SEQUENCE LISTING

<110> GENOCEA BIOSCIENCES INC.
CHILDREN'S HOSPITAL BOSTON

<120> VACCINES AND COMPOSITIONS AGAINST STREPTOCOCCUS PNEUMONIAE

<130> 105592-0003-WO1

<140>
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<150> 61/316,267
<151> 2010-03-22

<150> 61/240,616
<151> 2009-09-08

<150> 61/240,598
<151> 2009-09-08

<150> 61/221,541
<151> 2009-06-29

<160> 264

<170> PatentIn version 3.5

<210> 1
<211> 165
<212> PRT
<213> Streptococcus pneumoniae

<400> 1

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Met Ser Tyr Phe Glu Gln Phe Met Gln Ala Asn Gln Ala Tyr Val Ala
1               5                  10                  15

Leu His Gly Gln Leu Asn Leu Pro Leu Lys Pro Lys Thr Arg Val Ala
            20                  25                  30

Ile Val Thr Cys Met Asp Ser Arg Leu His Val Ala Gln Ala Leu Gly
        35                  40                  45

Leu Ala Leu Gly Asp Ala His Ile Leu Arg Asn Ala Gly Gly Arg Val
    50                  55                  60

Thr Glu Asp Met Ile Arg Ser Leu Val Ile Ser Gln Gln Gln Met Gly
65                  70                  75                  80

Thr Arg Glu Ile Val Val Leu His His Thr Asp Cys Gly Ala Gln Thr
                85                  90                  95

Phe Glu Asn Glu Pro Phe Gln Glu Tyr Leu Lys Glu Glu Leu Gly Val
            100                 105                 110

Asp Val Ser Asp Gln Asp Phe Leu Pro Phe Gln Asp Ile Glu Glu Ser
        115                 120                 125

Val Arg Glu Asp Met Gln Leu Leu Ile Glu Ser Pro Leu Ile Pro Asp
    130                 135                 140
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Asp Val Ile Ile Ser Gly Ala Ile Tyr Asn Val Asp Thr Gly Ser Met
145                 150                 155                 160

Thr Val Val Glu Leu
                165
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<210> 2
<211> 274
<212> PRT
<213> Streptococcus pneumoniae

<400> 2

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Met Asn Gln Ser Tyr Phe Tyr Leu Lys Met Lys Glu His Lys Leu Lys
1               5                   10                  15

Val Pro Tyr Thr Gly Lys Glu Arg Arg Val Arg Ile Leu Leu Pro Lys
            20                  25                  30

Asp Tyr Glu Lys Asp Thr Asp Arg Ser Tyr Pro Val Val Tyr Phe His
        35                  40                  45

Asp Gly Gln Asn Val Phe Asn Ser Lys Glu Ser Phe Ile Gly His Ser
    50                  55                  60

Trp Lys Ile Ile Pro Ala Ile Lys Arg Asn Pro Asp Ile Ser Arg Met
65                  70                  75                  80

Ile Val Val Ala Ile Asp Asn Asp Gly Met Gly Arg Met Asn Glu Tyr
                85                  90                  95

Ala Ala Trp Lys Phe Gln Glu Ser Pro Ile Pro Gly Gln Gln Phe Gly
            100                 105                 110

Gly Lys Gly Val Glu Tyr Ala Glu Phe Val Met Glu Val Val Lys Pro
        115                 120                 125

Phe Ile Asp Glu Thr Tyr Arg Thr Lys Ala Asp Cys Gln His Thr Ala
    130                 135                 140

Met Ile Gly Ser Ser Leu Gly Gly Asn Ile Thr Gln Phe Ile Gly Leu
145                 150                 155                 160

Glu Tyr Gln Asp Gln Ile Gly Cys Leu Gly Val Phe Ser Ser Ala Asn
                165                 170                 175

Trp Leu His Gln Glu Ala Phe Asn Arg Tyr Phe Glu Cys Gln Lys Leu
            180                 185                 190

