phe Ser Ile Ala Phe Ser Val Leu Glu Arg
                805                 810                 815

Asp Tyr Tyr Leu Leu Ile Asp Gly Lys Lys Lys Ser Ser Asp Tyr Thr
            820                 825                 830

Gly Glu Asp Met Leu Ala Leu Thr Arg Lys Phe Val Gly Glu Asp Ala
        835                 840                 845

Gly Leu Tyr Arg Glu Trp Lys Glu Lys Asn Ala Glu Ala Lys Asp Lys
    850                 855                 860

Tyr Phe Asp Lys Ala Glu Arg Lys Lys Val Leu Arg Gln Asn Asp Lys
865                 870                 875                 880

Met Ile Arg Lys Met His Phe Thr Pro His Ser Leu Asn Tyr Val Gln
                885                 890                 895

Lys Asn Leu Glu Ser Val Gln Ser Asn Gly Leu Ala Ala Val Ile Lys
            900                 905                 910

Glu Tyr Arg Asn Ala Val Ala His Leu Asn Ile Ile Asn Arg Leu Asp
        915                 920                 925

Glu Tyr Ile Gly Ser Ala Arg Ala Asp Ser Tyr Tyr Ser Leu Tyr Cys
    930                 935                 940

Tyr Cys Leu Gln Met Tyr Leu Ser Lys Asn Phe Ser Val Gly Tyr Leu
945                 950                 955                 960

Ile Asn Val Gln Lys Gln Leu Glu Glu His His Thr Tyr Met Lys Asp
                965                 970                 975

Leu Met Trp Leu Leu Asn Ile Pro Phe Ala Tyr Asn Leu Ala Arg Tyr
            980                 985                 990

Lys Asn Leu Ser Asn Glu Lys Leu  Phe Tyr Asp Glu Glu  Ala Ala Ala
        995                 1000                1005
```

Glu Lys Ala Asp Lys Ala Glu Asn Glu Arg Gly Glu
    1010   1015   1020

<210> 116
<211> 128
<212> PRT
<213> Artificial Sequence

<220>
<223> RNase1(K41R)

<400> 116

Lys Glu Ser Arg Ala Lys Lys Phe Gln Arg Gln His Met Asp Ser Asp
1   5   10   15

Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
            20   25   30

Arg Asn Met Thr Gln Gly Arg Cys Arg Pro Val Asn Thr Phe Val His
        35   40   45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr
    50   55   60

Cys Lys Asn Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65   70   75   80

Ile Thr Asp Cys Arg Leu Thr Asn Gly Ser Arg Tyr Pro Asn Cys Ala
                85   90   95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
            100   105   110

Ser Pro Tyr Val Pro Val His Phe Asp Ala Ser Val Glu Asp Ser Thr
        115   120   125

<210> 117
<211> 128
<212> PRT
<213> Artificial Sequence

<220>
<223> RNase1 (RNase1(K41R, D121E))

<400> 117

Lys Glu Ser Arg Ala Lys Lys Phe Gln Arg Gln His Met Asp Ser Asp
1 5 10 15

Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
20 25 30

Arg Asn Met Thr Gln Gly Arg Cys Arg Pro Val Asn Thr Phe Val His
35 40 45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr
50 55 60

Cys Lys Asn Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65 70 75 80

Ile Thr Asp Cys Arg Leu Thr Asn Gly Ser Arg Tyr Pro Asn Cys Ala
85 90 95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
100 105 110

Ser Pro Tyr Val Pro Val His Phe Glu Ala Ser Val Glu Asp Ser Thr
115 120 125

<210> 118
<211> 128
<212> PRT
<213> Artificial Sequence

<220>
<223> RNase1 (RNase1(K41R, D121E, H119N))

<400> 118

Lys Glu Ser Arg Ala Lys Lys Phe Gln Arg Gln His Met Asp Ser Asp
1 5 10 15

Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
20 25 30

Arg Asn Met Thr Gln Gly Arg Cys Arg Pro Val Asn Thr Phe Val His
35 40 45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr
50 55 60

Cys Lys Asn Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65 70 75 80

Ile Thr Asp Cys Arg Leu Thr Asn Gly Ser Arg Tyr Pro Asn Cys Ala
85 90 95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
100 105 110

Ser Pro Tyr Val Pro Val Asn Phe Glu Ala Ser Val Glu Asp Ser Thr
115 120 125

<210> 119
<211> 128
<212> PRT
<213> Artificial Sequence

<220>
<223> (RNase1(H119N))

<400> 119

Lys Glu Ser Arg Ala Lys Lys Phe Gln Arg Gln His Met Asp Ser Asp
1 5 10 15

Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
20 25 30

Arg Asn Met Thr Gln Gly Arg Cys Lys Pro Val Asn Thr Phe Val His
35 40 45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr
50 55 60

Cys Lys Asn Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65 70 75 80

Ile Thr Asp Cys Arg Leu Thr Asn Gly Ser Arg Tyr Pro Asn Cys Ala
85 90 95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
100 105 110

Ser Pro Tyr Val Pro Val Asn Phe Asp Ala Ser Val Glu Asp Ser Thr
115 120 125

<210> 120
<211> 128
<212> PRT
<213> Artificial Sequence

<220>
<223> (RNase1(R39D, N67D, N88A, G89D, R91D, H119N))

<400> 120

Lys Glu Ser Arg Ala Lys Lys Phe Gln Arg Gln His Met Asp Ser Asp
1 5 10 15

Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
20 25 30

Arg Asn Met Thr Gln Gly Asp Cys Lys Pro Val Asn Thr Phe Val His
35 40 45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr
50 55 60

Cys Lys Asp Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65 70 75 80

Ile Thr Asp Cys Arg Leu Thr Ala Asp Ser Asp Tyr Pro Asn Cys Ala
85 90 95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
100 105 110

Ser Pro Tyr Val Pro Val Asn Phe Asp Ala Ser Val Glu Asp Ser Thr
115 120 125

<210> 121
<211> 128

<212> PRT
<213> Artificial Sequence

<220>
<223> RNase1 (RNase1(R39D, N67D, N88A, G89D, R91D, H119N, K41R, D121E))

<400> 121

Lys Glu Ser Arg Ala Lys Lys Phe Gln Arg Gln His Met Asp Ser Asp
1 5 10 15

Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
20 25 30

Arg Asn Met Thr Gln Gly Asp Cys Arg Pro Val Asn Thr Phe Val His
35 40 45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr
50 55 60

Cys Lys Asp Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65 70 75 80

Ile Thr Asp Cys Arg Leu Thr Ala Asp Ser Asp Tyr Pro Asn Cys Ala
85 90 95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
100 105 110

Ser Pro Tyr Val Pro Val Asn Phe Glu Ala Ser Val Glu Asp Ser Thr
115 120 125

<210> 122
<211> 128
<212> PRT
<213> Artificial Sequence

<220>
<223> RNase1 (RNase1(R39D, N67D, N88A, G89D, R91D))

<400> 122

Lys Glu Ser Arg Ala Lys Lys Phe Gln Arg Gln His Met Asp Ser Asp
1 5 10 15

```
Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
            20                  25                  30

Arg Asn Met Thr Gln Gly Asp Cys Lys Pro Val Asn Thr Phe Val His
        35                  40                  45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr
    50                  55                  60

Cys Lys Asp Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65                  70                  75                  80

Ile Thr Asp Cys Arg Leu Thr Ala Asp Ser Asp Tyr Pro Asn Cys Ala
                85                  90                  95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
            100                 105                 110

Ser Pro Tyr Val Pro Val His Phe Asp Ala Ser Val Glu Asp Ser Thr
        115                 120                 125
```

<210> 123
<211> 311
<212> PRT
<213> Homo Sapiens

<400> 123

```
Cys Ser Pro Gln Glu Ser Gly Met Thr Ala Leu Ser Ala Arg Met Leu
1               5                   10                  15

Thr Arg Ser Arg Ser Leu Gly Pro Gly Ala Gly Pro Arg Gly Cys Arg
            20                  25                  30

Glu Glu Pro Gly Pro Leu Arg Arg Arg Glu Ala Ala Ala Glu Ala Arg
        35                  40                  45

Lys Ser His Ser Pro Val Lys Arg Pro Arg Lys Ala Gln Arg Leu Arg
    50                  55                  60

Val Ala Tyr Glu Gly Ser Asp Ser Glu Lys Gly Glu Gly Ala Glu Pro
65                  70                  75                  80
```

```
Leu Lys Val Pro Val Trp Glu Pro Gln Asp Trp Gln Gln Gln Leu Val
                85                  90                  95

Asn Ile Arg Ala Met Arg Asn Lys Lys Asp Ala Pro Val Asp His Leu
            100                 105                 110

Gly Thr Glu His Cys Tyr Asp Ser Ser Ala Pro Pro Lys Val Arg Arg
        115                 120                 125

Tyr Gln Val Leu Leu Ser Leu Met Leu Ser Ser Gln Thr Lys Asp Gln
    130                 135                 140

Val Thr Ala Gly Ala Met Gln Arg Leu Arg Ala Arg Gly Leu Thr Val
145                 150                 155                 160

Asp Ser Ile Leu Gln Thr Asp Asp Ala Thr Leu Gly Lys Leu Ile Tyr
                165                 170                 175

Pro Val Gly Phe Trp Arg Ser Lys Val Lys Tyr Ile Lys Gln Thr Ser
            180                 185                 190

Ala Ile Leu Gln Gln His Tyr Gly Gly Asp Ile Pro Ala Ser Val Ala
        195                 200                 205

Glu Leu Val Ala Leu Pro Gly Val Gly Pro Lys Met Ala His Leu Ala
    210                 215                 220

Met Ala Val Ala Trp Gly Thr Val Ser Gly Ile Ala Val Asp Thr His
225                 230                 235                 240

Val His Arg Ile Ala Asn Arg Leu Arg Trp Thr Lys Lys Ala Thr Lys
                245                 250                 255

Ser Pro Glu Glu Thr Arg Ala Ala Leu Glu Glu Trp Leu Pro Arg Glu
            260                 265                 270

Leu Trp His Glu Ile Asn Gly Leu Leu Val Gly Phe Gly Gln Gln Thr
        275                 280                 285

Cys Leu Pro Val His Pro Arg Cys His Ala Cys Leu Asn Gln Ala Leu
```

290 295 300

Cys Pro Ala Ala Gln Gly Leu
305 310

<210> 124
<211> 372
<212> PRT
<213> Homo Sapiens

<400> 124

Met Glu Ser Gly Gln Pro Ala Arg Arg Ile Ala Met Ala Pro Leu Leu
1 5 10 15

Glu Tyr Glu Arg Gln Leu Val Leu Glu Leu Leu Asp Thr Asp Gly Leu
20 25 30

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

Leu Gln Leu His Cys His Pro Ala Cys Leu Val Leu Val Leu Asn Thr
50 55 60

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

Val Glu His Leu Pro Arg Arg Val Thr Asn Glu Ile Thr Ser Asn Ser
85 90 95

Arg Tyr Glu Val Tyr Thr Gln Gly Gly Val Ile Phe Ala Thr Ser Arg
100 105 110

Ile Leu Val Val Asp Phe Leu Thr Asp Arg Ile Pro Ser Asp Leu Ile
115 120 125

Thr Gly Ile Leu Val Tyr Arg Ala His Arg Ile Ile Glu Ser Cys Gln
130 135 140

Glu Ala Phe Ile Leu Arg Leu Phe Arg Gln Lys Asn Lys Arg Gly Phe
145 150 155 160

```
Ile Lys Ala Phe Thr Asp Asn Ala Val Ala Phe Asp Thr Gly Phe Cys
                165                 170                 175

His Val Glu Arg Val Met Arg Asn Leu Phe Val Arg Lys Leu Tyr Leu
            180                 185                 190

Trp Pro Arg Phe His Val Ala Val Asn Ser Phe Leu Glu Gln His Lys
        195                 200                 205

Pro Glu Val Val Glu Ile His Val Ser Met Thr Pro Thr Met Leu Ala
    210                 215                 220

Ile Gln Thr Ala Ile Leu Asp Ile Leu Asn Ala Cys Leu Lys Glu Leu
225                 230                 235                 240

Lys Cys His Asn Pro Ser Leu Glu Val Glu Asp Leu Ser Leu Glu Asn
                245                 250                 255

Ala Ile Gly Lys Pro Phe Asp Lys Thr Ile Arg His Tyr Leu Asp Pro
            260                 265                 270

Leu Trp His Gln Leu Gly Ala Lys Thr Lys Ser Leu Val Gln Asp Leu
        275                 280                 285

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

Thr Phe Leu Asn Leu Leu Glu Ser Leu Arg Ala Thr Glu Lys Ala Phe
305                 310                 315                 320

Gly Gln Asn Ser Gly Trp Leu Phe Leu Asp Ser Ser Thr Ser Met Phe
                325                 330                 335

Ile Asn Ala Arg Ala Arg Val Tyr His Leu Pro Asp Ala Lys Met Ser
            340                 345                 350

Lys Lys Glu Lys Ile Ser Glu Lys Met Glu Ile Lys Glu Gly Glu Gly
        355                 360                 365

Ile Leu Trp Gly
    370
```

<210> 125
<211> 287
<212> PRT
<213> Homo Sapiens

<400> 125

```
Pro Lys Arg Gly Lys Lys Gly Ala Val Ala Glu Asp Gly Asp Glu Leu
1               5                  10                  15


Arg Thr Glu Pro Glu Ala Lys Lys Ser Lys Thr Ala Ala Lys Lys Asn
            20                  25                  30


Asp Lys Glu Ala Ala Gly Glu Gly Pro Ala Leu Tyr Glu Asp Pro Pro
        35                  40                  45


Asp Gln Lys Thr Ser Pro Ser Gly Lys Pro Ala Thr Leu Lys Ile Cys
    50                  55                  60


Ser Trp Asn Val Asp Gly Leu Arg Ala Trp Ile Lys Lys Lys Gly Leu
65                  70                  75                  80


Asp Trp Val Lys Glu Glu Ala Pro Asp Ile Leu Cys Leu Gln Glu Thr
                85                  90                  95


Lys Cys Ser Glu Asn Lys Leu Pro Ala Glu Leu Gln Glu Leu Pro Gly
            100                 105                 110


Leu Ser His Gln Tyr Trp Ser Ala Pro Ser Asp Lys Glu Gly Tyr Ser
        115                 120                 125


Gly Val Gly Leu Leu Ser Arg Gln Cys Pro Leu Lys Val Ser Tyr Gly
    130                 135                 140


Ile Gly Asp Glu Glu His Asp Gln Glu Gly Arg Val Ile Val Ala Glu
145                 150                 155                 160


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


Gly Leu Val Arg Leu Glu Tyr Arg Gln Arg Trp Asp Glu Ala Phe Arg
```

180 185 190

Lys Phe Leu Lys Gly Leu Ala Ser Arg Lys Pro Leu Val Leu Cys Gly
195 200 205

Asp Leu Asn Val Ala His Glu Glu Ile Asp Leu Arg Asn Pro Lys Gly
210 215 220

Asn Lys Lys Asn Ala Gly Phe Thr Pro Gln Glu Arg Gln Gly Phe Gly
225 230 235 240

Glu Leu Leu Gln Ala Val Pro Leu Ala Asp Ser Phe Arg His Leu Tyr
245 250 255

Pro Asn Thr Pro Tyr Ala Tyr Thr Phe Trp Thr Tyr Met Met Asn Ala
260 265 270

Arg Ser Lys Asn Val Gly Trp Arg Leu Asp Tyr Phe Leu Leu Ser
275 280 285

<210> 126
<211> 213
<212> PRT
<213> Homo Sapiens

<400> 126

Glu Ala Leu Phe Phe Pro Ser Gln Val Thr Cys Thr Glu Ala Leu Leu
1 5 10 15

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

Gly Leu Pro His Gly Glu Ser Ala Leu Ser Arg Leu Leu Arg Ala Leu
35 40 45

Leu Ala Ala Arg Ala Ser Leu Asp Leu Cys Leu Phe Ala Phe Ser Ser
50 55 60

Pro Gln Leu Gly Arg Ala Val Gln Leu Leu His Gln Arg Gly Val Arg
65 70 75 80

```
Val Arg Val Val Thr Asp Cys Asp Tyr Met Ala Leu Asn Gly Ser Gln
                85                  90                  95


Ile Gly Leu Leu Arg Lys Ala Gly Ile Gln Val Arg His Asp Gln Asp
            100                 105                 110


Pro Gly Tyr Met His His Lys Phe Ala Ile Val Asp Lys Arg Val Leu
        115                 120                 125


Ile Thr Gly Ser Leu Asn Trp Thr Thr Gln Ala Ile Gln Asn Asn Arg
    130                 135                 140


Glu Asn Val Leu Ile Thr Glu Asp Asp Glu Tyr Val Arg Leu Phe Leu
145                 150                 155                 160


Glu Glu Phe Glu Arg Ile Trp Glu Gln Phe Asn Pro Thr Lys Tyr Thr
                165                 170                 175


Phe Phe Pro Pro Lys Lys Ser His Gly Ser Cys Ala Pro Pro Val Ser
            180                 185                 190


Arg Ala Gly Gly Arg Leu Leu Ser Trp His Arg Thr Cys Gly Thr Ser
        195                 200                 205


Ser Glu Ser Gln Thr
    210


<210>  127
<211>  382
<212>  PRT
<213>  Homo Sapiens

<400>  127

Lys Ala Arg Tyr Lys Thr Leu Glu Pro Arg Gly Tyr Ser Leu Leu Ile
1               5                   10                  15


Arg Gly Leu Ile His Ser Asp Arg Trp Arg Glu Ala Leu Leu Leu Leu
            20                  25                  30


Glu Asp Ile Lys Lys Val Ile Thr Pro Ser Lys Lys Asn Tyr Asn Asp
        35                  40                  45
```

```
Cys Ile Gln Gly Ala Leu Leu His Gln Asp Val Asn Thr Ala Trp Asn
    50                  55                  60

Leu Tyr Gln Glu Leu Leu Gly His Asp Ile Val Pro Met Leu Glu Thr
65                  70                  75                  80

Leu Lys Ala Phe Phe Asp Phe Gly Lys Asp Ile Lys Asp Asp Asn Tyr
                85                  90                  95

Ser Asn Lys Leu Leu Asp Ile Leu Ser Tyr Leu Arg Asn Asn Gln Leu
            100                 105                 110

Tyr Pro Gly Glu Ser Phe Ala His Ser Ile Lys Thr Trp Phe Glu Ser
        115                 120                 125

Val Pro Gly Lys Gln Trp Lys Gly Gln Phe Thr Thr Val Arg Lys Ser
    130                 135                 140

Gly Gln Cys Ser Gly Cys Gly Lys Thr Ile Glu Ser Ile Gln Leu Ser
145                 150                 155                 160

Pro Glu Glu Tyr Glu Cys Leu Lys Gly Lys Ile Met Arg Asp Val Ile
                165                 170                 175

Asp Gly Gly Asp Gln Tyr Arg Lys Thr Thr Pro Gln Glu Leu Lys Arg
            180                 185                 190

Phe Glu Asn Phe Ile Lys Ser Arg Pro Pro Phe Asp Val Val Ile Asp
        195                 200                 205

Gly Leu Asn Val Ala Lys Met Phe Pro Lys Val Arg Glu Ser Gln Leu
    210                 215                 220

Leu Leu Asn Val Val Ser Gln Leu Ala Lys Arg Asn Leu Arg Leu Leu
225                 230                 235                 240

Val Leu Gly Arg Lys His Met Leu Arg Arg Ser Ser Gln Trp Ser Arg
                245                 250                 255

Asp Glu Met Glu Glu Val Gln Lys Gln Ala Ser Cys Phe Phe Ala Asp
```

260 265 270

Asp Ile Ser Glu Asp Asp Pro Phe Leu Leu Tyr Ala Thr Leu His Ser
275 280 285

Gly Asn His Cys Arg Phe Ile Thr Arg Asp Leu Met Arg Asp His Lys
290 295 300

Ala Cys Leu Pro Asp Ala Lys Thr Gln Arg Leu Phe Phe Lys Trp Gln
305 310 315 320

Gln Gly His Gln Leu Ala Ile Val Asn Arg Phe Pro Gly Ser Lys Leu
325 330 335

Thr Phe Gln Arg Ile Leu Ser Tyr Asp Thr Val Val Gln Thr Thr Gly
340 345 350

Asp Ser Trp His Ile Pro Tyr Asp Glu Asp Leu Val Glu Arg Cys Ser
355 360 365

Cys Glu Val Pro Thr Lys Trp Leu Cys Leu His Gln Lys Thr
370 375 380

<210> 128
<211> 360
<212> PRT
<213> Homo Sapiens

<400> 128

Ser Val Glu Pro Met Phe Arg His Leu Lys Asn Thr Tyr Ala Gly Leu
1 5 10 15

Gln Leu Val Val Val Ile Leu Pro Gly Lys Thr Pro Val Tyr Ala Glu
20 25 30

Val Lys Arg Val Gly Asp Thr Val Leu Gly Met Ala Thr Gln Cys Val
35 40 45

Gln Met Lys Asn Val Gln Arg Thr Thr Pro Gln Thr Leu Ser Asn Leu
50 55 60

```
Cys Leu Lys Ile Asn Val Lys Leu Gly Gly Val Asn Asn Ile Leu Leu
65                  70                  75                  80


Pro Gln Gly Arg Pro Pro Val Phe Gln Gln Pro Val Ile Phe Leu Gly
                85                  90                  95


Ala Asp Val Thr His Pro Pro Ala Gly Asp Gly Lys Lys Pro Ser Ile
            100                 105                 110


Ala Ala Val Val Gly Ser Met Asp Ala His Pro Asn Arg Tyr Cys Ala
        115                 120                 125


Thr Val Arg Val Gln Gln His Arg Gln Glu Ile Ile Gln Asp Leu Ala
    130                 135                 140


Ala Met Val Arg Glu Leu Leu Ile Gln Phe Tyr Lys Ser Thr Arg Phe
145                 150                 155                 160


Lys Pro Thr Arg Ile Ile Phe Tyr Arg Asp Gly Val Ser Glu Gly Gln
                165                 170                 175


Phe Gln Gln Val Leu His His Glu Leu Leu Ala Ile Arg Glu Ala Cys
            180                 185                 190


Ile Lys Leu Glu Lys Asp Tyr Gln Pro Gly Ile Thr Phe Ile Val Val
        195                 200                 205


Gln Lys Arg His His Thr Arg Leu Phe Cys Thr Asp Lys Asn Glu Arg
    210                 215                 220


Val Gly Lys Ser Gly Asn Ile Pro Ala Gly Thr Thr Val Asp Thr Lys
225                 230                 235                 240


Ile Thr His Pro Thr Glu Phe Asp Phe Tyr Leu Cys Ser His Ala Gly
                245                 250                 255


Ile Gln Gly Thr Ser Arg Pro Ser His Tyr His Val Leu Trp Asp Asp
            260                 265                 270


Asn Arg Phe Ser Ser Asp Glu Leu Gln Ile Leu Thr Tyr Gln Leu Cys
        275                 280                 285
```

```
His Thr Tyr Val Arg Cys Thr Arg Ser Val Ser Ile Pro Ala Pro Ala
    290                 295                 300

Tyr Tyr Ala His Leu Val Ala Phe Arg Ala Arg Tyr His Leu Val Asp
305                 310                 315                 320

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

Gly Arg Asp His Gln Ala Leu Ala Lys Ala Val Gln Val His Gln Asp
            340                 345                 350

Thr Leu Arg Thr Met Tyr Phe Ala
        355                 360
```

<210> 129
<211> 327
<212> PRT
<213> Homo Sapiens

<400> 129

```
Gln Gly Ala Glu Gly Ala Leu Thr Gly Lys Gln Pro Asp Gly Ser Ala
1               5                   10                  15

Glu Lys Ala Val Leu Glu Gln Phe Gly Phe Pro Leu Thr Gly Thr Glu
            20                  25                  30

Ala Arg Cys Tyr Thr Asn His Ala Leu Ser Tyr Asp Gln Ala Lys Arg
        35                  40                  45

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

Asp Ala Asp Arg Lys His Cys Lys Phe Lys Pro Asp Pro Asn Ile Pro
65                  70                  75                  80

Pro Thr Phe Ser Ala Phe Asn Glu Asp Tyr Val Gly Ser Gly Trp Ser
                85                  90                  95

Arg Gly His Met Ala Pro Ala Gly Asn Asn Lys Phe Ser Ser Lys Ala
```

```
            100                 105                 110

Met Ala Glu Thr Phe Tyr Leu Ser Asn Ile Val Pro Gln Asp Phe Asp
        115                 120                 125

Asn Asn Ser Gly Tyr Trp Asn Arg Ile Glu Met Tyr Cys Arg Glu Leu
    130                 135                 140

Thr Glu Arg Phe Glu Asp Val Trp Val Val Ser Gly Pro Leu Thr Leu
145                 150                 155                 160

Pro Gln Thr Arg Gly Asp Gly Lys Lys Ile Val Ser Tyr Gln Val Ile
                165                 170                 175

Gly Glu Asp Asn Val Ala Val Pro Ser His Leu Tyr Lys Val Ile Leu
            180                 185                 190

Ala Arg Arg Ser Ser Val Ser Thr Glu Pro Leu Ala Leu Gly Ala Phe
        195                 200                 205

Val Val Pro Asn Glu Ala Ile Gly Phe Gln Pro Gln Leu Thr Glu Phe
    210                 215                 220

Gln Val Ser Leu Gln Asp Leu Glu Lys Leu Ser Gly Leu Val Phe Phe
225                 230                 235                 240

Pro His Leu Asp Arg Thr Ser Asp Ile Arg Asn Ile Cys Ser Val Asp
                245                 250                 255

Thr Cys Lys Leu Leu Asp Phe Gln Glu Phe Thr Leu Tyr Leu Ser Thr
            260                 265                 270

Arg Lys Ile Glu Gly Ala Arg Ser Val Leu Arg Leu Glu Lys Ile Met
        275                 280                 285

Glu Asn Leu Lys Asn Ala Glu Ile Glu Pro Asp Asp Tyr Phe Met Ser
    290                 295                 300

Arg Tyr Glu Lys Lys Leu Glu Glu Leu Lys Ala Lys Glu Gln Ser Gly
305                 310                 315                 320
```

Thr Gln Ile Arg Lys Pro Ser
325

<210> 130
<211> 526
<212> PRT
<213> Homo Sapiens

<400> 130

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

Glu Asp Val Leu Arg Val Leu Gly Lys Leu Gly Glu Gly Ala Leu Val
20 25 30

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

Leu Glu His Pro Ala Ala Pro Arg Leu Val Pro Arg Gly Ser Cys Gly
50 55 60

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

Phe Arg Thr Leu Ala Ser Ser Leu Arg Pro Ile Val Ile Asp Gly Ser
85 90 95

Asn Val Ala Met Ser His Gly Asn Lys Glu Thr Phe Ser Cys Arg Gly
100 105 110

Ile Lys Leu Ala Val Asp Trp Phe Arg Asp Arg Gly His Thr Tyr Ile
115 120 125

Lys Val Phe Val Pro Ser Trp Arg Lys Asp Pro Pro Arg Ala Asp Thr
130 135 140

Pro Ile Arg Glu Gln His Val Leu Ala Glu Leu Glu Arg Gln Ala Val
145 150 155 160

Leu Val Tyr Thr Pro Ser Arg Lys Val His Gly Lys Arg Leu Val Cys
165 170 175

```
Tyr Asp Asp Arg Tyr Ile Val Lys Val Ala Tyr Glu Gln Asp Gly Val
            180                 185                 190

Ile Val Ser Asn Asp Asn Tyr Arg Asp Leu Gln Ser Glu Asn Pro Glu
        195                 200                 205

Trp Lys Trp Phe Ile Glu Gln Arg Leu Leu Met Phe Ser Phe Val Asn
    210                 215                 220

Asp Arg Phe Met Pro Pro Asp Asp Pro Leu Gly Arg His Gly Pro Ser
225                 230                 235                 240

Leu Ser Asn Phe Leu Ser Arg Lys Pro Lys Pro Pro Glu Pro Ser Trp
                245                 250                 255

Gln His Cys Pro Tyr Gly Lys Lys Cys Thr Tyr Gly Ile Lys Cys Lys
            260                 265                 270

Phe Tyr His Pro Glu Arg Pro His His Ala Gln Leu Ala Val Ala Asp
        275                 280                 285

Glu Leu Arg Ala Lys Thr Gly Ala Arg Pro Gly Ala Gly Ala Glu Glu
    290                 295                 300

Gln Arg Pro Pro Arg Ala Pro Gly Gly Ser Ala Gly Ala Arg Ala Ala
305                 310                 315                 320

Pro Arg Glu Pro Phe Ala His Ser Leu Pro Pro Ala Arg Gly Ser Pro
                325                 330                 335

Asp Leu Ala Ala Leu Arg Gly Ser Phe Ser Arg Leu Ala Phe Ser Asp
            340                 345                 350

Asp Leu Gly Pro Leu Gly Pro Pro Leu Pro Val Pro Ala Cys Ser Leu
        355                 360                 365

Thr Pro Arg Leu Gly Gly Pro Asp Trp Val Ser Ala Gly Gly Arg Val
    370                 375                 380
```

```
Pro Gly Pro Leu Ser Leu Pro Ser Pro Glu Ser Gln Phe Ser Pro Gly
385                 390                 395                 400


Asp Leu Pro Pro Pro Pro Gly Leu Gln Leu Gln Pro Arg Gly Glu His
                405                 410                 415


Arg Pro Arg Asp Leu His Gly Asp Leu Leu Ser Pro Arg Arg Pro Pro
            420                 425                 430


Asp Asp Pro Trp Ala Arg Pro Pro Arg Ser Asp Arg Phe Pro Gly Arg
        435                 440                 445


Ser Val Trp Ala Glu Pro Ala Trp Gly Asp Gly Ala Thr Gly Gly Leu
    450                 455                 460


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


Arg Ile Ala Leu Tyr Ser Val Phe Pro Arg Asp Gln Val Asp Arg Val
                485                 490                 495


Met Ala Ala Phe Pro Glu Leu Ser Asp Leu Ala Arg Leu Ile Leu Leu
            500                 505                 510


Val Gln Arg Cys Gln Ser Ala Gly Ala Pro Leu Gly Lys Pro
        515                 520                 525


<210>  131
<211>  475
<212>  PRT
<213>  Homo Sapiens

<400>  131

Arg Gln Gln Gln Pro Gln Val Val Glu Lys Gln Gln Glu Thr Pro Leu
1               5                   10                  15


Ala Pro Ala Asp Phe Ala His Ile Ser Gln Asp Ala Gln Ser Leu His
            20                  25                  30


Ser Gly Ala Ser Arg Arg Ser Gln Lys Arg Leu Gln Ser Pro Ser Lys
        35                  40                  45
```

```
Gln Ala Gln Pro Leu Asp Asp Pro Glu Ala Glu Gln Leu Thr Val Val
    50                  55                  60

Gly Lys Ile Ser Phe Asn Pro Lys Asp Val Leu Gly Arg Gly Ala Gly
65                  70                  75                  80

Gly Thr Phe Val Phe Arg Gly Gln Phe Glu Gly Arg Ala Val Ala Val
                85                  90                  95

Lys Arg Leu Leu Arg Glu Cys Phe Gly Leu Val Arg Arg Glu Val Gln
            100                 105                 110

Leu Leu Gln Glu Ser Asp Arg His Pro Asn Val Leu Arg Tyr Phe Cys
        115                 120                 125

Thr Glu Arg Gly Pro Gln Phe His Tyr Ile Ala Leu Glu Leu Cys Arg
    130                 135                 140

Ala Ser Leu Gln Glu Tyr Val Glu Asn Pro Asp Leu Asp Arg Gly Gly
145                 150                 155                 160

Leu Glu Pro Glu Val Val Leu Gln Gln Leu Met Ser Gly Leu Ala His
                165                 170                 175

Leu His Ser Leu His Ile Val His Arg Asp Leu Lys Pro Gly Asn Ile
            180                 185                 190

Leu Ile Thr Gly Pro Asp Ser Gln Gly Leu Gly Arg Val Val Leu Ser
        195                 200                 205

Asp Phe Gly Leu Cys Lys Lys Leu Pro Ala Gly Arg Cys Ser Phe Ser
    210                 215                 220

Leu His Ser Gly Ile Pro Gly Thr Glu Gly Trp Met Ala Pro Glu Leu
225                 230                 235                 240

Leu Gln Leu Leu Pro Pro Asp Ser Pro Thr Ser Ala Val Asp Ile Phe
                245                 250                 255

Ser Ala Gly Cys Val Phe Tyr Tyr Val Leu Ser Gly Gly Ser His Pro
```

```
            260                 265                 270

Phe Gly Asp Ser Leu Tyr Arg Gln Ala Asn Ile Leu Thr Gly Ala Pro
        275                 280                 285

Cys Leu Ala His Leu Glu Glu Glu Val His Asp Lys Val Val Ala Arg
    290                 295                 300

Asp Leu Val Gly Ala Met Leu Ser Pro Leu Pro Gln Pro Arg Pro Ser
305                 310                 315                 320

Ala Pro Gln Val Leu Ala His Pro Phe Phe Trp Ser Arg Ala Lys Gln
                325                 330                 335

Leu Gln Phe Phe Gln Asp Val Ser Asp Trp Leu Glu Lys Glu Ser Glu
            340                 345                 350

Gln Glu Pro Leu Val Arg Ala Leu Glu Ala Gly Gly Cys Ala Val Val
        355                 360                 365

Arg Asp Asn Trp His Glu His Ile Ser Met Pro Leu Gln Thr Asp Leu
    370                 375                 380

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

Ala Val Arg Asn Lys Lys His His Tyr Arg Glu Leu Pro Val Glu Val
                405                 410                 415

Arg Gln Ala Leu Gly Gln Val Pro Asp Gly Phe Val Gln Tyr Phe Thr
            420                 425                 430

Asn Arg Phe Pro Arg Leu Leu Leu His Thr His Arg Ala Met Arg Ser
        435                 440                 445

Cys Ala Ser Glu Ser Leu Phe Leu Pro Tyr Tyr Pro Pro Asp Ser Glu
    450                 455                 460

Ala Arg Arg Pro Cys Pro Gly Ala Thr Gly Arg
465                 470                 475
```

<210> 132
<211> 384
<212> PRT
<213> Homo Sapiens

<400> 132

```
Lys Leu Val Arg Lys Asn Ile Glu Lys Asp Asn Ala Gly Gln Val Thr
1               5                  10                  15


Leu Val Pro Glu Glu Pro Glu Asp Met Trp His Thr Tyr Asn Leu Val
            20                  25                  30


Gln Val Gly Asp Ser Leu Arg Ala Ser Thr Ile Arg Lys Val Gln Thr
        35                  40                  45


Glu Ser Ser Thr Gly Ser Val Gly Ser Asn Arg Val Arg Thr Thr Leu
    50                  55                  60


Thr Leu Cys Val Glu Ala Ile Asp Phe Asp Ser Gln Ala Cys Gln Leu
65                  70                  75                  80


Arg Val Lys Gly Thr Asn Ile Gln Glu Asn Glu Tyr Val Lys Met Gly
                85                  90                  95


Ala Tyr His Thr Ile Glu Leu Glu Pro Asn Arg Gln Phe Thr Leu Ala
            100                 105                 110


Lys Lys Gln Trp Asp Ser Val Val Leu Glu Arg Ile Glu Gln Ala Cys
        115                 120                 125


Asp Pro Ala Trp Ser Ala Asp Val Ala Ala Val Val Met Gln Glu Gly
    130                 135                 140


Leu Ala His Ile Cys Leu Val Thr Pro Ser Met Thr Leu Thr Arg Ala
145                 150                 155                 160


Lys Val Glu Val Asn Ile Pro Arg Lys Arg Lys Gly Asn Cys Ser Gln
                165                 170                 175


His Asp Arg Ala Leu Glu Arg Phe Tyr Glu Gln Val Val Gln Ala Ile
            180                 185                 190
```

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

Pro Gly Phe Val Arg Glu Gln Phe Cys Asp Tyr Leu Phe Gln Gln Ala
    210                 215                 220

Val Lys Thr Asp Asn Lys Leu Leu Leu Glu Asn Arg Ser Lys Phe Leu
225                 230                 235                 240

Gln Val His Ala Ser Ser Gly His Lys Tyr Ser Leu Lys Glu Ala Leu
                245                 250                 255

Cys Asp Pro Thr Val Ala Ser Arg Leu Ser Asp Thr Lys Ala Ala Gly
            260                 265                 270

Glu Val Lys Ala Leu Asp Asp Phe Tyr Lys Met Leu Gln His Glu Pro
        275                 280                 285

Asp Arg Ala Phe Tyr Gly Leu Lys Gln Val Glu Lys Ala Asn Glu Ala
    290                 295                 300

Met Ala Ile Asp Thr Leu Leu Ile Ser Asp Glu Leu Phe Arg His Gln
305                 310                 315                 320

Asp Val Ala Thr Arg Ser Arg Tyr Val Arg Leu Val Asp Ser Val Lys
                325                 330                 335

Glu Asn Ala Gly Thr Val Arg Ile Phe Ser Ser Leu His Val Ser Gly
            340                 345                 350

Glu Gln Leu Ser Gln Leu Thr Gly Val Ala Ala Ile Leu Arg Phe Pro
        355                 360                 365

Val Pro Glu Leu Ser Asp Gln Glu Gly Asp Ser Ser Ser Glu Glu Asp
    370                 375                 380
```

<210> 133
<211> 166
<212> PRT
<213> Homo Sapiens

<400> 133

```
Ser Leu Val Ile Arg Asn Leu Gln Arg Val Ile Pro Ile Arg Arg Ala
1               5                   10                  15


Pro Leu Arg Ser Lys Ile Glu Ile Val Arg Arg Ile Leu Gly Val Gln
            20                  25                  30


Lys Phe Asp Leu Gly Ile Ile Cys Val Asp Asn Lys Asn Ile Gln His
        35                  40                  45


Ile Asn Arg Ile Tyr Arg Asp Arg Asn Val Pro Thr Asp Val Leu Ser
    50                  55                  60


Phe Pro Phe His Glu His Leu Lys Ala Gly Glu Phe Pro Gln Pro Asp
65                  70                  75                  80


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


Ile Phe His Gln Cys Lys Glu Asn Glu Asp Tyr Asn Asp Val Leu Thr
            100                 105                 110


Val Thr Ala Thr His Gly Leu Cys His Leu Leu Gly Phe Thr His Gly
        115                 120                 125


Thr Glu Ala Glu Trp Gln Gln Met Phe Gln Lys Glu Lys Ala Val Leu
    130                 135                 140


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


Gly Leu Phe Gly Gly Ser
                165
```

<210> 134
<211> 178
<212> PRT
<213> Homo Sapiens

<400> 134

```
Gln Glu Val Ile Ala Gly Leu Glu Arg Phe Thr Phe Ala Phe Glu Lys
1               5                   10                  15


Asp Val Glu Met Gln Lys Gly Thr Gly Leu Leu Pro Phe Gln Gly Met
            20                  25                  30


Asp Lys Ser Ala Ser Ala Val Cys Asn Phe Phe Thr Lys Gly Leu Cys
        35                  40                  45


Glu Lys Gly Lys Leu Cys Pro Phe Arg His Asp Arg Gly Glu Lys Met
    50                  55                  60


Val Val Cys Lys His Trp Leu Arg Gly Leu Cys Lys Lys Gly Asp His
65                  70                  75                  80


Cys Lys Phe Leu His Gln Tyr Asp Leu Thr Arg Met Pro Glu Cys Tyr
                85                  90                  95


Phe Tyr Ser Lys Phe Gly Asp Cys Ser Asn Lys Glu Cys Ser Phe Leu
            100                 105                 110


His Val Lys Pro Ala Phe Lys Ser Gln Asp Cys Pro Trp Tyr Asp Gln
        115                 120                 125


Gly Phe Cys Lys Asp Gly Pro Leu Cys Lys Tyr Arg His Val Pro Arg
    130                 135                 140


Ile Met Cys Leu Asn Tyr Leu Val Gly Phe Cys Pro Glu Gly Pro Lys
145                 150                 155                 160


Cys Gln Phe Ala Gln Lys Ile Arg Glu Phe Lys Leu Leu Pro Gly Ser
                165                 170                 175


Lys Ile
```

<210> 135
<211> 384
<212> PRT
<213> Homo Sapiens

<400> 135

```
Lys Leu Val Arg Lys Asn Ile Glu Lys Asp Asn Ala Gly Gln Val Thr
1               5                   10                  15

Leu Val Pro Glu Glu Pro Glu Asp Met Trp His Thr Tyr Asn Leu Val
            20                  25                  30

Gln Val Gly Asp Ser Leu Arg Ala Ser Thr Ile Arg Lys Val Gln Thr
        35                  40                  45

Glu Ser Ser Thr Gly Ser Val Gly Ser Asn Arg Val Arg Thr Thr Leu
    50                  55                  60

Thr Leu Cys Val Glu Ala Ile Asp Phe Asp Ser Gln Ala Cys Gln Leu
65                  70                  75                  80

Arg Val Lys Gly Thr Asn Ile Gln Glu Asn Glu Tyr Val Lys Met Gly
                85                  90                  95

Ala Tyr His Thr Ile Glu Leu Glu Pro Asn Arg Gln Phe Thr Leu Ala
            100                 105                 110

Lys Lys Gln Trp Asp Ser Val Val Leu Glu Arg Ile Glu Gln Ala Cys
        115                 120                 125

Asp Pro Ala Trp Ser Ala Asp Val Ala Ala Val Val Met Gln Glu Gly
    130                 135                 140

Leu Ala His Ile Cys Leu Val Thr Pro Ser Met Thr Leu Thr Arg Ala
145                 150                 155                 160

Lys Val Glu Val Asn Ile Pro Arg Lys Arg Lys Gly Asn Cys Ser Gln
                165                 170                 175

His Asp Arg Ala Leu Glu Arg Phe Tyr Glu Gln Val Val Gln Ala Ile
            180                 185                 190

Gln Arg His Ile His Phe Asp Val Val Lys Cys Ile Leu Val Ala Ser
        195                 200                 205

Pro Gly Phe Val Arg Glu Gln Phe Cys Asp Tyr Met Phe Gln Gln Ala
```

```
    210                 215                 220

Val Lys Thr Asp Asn Lys Leu Leu Leu Glu Asn Arg Ser Lys Phe Leu
225                 230                 235                 240

Gln Val His Ala Ser Ser Gly His Lys Tyr Ser Leu Lys Glu Ala Leu
                245                 250                 255

Cys Asp Pro Thr Val Ala Ser Arg Leu Ser Asp Thr Lys Ala Ala Gly
            260                 265                 270

Glu Val Lys Ala Leu Asp Asp Phe Tyr Lys Met Leu Gln His Glu Pro
        275                 280                 285

Asp Arg Ala Phe Tyr Gly Leu Lys Gln Val Glu Lys Ala Asn Glu Ala
    290                 295                 300

Met Ala Ile Asp Thr Leu Leu Ile Ser Asp Glu Leu Phe Arg His Gln
305                 310                 315                 320

Asp Val Ala Thr Arg Ser Arg Tyr Val Arg Leu Val Asp Ser Val Lys
                325                 330                 335

Glu Asn Ala Gly Thr Val Arg Ile Phe Ser Ser Leu His Val Ser Gly
            340                 345                 350

Glu Gln Leu Ser Gln Leu Thr Gly Val Ala Ala Ile Leu Arg Phe Pro
        355                 360                 365

Val Pro Glu Leu Ser Asp Gln Glu Gly Asp Ser Ser Ser Glu Glu Asp
    370                 375                 380


<210>  136
<211>  256
<212>  PRT
<213>  Homo Sapiens

<400>  136

Asp Pro Ala Trp Ser Ala Asp Val Ala Ala Val Val Met Gln Glu Gly
1               5                   10                  15
```

```
Leu Ala His Ile Cys Leu Val Thr Pro Ser Met Thr Leu Thr Arg Ala
            20                  25                  30

Lys Val Glu Val Asn Ile Pro Arg Lys Arg Lys Gly Asn Cys Ser Gln
        35                  40                  45

His Asp Arg Ala Leu Glu Arg Phe Tyr Glu Gln Val Val Gln Ala Ile
    50                  55                  60

Gln Arg His Ile His Phe Asp Val Val Lys Cys Ile Leu Val Ala Ser
65                  70                  75                  80

Pro Gly Phe Val Arg Glu Gln Phe Cys Asp Tyr Met Phe Gln Gln Ala
                85                  90                  95

Val Lys Thr Asp Asn Lys Leu Leu Leu Glu Asn Arg Ser Lys Phe Leu
            100                 105                 110

Gln Val His Ala Ser Ser Gly His Lys Tyr Ser Leu Lys Glu Ala Leu
        115                 120                 125

Cys Asp Pro Thr Val Ala Ser Arg Leu Ser Asp Thr Lys Ala Ala Gly
    130                 135                 140

Glu Val Lys Ala Leu Asp Asp Phe Tyr Lys Met Leu Gln His Glu Pro
145                 150                 155                 160

Asp Arg Ala Phe Tyr Gly Leu Lys Gln Val Glu Lys Ala Asn Glu Ala
                165                 170                 175

Met Ala Ile Asp Thr Leu Leu Ile Ser Asp Glu Leu Phe Arg His Gln
            180                 185                 190

Asp Val Ala Thr Arg Ser Arg Tyr Val Arg Leu Val Asp Ser Val Lys
        195                 200                 205

Glu Asn Ala Gly Thr Val Arg Ile Phe Ser Ser Leu His Val Ser Gly
    210                 215                 220

Glu Gln Leu Ser Gln Leu Thr Gly Val Ala Ala Ile Leu Arg Phe Pro
225                 230                 235                 240
```

```
Val Pro Glu Leu Ser Asp Gln Glu Gly Asp Ser Ser Ser Glu Glu Asp
                245                 250                 255


<210>  137
<211>  209
<212>  PRT
<213>  Homo Sapiens

<400>  137

Met Asp Pro Gly Lys Asp Lys Glu Gly Val Pro Gln Pro Ser Gly Pro
1               5                   10                  15


Pro Ala Arg Lys Lys Phe Val Ile Pro Leu Asp Glu Asp Glu Val Pro
            20                  25                  30


Pro Gly Val Arg Gly Asn Pro Val Leu Lys Phe Val Arg Asn Val Pro
        35                  40                  45


Trp Glu Phe Gly Asp Val Ile Pro Asp Tyr Val Leu Gly Gln Ser Thr
    50                  55                  60


Cys Ala Leu Phe Leu Ser Leu Arg Tyr His Asn Leu His Pro Asp Tyr
65                  70                  75                  80


Ile His Gly Arg Leu Gln Ser Leu Gly Lys Asn Phe Ala Leu Arg Val
                85                  90                  95


Leu Leu Val Gln Val Asp Val Lys Asp Pro Gln Gln Ala Leu Lys Glu
            100                 105                 110


Leu Ala Lys Met Cys Ile Leu Ala Asp Cys Thr Leu Ile Leu Ala Trp
        115                 120                 125


Ser Pro Glu Glu Ala Gly Arg Tyr Leu Glu Thr Tyr Lys Ala Tyr Glu
    130                 135                 140


Gln Lys Pro Ala Asp Leu Leu Met Glu Lys Leu Glu Gln Asp Phe Val
145                 150                 155                 160


Ser Arg Val Thr Glu Cys Leu Thr Thr Val Lys Ser Val Asn Lys Thr
```

```
                165                 170                 175

Asp Ser Gln Thr Leu Leu Thr Thr Phe Gly Ser Leu Glu Gln Leu Ile
            180                 185                 190

Ala Ala Ser Arg Glu Asp Leu Ala Leu Cys Pro Gly Leu Gly Pro Gln
        195                 200                 205

Lys
```

<210> 138
<211> 128
<212> PRT
<213> Homo Sapiens

<400> 138

```
Lys Glu Ser Arg Ala Lys Lys Phe Gln Arg Gln His Met Asp Ser Asp
1               5                   10                  15

Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
            20                  25                  30

Arg Asn Met Thr Gln Gly Arg Cys Lys Pro Val Asn Thr Phe Val His
        35                  40                  45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr
    50                  55                  60

Cys Lys Asn Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65                  70                  75                  80

Ile Thr Asp Cys Arg Leu Thr Asn Gly Ser Arg Tyr Pro Asn Cys Ala
                85                  90                  95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
            100                 105                 110

Ser Pro Tyr Val Pro Val His Phe Asp Ala Ser Val Glu Asp Ser Thr
        115                 120                 125
```

<210> 139
<211> 123
<212> PRT
<213> Homo Sapiens

<400> 139

Gln Asp Asn Ser Arg Tyr Thr His Phe Leu Thr Gln His Tyr Asp Ala
1 5 10 15

Lys Pro Gln Gly Arg Asp Asp Arg Tyr Cys Glu Ser Ile Met Arg Arg
20 25 30

Arg Gly Leu Thr Ser Pro Cys Lys Asp Ile Asn Thr Phe Ile His Gly
35 40 45

Asn Lys Arg Ser Ile Lys Ala Ile Cys Glu Asn Lys Asn Gly Asn Pro
50 55 60

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

Cys Lys Leu His Gly Gly Ser Pro Trp Pro Pro Cys Gln Tyr Arg Ala
85 90 95

Thr Ala Gly Phe Arg Asn Val Val Val Ala Cys Glu Asn Gly Leu Pro
100 105 110

Val His Leu Asp Gln Ser Ile Phe Arg Arg Pro
115 120

<210> 140
<211> 129
<212> PRT
<213> Homo Sapiens

<400> 140

Gly Leu Gly Leu Val Gln Pro Ser Tyr Gly Gln Asp Gly Met Tyr Gln
1 5 10 15

Arg Phe Leu Arg Gln His Val His Pro Glu Glu Thr Gly Gly Ser Asp
20 25 30

Arg Tyr Cys Asn Leu Met Met Gln Arg Arg Lys Met Thr Leu Tyr His
        35   40   45

Cys Lys Arg Phe Asn Thr Phe Ile His Glu Asp Ile Trp Asn Ile Arg
    50   55   60

Ser Ile Cys Ser Thr Thr Asn Ile Gln Cys Lys Asn Gly Lys Met Asn
65   70   75   80

Cys His Glu Gly Val Val Lys Val Thr Asp Cys Arg Asp Thr Gly Ser
                85   90   95

Ser Arg Ala Pro Asn Cys Arg Tyr Arg Ala Ile Ala Ser Thr Arg Arg
            100   105   110

Val Val Ile Ala Cys Glu Gly Asn Pro Gln Val Pro Val His Phe Asp
        115   120   125

Gly

<210> 141
<211> 375
<212> PRT
<213> Homo Sapiens

<220>
<221> misc_feature
<222> (1)..(1)
<223> Xaa can be any naturally occurring amino acid

<400> 141

Xaa Ser Ala Val Asp Asn Ile Leu Leu Lys Leu Ala Lys Phe Lys Ile
1   5   10   15

Gly Phe Leu Arg Leu Gly Gln Ile Gln Lys Val His Pro Ala Ile Gln
            20   25   30

Gln Phe Thr Glu Gln Glu Ile Cys Arg Ser Lys Ser Ile Lys Ser Leu
        35   40   45

Ala Leu Leu Glu Glu Leu Tyr Asn Ser Gln Leu Ile Val Ala Thr Thr

```
    50                  55                  60

Cys Met Gly Ile Asn His Pro Ile Phe Ser Arg Lys Ile Phe Asp Phe
65                  70                  75                  80

Cys Ile Val Asp Glu Ala Ser Gln Ile Ser Gln Pro Ile Cys Leu Gly
                85                  90                  95

Pro Leu Phe Phe Ser Arg Arg Phe Val Leu Val Gly Asp His Gln Gln
            100                 105                 110

Leu Pro Pro Leu Val Leu Asn Arg Glu Ala Arg Ala Leu Gly Met Ser
        115                 120                 125

Glu Ser Leu Phe Lys Arg Leu Glu Gln Asn Lys Ser Ala Val Val Gln
    130                 135                 140

Leu Thr Val Gln Tyr Arg Met Asn Ser Lys Ile Met Ser Leu Ser Asn
145                 150                 155                 160

Lys Leu Thr Tyr Glu Gly Lys Leu Glu Cys Gly Ser Asp Lys Val Ala
                165                 170                 175

Asn Ala Val Ile Asn Leu Arg His Phe Lys Asp Val Lys Leu Glu Leu
            180                 185                 190

Glu Phe Tyr Ala Asp Tyr Ser Asp Asn Pro Trp Leu Met Gly Val Phe
        195                 200                 205

Glu Pro Asn Asn Pro Val Cys Phe Leu Asn Thr Asp Lys Val Pro Ala
    210                 215                 220

Pro Glu Gln Val Glu Lys Gly Gly Val Ser Asn Val Thr Glu Ala Lys
225                 230                 235                 240

Leu Ile Val Phe Leu Thr Ser Ile Phe Val Lys Ala Gly Cys Ser Pro
                245                 250                 255

Ser Asp Ile Gly Ile Ile Ala Pro Tyr Arg Gln Gln Leu Lys Ile Ile
            260                 265                 270
```

```
Asn Asp Leu Leu Ala Arg Ser Ile Gly Met Val Glu Val Asn Thr Val
        275                 280                 285

Asp Lys Tyr Gln Gly Arg Asp Lys Ser Ile Val Leu Val Ser Phe Val
    290                 295                 300

Arg Ser Asn Lys Asp Gly Thr Val Gly Glu Leu Leu Lys Asp Trp Arg
305                 310                 315                 320

Arg Leu Asn Val Ala Ile Thr Arg Ala Lys His Lys Leu Ile Leu Leu
                325                 330                 335

Gly Cys Val Pro Ser Leu Asn Cys Tyr Pro Pro Leu Glu Lys Leu Leu
            340                 345                 350

Asn His Leu Asn Ser Glu Lys Leu Ile Ser Phe Phe Phe Cys Ile Trp
        355                 360                 365

Ser His Leu Ile Ala Leu Leu
    370                 375
```

<210> 142
<211> 88
<212> PRT
<213> Homo Sapiens

<400> 142

```
Met Ala Leu Arg Ser His Asp Arg Ser Thr Arg Pro Leu Tyr Ile Ser
1               5                   10                  15

Val Gly His Arg Met Ser Leu Glu Ala Ala Val Arg Leu Thr Cys Cys
            20                  25                  30

Cys Cys Arg Phe Arg Ile Pro Glu Pro Val Arg Gln Ala Asp Ile Cys
        35                  40                  45

Ser Arg Glu His Ile Arg Lys Ser Leu Gly Leu Pro Gly Pro Pro Thr
    50                  55                  60

Pro Arg Ser Pro Lys Ala Gln Arg Pro Val Ala Cys Pro Lys Gly Asp
65                  70                  75                  80
```

Ser Gly Glu Ser Ser Ala Leu Cys
85

<210> 143
<211> 212
<212> PRT
<213> Homo Sapiens

<400> 143

Cys Tyr Thr Asn His Ala Leu Ser Tyr Asp Gln Ala Lys Arg Val Pro
1 5 10 15

Arg Trp Val Leu Glu His Ile Ser Lys Ser Lys Ile Met Gly Asp Ala
20 25 30

Asp Arg Lys His Cys Lys Phe Lys Pro Asp Pro Asn Ile Pro Pro Thr
35 40 45

Phe Ser Ala Phe Asn Glu Asp Tyr Val Gly Ser Gly Trp Ser Arg Gly
50 55 60

His Met Ala Pro Ala Gly Asn Asn Lys Phe Ser Ser Lys Ala Met Ala
65 70 75 80

Glu Thr Phe Tyr Leu Ser Asn Ile Val Pro Gln Asp Phe Asp Asn Asn
85 90 95

Ser Gly Tyr Trp Asn Arg Ile Glu Met Tyr Cys Arg Glu Leu Thr Glu
100 105 110

Arg Phe Glu Asp Val Trp Val Val Ser Gly Pro Leu Thr Leu Pro Gln
115 120 125

Thr Arg Gly Asp Gly Lys Lys Ile Val Ser Tyr Gln Val Ile Gly Glu
130 135 140

Asp Asn Val Ala Val Pro Ser His Leu Tyr Lys Val Ile Leu Ala Arg
145 150 155 160

Arg Ser Ser Val Ser Thr Glu Pro Leu Ala Leu Gly Ala Phe Val Val

```
                165                 170                 175

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

Ser Leu Gln Asp Leu Glu Lys Leu Ser Gly Leu Val Phe Phe Pro His
        195                 200                 205

Leu Asp Arg Thr
    210
```

<210> 144
<211> 123
<212> PRT
<213> Homo Sapiens

<400> 144

```
Val Thr Val Ser Gln Met Thr Ser Val Leu Asn Gly Lys Thr Arg Arg
1               5                   10                  15

Phe Ala Asp Ile Gln Leu Gln His Gly Ala Leu Cys Phe Asn Ile Arg
            20                  25                  30

Tyr Gly Thr Thr Val Glu Glu Glu Lys Asn His Val Leu Glu Ile Ala
        35                  40                  45

Arg Gln Arg Ala Val Ala Gln Ala Trp Thr Lys Glu Gln Arg Arg Leu
    50                  55                  60

Gln Glu Gly Glu Glu Gly Ile Arg Ala Trp Thr Glu Gly Glu Lys Gln
65                  70                  75                  80

Gln Leu Leu Ser Thr Gly Arg Val Gln Gly Tyr Asp Gly Tyr Phe Val
                85                  90                  95

Leu Ser Val Glu Gln Tyr Leu Glu Leu Ser Asp Ser Ala Asn Asn Ile
            100                 105                 110

His Phe Met Arg Gln Ser Glu Ile Gly Arg Arg
        115                 120
```

<210> 145
<211> 125
<212> PRT
<213> Homo Sapiens

<400> 145

Thr Val Ser Gln Pro Thr Leu Leu Val Asn Gly Lys Thr Arg Arg Phe
1 5 10 15

Thr Asn Ile Glu Phe Gln Tyr Ser Thr Leu Leu Leu Ser Ile Arg Tyr
20 25 30

Gly Leu Thr Pro Asp Thr Leu Asp Glu Glu Lys Ala Arg Val Leu Asp
35 40 45

Gln Ala Arg Gln Arg Ala Leu Gly Thr Ala Trp Ala Lys Glu Gln Gln
50 55 60

Lys Ala Arg Asp Gly Arg Glu Gly Ser Arg Leu Trp Thr Glu Gly Glu
65 70 75 80

Lys Gln Gln Leu Leu Ser Thr Gly Arg Val Gln Gly Tyr Glu Gly Tyr
85 90 95

Tyr Val Leu Pro Val Glu Gln Tyr Pro Glu Leu Ala Asp Ser Ser Ser
100 105 110

Asn Ile Gln Phe Leu Arg Gln Asn Glu Met Gly Lys Arg
115 120 125

<210> 146

<400> 146
000

<210> 147
<211> 1368
<212> PRT
<213> Streptococcus pyogenes

<400> 147

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

```
Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220
```

```
Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655
```

```
Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

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

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880
```

```
Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895


Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940


Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960


Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020


Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035


Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050


Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065


Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080
```

```
Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290
```

Tyr Asn Lys His Arg Asp Lys Pro Ile Arg Glu Gln Ala Glu Asn
    1295   1300   1305

Ile Ile His Leu Phe Thr Leu Thr Asn Leu Gly Ala Pro Ala Ala
    1310   1315   1320

Phe Lys Tyr Phe Asp Thr Thr Ile Asp Arg Lys Arg Tyr Thr Ser
    1325   1330   1335

Thr Lys Glu Val Leu Asp Ala Thr Leu Ile His Gln Ser Ile Thr
    1340   1345   1350

Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser Gln Leu Gly Gly Asp
    1355   1360   1365

<210> 148
<211> 1368
<212> PRT
<213> Streptococcus pyogenes

<400> 148

Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20   25   30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys

```
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320
```

```
Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

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

```
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750
```

```
Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

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

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp Ala Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
```

```
               965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170
```

```
Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365
```

<210> 149

<211> 1368
<212> PRT
<213> Streptococcus pyogenes

<400> 149

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175


Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190
```

```
Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620
```

```
Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

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

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845
```

```
Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050
```

```
Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260
```

```
His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275


Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320


Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335


Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  150
<211>  1053
<212>  PRT
<213>  Staphylococcus aureus

<400>  150

Met Lys Arg Asn Tyr Ile Leu Gly Leu Asp Ile Gly Ile Thr Ser Val
1               5                  10                  15


Gly Tyr Gly Ile Ile Asp Tyr Glu Thr Arg Asp Val Ile Asp Ala Gly
            20                  25                  30


Val Arg Leu Phe Lys Glu Ala Asn Val Glu Asn Asn Glu Gly Arg Arg
        35                  40                  45


Ser Lys Arg Gly Ala Arg Arg Leu Lys Arg Arg Arg Arg His Arg Ile
    50                  55                  60


Gln Arg Val Lys Lys Leu Leu Phe Asp Tyr Asn Leu Leu Thr Asp His
```

```
65                  70                  75                  80

Ser Glu Leu Ser Gly Ile Asn Pro Tyr Glu Ala Arg Val Lys Gly Leu
                85                  90                  95

Ser Gln Lys Leu Ser Glu Glu Glu Phe Ser Ala Ala Leu Leu His Leu
            100                 105                 110

Ala Lys Arg Arg Gly Val His Asn Val Asn Glu Val Glu Glu Asp Thr
        115                 120                 125

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

Leu Glu Glu Lys Tyr Val Ala Glu Leu Gln Leu Glu Arg Leu Lys Lys
145                 150                 155                 160

Asp Gly Glu Val Arg Gly Ser Ile Asn Arg Phe Lys Thr Ser Asp Tyr
                165                 170                 175

Val Lys Glu Ala Lys Gln Leu Leu Lys Val Gln Lys Ala Tyr His Gln
            180                 185                 190

Leu Asp Gln Ser Phe Ile Asp Thr Tyr Ile Asp Leu Leu Glu Thr Arg
        195                 200                 205

Arg Thr Tyr Tyr Glu Gly Pro Gly Glu Gly Ser Pro Phe Gly Trp Lys
    210                 215                 220

Asp Ile Lys Glu Trp Tyr Glu Met Leu Met Gly His Cys Thr Tyr Phe
225                 230                 235                 240

Pro Glu Glu Leu Arg Ser Val Lys Tyr Ala Tyr Asn Ala Asp Leu Tyr
                245                 250                 255

Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Thr Arg Asp Glu Asn
            260                 265                 270

Glu Lys Leu Glu Tyr Tyr Glu Lys Phe Gln Ile Ile Glu Asn Val Phe
        275                 280                 285
```

```
Lys Gln Lys Lys Lys Pro Thr Leu Lys Gln Ile Ala Lys Glu Ile Leu
    290                 295                 300

Val Asn Glu Glu Asp Ile Lys Gly Tyr Arg Val Thr Ser Thr Gly Lys
305                 310                 315                 320

Pro Glu Phe Thr Asn Leu Lys Val Tyr His Asp Ile Lys Asp Ile Thr
                325                 330                 335

Ala Arg Lys Glu Ile Ile Glu Asn Ala Glu Leu Leu Asp Gln Ile Ala
            340                 345                 350

Lys Ile Leu Thr Ile Tyr Gln Ser Ser Glu Asp Ile Gln Glu Glu Leu
        355                 360                 365

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

Asn Leu Lys Gly Tyr Thr Gly Thr His Asn Leu Ser Leu Lys Ala Ile
385                 390                 395                 400

Asn Leu Ile Leu Asp Glu Leu Trp His Thr Asn Asp Asn Gln Ile Ala
                405                 410                 415

Ile Phe Asn Arg Leu Lys Leu Val Pro Lys Lys Val Asp Leu Ser Gln
            420                 425                 430

Gln Lys Glu Ile Pro Thr Thr Leu Val Asp Asp Phe Ile Leu Ser Pro
        435                 440                 445

Val Val Lys Arg Ser Phe Ile Gln Ser Ile Lys Val Ile Asn Ala Ile
    450                 455                 460

Ile Lys Lys Tyr Gly Leu Pro Asn Asp Ile Ile Ile Glu Leu Ala Arg
465                 470                 475                 480

Glu Lys Asn Ser Lys Asp Ala Gln Lys Met Ile Asn Glu Met Gln Lys
                485                 490                 495

Arg Asn Arg Gln Thr Asn Glu Arg Ile Glu Glu Ile Ile Arg Thr Thr
```

```
            500                 505                 510

Gly Lys Glu Asn Ala Lys Tyr Leu Ile Glu Lys Ile Lys Leu His Asp
        515                 520                 525

Met Gln Glu Gly Lys Cys Leu Tyr Ser Leu Glu Ala Ile Pro Leu Glu
    530                 535                 540

Asp Leu Leu Asn Asn Pro Phe Asn Tyr Glu Val Asp His Ile Ile Pro
545                 550                 555                 560

Arg Ser Val Ser Phe Asp Asn Ser Phe Asn Asn Lys Val Leu Val Lys
                565                 570                 575

Gln Glu Glu Asn Ser Lys Lys Gly Asn Arg Thr Pro Phe Gln Tyr Leu
            580                 585                 590

Ser Ser Ser Asp Ser Lys Ile Ser Tyr Glu Thr Phe Lys Lys His Ile
        595                 600                 605

Leu Asn Leu Ala Lys Gly Lys Gly Arg Ile Ser Lys Thr Lys Lys Glu
    610                 615                 620

Tyr Leu Leu Glu Glu Arg Asp Ile Asn Arg Phe Ser Val Gln Lys Asp
625                 630                 635                 640

Phe Ile Asn Arg Asn Leu Val Asp Thr Arg Tyr Ala Thr Arg Gly Leu
                645                 650                 655

Met Asn Leu Leu Arg Ser Tyr Phe Arg Val Asn Asn Leu Asp Val Lys
            660                 665                 670

Val Lys Ser Ile Asn Gly Gly Phe Thr Ser Phe Leu Arg Arg Lys Trp
        675                 680                 685

Lys Phe Lys Lys Glu Arg Asn Lys Gly Tyr Lys His His Ala Glu Asp
    690                 695                 700

Ala Leu Ile Ile Ala Asn Ala Asp Phe Ile Phe Lys Glu Trp Lys Lys
705                 710                 715                 720
```

```
Leu Asp Lys Ala Lys Lys Val Met Glu Asn Gln Met Phe Glu Glu Lys
                725                 730                 735

Gln Ala Glu Ser Met Pro Glu Ile Glu Thr Glu Gln Glu Tyr Lys Glu
            740                 745                 750

Ile Phe Ile Thr Pro His Gln Ile Lys His Ile Lys Asp Phe Lys Asp
        755                 760                 765

Tyr Lys Tyr Ser His Arg Val Asp Lys Lys Pro Asn Arg Glu Leu Ile
    770                 775                 780

Asn Asp Thr Leu Tyr Ser Thr Arg Lys Asp Asp Lys Gly Asn Thr Leu
785                 790                 795                 800

Ile Val Asn Asn Leu Asn Gly Leu Tyr Asp Lys Asp Asn Asp Lys Leu
                805                 810                 815

Lys Lys Leu Ile Asn Lys Ser Pro Glu Lys Leu Leu Met Tyr His His
            820                 825                 830

Asp Pro Gln Thr Tyr Gln Lys Leu Lys Leu Ile Met Glu Gln Tyr Gly
        835                 840                 845

Asp Glu Lys Asn Pro Leu Tyr Lys Tyr Tyr Glu Glu Thr Gly Asn Tyr
    850                 855                 860

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

Lys Tyr Tyr Gly Asn Lys Leu Asn Ala His Leu Asp Ile Thr Asp Asp
                885                 890                 895

Tyr Pro Asn Ser Arg Asn Lys Val Val Lys Leu Ser Leu Lys Pro Tyr
            900                 905                 910

Arg Phe Asp Val Tyr Leu Asp Asn Gly Val Tyr Lys Phe Val Thr Val
        915                 920                 925

Lys Asn Leu Asp Val Ile Lys Lys Glu Asn Tyr Tyr Glu Val Asn Ser
```

```
    930                 935                 940

Lys Cys Tyr Glu Glu Ala Lys Lys Leu Lys Lys Ile Ser Asn Gln Ala
945                 950                 955                 960

Glu Phe Ile Ala Ser Phe Tyr Asn Asn Asp Leu Ile Lys Ile Asn Gly
                965                 970                 975

Glu Leu Tyr Arg Val Ile Gly Val Asn Asn Asp Leu Leu Asn Arg Ile
            980                 985                 990

Glu Val Asn Met Ile Asp Ile Thr  Tyr Arg Glu Tyr Leu  Glu Asn Met
        995                 1000                1005

Asn Asp  Lys Arg Pro Pro Arg  Ile Ile Lys Thr Ile  Ala Ser Lys
    1010                1015                1020

Thr Gln  Ser Ile Lys Lys Tyr  Ser Thr Asp Ile Leu  Gly Asn Leu
    1025                1030                1035

Tyr Glu  Val Lys Ser Lys Lys  His Pro Gln Ile Ile  Lys Lys Gly
    1040                1045                1050
```

<210> 151
<211> 1121
<212> PRT
<213> Streptococcus thermophilus

<400> 151

```
Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1               5                   10                  15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20                  25                  30

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

Asn Arg Gln Gly Arg Arg Leu Ala Arg Arg Lys Lys His Arg Arg Val
    50                  55                  60
```

```
Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65                  70                  75                  80

Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85                  90                  95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100                 105                 110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115                 120                 125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140

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

Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

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

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Ser Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285
```

```
Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400

Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495
```

```
Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Ser
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670

Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720
```

```
Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
               725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Asn
            740                 745                 750

Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Asp Gln
        755                 760                 765

Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780

Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800

Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
                805                 810                 815

Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Ala Asp Glu Thr Tyr Val Leu Gly Lys
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880

Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
                885                 890                 895

Gln Ile Asn Asp Lys Gly Lys Glu Val Pro Cys Asn Pro Phe Leu Lys
            900                 905                 910

Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
        915                 920                 925
```

```
Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Lys Asp Ser Asn Asn Lys Val Val Leu Gln
945                 950                 955                 960

Ser Val Ser Pro Trp Arg Ala Asp Val Tyr Phe Asn Lys Thr Thr Gly
                965                 970                 975

Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Asp Lys
            980                 985                 990

Gly Thr Gly Thr Tyr Lys Ile Ser  Gln Glu Lys Tyr Asn  Asp Ile Lys
        995                 1000                1005

Lys Lys  Glu Gly Val Asp Ser  Asp Ser Glu Phe Lys  Phe Thr Leu
    1010                1015                1020

Tyr Lys  Asn Asp Leu Leu Leu  Val Lys Asp Thr Glu  Thr Lys Glu
    1025                1030                1035

Gln Gln  Leu Phe Arg Phe Leu  Ser Arg Thr Met Pro  Lys Gln Lys
    1040                1045                1050

His Tyr  Val Glu Leu Lys Pro  Tyr Asp Lys Gln Lys  Phe Glu Gly
    1055                1060                1065

Gly Glu  Ala Leu Ile Lys Val  Leu Gly Asn Val Ala  Asn Ser Gly
    1070                1075                1080

Gln Cys  Lys Lys Gly Leu Gly  Lys Ser Asn Ile Ser  Ile Tyr Lys
    1085                1090                1095

Val Arg  Thr Asp Val Leu Gly  Asn Gln His Ile Ile  Lys Asn Glu
    1100                1105                1110

Gly Asp  Lys Pro Lys Leu Asp  Phe
    1115                1120
```

<210> 152
<211> 1082

<212> PRT
<213> Neisseria meningitidis

<400> 152

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1 5 10 15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
20 25 30

Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
35 40 45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
50 55 60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65 70 75 80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
85 90 95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
100 105 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
115 120 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
130 135 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145 150 155 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
165 170 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
180 185 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu

```
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

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

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415
```

```
Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

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

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
```

625 630 635 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
645 650 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
660 665 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
675 680 685

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

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

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
725 730 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
740 745 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
755 760 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
770 775 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785 790 795 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
805 810 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
820 825 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
835 840 845

```
Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990

Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005

Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020

His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035

His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050

Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
```

1055 1060 1065

Glu Ile Arg Pro Cys Arg Leu Lys Lys Arg Pro Pro Val Arg
1070 1075 1080

<210> 153
<211> 1037
<212> PRT
<213> Parvibaculum lavamentivorans

<400> 153

Met Glu Arg Ile Phe Gly Phe Asp Ile Gly Thr Thr Ser Ile Gly Phe
1 5 10 15

Ser Val Ile Asp Tyr Ser Ser Thr Gln Ser Ala Gly Asn Ile Gln Arg
20 25 30

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

Leu Asn Gln Gln Arg Arg Gln Lys Arg Met Met Arg Arg Gln Leu Arg
50 55 60

Arg Arg Arg Ile Arg Arg Lys Ala Leu Asn Glu Thr Leu His Glu Ala
65 70 75 80

Gly Phe Leu Pro Ala Tyr Gly Ser Ala Asp Trp Pro Val Val Met Ala
85 90 95

Asp Glu Pro Tyr Glu Leu Arg Arg Arg Gly Leu Glu Glu Gly Leu Ser
100 105 110

Ala Tyr Glu Phe Gly Arg Ala Ile Tyr His Leu Ala Gln His Arg His
115 120 125

Phe Lys Gly Arg Glu Leu Glu Glu Ser Asp Thr Pro Asp Pro Asp Val
130 135 140

Asp Asp Glu Lys Glu Ala Ala Asn Glu Arg Ala Ala Thr Leu Lys Ala
145 150 155 160

```
Leu Lys Asn Glu Gln Thr Thr Leu Gly Ala Trp Leu Ala Arg Arg Pro
                165                 170                 175

Pro Ser Asp Arg Lys Arg Gly Ile His Ala His Arg Asn Val Val Ala
            180                 185                 190

Glu Glu Phe Glu Arg Leu Trp Glu Val Gln Ser Lys Phe His Pro Ala
        195                 200                 205

Leu Lys Ser Glu Glu Met Arg Ala Arg Ile Ser Asp Thr Ile Phe Ala
    210                 215                 220

Gln Arg Pro Val Phe Trp Arg Lys Asn Thr Leu Gly Glu Cys Arg Phe
225                 230                 235                 240

Met Pro Gly Glu Pro Leu Cys Pro Lys Gly Ser Trp Leu Ser Gln Gln
                245                 250                 255

Arg Arg Met Leu Glu Lys Leu Asn Asn Leu Ala Ile Ala Gly Gly Asn
            260                 265                 270

Ala Arg Pro Leu Asp Ala Glu Glu Arg Asp Ala Ile Leu Ser Lys Leu
        275                 280                 285

Gln Gln Gln Ala Ser Met Ser Trp Pro Gly Val Arg Ser Ala Leu Lys
    290                 295                 300

Ala Leu Tyr Lys Gln Arg Gly Glu Pro Gly Ala Glu Lys Ser Leu Lys
305                 310                 315                 320

Phe Asn Leu Glu Leu Gly Gly Glu Ser Lys Leu Leu Gly Asn Ala Leu
                325                 330                 335

Glu Ala Lys Leu Ala Asp Met Phe Gly Pro Asp Trp Pro Ala His Pro
            340                 345                 350

Arg Lys Gln Glu Ile Arg His Ala Val His Glu Arg Leu Trp Ala Ala
        355                 360                 365

Asp Tyr Gly Glu Thr Pro Asp Lys Lys Arg Val Ile Ile Leu Ser Glu
    370                 375                 380
```

```
Lys Asp Arg Lys Ala His Arg Glu Ala Ala Ala Asn Ser Phe Val Ala
385                 390                 395                 400

Asp Phe Gly Ile Thr Gly Glu Gln Ala Ala Gln Leu Gln Ala Leu Lys
                405                 410                 415

Leu Pro Thr Gly Trp Glu Pro Tyr Ser Ile Pro Ala Leu Asn Leu Phe
            420                 425                 430

Leu Ala Glu Leu Glu Lys Gly Glu Arg Phe Gly Ala Leu Val Asn Gly
        435                 440                 445

Pro Asp Trp Glu Gly Trp Arg Arg Thr Asn Phe Pro His Arg Asn Gln
    450                 455                 460

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

Glu Arg Glu Arg Ile Ser Gln Leu Arg Asn Pro Thr Val Val Arg Thr
                485                 490                 495

Gln Asn Glu Leu Arg Lys Val Val Asn Asn Leu Ile Gly Leu Tyr Gly
            500                 505                 510

Lys Pro Asp Arg Ile Arg Ile Glu Val Gly Arg Asp Val Gly Lys Ser
        515                 520                 525

Lys Arg Glu Arg Glu Glu Ile Gln Ser Gly Ile Arg Arg Asn Glu Lys
    530                 535                 540

Gln Arg Lys Lys Ala Thr Glu Asp Leu Ile Lys Asn Gly Ile Ala Asn
545                 550                 555                 560

Pro Ser Arg Asp Asp Val Glu Lys Trp Ile Leu Trp Lys Glu Gly Gln
                565                 570                 575

Glu Arg Cys Pro Tyr Thr Gly Asp Gln Ile Gly Phe Asn Ala Leu Phe
            580                 585                 590
```

```
Arg Glu Gly Arg Tyr Glu Val Glu His Ile Trp Pro Arg Ser Arg Ser
        595                 600                 605

Phe Asp Asn Ser Pro Arg Asn Lys Thr Leu Cys Arg Lys Asp Val Asn
    610                 615                 620

Ile Glu Lys Gly Asn Arg Met Pro Phe Glu Ala Phe Gly His Asp Glu
625                 630                 635                 640

Asp Arg Trp Ser Ala Ile Gln Ile Arg Leu Gln Gly Met Val Ser Ala
                645                 650                 655

Lys Gly Gly Thr Gly Met Ser Pro Gly Lys Val Lys Arg Phe Leu Ala
            660                 665                 670

Lys Thr Met Pro Glu Asp Phe Ala Ala Arg Gln Leu Asn Asp Thr Arg
        675                 680                 685

Tyr Ala Ala Lys Gln Ile Leu Ala Gln Leu Lys Arg Leu Trp Pro Asp
    690                 695                 700

Met Gly Pro Glu Ala Pro Val Lys Val Glu Ala Val Thr Gly Gln Val
705                 710                 715                 720

Thr Ala Gln Leu Arg Lys Leu Trp Thr Leu Asn Asn Ile Leu Ala Asp
                725                 730                 735

Asp Gly Glu Lys Thr Arg Ala Asp His Arg His His Ala Ile Asp Ala
            740                 745                 750

Leu Thr Val Ala Cys Thr His Pro Gly Met Thr Asn Lys Leu Ser Arg
        755                 760                 765

Tyr Trp Gln Leu Arg Asp Asp Pro Arg Ala Glu Lys Pro Ala Leu Thr
    770                 775                 780

Pro Pro Trp Asp Thr Ile Arg Ala Asp Ala Glu Lys Ala Val Ser Glu
785                 790                 795                 800

Ile Val Val Ser His Arg Val Arg Lys Lys Val Ser Gly Pro Leu His
                805                 810                 815
```

```
Lys Glu Thr Thr Tyr Gly Asp Thr Gly Thr Asp Ile Lys Thr Lys Ser
            820                 825                 830

Gly Thr Tyr Arg Gln Phe Val Thr Arg Lys Lys Ile Glu Ser Leu Ser
        835                 840                 845

Lys Gly Glu Leu Asp Glu Ile Arg Asp Pro Arg Ile Lys Glu Ile Val
    850                 855                 860

Ala Ala His Val Ala Gly Arg Gly Gly Asp Pro Lys Lys Ala Phe Pro
865                 870                 875                 880

Pro Tyr Pro Cys Val Ser Pro Gly Gly Pro Glu Ile Arg Lys Val Arg
                885                 890                 895

Leu Thr Ser Lys Gln Gln Leu Asn Leu Met Ala Gln Thr Gly Asn Gly
            900                 905                 910

Tyr Ala Asp Leu Gly Ser Asn His His Ile Ala Ile Tyr Arg Leu Pro
        915                 920                 925

Asp Gly Lys Ala Asp Phe Glu Ile Val Ser Leu Phe Asp Ala Ser Arg
    930                 935                 940

Arg Leu Ala Gln Arg Asn Pro Ile Val Gln Arg Thr Arg Ala Asp Gly
945                 950                 955                 960

Ala Ser Phe Val Met Ser Leu Ala Ala Gly Glu Ala Ile Met Ile Pro
                965                 970                 975

Glu Gly Ser Lys Lys Gly Ile Trp Ile Val Gln Gly Val Trp Ala Ser
            980                 985                 990

Gly Gln Val Val Leu Glu Arg Asp  Thr Asp Ala Asp His  Ser Thr Thr
        995                 1000                1005

Thr Arg  Pro Met Pro Asn Pro  Ile Leu Lys Asp Asp  Ala Lys Lys
    1010                1015                1020
```

Val Ser Ile Asp Pro Ile Gly Arg Val Arg Pro Ser Asn Asp
    1025   1030   1035

<210> 154
<211> 1084
<212> PRT
<213> Corynebacter diphtheria

<400> 154

Met Lys Tyr His Val Gly Ile Asp Val Gly Thr Phe Ser Val Gly Leu
1   5   10   15

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

Leu Val Ser His Ile His Asp Ser Gly Leu Asp Pro Asp Glu Ile Lys
        35   40   45

Ser Ala Val Thr Arg Leu Ala Ser Ser Gly Ile Ala Arg Arg Thr Arg
    50   55   60

Arg Leu Tyr Arg Arg Lys Arg Arg Arg Leu Gln Gln Leu Asp Lys Phe
65   70   75   80

Ile Gln Arg Gln Gly Trp Pro Val Ile Glu Leu Glu Asp Tyr Ser Asp
                85   90   95

Pro Leu Tyr Pro Trp Lys Val Arg Ala Glu Leu Ala Ala Ser Tyr Ile
            100   105   110

Ala Asp Glu Lys Glu Arg Gly Glu Lys Leu Ser Val Ala Leu Arg His
        115   120   125

Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Ser Ser
    130   135   140

Leu Tyr Leu Pro Asp Gly Pro Ser Asp Ala Phe Lys Ala Ile Arg Glu
145   150   155   160

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

```
Gly Gln Met Val Thr Leu Cys Glu Leu Gly Thr Leu Lys Leu Arg Gly
            180                 185                 190

Glu Gly Gly Val Leu Ser Ala Arg Leu Gln Gln Ser Asp Tyr Ala Arg
        195                 200                 205

Glu Ile Gln Glu Ile Cys Arg Met Gln Glu Ile Gly Gln Glu Leu Tyr
    210                 215                 220

Arg Lys Ile Ile Asp Val Val Phe Ala Ala Glu Ser Pro Lys Gly Ser
225                 230                 235                 240

Ala Ser Ser Arg Val Gly Lys Asp Pro Leu Gln Pro Gly Lys Asn Arg
                245                 250                 255

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

Ile Gly Asn Leu Arg Val Arg Val Asp Gly Glu Lys Arg Ile Leu Ser
        275                 280                 285

Val Glu Glu Lys Asn Leu Val Phe Asp His Leu Val Asn Leu Thr Pro
    290                 295                 300

Lys Lys Glu Pro Glu Trp Val Thr Ile Ala Glu Ile Leu Gly Ile Asp
305                 310                 315                 320

Arg Gly Gln Leu Ile Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
                325                 330                 335

Ala Gly Ala Arg Pro Pro Thr His Asp Thr Asn Arg Ser Ile Val Asn
            340                 345                 350

Ser Arg Ile Ala Pro Leu Val Asp Trp Trp Lys Thr Ala Ser Ala Leu
        355                 360                 365

Glu Gln His Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp Asp
    370                 375                 380

Phe Asp Ser Pro Glu Gly Ala Lys Val Gln Ala Phe Phe Ala Asp Leu
```

```
385                 390                 395                 400

Asp Asp Asp Val His Ala Lys Leu Asp Ser Leu His Leu Pro Val Gly
                405                 410                 415

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Val Arg Leu Thr Arg Arg Met
            420                 425                 430

Leu Ser Asp Gly Val Asp Leu Tyr Thr Ala Arg Leu Gln Glu Phe Gly
        435                 440                 445

Ile Glu Pro Ser Trp Thr Pro Pro Thr Pro Arg Ile Gly Glu Pro Val
    450                 455                 460

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Thr Val Ser Arg Trp Leu
465                 470                 475                 480

Glu Ser Ala Thr Lys Thr Trp Gly Ala Pro Glu Arg Val Ile Ile Glu
                485                 490                 495

His Val Arg Glu Gly Phe Val Thr Glu Lys Arg Ala Arg Glu Met Asp
            500                 505                 510

Gly Asp Met Arg Arg Arg Ala Ala Arg Asn Ala Lys Leu Phe Gln Glu
        515                 520                 525

Met Gln Glu Lys Leu Asn Val Gln Gly Lys Pro Ser Arg Ala Asp Leu
    530                 535                 540

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
545                 550                 555                 560

Gly Ser Pro Ile Thr Phe Ser Asn Ser Glu Met Asp His Ile Val Pro
                565                 570                 575

Arg Ala Gly Gln Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Val
            580                 585                 590

Cys His Arg Cys Asn Gln Ser Lys Gly Asn Thr Pro Phe Ala Ile Trp
        595                 600                 605
```

```
Ala Lys Asn Thr Ser Ile Glu Gly Val Ser Val Lys Glu Ala Val Glu
    610                 615                 620

Arg Thr Arg His Trp Val Thr Asp Thr Gly Met Arg Ser Thr Asp Phe
625                 630                 635                 640

Lys Lys Phe Thr Lys Ala Val Val Glu Arg Phe Gln Arg Ala Thr Met
                645                 650                 655

Asp Glu Glu Ile Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
            660                 665                 670

Asn Glu Leu Arg Ser Arg Val Ala Gln His Phe Ala Ser His Gly Thr
        675                 680                 685

Thr Val Arg Val Tyr Arg Gly Ser Leu Thr Ala Glu Ala Arg Arg Ala
    690                 695                 700

Ser Gly Ile Ser Gly Lys Leu Lys Phe Phe Asp Gly Val Gly Lys Ser
705                 710                 715                 720

Arg Leu Asp Arg Arg His His Ala Ile Asp Ala Ala Val Ile Ala Phe
                725                 730                 735

Thr Ser Asp Tyr Val Ala Glu Thr Leu Ala Val Arg Ser Asn Leu Lys
            740                 745                 750

Gln Ser Gln Ala His Arg Gln Glu Ala Pro Gln Trp Arg Glu Phe Thr
        755                 760                 765

Gly Lys Asp Ala Glu His Arg Ala Ala Trp Arg Val Trp Cys Gln Lys
    770                 775                 780

Met Glu Lys Leu Ser Ala Leu Leu Thr Glu Asp Leu Arg Asp Asp Arg
785                 790                 795                 800

Val Val Val Met Ser Asn Val Arg Leu Arg Leu Gly Asn Gly Ser Ala
                805                 810                 815

His Lys Glu Thr Ile Gly Lys Leu Ser Lys Val Lys Leu Ser Ser Gln
```

```
            820                 825                 830

Leu Ser Val Ser Asp Ile Asp Lys Ala Ser Ser Glu Ala Leu Trp Cys
        835                 840                 845

Ala Leu Thr Arg Glu Pro Gly Phe Asp Pro Lys Glu Gly Leu Pro Ala
    850                 855                 860

Asn Pro Glu Arg His Ile Arg Val Asn Gly Thr His Val Tyr Ala Gly
865                 870                 875                 880

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

Gly Gly Tyr Ala Glu Leu Gly Ser Ser Phe His His Ala Arg Val Tyr
            900                 905                 910

Lys Ile Thr Ser Gly Lys Lys Pro Ala Phe Ala Met Leu Arg Val Tyr
        915                 920                 925

Thr Ile Asp Leu Leu Pro Tyr Arg Asn Gln Asp Leu Phe Ser Val Glu
    930                 935                 940

Leu Lys Pro Gln Thr Met Ser Met Arg Gln Ala Glu Lys Lys Leu Arg
945                 950                 955                 960

Asp Ala Leu Ala Thr Gly Asn Ala Glu Tyr Leu Gly Trp Leu Val Val
                965                 970                 975

Asp Asp Glu Leu Val Val Asp Thr Ser Lys Ile Ala Thr Asp Gln Val
            980                 985                 990

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

Gly Phe  Phe Ser Pro Ser Lys  Leu Arg Leu Arg Pro  Leu Gln Met
    1010                1015                1020

Ser Lys  Glu Gly Ile Lys Lys  Glu Ser Ala Pro Glu  Leu Ser Lys
    1025                1030                1035
```

Ile Ile Asp Arg Pro Gly Trp Leu Pro Ala Val Asn Lys Leu Phe
    1040   1045   1050

Ser Asp Gly Asn Val Thr Val Val Arg Arg Asp Ser Leu Gly Arg
    1055   1060   1065