Ser Pro Asp Gln Arg Ile Phe Ile Tyr Val Gly Thr Glu Glu Ala Asp
        195                 200                 205
```

Asp Thr Asp Lys Thr Leu Met Asp Gly Asn Ile Lys Gln Ala Tyr Ile
210 215 220

Asp Ser Ser Leu Cys Tyr Tyr His Asp Leu Ile Ala Gly Gly Val His
225 230 235 240

Leu Asp Asn Leu Val Leu Lys Val Gln Ser Gly Ala Ile His Ser Glu
245 250 255

Ile Pro Trp Ser Glu Asn Leu Pro Asp Cys Leu Arg Phe Phe Ala Glu
260 265 270

Lys Trp

<210> 3
<211> 130
<212> PRT
<213> Streptococcus pneumoniae

<400> 3
Met Asn Gln Ser Tyr Phe Tyr Leu Lys Met Lys Glu His Lys Leu Lys
1 5 10 15

Val Pro Tyr Thr Gly Lys Glu Arg Arg Val Arg Ile Leu Leu Pro Lys
20 25 30

Asp Tyr Glu Lys Asp Thr Asp Arg Ser Tyr Pro Val Val Tyr Phe His
35 40 45

Asp Gly Gln Asn Val Phe Asn Ser Lys Glu Ser Phe Ile Gly His Ser
50 55 60

Trp Lys Ile Ile Pro Ala Ile Lys Arg Asn Pro Asp Ile Ser Arg Met
65 70 75 80

Ile Val Val Ala Ile Asp Asn Asp Gly Met Gly Arg Met Asn Glu Tyr
85 90 95

Ala Ala Trp Lys Phe Gln Glu Ser Pro Ile Pro Gly Gln Gln Phe Gly
100 105 110

Gly Lys Gly Val Glu Tyr Ala Glu Phe Val Met Glu Val Val Lys Pro
115 120 125

Phe Ile
130

<210> 4
<211> 299
<212> PRT
<213> Streptococcus pneumoniae

<400> 4

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

Leu Ala Ser Leu Leu Leu Val Ala Cys Met Asn Gln Ser Tyr Phe Tyr
            20                  25                  30

Leu Lys Met Lys Glu His Lys Leu Lys Val Pro Tyr Thr Gly Lys Glu
        35                  40                  45

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

Arg Ser Tyr Pro Val Val Tyr Phe His Asp Gly Gln Asn Val Phe Asn
65                  70                  75                  80

Ser Lys Glu Ser Phe Ile Gly His Ser Trp Lys Ile Ile Pro Ala Ile
                85                  90                  95

Lys Arg Asn Pro Asp Ile Ser Arg Met Ile Val Val Ala Ile Asp Asn
            100                 105                 110

Asp Gly Met Gly Arg Met Asn Glu Tyr Ala Ala Trp Lys Phe Gln Glu
        115                 120                 125

Ser Pro Ile Pro Gly Gln Gln Phe Gly Gly Lys Gly Val Glu Tyr Ala
    130                 135                 140

Glu Phe Val Met Glu Val Val Lys Pro Phe Ile Asp Glu Thr Tyr Arg
145                 150                 155                 160

Thr Lys Ala Asp Cys Gln His Thr Ala Met Ile Gly Ser Ser Leu Gly
                165                 170                 175

Gly Asn Ile Thr Gln Phe Ile Gly Leu Glu Tyr Gln Asp Gln Ile Gly
            180                 185                 190

Cys Leu Gly Val Phe Ser Ser Ala Asn Trp Leu His Gln Glu Ala Phe
        195                 200                 205

Asn Arg Tyr Phe Glu Cys Gln Lys Leu Ser Pro Asp Gln Arg Ile Phe
    210                 215                 220

Ile Tyr Val Gly Thr Glu Glu Ala Asp Asp Thr Asp Lys Thr Leu Met
225                 230                 235                 240

Asp Gly Asn Ile Lys Gln Ala Tyr Ile Asp Ser Ser Leu Cys Tyr Tyr
                245                 250                 255

His Asp Leu Ile Ala Gly Gly Val His Leu Asp Asn Leu Val Leu Lys
            260                 265                 270
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Val Gln Ser Gly Ala Ile His Ser Glu Ile Pro Trp Ser Glu Asn Leu
275 280 285

Pro Asp Cys Leu Arg Phe Phe Ala Glu Lys Trp
290 295

<210> 5
<211> 155
<212> PRT
<213> Streptococcus pneumoniae

<400> 5
Met Ser Ser Lys Phe Met Lys Ser Ala Ala Val Leu Gly Thr Ala Thr
1 5 10 15

Leu Ala Ser Leu Leu Leu Val Ala Cys Met Asn Gln Ser Tyr Phe Tyr