Val Arg Leu Glu Ser Thr Ala His Leu Pro Val Thr Trp Lys Val
    1070   1075   1080

Gln

<210> 155
<211> 1130
<212> PRT
<213> Streptococcus pasteurianus

<400> 155

Met Thr Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1   5   10   15

Gly Val Gly Ile Ile Glu Ala Lys Thr Gly Lys Val Val His Ala Asn
            20   25   30

Ser Arg Leu Phe Ser Ala Ala Asn Ala Glu Asn Asn Ala Glu Arg Arg
        35   40   45

Gly Phe Arg Gly Ser Arg Arg Leu Asn Arg Arg Lys Lys His Arg Val
    50   55   60

Lys Arg Val Arg Asp Leu Phe Glu Lys Tyr Gly Ile Val Thr Asp Phe
65   70   75   80

Arg Asn Leu Asn Leu Asn Pro Tyr Glu Leu Arg Val Lys Gly Leu Thr
                85   90   95

Glu Gln Leu Lys Asn Glu Glu Leu Phe Ala Ala Leu Arg Thr Ile Ser
            100   105   110

Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Asp Asp Ser Thr
        115   120   125

```
Gly Ser Thr Asp Tyr Ala Lys Ser Ile Asp Glu Asn Arg Arg Leu Leu
    130                 135                 140

Lys Asn Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Leu Glu Lys Tyr
145                 150                 155                 160

Gly Gln Leu Arg Gly Asn Phe Thr Val Tyr Asp Glu Asn Gly Glu Ala
                165                 170                 175

His Arg Leu Ile Asn Val Phe Ser Thr Ser Asp Tyr Glu Lys Glu Ala
            180                 185                 190

Arg Lys Ile Leu Glu Thr Gln Ala Asp Tyr Asn Lys Lys Ile Thr Ala
        195                 200                 205

Glu Phe Ile Asp Asp Tyr Val Glu Ile Leu Thr Gln Lys Arg Lys Tyr
    210                 215                 220

Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg Phe
225                 230                 235                 240

Arg Thr Asp Gly Thr Thr Leu Glu Asn Ile Phe Gly Ile Leu Ile Gly
                245                 250                 255

Lys Cys Asn Phe Tyr Pro Asp Glu Tyr Arg Ala Ser Lys Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Tyr Asn Phe Leu Asn Asp Leu Asn Asn Leu Lys Val
        275                 280                 285

Ser Thr Glu Thr Gly Lys Leu Ser Thr Glu Gln Lys Glu Ser Leu Val
    290                 295                 300

Glu Phe Ala Lys Asn Thr Ala Thr Leu Gly Pro Ala Lys Leu Leu Lys
305                 310                 315                 320

Glu Ile Ala Lys Ile Leu Asp Cys Lys Val Asp Glu Ile Lys Gly Tyr
                325                 330                 335
```

```
Arg Glu Asp Asp Lys Gly Lys Pro Asp Leu His Thr Phe Glu Pro Tyr
            340                 345                 350

Arg Lys Leu Lys Phe Asn Leu Glu Ser Ile Asn Ile Asp Asp Leu Ser
        355                 360                 365

Arg Glu Val Ile Asp Lys Leu Ala Asp Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Asp Ala Ile Lys Arg Asn Leu Pro Asn Gln Phe
385                 390                 395                 400

Thr Glu Glu Gln Ile Ser Glu Ile Ile Lys Val Arg Lys Ser Gln Ser
                405                 410                 415

Thr Ala Phe Asn Lys Gly Trp His Ser Phe Ser Ala Lys Leu Met Asn
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Ala Thr Ser Asp Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Glu Lys Phe Lys Val Asn Lys Lys Ser Ser Lys Asn
    450                 455                 460

Thr Lys Thr Ile Asp Glu Lys Glu Val Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Thr Ile Lys Ile Ile Asn Ala Ala
                485                 490                 495

Val Lys Lys Tyr Gly Asp Phe Asp Lys Ile Val Ile Glu Met Pro Arg
            500                 505                 510

Asp Lys Asn Ala Asp Asp Glu Lys Lys Phe Ile Asp Lys Arg Asn Lys
        515                 520                 525

Glu Asn Lys Lys Glu Lys Asp Asp Ala Leu Lys Arg Ala Ala Tyr Leu
    530                 535                 540

Tyr Asn Ser Ser Asp Lys Leu Pro Asp Glu Val Phe His Gly Asn Lys
545                 550                 555                 560
```

```
Gln Leu Glu Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Ser Gly Lys Pro Ile Ser Ile Gln Glu Leu Val His Asn Ser
            580                 585                 590

Asn Asn Phe Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Trp Thr Asn Gln Glu
    610                 615                 620

Lys Gly Gln Lys Thr Pro Tyr Gln Val Ile Asp Ser Met Asp Ala Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Met Lys Asp Tyr Val Leu Lys Gln Lys Gly Leu
                645                 650                 655

Gly Lys Lys Lys Arg Asp Tyr Leu Leu Thr Thr Glu Asn Ile Asp Lys
            660                 665                 670

Ile Glu Val Lys Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ser Leu Gln Ser Ala Leu Arg Glu
    690                 695                 700

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

Gln Leu Arg Arg Lys Trp Lys Ile Asp Lys Ser Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Lys
            740                 745                 750

Leu Trp Glu Lys Gln Asp Asn Pro Met Phe Val Asp Tyr Gly Lys Asn
        755                 760                 765
```

```
Gln Val Val Asp Lys Gln Thr Gly Glu Ile Leu Ser Val Ser Asp Asp
    770                 775                 780

Glu Tyr Lys Glu Leu Val Phe Gln Pro Pro Tyr Gln Gly Phe Val Asn
785                 790                 795                 800

Thr Ile Ser Ser Lys Gly Phe Glu Asp Glu Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Tyr Asn Arg Lys Val Ser Asp Ala Thr Ile Tyr Ser
            820                 825                 830

Thr Arg Lys Ala Lys Ile Gly Lys Asp Lys Lys Glu Glu Thr Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Asn Gly Phe Asp Thr Phe
    850                 855                 860

Ile Lys Lys Tyr Asn Lys Asp Lys Thr Gln Phe Leu Met Tyr Gln Lys
865                 870                 875                 880

Asp Ser Leu Thr Trp Glu Asn Val Ile Glu Val Ile Leu Arg Asp Tyr
                885                 890                 895

Pro Thr Thr Lys Lys Ser Glu Asp Gly Lys Asn Asp Val Lys Cys Asn
            900                 905                 910

Pro Phe Glu Glu Tyr Arg Arg Glu Asn Gly Leu Ile Cys Lys Tyr Ser
        915                 920                 925

Lys Lys Gly Lys Gly Thr Pro Ile Lys Ser Leu Lys Tyr Tyr Asp Lys
    930                 935                 940

Lys Leu Gly Asn Cys Ile Asp Ile Thr Pro Glu Glu Ser Arg Asn Lys
945                 950                 955                 960

Val Ile Leu Gln Ser Ile Asn Pro Trp Arg Ala Asp Val Tyr Phe Asn
                965                 970                 975

Pro Glu Thr Leu Lys Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu
            980                 985                 990
```

```
Ser Phe Glu Lys Gly Thr Gly Asn  Tyr His Ile Ser Gln  Glu Lys Tyr
        995                 1000                1005


Asp Ala  Ile Lys Glu Lys Glu  Gly Ile Gly Lys Lys  Ser Glu Phe
    1010                1015                1020


Lys Phe  Thr Leu Tyr Arg Asn  Asp Leu Ile Leu Ile  Lys Asp Ile
    1025                1030                1035


Ala Ser  Gly Glu Gln Glu Ile  Tyr Arg Phe Leu Ser  Arg Thr Met
    1040                1045                1050


Pro Asn  Val Asn His Tyr Val  Glu Leu Lys Pro Tyr  Asp Lys Glu
    1055                1060                1065


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


Asp Lys  Val Gly Arg Cys Ile  Lys Gly Leu Asn Lys  Pro Asn Ile
    1085                1090                1095


Ser Ile  Tyr Lys Val Arg Thr  Asp Val Leu Gly Asn  Lys Tyr Phe
    1100                1105                1110


Val Lys  Lys Lys Gly Asp Lys  Pro Lys Leu Asp Phe  Lys Asn Asn
    1115                1120                1125


Lys Lys
    1130


<210>  156
<211>  1082
<212>  PRT
<213>  Neisseria cinerea

<400>  156

Met Ala Ala Phe Lys Pro Asn Pro Met Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Ile Val Glu Ile Asp Glu Glu
```

```
            20                  25                  30

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

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Ala Ala Arg Arg Leu
    50                  55                  60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Thr His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Asn Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Asp Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240
```

```
Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Thr Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Val Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Asp Leu Asp Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

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

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Asn Arg Tyr Asp Glu Ala Cys Thr Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
```

```
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

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

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ser Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Ala Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670
```

```
Ile Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Met Leu Leu Thr
        675                 680                 685

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

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

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Ile Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Ala His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Lys Tyr Val Thr Pro Leu Phe Ile Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Ile Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
```

```
               885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val His Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Ile Val Arg Val Asp Val Phe Glu Lys Gly Gly Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Thr Val Met Asp
            980                 985                 990

Asp Ser Phe Glu Phe Lys Phe Val  Leu Tyr Ala Asn Asp  Leu Ile Lys
        995                 1000                1005

Leu Thr  Ala Lys Lys Asn Glu  Phe Leu Gly Tyr Phe  Val Ser Leu
    1010                1015                1020

Asn Arg  Ala Thr Gly Ala Ile  Asp Ile Arg Thr His  Asp Thr Asp
    1025                1030                1035

Ser Thr  Lys Gly Lys Asn Gly  Ile Phe Gln Ser Val  Gly Val Lys
    1040                1045                1050

Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065

Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080
```

<210> 157
<211> 1003
<212> PRT

<213> Campylobacter lari

<400> 157

```
Met Arg Ile Leu Gly Phe Asp Ile Gly Ile Asn Ser Ile Gly Trp Ala
1               5                  10                  15


Phe Val Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe Thr
            20                  25                  30


Lys Ala Glu Asn Pro Lys Asn Lys Glu Ser Leu Ala Leu Pro Arg Arg
        35                  40                  45


Asn Ala Arg Ser Ser Arg Arg Arg Leu Lys Arg Arg Lys Ala Arg Leu
    50                  55                  60


Ile Ala Ile Lys Arg Ile Leu Ala Lys Glu Leu Lys Leu Asn Tyr Lys
65                  70                  75                  80


Asp Tyr Val Ala Ala Asp Gly Glu Leu Pro Lys Ala Tyr Glu Gly Ser
                85                  90                  95


Leu Ala Ser Val Tyr Glu Leu Arg Tyr Lys Ala Leu Thr Gln Asn Leu
            100                 105                 110


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


Gly Tyr Met Asn Lys Asn Glu Lys Lys Ser Asn Asp Ala Lys Lys Gly
    130                 135                 140


Lys Ile Leu Ser Ala Leu Lys Asn Asn Ala Leu Lys Leu Glu Asn Tyr
145                 150                 155                 160


Gln Ser Val Gly Glu Tyr Phe Tyr Lys Glu Phe Phe Gln Lys Tyr Lys
                165                 170                 175


Lys Asn Thr Lys Asn Phe Ile Lys Ile Arg Asn Thr Lys Asp Asn Tyr
            180                 185                 190


Asn Asn Cys Val Leu Ser Ser Asp Leu Glu Lys Glu Leu Lys Leu Ile
        195                 200                 205
```

```
Leu Glu Lys Gln Lys Glu Phe Gly Tyr Asn Tyr Ser Glu Asp Phe Ile
    210                 215                 220

Asn Glu Ile Leu Lys Val Ala Phe Phe Gln Arg Pro Leu Lys Asp Phe
225                 230                 235                 240

Ser His Leu Val Gly Ala Cys Thr Phe Phe Glu Glu Glu Lys Arg Ala
                245                 250                 255

Cys Lys Asn Ser Tyr Ser Ala Trp Glu Phe Val Ala Leu Thr Lys Ile
            260                 265                 270

Ile Asn Glu Ile Lys Ser Leu Glu Lys Ile Ser Gly Glu Ile Val Pro
        275                 280                 285

Thr Gln Thr Ile Asn Glu Val Leu Asn Leu Ile Leu Asp Lys Gly Ser
    290                 295                 300

Ile Thr Tyr Lys Lys Phe Arg Ser Cys Ile Asn Leu His Glu Ser Ile
305                 310                 315                 320

Ser Phe Lys Ser Leu Lys Tyr Asp Lys Glu Asn Ala Glu Asn Ala Lys
                325                 330                 335

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

His Ser Leu Ser Arg Gln Glu Leu Asp Gln Ile Ser Thr His Ile Thr
        355                 360                 365

Leu Ile Lys Asp Asn Val Lys Leu Lys Thr Val Leu Glu Lys Tyr Asn
    370                 375                 380

Leu Ser Asn Glu Gln Ile Asn Asn Leu Leu Glu Ile Glu Phe Asn Asp
385                 390                 395                 400

Tyr Ile Asn Leu Ser Phe Lys Ala Leu Gly Met Ile Leu Pro Leu Met
                405                 410                 415
```

```
Arg Glu Gly Lys Arg Tyr Asp Glu Ala Cys Glu Ile Ala Asn Leu Lys
            420                 425                 430

Pro Lys Thr Val Asp Glu Lys Lys Asp Phe Leu Pro Ala Phe Cys Asp
        435                 440                 445

Ser Ile Phe Ala His Glu Leu Ser Asn Pro Val Val Asn Arg Ala Ile
    450                 455                 460

Ser Glu Tyr Arg Lys Val Leu Asn Ala Leu Leu Lys Lys Tyr Gly Lys
465                 470                 475                 480

Val His Lys Ile His Leu Glu Leu Ala Arg Asp Val Gly Leu Ser Lys
                485                 490                 495

Lys Ala Arg Glu Lys Ile Glu Lys Glu Gln Lys Glu Asn Gln Ala Val
            500                 505                 510

Asn Ala Trp Ala Leu Lys Glu Cys Glu Asn Ile Gly Leu Lys Ala Ser
        515                 520                 525

Ala Lys Asn Ile Leu Lys Leu Lys Leu Trp Lys Glu Gln Lys Glu Ile
    530                 535                 540

Cys Ile Tyr Ser Gly Asn Lys Ile Ser Ile Glu His Leu Lys Asp Glu
545                 550                 555                 560

Lys Ala Leu Glu Val Asp His Ile Tyr Pro Tyr Ser Arg Ser Phe Asp
                565                 570                 575

Asp Ser Phe Ile Asn Lys Val Leu Val Phe Thr Lys Glu Asn Gln Glu
            580                 585                 590

Lys Leu Asn Lys Thr Pro Phe Glu Ala Phe Gly Lys Asn Ile Glu Lys
        595                 600                 605

Trp Ser Lys Ile Gln Thr Leu Ala Gln Asn Leu Pro Tyr Lys Lys Lys
    610                 615                 620

Asn Lys Ile Leu Asp Glu Asn Phe Lys Asp Lys Gln Gln Glu Asp Phe
625                 630                 635                 640
```

```
Ile Ser Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ala Thr Leu Ile Ala
                645                 650                 655

Lys Tyr Thr Lys Glu Tyr Leu Asn Phe Leu Leu Leu Ser Glu Asn Glu
            660                 665                 670

Asn Ala Asn Leu Lys Ser Gly Glu Lys Gly Ser Lys Ile His Val Gln
        675                 680                 685

Thr Ile Ser Gly Met Leu Thr Ser Val Leu Arg His Thr Trp Gly Phe
    690                 695                 700

Asp Lys Lys Asp Arg Asn Asn His Leu His His Ala Leu Asp Ala Ile
705                 710                 715                 720

Ile Val Ala Tyr Ser Thr Asn Ser Ile Ile Lys Ala Phe Ser Asp Phe
                725                 730                 735

Arg Lys Asn Gln Glu Leu Leu Lys Ala Arg Phe Tyr Ala Lys Glu Leu
            740                 745                 750

Thr Ser Asp Asn Tyr Lys His Gln Val Lys Phe Phe Glu Pro Phe Lys
        755                 760                 765

Ser Phe Arg Glu Lys Ile Leu Ser Lys Ile Asp Glu Ile Phe Val Ser
    770                 775                 780

Lys Pro Pro Arg Lys Arg Ala Arg Arg Ala Leu His Lys Asp Thr Phe
785                 790                 795                 800

His Ser Glu Asn Lys Ile Ile Asp Lys Cys Ser Tyr Asn Ser Lys Glu
                805                 810                 815

Gly Leu Gln Ile Ala Leu Ser Cys Gly Arg Val Arg Lys Ile Gly Thr
            820                 825                 830

Lys Tyr Val Glu Asn Asp Thr Ile Val Arg Val Asp Ile Phe Lys Lys
        835                 840                 845
```

```
Gln Asn Lys Phe Tyr Ala Ile Pro Ile Tyr Ala Met Asp Phe Ala Leu
    850                 855                 860

Gly Ile Leu Pro Asn Lys Ile Val Ile Thr Gly Lys Asp Lys Asn Asn
865                 870                 875                 880

Asn Pro Lys Gln Trp Gln Thr Ile Asp Glu Ser Tyr Glu Phe Cys Phe
                885                 890                 895

Ser Leu Tyr Lys Asn Asp Leu Ile Leu Leu Gln Lys Lys Asn Met Gln
            900                 905                 910

Glu Pro Glu Phe Ala Tyr Tyr Asn Asp Phe Ser Ile Ser Thr Ser Ser
        915                 920                 925

Ile Cys Val Glu Lys His Asp Asn Lys Phe Glu Asn Leu Thr Ser Asn
    930                 935                 940

Gln Lys Leu Leu Phe Ser Asn Ala Lys Glu Gly Ser Val Lys Val Glu
945                 950                 955                 960

Ser Leu Gly Ile Gln Asn Leu Lys Val Phe Glu Lys Tyr Ile Ile Thr
                965                 970                 975

Pro Leu Gly Asp Lys Ile Lys Ala Asp Phe Gln Pro Arg Glu Asn Ile
            980                 985                 990

Ser Leu Lys Thr Ser Lys Lys Tyr  Gly Leu Arg
        995                 1000


<210>  158
<211>  1395
<212>  PRT
<213>  Treponema denticola

<400>  158

Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1               5                   10                  15

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

```
Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
        35                  40                  45

Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
    50                  55                  60

Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65                  70                  75                  80

Ile Ala Lys Thr Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro
                85                  90                  95

Phe Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Thr Leu Phe Asn
            100                 105                 110

Asp Lys Asp Phe Ala Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
        115                 120                 125

Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
    130                 135                 140

Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145                 150                 155                 160

Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
                165                 170                 175

Ile Gln Ala Leu Phe Glu Tyr Leu Arg Glu Asp Met Glu Val Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Val Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205

Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Ile Leu Gly Leu Lys
    210                 215                 220

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

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
```

```
               245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285

Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320

Thr Asp Leu Thr Lys Leu Lys Asn Val Ile Lys Lys His Phe Pro Lys
               325                 330                 335

Asp Tyr Lys Lys Val Phe Gly Tyr Asn Lys Asn Glu Lys Asn Asn Asn
            340                 345                 350

Asn Tyr Ser Gly Tyr Val Gly Val Cys Lys Thr Lys Ser Lys Lys Leu
        355                 360                 365

Ile Ile Asn Asn Ser Val Asn Gln Glu Asp Phe Tyr Lys Phe Leu Lys
    370                 375                 380

Thr Ile Leu Ser Ala Lys Ser Glu Ile Lys Glu Val Asn Asp Ile Leu
385                 390                 395                 400

Thr Glu Ile Glu Thr Gly Thr Phe Leu Pro Lys Gln Ile Ser Lys Ser
               405                 410                 415

Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys Ile
            420                 425                 430

Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp Glu
        435                 440                 445

Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe Lys
    450                 455                 460
```

```
Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Phe Phe
465                 470                 475                 480

Pro Asp Arg Cys Trp Val Val Lys Lys Glu Lys Ser Pro Ser Gly Lys
                485                 490                 495

Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Glu Lys Thr Ala
            500                 505                 510

Glu Ala Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Val Gly
        515                 520                 525

Glu Ser Val Leu Pro Lys Ser Ser Leu Leu Tyr Ser Glu Tyr Thr Val
    530                 535                 540

Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn Ile
545                 550                 555                 560

Cys Asp Ile Lys Leu Lys Gln Lys Ile Tyr Glu Asp Leu Phe Lys Lys
                565                 570                 575

Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His Glu
            580                 585                 590

Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp Lys
        595                 600                 605

Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile Phe
    610                 615                 620

Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Glu Ile
625                 630                 635                 640

Ile Arg Trp Ala Thr Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile Leu
                645                 650                 655

Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu Gln
            660                 665                 670

Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu Ser
```

```
        675                 680                 685

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

Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu Met
705                 710                 715                 720

Glu Leu Leu Ser Ser Glu Phe Thr Phe Thr Glu Asn Ile Lys Lys Ile
                725                 730                 735

Asn Ser Gly Phe Glu Asp Ala Glu Lys Gln Phe Ser Tyr Asp Gly Leu
            740                 745                 750

Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Met Leu Trp Gln
        755                 760                 765

Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr Gln Ala Pro Pro
    770                 775                 780

Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu Leu Glu Pro Ala
785                 790                 795                 800

Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu Tyr Asn Asn Cys
                805                 810                 815

Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Lys Asp Leu Ser Gly
            820                 825                 830

Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser Asp Lys Leu Tyr
        835                 840                 845

Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys Gly Lys Pro Ile
    850                 855                 860

Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp Ile Asp His Ile
865                 870                 875                 880

Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser Asn Arg Val Leu
                885                 890                 895
```

```
Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys Tyr Pro Leu Lys
            900                 905                 910

Ser Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn Phe Leu Gln Arg
        915                 920                 925

Asn Asn Phe Ile Ser Leu Glu Lys Leu Asn Arg Leu Thr Arg Ala Thr
    930                 935                 940

Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala Arg Gln Leu Val
945                 950                 955                 960

Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Lys Val Leu Glu Lys Met
                965                 970                 975

Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu Thr Val Ser Met
            980                 985                 990

Phe Arg Asn Lys Phe Asp Ile Val  Lys Cys Arg Glu Ile  Asn Asp Phe
        995                 1000                1005

His His  Ala His Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Val
    1010                1015                1020

Tyr Asn  Thr Lys Phe Thr Asn  Asn Pro Trp Asn Phe  Ile Lys Glu
    1025                1030                1035

Lys Arg  Asp Asn Pro Lys Ile  Ala Asp Thr Tyr Asn  Tyr Tyr Lys
    1040                1045                1050

Val Phe  Asp Tyr Asp Val Lys  Arg Asn Asn Ile Thr  Ala Trp Glu
    1055                1060                1065

Lys Gly  Lys Thr Ile Ile Thr  Val Lys Asp Met Leu  Lys Arg Asn
    1070                1075                1080

Thr Pro  Ile Tyr Thr Arg Gln  Ala Ala Cys Lys Lys  Gly Glu Leu
    1085                1090                1095

Phe Asn  Gln Thr Ile Met Lys  Lys Gly Leu Gly Gln  His Pro Leu
```

```
    1100                1105                1110

Lys Lys  Glu Gly Pro Phe Ser  Asn Ile Ser Lys Tyr  Gly Gly Tyr
    1115                1120                1125

Asn Lys  Val Ser Ala Ala Tyr  Tyr Thr Leu Ile Glu  Tyr Glu Glu
    1130                1135                1140

Lys Gly  Asn Lys Ile Arg Ser  Leu Glu Thr Ile Pro  Leu Tyr Leu
    1145                1150                1155

Val Lys  Asp Ile Gln Lys Asp  Gln Asp Val Leu Lys  Ser Tyr Leu
    1160                1165                1170

Thr Asp  Leu Leu Gly Lys Lys  Glu Phe Lys Ile Leu  Val Pro Lys
    1175                1180                1185

Ile Lys  Ile Asn Ser Leu Leu  Lys Ile Asn Gly Phe  Pro Cys His
    1190                1195                1200

Ile Thr  Gly Lys Thr Asn Asp  Ser Phe Leu Leu Arg  Pro Ala Val
    1205                1210                1215

Gln Phe  Cys Cys Ser Asn Asn  Glu Val Leu Tyr Phe  Lys Lys Ile
    1220                1225                1230

Ile Arg  Phe Ser Glu Ile Arg  Ser Gln Arg Glu Lys  Ile Gly Lys
    1235                1240                1245

Thr Ile  Ser Pro Tyr Glu Asp  Leu Ser Phe Arg Ser  Tyr Ile Lys
    1250                1255                1260

Glu Asn  Leu Trp Lys Lys Thr  Lys Asn Asp Glu Ile  Gly Glu Lys
    1265                1270                1275

Glu Phe  Tyr Asp Leu Leu Gln  Lys Lys Asn Leu Glu  Ile Tyr Asp
    1280                1285                1290

Met Leu  Leu Thr Lys His Lys  Asp Thr Ile Tyr Lys  Lys Arg Pro
    1295                1300                1305
```

Asn Ser Ala Thr Ile Asp Ile Leu Val Lys Gly Lys Glu Lys Phe
    1310   1315   1320

Lys Ser Leu Ile Ile Glu Asn Gln Phe Glu Val Ile Leu Glu Ile
    1325   1330   1335

Leu Lys Leu Phe Ser Ala Thr Arg Asn Val Ser Asp Leu Gln His
    1340   1345   1350

Ile Gly Gly Ser Lys Tyr Ser Gly Val Ala Lys Ile Gly Asn Lys
    1355   1360   1365

Ile Ser Ser Leu Asp Asn Cys Ile Leu Ile Tyr Gln Ser Ile Thr
    1370   1375   1380

Gly Ile Phe Glu Lys Arg Ile Asp Leu Leu Lys Val
    1385   1390   1395

<210> 159
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 159

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20   25   30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85   90   95

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300
```

```
Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525
```

```
Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

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

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735
```

```
Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

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

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
           980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Asn  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 160
<211> 1388

<212> PRT
<213> Streptococcus thermophilus

<400> 160

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Met Thr Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Thr Thr Asp Asn Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Ser Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Val Leu Leu Phe Asp Ser Gly Ile Thr Ala Glu Gly Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Thr Glu Met Ala Thr Leu Asp Asp Ala
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Pro Asp Asp Lys Arg
            100                 105                 110


Asp Ser Lys Tyr Pro Ile Phe Gly Asn Leu Val Glu Glu Lys Ala Tyr
        115                 120                 125


His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140


Ser Thr Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Phe Asn Ser
                165                 170                 175


Lys Asn Asn Asp Ile Gln Lys Asn Phe Gln Asp Phe Leu Asp Thr Tyr
            180                 185                 190


Asn Ala Ile Phe Glu Ser Asp Leu Ser Leu Glu Asn Ser Lys Gln Leu
```

```
        195                 200                 205

Glu Glu Ile Val Lys Asp Lys Ile Ser Lys Leu Glu Lys Lys Asp Arg
    210                 215                 220

Ile Leu Lys Leu Phe Pro Gly Glu Lys Asn Ser Gly Ile Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Arg Lys Cys Phe
                245                 250                 255

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

Glu Asp Leu Glu Thr Leu Leu Gly Tyr Ile Gly Asp Asp Tyr Ser Asp
        275                 280                 285

Val Phe Leu Lys Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

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

Met Ile Lys Arg Tyr Asn Glu His Lys Glu Asp Leu Ala Leu Leu Lys
                325                 330                 335

Glu Tyr Ile Arg Asn Ile Ser Leu Lys Thr Tyr Asn Glu Val Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Asp Phe Tyr Val Tyr Leu Lys Lys Leu Leu Ala Glu Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Glu Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Leu Asp Lys Gln Ala Lys Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Lys Asn Lys Glu Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala Trp
    450                 455                 460

Ser Ile Arg Lys Arg Asn Glu Lys Ile Thr Pro Trp Asn Phe Glu Asp
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Ser Phe Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Asn Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Phe Ile Ala Glu Ser Met Arg Asp Tyr Gln Phe Leu Asp Ser Lys Gln
    530                 535                 540

Lys Lys Asp Ile Val Arg Leu Tyr Phe Lys Asp Lys Arg Lys Val Thr
545                 550                 555                 560

Asp Lys Asp Ile Ile Glu Tyr Leu His Ala Ile Tyr Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ser Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Asn Ile Ile Asn Asp Lys Glu Phe Leu Asp Asp
        595                 600                 605

Ser Ser Asn Glu Ala Ile Ile Glu Glu Ile Ile His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ser Lys Phe Glu Asn
```

625 630 635 640

Ile Phe Asp Lys Ser Val Leu Lys Lys Leu Ser Arg Arg His Tyr Thr
645 650 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Glu
660 665 670

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

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ala Leu Ser Phe Lys
690 695 700

Lys Lys Ile Gln Lys Ala Gln Ile Ile Gly Asp Glu Asp Lys Gly Asn
705 710 715 720

Ile Lys Glu Val Val Lys Ser Leu Pro Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met
740 745 750

Gly Gly Arg Lys Pro Glu Ser Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Tyr Thr Asn Gln Gly Lys Ser Asn Ser Gln Gln Arg Leu Lys Arg
770 775 780

Leu Glu Lys Ser Leu Lys Glu Leu Gly Ser Lys Ile Leu Lys Glu Asn
785 790 795 800

Ile Pro Ala Lys Leu Ser Lys Ile Asp Asn Asn Ala Leu Gln Asn Asp
805 810 815

Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly
820 825 830

Asp Asp Leu Asp Ile Asp Arg Leu Ser Asn Tyr Asp Ile Asp His Ile
835 840 845

```
Ile Pro Gln Ala Phe Leu Lys Asp Asn Ser Ile Asp Asn Lys Val Leu
    850                 855                 860

Val Ser Ser Ala Ser Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Leu
865                 870                 875                 880

Glu Val Val Lys Lys Arg Lys Thr Phe Trp Tyr Gln Leu Leu Lys Ser
                885                 890                 895

Lys Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
            900                 905                 910

Gly Gly Leu Ser Pro Glu Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu
        915                 920                 925

Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Leu Leu Asp Glu
    930                 935                 940

Lys Phe Asn Asn Lys Lys Asp Glu Asn Asn Arg Ala Val Arg Thr Val
945                 950                 955                 960

Lys Ile Ile Thr Leu Lys Ser Thr Leu Val Ser Gln Phe Arg Lys Asp
                965                 970                 975

Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Phe His His Ala His
            980                 985                 990

Asp Ala Tyr Leu Asn Ala Val Val  Ala Ser Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005

Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly Asp Tyr  Pro Lys Tyr
    1010                1015                1020

Asn Ser  Phe Arg Glu Arg Lys  Ser Ala Thr Glu Lys  Val Tyr Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Ile  Phe Lys Lys Ser Ile  Ser Leu Ala
    1040                1045                1050

Asp Gly  Arg Val Ile Glu Arg  Pro Leu Ile Glu Val  Asn Glu Glu
```

```
    1055                1060                1065

Thr Gly  Glu Ser Val Trp Asn  Lys Glu Ser Asp Leu  Ala Thr Val
    1070                1075                1080

Arg Arg  Val Leu Ser Tyr Pro  Gln Val Asn Val Val  Lys Lys Val
    1085                1090                1095

Glu Glu  Gln Asn His Gly Leu  Asp Arg Gly Lys Pro  Lys Gly Leu
    1100                1105                1110

Phe Asn  Ala Asn Leu Ser Ser  Lys Pro Lys Pro Asn  Ser Asn Glu
    1115                1120                1125

Asn Leu  Val Gly Ala Lys Glu  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1130                1135                1140

Gly Tyr  Ala Gly Ile Ser Asn  Ser Phe Thr Val Leu  Val Lys Gly
    1145                1150                1155

Thr Ile  Glu Lys Gly Ala Lys  Lys Lys Ile Thr Asn  Val Leu Glu
    1160                1165                1170

Phe Gln  Gly Ile Ser Ile Leu  Asp Arg Ile Asn Tyr  Arg Lys Asp
    1175                1180                1185

Lys Leu  Asn Phe Leu Leu Glu  Lys Gly Tyr Lys Asp  Ile Glu Leu
    1190                1195                1200

Ile Ile  Glu Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Ser Asp Gly
    1205                1210                1215

Ser Arg  Arg Met Leu Ala Ser  Ile Leu Ser Thr Asn  Asn Lys Arg
    1220                1225                1230

Gly Glu  Ile His Lys Gly Asn  Gln Ile Phe Leu Ser  Gln Lys Phe
    1235                1240                1245

Val Lys  Leu Leu Tyr His Ala  Lys Arg Ile Ser Asn  Thr Ile Asn
    1250                1255                1260
```

```
Glu Asn  His Arg Lys Tyr Val  Glu Asn His Lys Lys  Glu Phe Glu
    1265                1270                1275


Glu Leu  Phe Tyr Tyr Ile Leu  Glu Phe Asn Glu Asn  Tyr Val Gly
    1280                1285                1290


Ala Lys  Lys Asn Gly Lys Leu  Leu Asn Ser Ala Phe  Gln Ser Trp
    1295                1300                1305


Gln Asn  His Ser Ile Asp Glu  Leu Cys Ser Ser Phe  Ile Gly Pro
    1310                1315                1320


Thr Gly  Ser Glu Arg Lys Gly  Leu Phe Glu Leu Thr  Ser Arg Gly
    1325                1330                1335


Ser Ala  Ala Asp Phe Glu Phe  Leu Gly Val Lys Ile  Pro Arg Tyr
    1340                1345                1350


Arg Asp  Tyr Thr Pro Ser Ser  Leu Leu Lys Asp Ala  Thr Leu Ile
    1355                1360                1365


His Gln  Ser Val Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ala
    1370                1375                1380


Lys Leu  Gly Glu Gly
    1385


<210>  161
<211>  984
<212>  PRT
<213>  Campylobacter jejuni

<400>  161

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45
```

```
Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

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

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

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

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255
```

```
Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Val Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

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

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480
```

```
Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
               485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
               565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
               645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685
```

```
Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910
```

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
915 920 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
930 935 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945 950 955 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
965 970 975

Arg Gln Arg Glu Asp Phe Lys Lys
980

<210> 162
<211> 1056
<212> PRT
<213> Pasteurella multocida

<400> 162

Met Gln Thr Thr Asn Leu Ser Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1 5 10 15

Ala Ser Val Gly Trp Ala Val Val Glu Ile Asn Glu Asn Glu Asp Pro
20 25 30

Ile Gly Leu Ile Asp Val Gly Val Arg Ile Phe Glu Arg Ala Glu Val
35 40 45

Pro Lys Thr Gly Glu Ser Leu Ala Leu Ser Arg Arg Leu Ala Arg Ser
50 55 60

Thr Arg Arg Leu Ile Arg Arg Arg Ala His Arg Leu Leu Leu Ala Lys
65 70 75 80

Arg Phe Leu Lys Arg Glu Gly Ile Leu Ser Thr Ile Asp Leu Glu Lys
85 90 95

Gly Leu Pro Asn Gln Ala Trp Glu Leu Arg Val Ala Gly Leu Glu Arg

```
            100                 105                 110

Arg Leu Ser Ala Ile Glu Trp Gly Ala Val Leu Leu His Leu Ile Lys
        115                 120                 125

His Arg Gly Tyr Leu Ser Lys Arg Lys Asn Glu Ser Gln Thr Asn Asn
    130                 135                 140

Lys Glu Leu Gly Ala Leu Leu Ser Gly Val Ala Gln Asn His Gln Leu
145                 150                 155                 160

Leu Gln Ser Asp Asp Tyr Arg Thr Pro Ala Glu Leu Ala Leu Lys Lys
                165                 170                 175

Phe Ala Lys Glu Glu Gly His Ile Arg Asn Gln Arg Gly Ala Tyr Thr
            180                 185                 190

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

Ala Gln Gln His Gln Phe Gly Asn Pro His Cys Lys Glu His Ile Gln
    210                 215                 220

Gln Tyr Met Thr Glu Leu Leu Met Trp Gln Lys Pro Ala Leu Ser Gly
225                 230                 235                 240

Glu Ala Ile Leu Lys Met Leu Gly Lys Cys Thr His Glu Lys Asn Glu
                245                 250                 255

Phe Lys Ala Ala Lys His Thr Tyr Ser Ala Glu Arg Phe Val Trp Leu
            260                 265                 270

Thr Lys Leu Asn Asn Leu Arg Ile Leu Glu Asp Gly Ala Glu Arg Ala
        275                 280                 285

Leu Asn Glu Glu Glu Arg Gln Leu Leu Ile Asn His Pro Tyr Glu Lys
    290                 295                 300

Ser Lys Leu Thr Tyr Ala Gln Val Arg Lys Leu Leu Gly Leu Ser Glu
305                 310                 315                 320
```

```
Gln Ala Ile Phe Lys His Leu Arg Tyr Ser Lys Glu Asn Ala Glu Ser
                325                 330                 335

Ala Thr Phe Met Glu Leu Lys Ala Trp His Ala Ile Arg Lys Ala Leu
            340                 345                 350

Glu Asn Gln Gly Leu Lys Asp Thr Trp Gln Asp Leu Ala Lys Lys Pro
        355                 360                 365

Asp Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp
    370                 375                 380

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

Asn Ala Leu Leu Val Ser Leu Asn Phe Asp Lys Phe Ile Glu Leu Ser
                405                 410                 415

Leu Lys Ser Leu Arg Lys Ile Leu Pro Leu Met Glu Gln Gly Lys Arg
            420                 425                 430

Tyr Asp Gln Ala Cys Arg Glu Ile Tyr Gly His His Tyr Gly Glu Ala
        435                 440                 445

Asn Gln Lys Thr Ser Gln Leu Leu Pro Ala Ile Pro Ala Gln Glu Ile
    450                 455                 460

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

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

Thr Gly Arg Glu Leu Gly Lys Ser Phe Lys Glu Arg Arg Glu Ile Gln
            500                 505                 510

Lys Gln Gln Glu Asp Asn Arg Thr Lys Arg Glu Ser Ala Val Gln Lys
        515                 520                 525

Phe Lys Glu Leu Phe Ser Asp Phe Ser Ser Glu Pro Lys Ser Lys Asp
```

```
    530                 535                 540

Ile Leu Lys Phe Arg Leu Tyr Glu Gln Gln His Gly Lys Cys Leu Tyr
545                 550                 555                 560

Ser Gly Lys Glu Ile Asn Ile His Arg Leu Asn Glu Lys Gly Tyr Val
                565                 570                 575

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

Asn Asn Lys Val Leu Val Leu Ala Ser Glu Asn Gln Asn Lys Gly Asn
        595                 600                 605

Gln Thr Pro Tyr Glu Trp Leu Gln Gly Lys Ile Asn Ser Glu Arg Trp
    610                 615                 620

Lys Asn Phe Val Ala Leu Val Leu Gly Ser Gln Cys Ser Ala Ala Lys
625                 630                 635                 640

Lys Gln Arg Leu Leu Thr Gln Val Ile Asp Asp Asn Lys Phe Ile Asp
                645                 650                 655

Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ala Arg Phe Leu Ser Asn Tyr
            660                 665                 670

Ile Gln Glu Asn Leu Leu Leu Val Gly Lys Asn Lys Lys Asn Val Phe
        675                 680                 685

Thr Pro Asn Gly Gln Ile Thr Ala Leu Leu Arg Ser Arg Trp Gly Leu
    690                 695                 700

Ile Lys Ala Arg Glu Asn Asn Asn Arg His His Ala Leu Asp Ala Ile
705                 710                 715                 720

Val Val Ala Cys Ala Thr Pro Ser Met Gln Gln Lys Ile Thr Arg Phe
                725                 730                 735

Ile Arg Phe Lys Glu Val His Pro Tyr Lys Ile Glu Asn Arg Tyr Glu
            740                 745                 750
```

```
Met Val Asp Gln Glu Ser Gly Glu Ile Ile Ser Pro His Phe Pro Glu
        755                 760                 765

Pro Trp Ala Tyr Phe Arg Gln Glu Val Asn Ile Arg Val Phe Asp Asn
    770                 775                 780

His Pro Asp Thr Val Leu Lys Glu Met Leu Pro Asp Arg Pro Gln Ala
785                 790                 795                 800

Asn His Gln Phe Val Gln Pro Leu Phe Val Ser Arg Ala Pro Thr Arg
                805                 810                 815

Lys Met Ser Gly Gln Gly His Met Glu Thr Ile Lys Ser Ala Lys Arg
            820                 825                 830

Leu Ala Glu Gly Ile Ser Val Leu Arg Ile Pro Leu Thr Gln Leu Lys
        835                 840                 845

Pro Asn Leu Leu Glu Asn Met Val Asn Lys Glu Arg Glu Pro Ala Leu
    850                 855                 860

Tyr Ala Gly Leu Lys Ala Arg Leu Ala Glu Phe Asn Gln Asp Pro Ala
865                 870                 875                 880

Lys Ala Phe Ala Thr Pro Phe Tyr Lys Gln Gly Gly Gln Gln Val Lys
                885                 890                 895

Ala Ile Arg Val Glu Gln Val Gln Lys Ser Gly Val Leu Val Arg Glu
            900                 905                 910

Asn Asn Gly Val Ala Asp Asn Ala Ser Ile Val Arg Thr Asp Val Phe
        915                 920                 925

Ile Lys Asn Asn Lys Phe Phe Leu Val Pro Ile Tyr Thr Trp Gln Val
    930                 935                 940

Ala Lys Gly Ile Leu Pro Asn Lys Ala Ile Val Ala His Lys Asn Glu
945                 950                 955                 960

Asp Glu Trp Glu Glu Met Asp Glu Gly Ala Lys Phe Lys Phe Ser Leu
```