20 25 30

Leu Lys Met Lys Glu His Lys Leu Lys Val Pro Tyr Thr Gly Lys Glu
35 40 45

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

Arg Ser Tyr Pro Val Val Tyr Phe His Asp Gly Gln Asn Val Phe Asn
65 70 75 80

Ser Lys Glu Ser Phe Ile Gly His Ser Trp Lys Ile Ile Pro Ala Ile
85 90 95

Lys Arg Asn Pro Asp Ile Ser Arg Met Ile Val Val Ala Ile Asp Asn
100 105 110

Asp Gly Met Gly Arg Met Asn Glu Tyr Ala Ala Trp Lys Phe Gln Glu
115 120 125

Ser Pro Ile Pro Gly Gln Gln Phe Gly Gly Lys Gly Val Glu Tyr Ala
130 135 140

Glu Phe Val Met Glu Val Val Lys Pro Phe Ile
145 150 155

<210> 6
<211> 254
<212> PRT
<213> Streptococcus pneumoniae

<400> 6
Met Cys Ser Gly Gly Ala Lys Lys Glu Gly Glu Ala Ala Ser Lys Lys
1 5 10 15

Glu Ile Ile Val Ala Thr Asn Gly Ser Pro Lys Pro Phe Ile Tyr Glu
20 25 30

Glu Asn Gly Glu Leu Thr Gly Tyr Glu Ile Glu Val Val Arg Ala Ile
35 40 45

Phe Lys Asp Ser Asp Lys Tyr Asp Val Lys Phe Glu Lys Thr Glu Trp
50 55 60

Ser Gly Val Phe Ala Gly Leu Asp Ala Asp Arg Tyr Asn Met Ala Val
65 70 75 80

Asn Asn Leu Ser Tyr Thr Lys Glu Arg Ala Glu Lys Tyr Leu Tyr Ala
85 90 95

Ala Pro Ile Ala Gln Asn Pro Asn Val Leu Val Val Lys Lys Asp Asp
100 105 110

Ser Ser Ile Lys Ser Leu Asp Asp Ile Gly Gly Lys Ser Thr Glu Val
115 120 125

Val Gln Ala Thr Thr Ser Ala Lys Gln Leu Glu Ala Tyr Asn Ala Glu
130 135 140

His Thr Asp Asn Pro Thr Ile Leu Asn Tyr Thr Lys Ala Asp Phe Gln
145 150 155 160

Gln Ile Met Val Arg Leu Ser Asp Gly Gln Phe Asp Tyr Lys Ile Phe
165 170 175

Asp Lys Ile Gly Val Glu Thr Val Ile Lys Asn Gln Gly Leu Asp Asn
180 185 190

Leu Lys Val Ile Glu Leu Pro Ser Asp Gln Gln Pro Tyr Val Tyr Pro
195 200 205

Leu Leu Ala Gln Gly Gln Asp Glu Leu Lys Ser Phe Val Asp Lys Arg
210 215 220

Ile Lys Glu Leu Tyr Lys Asp Gly Thr Leu Glu Lys Leu Ser Lys Gln
225 230 235 240

Phe Phe Gly Asp Thr Tyr Leu Pro Ala Glu Ala Asp Ile Lys
245 250

<210> 7
<211> 276
<212> PRT
<213> Streptococcus pneumoniae

<400> 7
Met Lys Lys Ile Val Lys Tyr Ser Ser Leu Ala Ala Leu Ala Leu Val
1 5 10 15

Ala Ala Gly Val Leu Ala Ala Cys Ser Gly Gly Ala Lys Lys Glu Gly
20 25 30

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Glu Ala Ala Ser Lys Lys Glu Ile Ile Val Ala Thr Asn Gly Ser Pro
        35                  40                  45

Lys Pro Phe Ile Tyr Glu Glu Asn Gly Glu Leu Thr Gly Tyr Glu Ile
    50                  55                  60

Glu Val Val Arg Ala Ile Phe Lys Asp Ser Asp Lys Tyr Asp Val Lys
65                  70                  75                  80

Phe Glu Lys Thr Glu Trp Ser Gly Val Phe Ala Gly Leu Asp Ala Asp
                85                  90                  95

Arg Tyr Asn Met Ala Val Asn Asn Leu Ser Tyr Thr Lys Glu Arg Ala
            100                 105                 110

Glu Lys Tyr Leu Tyr Ala Ala Pro Ile Ala Gln Asn Pro Asn Val Leu
        115                 120                 125

Val Val Lys Lys Asp Asp Ser Ser Ile Lys Ser Leu Asp Asp Ile Gly
    130                 135                 140

Gly Lys Ser Thr Glu Val Val Gln Ala Thr Thr Ser Ala Lys Gln Leu
145                 150                 155                 160

Glu Ala Tyr Asn Ala Glu His Thr Asp Asn Pro Thr Ile Leu Asn Tyr
                165                 170                 175

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

Phe Asp Tyr Lys Ile Phe Asp Lys Ile Gly Val Glu Thr Val Ile Lys
        195                 200                 205

Asn Gln Gly Leu Asp Asn Leu Lys Val Ile Glu Leu Pro Ser Asp Gln
    210                 215                 220