965 970 975

Phe Pro Asn Asp Leu Val Glu Leu Lys Thr Lys Lys Glu Tyr Phe Phe
980 985 990

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

Glu His Asp Gly Glu Ile Ser Lys Gly Lys Asp Gly Val Tyr Arg
1010 1015 1020

Val Gly Val Lys Leu Ala Leu Ser Phe Glu Lys Tyr Gln Val Asp
1025 1030 1035

Glu Leu Gly Lys Asn Arg Gln Ile Cys Arg Pro Gln Gln Arg Gln
1040 1045 1050

Pro Val Arg
1055

<210> 163
<211> 1629
<212> PRT
<213> Francisella novicida

<400> 163

Met Asn Phe Lys Ile Leu Pro Ile Ala Ile Asp Leu Gly Val Lys Asn
1 5 10 15

Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Arg
20 25 30

Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
35 40 45

Thr Leu Leu Met Asn Asn Arg Thr Ala Arg Arg His Gln Arg Arg Gly
50 55 60

Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Ile Trp Thr
65 70 75 80

```
Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
                85                  90                  95

Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
            100                 105                 110

Pro Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
        115                 120                 125

Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
    130                 135                 140

Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145                 150                 155                 160

Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Met Lys Leu Cys Thr Asp
                165                 170                 175

Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190

Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ser
        195                 200                 205

Leu Lys Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg His Ala Thr Ile Asn Asp Arg Ile Leu Asp Thr Leu Leu Thr
                245                 250                 255

Asp Asp Leu Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Asn Gln Glu Asp Lys Asp His Ile Gln
        275                 280                 285

Ala His Leu His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu
    290                 295                 300
```

```
Met Ala Ser Gly Gly Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
                325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350

Leu Val Asn Leu Ile Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
        355                 360                 365

Arg Lys Tyr Phe Asn Asp Lys Ile His Ala Lys Ala Asp His Trp Asp
    370                 375                 380

Glu Gln Lys Phe Thr Glu Thr Tyr Cys His Trp Ile Leu Gly Glu Trp
385                 390                 395                 400

Arg Val Gly Val Lys Asp Gln Asp Lys Lys Asp Gly Ala Lys Tyr Ser
                405                 410                 415

Tyr Lys Asp Leu Cys Asn Glu Leu Lys Gln Lys Val Thr Lys Ala Gly
            420                 425                 430

Leu Val Asp Phe Leu Leu Glu Leu Asp Pro Cys Arg Thr Ile Pro Pro
        435                 440                 445

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
    450                 455                 460

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
465                 470                 475                 480

Leu Gln Glu Leu Lys Lys Leu Gln Ser Ile Gln Asn Tyr Leu Asp Ser
                485                 490                 495

Phe Glu Thr Asp Leu Lys Val Leu Lys Ser Ser Lys Asp Gln Pro Tyr
            500                 505                 510
```

```
Phe Val Glu Tyr Lys Ser Ser Asn Gln Gln Ile Ala Ser Gly Gln Arg
        515                 520                 525

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
    530                 535                 540

Val Lys Ala Ser Asp Glu Leu Leu Leu Asn Glu Ile Tyr Phe Gln Ala
545                 550                 555                 560

Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
                565                 570                 575

Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser Gln Ile
            580                 585                 590

Leu Lys Ser Gln His Thr Asn Gly Ile Phe Glu Gln Gly Thr Phe Leu
        595                 600                 605

His Leu Val Cys Lys Tyr Tyr Lys Gln Arg Gln Arg Ala Arg Asp Ser
    610                 615                 620

Arg Leu Tyr Ile Met Pro Glu Tyr Arg Tyr Asp Lys Lys Leu His Lys
625                 630                 635                 640

Tyr Asn Asn Thr Gly Arg Phe Asp Asp Asp Asn Gln Leu Leu Thr Tyr
                645                 650                 655

Cys Asn His Lys Pro Arg Gln Lys Arg Tyr Gln Leu Leu Asn Asp Leu
            660                 665                 670

Ala Gly Val Leu Gln Val Ser Pro Asn Phe Leu Lys Asp Lys Ile Gly
        675                 680                 685

Ser Asp Asp Asp Leu Phe Ile Ser Lys Trp Leu Val Glu His Ile Arg
    690                 695                 700

Gly Phe Lys Lys Ala Cys Glu Asp Ser Leu Lys Ile Gln Lys Asp Asn
705                 710                 715                 720

Arg Gly Leu Leu Asn His Lys Ile Asn Ile Ala Arg Asn Thr Lys Gly
                725                 730                 735
```

```
Lys Cys Glu Lys Glu Ile Phe Asn Leu Ile Cys Lys Ile Glu Gly Ser
            740                 745                 750

Glu Asp Lys Lys Gly Asn Tyr Lys His Gly Leu Ala Tyr Glu Leu Gly
        755                 760                 765

Val Leu Leu Phe Gly Glu Pro Asn Glu Ala Ser Lys Pro Glu Phe Asp
    770                 775                 780

Arg Lys Ile Lys Lys Phe Asn Ser Ile Tyr Ser Phe Ala Gln Ile Gln
785                 790                 795                 800

Gln Ile Ala Phe Ala Glu Arg Lys Gly Asn Ala Asn Thr Cys Ala Val
                805                 810                 815

Cys Ser Ala Asp Asn Ala His Arg Met Gln Gln Ile Lys Ile Thr Glu
            820                 825                 830

Pro Val Glu Asp Asn Lys Asp Lys Ile Ile Leu Ser Ala Lys Ala Gln
        835                 840                 845

Arg Leu Pro Ala Ile Pro Thr Arg Ile Val Asp Gly Ala Val Lys Lys
    850                 855                 860

Met Ala Thr Ile Leu Ala Lys Asn Ile Val Asp Asp Asn Trp Gln Asn
865                 870                 875                 880

Ile Lys Gln Val Leu Ser Ala Lys His Gln Leu His Ile Pro Ile Ile
                885                 890                 895

Thr Glu Ser Asn Ala Phe Glu Phe Glu Pro Ala Leu Ala Asp Val Lys
            900                 905                 910

Gly Lys Ser Leu Lys Asp Arg Arg Lys Lys Ala Leu Glu Arg Ile Ser
        915                 920                 925

Pro Glu Asn Ile Phe Lys Asp Lys Asn Asn Arg Ile Lys Glu Phe Ala
    930                 935                 940
```

```
Lys Gly Ile Ser Ala Tyr Ser Gly Ala Asn Leu Thr Asp Gly Asp Phe
945                 950                 955                 960


Asp Gly Ala Lys Glu Glu Leu Asp His Ile Ile Pro Arg Ser His Lys
                965                 970                 975


Lys Tyr Gly Thr Leu Asn Asp Glu Ala Asn Leu Ile Cys Val Thr Arg
            980                 985                 990


Gly Asp Asn Lys Asn Lys Gly Asn  Arg Ile Phe Cys Leu  Arg Asp Leu
        995                 1000                1005


Ala Asp  Asn Tyr Lys Leu Lys  Gln Phe Glu Thr Thr  Asp Asp Leu
    1010                1015                1020


Glu Ile  Glu Lys Lys Ile Ala  Asp Thr Ile Trp Asp  Ala Asn Lys
    1025                1030                1035


Lys Asp  Phe Lys Phe Gly Asn  Tyr Arg Ser Phe Ile  Asn Leu Thr
    1040                1045                1050


Pro Gln  Glu Gln Lys Ala Phe  Arg His Ala Leu Phe  Leu Ala Asp
    1055                1060                1065


Glu Asn  Pro Ile Lys Gln Ala  Val Ile Arg Ala Ile  Asn Asn Arg
    1070                1075                1080


Asn Arg  Thr Phe Val Asn Gly  Thr Gln Arg Tyr Phe  Ala Glu Val
    1085                1090                1095


Leu Ala  Asn Asn Ile Tyr Leu  Arg Ala Lys Lys Glu  Asn Leu Asn
    1100                1105                1110


Thr Asp  Lys Ile Ser Phe Asp  Tyr Phe Gly Ile Pro  Thr Ile Gly
    1115                1120                1125


Asn Gly  Arg Gly Ile Ala Glu  Ile Arg Gln Leu Tyr  Glu Lys Val
    1130                1135                1140


Asp Ser  Asp Ile Gln Ala Tyr  Ala Lys Gly Asp Lys  Pro Gln Ala
    1145                1150                1155
```

```
Ser Tyr  Ser His Leu Ile Asp  Ala Met Leu Ala Phe  Cys Ile Ala
    1160                1165                1170

Ala Asp  Glu His Arg Asn Asp  Gly Ser Ile Gly Leu  Glu Ile Asp
    1175                1180                1185

Lys Asn  Tyr Ser Leu Tyr Pro  Leu Asp Lys Asn Thr  Gly Glu Val
    1190                1195                1200

Phe Thr  Lys Asp Ile Phe Ser  Gln Ile Lys Ile Thr  Asp Asn Glu
    1205                1210                1215

Phe Ser  Asp Lys Lys Leu Val  Arg Lys Lys Ala Ile  Glu Gly Phe
    1220                1225                1230

Asn Thr  His Arg Gln Met Thr  Arg Asp Gly Ile Tyr  Ala Glu Asn
    1235                1240                1245

Tyr Leu  Pro Ile Leu Ile His  Lys Glu Leu Asn Glu  Val Arg Lys
    1250                1255                1260

Gly Tyr  Thr Trp Lys Asn Ser  Glu Glu Ile Lys Ile  Phe Lys Gly
    1265                1270                1275

Lys Lys  Tyr Asp Ile Gln Gln  Leu Asn Asn Leu Val  Tyr Cys Leu
    1280                1285                1290

Lys Phe  Val Asp Lys Pro Ile  Ser Ile Asp Ile Gln  Ile Ser Thr
    1295                1300                1305

Leu Glu  Glu Leu Arg Asn Ile  Leu Thr Thr Asn Asn  Ile Ala Ala
    1310                1315                1320

Thr Ala  Glu Tyr Tyr Tyr Ile  Asn Leu Lys Thr Gln  Lys Leu His
    1325                1330                1335

Glu Tyr  Tyr Ile Glu Asn Tyr  Asn Thr Ala Leu Gly  Tyr Lys Lys
    1340                1345                1350
```

```
Tyr Ser  Lys Glu Met Glu Phe  Leu Arg Ser Leu Ala  Tyr Arg Ser
    1355                1360                1365

Glu Arg  Val Lys Ile Lys Ser  Ile Asp Asp Val Lys  Gln Val Leu
    1370                1375                1380

Asp Lys  Asp Ser Asn Phe Ile  Ile Gly Lys Ile Thr  Leu Pro Phe
    1385                1390                1395

Lys Lys  Glu Trp Gln Arg Leu  Tyr Arg Glu Trp Gln  Asn Thr Thr
    1400                1405                1410

Ile Lys  Asp Asp Tyr Glu Phe  Leu Lys Ser Phe Phe  Asn Val Lys
    1415                1420                1425

Ser Ile  Thr Lys Leu His Lys  Lys Val Arg Lys Asp  Phe Ser Leu
    1430                1435                1440

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

Trp Asp  Asn Asn Phe Ile Tyr  Gln Ile Leu Asn Asp  Ser Asp Ser
    1460                1465                1470

Arg Ala  Asp Gly Thr Lys Pro  Phe Ile Pro Ala Phe  Asp Ile Ser
    1475                1480                1485

Lys Asn  Glu Ile Val Glu Ala  Ile Ile Asp Ser Phe  Thr Ser Lys
    1490                1495                1500

Asn Ile  Phe Trp Leu Pro Lys  Asn Ile Glu Leu Gln  Lys Val Asp
    1505                1510                1515

Asn Lys  Asn Ile Phe Ala Ile  Asp Thr Ser Lys Trp  Phe Glu Val
    1520                1525                1530

Glu Thr  Pro Ser Asp Leu Arg  Asp Ile Gly Ile Ala  Thr Ile Gln
    1535                1540                1545

Tyr Lys  Ile Asp Asn Asn Ser  Arg Pro Lys Val Arg  Val Lys Leu
    1550                1555                1560
```

Asp Tyr Val Ile Asp Asp Asp Ser Lys Ile Asn Tyr Phe Met Asn
    1565   1570   1575

His Ser Leu Leu Lys Ser Arg Tyr Pro Asp Lys Val Leu Glu Ile
    1580   1585   1590

Leu Lys Gln Ser Thr Ile Ile Glu Phe Glu Ser Ser Gly Phe Asn
    1595   1600   1605

Lys Thr Ile Lys Glu Met Leu Gly Met Lys Leu Ala Gly Ile Tyr
    1610   1615   1620

Asn Glu Thr Ser Asn Asn
    1625

<210> 164
<211> 1371
<212> PRT
<213> Lactobacillus buchneri

<400> 164

Met Lys Val Asn Asn Tyr His Ile Gly Leu Asp Ile Gly Thr Ser Ser
1   5   10   15

Ile Gly Trp Val Ala Ile Gly Lys Asp Gly Lys Pro Leu Arg Val Lys
            20   25   30

Gly Lys Thr Ala Ile Gly Ala Arg Leu Phe Gln Glu Gly Asn Pro Ala
        35   40   45

Ala Asp Arg Arg Met Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg
    50   55   60

Lys Trp Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Pro Tyr Ile Thr
65   70   75   80

Pro Val Asp Ser Thr Phe Phe Ala Arg Leu Lys Gln Ser Asn Leu Ser
                85   90   95

Pro Lys Asp Ser Arg Lys Glu Phe Lys Gly Ser Met Leu Phe Pro Asp

```
            100                 105                 110

Leu Thr Asp Met Gln Tyr His Lys Asn Tyr Pro Thr Ile Tyr His Leu
        115                 120                 125

Arg His Ala Leu Met Thr Gln Asp Lys Lys Phe Asp Ile Arg Met Val
    130                 135                 140

Tyr Leu Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Asn
145                 150                 155                 160

Ser Thr Pro Val Asp Ser Phe Lys Ala Ser Lys Val Asp Phe Val Asp
                165                 170                 175

Gln Phe Lys Lys Leu Asn Glu Leu Tyr Ala Ala Ile Asn Pro Glu Glu
            180                 185                 190

Ser Phe Lys Ile Asn Leu Ala Asn Ser Glu Asp Ile Gly His Gln Phe
        195                 200                 205

Leu Asp Pro Ser Ile Arg Lys Phe Asp Lys Lys Lys Gln Ile Pro Lys
    210                 215                 220

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

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

Leu Asp Val Val Leu Gln Cys Thr Pro Val Asp Ser Lys Pro Trp Ala
            260                 265                 270

Leu Lys Phe Asp Asp Glu Asp Ile Asp Ala Lys Leu Glu Lys Ile Leu
        275                 280                 285

Pro Glu Met Asp Glu Asn Gln Gln Ser Ile Val Ala Ile Leu Gln Asn
    290                 295                 300

Leu Tyr Ser Gln Val Thr Leu Asn Gln Ile Val Pro Asn Gly Met Ser
305                 310                 315                 320
```

```
Leu Ser Glu Ser Met Ile Glu Lys Tyr Asn Asp His His Asp His Leu
                325                 330                 335

Lys Leu Tyr Lys Lys Leu Ile Asp Gln Leu Ala Asp Pro Lys Lys Lys
            340                 345                 350

Ala Val Leu Lys Lys Ala Tyr Ser Gln Tyr Val Gly Asp Asp Gly Lys
        355                 360                 365

Val Ile Glu Gln Ala Glu Phe Trp Ser Ser Val Lys Lys Asn Leu Asp
    370                 375                 380

Asp Ser Glu Leu Ser Lys Gln Ile Met Asp Leu Ile Asp Ala Glu Lys
385                 390                 395                 400

Phe Met Pro Lys Gln Arg Thr Ser Gln Asn Gly Val Ile Pro His Gln
                405                 410                 415

Leu His Gln Arg Glu Leu Asp Glu Ile Ile Glu His Gln Ser Lys Tyr
            420                 425                 430

Tyr Pro Trp Leu Val Glu Ile Asn Pro Asn Lys His Asp Leu His Leu
        435                 440                 445

Ala Lys Tyr Lys Ile Glu Gln Leu Val Ala Phe Arg Val Pro Tyr Tyr
    450                 455                 460

Val Gly Pro Met Ile Thr Pro Lys Asp Gln Ala Glu Ser Ala Glu Thr
465                 470                 475                 480

Val Phe Ser Trp Met Glu Arg Lys Gly Thr Glu Thr Gly Gln Ile Thr
                485                 490                 495

Pro Trp Asn Phe Asp Glu Lys Val Asp Arg Lys Ala Ser Ala Asn Arg
            500                 505                 510

Phe Ile Lys Arg Met Thr Thr Lys Asp Thr Tyr Leu Ile Gly Glu Asp
        515                 520                 525

Val Leu Pro Asp Glu Ser Leu Leu Tyr Glu Lys Phe Lys Val Leu Asn
```

```
    530                 535                 540

Glu Leu Asn Met Val Arg Val Asn Gly Lys Leu Leu Lys Val Ala Asp
545                 550                 555                 560

Lys Gln Ala Ile Phe Gln Asp Leu Phe Glu Asn Tyr Lys His Val Ser
                565                 570                 575

Val Lys Lys Leu Gln Asn Tyr Ile Lys Ala Lys Thr Gly Leu Pro Ser
            580                 585                 590

Asp Pro Glu Ile Ser Gly Leu Ser Asp Pro Glu His Phe Asn Asn Ser
        595                 600                 605

Leu Gly Thr Tyr Asn Asp Phe Lys Lys Leu Phe Gly Ser Lys Val Asp
    610                 615                 620

Glu Pro Asp Leu Gln Asp Asp Phe Glu Lys Ile Val Glu Trp Ser Thr
625                 630                 635                 640

Val Phe Glu Asp Lys Lys Ile Leu Arg Glu Lys Leu Asn Glu Ile Thr
                645                 650                 655

Trp Leu Ser Asp Gln Gln Lys Asp Val Leu Glu Ser Ser Arg Tyr Gln
            660                 665                 670

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

Gln Gly Glu Arg Ile Ile Asp Lys Leu Trp Asn Thr Asn Lys Asn Phe
    690                 695                 700

Met Gln Ile Gln Ser Asp Asp Asp Phe Ala Lys Arg Ile His Glu Ala
705                 710                 715                 720

Asn Ala Asp Gln Met Gln Ala Val Asp Val Glu Asp Val Leu Ala Asp
                725                 730                 735

Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg Gln Val Val Lys
            740                 745                 750
```

```
Val Val Asp Asp Ile Gln Lys Ala Met Gly Gly Val Ala Pro Lys Tyr
        755                 760                 765

Ile Ser Ile Glu Phe Thr Arg Ser Glu Asp Arg Asn Pro Arg Arg Thr
    770                 775                 780

Ile Ser Arg Gln Arg Gln Leu Glu Asn Thr Leu Lys Asp Thr Ala Lys
785                 790                 795                 800

Ser Leu Ala Lys Ser Ile Asn Pro Glu Leu Leu Ser Glu Leu Asp Asn
                805                 810                 815

Ala Ala Lys Ser Lys Lys Gly Leu Thr Asp Arg Leu Tyr Leu Tyr Phe
            820                 825                 830

Thr Gln Leu Gly Lys Asp Ile Tyr Thr Gly Glu Pro Ile Asn Ile Asp
        835                 840                 845

Glu Leu Asn Lys Tyr Asp Ile Asp His Ile Leu Pro Gln Ala Phe Ile
    850                 855                 860

Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val Leu Thr Ala Val Asn
865                 870                 875                 880

Asn Gly Lys Ser Asp Asn Val Pro Leu Arg Met Phe Gly Ala Lys Met
                885                 890                 895

Gly His Phe Trp Lys Gln Leu Ala Glu Ala Gly Leu Ile Ser Lys Arg
            900                 905                 910

Lys Leu Lys Asn Leu Gln Thr Asp Pro Asp Thr Ile Ser Lys Tyr Ala
        915                 920                 925

Met His Gly Phe Ile Arg Arg Gln Leu Val Glu Thr Ser Gln Val Ile
    930                 935                 940

Lys Leu Val Ala Asn Ile Leu Gly Asp Lys Tyr Arg Asn Asp Asp Thr
945                 950                 955                 960

Lys Ile Ile Glu Ile Thr Ala Arg Met Asn His Gln Met Arg Asp Glu
```

```
               965                 970                 975

Phe Gly Phe Ile Lys Asn Arg Glu Ile Asn Asp Tyr His His Ala Phe
            980                 985                 990

Asp Ala Tyr Leu Thr Ala Phe Leu  Gly Arg Tyr Leu Tyr  His Arg Tyr
        995                 1000                1005

Ile Lys  Leu Arg Pro Tyr Phe  Val Tyr Gly Asp Phe  Lys Lys Phe
    1010                1015                1020

Arg Glu  Asp Lys Val Thr Met  Arg Asn Phe Asn Phe  Leu His Asp
    1025                1030                1035

Leu Thr  Asp Asp Thr Gln Glu  Lys Ile Ala Asp Ala  Glu Thr Gly
    1040                1045                1050

Glu Val  Ile Trp Asp Arg Glu  Asn Ser Ile Gln Gln  Leu Lys Asp
    1055                1060                1065

Val Tyr  His Tyr Lys Phe Met  Leu Ile Ser His Glu  Val Tyr Thr
    1070                1075                1080

Leu Arg  Gly Ala Met Phe Asn  Gln Thr Val Tyr Pro  Ala Ser Asp
    1085                1090                1095

Ala Gly  Lys Arg Lys Leu Ile  Pro Val Lys Ala Asp  Arg Pro Val
    1100                1105                1110

Asn Val  Tyr Gly Gly Tyr Ser  Gly Ser Ala Asp Ala  Tyr Met Ala
    1115                1120                1125

Ile Val  Arg Ile His Asn Lys  Lys Gly Asp Lys Tyr  Arg Val Val
    1130                1135                1140

Gly Val  Pro Met Arg Ala Leu  Asp Arg Leu Asp Ala  Ala Lys Asn
    1145                1150                1155

Val Ser  Asp Ala Asp Phe Asp  Arg Ala Leu Lys Asp  Val Leu Ala
    1160                1165                1170
```

```
Pro Gln  Leu Thr Lys Thr Lys  Lys Ser Arg Lys Thr  Gly Glu Ile
    1175                1180                1185

Thr Gln  Val Ile Glu Asp Phe  Glu Ile Val Leu Gly  Lys Val Met
    1190                1195                1200

Tyr Arg  Gln Leu Met Ile Asp  Gly Asp Lys Lys Phe  Met Leu Gly
    1205                1210                1215

Ser Ser  Thr Tyr Gln Tyr Asn  Ala Lys Gln Leu Val  Leu Ser Asp
    1220                1225                1230

Gln Ser  Val Lys Thr Leu Ala  Ser Lys Gly Arg Leu  Asp Pro Leu
    1235                1240                1245

Gln Glu  Ser Met Asp Tyr Asn  Asn Val Tyr Thr Glu  Ile Leu Asp
    1250                1255                1260

Lys Val  Asn Gln Tyr Phe Ser  Leu Tyr Asp Met Asn  Lys Phe Arg
    1265                1270                1275

His Lys  Leu Asn Leu Gly Phe  Ser Lys Phe Ile Ser  Phe Pro Asn
    1280                1285                1290

His Asn  Val Leu Asp Gly Asn  Thr Lys Val Ser Ser  Gly Lys Arg
    1295                1300                1305

Glu Ile  Leu Gln Glu Ile Leu  Asn Gly Leu His Ala  Asn Pro Thr
    1310                1315                1320

Phe Gly  Asn Leu Lys Asp Val  Gly Ile Thr Thr Pro  Phe Gly Gln
    1325                1330                1335

Leu Gln  Gln Pro Asn Gly Ile  Leu Leu Ser Asp Glu  Thr Lys Ile
    1340                1345                1350

Arg Tyr  Gln Ser Pro Thr Gly  Leu Phe Glu Arg Thr  Val Ser Leu
    1355                1360                1365

Lys Asp  Leu
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1370

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<400> 165

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Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


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


Lys Ile Ala Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Ala Asp Arg Arg Met
    50                  55                  60


Ala Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80


Tyr Leu Gln Gly Ile Phe Ala Glu Glu Met Ser Lys Thr Asp Ala Asn
                85                  90                  95


Phe Phe Cys Arg Leu Ser Asp Ser Phe Tyr Val Asp Asn Glu Lys Arg
            100                 105                 110


Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Glu Tyr
        115                 120                 125


His Lys Asn Tyr Pro Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140


Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175
```

```
Gln Asn Thr Ser Val Asp Gly Ile Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Ala Ser Gly Ile Glu Asp Gly Ser Leu Lys Lys Leu
        195                 200                 205

Glu Asp Asn Lys Asp Val Ala Lys Ile Leu Val Glu Lys Val Thr Arg
    210                 215                 220

Lys Glu Lys Leu Glu Arg Ile Leu Lys Leu Tyr Pro Gly Glu Lys Ser
225                 230                 235                 240

Ala Gly Met Phe Ala Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly
                245                 250                 255

Asn Phe Gln Lys Pro Phe Asp Leu Ile Glu Lys Ser Asp Ile Glu Cys
            260                 265                 270

Ala Lys Asp Ser Tyr Glu Glu Asp Leu Glu Ser Leu Leu Ala Leu Ile
        275                 280                 285

Gly Asp Glu Tyr Ala Glu Leu Phe Val Ala Ala Lys Asn Ala Tyr Ser
    290                 295                 300

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

Ala Lys Leu Ser Ala Ser Met Ile Glu Arg Phe Asp Thr His Glu Glu
                325                 330                 335

Asp Leu Gly Glu Leu Lys Ala Phe Ile Lys Leu His Leu Pro Lys His
            340                 345                 350

Tyr Glu Glu Ile Phe Ser Asn Thr Glu Lys His Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Asp Gly Lys Thr Lys Gln Ala Asp Phe Tyr Lys Tyr Met Lys Met
    370                 375                 380

Thr Leu Glu Asn Ile Glu Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu
385                 390                 395                 400
```

```
Lys Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu His Gln Gln
            420                 425                 430

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

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

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

Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
                485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Leu Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Val Arg Tyr Ile Asn Asp Gln Gly Lys Thr Ser Tyr
    530                 535                 540

Phe Ser Gly Gln Glu Lys Glu Gln Ile Phe Asn Asp Leu Phe Lys Gln
545                 550                 555                 560

Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu Arg Asn Met
                565                 570                 575

Ser His Val Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ser Ser Tyr Ser Thr Tyr His Asp Leu Leu Lys Val Gly Ile Lys Gln
        595                 600                 605
```

```
Glu Ile Leu Asp Asn Pro Val Asn Thr Glu Met Leu Glu Asn Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys Glu Gln Leu
625                 630                 635                 640

Gln Gln Phe Ser Asp Val Leu Asp Gly Val Val Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Met
            660                 665                 670

Gly Ile Arg Asp Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
        675                 680                 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Thr Thr Ala
705                 710                 715                 720

Asp Lys Asp Ile Gln Ser Ile Val Ala Asp Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ser Val Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Arg Pro Arg Tyr
    770                 775                 780

Lys Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Gln Glu Leu Arg Asn Asn Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Gln Asp Leu Asp
            820                 825                 830
```

```
Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845

Phe Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Asp Asp Val Pro Pro Leu Glu Ile Val Arg
865                 870                 875                 880

Lys Arg Lys Val Phe Trp Glu Lys Leu Tyr Gln Gly Asn Leu Met Ser
                885                 890                 895

Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910

Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Tyr
    930                 935                 940

Glu Lys Asp Asp His Gly Asn Thr Met Lys Gln Val Arg Ile Val Thr
945                 950                 955                 960

Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Leu Tyr
                965                 970                 975

Lys Val Arg Asp Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Gly Val Val Ala Asn Thr Leu  Leu Lys Val Tyr Pro  Gln Leu Glu
        995                 1000                1005

Pro Glu  Phe Val Tyr Gly Asp  Tyr His Gln Phe Asp  Trp Phe Lys
    1010                1015                1020

Ala Asn  Lys Ala Thr Ala Lys  Lys Gln Phe Tyr Thr  Asn Ile Met
    1025                1030                1035
```

```
Leu Phe  Phe Ala Gln Lys Asp  Arg Ile Ile Asp Glu  Asn Gly Glu
    1040                1045                1050

Ile Leu  Trp Asp Lys Lys Tyr  Leu Asp Thr Val Lys  Lys Val Met
    1055                1060                1065

Ser Tyr  Arg Gln Met Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys
    1070                1075                1080

Gly Glu  Phe Ser Lys Ala Thr  Ile Lys Pro Lys Gly  Asn Ser Ser
    1085                1090                1095

Lys Leu  Ile Pro Arg Lys Thr  Asn Trp Asp Pro Met  Lys Tyr Gly
    1100                1105                1110

Gly Leu  Asp Ser Pro Asn Met  Ala Tyr Ala Val Val  Ile Glu Tyr
    1115                1120                1125

Ala Lys  Gly Lys Asn Lys Leu  Val Phe Glu Lys Lys  Ile Ile Arg
    1130                1135                1140

Val Thr  Ile Met Glu Arg Lys  Ala Phe Glu Lys Asp  Glu Lys Ala
    1145                1150                1155

Phe Leu  Glu Glu Gln Gly Tyr  Arg Gln Pro Lys Val  Leu Ala Lys
    1160                1165                1170

Leu Pro  Lys Tyr Thr Leu Tyr  Glu Cys Glu Glu Gly  Arg Arg Arg
    1175                1180                1185

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

Leu Pro  Asn His Leu Val Thr  Leu Leu His His Ala  Ala Asn Cys
    1205                1210                1215

Glu Val  Ser Asp Gly Lys Ser  Leu Asp Tyr Ile Glu  Ser Asn Arg
    1220                1225                1230

Glu Met  Phe Ala Glu Leu Leu  Ala His Val Ser Glu  Phe Ala Lys
    1235                1240                1245
```

```
Arg Tyr  Thr Leu Ala Glu Ala  Asn Leu Asn Lys Ile  Asn Gln Leu
    1250                1255                1260


Phe Glu  Gln Asn Lys Glu Gly  Asp Ile Lys Ala Ile  Ala Gln Ser
    1265                1270                1275


Phe Val  Asp Leu Met Ala Phe  Asn Ala Met Gly Ala  Pro Ala Ser
    1280                1285                1290


Phe Lys  Phe Phe Glu Thr Thr  Ile Glu Arg Lys Arg  Tyr Asn Asn
    1295                1300                1305


Leu Lys  Glu Leu Leu Asn Ser  Thr Ile Ile Tyr Gln  Ser Ile Thr
    1310                1315                1320


Gly Leu  Tyr Glu Ser Arg Lys  Arg Leu Asp Asp
    1325                1330


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<212>  PRT
<213>  Legionella pneumophila

<400>  166

Met Glu Ser Ser Gln Ile Leu Ser Pro Ile Gly Ile Asp Leu Gly Gly
1               5                   10                  15


Lys Phe Thr Gly Val Cys Leu Ser His Leu Glu Ala Phe Ala Glu Leu
            20                  25                  30


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


Asn Phe Gln Leu Ser Gln Ala Gln Arg Arg Ala Thr Arg His Arg Val
    50                  55                  60


Arg Asn Lys Lys Arg Asn Gln Phe Val Lys Arg Val Ala Leu Gln Leu
65                  70                  75                  80


Phe Gln His Ile Leu Ser Arg Asp Leu Asn Ala Lys Glu Glu Thr Ala
```

```
                85                  90                  95

Leu Cys His Tyr Leu Asn Asn Arg Gly Tyr Thr Tyr Val Asp Thr Asp
            100                 105                 110

Leu Asp Glu Tyr Ile Lys Asp Glu Thr Thr Ile Asn Leu Leu Lys Glu
        115                 120                 125

Leu Leu Pro Ser Glu Ser Glu His Asn Phe Ile Asp Trp Phe Leu Gln
    130                 135                 140

Lys Met Gln Ser Ser Glu Phe Arg Lys Ile Leu Val Ser Lys Val Glu
145                 150                 155                 160

Glu Lys Lys Asp Asp Lys Glu Leu Lys Asn Ala Val Lys Asn Ile Lys
                165                 170                 175

Asn Phe Ile Thr Gly Phe Glu Lys Asn Ser Val Glu Gly His Arg His
            180                 185                 190

Arg Lys Val Tyr Phe Glu Asn Ile Lys Ser Asp Ile Thr Lys Asp Asn
        195                 200                 205

Gln Leu Asp Ser Ile Lys Lys Lys Ile Pro Ser Val Cys Leu Ser Asn
    210                 215                 220

Leu Leu Gly His Leu Ser Asn Leu Gln Trp Lys Asn Leu His Arg Tyr
225                 230                 235                 240

Leu Ala Lys Asn Pro Lys Gln Phe Asp Glu Gln Thr Phe Gly Asn Glu
                245                 250                 255

Phe Leu Arg Met Leu Lys Asn Phe Arg His Leu Lys Gly Ser Gln Glu
            260                 265                 270

Ser Leu Ala Val Arg Asn Leu Ile Gln Gln Leu Glu Gln Ser Gln Asp
        275                 280                 285

Tyr Ile Ser Ile Leu Glu Lys Thr Pro Pro Glu Ile Thr Ile Pro Pro
    290                 295                 300
```

```
Tyr Glu Ala Arg Thr Asn Thr Gly Met Glu Lys Asp Gln Ser Leu Leu
305                 310                 315                 320

Leu Asn Pro Glu Lys Leu Asn Asn Leu Tyr Pro Asn Trp Arg Asn Leu
                325                 330                 335

Ile Pro Gly Ile Ile Asp Ala His Pro Phe Leu Glu Lys Asp Leu Glu
            340                 345                 350

His Thr Lys Leu Arg Asp Arg Lys Arg Ile Ile Ser Pro Ser Lys Gln
        355                 360                 365

Asp Glu Lys Arg Asp Ser Tyr Ile Leu Gln Arg Tyr Leu Asp Leu Asn
    370                 375                 380

Lys Lys Ile Asp Lys Phe Lys Ile Lys Lys Gln Leu Ser Phe Leu Gly
385                 390                 395                 400

Gln Gly Lys Gln Leu Pro Ala Asn Leu Ile Glu Thr Gln Lys Glu Met
                405                 410                 415

Glu Thr His Phe Asn Ser Ser Leu Val Ser Val Leu Ile Gln Ile Ala
            420                 425                 430

Ser Ala Tyr Asn Lys Glu Arg Glu Asp Ala Ala Gln Gly Ile Trp Phe
        435                 440                 445

Asp Asn Ala Phe Ser Leu Cys Glu Leu Ser Asn Ile Asn Pro Pro Arg
    450                 455                 460

Lys Gln Lys Ile Leu Pro Leu Leu Val Gly Ala Ile Leu Ser Glu Asp
465                 470                 475                 480

Phe Ile Asn Asn Lys Asp Lys Trp Ala Lys Phe Lys Ile Phe Trp Asn
                485                 490                 495

Thr His Lys Ile Gly Arg Thr Ser Leu Lys Ser Lys Cys Lys Glu Ile
            500                 505                 510

Glu Glu Ala Arg Lys Asn Ser Gly Asn Ala Phe Lys Ile Asp Tyr Glu
```

```
        515                 520                 525

Glu Ala Leu Asn His Pro Glu His Ser Asn Asn Lys Ala Leu Ile Lys
    530                 535                 540

Ile Ile Gln Thr Ile Pro Asp Ile Ile Gln Ala Ile Gln Ser His Leu
545                 550                 555                 560

Gly His Asn Asp Ser Gln Ala Leu Ile Tyr His Asn Pro Phe Ser Leu
                565                 570                 575

Ser Gln Leu Tyr Thr Ile Leu Glu Thr Lys Arg Asp Gly Phe His Lys
            580                 585                 590

Asn Cys Val Ala Val Thr Cys Glu Asn Tyr Trp Arg Ser Gln Lys Thr
        595                 600                 605

Glu Ile Asp Pro Glu Ile Ser Tyr Ala Ser Arg Leu Pro Ala Asp Ser
    610                 615                 620

Val Arg Pro Phe Asp Gly Val Leu Ala Arg Met Met Gln Arg Leu Ala
625                 630                 635                 640

Tyr Glu Ile Ala Met Ala Lys Trp Glu Gln Ile Lys His Ile Pro Asp
                645                 650                 655

Asn Ser Ser Leu Leu Ile Pro Ile Tyr Leu Glu Gln Asn Arg Phe Glu
            660                 665                 670

Phe Glu Glu Ser Phe Lys Lys Ile Lys Gly Ser Ser Ser Asp Lys Thr
        675                 680                 685

Leu Glu Gln Ala Ile Glu Lys Gln Asn Ile Gln Trp Glu Glu Lys Phe
    690                 695                 700

Gln Arg Ile Ile Asn Ala Ser Met Asn Ile Cys Pro Tyr Lys Gly Ala
705                 710                 715                 720

Ser Ile Gly Gly Gln Gly Glu Ile Asp His Ile Tyr Pro Arg Ser Leu
                725                 730                 735
```

```
Ser Lys Lys His Phe Gly Val Ile Phe Asn Ser Glu Val Asn Leu Ile
            740                 745                 750

Tyr Cys Ser Ser Gln Gly Asn Arg Glu Lys Lys Glu Glu His Tyr Leu
        755                 760                 765

Leu Glu His Leu Ser Pro Leu Tyr Leu Lys His Gln Phe Gly Thr Asp
    770                 775                 780

Asn Val Ser Asp Ile Lys Asn Phe Ile Ser Gln Asn Val Ala Asn Ile
785                 790                 795                 800

Lys Lys Tyr Ile Ser Phe His Leu Leu Thr Pro Glu Gln Gln Lys Ala
                805                 810                 815

Ala Arg His Ala Leu Phe Leu Asp Tyr Asp Asp Glu Ala Phe Lys Thr
            820                 825                 830

Ile Thr Lys Phe Leu Met Ser Gln Gln Lys Ala Arg Val Asn Gly Thr
        835                 840                 845

Gln Lys Phe Leu Gly Lys Gln Ile Met Glu Phe Leu Ser Thr Leu Ala
    850                 855                 860

Asp Ser Lys Gln Leu Gln Leu Glu Phe Ser Ile Lys Gln Ile Thr Ala
865                 870                 875                 880

Glu Glu Val His Asp His Arg Glu Leu Leu Ser Lys Gln Glu Pro Lys
                885                 890                 895

Leu Val Lys Ser Arg Gln Gln Ser Phe Pro Ser His Ala Ile Asp Ala
            900                 905                 910

Thr Leu Thr Met Ser Ile Gly Leu Lys Glu Phe Pro Gln Phe Ser Gln
        915                 920                 925

Glu Leu Asp Asn Ser Trp Phe Ile Asn His Leu Met Pro Asp Glu Val
    930                 935                 940

His Leu Asn Pro Val Arg Ser Lys Glu Lys Tyr Asn Lys Pro Asn Ile
```

```
945                 950                 955                 960

Ser Ser Thr Pro Leu Phe Lys Asp Ser Leu Tyr Ala Glu Arg Phe Ile
               965                 970                 975

Pro Val Trp Val Lys Gly Glu Thr Phe Ala Ile Gly Phe Ser Glu Lys
           980                 985                 990

Asp Leu Phe Glu Ile Lys Pro Ser  Asn Lys Glu Lys Leu  Phe Thr Leu
        995                 1000                1005

Leu Lys  Thr Tyr Ser Thr Lys  Asn Pro Gly Glu Ser  Leu Gln Glu
    1010                1015                1020

Leu Gln  Ala Lys Ser Lys Ala  Lys Trp Leu Tyr Phe  Pro Ile Asn
    1025                1030                1035

Lys Thr  Leu Ala Leu Glu Phe  Leu His His Tyr Phe  His Lys Glu
    1040                1045                1050

Ile Val  Thr Pro Asp Asp Thr  Thr Val Cys His Phe  Ile Asn Ser
    1055                1060                1065

Leu Arg  Tyr Tyr Thr Lys Lys  Glu Ser Ile Thr Val  Lys Ile Leu
    1070                1075                1080

Lys Glu  Pro Met Pro Val Leu  Ser Val Lys Phe Glu  Ser Ser Lys
    1085                1090                1095

Lys Asn  Val Leu Gly Ser Phe  Lys His Thr Ile Ala  Leu Pro Ala
    1100                1105                1110

Thr Lys  Asp Trp Glu Arg Leu  Phe Asn His Pro Asn  Phe Leu Ala
    1115                1120                1125

Leu Lys  Ala Asn Pro Ala Pro  Asn Pro Lys Glu Phe  Asn Glu Phe
    1130                1135                1140

Ile Arg  Lys Tyr Phe Leu Ser  Asp Asn Asn Pro Asn  Ser Asp Ile
    1145                1150                1155
```

```
Pro Asn  Asn Gly His Asn Ile  Lys Pro Gln Lys His  Lys Ala Val
    1160                1165                1170

Arg Lys  Val Phe Ser Leu Pro  Val Ile Pro Gly Asn  Ala Gly Thr
    1175                1180                1185

Met Met  Arg Ile Arg Arg Lys  Asp Asn Lys Gly Gln  Pro Leu Tyr
    1190                1195                1200

Gln Leu  Gln Thr Ile Asp Asp  Thr Pro Ser Met Gly  Ile Gln Ile
    1205                1210                1215

Asn Glu  Asp Arg Leu Val Lys  Gln Glu Val Leu Met  Asp Ala Tyr
    1220                1225                1230

Lys Thr  Arg Asn Leu Ser Thr  Ile Asp Gly Ile Asn  Asn Ser Glu
    1235                1240                1245

Gly Gln  Ala Tyr Ala Thr Phe  Asp Asn Trp Leu Thr  Leu Pro Val
    1250                1255                1260

Ser Thr  Phe Lys Pro Glu Ile  Ile Lys Leu Glu Met  Lys Pro His
    1265                1270                1275

Ser Lys  Thr Arg Arg Tyr Ile  Arg Ile Thr Gln Ser  Leu Ala Asp
    1280                1285                1290

Phe Ile  Lys Thr Ile Asp Glu  Ala Leu Met Ile Lys  Pro Ser Asp
    1295                1300                1305

Ser Ile  Asp Asp Pro Leu Asn  Met Pro Asn Glu Ile  Val Cys Lys
    1310                1315                1320

Asn Lys  Leu Phe Gly Asn Glu  Leu Lys Pro Arg Asp  Gly Lys Met
    1325                1330                1335

Lys Ile  Val Ser Thr Gly Lys  Ile Val Thr Tyr Glu  Phe Glu Ser
    1340                1345                1350

Asp Ser  Thr Pro Gln Trp Ile  Gln Thr Leu Tyr Val  Thr Gln Leu
```

1355 1360 1365

Lys Lys Gln Pro
1370

<210> 167
<211> 1082
<212> PRT
<213> Neisseria lactamica

<400> 167

Met Ala Ala Phe Lys Pro Asn Pro Met Asn Tyr Ile Leu Gly Leu Asp
1 5 10 15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Val Asp Glu Glu
20 25 30

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

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
50 55 60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65 70 75 80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Asp Ala Asp
85 90 95

Phe Asp Glu Asn Gly Leu Val Lys Ser Leu Pro Asn Thr Pro Trp Gln
100 105 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Cys Leu Glu Trp Ser
115 120 125

Ala Val Leu Leu His Leu Val Lys His Arg Gly Tyr Leu Ser Gln Arg
130 135 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145 150 155 160

```
Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Asp Gly Leu Lys Glu Asp Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Ala Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

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

Lys Ser Pro Leu Asn Leu Ser Thr Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380
```

```
Ala Phe Ser Leu Phe Lys Thr Asp Lys Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Cys Lys Lys Asn Ala Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Cys Val Val Arg Arg Tyr Gly
                485                 490                 495

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

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Val
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590
```

```
Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Glu Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Ile Leu Leu Thr
        675                 680                 685

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

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Thr Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Ala His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815
```

```
Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Ile Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Gly Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Asp Ala Leu Lys Ala Gln Leu Glu Thr His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Ser Arg Thr Gln Gln Val Lys Ala Val Arg Ile Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Gly Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Ala Phe Lys Asp Glu Glu Asp Trp Thr Val Met Asp
            980                 985                 990

Asp Ser Phe Glu Phe Arg Phe Val  Leu Tyr Ala Asn Asp  Leu Ile Lys
        995                 1000                1005

Leu Thr  Ala Lys Lys Asn Glu  Phe Leu Gly Tyr Phe  Val Ser Leu
    1010                1015                1020
```

Asn Arg Ala Thr Gly Ala Ile Asp Ile Arg Thr His Asp Thr Asp
    1025   1030   1035

Ser Thr Lys Gly Lys Asn Gly Ile Phe Gln Ser Val Gly Val Lys
    1040   1045   1050

Thr Ala Leu Ser Phe Gln Lys Asn Gln Ile Asp Glu Leu Gly Lys
    1055   1060   1065

Glu Ile Arg Pro Cys Arg Leu Lys Lys Arg Pro Pro Val Arg
    1070   1075   1080

<210> 168
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 168

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1   5   10   15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
            20   25   30

Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35   40   45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50   55   60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65   70   75   80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85   90   95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100   105   110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115   120   125

```
Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
```

```
            340                 345                 350

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

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

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

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560
```

```
Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
               565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
               645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

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

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

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
               725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
```

```
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990
```

Asp Ser Phe Asn Phe Lys Phe Ser Leu His Pro Asn Asp Leu Val Glu
        995   1000   1005

Val Ile Thr Lys Lys Ala Arg Met Phe Gly Tyr Phe Ala Ser Cys
    1010   1015   1020

His Arg Gly Thr Gly Asn Ile Asn Ile Arg Ile His Asp Leu Asp
    1025   1030   1035

His Lys Ile Gly Lys Asn Gly Ile Leu Glu Gly Ile Gly Val Lys
    1040   1045   1050

Thr Ala Leu Ser Phe Gln Lys Tyr Gln Ile Asp Glu Leu Gly Lys
    1055   1060   1065

Glu Ile Arg Pro Cys Arg Leu Lys Lys Arg Pro Pro Val Arg
    1070   1075   1080

<210> 169
<211> 1187
<212> PRT
<213> Bifidobacterium longum

<400> 169

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

Ser Tyr Ser Tyr Asn Val Gln Asp Asn Asp Val His Cys Ser Tyr Gly
            20   25   30

Glu Arg Cys Phe Met Arg Gly Lys Arg Tyr Arg Ile Gly Ile Asp Val
        35   40   45

Gly Leu Asn Ser Val Gly Leu Ala Ala Val Glu Val Ser Asp Glu Asn
    50   55   60

Ser Pro Val Arg Leu Leu Asn Ala Gln Ser Val Ile His Asp Gly Gly
65   70   75   80