Gln Pro Tyr Val Tyr Pro Leu Leu Ala Gln Gly Gln Asp Glu Leu Lys
225                 230                 235                 240

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

Glu Lys Leu Ser Lys Gln Phe Phe Gly Asp Thr Tyr Leu Pro Ala Glu
            260                 265                 270

Ala Asp Ile Lys
        275
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<210> 8
<211> 586

<212> PRT
<213> Streptococcus pneumoniae

<400> 8

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

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

Tyr Leu Gly Leu Cys Pro Phe His Gly Glu Lys Thr Pro Ser Phe Asn
        35                  40                  45

Val Val Glu Asp Lys Gln Phe Tyr His Cys Phe Gly Cys Gly Arg Ser
    50                  55                  60

Gly Asp Val Phe Lys Phe Ile Glu Glu Tyr Gln Gly Val Pro Phe Ile
65                  70                  75                  80

Glu Ala Val Gln Ile Leu Gly Gln Arg Val Gly Ile Glu Val Glu Lys
                85                  90                  95

Pro Leu Tyr Ser Glu Gln Lys Ser Ala Ser Pro His Gln Ala Leu Tyr
            100                 105                 110

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

Thr Thr Met Gly Glu Glu Ala Arg Asn Tyr Leu Tyr Gln Arg Gly Leu
    130                 135                 140

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

Arg Asn Tyr Leu Tyr Gln Arg Leu Ser Asp Gln Tyr Arg Glu Glu Asp
                165                 170                 175

Leu Leu Asp Ser Gly Leu Phe Tyr Leu Ser Asp Ala Asn Gln Phe Val
            180                 185                 190

Asp Thr Phe His Asn Arg Ile Met Phe Pro Leu Thr Asn Asp Gln Gly
        195                 200                 205

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

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

Tyr Glu Leu Tyr His Met Asp Arg Ala Lys Arg Ser Ser Gly Lys Ala
                245                 250                 255
```

```
Ser Glu Ile Tyr Leu Met Glu Gly Phe Met Asp Val Ile Ala Ala Tyr
            260                 265                 270

Arg Ala Gly Ile Glu Asn Ala Val Ala Ser Met Gly Thr Ala Leu Ser
        275                 280                 285

Arg Glu His Val Glu His Leu Lys Arg Leu Thr Lys Lys Leu Val Leu
    290                 295                 300

Val Tyr Asp Gly Asp Lys Ala Gly Gln Ala Ala Thr Leu Lys Ala Leu
305                 310                 315                 320

Asp Glu Ile Gly Asp Met Pro Val Gln Ile Val Ser Met Pro Asp Asn
                325                 330                 335

Leu Asp Pro Asp Glu Tyr Leu Gln Lys Asn Gly Pro Glu Asp Leu Ala
            340                 345                 350

Tyr Leu Leu Thr Lys Thr Arg Ile Ser Pro Ile Glu Phe Tyr Ile His
        355                 360                 365

Gln Tyr Lys Pro Glu Asn Ser Glu Asn Leu Gln Ala Gln Ile Glu Phe
    370                 375                 380

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

Gln Asn Ser Tyr Ile His Ile Leu Ala Asp Ser Leu Ala Ser Phe Asp
                405                 410                 415

Tyr Thr Gln Ile Glu Gln Ile Val Asn Glu Ser Arg Gln Val Gln Arg
            420                 425                 430

Gln Asn Arg Met Glu Gly Ile Ser Arg Pro Thr Pro Ile Thr Met Pro
        435                 440                 445

Val Thr Lys Gln Leu Ser Ala Ile Met Arg Ala Glu Ala His Leu Leu
    450                 455                 460

Tyr Arg Met Met Glu Ser Pro Leu Val Leu Asn Asp Tyr Arg Leu Arg
465                 470                 475                 480

Glu Asp Phe Ala Phe Ala Thr Pro Glu Phe Gln Val Leu Tyr Asp Leu
                485                 490                 495

Leu Gly Gln Tyr Gly Asn Leu Pro Pro Glu Val Leu Ala Glu Gln Thr
            500                 505                 510

Glu Glu Val Glu Arg Ala Trp Tyr Gln Val Leu Ala Gln Asp Leu Pro
        515                 520                 525
```

```
Ala Glu Ile Ser Pro Gln Glu Leu Ser Glu Val Glu Met Thr Arg Asn
    530                 535                 540

Lys Ala Leu Leu Asn Gln Asp Asn Met Arg Ile Lys Lys Lys Val Gln
545                 550                 555                 560

Glu Ala Ser His Val Gly Asp Thr Asp Thr Ala Leu Glu Glu Leu Glu
                565                 570                 575

Arg Leu Ile Ser Gln Lys Arg Arg Met Glu
            580                 585
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<210> 9
<211> 423
<212> PRT
<213> Streptococcus pneumoniae

<400> 9

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

Leu Ala Ser Leu Leu Leu Val Ala Cys Gly Ser Lys Thr Ala Asp Lys
            20                  25                  30

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

Asp Glu Gly Tyr Lys Ser Tyr Ile Glu Glu Val Ala Lys Ala Tyr Glu
    50                  55                  60

Lys Glu Ala Gly Val Lys Val Thr Leu Lys Thr Gly Asp Ala Leu Gly
65                  70                  75                  80

Gly Leu Asp Lys Leu Ser Leu Asp Asn Gln Ser Gly Asn Val Pro Asp
                85                  90                  95

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

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

Thr Lys Ser Leu Val Thr Ala Ala Asn Gly Lys Val Tyr Gly Ala Pro
    130                 135                 140

Ala Val Ile Glu Ser Leu Val Met Tyr Tyr Asn Lys Asp Leu Val Lys
145                 150                 155                 160

Asp Ala Pro Lys Thr Phe Ala Asp Leu Glu Asn Leu Ala Lys Asp Ser
                165                 170                 175

Lys Tyr Ala Phe Ala Gly Glu Asp Gly Lys Thr Thr Ala Phe Leu Ala
            180                 185                 190
```

```
Asp Trp Thr Asn Phe Tyr Tyr Thr Tyr Gly Leu Leu Ala Gly Asn Gly
        195                 200                 205

Ala Tyr Val Phe Gly Gln Asn Gly Lys Asp Ala Lys Asp Ile Gly Leu
    210                 215                 220

Ala Asn Asp Gly Ser Ile Val Gly Ile Asn Tyr Ala Lys Ser Trp Tyr
225                 230                 235                 240

Glu Lys Trp Pro Lys Gly Met Gln Asp Thr Glu Gly Ala Gly Asn Leu
                245                 250                 255

Ile Gln Thr Gln Phe Gln Glu Gly Lys Thr Ala Ala Ile Ile Asp Gly
            260                 265                 270

Pro Trp Lys Ala Gln Ala Phe Lys Asp Ala Lys Val Asn Tyr Gly Val
        275                 280                 285

Ala Thr Ile Pro Thr Leu Pro Asn Gly Lys Glu Tyr Ala Ala Phe Gly
    290                 295                 300

Gly Gly Lys Ala Trp Val Ile Pro Gln Ala Val Lys Asn Leu Glu Ala
305                 310                 315                 320

Ser Gln Lys Phe Val Asp Phe Leu Val Ala Thr Glu Gln Gln Lys Val
                325                 330                 335

Leu Tyr Asp Lys Thr Asn Glu Ile Pro Ala Asn Thr Glu Ala Arg Ser
            340                 345                 350