Val Asp Pro Gln Lys Asn Lys Glu Ala Ile Thr Arg Lys Asn Met Ser
                85   90   95

```
Gly Val Ala Arg Arg Thr Arg Arg Met Arg Arg Arg Lys Arg Glu Arg
            100                 105                 110

Leu His Lys Leu Asp Met Leu Leu Gly Lys Phe Gly Tyr Pro Val Ile
        115                 120                 125

Glu Pro Glu Ser Leu Asp Lys Pro Phe Glu Glu Trp His Val Arg Ala
    130                 135                 140

Glu Leu Ala Thr Arg Tyr Ile Glu Asp Asp Glu Leu Arg Arg Glu Ser
145                 150                 155                 160

Ile Ser Ile Ala Leu Arg His Met Ala Arg His Arg Gly Trp Arg Asn
                165                 170                 175

Pro Tyr Arg Gln Val Asp Ser Leu Ile Ser Asp Asn Pro Tyr Ser Lys
            180                 185                 190

Gln Tyr Gly Glu Leu Lys Glu Lys Ala Lys Ala Tyr Asn Asp Asp Ala
        195                 200                 205

Thr Ala Ala Glu Glu Glu Ser Thr Pro Ala Gln Leu Val Val Ala Met
    210                 215                 220

Leu Asp Ala Gly Tyr Ala Glu Ala Pro Arg Leu Arg Trp Arg Thr Gly
225                 230                 235                 240

Ser Lys Lys Pro Asp Ala Glu Gly Tyr Leu Pro Val Arg Leu Met Gln
                245                 250                 255

Glu Asp Asn Ala Asn Glu Leu Lys Gln Ile Phe Arg Val Gln Arg Val
            260                 265                 270

Pro Ala Asp Glu Trp Lys Pro Leu Phe Arg Ser Val Phe Tyr Ala Val
        275                 280                 285

Ser Pro Lys Gly Ser Ala Glu Gln Arg Val Gly Gln Asp Pro Leu Ala
    290                 295                 300
```

```
Pro Glu Gln Ala Arg Ala Leu Lys Ala Ser Leu Ala Phe Gln Glu Tyr
305                 310                 315                 320

Arg Ile Ala Asn Val Ile Thr Asn Leu Arg Ile Lys Asp Ala Ser Ala
                325                 330                 335

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

Leu Val Ser Pro Ser Ser Glu Asp Ile Thr Trp Ser Asp Leu Cys Asp
        355                 360                 365

Phe Leu Gly Phe Lys Arg Ser Gln Leu Lys Gly Val Gly Ser Leu Thr
    370                 375                 380

Glu Asp Gly Glu Glu Arg Ile Ser Ser Arg Pro Pro Arg Leu Thr Ser
385                 390                 395                 400

Val Gln Arg Ile Tyr Glu Ser Asp Asn Lys Ile Arg Lys Pro Leu Val
                405                 410                 415

Ala Trp Trp Lys Ser Ala Ser Asp Asn Glu His Glu Ala Met Ile Arg
            420                 425                 430

Leu Leu Ser Asn Thr Val Asp Ile Asp Lys Val Arg Glu Asp Val Ala
        435                 440                 445

Tyr Ala Ser Ala Ile Glu Phe Ile Asp Gly Leu Asp Asp Asp Ala Leu
    450                 455                 460

Thr Lys Leu Asp Ser Val Asp Leu Pro Ser Gly Arg Ala Ala Tyr Ser
465                 470                 475                 480

Val Glu Thr Leu Gln Lys Leu Thr Arg Gln Met Leu Thr Thr Asp Asp
                485                 490                 495

Asp Leu His Glu Ala Arg Lys Thr Leu Phe Asn Val Thr Asp Ser Trp
            500                 505                 510

Arg Pro Pro Ala Asp Pro Ile Gly Glu Pro Leu Gly Asn Pro Ser Val
        515                 520                 525
```

```
Asp Arg Val Leu Lys Asn Val Asn Arg Tyr Leu Met Asn Cys Gln Gln
    530                 535                 540

Arg Trp Gly Asn Pro Val Ser Val Asn Ile Glu His Val Arg Ser Ser
545                 550                 555                 560

Phe Ser Ser Val Ala Phe Ala Arg Lys Asp Lys Arg Glu Tyr Glu Lys
                565                 570                 575

Asn Asn Glu Lys Arg Ser Ile Phe Arg Ser Ser Leu Ser Glu Gln Leu
            580                 585                 590

Arg Ala Asp Glu Gln Met Glu Lys Val Arg Glu Ser Asp Leu Arg Arg
        595                 600                 605

Leu Glu Ala Ile Gln Arg Gln Asn Gly Gln Cys Leu Tyr Cys Gly Arg
    610                 615                 620

Thr Ile Thr Phe Arg Thr Cys Glu Met Asp His Ile Val Pro Arg Lys
625                 630                 635                 640

Gly Val Gly Ser Thr Asn Thr Arg Thr Asn Phe Ala Ala Val Cys Ala
                645                 650                 655

Glu Cys Asn Arg Met Lys Ser Asn Thr Pro Phe Ala Ile Trp Ala Arg
            660                 665                 670

Ser Glu Asp Ala Gln Thr Arg Gly Val Ser Leu Ala Glu Ala Lys Lys
        675                 680                 685

Arg Val Thr Met Phe Thr Phe Asn Pro Lys Ser Tyr Ala Pro Arg Glu
    690                 695                 700

Val Lys Ala Phe Lys Gln Ala Val Ile Ala Arg Leu Gln Gln Thr Glu
705                 710                 715                 720

Asp Asp Ala Ala Ile Asp Asn Arg Ser Ile Glu Ser Val Ala Trp Met
                725                 730                 735
```

```
Ala Asp Glu Leu His Arg Arg Ile Asp Trp Tyr Phe Asn Ala Lys Gln
            740                 745                 750

Tyr Val Asn Ser Ala Ser Ile Asp Asp Ala Glu Ala Glu Thr Met Lys
        755                 760                 765

Thr Thr Val Ser Val Phe Gln Gly Arg Val Thr Ala Ser Ala Arg Arg
    770                 775                 780

Ala Ala Gly Ile Glu Gly Lys Ile His Phe Ile Gly Gln Gln Ser Lys
785                 790                 795                 800

Thr Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ser Val Ile Ala
                805                 810                 815

Met Met Asn Thr Ala Ala Ala Gln Thr Leu Met Glu Arg Glu Ser Leu
            820                 825                 830

Arg Glu Ser Gln Arg Leu Ile Gly Leu Met Pro Gly Glu Arg Ser Trp
        835                 840                 845

Lys Glu Tyr Pro Tyr Glu Gly Thr Ser Arg Tyr Glu Ser Phe His Leu
    850                 855                 860

Trp Leu Asp Asn Met Asp Val Leu Leu Glu Leu Leu Asn Asp Ala Leu
865                 870                 875                 880

Asp Asn Asp Arg Ile Ala Val Met Gln Ser Gln Arg Tyr Val Leu Gly
                885                 890                 895

Asn Ser Ile Ala His Asp Ala Thr Ile His Pro Leu Glu Lys Val Pro
            900                 905                 910

Leu Gly Ser Ala Met Ser Ala Asp Leu Ile Arg Arg Ala Ser Thr Pro
        915                 920                 925

Ala Leu Trp Cys Ala Leu Thr Arg Leu Pro Asp Tyr Asp Glu Lys Glu
    930                 935                 940

Gly Leu Pro Glu Asp Ser His Arg Glu Ile Arg Val His Asp Thr Arg
945                 950                 955                 960
```

```
Tyr Ser Ala Asp Asp Glu Met Gly Phe Phe Ala Ser Gln Ala Ala Gln
               965                 970                 975


Ile Ala Val Gln Glu Gly Ser Ala Asp Ile Gly Ser Ala Ile His His
           980                 985                 990


Ala Arg Val Tyr Arg Cys Trp Lys  Thr Asn Ala Lys Gly  Val Arg Lys
        995                1000                1005


Tyr Phe  Tyr Gly Met Ile Arg  Val Phe Gln Thr Asp  Leu Leu Arg
    1010                1015                1020


Ala Cys  His Asp Asp Leu Phe  Thr Val Pro Leu Pro  Pro Gln Ser
    1025                1030                1035


Ile Ser  Met Arg Tyr Gly Glu  Pro Arg Val Val Gln  Ala Leu Gln
    1040                1045                1050


Ser Gly  Asn Ala Gln Tyr Leu  Gly Ser Leu Val Val  Gly Asp Glu
    1055                1060                1065


Ile Glu  Met Asp Phe Ser Ser  Leu Asp Val Asp Gly  Gln Ile Gly
    1070                1075                1080


Glu Tyr  Leu Gln Phe Phe Ser  Gln Phe Ser Gly Gly  Asn Leu Ala
    1085                1090                1095


Trp Lys  His Trp Val Val Asp  Gly Phe Phe Asn Gln  Thr Gln Leu
    1100                1105                1110


Arg Ile  Arg Pro Arg Tyr Leu  Ala Ala Glu Gly Leu  Ala Lys Ala
    1115                1120                1125


Phe Ser  Asp Asp Val Val Pro  Asp Gly Val Gln Lys  Ile Val Thr
    1130                1135                1140


Lys Gln  Gly Trp Leu Pro Pro  Val Asn Thr Ala Ser  Lys Thr Ala
    1145                1150                1155
```

Val Arg Ile Val Arg Arg Asn Ala Phe Gly Glu Pro Arg Leu Ser
    1160   1165   1170

Ser Ala His His Met Pro Cys Ser Trp Gln Trp Arg His Glu
    1175   1180   1185

<210> 170
<211> 1101
<212> PRT
<213> Akkermansia muciniphila

<400> 170

Met Ser Arg Ser Leu Thr Phe Ser Phe Asp Ile Gly Tyr Ala Ser Ile
1   5   10   15

Gly Trp Ala Val Ile Ala Ser Ala Ser His Asp Asp Ala Asp Pro Ser
            20   25   30

Val Cys Gly Cys Gly Thr Val Leu Phe Pro Lys Asp Asp Cys Gln Ala
        35   40   45

Phe Lys Arg Arg Glu Tyr Arg Arg Leu Arg Arg Asn Ile Arg Ser Arg
    50   55   60

Arg Val Arg Ile Glu Arg Ile Gly Arg Leu Leu Val Gln Ala Gln Ile
65   70   75   80

Ile Thr Pro Glu Met Lys Glu Thr Ser Gly His Pro Ala Pro Phe Tyr
                85   90   95

Leu Ala Ser Glu Ala Leu Lys Gly His Arg Thr Leu Ala Pro Ile Glu
            100   105   110

Leu Trp His Val Leu Arg Trp Tyr Ala His Asn Arg Gly Tyr Asp Asn
        115   120   125

Asn Ala Ser Trp Ser Asn Ser Leu Ser Glu Asp Gly Gly Asn Gly Glu
    130   135   140

Asp Thr Glu Arg Val Lys His Ala Gln Asp Leu Met Asp Lys His Gly
145   150   155   160

```
Thr Ala Thr Met Ala Glu Thr Ile Cys Arg Glu Leu Lys Leu Glu Glu
                165                 170                 175

Gly Lys Ala Asp Ala Pro Met Glu Val Ser Thr Pro Ala Tyr Lys Asn
            180                 185                 190

Leu Asn Thr Ala Phe Pro Arg Leu Ile Val Glu Lys Glu Val Arg Arg
        195                 200                 205

Ile Leu Glu Leu Ser Ala Pro Leu Ile Pro Gly Leu Thr Ala Glu Ile
    210                 215                 220

Ile Glu Leu Ile Ala Gln His His Pro Leu Thr Thr Glu Gln Arg Gly
225                 230                 235                 240

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

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

Arg Cys Pro Val Thr Trp Ala Gln Val Tyr Glu Ala Glu Leu Lys Lys
        275                 280                 285

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

Val Pro Thr Ala Asn Cys Pro Glu Phe Tyr Glu Tyr Arg Met Ala Arg
305                 310                 315                 320

Ile Leu Cys Asn Ile Arg Ala Asp Gly Glu Pro Leu Ser Ala Glu Ile
                325                 330                 335

Arg Arg Glu Leu Met Asn Gln Ala Arg Gln Glu Gly Lys Leu Thr Lys
            340                 345                 350

Ala Ser Leu Glu Lys Ala Ile Ser Ser Arg Leu Gly Lys Glu Thr Glu
        355                 360                 365

Thr Asn Val Ser Asn Tyr Phe Thr Leu His Pro Asp Ser Glu Glu Ala
```

```
    370                 375                 380

Leu Tyr Leu Asn Pro Ala Val Glu Val Leu Gln Arg Ser Gly Ile Gly
385                 390                 395                 400

Gln Ile Leu Ser Pro Ser Val Tyr Arg Ile Ala Ala Asn Arg Leu Arg
                405                 410                 415

Arg Gly Lys Ser Val Thr Pro Asn Tyr Leu Leu Asn Leu Leu Lys Ser
            420                 425                 430

Arg Gly Glu Ser Gly Glu Ala Leu Glu Lys Lys Ile Glu Lys Glu Ser
        435                 440                 445

Lys Lys Lys Glu Ala Asp Tyr Ala Asp Thr Pro Leu Lys Pro Lys Tyr
    450                 455                 460

Ala Thr Gly Arg Ala Pro Tyr Ala Arg Thr Val Leu Lys Lys Val Val
465                 470                 475                 480

Glu Glu Ile Leu Asp Gly Glu Asp Pro Thr Arg Pro Ala Arg Gly Glu
                485                 490                 495

Ala His Pro Asp Gly Glu Leu Lys Ala His Asp Gly Cys Leu Tyr Cys
            500                 505                 510

Leu Leu Asp Thr Asp Ser Ser Val Asn Gln His Gln Lys Glu Arg Arg
        515                 520                 525

Leu Asp Thr Met Thr Asn Asn His Leu Val Arg His Arg Met Leu Ile
    530                 535                 540

Leu Asp Arg Leu Leu Lys Asp Leu Ile Gln Asp Phe Ala Asp Gly Gln
545                 550                 555                 560

Lys Asp Arg Ile Ser Arg Val Cys Val Glu Val Gly Lys Glu Leu Thr
                565                 570                 575

Thr Phe Ser Ala Met Asp Ser Lys Lys Ile Gln Arg Glu Leu Thr Leu
            580                 585                 590
```

```
Arg Gln Lys Ser His Thr Asp Ala Val Asn Arg Leu Lys Arg Lys Leu
        595                 600                 605

Pro Gly Lys Ala Leu Ser Ala Asn Leu Ile Arg Lys Cys Arg Ile Ala
    610                 615                 620

Met Asp Met Asn Trp Thr Cys Pro Phe Thr Gly Ala Thr Tyr Gly Asp
625                 630                 635                 640

His Glu Leu Glu Asn Leu Glu Leu Glu His Ile Val Pro His Ser Phe
                645                 650                 655

Arg Gln Ser Asn Ala Leu Ser Ser Leu Val Leu Thr Trp Pro Gly Val
            660                 665                 670

Asn Arg Met Lys Gly Gln Arg Thr Gly Tyr Asp Phe Val Glu Gln Glu
        675                 680                 685

Gln Glu Asn Pro Val Pro Asp Lys Pro Asn Leu His Ile Cys Ser Leu
    690                 695                 700

Asn Asn Tyr Arg Glu Leu Val Glu Lys Leu Asp Asp Lys Lys Gly His
705                 710                 715                 720

Glu Asp Asp Arg Arg Arg Lys Lys Lys Arg Lys Ala Leu Leu Met Val
                725                 730                 735

Arg Gly Leu Ser His Lys His Gln Ser Gln Asn His Glu Ala Met Lys
            740                 745                 750

Glu Ile Gly Met Thr Glu Gly Met Met Thr Gln Ser Ser His Leu Met
        755                 760                 765

Lys Leu Ala Cys Lys Ser Ile Lys Thr Ser Leu Pro Asp Ala His Ile
    770                 775                 780

Asp Met Ile Pro Gly Ala Val Thr Ala Glu Val Arg Lys Ala Trp Asp
785                 790                 795                 800

Val Phe Gly Val Phe Lys Glu Leu Cys Pro Glu Ala Ala Asp Pro Asp
```

```
               805                 810                 815

Ser Gly Lys Ile Leu Lys Glu Asn Leu Arg Ser Leu Thr His Leu His
            820                 825                 830

His Ala Leu Asp Ala Cys Val Leu Gly Leu Ile Pro Tyr Ile Ile Pro
        835                 840                 845

Ala His His Asn Gly Leu Leu Arg Arg Val Leu Ala Met Arg Arg Ile
    850                 855                 860

Pro Glu Lys Leu Ile Pro Gln Val Arg Pro Val Ala Asn Gln Arg His
865                 870                 875                 880

Tyr Val Leu Asn Asp Asp Gly Arg Met Met Leu Arg Asp Leu Ser Ala
               885                 890                 895

Ser Leu Lys Glu Asn Ile Arg Glu Gln Leu Met Glu Gln Arg Val Ile
            900                 905                 910

Gln His Val Pro Ala Asp Met Gly Gly Ala Leu Leu Lys Glu Thr Met
        915                 920                 925

Gln Arg Val Leu Ser Val Asp Gly Ser Gly Glu Asp Ala Met Val Ser
    930                 935                 940

Leu Ser Lys Lys Lys Asp Gly Lys Lys Glu Lys Asn Gln Val Lys Ala
945                 950                 955                 960

Ser Lys Leu Val Gly Val Phe Pro Glu Gly Pro Ser Lys Leu Lys Ala
               965                 970                 975

Leu Lys Ala Ala Ile Glu Ile Asp Gly Asn Tyr Gly Val Ala Leu Asp
            980                 985                 990

Pro Lys Pro Val Val Ile Arg His  Ile Lys Val Phe Lys  Arg Ile Met
        995                 1000                1005

Ala Leu  Lys Glu Gln Asn Gly  Gly Lys Pro Val Arg  Ile Leu Lys
    1010                1015                1020
```

Lys Gly Met Leu Ile His Leu Thr Ser Ser Lys Asp Pro Lys His
    1025   1030   1035

Ala Gly Val Trp Arg Ile Glu Ser Ile Gln Asp Ser Lys Gly Gly
    1040   1045   1050

Val Lys Leu Asp Leu Gln Arg Ala His Cys Ala Val Pro Lys Asn
    1055   1060   1065

Lys Thr His Glu Cys Asn Trp Arg Glu Val Asp Leu Ile Ser Leu
    1070   1075   1080

Leu Lys Lys Tyr Gln Met Lys Arg Tyr Pro Thr Ser Tyr Thr Gly
    1085   1090   1095

Thr Pro Arg
    1100

<210> 171
<211> 1498
<212> PRT
<213> Odoribacter laneus

<400> 171

Met Glu Thr Thr Leu Gly Ile Asp Leu Gly Thr Asn Ser Ile Gly Leu
1   5   10   15

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

Ile Phe Pro Glu Gly Ile Asn Lys Asp Thr Ile Gly Leu Gly Glu Lys
        35   40   45

Glu Glu Ser Arg Asn Ala Thr Arg Arg Ala Lys Arg Gln Met Arg Arg
    50   55   60

Gln Tyr Phe Arg Lys Lys Leu Arg Lys Ala Lys Leu Leu Glu Leu Leu
65   70   75   80

Ile Ala Tyr Asp Met Cys Pro Leu Lys Pro Glu Asp Val Arg Arg Trp
                85   90   95

```
Lys Asn Trp Asp Lys Gln Gln Lys Ser Thr Val Arg Gln Phe Pro Asp
            100                 105                 110

Thr Pro Ala Phe Arg Glu Trp Leu Lys Gln Asn Pro Tyr Glu Leu Arg
        115                 120                 125

Lys Gln Ala Val Thr Glu Asp Val Thr Arg Pro Glu Leu Gly Arg Ile
    130                 135                 140

Leu Tyr Gln Met Ile Gln Arg Arg Gly Phe Leu Ser Ser Arg Lys Gly
145                 150                 155                 160

Lys Glu Glu Gly Lys Ile Phe Thr Gly Lys Asp Arg Met Val Gly Ile
                165                 170                 175

Asp Glu Thr Arg Lys Asn Leu Gln Lys Gln Thr Leu Gly Ala Tyr Leu
            180                 185                 190

Tyr Asp Ile Ala Pro Lys Asn Gly Glu Lys Tyr Arg Phe Arg Thr Glu
        195                 200                 205

Arg Val Arg Ala Arg Tyr Thr Leu Arg Asp Met Tyr Ile Arg Glu Phe
    210                 215                 220

Glu Ile Ile Trp Gln Arg Gln Ala Gly His Leu Gly Leu Ala His Glu
225                 230                 235                 240

Gln Ala Thr Arg Lys Lys Asn Ile Phe Leu Glu Gly Ser Ala Thr Asn
                245                 250                 255

Val Arg Asn Ser Lys Leu Ile Thr His Leu Gln Ala Lys Tyr Gly Arg
            260                 265                 270

Gly His Val Leu Ile Glu Asp Thr Arg Ile Thr Val Thr Phe Gln Leu
        275                 280                 285

Pro Leu Lys Glu Val Leu Gly Gly Lys Ile Glu Ile Glu Glu Glu Gln
    290                 295                 300
```

```
Leu Lys Phe Lys Ser Asn Glu Ser Val Leu Phe Trp Gln Arg Pro Leu
305                 310                 315                 320

Arg Ser Gln Lys Ser Leu Leu Ser Lys Cys Val Phe Glu Gly Arg Asn
                325                 330                 335

Phe Tyr Asp Pro Val His Gln Lys Trp Ile Ile Ala Gly Pro Thr Pro
            340                 345                 350

Ala Pro Leu Ser His Pro Glu Phe Glu Glu Phe Arg Ala Tyr Gln Phe
        355                 360                 365

Ile Asn Asn Ile Ile Tyr Gly Lys Asn Glu His Leu Thr Ala Ile Gln
    370                 375                 380

Arg Glu Ala Val Phe Glu Leu Met Cys Thr Glu Ser Lys Asp Phe Asn
385                 390                 395                 400

Phe Glu Lys Ile Pro Lys His Leu Lys Leu Phe Glu Lys Phe Asn Phe
                405                 410                 415

Asp Asp Thr Thr Lys Val Pro Ala Cys Thr Thr Ile Ser Gln Leu Arg
            420                 425                 430

Lys Leu Phe Pro His Pro Val Trp Glu Glu Lys Arg Glu Glu Ile Trp
        435                 440                 445

His Cys Phe Tyr Phe Tyr Asp Asp Asn Thr Leu Leu Phe Glu Lys Leu
    450                 455                 460

Gln Lys Asp Tyr Ala Leu Gln Thr Asn Asp Leu Glu Lys Ile Lys Lys
465                 470                 475                 480

Ile Arg Leu Ser Glu Ser Tyr Gly Asn Val Ser Leu Lys Ala Ile Arg
                485                 490                 495

Arg Ile Asn Pro Tyr Leu Lys Lys Gly Tyr Ala Tyr Ser Thr Ala Val
            500                 505                 510

Leu Leu Gly Gly Ile Arg Asn Ser Phe Gly Lys Arg Phe Glu Tyr Phe
        515                 520                 525
```

```
Lys Glu Tyr Glu Pro Glu Ile Glu Lys Ala Val Cys Arg Ile Leu Lys
    530                 535                 540

Glu Lys Asn Ala Glu Gly Glu Val Ile Arg Lys Ile Lys Asp Tyr Leu
545                 550                 555                 560

Val His Asn Arg Phe Gly Phe Ala Lys Asn Asp Arg Ala Phe Gln Lys
                565                 570                 575

Leu Tyr His His Ser Gln Ala Ile Thr Thr Gln Ala Gln Lys Glu Arg
            580                 585                 590

Leu Pro Glu Thr Gly Asn Leu Arg Asn Pro Ile Val Gln Gln Gly Leu
        595                 600                 605

Asn Glu Leu Arg Arg Thr Val Asn Lys Leu Leu Ala Thr Cys Arg Glu
    610                 615                 620

Lys Tyr Gly Pro Ser Phe Lys Phe Asp His Ile His Val Glu Met Gly
625                 630                 635                 640

Arg Glu Leu Arg Ser Ser Lys Thr Glu Arg Glu Lys Gln Ser Arg Gln
                645                 650                 655

Ile Arg Glu Asn Glu Lys Lys Asn Glu Ala Ala Lys Val Lys Leu Ala
            660                 665                 670

Glu Tyr Gly Leu Lys Ala Tyr Arg Asp Asn Ile Gln Lys Tyr Leu Leu
        675                 680                 685

Tyr Lys Glu Ile Glu Glu Lys Gly Gly Thr Val Cys Cys Pro Tyr Thr
    690                 695                 700

Gly Lys Thr Leu Asn Ile Ser His Thr Leu Gly Ser Asp Asn Ser Val
705                 710                 715                 720

Gln Ile Glu His Ile Ile Pro Tyr Ser Ile Ser Leu Asp Asp Ser Leu
                725                 730                 735
```

```
Ala Asn Lys Thr Leu Cys Asp Ala Thr Phe Asn Arg Glu Lys Gly Glu
            740                 745                 750

Leu Thr Pro Tyr Asp Phe Tyr Gln Lys Asp Pro Ser Pro Glu Lys Trp
        755                 760                 765

Gly Ala Ser Ser Trp Glu Glu Ile Glu Asp Arg Ala Phe Arg Leu Leu
    770                 775                 780

Pro Tyr Ala Lys Ala Gln Arg Phe Ile Arg Arg Lys Pro Gln Glu Ser
785                 790                 795                 800

Asn Glu Phe Ile Ser Arg Gln Leu Asn Asp Thr Arg Tyr Ile Ser Lys
                805                 810                 815

Lys Ala Val Glu Tyr Leu Ser Ala Ile Cys Ser Asp Val Lys Ala Phe
            820                 825                 830

Pro Gly Gln Leu Thr Ala Glu Leu Arg His Leu Trp Gly Leu Asn Asn
        835                 840                 845

Ile Leu Gln Ser Ala Pro Asp Ile Thr Phe Pro Leu Pro Val Ser Ala
    850                 855                 860

Thr Glu Asn His Arg Glu Tyr Tyr Val Ile Thr Asn Glu Gln Asn Glu
865                 870                 875                 880

Val Ile Arg Leu Phe Pro Lys Gln Gly Glu Thr Pro Arg Thr Glu Lys
                885                 890                 895

Gly Glu Leu Leu Leu Thr Gly Glu Val Glu Arg Lys Val Phe Arg Cys
            900                 905                 910

Lys Gly Met Gln Glu Phe Gln Thr Asp Val Ser Asp Gly Lys Tyr Trp
        915                 920                 925

Arg Arg Ile Lys Leu Ser Ser Ser Val Thr Trp Ser Pro Leu Phe Ala
    930                 935                 940

Pro Lys Pro Ile Ser Ala Asp Gly Gln Ile Val Leu Lys Gly Arg Ile
945                 950                 955                 960
```

```
Glu Lys Gly Val Phe Val Cys Asn Gln Leu Lys Gln Lys Leu Lys Thr
               965                 970                 975

Gly Leu Pro Asp Gly Ser Tyr Trp Ile Ser Leu Pro Val Ile Ser Gln
            980                 985                 990

Thr Phe Lys Glu Gly Glu Ser Val  Asn Asn Ser Lys Leu  Thr Ser Gln
        995                 1000                1005

Gln Val  Gln Leu Phe Gly Arg  Val Arg Glu Gly Ile  Phe Arg Cys
    1010                1015                1020

His Asn  Tyr Gln Cys Pro Ala  Ser Gly Ala Asp Gly  Asn Phe Trp
    1025                1030                1035

Cys Thr  Leu Asp Thr Asp Thr  Ala Gln Pro Ala Phe  Thr Pro Ile
    1040                1045                1050

Lys Asn  Ala Pro Pro Gly Val  Gly Gly Gly Gln Ile  Ile Leu Thr
    1055                1060                1065

Gly Asp  Val Asp Asp Lys Gly  Ile Phe His Ala Asp  Asp Asp Leu
    1070                1075                1080

His Tyr  Glu Leu Pro Ala Ser  Leu Pro Lys Gly Lys  Tyr Tyr Gly
    1085                1090                1095

Ile Phe  Thr Val Glu Ser Cys  Asp Pro Thr Leu Ile  Pro Ile Glu
    1100                1105                1110

Leu Ser  Ala Pro Lys Thr Ser  Lys Gly Glu Asn Leu  Ile Glu Gly
    1115                1120                1125

Asn Ile  Trp Val Asp Glu His  Thr Gly Glu Val Arg  Phe Asp Pro
    1130                1135                1140

Lys Lys  Asn Arg Glu Asp Gln  Arg His His Ala Ile  Asp Ala Ile
    1145                1150                1155
```

```
Val Ile  Ala Leu Ser Ser Gln  Ser Leu Phe Gln Arg  Leu Ser Thr
    1160                1165                1170

Tyr Asn  Ala Arg Arg Glu Asn  Lys Lys Arg Gly Leu  Asp Ser Thr
    1175                1180                1185

Glu His  Phe Pro Ser Pro Trp  Pro Gly Phe Ala Gln  Asp Val Arg
    1190                1195                1200

Gln Ser  Val Val Pro Leu Leu  Val Ser Tyr Lys Gln  Asn Pro Lys
    1205                1210                1215

Thr Leu  Cys Lys Ile Ser Lys  Thr Leu Tyr Lys Asp  Gly Lys Lys
    1220                1225                1230

Ile His  Ser Cys Gly Asn Ala  Val Arg Gly Gln Leu  His Lys Glu
    1235                1240                1245

Thr Val  Tyr Gly Gln Arg Thr  Ala Pro Gly Ala Thr  Glu Lys Ser
    1250                1255                1260

Tyr His  Ile Arg Lys Asp Ile  Arg Glu Leu Lys Thr  Ser Lys His
    1265                1270                1275

Ile Gly  Lys Val Val Asp Ile  Thr Ile Arg Gln Met  Leu Leu Lys
    1280                1285                1290

His Leu  Gln Glu Asn Tyr His  Ile Asp Ile Thr Gln  Glu Phe Asn
    1295                1300                1305

Ile Pro  Ser Asn Ala Phe Phe  Lys Glu Gly Val Tyr  Arg Ile Phe
    1310                1315                1320

Leu Pro  Asn Lys His Gly Glu  Pro Val Pro Ile Lys  Lys Ile Arg
    1325                1330                1335

Met Lys  Glu Glu Leu Gly Asn  Ala Glu Arg Leu Lys  Asp Asn Ile
    1340                1345                1350

Asn Gln  Tyr Val Asn Pro Arg  Asn Asn His His Val  Met Ile Tyr
    1355                1360                1365
```

Gln Asp Ala Asp Gly Asn Leu Lys Glu Glu Ile Val Ser Phe Trp
1370 1375 1380

Ser Val Ile Glu Arg Gln Asn Gln Gly Gln Pro Ile Tyr Gln Leu
1385 1390 1395

Pro Arg Glu Gly Arg Asn Ile Val Ser Ile Leu Gln Ile Asn Asp
1400 1405 1410

Thr Phe Leu Ile Gly Leu Lys Glu Glu Glu Pro Glu Val Tyr Arg
1415 1420 1425

Asn Asp Leu Ser Thr Leu Ser Lys His Leu Tyr Arg Val Gln Lys
1430 1435 1440

Leu Ser Gly Met Tyr Tyr Thr Phe Arg His His Leu Ala Ser Thr
1445 1450 1455

Leu Asn Asn Glu Arg Glu Glu Phe Arg Ile Gln Ser Leu Glu Ala
1460 1465 1470

Trp Lys Arg Ala Asn Pro Val Lys Val Gln Ile Asp Glu Ile Gly
1475 1480 1485

Arg Ile Thr Phe Leu Asn Gly Pro Leu Cys
1490 1495

<210> 172
<211> 1300
<212> PRT
<213> Francisella tularensis subsp. Novicida

<400> 172

Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
1 5 10 15

Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
20 25 30

Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys

```
        35                  40                  45

Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
    50                  55                  60

Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
65                  70                  75                  80

Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
                85                  90                  95

Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
            100                 105                 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
        115                 120                 125

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

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145                 150                 155                 160

Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
                165                 170                 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
            180                 185                 190

Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
        195                 200                 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys
    210                 215                 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225                 230                 235                 240

Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
                245                 250                 255
```

```
Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
            260                 265                 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
        275                 280                 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
    290                 295                 300

Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
305                 310                 315                 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
                325                 330                 335

Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
            340                 345                 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
        355                 360                 365

Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
    370                 375                 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385                 390                 395                 400

Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
                405                 410                 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn
            420                 425                 430

Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
        435                 440                 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
    450                 455                 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
```

```
465                 470                 475                 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
                485                 490                 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
            500                 505                 510

Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp
        515                 520                 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
    530                 535                 540

Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545                 550                 555                 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
                565                 570                 575

Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
            580                 585                 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
        595                 600                 605

Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
    610                 615                 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
625                 630                 635                 640

Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
                645                 650                 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
            660                 665                 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
        675                 680                 685
```

```
Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln
    690                 695                 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705                 710                 715                 720

Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp
                725                 730                 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
            740                 745                 750

Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
        755                 760                 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
    770                 775                 780

Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785                 790                 795                 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
                805                 810                 815

Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
            820                 825                 830

Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala
        835                 840                 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
    850                 855                 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe
865                 870                 875                 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
                885                 890                 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His
```

```
            900                 905                 910

Ile Leu Ser Ile Asp Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
        915                 920                 925

Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile
    930                 935                 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945                 950                 955                 960

Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
                965                 970                 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
            980                 985                 990

Ala Lys Leu Val Ile Glu Tyr Asn  Ala Ile Val Val Phe  Glu Asp Leu
        995                 1000                1005

Asn Phe  Gly Phe Lys Arg Gly  Arg Phe Lys Val Glu  Lys Gln Val
    1010                1015                1020

Tyr Gln  Lys Leu Glu Lys Met  Leu Ile Glu Lys Leu  Asn Tyr Leu
    1025                1030                1035

Val Phe  Lys Asp Asn Glu Phe  Asp Lys Thr Gly Gly  Val Leu Arg
    1040                1045                1050

Ala Tyr  Gln Leu Thr Ala Pro  Phe Glu Thr Phe Lys  Lys Met Gly
    1055                1060                1065

Lys Gln  Thr Gly Ile Ile Tyr  Tyr Val Pro Ala Gly  Phe Thr Ser
    1070                1075                1080

Lys Ile  Cys Pro Val Thr Gly  Phe Val Asn Gln Leu  Tyr Pro Lys
    1085                1090                1095

Tyr Glu  Ser Val Ser Lys Ser  Gln Glu Phe Phe Ser  Lys Phe Asp
    1100                1105                1110
```

```
Lys Ile  Cys Tyr Asn Leu Asp  Lys Gly Tyr Phe Glu  Phe Ser Phe
    1115                1120                1125

Asp Tyr  Lys Asn Phe Gly Asp  Lys Ala Ala Lys Gly  Lys Trp Thr
    1130                1135                1140

Ile Ala  Ser Phe Gly Ser Arg  Leu Ile Asn Phe Arg  Asn Ser Asp
    1145                1150                1155

Lys Asn  His Asn Trp Asp Thr  Arg Glu Val Tyr Pro  Thr Lys Glu
    1160                1165                1170

Leu Glu  Lys Leu Leu Lys Asp  Tyr Ser Ile Glu Tyr  Gly His Gly
    1175                1180                1185

Glu Cys  Ile Lys Ala Ala Ile  Cys Gly Glu Ser Asp  Lys Lys Phe
    1190                1195                1200

Phe Ala  Lys Leu Thr Ser Val  Leu Asn Thr Ile Leu  Gln Met Arg
    1205                1210                1215

Asn Ser  Lys Thr Gly Thr Glu  Leu Asp Tyr Leu Ile  Ser Pro Val
    1220                1225                1230

Ala Asp  Val Asn Gly Asn Phe  Phe Asp Ser Arg Gln  Ala Pro Lys
    1235                1240                1245

Asn Met  Pro Gln Asp Ala Asp  Ala Asn Gly Ala Tyr  His Ile Gly
    1250                1255                1260

Leu Lys  Gly Leu Met Leu Leu  Gly Arg Ile Lys Asn  Asn Gln Glu
    1265                1270                1275

Gly Lys  Lys Leu Asn Leu Val  Ile Lys Asn Glu Glu  Tyr Phe Glu
    1280                1285                1290

Phe Val  Gln Asn Arg Asn Asn
    1295                1300
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<210> 173

<211> 1228
<212> PRT
<213> Lachnospiraceae bacterium sp. ND2006

<400> 173

Ala Ala Ser Lys Leu Glu Lys Phe Thr Asn Cys Tyr Ser Leu Ser Lys
1 5 10 15

Thr Leu Arg Phe Lys Ala Ile Pro Val Gly Lys Thr Gln Glu Asn Ile
20 25 30

Asp Asn Lys Arg Leu Leu Val Glu Asp Glu Lys Arg Ala Glu Asp Tyr
35 40 45

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

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

Leu Phe Arg Lys Lys Thr Arg Thr Glu Lys Glu Asn Lys Glu Leu Glu
85 90 95

Asn Leu Glu Ile Asn Leu Arg Lys Glu Ile Ala Lys Ala Phe Lys Gly
100 105 110

Ala Ala Gly Tyr Lys Ser Leu Phe Lys Lys Asp Ile Ile Glu Thr Ile
115 120 125

Leu Pro Glu Ala Ala Asp Asp Lys Asp Glu Ile Ala Leu Val Asn Ser
130 135 140

Phe Asn Gly Phe Thr Thr Ala Phe Thr Gly Phe Phe Asp Asn Arg Glu
145 150 155 160

Asn Met Phe Ser Glu Glu Ala Lys Ser Thr Ser Ile Ala Phe Arg Cys
165 170 175

Ile Asn Glu Asn Leu Thr Arg Tyr Ile Ser Asn Met Asp Ile Phe Glu
180 185 190

```
Lys Val Asp Ala Ile Phe Asp Lys His Glu Val Gln Glu Ile Lys Glu
        195                 200                 205

Lys Ile Leu Asn Ser Asp Tyr Asp Val Glu Asp Phe Phe Glu Gly Glu
    210                 215                 220

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

Ile Ile Gly Gly Phe Val Thr Glu Ser Gly Glu Lys Ile Lys Gly Leu
                245                 250                 255

Asn Glu Tyr Ile Asn Leu Tyr Asn Ala Lys Thr Lys Gln Ala Leu Pro
            260                 265                 270

Lys Phe Lys Pro Leu Tyr Lys Gln Val Leu Ser Asp Arg Glu Ser Leu
        275                 280                 285

Ser Phe Tyr Gly Glu Gly Tyr Thr Ser Asp Glu Glu Val Leu Glu Val
    290                 295                 300

Phe Arg Asn Thr Leu Asn Lys Asn Ser Glu Ile Phe Ser Ser Ile Lys
305                 310                 315                 320

Lys Leu Glu Lys Leu Phe Lys Asn Phe Asp Glu Tyr Ser Ser Ala Gly
                325                 330                 335

Ile Phe Val Lys Asn Gly Pro Ala Ile Ser Thr Ile Ser Lys Asp Ile
            340                 345                 350

Phe Gly Glu Trp Asn Leu Ile Arg Asp Lys Trp Asn Ala Glu Tyr Asp
        355                 360                 365

Asp Ile His Leu Lys Lys Lys Ala Val Val Thr Glu Lys Tyr Glu Asp
    370                 375                 380

Asp Arg Arg Lys Ser Phe Lys Lys Ile Gly Ser Phe Ser Leu Glu Gln
385                 390                 395                 400

Leu Gln Glu Tyr Ala Asp Ala Asp Leu Ser Val Val Glu Lys Leu Lys
                405                 410                 415
```

```
Glu Ile Ile Ile Gln Lys Val Asp Glu Ile Tyr Lys Val Tyr Gly Ser
            420                 425                 430

Ser Glu Lys Leu Phe Asp Ala Asp Phe Val Leu Glu Lys Ser Leu Lys
        435                 440                 445

Lys Asn Asp Ala Val Val Ala Ile Met Lys Asp Leu Leu Asp Ser Val
    450                 455                 460

Lys Ser Phe Glu Asn Tyr Ile Lys Ala Phe Phe Gly Glu Gly Lys Glu
465                 470                 475                 480

Thr Asn Arg Asp Glu Ser Phe Tyr Gly Asp Phe Val Leu Ala Tyr Asp
                485                 490                 495

Ile Leu Leu Lys Val Asp His Ile Tyr Asp Ala Ile Arg Asn Tyr Val
            500                 505                 510

Thr Gln Lys Pro Tyr Ser Lys Asp Lys Phe Lys Leu Tyr Phe Gln Asn
        515                 520                 525

Pro Gln Phe Met Gly Gly Trp Asp Lys Asp Lys Glu Thr Asp Tyr Arg
    530                 535                 540

Ala Thr Ile Leu Arg Tyr Gly Ser Lys Tyr Tyr Leu Ala Ile Met Asp
545                 550                 555                 560

Lys Lys Tyr Ala Lys Cys Leu Gln Lys Ile Asp Lys Asp Asp Val Asn
                565                 570                 575

Gly Asn Tyr Glu Lys Ile Asn Tyr Lys Leu Leu Pro Gly Pro Asn Lys
            580                 585                 590

Met Leu Pro Lys Val Phe Phe Ser Lys Lys Trp Met Ala Tyr Tyr Asn
        595                 600                 605

Pro Ser Glu Asp Ile Gln Lys Ile Tyr Lys Asn Gly Thr Phe Lys Lys
    610                 615                 620
```

```
Gly Asp Met Phe Asn Leu Asn Asp Cys His Lys Leu Ile Asp Phe Phe
625                 630                 635                 640


Lys Asp Ser Ile Ser Arg Tyr Pro Lys Trp Ser Asn Ala Tyr Asp Phe
                645                 650                 655


Asn Phe Ser Glu Thr Glu Lys Tyr Lys Asp Ile Ala Gly Phe Tyr Arg
            660                 665                 670


Glu Val Glu Glu Gln Gly Tyr Lys Val Ser Phe Glu Ser Ala Ser Lys
        675                 680                 685


Lys Glu Val Asp Lys Leu Val Glu Glu Gly Lys Leu Tyr Met Phe Gln
    690                 695                 700


Ile Tyr Asn Lys Asp Phe Ser Asp Lys Ser His Gly Thr Pro Asn Leu
705                 710                 715                 720


His Thr Met Tyr Phe Lys Leu Leu Phe Asp Glu Asn Asn His Gly Gln
                725                 730                 735


Ile Arg Leu Ser Gly Gly Ala Glu Leu Phe Met Arg Arg Ala Ser Leu
            740                 745                 750


Lys Lys Glu Glu Leu Val Val His Pro Ala Asn Ser Pro Ile Ala Asn
        755                 760                 765


Lys Asn Pro Asp Asn Pro Lys Lys Thr Thr Thr Leu Ser Tyr Asp Val
    770                 775                 780


Tyr Lys Asp Lys Arg Phe Ser Glu Asp Gln Tyr Glu Leu His Ile Pro
785                 790                 795                 800


Ile Ala Ile Asn Lys Cys Pro Lys Asn Ile Phe Lys Ile Asn Thr Glu
                805                 810                 815


Val Arg Val Leu Leu Lys His Asp Asp Asn Pro Tyr Val Ile Gly Ile
            820                 825                 830


Asp Arg Gly Glu Arg Asn Leu Leu Tyr Ile Val Val Val Asp Gly Lys
        835                 840                 845
```

```
Gly Asn Ile Val Glu Gln Tyr Ser Leu Asn Glu Ile Ile Asn Asn Phe
    850                 855                 860

Asn Gly Ile Arg Ile Lys Thr Asp Tyr His Ser Leu Leu Asp Lys Lys
865                 870                 875                 880

Glu Lys Glu Arg Phe Glu Ala Arg Gln Asn Trp Thr Ser Ile Glu Asn
                885                 890                 895

Ile Lys Glu Leu Lys Ala Gly Tyr Ile Ser Gln Val Val His Lys Ile
            900                 905                 910

Cys Glu Leu Val Glu Lys Tyr Asp Ala Val Ile Ala Leu Glu Asp Leu
        915                 920                 925

Asn Ser Gly Phe Lys Asn Ser Arg Val Lys Val Glu Lys Gln Val Tyr
    930                 935                 940

Gln Lys Phe Glu Lys Met Leu Ile Asp Lys Leu Asn Tyr Met Val Asp
945                 950                 955                 960

Lys Lys Ser Asn Pro Cys Ala Thr Gly Gly Ala Leu Lys Gly Tyr Gln
                965                 970                 975

Ile Thr Asn Lys Phe Glu Ser Phe Lys Ser Met Ser Thr Gln Asn Gly
            980                 985                 990

Phe Ile Phe Tyr Ile Pro Ala Trp  Leu Thr Ser Lys Ile  Asp Pro Ser
        995                 1000                1005

Thr Gly  Phe Val Asn Leu Leu  Lys Thr Lys Tyr Thr  Ser Ile Ala
    1010                1015                1020

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

Pro Glu  Glu Asp Leu Phe Glu  Phe Ala Leu Asp Tyr  Lys Asn Phe
    1040                1045                1050
```

```
Ser Arg  Thr Asp Ala Asp Tyr  Ile Lys Lys Trp Lys  Leu Tyr Ser
    1055                1060                1065

Tyr Gly  Asn Arg Ile Arg Ile  Phe Ala Ala Ala Lys  Lys Asn Asn
    1070                1075                1080