Tyr Ala Glu Gly Lys Asn Asp Glu Leu Thr Thr Ala Val Ile Lys Gln
        355                 360                 365

Phe Lys Asn Thr Gln Pro Leu Pro Asn Ile Ser Gln Met Ser Ala Val
    370                 375                 380

Trp Asp Pro Ala Lys Asn Met Leu Phe Asp Ala Val Ser Gly Gln Lys
385                 390                 395                 400

Asp Ala Lys Thr Ala Ala Asn Asp Ala Val Thr Leu Ile Lys Glu Thr
                405                 410                 415

Ile Lys Gln Lys Phe Gly Glu
            420
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<210> 10
<211> 400
<212> PRT
<213> Streptococcus pneumoniae

<400> 10

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Met Cys Gly Ser Lys Thr Ala Asp Lys Pro Ala Asp Ser Gly Ser Ser
1               5                  10                  15

Glu Val Lys Glu Leu Thr Val Tyr Val Asp Glu Gly Tyr Lys Ser Tyr
            20                  25                  30

Ile Glu Glu Val Ala Lys Ala Tyr Glu Lys Glu Ala Gly Val Lys Val
        35                  40                  45

Thr Leu Lys Thr Gly Asp Ala Leu Gly Gly Leu Asp Lys Leu Ser Leu
    50                  55                  60

Asp Asn Gln Ser Gly Asn Val Pro Asp Val Met Met Ala Pro Tyr Asp
65                  70                  75                  80

Arg Val Gly Ser Leu Gly Ser Asp Gly Gln Leu Ser Glu Val Lys Leu
                85                  90                  95

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

Ala Asn Gly Lys Val Tyr Gly Ala Pro Ala Val Ile Glu Ser Leu Val
        115                 120                 125

Met Tyr Tyr Asn Lys Asp Leu Val Lys Asp Ala Pro Lys Thr Phe Ala
    130                 135                 140

Asp Leu Glu Asn Leu Ala Lys Asp Ser Lys Tyr Ala Phe Ala Gly Glu
145                 150                 155                 160

Asp Gly Lys Thr Thr Ala Phe Leu Ala Asp Trp Thr Asn Phe Tyr Tyr
                165                 170                 175

Thr Tyr Gly Leu Leu Ala Gly Asn Gly Ala Tyr Val Phe Gly Gln Asn
            180                 185                 190

Gly Lys Asp Ala Lys Asp Ile Gly Leu Ala Asn Asp Gly Ser Ile Val
        195                 200                 205

Gly Ile Asn Tyr Ala Lys Ser Trp Tyr Glu Lys Trp Pro Lys Gly Met
    210                 215                 220

Gln Asp Thr Glu Gly Ala Gly Asn Leu Ile Gln Thr Gln Phe Gln Glu
225                 230                 235                 240

Gly Lys Thr Ala Ala Ile Ile Asp Gly Pro Trp Lys Ala Gln Ala Phe
                245                 250                 255

Lys Asp Ala Lys Val Asn Tyr Gly Val Ala Thr Ile Pro Thr Leu Pro
            260                 265                 270
```

```
Asn Gly Lys Glu Tyr Ala Ala Phe Gly Gly Gly Lys Ala Trp Val Ile
        275                 280                 285

Pro Gln Ala Val Lys Asn Leu Glu Ala Ser Gln Lys Phe Val Asp Phe
    290                 295                 300

Leu Val Ala Thr Glu Gln Gln Lys Val Leu Tyr Asp Lys Thr Asn Glu
305                 310                 315                 320

Ile Pro Ala Asn Thr Glu Ala Arg Ser Tyr Ala Glu Gly Lys Asn Asp
                325                 330                 335

Glu Leu Thr Thr Ala Val Ile Lys Gln Phe Lys Asn Thr Gln Pro Leu
            340                 345                 350

Pro Asn Ile Ser Gln Met Ser Ala Val Trp Asp Pro Ala Lys Asn Met
        355                 360                 365

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

Asp Ala Val Thr Leu Ile Lys Glu Thr Ile Lys Gln Lys Phe Gly Glu