Val Phe  Ala Trp Glu Glu Val  Cys Leu Thr Ser Ala  Tyr Lys Glu
    1085                1090                1095

Leu Phe  Asn Lys Tyr Gly Ile  Asn Tyr Gln Gln Gly  Asp Ile Arg
    1100                1105                1110

Ala Leu  Leu Cys Glu Gln Ser  Asp Lys Ala Phe Tyr  Ser Ser Phe
    1115                1120                1125

Met Ala  Leu Met Ser Leu Met  Leu Gln Met Arg Asn  Ser Ile Thr
    1130                1135                1140

Gly Arg  Thr Asp Val Asp Phe  Leu Ile Ser Pro Val  Lys Asn Ser
    1145                1150                1155

Asp Gly  Ile Phe Tyr Asp Ser  Arg Asn Tyr Glu Ala  Gln Glu Asn
    1160                1165                1170

Ala Ile  Leu Pro Lys Asn Ala  Asp Ala Asn Gly Ala  Tyr Asn Ile
    1175                1180                1185

Ala Arg  Lys Val Leu Trp Ala  Ile Gly Gln Phe Lys  Lys Ala Glu
    1190                1195                1200

Asp Glu  Lys Leu Asp Lys Val  Lys Ile Ala Ile Ser  Asn Lys Glu
    1205                1210                1215

Trp Leu  Glu Tyr Ala Gln Thr  Ser Val Lys
    1220                1225
```

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<211> 1307
<212> PRT
<213> Acidaminococcus sp. BV3L6

<400> 174

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

Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Lys His Ile Gln
            20                  25                  30

Glu Gln Gly Phe Ile Glu Glu Asp Lys Ala Arg Asn Asp His Tyr Lys
        35                  40                  45

Glu Leu Lys Pro Ile Ile Asp Arg Ile Tyr Lys Thr Tyr Ala Asp Gln
    50                  55                  60

Cys Leu Gln Leu Val Gln Leu Asp Trp Glu Asn Leu Ser Ala Ala Ile
65                  70                  75                  80

Asp Ser Tyr Arg Lys Glu Lys Thr Glu Glu Thr Arg Asn Ala Leu Ile
                85                  90                  95

Glu Glu Gln Ala Thr Tyr Arg Asn Ala Ile His Asp Tyr Phe Ile Gly
            100                 105                 110

Arg Thr Asp Asn Leu Thr Asp Ala Ile Asn Lys Arg His Ala Glu Ile
        115                 120                 125

Tyr Lys Gly Leu Phe Lys Ala Glu Leu Phe Asn Gly Lys Val Leu Lys
    130                 135                 140

Gln Leu Gly Thr Val Thr Thr Thr Glu His Glu Asn Ala Leu Leu Arg
145                 150                 155                 160

Ser Phe Asp Lys Phe Thr Thr Tyr Phe Ser Gly Phe Tyr Glu Asn Arg
                165                 170                 175

Lys Asn Val Phe Ser Ala Glu Asp Ile Ser Thr Ala Ile Pro His Arg
            180                 185                 190

Ile Val Gln Asp Asn Phe Pro Lys Phe Lys Glu Asn Cys His Ile Phe
        195                 200                 205

Thr Arg Leu Ile Thr Ala Val Pro Ser Leu Arg Glu His Phe Glu Asn
```

```
    210                 215                 220

Val Lys Lys Ala Ile Gly Ile Phe Val Ser Thr Ser Ile Glu Glu Val
225                 230                 235                 240

Phe Ser Phe Pro Phe Tyr Asn Gln Leu Leu Thr Gln Thr Gln Ile Asp
                245                 250                 255

Leu Tyr Asn Gln Leu Leu Gly Gly Ile Ser Arg Glu Ala Gly Thr Glu
            260                 265                 270

Lys Ile Lys Gly Leu Asn Glu Val Leu Asn Leu Ala Ile Gln Lys Asn
        275                 280                 285

Asp Glu Thr Ala His Ile Ile Ala Ser Leu Pro His Arg Phe Ile Pro
    290                 295                 300

Leu Phe Lys Gln Ile Leu Ser Asp Arg Asn Thr Leu Ser Phe Ile Leu
305                 310                 315                 320

Glu Glu Phe Lys Ser Asp Glu Glu Val Ile Gln Ser Phe Cys Lys Tyr
                325                 330                 335

Lys Thr Leu Leu Arg Asn Glu Asn Val Leu Glu Thr Ala Glu Ala Leu
            340                 345                 350

Phe Asn Glu Leu Asn Ser Ile Asp Leu Thr His Ile Phe Ile Ser His
        355                 360                 365

Lys Lys Leu Glu Thr Ile Ser Ser Ala Leu Cys Asp His Trp Asp Thr
    370                 375                 380

Leu Arg Asn Ala Leu Tyr Glu Arg Arg Ile Ser Glu Leu Thr Gly Lys
385                 390                 395                 400

Ile Thr Lys Ser Ala Lys Glu Lys Val Gln Arg Ser Leu Lys His Glu
                405                 410                 415

Asp Ile Asn Leu Gln Glu Ile Ile Ser Ala Ala Gly Lys Glu Leu Ser
            420                 425                 430
```

```
Glu Ala Phe Lys Gln Lys Thr Ser Glu Ile Leu Ser His Ala His Ala
        435                 440                 445

Ala Leu Asp Gln Pro Leu Pro Thr Thr Leu Lys Lys Gln Glu Glu Lys
    450                 455                 460

Glu Ile Leu Lys Ser Gln Leu Asp Ser Leu Leu Gly Leu Tyr His Leu
465                 470                 475                 480

Leu Asp Trp Phe Ala Val Asp Glu Ser Asn Glu Val Asp Pro Glu Phe
                485                 490                 495

Ser Ala Arg Leu Thr Gly Ile Lys Leu Glu Met Glu Pro Ser Leu Ser
            500                 505                 510

Phe Tyr Asn Lys Ala Arg Asn Tyr Ala Thr Lys Lys Pro Tyr Ser Val
        515                 520                 525

Glu Lys Phe Lys Leu Asn Phe Gln Met Pro Thr Leu Ala Ser Gly Trp
    530                 535                 540

Asp Val Asn Lys Glu Lys Asn Asn Gly Ala Ile Leu Phe Val Lys Asn
545                 550                 555                 560

Gly Leu Tyr Tyr Leu Gly Ile Met Pro Lys Gln Lys Gly Arg Tyr Lys
                565                 570                 575

Ala Leu Ser Phe Glu Pro Thr Glu Lys Thr Ser Glu Gly Phe Asp Lys
            580                 585                 590

Met Tyr Tyr Asp Tyr Phe Pro Asp Ala Ala Lys Met Ile Pro Lys Cys
        595                 600                 605

Ser Thr Gln Leu Lys Ala Val Thr Ala His Phe Gln Thr His Thr Thr
    610                 615                 620

Pro Ile Leu Leu Ser Asn Asn Phe Ile Glu Pro Leu Glu Ile Thr Lys
625                 630                 635                 640

Glu Ile Tyr Asp Leu Asn Asn Pro Glu Lys Glu Pro Lys Lys Phe Gln
```

```
               645                 650                 655

Thr Ala Tyr Ala Lys Lys Thr Gly Asp Gln Lys Gly Tyr Arg Glu Ala
            660                 665                 670

Leu Cys Lys Trp Ile Asp Phe Thr Arg Asp Phe Leu Ser Lys Tyr Thr
        675                 680                 685

Lys Thr Thr Ser Ile Asp Leu Ser Ser Leu Arg Pro Ser Ser Gln Tyr
    690                 695                 700

Lys Asp Leu Gly Glu Tyr Tyr Ala Glu Leu Asn Pro Leu Leu Tyr His
705                 710                 715                 720

Ile Ser Phe Gln Arg Ile Ala Glu Lys Glu Ile Met Asp Ala Val Glu
                725                 730                 735

Thr Gly Lys Leu Tyr Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ala Lys
            740                 745                 750

Gly His His Gly Lys Pro Asn Leu His Thr Leu Tyr Trp Thr Gly Leu
        755                 760                 765

Phe Ser Pro Glu Asn Leu Ala Lys Thr Ser Ile Lys Leu Asn Gly Gln
    770                 775                 780

Ala Glu Leu Phe Tyr Arg Pro Lys Ser Arg Met Lys Arg Met Ala His
785                 790                 795                 800

Arg Leu Gly Glu Lys Met Leu Asn Lys Lys Leu Lys Asp Gln Lys Thr
                805                 810                 815

Pro Ile Pro Asp Thr Leu Tyr Gln Glu Leu Tyr Asp Tyr Val Asn His
            820                 825                 830

Arg Leu Ser His Asp Leu Ser Asp Glu Ala Arg Ala Leu Leu Pro Asn
        835                 840                 845

Val Ile Thr Lys Glu Val Ser His Glu Ile Ile Lys Asp Arg Arg Phe
    850                 855                 860
```

```
Thr Ser Asp Lys Phe Phe Phe His Val Pro Ile Thr Leu Asn Tyr Gln
865                 870                 875                 880


Ala Ala Asn Ser Pro Ser Lys Phe Asn Gln Arg Val Asn Ala Tyr Leu
                885                 890                 895


Lys Glu His Pro Glu Thr Pro Ile Ile Gly Ile Asp Arg Gly Glu Arg
            900                 905                 910


Asn Leu Ile Tyr Ile Thr Val Ile Asp Ser Thr Gly Lys Ile Leu Glu
        915                 920                 925


Gln Arg Ser Leu Asn Thr Ile Gln Gln Phe Asp Tyr Gln Lys Lys Leu
    930                 935                 940


Asp Asn Arg Glu Lys Glu Arg Val Ala Ala Arg Gln Ala Trp Ser Val
945                 950                 955                 960


Val Gly Thr Ile Lys Asp Leu Lys Gln Gly Tyr Leu Ser Gln Val Ile
                965                 970                 975


His Glu Ile Val Asp Leu Met Ile His Tyr Gln Ala Val Val Val Leu
            980                 985                 990


Glu Asn Leu Asn Phe Gly Phe Lys  Ser Lys Arg Thr Gly  Ile Ala Glu
        995                 1000                1005


Lys Ala  Val Tyr Gln Gln Phe  Glu Lys Met Leu Ile  Asp Lys Leu
    1010                1015                1020


Asn Cys  Leu Val Leu Lys Asp  Tyr Pro Ala Glu Lys  Val Gly Gly
    1025                1030                1035


Val Leu  Asn Pro Tyr Gln Leu  Thr Asp Gln Phe Thr  Ser Phe Ala
    1040                1045                1050


Lys Met  Gly Thr Gln Ser Gly  Phe Leu Phe Tyr Val  Pro Ala Pro
    1055                1060                1065


Tyr Thr  Ser Lys Ile Asp Pro  Leu Thr Gly Phe Val  Asp Pro Phe
```

```
    1070                1075                1080

Val Trp  Lys Thr Ile Lys Asn  His Glu Ser Arg Lys  His Phe Leu
    1085                1090                1095

Glu Gly  Phe Asp Phe Leu His  Tyr Asp Val Lys Thr  Gly Asp Phe
    1100                1105                1110

Ile Leu  His Phe Lys Met Asn  Arg Asn Leu Ser Phe  Gln Arg Gly
    1115                1120                1125

Leu Pro  Gly Phe Met Pro Ala  Trp Asp Ile Val Phe  Glu Lys Asn
    1130                1135                1140

Glu Thr  Gln Phe Asp Ala Lys  Gly Thr Pro Phe Ile  Ala Gly Lys
    1145                1150                1155

Arg Ile  Val Pro Val Ile Glu  Asn His Arg Phe Thr  Gly Arg Tyr
    1160                1165                1170

Arg Asp  Leu Tyr Pro Ala Asn  Glu Leu Ile Ala Leu  Leu Glu Glu
    1175                1180                1185

Lys Gly  Ile Val Phe Arg Asp  Gly Ser Asn Ile Leu  Pro Lys Leu
    1190                1195                1200

Leu Glu  Asn Asp Asp Ser His  Ala Ile Asp Thr Met  Val Ala Leu
    1205                1210                1215

Ile Arg  Ser Val Leu Gln Met  Arg Asn Ser Asn Ala  Ala Thr Gly
    1220                1225                1230

Glu Asp  Tyr Ile Asn Ser Pro  Val Arg Asp Leu Asn  Gly Val Cys
    1235                1240                1245

Phe Asp  Ser Arg Phe Gln Asn  Pro Glu Trp Pro Met  Asp Ala Asp
    1250                1255                1260

Ala Asn  Gly Ala Tyr His Ile  Ala Leu Lys Gly Gln  Leu Leu Leu
    1265                1270                1275
```

Asn His Leu Lys Glu Ser Lys Asp Leu Lys Leu Gln Asn Gly Ile
    1280   1285   1290

Ser Asn Gln Asp Trp Leu Ala Tyr Ile Gln Glu Leu Arg Asn
    1295   1300   1305

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<212> DNA
<213> Leptotrichia shahii

<400> 175
ccaccccaat atcgaagggg actaaaac   28

<210> 176
<211> 36
<212> DNA
<213> Leptotrichia wadei

<400> 176
gatttagact accccaaaaa cgaaggggac taaaac   36

<210> 177
<211> 36
<212> DNA
<213> Listeria seeligeri

<400> 177
gtaagagact acctctatat gaaagaggac taaaac   36

<210> 178
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<212> DNA
<213> Lachnospiraceae bacterium MA2020

<400> 178
gtattgagaa aagccagata tagttggcaa tagac   35

<210> 179
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<212> DNA
<213> Lachnospiraceae bacterium NK4A179

<400> 179
gttgatgaga agagcccaag atagagggca ataac   35

<210> 180
<211> 35
<212> DNA
<213> Clostridium aminophilum DSM 10710

<400> 180
gtctattgcc ctctatatcg ggctgttctc caaac 35

<210> 181
<211> 36
<212> DNA
<213> Carnobacterium gallinarum DSM 4847

<400> 181
attaaagact acctctaaat gtaagaggac tataac 36

<210> 182
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<212> DNA
<213> Carnobacterium gallinarum DSM 4847

<400> 182
aatataaact acctctaaat gtaagaggac tataac 36

<210> 183
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<213> Paludibacter propionicigenes WB4

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cttgtggatt atcccaaaat tgaagggaac tacaac 36

<210> 184
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<212> DNA
<213> Listeria weihenstephanensis FSL R9-0317

<400> 184
gatttagagt acctcaaaat agaagaggtc taaaac 36

<210> 185
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<212> DNA
<213> Listeriaceae bacterium FSL M6-0635

<400> 185
gatttagagt acctcaaaac aaaagaggac taaaac 36

<210> 186
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<213> Leptotrichia wadei F0279

<400> 186
gatatagata accccaaaaa cgaagggatc taaaac 36

<210> 187
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<212> DNA
<213> Rhodobacter capsulatus SB 1003

<400> 187
gcctcacatc accgccaaga cgacggcgga ctgaac 36

<210> 188
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<400> 188
gcctcacatc accgccaaga cgacggcgga ctgaac 36

<210> 189
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<400> 189
gcctcacatc accgccaaga cgacggcgga ctgaac 36

<210> 190
<211> 1389
<212> PRT
<213> Unknown

<220>
<223> Cas13a

<400> 190

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Lys Asp Phe Lys Ile Lys Arg Lys Val Lys Val Lys Arg Asn Tyr Asp
20 25 30

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Gly Asn Lys Tyr Ile Leu Asn Ile Asn Glu Asn Asn Asn Lys Glu Lys
        35                  40                  45

Ile Asp Asn Asn Lys Phe Ile Arg Lys Tyr Ile Asn Tyr Lys Lys Asn
    50                  55                  60

Asp Asn Ile Leu Lys Glu Phe Thr Arg Lys Phe His Ala Gly Asn Ile
65                  70                  75                  80

Leu Phe Lys Leu Lys Gly Lys Glu Gly Ile Ile Arg Ile Glu Asn Asn
                85                  90                  95

Asp Asp Phe Leu Glu Thr Glu Glu Val Val Leu Tyr Ile Glu Ala Tyr
            100                 105                 110

Gly Lys Ser Glu Lys Leu Lys Ala Leu Gly Ile Thr Lys Lys Lys Ile
        115                 120                 125

Ile Asp Glu Ala Ile Arg Gln Gly Ile Thr Lys Asp Asp Lys Lys Ile
    130                 135                 140

Glu Ile Lys Arg Gln Glu Asn Glu Glu Glu Ile Glu Ile Asp Ile Arg
145                 150                 155                 160

Asp Glu Tyr Thr Asn Lys Thr Leu Asn Asp Cys Ser Ile Ile Leu Arg
                165                 170                 175

Ile Ile Glu Asn Asp Glu Leu Glu Thr Lys Lys Ser Ile Tyr Glu Ile
            180                 185                 190

Phe Lys Asn Ile Asn Met Ser Leu Tyr Lys Ile Ile Glu Lys Ile Ile
        195                 200                 205

Glu Asn Glu Thr Glu Lys Val Phe Glu Asn Arg Tyr Tyr Glu Glu His
    210                 215                 220

Leu Arg Glu Lys Leu Leu Lys Asp Asp Lys Ile Asp Val Ile Leu Thr
225                 230                 235                 240

Asn Phe Met Glu Ile Arg Glu Lys Ile Lys Ser Asn Leu Glu Ile Leu
                245                 250                 255
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```
Gly Phe Val Lys Phe Tyr Leu Asn Val Gly Gly Asp Lys Lys Lys Ser
            260                 265                 270

Lys Asn Lys Lys Met Leu Val Glu Lys Ile Leu Asn Ile Asn Val Asp
        275                 280                 285

Leu Thr Val Glu Asp Ile Ala Asp Phe Val Ile Lys Glu Leu Glu Phe
    290                 295                 300

Trp Asn Ile Thr Lys Arg Ile Glu Lys Val Lys Lys Val Asn Asn Glu
305                 310                 315                 320

Phe Leu Glu Lys Arg Arg Asn Arg Thr Tyr Ile Lys Ser Tyr Val Leu
                325                 330                 335

Leu Asp Lys His Glu Lys Phe Lys Ile Glu Arg Glu Asn Lys Lys Asp
            340                 345                 350

Lys Ile Val Lys Phe Phe Val Glu Asn Ile Lys Asn Asn Ser Ile Lys
        355                 360                 365

Glu Lys Ile Glu Lys Ile Leu Ala Glu Phe Lys Ile Asp Glu Leu Ile
    370                 375                 380

Lys Lys Leu Glu Lys Glu Leu Lys Lys Gly Asn Cys Asp Thr Glu Ile
385                 390                 395                 400

Phe Gly Ile Phe Lys Lys His Tyr Lys Val Asn Phe Asp Ser Lys Lys
                405                 410                 415

Phe Ser Lys Lys Ser Asp Glu Glu Lys Glu Leu Tyr Lys Ile Ile Tyr
            420                 425                 430

Arg Tyr Leu Lys Gly Arg Ile Glu Lys Ile Leu Val Asn Glu Gln Lys
        435                 440                 445

Val Arg Leu Lys Lys Met Glu Lys Ile Glu Ile Glu Lys Ile Leu Asn
    450                 455                 460
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```
Glu Ser Ile Leu Ser Glu Lys Ile Leu Lys Arg Val Lys Gln Tyr Thr
465                 470                 475                 480

Leu Glu His Ile Met Tyr Leu Gly Lys Leu Arg His Asn Asp Ile Asp
                485                 490                 495

Met Thr Thr Val Asn Thr Asp Asp Phe Ser Arg Leu His Ala Lys Glu
            500                 505                 510

Glu Leu Asp Leu Glu Leu Ile Thr Phe Phe Ala Ser Thr Asn Met Glu
        515                 520                 525

Leu Asn Lys Ile Phe Ser Arg Glu Asn Ile Asn Asn Asp Glu Asn Ile
    530                 535                 540

Asp Phe Phe Gly Gly Asp Arg Glu Lys Asn Tyr Val Leu Asp Lys Lys
545                 550                 555                 560

Ile Leu Asn Ser Lys Ile Lys Ile Ile Arg Asp Leu Asp Phe Ile Asp
                565                 570                 575

Asn Lys Asn Asn Ile Thr Asn Asn Phe Ile Arg Lys Phe Thr Lys Ile
            580                 585                 590

Gly Thr Asn Glu Arg Asn Arg Ile Leu His Ala Ile Ser Lys Glu Arg
        595                 600                 605

Asp Leu Gln Gly Thr Gln Asp Asp Tyr Asn Lys Val Ile Asn Ile Ile
    610                 615                 620

Gln Asn Leu Lys Ile Ser Asp Glu Glu Val Ser Lys Ala Leu Asn Leu
625                 630                 635                 640

Asp Val Val Phe Lys Asp Lys Lys Asn Ile Ile Thr Lys Ile Asn Asp
                645                 650                 655

Ile Lys Ile Ser Glu Glu Asn Asn Asn Asp Ile Lys Tyr Leu Pro Ser
            660                 665                 670

Phe Ser Lys Val Leu Pro Glu Ile Leu Asn Leu Tyr Arg Asn Asn Pro
        675                 680                 685
```

```
Lys Asn Glu Pro Phe Asp Thr Ile Glu Thr Glu Lys Ile Val Leu Asn
    690                 695                 700

Ala Leu Ile Tyr Val Asn Lys Glu Leu Tyr Lys Lys Leu Ile Leu Glu
705                 710                 715                 720

Asp Asp Leu Glu Glu Asn Glu Ser Lys Asn Ile Phe Leu Gln Glu Leu
                725                 730                 735

Lys Lys Thr Leu Gly Asn Ile Asp Glu Ile Asp Glu Asn Ile Ile Glu
            740                 745                 750

Asn Tyr Tyr Lys Asn Ala Gln Ile Ser Ala Ser Lys Gly Asn Asn Lys
        755                 760                 765

Ala Ile Lys Lys Tyr Gln Lys Lys Val Ile Glu Cys Tyr Ile Gly Tyr
    770                 775                 780

Leu Arg Lys Asn Tyr Glu Glu Leu Phe Asp Phe Ser Asp Phe Lys Met
785                 790                 795                 800

Asn Ile Gln Glu Ile Lys Lys Gln Ile Lys Asp Ile Asn Asp Asn Lys
                805                 810                 815

Thr Tyr Glu Arg Ile Thr Val Lys Thr Ser Asp Lys Thr Ile Val Ile
            820                 825                 830

Asn Asp Asp Phe Glu Tyr Ile Ile Ser Ile Phe Ala Leu Leu Asn Ser
        835                 840                 845

Asn Ala Val Ile Asn Lys Ile Arg Asn Arg Phe Phe Ala Thr Ser Val
    850                 855                 860

Trp Leu Asn Thr Ser Glu Tyr Gln Asn Ile Ile Asp Ile Leu Asp Glu
865                 870                 875                 880

Ile Met Gln Leu Asn Thr Leu Arg Asn Glu Cys Ile Thr Glu Asn Trp
                885                 890                 895
```

```
Asn Leu Asn Leu Glu Glu Phe Ile Gln Lys Met Lys Glu Ile Glu Lys
            900                 905                 910

Asp Phe Asp Asp Phe Lys Ile Gln Thr Lys Lys Glu Ile Phe Asn Asn
        915                 920                 925

Tyr Tyr Glu Asp Ile Lys Asn Asn Ile Leu Thr Glu Phe Lys Asp Asp
    930                 935                 940

Ile Asn Gly Cys Asp Val Leu Glu Lys Lys Leu Glu Lys Ile Val Ile
945                 950                 955                 960

Phe Asp Asp Glu Thr Lys Phe Glu Ile Asp Lys Lys Ser Asn Ile Leu
                965                 970                 975

Gln Asp Glu Gln Arg Lys Leu Ser Asn Ile Asn Lys Lys Asp Leu Lys
            980                 985                 990

Lys Lys Val Asp Gln Tyr Ile Lys  Asp Lys Asp Gln Glu  Ile Lys Ser
        995                 1000                1005

Lys Ile  Leu Cys Arg Ile Ile  Phe Asn Ser Asp Phe  Leu Lys Lys
    1010                1015                1020

Tyr Lys  Lys Glu Ile Asp Asn  Leu Ile Glu Asp Met  Glu Ser Glu
    1025                1030                1035

Asn Glu  Asn Lys Phe Gln Glu  Ile Tyr Tyr Pro Lys  Glu Arg Lys
    1040                1045                1050

Asn Glu  Leu Tyr Ile Tyr Lys  Lys Asn Leu Phe Leu  Asn Ile Gly
    1055                1060                1065

Asn Pro  Asn Phe Asp Lys Ile  Tyr Gly Leu Ile Ser  Asn Asp Ile
    1070                1075                1080

Lys Met  Ala Asp Ala Lys Phe  Leu Phe Asn Ile Asp  Gly Lys Asn
    1085                1090                1095

Ile Arg  Lys Asn Lys Ile Ser  Glu Ile Asp Ala Ile  Leu Lys Asn
    1100                1105                1110
```

```
Leu Asn  Asp Lys Leu Asn Gly  Tyr Ser Lys Glu Tyr  Lys Glu Lys
    1115                1120                1125

Tyr Ile  Lys Lys Leu Lys Glu  Asn Asp Asp Phe Phe  Ala Lys Asn
    1130                1135                1140

Ile Gln  Asn Lys Asn Tyr Lys  Ser Phe Glu Lys Asp  Tyr Asn Arg
    1145                1150                1155

Val Ser  Glu Tyr Lys Lys Ile  Arg Asp Leu Val Glu  Phe Asn Tyr
    1160                1165                1170

Leu Asn  Lys Ile Glu Ser Tyr  Leu Ile Asp Ile Asn  Trp Lys Leu
    1175                1180                1185

Ala Ile  Gln Met Ala Arg Phe  Glu Arg Asp Met His  Tyr Ile Val
    1190                1195                1200

Asn Gly  Leu Arg Glu Leu Gly  Ile Ile Lys Leu Ser  Gly Tyr Asn
    1205                1210                1215

Thr Gly  Ile Ser Arg Ala Tyr  Pro Lys Arg Asn Gly  Ser Asp Gly
    1220                1225                1230

Phe Tyr  Thr Thr Thr Ala Tyr  Tyr Lys Phe Phe Asp  Glu Glu Ser
    1235                1240                1245

Tyr Lys  Lys Phe Glu Lys Ile  Cys Tyr Gly Phe Gly  Ile Asp Leu
    1250                1255                1260

Ser Glu  Asn Ser Glu Ile Asn  Lys Pro Glu Asn Glu  Ser Ile Arg
    1265                1270                1275

Asn Tyr  Ile Ser His Phe Tyr  Ile Val Arg Asn Pro  Phe Ala Asp
    1280                1285                1290

Tyr Ser  Ile Ala Glu Gln Ile  Asp Arg Val Ser Asn  Leu Leu Ser
    1295                1300                1305
```

Tyr Ser Thr Arg Tyr Asn Asn Ser Thr Tyr Ala Ser Val Phe Glu
    1310   1315   1320

Val Phe Lys Lys Asp Val Asn Leu Asp Tyr Asp Glu Leu Lys Lys
    1325   1330   1335

Lys Phe Lys Leu Ile Gly Asn Asn Asp Ile Leu Glu Arg Leu Met
    1340   1345   1350

Lys Pro Lys Lys Val Ser Val Leu Glu Leu Glu Ser Tyr Asn Ser
    1355   1360   1365

Asp Tyr Ile Lys Asn Leu Ile Ile Glu Leu Leu Thr Lys Ile Glu
    1370   1375   1380

Asn Thr Asn Asp Thr Leu
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Lys Pro Gln Asp Lys Ser Tyr Phe Ala Gly Tyr Phe Asn Ala Ala Met
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Glu Asn Thr Asp Ser Val Phe Arg Glu Leu Gly Lys Arg Leu Lys Gly
        35   40   45

Lys Glu Tyr Thr Ser Glu Asn Phe Phe Asp Ala Ile Phe Lys Glu Asn
    50   55   60

Ile Ser Leu Val Glu Tyr Glu Arg Tyr Val Lys Leu Leu Ser Asp Tyr
65   70   75   80

Phe Pro Met Ala Arg Leu Leu Asp Lys Lys Glu Val Pro Ile Lys Glu
                85   90   95

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Arg Lys Glu Asn Phe Lys Lys Asn Phe Lys Gly Ile Ile Lys Ala Val
            100                 105                 110

Arg Asp Leu Arg Asn Phe Tyr Thr His Lys Glu His Gly Glu Val Glu
        115                 120                 125

Ile Thr Asp Glu Ile Phe Gly Val Leu Asp Glu Met Leu Lys Ser Thr
    130                 135                 140

Val Leu Thr Val Lys Lys Lys Lys Val Lys Thr Asp Lys Thr Lys Glu
145                 150                 155                 160

Ile Leu Lys Lys Ser Ile Glu Lys Gln Leu Asp Ile Leu Cys Gln Lys
                165                 170                 175

Lys Leu Glu Tyr Leu Arg Asp Thr Ala Arg Lys Ile Glu Glu Lys Arg
            180                 185                 190

Arg Asn Gln Arg Glu Arg Gly Glu Lys Glu Leu Val Ala Pro Phe Lys
        195                 200                 205

Tyr Ser Asp Lys Arg Asp Asp Leu Ile Ala Ala Ile Tyr Asn Asp Ala
    210                 215                 220

Phe Asp Val Tyr Ile Asp Lys Lys Lys Asp Ser Leu Lys Glu Ser Ser
225                 230                 235                 240

Lys Ala Lys Tyr Asn Thr Lys Ser Asp Pro Gln Gln Glu Glu Gly Asp
                245                 250                 255

Leu Lys Ile Pro Ile Ser Lys Asn Gly Val Val Phe Leu Leu Ser Leu
            260                 265                 270

Phe Leu Thr Lys Gln Glu Ile His Ala Phe Lys Ser Lys Ile Ala Gly
        275                 280                 285

Phe Lys Ala Thr Val Ile Asp Glu Ala Thr Val Ser Glu Ala Thr Val
    290                 295                 300

Ser His Gly Lys Asn Ser Ile Cys Phe Met Ala Thr His Glu Ile Phe
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305                 310                 315                 320

Ser His Leu Ala Tyr Lys Lys Leu Lys Arg Lys Val Arg Thr Ala Glu
                325                 330                 335

Ile Asn Tyr Gly Glu Ala Glu Asn Ala Glu Gln Leu Ser Val Tyr Ala
            340                 345                 350

Lys Glu Thr Leu Met Met Gln Met Leu Asp Glu Leu Ser Lys Val Pro
        355                 360                 365

Asp Val Val Tyr Gln Asn Leu Ser Glu Asp Val Gln Lys Thr Phe Ile
    370                 375                 380

Glu Asp Trp Asn Glu Tyr Leu Lys Glu Asn Asn Gly Asp Val Gly Thr
385                 390                 395                 400

Met Glu Glu Glu Gln Val Ile His Pro Val Ile Arg Lys Arg Tyr Glu
                405                 410                 415

Asp Lys Phe Asn Tyr Phe Ala Ile Arg Phe Leu Asp Glu Phe Ala Gln
            420                 425                 430

Phe Pro Thr Leu Arg Phe Gln Val His Leu Gly Asn Tyr Leu His Asp
        435                 440                 445

Ser Arg Pro Lys Glu Asn Leu Ile Ser Asp Arg Arg Ile Lys Glu Lys
    450                 455                 460

Ile Thr Val Phe Gly Arg Leu Ser Glu Leu Glu His Lys Lys Ala Leu
465                 470                 475                 480

Phe Ile Lys Asn Thr Glu Thr Asn Glu Asp Arg Glu His Tyr Trp Glu
                485                 490                 495

Ile Phe Pro Asn Pro Asn Tyr Asp Phe Pro Lys Glu Asn Ile Ser Val
            500                 505                 510

Asn Asp Lys Asp Phe Pro Ile Ala Gly Ser Ile Leu Asp Arg Glu Lys
        515                 520                 525
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Gln Pro Val Ala Gly Lys Ile Gly Ile Lys Val Lys Leu Leu Asn Gln
    530                 535                 540

Gln Tyr Val Ser Glu Val Asp Lys Ala Val Lys Ala His Gln Leu Lys
545                 550                 555                 560

Gln Arg Lys Ala Ser Lys Pro Ser Ile Gln Asn Ile Ile Glu Glu Ile
                565                 570                 575

Val Pro Ile Asn Glu Ser Asn Pro Lys Glu Ala Ile Val Phe Gly Gly
            580                 585                 590

Gln Pro Thr Ala Tyr Leu Ser Met Asn Asp Ile His Ser Ile Leu Tyr
        595                 600                 605

Glu Phe Phe Asp Lys Trp Glu Lys Lys Lys Glu Lys Leu Glu Lys Lys
    610                 615                 620

Gly Glu Lys Glu Leu Arg Lys Glu Ile Gly Lys Glu Leu Glu Lys Lys
625                 630                 635                 640

Ile Val Gly Lys Ile Gln Ala Gln Ile Gln Gln Ile Ile Asp Lys Asp
                645                 650                 655

Thr Asn Ala Lys Ile Leu Lys Pro Tyr Gln Asp Gly Asn Ser Thr Ala
            660                 665                 670

Ile Asp Lys Glu Lys Leu Ile Lys Asp Leu Lys Gln Glu Gln Asn Ile
        675                 680                 685

Leu Gln Lys Leu Lys Asp Glu Gln Thr Val Arg Glu Lys Glu Tyr Asn
    690                 695                 700

Asp Phe Ile Ala Tyr Gln Asp Lys Asn Arg Glu Ile Asn Lys Val Arg
705                 710                 715                 720

Asp Arg Asn His Lys Gln Tyr Leu Lys Asp Asn Leu Lys Arg Lys Tyr
                725                 730                 735

Pro Glu Ala Pro Ala Arg Lys Glu Val Leu Tyr Tyr Arg Glu Lys Gly
```

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            740                 745                 750

Lys Val Ala Val Trp Leu Ala Asn Asp Ile Lys Arg Phe Met Pro Thr
        755                 760                 765

Asp Phe Lys Asn Glu Trp Lys Gly Glu Gln His Ser Leu Leu Gln Lys
    770                 775                 780

Ser Leu Ala Tyr Tyr Glu Gln Cys Lys Glu Glu Leu Lys Asn Leu Leu
785                 790                 795                 800

Pro Glu Lys Val Phe Gln His Leu Pro Phe Lys Leu Gly Gly Tyr Phe
                805                 810                 815

Gln Gln Lys Tyr Leu Tyr Gln Phe Tyr Thr Cys Tyr Leu Asp Lys Arg
            820                 825                 830

Leu Glu Tyr Ile Ser Gly Leu Val Gln Gln Ala Glu Asn Phe Lys Ser
        835                 840                 845

Glu Asn Lys Val Phe Lys Lys Val Glu Asn Glu Cys Phe Lys Phe Leu
    850                 855                 860

Lys Lys Gln Asn Tyr Thr His Lys Glu Leu Asp Ala Arg Val Gln Ser
865                 870                 875                 880

Ile Leu Gly Tyr Pro Ile Phe Leu Glu Arg Gly Phe Met Asp Glu Lys
                885                 890                 895

Pro Thr Ile Ile Lys Gly Lys Thr Phe Lys Gly Asn Glu Ala Leu Phe
            900                 905                 910

Ala Asp Trp Phe Arg Tyr Tyr Lys Glu Tyr Gln Asn Phe Gln Thr Phe
        915                 920                 925

Tyr Asp Thr Glu Asn Tyr Pro Leu Val Glu Leu Glu Lys Lys Gln Ala
    930                 935                 940

Asp Arg Lys Arg Lys Thr Lys Ile Tyr Gln Gln Lys Lys Asn Asp Val
945                 950                 955                 960
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Phe Thr Leu Leu Met Ala Lys His Ile Phe Lys Ser Val Phe Lys Gln
                965                 970                 975

Asp Ser Ile Asp Gln Phe Ser Leu Glu Asp Leu Tyr Gln Ser Arg Glu
            980                 985                 990

Glu Arg Leu Gly Asn Gln Glu Arg  Ala Arg Gln Thr Gly  Glu Arg Asn
        995                 1000                1005

Thr Asn  Tyr Ile Trp Asn Lys  Thr Val Asp Leu Lys  Leu Cys Asp
    1010                1015                1020

Gly Lys  Ile Thr Val Glu Asn  Val Lys Leu Lys Asn  Val Gly Asp
    1025                1030                1035

Phe Ile  Lys Tyr Glu Tyr Asp  Gln Arg Val Gln Ala  Phe Leu Lys
    1040                1045                1050

Tyr Glu  Glu Asn Ile Glu Trp  Gln Ala Phe Leu Ile  Lys Glu Ser
    1055                1060                1065

Lys Glu  Glu Glu Asn Tyr Pro  Tyr Val Val Glu Arg  Glu Ile Glu
    1070                1075                1080

Gln Tyr  Glu Lys Val Arg Arg  Glu Glu Leu Leu Lys  Glu Val His
    1085                1090                1095

Leu Ile  Glu Glu Tyr Ile Leu  Glu Lys Val Lys Asp  Lys Glu Ile
    1100                1105                1110

Leu Lys  Lys Gly Asp Asn Gln  Asn Phe Lys Tyr Tyr  Ile Leu Asn
    1115                1120                1125

Gly Leu  Leu Lys Gln Leu Lys  Asn Glu Asp Val Glu  Ser Tyr Lys
    1130                1135                1140

Val Phe  Asn Leu Asn Thr Glu  Pro Glu Asp Val Asn  Ile Asn Gln
    1145                1150                1155

Leu Lys  Gln Glu Ala Thr Asp  Leu Glu Gln Lys Ala  Phe Val Leu
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1160 1165 1170

Thr Tyr Ile Arg Asn Lys Phe Ala His Asn Gln Leu Pro Lys Lys
1175 1180 1185

Glu Phe Trp Asp Tyr Cys Gln Glu Lys Tyr Gly Lys Glu Lys Thr
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Tyr Ala Glu Tyr Phe Ala Glu Val Phe Lys Lys Glu Lys Glu Ala
1205 1210 1215

Leu Ile Lys
1220

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<400> 193
tgtggtcatg agtccttcca 20

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gaggagagtg ccagagttgt 20

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<223> n is a, c, g, t or u

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atttgactgt aaacacaaag atattagtac aaaatacgtg acgtagaaag taataatttc 180

ttgggtagtt tgcagtttta aaattatgtt ttaaaatgga ctatcatatg cttaccgtaa 240

cttgaaagta tttcgatttc ttggctttat atatcttgtg gaaaggacga aacaccnnnn 300

nnnnnnnnnn nnnnngtttt agtccctgaa gggactaaaa taaagagttt gcgggactct 360

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tagagcggcc gccaccgcgg tggagctcca gcttttgttc cctttagtga gggttaattg 480

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ttgggtagtt tgcagtttta aaattatgtt ttaaaatgga ctatcatatg cttaccgtaa 240

cttgaaagta tttcgatttc ttggctttat atatcttgtg gaaaggacga aacaccnnnn 300

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gacatgcttg cccgtgcacc cccggtgtca tgcttgcttg aaccaggctt tgtgcccagc 1980

tgcccagggc ctgagtggaa gtgagacacc gggaacatct gagtctgcga ccccggagag 2040

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tgaaaacgac gaactgaagg attgcggcgt gcgaattttc actaaggtcg aaaatcccaa 2160

aactggtgaa tcactcgctc tccctagacg actggcacgc tccgcacgaa agaggcttgc 2220

ccgccgcaag gcacgcttga accatcttaa acaccttatt gcaaatgagt ttaaactgaa 2280

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atccccgtat gagctccggt tcagagcact caacgaactg ctgtccaaac aggattttgc 2400

tcgcgtgatt ctccacatag cgaagaggcg aggatacgat gacattaaaa acagtgatga 2460

taaggaaaaa ggggccatac tcaaagcgat taagcaaaat gaagagaagc tcgctaacta 2520

tcaatcagta ggggagtatc tctataaaga gtacttccag aagttcaaag aaaatagcaa 2580

ggaatttact aatgtccgga ataaaaagga gtcttacgaa agatgtattg cgcaatcttt 2640

cctcaaggac gagctcaaat tgattttcaa gaaacaaagg gaatttgggt tcagcttctc 2700

aaaaaaattt gaggaagagg ttctgagcgt tgccttttac aaacgcgccc ttaaggactt 2760

ctcacatctc gtagggaatt gtagtttctt caccgatgaa aaacgggcgc caaaaaatag 2820

ccctttggct tttatgtttg tcgctctgac tcgcatcatt aatctgctca acaaccttaa 2880

aaacacggaa gggattctgt acacaaagga tgatctgaac gctctgctta acgaagtttt 2940

gaagaacggg actttgacct acaaacaaac caaaaagctt cttggtctca gtgatgacta 3000

cgaattcaag ggagaaaaag ggacatattt catcgaattc aagaagtata aggagttcat 3060

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cactctgatt aaagacgaga tcaagctcaa aaaggcgttg gcgaagtatg accttaacca 3180

aaaccaaata gatagcctca gcaagttgga atttaaagat cacttgaata taagtttcaa 3240

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aaacagcaag aacattctca aactccgcct cttcaaagaa caaaaagaat tttgtgctta 3660

tagtggtgag aaaataaaaa tctccgatct tcaagacgag aagatgctcg aaatagacgc 3720

gatatatcca tatagcaggt cttttgacga ttcttacatg aataaagtgc ttgttttcac 3780

taagcagaat caggaaaagt tgaatcagac ccccttgag gcctttggca acgactcagc 3840

aaagtggcag aagatcgagg tcttggctaa gaatcttcct actaagaaac agaaaaggat 3900

attggataag aactataaag acaaagaaca aaagaacttt aaagaccgca acctcaatga 3960

caccagatac atagcaagat tggttctgaa ctacacaaaa gattatttgg acttcttgcc 4020

gctgtctgat gatgagaaca cgaaactcaa cgacacgcaa aaggggtcta aagtccacgt 4080

cgaagctaaa tctgggatgc tcacctcagc attgaggcat acgtggggat tctcagcaaa 4140

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aaggaaaaag ccctcaggcg ccttgcacga agagactttc aggaaggaag aggaattcta 4440

ccaaagctac ggcggaaaag agggagtttt gaaggctctc gaacttggaa agattaggaa 4500

ggtgaacggc aagatagtga aaaacggcga tatgttccgg gttgatatct tcaaacataa 4560

aaaaacgaat aaattttatg ctgtgcctat atacactatg gacttcgcac ttaaggtcct 4620

gccgaataag gcggtagccc gatctaaaaa aggcgaaatt aaggactgga ttttgatgga 4680

tgaaaattac gagttctgct tttctctcta caaggattcc cttatattga tacagacgaa 4740

agatatgcag gaaccggaat tcgtgtatta caacgctttt acttcctcta cggtatcttt 4800

gattgtctcc aaacatgaca acaaattcga aacactcagt aaaaaccaaa agattctctt 4860

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agaggacttc aaaaaatcag gtccacccaa gaaaaaacgc aaggtggaag atccgaagaa 5040

aaagcgaaaa gtggatgtgt aacgttttcc gggacgccgg ctggatgatc ctccagcgcg 5100

gggatctcat gctggagttc ttcgcccacc ccaacttgtt tattgcagct tataatggtt 5160

acaaataaag caatagcatc acaaatttca caaataaagc attttttca ctgcattcta 5220

gttgtggttt gtccaaactc atcaatgtat cttatcatgt ctgtataccg 5270

<210> 204
<211> 137
<212> PRT
<213> Unknown

<220>
<223> RNAseK

<400> 204

Met Gly Trp Leu Arg Pro Gly Pro Arg Pro Leu Cys Pro Pro Ala Arg
1 5 10 15

Ala Ser Trp Ala Phe Ser His Arg Phe Pro Ser Pro Leu Ala Pro Arg
20 25 30

```
Arg Ser Pro Thr Pro Phe Phe Met Ala Ser Leu Leu Cys Cys Gly Pro
        35                  40                  45

Lys Leu Ala Ala Cys Gly Ile Val Leu Ser Ala Trp Gly Val Ile Met
    50                  55                  60

Leu Ile Met Leu Gly Ile Phe Phe Asn Val His Ser Ala Val Leu Ile
65                  70                  75                  80

Glu Asp Val Pro Phe Thr Glu Lys Asp Phe Glu Asn Gly Pro Gln Asn
                85                  90                  95

Ile Tyr Asn Leu Tyr Glu Gln Val Ser Tyr Asn Cys Phe Ile Ala Ala
            100                 105                 110

Gly Leu Tyr Leu Leu Leu Gly Gly Phe Ser Phe Cys Gln Val Arg Leu
        115                 120                 125

Asn Lys Arg Lys Glu Tyr Met Val Arg
    130                 135
```

<210> 205
<211> 1245
<212> PRT
<213> Unknown

<220>
<223> TALEN

<400> 205

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Met Arg Ile Gly Lys Ser Ser Gly Trp Leu Asn Glu Ser Val Ser Leu
1               5                   10                  15

Glu Tyr Glu His Val Ser Pro Pro Thr Arg Pro Arg Asp Thr Arg Arg
            20                  25                  30

Arg Pro Arg Ala Ala Gly Asp Gly Gly Leu Ala His Leu His Arg Arg
        35                  40                  45

Leu Ala Val Gly Tyr Ala Glu Asp Thr Pro Arg Thr Glu Ala Arg Ser
    50                  55                  60
```

```
Pro Ala Pro Arg Arg Pro Leu Pro Val Ala Pro Ala Ser Ala Pro Pro
65                  70                  75                  80

Ala Pro Ser Leu Val Pro Glu Pro Pro Met Pro Val Ser Leu Pro Ala
                85                  90                  95

Val Ser Ser Pro Arg Phe Ser Ala Gly Ser Ser Ala Ala Ile Thr Asp
            100                 105                 110

Pro Phe Pro Ser Leu Pro Pro Thr Pro Val Leu Tyr Ala Met Ala Arg
        115                 120                 125

Glu Leu Glu Ala Leu Ser Asp Ala Thr Trp Gln Pro Ala Val Pro Leu
    130                 135                 140

Pro Ala Glu Pro Pro Thr Asp Ala Arg Arg Gly Asn Thr Val Phe Asp
145                 150                 155                 160

Glu Ala Ser Ala Ser Ser Pro Val Ile Ala Ser Ala Cys Pro Gln Ala
                165                 170                 175

Phe Ala Ser Pro Pro Arg Ala Pro Arg Ser Ala Arg Ala Arg Arg Ala
            180                 185                 190

Arg Thr Gly Gly Asp Ala Trp Pro Ala Pro Thr Phe Leu Ser Arg Pro
        195                 200                 205

Ser Ser Ser Arg Ile Gly Arg Asp Val Phe Gly Lys Leu Val Ala Leu
    210                 215                 220

Gly Tyr Ser Arg Glu Gln Ile Arg Lys Leu Lys Gln Glu Ser Leu Ser
225                 230                 235                 240

Glu Ile Ala Lys Tyr His Thr Thr Leu Thr Gly Gln Gly Phe Thr His
                245                 250                 255

Ala Asp Ile Cys Arg Ile Ser Arg Arg Arg Gln Ser Leu Arg Val Val
            260                 265                 270

Ala Arg Asn Tyr Pro Glu Leu Ala Ala Ala Leu Pro Glu Leu Thr Arg
```

```
        275                 280                 285

Ala His Ile Val Asp Ile Ala Arg Gln Arg Ser Gly Asp Leu Ala Leu
    290                 295                 300

Gln Ala Leu Leu Pro Val Ala Thr Ala Leu Thr Ala Ala Pro Leu Arg
305                 310                 315                 320

Leu Ser Ala Ser Gln Ile Ala Thr Val Ala Gln Tyr Gly Glu Arg Pro
                325                 330                 335

Ala Ile Gln Ala Leu Tyr Arg Leu Arg Arg Lys Leu Thr Arg Ala Pro
            340                 345                 350

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

Gly Lys Arg Ala Leu Glu Ala Val Cys Val Gln Leu Pro Val Leu Arg
    370                 375                 380

Ala Ala Pro Tyr Arg Leu Ser Thr Glu Gln Val Val Ala Ile Ala Ser
385                 390                 395                 400

Asn Lys Gly Gly Lys Gln Ala Leu Glu Ala Val Lys Ala His Leu Leu
                405                 410                 415

Asp Leu Leu Gly Ala Pro Tyr Val Leu Asp Thr Glu Gln Val Val Ala
            420                 425                 430

Ile Ala Ser His Asn Gly Gly Lys Gln Ala Leu Glu Ala Val Lys Ala
        435                 440                 445

Asp Leu Leu Asp Leu Arg Gly Ala Pro Tyr Ala Leu Ser Thr Glu Gln
    450                 455                 460

Val Val Ala Ile Ala Ser His Asn Gly Gly Lys Gln Ala Leu Glu Ala
465                 470                 475                 480

Val Lys Ala Asp Leu Leu Glu Leu Arg Gly Ala Pro Tyr Ala Leu Ser
                485                 490                 495
```

```
Thr Glu Gln Val Val Ala Ile Ala Ser His Asn Gly Gly Lys Gln Ala
            500                 505                 510

Leu Glu Ala Val Lys Ala His Leu Leu Asp Leu Arg Gly Val Pro Tyr
        515                 520                 525

Ala Leu Ser Thr Glu Gln Val Val Ala Ile Ala Ser His Asn Gly Gly
    530                 535                 540

Lys Gln Ala Leu Glu Ala Val Lys Ala Gln Leu Leu Asp Leu Arg Gly
545                 550                 555                 560

Ala Pro Tyr Ala Leu Ser Thr Ala Gln Val Val Ala Ile Ala Ser Asn
                565                 570                 575

Gly Gly Gly Lys Gln Ala Leu Glu Gly Ile Gly Glu Gln Leu Leu Lys
            580                 585                 590

Leu Arg Thr Ala Pro Tyr Gly Leu Ser Thr Glu Gln Val Val Ala Ile
        595                 600                 605

Ala Ser His Asp Gly Gly Lys Gln Ala Leu Glu Ala Val Gly Ala Gln
    610                 615                 620

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

Val Ala Ile Ala Ser Asn Lys Gly Gly Lys Gln Ala Leu Glu Ala Val
                645                 650                 655

Lys Ala Gln Leu Leu Glu Leu Arg Gly Ala Pro Tyr Ala Leu Ser Thr
            660                 665                 670

Ala Gln Val Val Ala Ile Ala Ser His Asp Gly Gly Asn Gln Ala Leu
        675                 680                 685

Glu Ala Val Gly Thr Gln Leu Val Ala Leu Arg Ala Ala Pro Tyr Ala
    690                 695                 700

Leu Ser Thr Glu Gln Val Val Ala Ile Ala Ser His Asp Gly Gly Lys
```

```
705                 710                 715                 720

Gln Ala Leu Glu Ala Val Gly Ala Gln Leu Val Ala Leu Arg Ala Ala
                725                 730                 735

Pro Tyr Ala Leu Asn Thr Glu Gln Val Val Ala Ile Ala Ser Ser His
            740                 745                 750

Gly Gly Lys Gln Ala Leu Glu Ala Val Arg Ala Leu Phe Pro Asp Leu
        755                 760                 765

Arg Ala Ala Pro Tyr Ala Leu Ser Thr Ala Gln Leu Val Ala Ile Ala
    770                 775                 780

Ser Asn Pro Gly Gly Lys Gln Ala Leu Glu Ala Val Arg Ala Leu Phe
785                 790                 795                 800

Arg Glu Leu Arg Ala Ala Pro Tyr Ala Leu Ser Thr Glu Gln Val Val
                805                 810                 815

Ala Ile Ala Ser Asn His Gly Gly Lys Gln Ala Leu Glu Ala Val Arg
            820                 825                 830

Ala Leu Phe Arg Gly Leu Arg Ala Ala Pro Tyr Gly Leu Ser Thr Ala
        835                 840                 845

Gln Val Val Ala Ile Ala Ser Ser Asn Gly Gly Lys Gln Ala Leu Glu
    850                 855                 860

Ala Val Trp Ala Leu Leu Pro Val Leu Arg Ala Thr Pro Tyr Asp Leu
865                 870                 875                 880

Asn Thr Ala Gln Ile Val Ala Ile Ala Ser His Asp Gly Gly Lys Pro
                885                 890                 895

Ala Leu Glu Ala Val Trp Ala Lys Leu Pro Val Leu Arg Gly Ala Pro
            900                 905                 910

Tyr Ala Leu Ser Thr Ala Gln Val Val Ala Ile Ala Cys Ile Ser Gly
        915                 920                 925
```

```
Gln Gln Ala Leu Glu Ala Ile Glu Ala His Met Pro Thr Leu Arg Gln
    930                 935                 940

Ala Ser His Ser Leu Ser Pro Glu Arg Val Ala Ala Ile Ala Cys Ile
945                 950                 955                 960

Gly Gly Arg Ser Ala Val Glu Ala Val Arg Gln Gly Leu Pro Val Lys
                965                 970                 975

Ala Ile Arg Arg Ile Arg Arg Glu Lys Ala Pro Val Ala Gly Pro Pro
            980                 985                 990

Pro Ala Ser Leu Gly Pro Thr Pro  Gln Glu Leu Val Ala  Val Leu His
        995                 1000                1005

Phe Phe  Arg Ala His Gln Gln  Pro Arg Gln Ala Phe  Val Asp Ala
    1010                1015                1020

Leu Ala  Ala Phe Gln Ala Thr  Arg Pro Ala Leu Leu  Arg Leu Leu
    1025                1030                1035

Ser Ser  Val Gly Val Thr Glu  Ile Glu Ala Leu Gly  Gly Thr Ile
    1040                1045                1050

Pro Asp  Ala Thr Glu Arg Trp  Gln Arg Leu Leu Gly  Arg Leu Gly
    1055                1060                1065

Phe Arg  Pro Ala Thr Gly Ala  Ala Ala Pro Ser Pro  Asp Ser Leu
    1070                1075                1080

Gln Gly  Phe Ala Gln Ser Leu  Glu Arg Thr Leu Gly  Ser Pro Gly
    1085                1090                1095

Met Ala  Gly Gln Ser Ala Cys  Ser Pro His Arg Lys  Arg Pro Ala
    1100                1105                1110

Glu Thr  Ala Ile Ala Pro Arg  Ser Ile Arg Arg Ser  Pro Asn Asn
    1115                1120                1125

Ala Gly  Gln Pro Ser Glu Pro  Trp Pro Asp Gln Leu  Ala Trp Leu
```

```
    1130                1135                1140

Gln Arg  Arg Lys Arg Thr Ala  Arg Ser His Ile Arg  Ala Asp Ser
    1145                1150                1155

Ala Ala  Ser Val Pro Ala Asn  Leu His Leu Gly Thr  Arg Ala Gln
    1160                1165                1170

Phe Thr  Pro Asp Arg Leu Arg  Ala Glu Pro Gly Pro  Ile Met Gln
    1175                1180                1185

Ala His  Thr Ser Pro Ala Ser  Val Ser Phe Gly Ser  His Val Ala
    1190                1195                1200

Phe Glu  Pro Gly Leu Pro Asp  Pro Gly Thr Pro Thr  Ser Ala Asp
    1205                1210                1215

Leu Ala  Ser Phe Glu Ala Glu  Pro Phe Gly Val Gly  Pro Leu Asp
    1220                1225                1230

Phe His  Leu Asp Trp Leu Leu  Gln Ile Leu Glu Thr
    1235                1240                1245
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<210> 206
<211> 1373
<212> PRT
<213> Unknown

<220>
<223> TALEN

<400> 206

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Met Asp Pro Ile Arg Ser Arg Thr Pro Ser Pro Ala Arg Glu Leu Leu
1               5                   10                  15

Pro Gly Pro Gln Pro Asp Arg Val Gln Pro Thr Ala Asp Arg Gly Gly
            20                  25                  30

Ala Pro Pro Ala Gly Gly Pro Leu Asp Gly Leu Pro Ala Arg Arg Thr
        35                  40                  45

Met Ser Arg Thr Arg Leu Pro Ser Pro Pro Ala Pro Ser Pro Ala Phe
```

```
    50                  55                  60

Ser Ala Gly Ser Phe Ser Asp Leu Leu Arg Gln Phe Asp Pro Ser Leu
65                  70                  75                  80

Leu Asp Thr Ser Leu Leu Asp Ser Met Pro Ala Val Gly Thr Pro His
                85                  90                  95

Thr Ala Ala Ala Pro Ala Glu Cys Asp Glu Val Gln Ser Gly Leu Arg
            100                 105                 110

Ala Ala Asp Asp Pro Pro Pro Thr Val Arg Val Ala Val Thr Ala Ala
        115                 120                 125

Arg Pro Pro Arg Ala Lys Pro Ala Pro Arg Arg Arg Ala Ala Gln Pro
    130                 135                 140

Ser Asp Ala Ser Pro Ala Ala Gln Val Asp Leu Arg Thr Leu Gly Tyr
145                 150                 155                 160

Ser Gln Gln Gln Gln Glu Lys Ile Lys Pro Lys Val Gly Ser Thr Val
                165                 170                 175

Ala Gln His His Glu Ala Leu Val Gly His Gly Phe Thr His Ala His
            180                 185                 190

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

Lys Tyr Gln Asp Met Ile Ala Ala Leu Pro Glu Ala Thr His Glu Asp
    210                 215                 220

Ile Val Gly Val Gly Lys Gln Trp Ser Gly Ala Arg Ala Leu Glu Ala
225                 230                 235                 240

Leu Leu Thr Val Ala Gly Glu Leu Arg Gly Pro Pro Leu Gln Leu Asp
                245                 250                 255

Thr Gly Gln Leu Val Lys Ile Ala Lys Arg Gly Gly Val Thr Ala Val
            260                 265                 270
```

```
Glu Ala Val His Ala Ser Arg Asn Ala Leu Thr Gly Ala Pro Leu Asn
        275                 280                 285

Leu Thr Pro Ala Gln Val Val Ala Ile Ala Ser Asn Asn Gly Gly Lys
    290                 295                 300

Gln Ala Leu Glu Thr Val Gln Arg Leu Leu Pro Val Leu Cys Gln Ala
305                 310                 315                 320

His Gly Leu Thr Pro Ala Gln Val Val Ala Ile Ala Ser His Asp Gly
                325                 330                 335

Gly Lys Gln Ala Leu Glu Thr Met Gln Arg Leu Leu Pro Val Leu Cys
            340                 345                 350

Gln Ala His Gly Leu Pro Pro Asp Gln Val Val Ala Ile Ala Ser Asn
        355                 360                 365

Ile Gly Gly Lys Gln Ala Leu Glu Thr Val Gln Arg Leu Leu Pro Val
    370                 375                 380

Leu Cys Gln Ala His Gly Leu Thr Pro Asp Gln Val Val Ala Ile Ala
385                 390                 395                 400

Ser His Gly Gly Gly Lys Gln Ala Leu Glu Thr Val Gln Arg Leu Leu
                405                 410                 415

Pro Val Leu Cys Gln Ala His Gly Leu Thr Pro Asp Gln Val Val Ala
            420                 425                 430

Ile Ala Ser His Asp Gly Gly Lys Gln Ala Leu Glu Thr Val Gln Arg
        435                 440                 445

Leu Leu Pro Val Leu Cys Gln Ala His Gly Leu Thr Pro Asp Gln Val
    450                 455                 460

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

Gln Arg Leu Leu Pro Val Leu Cys Gln Ala His Gly Leu Thr Pro Asp
```

```
               485                 490                 495

Gln Val Val Ala Ile Ala Ser Asn Gly Gly Lys Gln Ala Leu Glu Thr
            500                 505                 510

Val Gln Arg Leu Leu Pro Val Leu Cys Gln Ala His Gly Leu Thr Pro
        515                 520                 525

Asp Gln Val Val Ala Ile Ala Ser His Asp Gly Gly Lys Gln Ala Leu
    530                 535                 540

Glu Thr Val Gln Arg Leu Leu Pro Val Leu Cys Gln Thr His Gly Leu
545                 550                 555                 560

Thr Pro Ala Gln Val Val Ala Ile Ala Ser His Asp Gly Gly Lys Gln
               565                 570                 575

Ala Leu Glu Thr Val Gln Gln Leu Leu Pro Val Leu Cys Gln Ala His
            580                 585                 590

Gly Leu Thr Pro Asp Gln Val Val Ala Ile Ala Ser Asn Ile Gly Gly
        595                 600                 605

Lys Gln Ala Leu Ala Thr Val Gln Arg Leu Leu Pro Val Leu Cys Gln
    610                 615                 620

Ala His Gly Leu Thr Pro Asp Gln Val Val Ala Ile Ala Ser Asn Gly
625                 630                 635                 640

Gly Gly Lys Gln Ala Leu Glu Thr Val Gln Arg Leu Leu Pro Val Leu
               645                 650                 655

Cys Gln Ala His Gly Leu Thr Pro Asp Gln Val Val Ala Ile Ala Ser
            660                 665                 670

Asn Gly Gly Gly Lys Gln Ala Leu Glu Thr Val Gln Arg Leu Leu Pro
        675                 680                 685

Val Leu Cys Gln Ala His Gly Leu Thr Gln Val Gln Val Val Ala Ile
    690                 695                 700
```

```
Ala Ser Asn Ile Gly Gly Lys Gln Ala Leu Glu Thr Val Gln Arg Leu
705                 710                 715                 720


Leu Pro Val Leu Cys Gln Ala His Gly Leu Thr Pro Ala Gln Val Val
                725                 730                 735


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


Arg Leu Leu Pro Val Leu Cys Gln Ala His Gly Leu Thr Pro Asp Gln
        755                 760                 765


Val Val Ala Ile Ala Ser Asn Gly Gly Gly Lys Gln Ala Leu Glu Thr
    770                 775                 780


Val Gln Arg Leu Leu Pro Val Leu Cys Gln Ala His Gly Leu Thr Gln
785                 790                 795                 800


Glu Gln Val Val Ala Ile Ala Ser Asn Asn Gly Gly Lys Gln Ala Leu
                805                 810                 815


Glu Thr Val Gln Arg Leu Leu Pro Val Leu Cys Gln Ala His Gly Leu
            820                 825                 830


Thr Pro Asp Gln Val Val Ala Ile Ala Ser Asn Gly Gly Gly Lys Gln
        835                 840                 845


Ala Leu Glu Thr Val Gln Arg Leu Leu Pro Val Leu Cys Gln Ala His
    850                 855                 860


Gly Leu Thr Pro Ala Gln Val Val Ala Ile Ala Ser Asn Ile Gly Gly
865                 870                 875                 880


Lys Gln Ala Leu Glu Thr Val Gln Arg Leu Leu Pro Val Leu Cys Gln
                885                 890                 895


Asp His Gly Leu Thr Leu Ala Gln Val Val Ala Ile Ala Ser Asn Ile
            900                 905                 910


Gly Gly Lys Gln Ala Leu Glu Thr Val Gln Arg Leu Leu Pro Val Leu
```

```
        915                 920                 925

Cys Gln Ala His Gly Leu Thr Gln Asp Gln Val Val Ala Ile Ala Ser
    930                 935                 940

Asn Ile Gly Gly Lys Gln Ala Leu Glu Thr Val Gln Arg Leu Leu Pro
945                 950                 955                 960

Val Leu Cys Gln Asp His Gly Leu Thr Pro Asp Gln Val Val Ala Ile
                965                 970                 975

Ala Ser Asn Ile Gly Gly Lys Gln Ala Leu Glu Thr Val Gln Arg Leu
            980                 985                 990

Leu Pro Val Leu Cys Gln Asp His  Gly Leu Thr Leu Asp  Gln Val Val
        995                 1000                1005

Ala Ile  Ala Ser Asn Gly Gly  Lys Gln Ala Leu Glu  Thr Val Gln
    1010                1015                1020

Arg Leu  Leu Pro Val Leu Cys  Gln Asp His Gly Leu  Thr Pro Asp
    1025                1030                1035

Gln Val  Val Ala Ile Ala Ser  Asn Ser Gly Gly Lys  Gln Ala Leu
    1040                1045                1050

Glu Thr  Val Gln Arg Leu Leu  Pro Val Leu Cys Gln  Asp His Gly
    1055                1060                1065

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

Gln Ala  Leu Glu Ser Ile Val  Ala Gln Leu Ser Arg  Pro Asp Pro
    1085                1090                1095

Ala Leu  Ala Ala Leu Thr Asn  Asp His Leu Val Ala  Leu Ala Cys
    1100                1105                1110

Leu Gly  Gly Arg Pro Ala Met  Asp Ala Val Lys Lys  Gly Leu Pro
    1115                1120                1125
```

```
His Ala  Pro Glu Leu Ile Arg  Arg Val Asn Arg Arg  Ile Gly Glu
    1130                1135                1140

Arg Thr  Ser His Arg Val Ala  Asp Tyr Ala Gln Val  Val Arg Val
    1145                1150                1155

Leu Glu  Phe Phe Gln Cys His  Ser His Pro Ala Tyr  Ala Phe Asp
    1160                1165                1170

Glu Ala  Met Thr Gln Phe Gly  Met Ser Arg Asn Gly  Leu Val Gln
    1175                1180                1185

Leu Phe  Arg Arg Val Gly Val  Thr Glu Leu Glu Ala  Arg Gly Gly
    1190                1195                1200

Thr Leu  Pro Pro Ala Ser Gln  Arg Trp Asp Arg Ile  Leu Gln Ala
    1205                1210                1215

Ser Gly  Met Lys Arg Ala Lys  Pro Ser Pro Thr Ser  Ala Gln Thr
    1220                1225                1230

Pro Asp  Gln Ala Ser Leu His  Ala Phe Ala Asp Ser  Leu Glu Arg
    1235                1240                1245

Asp Leu  Asp Ala Pro Ser Pro  Met His Glu Gly Asp  Gln Thr Gly
    1250                1255                1260

Ala Ser  Ser Arg Lys Arg Ser  Arg Ser Asp Arg Ala  Val Thr Gly
    1265                1270                1275

Pro Ser  Ala Gln His Ser Phe  Glu Val Arg Val Pro  Glu Gln Arg
    1280                1285                1290

Asp Ala  Leu His Leu Pro Leu  Ser Trp Arg Val Lys  Arg Pro Arg
    1295                1300                1305

Thr Arg  Ile Gly Gly Gly Leu  Pro Asp Pro Gly Thr  Pro Ile Ala
    1310                1315                1320

Ala Asp  Leu Ala Ala Ser Ser  Thr Val Met Trp Glu  Gln Asp Ala
```

```
    1325                1330                1335

Ala Pro  Phe Ala Gly Ala Ala  Asp Asp Phe Pro Ala  Phe Asn Glu
    1340                1345                1350

Glu Glu  Leu Ala Trp Leu Met  Glu Leu Leu Pro Gln  Ser Gly Ser
    1355                1360                1365

Val Gly  Gly Thr Ile
    1370
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<210> 207
<211> 1978
<212> PRT
<213> Unknown

<220>
<223> ZNF638

<400> 207

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

Pro Arg Ala Pro Asn Pro Ser Gly Met Arg Pro Pro Gly Pro Phe Met
            20                  25                  30

Arg Pro Gly Ser Met Gly Leu Pro Arg Phe Tyr Pro Ala Gly Arg Ala
        35                  40                  45

Arg Gly Ile Pro His Arg Phe Ala Gly His Glu Ser Tyr Gln Asn Met
    50                  55                  60

Gly Pro Gln Arg Met Asn Val Gln Val Thr Gln His Arg Thr Asp Pro
65                  70                  75                  80

Arg Leu Thr Lys Glu Lys Leu Asp Phe His Glu Ala Gln Gln Lys Lys
                85                  90                  95

Gly Lys Pro His Gly Ser Arg Trp Asp Asp Glu Pro His Ile Ser Ala
            100                 105                 110

Ser Val Ala Val Lys Gln Ser Ser Val Thr Gln Val Thr Glu Gln Ser
```

```
        115                 120                 125

Pro Lys Val Gln Ser Arg Tyr Thr Lys Glu Ser Ala Ser Ser Ile Leu
    130                 135                 140

Ala Ser Phe Gly Leu Ser Asn Glu Asp Leu Glu Glu Leu Ser Arg Tyr
145                 150                 155                 160

Pro Asp Glu Gln Leu Thr Pro Glu Asn Met Pro Leu Ile Leu Arg Asp
                165                 170                 175

Ile Arg Met Arg Lys Met Gly Arg Arg Leu Pro Asn Leu Pro Ser Gln
            180                 185                 190

Ser Arg Asn Lys Glu Thr Leu Gly Ser Glu Ala Val Ser Ser Asn Val
        195                 200                 205

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

Glu Val Arg Ile Tyr Asp Pro Glu Ile Pro Thr Asp Glu Val Glu Asn
225                 230                 235                 240

Glu Phe Gln Ser Gln Gln Asn Ile Ser Ala Ser Val Pro Asn Pro Asn
                245                 250                 255

Val Ile Cys Asn Ser Met Phe Pro Val Glu Asp Val Phe Arg Gln Met
            260                 265                 270

Asp Phe Pro Gly Glu Ser Ser Asn Asn Arg Ser Phe Phe Ser Val Glu
        275                 280                 285

Ser Gly Thr Lys Met Ser Gly Leu His Ile Ser Gly Gly Gln Ser Val
    290                 295                 300

Leu Glu Pro Ile Lys Ser Val Asn Gln Ser Ile Asn Gln Thr Val Ser
305                 310                 315                 320

Gln Thr Met Ser Gln Ser Leu Ile Pro Pro Ser Met Asn Gln Gln Pro
                325                 330                 335
```

```
Phe Ser Ser Glu Leu Ile Ser Ser Val Ser Gln Gln Glu Arg Ile Pro
            340                 345                 350

His Glu Pro Val Ile Asn Ser Ser Asn Val His Val Gly Ser Arg Gly
        355                 360                 365

Ser Lys Lys Asn Tyr Gln Ser Gln Ala Asp Ile Pro Ile Arg Ser Pro
    370                 375                 380

Phe Gly Ile Val Lys Ala Ser Trp Leu Pro Lys Phe Ser His Ala Asp
385                 390                 395                 400

Ala Gln Lys Met Lys Arg Leu Pro Thr Pro Ser Met Met Asn Asp Tyr
                405                 410                 415

Tyr Ala Ala Ser Pro Arg Ile Phe Pro His Leu Cys Ser Leu Cys Asn
            420                 425                 430

Val Glu Cys Ser His Leu Lys Asp Trp Ile Gln His Gln Asn Thr Ser
        435                 440                 445

Thr His Ile Glu Ser Cys Arg Gln Leu Arg Gln Gln Tyr Pro Asp Trp
    450                 455                 460

Asn Pro Glu Ile Leu Pro Ser Arg Arg Asn Glu Gly Asn Arg Lys Glu
465                 470                 475                 480

Asn Glu Thr Pro Arg Arg Arg Ser His Ser Pro Ser Pro Arg Arg Ser
                485                 490                 495

Arg Arg Ser Ser Ser Ser His Arg Phe Arg Arg Ser Arg Ser Pro Met
            500                 505                 510

His Tyr Met Tyr Arg Pro Arg Ser Arg Ser Pro Arg Ile Cys His Arg
        515                 520                 525

Phe Ile Ser Arg Tyr Arg Ser Arg Ser Arg Ser Arg Ser Pro Tyr Arg
    530                 535                 540

Ile Arg Asn Pro Phe Arg Gly Ser Pro Lys Cys Phe Arg Ser Val Ser
```

```
545                 550                 555                 560

Pro Glu Arg Met Ser Arg Arg Ser Val Arg Ser Ser Asp Arg Lys Lys
                565                 570                 575

Ala Leu Glu Asp Val Val Gln Arg Ser Gly His Gly Thr Glu Phe Asn
            580                 585                 590

Lys Gln Lys His Leu Glu Ala Ala Asp Lys Gly His Ser Pro Ala Gln
        595                 600                 605

Lys Pro Lys Thr Ser Ser Gly Thr Lys Pro Ser Val Lys Pro Thr Ser
    610                 615                 620

Ala Thr Lys Ser Asp Ser Asn Leu Gly Gly His Ser Ile Arg Cys Lys
625                 630                 635                 640

Ser Lys Asn Leu Glu Asp Asp Thr Leu Ser Glu Cys Lys Gln Val Ser
                645                 650                 655

Asp Lys Ala Val Ser Leu Gln Arg Lys Leu Arg Lys Glu Gln Ser Leu
            660                 665                 670

His Tyr Gly Ser Val Leu Leu Ile Thr Glu Leu Pro Glu Asp Gly Cys
        675                 680                 685

Thr Glu Glu Asp Val Arg Lys Leu Phe Gln Pro Phe Gly Lys Val Asn
    690                 695                 700

Asp Val Leu Ile Val Pro Tyr Arg Lys Glu Ala Tyr Leu Glu Met Glu
705                 710                 715                 720

Phe Lys Glu Ala Ile Thr Ala Ile Met Lys Tyr Ile Glu Thr Thr Pro
                725                 730                 735

Leu Thr Ile Lys Gly Lys Ser Val Lys Ile Cys Val Pro Gly Lys Lys
            740                 745                 750

Lys Ala Gln Asn Lys Glu Val Lys Lys Lys Thr Leu Glu Ser Lys Lys
        755                 760                 765
```

```
Val Ser Ala Ser Thr Leu Lys Arg Asp Ala Asp Ala Ser Lys Ala Val
    770                 775                 780

Glu Ile Val Thr Ser Thr Ser Ala Ala Lys Thr Gly Gln Ala Lys Ala
785                 790                 795                 800

Ser Val Ala Lys Val Asn Lys Ser Thr Gly Lys Ser Ala Ser Ser Val
                805                 810                 815

Lys Ser Val Val Thr Val Ala Val Lys Gly Asn Lys Ala Ser Ile Lys
            820                 825                 830

Thr Ala Lys Ser Gly Gly Lys Lys Ser Leu Glu Ala Lys Lys Thr Gly
        835                 840                 845

Asn Val Lys Asn Lys Asp Ser Asn Lys Pro Val Thr Ile Pro Glu Asn
    850                 855                 860

Ser Glu Ile Lys Thr Ser Ile Glu Val Lys Ala Thr Glu Asn Cys Ala
865                 870                 875                 880

Lys Glu Ala Ile Ser Asp Ala Ala Leu Glu Ala Thr Glu Asn Glu Pro
                885                 890                 895

Leu Asn Lys Glu Thr Glu Glu Met Cys Val Met Leu Val Ser Asn Leu
            900                 905                 910

Pro Asn Lys Gly Tyr Ser Val Glu Glu Val Tyr Asp Leu Ala Lys Pro
        915                 920                 925

Phe Gly Gly Leu Lys Asp Ile Leu Ile Leu Ser Ser His Lys Lys Ala
    930                 935                 940

Tyr Ile Glu Ile Asn Arg Lys Ala Ala Glu Ser Met Val Lys Phe Tyr
945                 950                 955                 960

Thr Cys Phe Pro Val Leu Met Asp Gly Asn Gln Leu Ser Ile Ser Met
                965                 970                 975

Ala Pro Glu Asn Met Asn Ile Lys Asp Glu Glu Ala Ile Phe Ile Thr
```

```
           980                 985                 990

Leu Val Lys Glu Asn Asp Pro Glu  Ala Asn Ile Asp Thr  Ile Tyr Asp
        995                 1000                1005

Arg Phe  Val His Leu Asp Asn  Leu Pro Glu Asp Gly  Leu Gln Cys
    1010                1015                1020

Val Leu  Cys Val Gly Leu Gln  Phe Gly Lys Val Asp  His His Val
    1025                1030                1035

Phe Ile  Ser Asn Arg Asn Lys  Ala Ile Leu Gln Leu  Asp Ser Pro
    1040                1045                1050

Glu Ser  Ala Gln Ser Met Tyr  Ser Phe Leu Lys Gln  Asn Pro Gln
    1055                1060                1065

Asn Ile  Gly Asp His Met Leu  Thr Cys Ser Leu Ser  Pro Lys Ile
    1070                1075                1080

Asp Leu  Pro Glu Val Gln Ile  Glu His Asp Pro Glu  Leu Glu Lys
    1085                1090                1095

Glu Ser  Pro Gly Leu Lys Asn  Ser Pro Ile Asp Glu  Ser Glu Val
    1100                1105                1110

Gln Thr  Ala Thr Asp Ser Pro  Ser Val Lys Pro Asn  Glu Leu Glu
    1115                1120                1125

Glu Glu  Ser Thr Pro Ser Ile  Gln Thr Glu Thr Leu  Val Gln Gln
    1130                1135                1140

Glu Glu  Pro Cys Glu Glu Glu  Ala Glu Lys Ala Thr  Cys Asp Ser
    1145                1150                1155

Asp Phe  Ala Val Glu Thr Leu  Glu Leu Glu Thr Gln  Gly Glu Glu
    1160                1165                1170

Val Lys  Glu Glu Ile Pro Leu  Val Ala Ser Ala Ser  Val Ser Ile
    1175                1180                1185
```

```
Glu Gln  Phe Thr Glu Asn Ala  Glu Glu Cys Ala Leu  Asn Gln Gln
    1190                1195                1200

Met Phe  Asn Ser Asp Leu Glu  Lys Lys Gly Ala Glu  Ile Ile Asn
    1205                1210                1215

Pro Lys  Thr Ala Leu Leu Pro  Ser Asp Ser Val Phe  Ala Glu Glu
    1220                1225                1230

Arg Asn  Leu Lys Gly Ile Leu  Glu Glu Ser Pro Ser  Glu Ala Glu
    1235                1240                1245

Asp Phe  Ile Ser Gly Ile Thr  Gln Thr Met Val Glu  Ala Val Ala
    1250                1255                1260

Glu Val  Glu Lys Asn Glu Thr  Val Ser Glu Ile Leu  Pro Ser Thr
    1265                1270                1275

Cys Ile  Val Thr Leu Val Pro  Gly Ile Pro Thr Gly  Asp Glu Lys
    1280                1285                1290

Thr Val  Asp Lys Lys Asn Ile  Ser Glu Lys Lys Gly  Asn Met Asp
    1295                1300                1305

Glu Lys  Glu Glu Lys Glu Phe  Asn Thr Lys Glu Thr  Arg Met Asp
    1310                1315                1320

Leu Gln  Ile Gly Thr Glu Lys  Ala Glu Lys Asn Glu  Gly Arg Met
    1325                1330                1335

Asp Ala  Glu Lys Val Glu Lys  Met Ala Ala Met Lys  Glu Lys Pro
    1340                1345                1350

Ala Glu  Asn Thr Leu Phe Lys  Ala Tyr Pro Asn Lys  Gly Val Gly
    1355                1360                1365

Gln Ala  Asn Lys Pro Asp Glu  Thr Ser Lys Thr Ser  Ile Leu Ala
    1370                1375                1380

Val Ser  Asp Val Ser Ser Ser  Lys Pro Ser Ile Lys  Ala Val Ile
```

```
    1385                1390                1395

Val Ser  Ser Pro Lys Ala Lys  Ala Thr Val Ser Lys  Thr Glu Asn
    1400                1405                1410

Gln Lys  Ser Phe Pro Lys Ser  Val Pro Arg Asp Gln  Ile Asn Ala
    1415                1420                1425

Glu Lys  Lys Leu Ser Ala Lys  Glu Phe Gly Leu Leu  Lys Pro Thr
    1430                1435                1440

Ser Ala  Arg Ser Gly Leu Ala  Glu Ser Ser Ser Lys  Phe Lys Pro
    1445                1450                1455

Thr Gln  Ser Ser Leu Thr Arg  Gly Gly Ser Gly Arg  Ile Ser Ala
    1460                1465                1470

Leu Gln  Gly Lys Leu Ser Lys  Leu Asp Tyr Arg Asp  Ile Thr Lys
    1475                1480                1485

Gln Ser  Gln Glu Thr Glu Ala  Arg Pro Ser Ile Met  Lys Arg Asp
    1490                1495                1500

Asp Ser  Asn Asn Lys Thr Leu  Ala Glu Gln Asn Thr  Lys Asn Pro
    1505                1510                1515

Lys Ser  Thr Thr Gly Arg Ser  Ser Lys Ser Lys Glu  Glu Pro Leu
    1520                1525                1530

Phe Pro  Phe Asn Leu Asp Glu  Phe Val Thr Val Asp  Glu Val Ile
    1535                1540                1545

Glu Glu  Val Asn Pro Ser Gln  Ala Lys Gln Asn Pro  Leu Lys Gly
    1550                1555                1560

Lys Arg  Lys Glu Thr Leu Lys  Asn Val Pro Phe Ser  Glu Leu Asn
    1565                1570                1575

Leu Lys  Lys Lys Lys Gly Lys  Thr Ser Thr Pro Arg  Gly Val Glu
    1580                1585                1590
```

```
Gly Glu  Leu Ser Phe Val Thr  Leu Asp Glu Ile Gly  Glu Glu Glu
    1595                 1600                 1605

Asp Ala  Ala Ala His Leu Ala  Gln Ala Leu Val Thr  Val Asp Glu
    1610                 1615                 1620

Val Ile  Asp Glu Glu Glu Leu  Asn Met Glu Glu Met  Val Lys Asn
    1625                 1630                 1635

Ser Asn  Ser Leu Phe Thr Leu  Asp Glu Leu Ile Asp  Gln Asp Asp
    1640                 1645                 1650

Cys Ile  Ser His Ser Glu Pro  Lys Asp Val Thr Val  Leu Ser Val
    1655                 1660                 1665

Ala Glu  Glu Gln Asp Leu Leu  Lys Gln Glu Arg Leu  Val Thr Val
    1670                 1675                 1680

Asp Glu  Ile Gly Glu Val Glu  Glu Leu Pro Leu Asn  Glu Ser Ala
    1685                 1690                 1695

Asp Ile  Thr Phe Ala Thr Leu  Asn Thr Lys Gly Asn  Glu Gly Asp
    1700                 1705                 1710

Thr Val  Arg Asp Ser Ile Gly  Phe Ile Ser Ser Gln  Val Pro Glu
    1715                 1720                 1725

Asp Pro  Ser Thr Leu Val Thr  Val Asp Glu Ile Gln  Asp Asp Ser
    1730                 1735                 1740

Ser Asp  Leu His Leu Val Thr  Leu Asp Glu Val Thr  Glu Glu Asp
    1745                 1750                 1755

Glu Asp  Ser Leu Ala Asp Phe  Asn Asn Leu Lys Glu  Glu Leu Asn
    1760                 1765                 1770

Phe Val  Thr Val Asp Glu Val  Gly Glu Glu Glu Asp  Gly Asp Asn
    1775                 1780                 1785

Asp Leu  Lys Val Glu Leu Ala  Gln Ser Lys Asn Asp  His Pro Thr
```

```
    1790                1795                1800

Asp Lys  Lys Gly Asn Arg Lys  Lys Arg Ala Val Asp  Thr Lys Lys
    1805                1810                1815

Thr Lys  Leu Glu Ser Leu Ser  Gln Val Gly Pro Val  Asn Glu Asn
    1820                1825                1830

Val Met  Glu Glu Asp Leu Lys  Thr Met Ile Glu Arg  His Leu Thr
    1835                1840                1845

Ala Lys  Thr Pro Thr Lys Arg  Val Arg Ile Gly Lys  Thr Leu Pro
    1850                1855                1860

Ser Glu  Lys Ala Val Val Thr  Glu Pro Ala Lys Gly  Glu Glu Ala
    1865                1870                1875

Phe Gln  Met Ser Glu Val Asp  Glu Glu Ser Gly Leu  Lys Asp Ser
    1880                1885                1890

Glu Pro  Glu Arg Lys Arg Lys  Lys Thr Glu Asp Ser  Ser Ser Gly
    1895                1900                1905

Lys Ser  Val Ala Ser Asp Val  Pro Glu Glu Leu Asp  Phe Leu Val
    1910                1915                1920

Pro Lys  Ala Gly Phe Phe Cys  Pro Ile Cys Ser Leu  Phe Tyr Ser
    1925                1930                1935

Gly Glu  Lys Ala Met Thr Asn  His Cys Lys Ser Thr  Arg His Lys
    1940                1945                1950

Gln Asn  Thr Glu Lys Phe Met  Ala Lys Gln Arg Lys  Glu Lys Glu
    1955                1960                1965

Gln Asn  Glu Ala Glu Glu Arg  Ser Ser Arg
    1970                1975

<210>  208
<211>  128
<212>  PRT
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<213> Artificial Sequence

<220>
<223> Rnase1 (R39D, N67D, N88A, G89D, R91D, H119N, K41R, D121E)

<400> 208

Lys Glu Ser Arg Ala Lys Lys Phe Gln Arg Gln His Met Asp Ser Asp
1   5   10   15

Ser Ser Pro Ser Ser Ser Ser Thr Tyr Cys Asn Gln Met Met Arg Arg
            20   25   30

Arg Asn Met Thr Gln Gly Asp Cys Arg Pro Val Asn Thr Phe Val His
        35   40   45

Glu Pro Leu Val Asp Val Gln Asn Val Cys Phe Gln Glu Lys Val Thr
    50   55   60

Cys Lys Asp Gly Gln Gly Asn Cys Tyr Lys Ser Asn Ser Ser Met His
65   70   75   80

Ile Thr Asp Cys Arg Leu Thr Ala Asp Ser Asp Tyr Pro Asn Cys Ala
                85   90   95

Tyr Arg Thr Ser Pro Lys Glu Arg His Ile Ile Val Ala Cys Glu Gly
            100   105   110

Ser Pro Tyr Val Pro Val Asn Phe Glu Ala Ser Val Glu Asp Ser Thr
        115   120   125

<210> 209
<211> 1091
<212> PRT
<213> Unknown

<220>
<223> PUMBY

<400> 209

Met Asp Lys Ser Lys Gln Met Asn Ile Asn Asn Leu Ser Asn Ile Pro
1   5   10   15

Glu Val Ile Asp Pro Gly Ile Thr Ile Pro Ile Tyr Glu Glu Glu Tyr

```
            20                  25                  30

Glu Asn Asn Gly Glu Ser Asn Ser Gln Leu Gln Gln Pro Gln Lys
        35                  40                  45

Leu Gly Ser Tyr Arg Ser Arg Ala Gly Lys Phe Ser Asn Thr Leu Ser
    50                  55                  60

Asn Leu Leu Pro Ser Ile Ser Ala Lys Leu His His Ser Lys Lys Asn
65                  70                  75                  80

Ser His Gly Lys Asn Gly Ala Glu Phe Ser Ser Ser Asn Asn Ser Ser
                85                  90                  95

Gln Ser Thr Val Ala Ser Lys Thr Pro Arg Ala Ser Pro Ser Arg Ser
            100                 105                 110

Lys Met Met Glu Ser Ser Ile Asp Gly Val Thr Met Asp Arg Pro Gly
        115                 120                 125

Ser Leu Thr Pro Pro Gln Asp Met Glu Lys Leu Val His Phe Pro Asp
    130                 135                 140

Ser Ser Asn Asn Phe Leu Ile Pro Ala Pro Arg Gly Ser Ser Asp Ser
145                 150                 155                 160

Phe Asn Leu Pro His Gln Ile Ser Arg Thr Arg Asn Asn Thr Met Ser
                165                 170                 175

Ser Gln Ile Thr Ser Ile Ser Ser Ile Ala Pro Lys Pro Arg Thr Ser
            180                 185                 190

Ser Gly Ile Trp Ser Ser Asn Ala Ser Ala Asn Asp Pro Met Gln Gln
        195                 200                 205

His Leu Leu Gln Gln Leu Gln Pro Thr Thr Ser Asn Asn Thr Thr Asn
    210                 215                 220

Ser Asn Thr Leu Asn Asp Tyr Ser Thr Lys Thr Ala Tyr Phe Asp Asn
225                 230                 235                 240
```

```
Met Val Ser Thr Ser Gly Ser Gln Met Ala Asp Asn Lys Met Asn Thr
                245                 250                 255

Asn Asn Leu Ala Ile Pro Asn Ser Val Trp Ser Asn Thr Arg Gln Arg
            260                 265                 270

Ser Gln Ser Asn Ala Ser Ser Ile Tyr Thr Asp Ala Pro Leu Tyr Glu
        275                 280                 285

Gln Pro Ala Arg Ala Ser Ile Ser Ser His Tyr Thr Ile Pro Thr Gln
    290                 295                 300

Glu Ser Pro Leu Ile Ala Asp Glu Ile Asp Pro Gln Ser Ile Asn Trp
305                 310                 315                 320

Val Thr Met Asp Pro Thr Val Pro Ser Ile Asn Gln Ile Ser Asn Leu
                325                 330                 335

Leu Pro Thr Asn Thr Ile Ser Ile Ser Asn Val Phe Pro Leu Gln His
            340                 345                 350

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

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

Arg Asn Leu Asn Met Ala Leu Val Glu Phe Ser Ser Val Glu Ser Ala
385                 390                 395                 400

Val Lys Ala Leu Asp Ser Leu Gln Gly Lys Glu Val Ser Met Ile Gly
                405                 410                 415

Ala Pro Ser Lys Ile Ser Phe Ala Lys Ile Leu Pro Met His Gln Gln
            420                 425                 430

Pro Pro Gln Phe Leu Leu Asn Ser Gln Gly Leu Pro Leu Gly Leu Glu
        435                 440                 445

Asn Asn Asn Leu Gln Pro Gln Pro Leu Leu Gln Glu Gln Leu Phe Asn
```

```
    450                 455                 460

Gly Ala Val Thr Phe Gln Gln Gln Gly Asn Val Ser Ile Pro Val Phe
465                 470                 475                 480

Asn Gln Gln Ser Gln Gln Ser Gln His Gln Asn His Ser Ser Gly Ser
                485                 490                 495

Ala Gly Phe Ser Asn Val Leu His Gly Tyr Asn Asn Asn Asn Ser Met
            500                 505                 510

His Gly Asn Asn Asn Asn Ser Ala Asn Glu Lys Glu Gln Cys Pro Phe
        515                 520                 525

Pro Leu Pro Pro Pro Asn Val Asn Glu Lys Glu Asp Leu Leu Arg Glu
    530                 535                 540

Ile Ile Glu Leu Phe Glu Ala Asn Ser Asp Glu Tyr Gln Ile Asn Ser
545                 550                 555                 560

Leu Ile Lys Lys Ser Leu Asn His Lys Gly Thr Ser Asp Thr Gln Asn
                565                 570                 575

Phe Gly Pro Leu Pro Glu Pro Leu Ser Gly Arg Glu Phe Asp Pro Pro
            580                 585                 590

Lys Leu Arg Glu Leu Arg Lys Ser Ile Asp Ser Asn Ala Phe Ser Asp
        595                 600                 605

Leu Glu Ile Glu Gln Leu Ala Ile Ala Met Leu Asp Glu Leu Pro Glu
    610                 615                 620

Leu Ser Ser Asp Tyr Leu Gly Asn Thr Ile Val Gln Lys Leu Phe Glu
625                 630                 635                 640

His Ser Ser Asp Ile Ile Lys Asp Ile Met Leu Arg Lys Thr Ser Lys
                645                 650                 655

Tyr Leu Thr Ser Met Gly Val His Lys Asn Gly Thr Trp Ala Cys Gln
            660                 665                 670
```

```
Lys Met Ile Thr Met Ala His Thr Pro Arg Gln Ile Met Gln Val Thr
        675                 680                 685

Gln Gly Val Lys Asp Tyr Cys Thr Pro Leu Ile Asn Asp Gln Phe Gly
    690                 695                 700

Asn Tyr Val Ile Gln Cys Val Leu Lys Phe Gly Phe Pro Trp Asn Gln
705                 710                 715                 720

Phe Ile Phe Glu Ser Ile Ile Ala Asn Phe Trp Val Ile Val Gln Asn
                725                 730                 735

Arg Tyr Gly Ala Arg Ala Val Arg Ala Cys Leu Glu Ala His Asp Ile
            740                 745                 750

Val Thr Pro Glu Gln Ser Ile Val Leu Ser Ala Met Ile Val Thr Tyr
        755                 760                 765

Ala Glu Tyr Leu Ser Thr Asn Ser Asn Gly Ala Leu Leu Val Thr Trp
    770                 775                 780

Phe Leu Asp Thr Ser Val Leu Pro Asn Arg His Ser Ile Leu Ala Pro
785                 790                 795                 800

Arg Leu Thr Lys Arg Ile Val Glu Leu Cys Gly His Arg Leu Ala Ser
                805                 810                 815

Leu Thr Ile Leu Lys Val Leu Asn Tyr Arg Gly Asp Asp Asn Ala Arg
            820                 825                 830

Lys Ile Ile Leu Asp Ser Leu Phe Gly Asn Val Asn Ala His Asp Ser
        835                 840                 845

Ser Pro Pro Lys Glu Leu Thr Lys Leu Leu Cys Glu Thr Asn Tyr Gly
    850                 855                 860

Pro Thr Phe Val His Lys Val Leu Ala Met Pro Leu Leu Glu Asp Asp
865                 870                 875                 880

Leu Arg Ala His Ile Ile Lys Gln Val Arg Lys Val Leu Thr Asp Ser
```

```
               885                 890                 895

Thr Gln Ile Gln Pro Ser Arg Arg Leu Leu Glu Glu Val Gly Leu Ala
            900                 905                 910

Ser Pro Ser Ser Thr His Asn Lys Thr Lys Gln Gln Gln Gln Gln His
        915                 920                 925

His Asn Ser Ser Ile Ser His Met Phe Ala Thr Pro Asp Thr Ser Gly
    930                 935                 940

Gln His Met Arg Gly Leu Ser Val Ser Ser Val Lys Ser Gly Gly Ser
945                 950                 955                 960

Lys His Thr Thr Met Asn Thr Thr Thr Thr Asn Gly Ser Ser Ala Ser
               965                 970                 975

Thr Leu Ser Pro Gly Gln Pro Leu Asn Ala Asn Ser Asn Ser Ser Met
            980                 985                 990

Gly Tyr Phe Ser Tyr Pro Gly Val  Phe Pro Val Ser Gly  Phe Ser Gly
        995                 1000                1005

Asn Ala  Ser Asn Gly Tyr Ala  Met Asn Asn Asp Asp  Leu Ser Ser
    1010                1015                1020

Gln Phe  Asp Met Leu Asn Phe  Asn Asn Gly Thr Arg  Leu Ser Leu
    1025                1030                1035

Pro Gln  Leu Ser Leu Thr Asn  His Asn Asn Thr Thr  Met Glu Leu
    1040                1045                1050

Val Asn  Asn Val Gly Ser Ser  Gln Pro His Thr Asn  Asn Asn Asn
    1055                1060                1065

Asn Asn  Asn Asn Thr Asn Tyr  Asn Asp Asp Asn Thr  Val Phe Glu
    1070                1075                1080

Thr Leu  Thr Leu His Ser Ala  Asn
    1085                1090
```

<210> 210
<211> 879
<212> PRT
<213> Unknown

<220>
<223> PUF3

<400> 210

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Met Glu Met Asn Met Asp Met Asp Met Asp Met Glu Leu Ala Ser Ile
1               5                   10                  15


Val Ser Ser Leu Ser Ala Leu Ser His Ser Asn Asn Asn Gly Gly Gln
            20                  25                  30


Ala Ala Ala Ala Gly Ile Val Asn Gly Gly Ala Ala Gly Ser Gln Gln
        35                  40                  45


Ile Gly Gly Phe Arg Arg Ser Ser Phe Thr Thr Ala Asn Glu Val Asp
    50                  55                  60


Ser Glu Ile Leu Leu Leu His Gly Ser Ser Glu Ser Ser Pro Ile Phe
65                  70                  75                  80


Lys Lys Thr Ala Leu Ser Val Gly Thr Ala Pro Pro Phe Ser Thr Asn
                85                  90                  95


Ser Lys Lys Phe Phe Gly Asn Gly Gly Asn Tyr Tyr Gln Tyr Arg Ser
            100                 105                 110


Thr Asp Thr Ala Ser Leu Ser Ser Ala Ser Tyr Asn Asn Tyr His Thr
        115                 120                 125


His His Thr Ala Ala Asn Leu Gly Lys Asn Asn Lys Val Asn His Leu
    130                 135                 140


Leu Gly Gln Tyr Ser Ala Ser Ile Ala Gly Pro Val Tyr Tyr Asn Gly
145                 150                 155                 160


Asn Asp Asn Asn Asn Ser Gly Gly Glu Gly Phe Phe Glu Lys Phe Gly
                165                 170                 175
```

```
Lys Ser Leu Ile Asp Gly Thr Arg Glu Leu Glu Ser Gln Asp Arg Pro
            180                 185                 190

Asp Ala Val Asn Thr Gln Ser Gln Phe Ile Ser Lys Ser Val Ser Asn
        195                 200                 205

Ala Ser Leu Asp Thr Gln Asn Thr Phe Glu Gln Asn Val Glu Ser Asp
    210                 215                 220

Lys Asn Phe Asn Lys Leu Asn Arg Asn Thr Thr Asn Ser Gly Ser Leu
225                 230                 235                 240

Tyr His Ser Ser Ser Asn Ser Gly Ser Ser Ala Ser Leu Glu Ser Glu
                245                 250                 255

Asn Ala His Tyr Pro Lys Arg Asn Ile Trp Asn Val Ala Asn Thr Pro
            260                 265                 270

Val Phe Arg Pro Ser Asn Asn Pro Ala Ala Val Gly Ala Thr Asn Val
        275                 280                 285

Ala Leu Pro Asn Gln Gln Asp Gly Pro Ala Asn Asn Asn Phe Pro Pro
    290                 295                 300

Tyr Met Asn Gly Phe Pro Pro Asn Gln Phe His Gln Gly Pro His Tyr
305                 310                 315                 320

Gln Asn Phe Pro Asn Tyr Leu Ile Gly Ser Pro Ser Asn Phe Ile Ser
                325                 330                 335

Gln Met Ile Ser Val Gln Ile Pro Ala Asn Glu Asp Thr Glu Asp Ser
            340                 345                 350

Asn Gly Lys Lys Lys Lys Lys Ala Asn Arg Pro Ser Ser Val Ser Ser
        355                 360                 365

Pro Ser Ser Pro Pro Asn Asn Ser Pro Phe Pro Phe Ala Tyr Pro Asn
    370                 375                 380

Pro Met Met Phe Met Pro Pro Pro Pro Leu Ser Ala Pro Gln Gln Gln
```

```
385                 390                 395                 400

Gln Gln Gln Gln Gln Gln Gln Gln Gln Glu Asp Gln Gln Gln Gln Gln
                405                 410                 415

Gln Gln Glu Asn Pro Tyr Ile Tyr Tyr Pro Thr Pro Asn Pro Ile Pro
            420                 425                 430

Val Lys Met Pro Lys Asp Glu Lys Thr Phe Lys Lys Arg Asn Asn Lys
        435                 440                 445

Asn His Pro Ala Asn Asn Ser Asn Asn Ala Asn Lys Gln Ala Asn Pro
    450                 455                 460

Tyr Leu Glu Asn Ser Ile Pro Thr Lys Asn Thr Ser Lys Lys Asn Ala
465                 470                 475                 480

Ser Ser Lys Ser Asn Glu Ser Thr Ala Asn Asn His Lys Ser His Ser
                485                 490                 495

His Ser His Pro His Ser Gln Ser Leu Gln Gln Gln Gln Gln Thr Tyr
            500                 505                 510

His Arg Ser Pro Leu Leu Glu Gln Leu Arg Asn Ser Ser Ser Asp Lys
        515                 520                 525

Asn Ser Asn Ser Asn Met Ser Leu Lys Asp Ile Phe Gly His Ser Leu
    530                 535                 540

Glu Phe Cys Lys Asp Gln His Gly Ser Arg Phe Ile Gln Arg Glu Leu
545                 550                 555                 560

Ala Thr Ser Pro Ala Ser Glu Lys Glu Val Ile Phe Asn Glu Ile Arg
                565                 570                 575

Asp Asp Ala Ile Glu Leu Ser Asn Asp Val Phe Gly Asn Tyr Val Ile
            580                 585                 590

Gln Lys Phe Phe Glu Phe Gly Ser Lys Ile Gln Lys Asn Thr Leu Val
        595                 600                 605
```

```
Asp Gln Phe Lys Gly Asn Met Lys Gln Leu Ser Leu Gln Met Tyr Ala
    610                 615                 620

Cys Arg Val Ile Gln Lys Ala Leu Glu Tyr Ile Asp Ser Asn Gln Arg
625                 630                 635                 640

Ile Glu Leu Val Leu Glu Leu Ser Asp Ser Val Leu Gln Met Ile Lys
                645                 650                 655

Asp Gln Asn Gly Asn His Val Ile Gln Lys Ala Ile Glu Thr Ile Pro
            660                 665                 670

Ile Glu Lys Leu Pro Phe Ile Leu Ser Ser Leu Thr Gly His Ile Tyr
        675                 680                 685

His Leu Ser Thr His Ser Tyr Gly Cys Arg Val Ile Gln Arg Leu Leu
    690                 695                 700

Glu Phe Gly Ser Ser Glu Asp Gln Glu Ser Ile Leu Asn Glu Leu Lys
705                 710                 715                 720

Asp Phe Ile Pro Tyr Leu Ile Gln Asp Gln Tyr Gly Asn Tyr Val Ile
                725                 730                 735

Gln Tyr Val Leu Gln Gln Asp Gln Phe Thr Asn Lys Glu Met Val Asp
            740                 745                 750

Ile Lys Gln Glu Ile Ile Glu Thr Val Ala Asn Asn Val Val Glu Tyr
        755                 760                 765

Ser Lys His Lys Phe Ala Ser Asn Val Val Glu Lys Ser Ile Leu Tyr
    770                 775                 780

Gly Ser Lys Asn Gln Lys Asp Leu Ile Ile Ser Lys Ile Leu Pro Arg
785                 790                 795                 800

Asp Lys Asn His Ala Leu Asn Leu Glu Asp Asp Ser Pro Met Ile Leu
                805                 810                 815

Met Ile Lys Asp Gln Phe Ala Asn Tyr Val Ile Gln Lys Leu Val Asn
```

820 825 830

Val Ser Glu Gly Glu Gly Lys Lys Leu Ile Val Ile Ala Ile Arg Ala
835 840 845

Tyr Leu Asp Lys Leu Asn Lys Ser Asn Ser Leu Gly Asn Arg His Leu
850 855 860

Ala Ser Val Glu Lys Leu Ala Ala Leu Val Glu Asn Ala Glu Val
865 870 875

<210> 211
<211> 888
<212> PRT
<213> Unknown

<220>
<223> PUF4

<400> 211

Met Ser Thr Lys Gly Leu Lys Glu Glu Ile Asp Asp Val Pro Ser Val
1 5 10 15

Asp Pro Val Val Ser Glu Thr Val Asn Ser Ala Leu Glu Gln Leu Gln
20 25 30

Leu Asp Asp Pro Glu Glu Asn Ala Thr Ser Asn Ala Phe Ala Asn Lys
35 40 45

Val Ser Gln Asp Ser Gln Phe Ala Asn Gly Pro Pro Ser Gln Met Phe
50 55 60

Pro His Pro Gln Met Met Gly Gly Met Gly Phe Met Pro Tyr Ser Gln
65 70 75 80

Met Met Gln Val Pro His Asn Pro Cys Pro Phe Phe Pro Pro Pro Asp
85 90 95

Phe Asn Asp Pro Thr Ala Pro Leu Ser Ser Ser Pro Leu Asn Ala Gly
100 105 110

Gly Pro Pro Met Leu Phe Lys Asn Asp Ser Leu Pro Phe Gln Met Leu

```
        115                 120                 125

Ser Ser Gly Ala Ala Val Ala Thr Gln Gly Gly Gln Asn Leu Asn Pro
    130                 135                 140

Leu Ile Asn Asp Asn Ser Met Lys Val Leu Pro Ile Ala Ser Ala Asp
145                 150                 155                 160

Pro Leu Trp Thr His Ser Asn Val Pro Gly Ser Ala Ser Val Ala Ile
                165                 170                 175

Glu Glu Thr Thr Ala Thr Leu Gln Glu Ser Leu Pro Ser Lys Gly Arg
            180                 185                 190

Glu Ser Asn Asn Lys Ala Ser Ser Phe Arg Arg Gln Thr Phe His Ala
        195                 200                 205

Leu Ser Pro Thr Asp Leu Ile Asn Ala Ala Asn Asn Val Thr Leu Ser
    210                 215                 220

Lys Asp Phe Gln Ser Asp Met Gln Asn Phe Ser Lys Ala Lys Lys Pro
225                 230                 235                 240

Ser Val Gly Ala Asn Asn Thr Ala Lys Thr Arg Thr Gln Ser Ile Ser
                245                 250                 255

Phe Asp Asn Thr Pro Ser Ser Thr Ser Phe Ile Pro Pro Thr Asn Ser
            260                 265                 270

Val Ser Glu Lys Leu Ser Asp Phe Lys Ile Glu Thr Ser Lys Glu Asp
        275                 280                 285

Leu Ile Asn Lys Thr Ala Pro Ala Lys Lys Glu Ser Pro Thr Thr Tyr
    290                 295                 300

Gly Ala Ala Tyr Pro Tyr Gly Gly Pro Leu Leu Gln Pro Asn Pro Ile
305                 310                 315                 320

Met Pro Gly His Pro His Asn Ile Ser Ser Pro Ile Tyr Gly Ile Arg
                325                 330                 335
```

```
Ser Pro Phe Pro Asn Ser Tyr Glu Met Gly Ala Gln Phe Gln Pro Phe
            340                 345                 350

Ser Pro Ile Leu Asn Pro Thr Ser His Ser Leu Asn Ala Asn Ser Pro
        355                 360                 365

Ile Pro Leu Thr Gln Ser Pro Ile His Leu Ala Pro Val Leu Asn Pro
    370                 375                 380

Ser Ser Asn Ser Val Ala Phe Ser Asp Met Lys Asn Asp Gly Gly Lys
385                 390                 395                 400

Pro Thr Thr Asp Asn Asp Lys Ala Gly Pro Asn Val Arg Met Asp Leu
                405                 410                 415

Ile Asn Pro Asn Leu Gly Pro Ser Met Gln Pro Phe His Ile Leu Pro
            420                 425                 430

Pro Gln Gln Asn Thr Pro Pro Pro Pro Trp Leu Tyr Ser Thr Pro Pro
        435                 440                 445

Pro Phe Asn Ala Met Val Pro Pro His Leu Leu Ala Gln Asn His Met
    450                 455                 460

Pro Leu Met Asn Ser Ala Asn Asn Lys His His Gly Arg Asn Asn Asn
465                 470                 475                 480

Ser Met Ser Ser His Asn Asp Asn Asp Asn Ile Gly Asn Ser Asn Tyr
                485                 490                 495

Asn Asn Lys Asp Thr Gly Arg Ser Asn Val Gly Lys Met Lys Asn Met
            500                 505                 510

Lys Asn Ser Tyr His Gly Tyr Tyr Asn Asn Asn Asn Asn Asn Asn Asn
        515                 520                 525

Asn Asn Asn Asn Asn Asn Asn Ser Asn Ala Thr Asn Ser Asn Ser Ala
    530                 535                 540

Glu Lys Gln Arg Lys Ile Glu Glu Ser Ser Arg Phe Ala Asp Ala Val
```

```
545                 550                 555                 560

Leu Asp Gln Tyr Ile Gly Ser Ile His Ser Leu Cys Lys Asp Gln His
                565                 570                 575

Gly Cys Arg Phe Leu Gln Lys Gln Leu Asp Ile Leu Gly Ser Lys Ala
            580                 585                 590

Ala Asp Ala Ile Phe Glu Glu Thr Lys Asp Tyr Thr Val Glu Leu Met
        595                 600                 605

Thr Asp Ser Phe Gly Asn Tyr Leu Ile Gln Lys Leu Leu Glu Glu Val
    610                 615                 620

Thr Thr Glu Gln Arg Ile Val Leu Thr Lys Ile Ser Ser Pro His Phe
625                 630                 635                 640

Val Glu Ile Ser Leu Asn Pro His Gly Thr Arg Ala Leu Gln Lys Leu
                645                 650                 655

Ile Glu Cys Ile Lys Thr Asp Glu Glu Ala Gln Ile Val Val Asp Ser
            660                 665                 670

Leu Arg Pro Tyr Thr Val Gln Leu Ser Lys Asp Leu Asn Gly Asn His
        675                 680                 685

Val Ile Gln Lys Cys Leu Gln Arg Leu Lys Pro Glu Asn Phe Gln Phe
    690                 695                 700

Ile Phe Asp Ala Ile Ser Asp Ser Cys Ile Asp Ile Ala Thr His Arg
705                 710                 715                 720

His Gly Cys Cys Val Leu Gln Arg Cys Leu Asp His Gly Thr Thr Glu
                725                 730                 735

Gln Cys Asp Asn Leu Cys Asp Lys Leu Leu Ala Leu Val Asp Lys Leu
            740                 745                 750

Thr Leu Asp Pro Phe Gly Asn Tyr Val Val Gln Tyr Ile Ile Thr Lys
        755                 760                 765
```

```
Glu Ala Glu Lys Asn Lys Tyr Asp Tyr Thr His Lys Ile Val His Leu
    770                 775                 780

Leu Lys Pro Arg Ala Ile Glu Leu Ser Ile His Lys Phe Gly Ser Asn
785                 790                 795                 800

Val Ile Glu Lys Ile Leu Lys Thr Ala Ile Val Ser Glu Pro Met Ile
                805                 810                 815

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

Asn Asp Ser Tyr Gly Asn Tyr Val Leu Gln Thr Ala Leu Asp Ile Ser
        835                 840                 845

His Lys Gln Asn Asp Tyr Leu Tyr Lys Arg Leu Ser Glu Ile Val Ala
    850                 855                 860

Pro Leu Leu Val Gly Pro Ile Arg Asn Thr Pro His Gly Lys Arg Ile
865                 870                 875                 880

Ile Gly Met Leu His Leu Asp Ser
                885
```

<210> 212
<211> 553
<212> PRT
<213> Unknown

<220>
<223> PUF5

<400> 212

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

Ser Ile Ser Asp His Gln Thr Ala Asp Leu Ser Ile Phe Asn Gly Ser
            20                  25                  30

Phe Asp Gly Gly Ala Phe Ser Ser Ser Asn Ile Pro Leu Phe Asn Phe
        35                  40                  45
```

```
Met Gly Thr Gly Asn Gln Arg Phe Gln Tyr Ser Pro His Pro Phe Ala
    50                  55                  60

Lys Ser Ser Asp Pro Cys Arg Leu Ala Ala Leu Thr Pro Ser Thr Pro
65                  70                  75                  80

Lys Gly Pro Leu Asn Leu Thr Pro Ala Asp Phe Gly Leu Ala Asp Phe
                85                  90                  95

Ser Val Gly Asn Glu Ser Phe Ala Asp Phe Thr Ala Asn Asn Thr Ser
            100                 105                 110

Phe Val Gly Asn Val Gln Ser Asn Val Arg Ser Thr Arg Leu Leu Pro
        115                 120                 125

Ala Trp Ala Val Asp Asn Ser Gly Asn Ile Arg Asp Asp Leu Thr Leu
    130                 135                 140

Gln Asp Val Val Ser Asn Gly Ser Leu Ile Asp Phe Ala Met Asp Arg
145                 150                 155                 160

Thr Gly Val Lys Phe Leu Glu Arg His Phe Pro Glu Asp His Asp Asn
                165                 170                 175

Glu Met His Phe Val Leu Phe Asp Lys Leu Thr Glu Gln Gly Ala Val
            180                 185                 190

Phe Thr Ser Leu Cys Arg Ser Ala Ala Gly Asn Phe Ile Ile Gln Lys
        195                 200                 205

Phe Val Glu His Ala Thr Leu Asp Glu Gln Glu Arg Leu Val Arg Lys
    210                 215                 220

Met Cys Asp Asn Gly Leu Ile Glu Met Cys Leu Asp Lys Phe Ala Cys
225                 230                 235                 240

Arg Val Val Gln Met Ser Ile Gln Lys Phe Asp Val Ser Ile Ala Met
                245                 250                 255

Lys Leu Val Glu Lys Ile Ser Ser Leu Asp Phe Leu Pro Leu Cys Thr
```

```
            260                 265                 270

Asp Gln Cys Ala Ile His Val Leu Gln Lys Val Val Lys Leu Leu Pro
        275                 280                 285

Ile Ser Ala Trp Ser Phe Phe Val Lys Phe Leu Cys Arg Asp Asp Asn
    290                 295                 300

Leu Met Thr Val Cys Gln Asp Lys Tyr Gly Cys Arg Leu Val Gln Gln
305                 310                 315                 320

Thr Ile Asp Lys Leu Ser Asp Asn Pro Lys Leu His Cys Phe Asn Thr
                325                 330                 335

Arg Leu Gln Leu Leu His Gly Leu Met Thr Ser Val Ala Arg Asn Cys
            340                 345                 350

Phe Arg Leu Ser Ser Asn Glu Phe Ala Asn Tyr Val Val Gln Tyr Val
        355                 360                 365

Ile Lys Ser Ser Gly Val Met Glu Met Tyr Arg Asp Thr Ile Ile Glu
    370                 375                 380

Lys Cys Leu Leu Arg Asn Ile Leu Ser Met Ser Gln Asp Lys Tyr Ala
385                 390                 395                 400

Ser His Val Val Glu Gly Ala Phe Leu Phe Ala Pro Pro Leu Leu Leu
                405                 410                 415

Ser Glu Met Met Asp Glu Ile Phe Asp Gly Tyr Val Lys Asp Gln Glu
            420                 425                 430

Thr Asn Arg Asp Ala Leu Asp Ile Leu Leu Phe His Gln Tyr Gly Asn
        435                 440                 445

Tyr Val Val Gln Gln Met Ile Ser Ile Cys Ile Ser Ala Leu Leu Gly
    450                 455                 460

Lys Glu Glu Arg Lys Met Val Ala Ser Glu Met Arg Leu Tyr Ala Lys
465                 470                 475                 480
```

```
Trp Phe Asp Arg Ile Lys Asn Arg Val Asn Arg His Ser Gly Arg Leu
                485                 490                 495

Glu Arg Phe Ser Ser Gly Lys Lys Ile Ile Glu Ser Leu Gln Lys Leu
            500                 505                 510

Asn Val Pro Met Thr Met Thr Asn Glu Pro Met Pro Tyr Trp Ala Met
        515                 520                 525

Pro Thr Pro Leu Met Asp Ile Ser Ala His Phe Met Asn Lys Leu Asn
    530                 535                 540

Phe Gln Lys Asn Ser Val Phe Asp Glu
545                 550
```

<210> 213
<211> 485
<212> PRT
<213> Unknown

<220>
<223> PUF6

<400> 213

```
Met Thr Pro Asn Arg Arg Ser Thr Asp Ser Tyr Asn Met Leu Gly Ala
1               5                   10                  15

Ser Phe Asp Phe Asp Pro Asp Phe Ser Leu Leu Ser Asn Lys Thr His
            20                  25                  30

Lys Asn Lys Asn Pro Lys Pro Pro Val Lys Leu Leu Pro Tyr Arg His
        35                  40                  45

Gly Ser Asn Thr Thr Ser Ser Asp Leu Asp Asn Tyr Ile Phe Asn Ser
    50                  55                  60

Gly Ser Gly Ser Ser Asp Asp Glu Thr Pro Pro Pro Ala Ala Pro Ile
65                  70                  75                  80

Phe Ile Ser Leu Glu Glu Val Leu Leu Asn Gly Leu Leu Ile Asp Phe
                85                  90                  95
```

```
Ala Ile Asp Pro Ser Gly Val Lys Phe Leu Glu Ala Asn Tyr Pro Leu
            100                 105                 110

Asp Ser Glu Asp Gln Ile Arg Lys Ala Val Phe Glu Lys Leu Thr Glu
        115                 120                 125

Ser Thr Thr Leu Phe Val Gly Leu Cys His Ser Arg Asn Gly Asn Phe
    130                 135                 140

Ile Val Gln Lys Leu Val Glu Leu Ala Thr Pro Ala Glu Gln Arg Glu
145                 150                 155                 160

Leu Leu Arg Gln Met Ile Asp Gly Gly Leu Leu Val Met Cys Lys Asp
                165                 170                 175

Lys Phe Ala Cys Arg Val Val Gln Leu Ala Leu Gln Lys Phe Asp His
            180                 185                 190

Ser Asn Val Phe Gln Leu Ile Gln Glu Leu Ser Thr Phe Asp Leu Ala
        195                 200                 205

Ala Met Cys Thr Asp Gln Ile Ser Ile His Val Ile Gln Arg Val Val
    210                 215                 220

Lys Gln Leu Pro Val Asp Met Trp Thr Phe Phe Val His Phe Leu Ser
225                 230                 235                 240

Ser Gly Asp Ser Leu Met Ala Val Cys Gln Asp Lys Tyr Gly Cys Arg
                245                 250                 255

Leu Val Gln Gln Val Ile Asp Arg Leu Ala Glu Asn Pro Lys Leu Pro
            260                 265                 270

Cys Phe Lys Phe Arg Ile Gln Leu Leu His Ser Leu Met Thr Cys Ile
        275                 280                 285

Val Arg Asn Cys Tyr Arg Leu Ser Ser Asn Glu Phe Ala Asn Tyr Val
    290                 295                 300

Ile Gln Tyr Val Ile Lys Ser Ser Gly Ile Met Glu Met Tyr Arg Asp
```

```
305                 310                 315                 320

Thr Ile Ile Asp Lys Cys Leu Leu Arg Asn Leu Leu Ser Met Ser Gln
                325                 330                 335

Asp Lys Tyr Ala Ser His Val Ile Glu Gly Ala Phe Leu Phe Ala Pro
            340                 345                 350

Pro Ala Leu Leu His Glu Met Met Glu Glu Ile Phe Ser Gly Tyr Val
        355                 360                 365

Lys Asp Val Glu Leu Asn Arg Asp Ala Leu Asp Ile Leu Leu Phe His
    370                 375                 380

Gln Tyr Gly Asn Tyr Val Val Gln Gln Met Ile Ser Ile Cys Thr Ala
385                 390                 395                 400

Ala Leu Ile Gly Lys Glu Glu Arg Gln Leu Pro Pro Ala Ile Leu Leu
                405                 410                 415

Leu Tyr Ser Gly Trp Tyr Glu Lys Met Lys Gln Arg Val Leu Gln His
            420                 425                 430

Ala Ser Arg Leu Glu Arg Phe Ser Ser Gly Lys Lys Ile Ile Asp Ser
        435                 440                 445

Val Met Arg His Gly Val Pro Thr Ala Ala Ala Ile Asn Ala Gln Ala
    450                 455                 460

Ala Pro Ser Leu Met Glu Leu Thr Ala Gln Phe Asp Ala Met Phe Pro
465                 470                 475                 480

Ser Phe Leu Ala Arg
                485
```

<210> 214
<211> 485
<212> PRT
<213> Unknown

<220>
<223> PUF7

<400> 214

```
Met Thr Pro Asn Arg Arg Ser Thr Asp Ser Tyr Asn Met Leu Gly Ala
1               5                   10                  15

Ser Phe Asp Phe Asp Pro Asp Phe Ser Leu Leu Ser Asn Lys Thr His
            20                  25                  30

Lys Asn Lys Asn Pro Lys Pro Pro Val Lys Leu Leu Pro Tyr Arg His
        35                  40                  45

Gly Ser Asn Thr Thr Ser Ser Asp Ser Asp Ser Tyr Ile Phe Asn Ser
    50                  55                  60

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

Phe Ile Ser Leu Glu Asp Val Leu Leu Asn Gly Gln Leu Ile Asp Phe
                85                  90                  95

Ala Ile Asp Pro Ser Gly Val Lys Phe Leu Glu Ala Asn Tyr Pro Leu
            100                 105                 110

Asp Ser Glu Asp Gln Ile Arg Lys Ala Val Phe Glu Lys Phe Thr Glu
        115                 120                 125

Ser Thr Thr Leu Phe Val Gly Leu Cys His Ser Arg Asn Gly Asn Phe
    130                 135                 140

Ile Val Gln Lys Leu Val Glu Leu Ala Thr Pro Ala Glu Gln Arg Glu
145                 150                 155                 160

Leu Leu Arg Gln Met Ile Asp Gly Gly Leu Leu Ala Met Cys Lys Asp
                165                 170                 175

Lys Phe Ala Cys Arg Val Val Gln Leu Ala Leu Gln Lys Phe Asp His
            180                 185                 190

Ser Asn Val Phe Gln Leu Ile Gln Glu Leu Ser Thr Phe Asp Leu Ala
        195                 200                 205
```

```
Ala Met Cys Thr Asp Gln Ile Ser Ile His Val Ile Gln Arg Val Val
    210                 215                 220

Lys Gln Leu Pro Val Asp Met Trp Thr Phe Phe Val His Phe Leu Ser
225                 230                 235                 240

Ser Gly Asp Ser Leu Met Ala Val Cys Gln Asp Lys Tyr Gly Cys Arg
                245                 250                 255

Leu Val Gln Gln Val Ile Asp Arg Leu Ala Glu Asn Pro Lys Leu Pro
            260                 265                 270

Cys Phe Lys Phe Arg Ile Gln Leu Leu His Ser Leu Met Thr Cys Ile
        275                 280                 285

Val Arg Asn Cys Tyr Arg Leu Ser Ser Asn Glu Phe Ala Asn Tyr Val
    290                 295                 300

Ile Gln Tyr Val Ile Lys Ser Ser Gly Ile Met Glu Met Tyr Arg Asp
305                 310                 315                 320

Thr Ile Ile Asp Lys Cys Leu Leu Arg Asn Leu Leu Ser Met Ser Gln
                325                 330                 335

Asp Lys Tyr Ala Ser His Val Ile Glu Gly Ala Phe Leu Phe Ala Pro
            340                 345                 350

Pro Ala Leu Leu His Glu Met Met Glu Glu Ile Phe Ser Gly Tyr Val
        355                 360                 365

Lys Asp Val Glu Ser Asn Arg Asp Ala Leu Asp Ile Leu Leu Phe His
    370                 375                 380

Gln Tyr Gly Asn Tyr Val Val Gln Gln Met Ile Ser Ile Cys Thr Ala
385                 390                 395                 400

Ala Leu Ile Gly Lys Glu Glu Arg Glu Leu Pro Pro Ala Ile Leu Leu
                405                 410                 415

Leu Tyr Ser Gly Trp Tyr Glu Lys Met Lys Gln Arg Val Leu Gln His
```

420 425 430

Ala Ser Arg Leu Glu Arg Phe Ser Ser Gly Lys Lys Ile Ile Asp Ser
435 440 445

Val Met Arg His Gly Val Pro Thr Ala Ala Ala Val Asn Ala Gln Ala
450 455 460

Ala Pro Ser Leu Met Glu Leu Thr Ala Gln Phe Asp Ala Met Phe Pro
465 470 475 480

Ser Phe Leu Ala Arg
485

<210> 215
<211> 535
<212> PRT
<213> Unknown

<220>
<223> PUF8

<400> 215

Met Ser Arg Pro Ile Ser Ile Gly Asn Thr Cys Thr Phe Asp Pro Ser
1 5 10 15

Ala Ser Pro Ile Glu Ser Leu Gly Arg Ser Ile Gly Ala Gln Lys Ile
20 25 30

Val Asp Ser Val Cys Gly Ser Pro Ile Arg Ser Tyr Gly Arg His Ile
35 40 45

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

Phe Ala Thr Tyr Met His Gln Gly Gly Lys Val Ile Gly Gln Asn Thr
65 70 75 80

Leu His Met Phe Gly Thr Pro Pro Ser Cys Tyr Cys Ala Gln Glu Asn
85 90 95

Ile Pro Ile Ser Ser Asn Val Gly His Val Leu Ser Thr Ile Asn Asn

```
            100                 105                 110

Asn Tyr Met Asn His Gln Tyr Asn Gly Ser Asn Met Phe Ser Asn Gln
        115                 120                 125

Met Thr Gln Met Leu Gln Ala Gln Ala Tyr Asn Asp Leu Gln Met His
    130                 135                 140

Gln Ala His Ser Gln Ser Ile Arg Val Pro Val Gln Pro Ser Ala Thr
145                 150                 155                 160

Gly Ile Phe Ser Asn Pro Tyr Arg Glu Pro Thr Thr Thr Asp Asp Leu
                165                 170                 175

Leu Thr Arg Tyr Arg Ala Asn Pro Ala Met Met Lys Asn Leu Lys Leu
            180                 185                 190

Ser Asp Ile Arg Gly Ala Leu Leu Lys Phe Ala Lys Asp Gln Val Gly
        195                 200                 205

Ser Arg Phe Ile Gln Gln Glu Leu Ala Ser Ser Lys Asp Arg Phe Glu
    210                 215                 220

Lys Asp Ser Ile Phe Asp Glu Val Val Ser Asn Ala Asp Glu Leu Val
225                 230                 235                 240

Asp Asp Ile Phe Gly Asn Tyr Val Val Gln Lys Phe Phe Glu Tyr Gly
                245                 250                 255

Glu Glu Arg His Trp Ala Arg Leu Val Asp Ala Ile Ile Asp Arg Val
            260                 265                 270

Pro Glu Tyr Ala Phe Gln Met Tyr Ala Cys Arg Val Leu Gln Lys Ala
        275                 280                 285

Leu Glu Lys Ile Asn Glu Pro Leu Gln Ile Lys Ile Leu Ser Gln Ile
    290                 295                 300

Arg His Val Ile His Arg Cys Met Lys Asp Gln Asn Gly Asn His Val
305                 310                 315                 320
```

```
Val Gln Lys Ala Ile Glu Lys Val Ser Pro Gln Tyr Val Gln Phe Ile
                325                 330                 335

Val Asp Thr Leu Leu Glu Ser Ser Asn Thr Ile Tyr Glu Met Ser Val
            340                 345                 350

Asp Pro Tyr Gly Cys Arg Val Val Gln Arg Cys Leu Glu His Cys Ser
        355                 360                 365

Pro Ser Gln Thr Lys Pro Val Ile Gly Gln Ile His Lys Arg Phe Asp
    370                 375                 380

Glu Ile Ala Asn Asn Gln Tyr Gly Asn Tyr Val Val Gln His Val Ile
385                 390                 395                 400

Glu His Gly Ser Glu Glu Asp Arg Met Val Ile Val Thr Arg Val Ser
                405                 410                 415

Asn Asn Leu Phe Glu Phe Ala Thr His Lys Tyr Ser Ser Asn Val Ile
            420                 425                 430

Glu Lys Cys Leu Glu Gln Gly Ala Val Tyr His Lys Ser Met Ile Val
        435                 440                 445

Gly Ala Ala Cys His His Gln Glu Gly Ser Val Pro Ile Val Val Gln
    450                 455                 460

Met Met Lys Asp Gln Tyr Ala Asn Tyr Val Val Gln Lys Met Phe Asp
465                 470                 475                 480

Gln Val Thr Ser Glu Gln Arg Arg Glu Leu Ile Leu Thr Val Arg Pro
                485                 490                 495

His Ile Pro Val Leu Arg Gln Phe Pro His Gly Lys His Ile Leu Ala
            500                 505                 510

Lys Leu Glu Lys Tyr Phe Gln Lys Pro Ala Val Met Ser Tyr Pro Tyr
        515                 520                 525

Gln Asp Met Gln Gly Ser His
```

530 535

<210> 216
<211> 703
<212> PRT
<213> Unknown

<220>
<223> PUF9

<400> 216

Met Ala Asp Pro Asn Trp Ala Tyr Ala Pro Pro Thr Asn Tyr Tyr Ala
1 5 10 15

Asp His Ser Ile Ala Lys Pro Ile Met Ile Ser Gly Gly His Pro Ser
20 25 30

Gln Asp Gln Gly His Ser Pro Lys Ser Glu Ser Phe Gly Gln Ser Val
35 40 45

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

Ser Ser Val Gln Gln Arg Asn Tyr Phe Thr Thr Thr Pro Phe Pro Ile
65 70 75 80

Ser Arg Ser Pro Asn Asp Arg Asn Asp Asp Lys Ile Met Gly Asn Gly
85 90 95

Ser Tyr Gly Val Pro Ile Pro Ile Pro Gln Asp Gly Val Pro Gln Gly
100 105 110

Thr Pro Asp Phe Gln Met Thr Pro Phe Leu Gln Gln Gly Gly His Leu
115 120 125

Ile Gly Gly Ser Pro Asn Gly Pro Val Gln Val Ser Gly Asn Trp Tyr
130 135 140

Ser Gly Gly Ala Gly Ile Phe Ser Thr Met Gln Gln Ala Asp Pro Ser
145 150 155 160

Asn Gly Met Pro Gly Met Ala Ala Glu Phe Val Asn Asn Glu Asn Gly

```
               165                 170                 175

Met Pro Gly Pro Asn Gly Met His Gln Gln Ala Met Ile Ser Gly Ser
            180                 185                 190

Pro Pro Phe Pro Tyr Gln Asn Met Met Asn Leu Thr Thr Ser Phe Gly
        195                 200                 205

Ala Met Gly Leu Gly Pro Gln Gln Ile Gln Gln Arg Asp Pro Gln Met
    210                 215                 220

Phe Gln Gln Pro Ile Leu His Glu Pro Ile Gln Gly Met Ala Gln Asn
225                 230                 235                 240

Gly Phe Gly Gln Gln Val Phe Phe Thr Gln Met Gln Asn Gln Gln His
                245                 250                 255

Pro Gln Gly Gln Ala Gln Gln Gln Leu Gln Gln Leu Ala Gln Gln His
            260                 265                 270

Gln Gln Gln Gln Asn Ser Gln Gln Phe Phe Gly Gln Gly Pro Asn Gly
        275                 280                 285

Met Gly Asn Gly Gly Val Met Asn Asp Trp Ser Gln Arg Ser Phe Gly
    290                 295                 300

Met Pro Gln Gln Gln Ala Gln Gln Asn Gly Leu Pro Pro Asn Phe Ser
305                 310                 315                 320

Gln Asn Pro Pro Arg Arg Arg Gly Pro Glu Asp Pro Asn Gly Gln Thr
                325                 330                 335

Pro Lys Thr Leu Gln Asp Ile Lys Asn Asn Val Ile Glu Phe Ala Lys
            340                 345                 350

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

Leu Arg Asp Lys Ala Ala Ile Phe Thr Pro Val Leu Glu Asn Ala Glu
    370                 375                 380
```

```
Glu Leu Met Thr Asp Val Phe Gly Asn Tyr Val Ile Gln Lys Phe Phe
385                 390                 395                 400

Glu Phe Gly Asn Asn Glu Gln Arg Asn Gln Leu Val Gly Thr Ile Arg
                405                 410                 415

Gly Asn Val Met Lys Leu Ala Leu Gln Met Tyr Gly Cys Arg Val Ile
            420                 425                 430

Gln Lys Ala Leu Glu Tyr Val Glu Glu Lys Tyr Gln His Glu Ile Leu
        435                 440                 445

Gly Glu Met Glu Gly Gln Val Leu Lys Cys Val Lys Asp Gln Asn Gly
    450                 455                 460

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

Gln Phe Ile Ile Asp Ala Phe Thr Lys Asn Asn Ser Asp Asn Val Tyr
                485                 490                 495

Thr Leu Ser Val His Pro Tyr Gly Cys Arg Val Ile Gln Arg Val Leu
            500                 505                 510

Glu Tyr Cys Asn Glu Glu Gln Lys Gln Pro Val Leu Asp Ala Leu Gln
        515                 520                 525

Ile His Leu Lys Gln Leu Val Leu Asp Gln Tyr Gly Asn Tyr Val Ile
    530                 535                 540

Gln His Val Ile Glu His Gly Ser Pro Ser Asp Lys Glu Gln Ile Val
545                 550                 555                 560

Gln Asp Val Ile Ser Asp Asp Leu Leu Lys Phe Ala Gln His Lys Phe
                565                 570                 575

Ala Ser Asn Val Ile Glu Lys Cys Leu Thr Phe Gly Gly His Ala Glu
            580                 585                 590

Arg Asn Leu Ile Ile Asp Lys Val Cys Gly Asp Pro Asn Asp Pro Ser
```

```
        595                 600                 605

Pro Pro Leu Leu Gln Met Met Lys Asp Pro Phe Ala Asn Tyr Val Val
    610                 615                 620

Gln Lys Met Leu Asp Val Ala Asp Pro Gln His Arg Lys Lys Ile Thr
625                 630                 635                 640

Leu Thr Ile Lys Pro His Ile Ala Thr Leu Arg Lys Tyr Asn Phe Gly
                645                 650                 655

Lys His Ile Leu Leu Lys Leu Glu Lys Tyr Phe Ala Lys Gln Ala Pro
            660                 665                 670

Ala Asn Ser Ser Asn Ser Ser Ser Asn Asp Gln Ile Tyr Glu His Ser
        675                 680                 685

Pro Phe Asp Ile Pro Leu Gly Ala Asp Phe Ser Asn His Pro Phe
    690                 695                 700
```