385                 390                 395                 400
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<210> 11
<211> 648
<212> PRT
<213> Streptococcus pneumoniae

<400> 11

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Met Ser Gly Thr Ser Met Ala Thr Pro Ile Val Ala Ala Ser Thr Val
1               5                   10                  15

Leu Ile Arg Pro Lys Leu Lys Glu Met Leu Glu Arg Pro Val Leu Lys
            20                  25                  30

Asn Leu Lys Gly Asp Asp Lys Ile Asp Leu Thr Ser Leu Thr Lys Ile
        35                  40                  45

Ala Leu Gln Asn Thr Ala Arg Pro Met Met Asp Ala Thr Ser Trp Lys
    50                  55                  60

Glu Lys Ser Gln Tyr Phe Ala Ser Pro Arg Gln Gln Gly Ala Gly Leu
65                  70                  75                  80

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

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

Lys Glu Ile Lys Gly Asp Lys Lys Tyr Phe Thr Ile Lys Leu His Asn
        115                 120                 125
```

```
Thr Ser Asn Arg Pro Leu Thr Phe Lys Val Ser Ala Ser Ala Ile Thr
    130                 135                 140

Thr Asp Ser Leu Thr Asp Arg Leu Lys Leu Asp Glu Thr Tyr Lys Asp
145                 150                 155                 160

Glu Lys Ser Pro Asp Gly Lys Gln Ile Val Pro Glu Ile His Pro Glu
                165                 170                 175

Lys Val Lys Gly Ala Asn Ile Thr Phe Glu His Asp Thr Phe Thr Ile
            180                 185                 190

Gly Ala Asn Ser Ser Phe Asp Leu Asn Ala Val Ile Asn Val Gly Glu
        195                 200                 205

Ala Lys Asn Lys Asn Lys Phe Val Glu Ser Phe Ile His Phe Glu Ser
    210                 215                 220

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

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

His Glu Pro Ile Leu Asp Lys Trp Ala Trp Glu Glu Gly Ser Arg Ser
            260                 265                 270

Lys Thr Leu Gly Gly Tyr Asp Asp Asp Gly Lys Pro Lys Ile Pro Gly
        275                 280                 285

Thr Leu Asn Lys Gly Ile Gly Gly Glu His Gly Ile Asp Lys Phe Asn
    290                 295                 300

Pro Ala Gly Val Ile Gln Asn Arg Lys Asp Lys Asn Thr Thr Ser Leu
305                 310                 315                 320

Asp Gln Asn Pro Glu Leu Phe Ala Phe Asn Asn Glu Gly Ile Asn Ala
                325                 330                 335

Pro Ser Ser Ser Gly Ser Lys Ile Ala Asn Ile Tyr Pro Leu Asp Ser
            340                 345                 350

Asn Gly Asn Pro Gln Asp Ala Gln Leu Glu Arg Gly Leu Thr Pro Ser
        355                 360                 365

Pro Leu Val Leu Arg Ser Ala Glu Glu Gly Leu Ile Ser Ile Val Asn
    370                 375                 380

Thr Asn Lys Glu Gly Glu Asn Gln Arg Asp Leu Lys Val Ile Ser Arg
385                 390                 395                 400
```

```
Glu His Phe Ile Arg Gly Ile Leu Asn Ser Lys Ser Asn Asp Ala Lys
                405                 410                 415

Gly Ile Lys Ser Ser Lys Leu Lys Val Trp Gly Asp Leu Lys Trp Asp
            420                 425                 430

Gly Leu Ile Tyr Asn Pro Arg Gly Arg Glu Glu Asn Ala Pro Glu Ser
        435                 440                 445

Lys Asp Asn Gln Asp Pro Ala Thr Lys Ile Arg Gly Gln Phe Glu Pro
    450                 455                 460

Ile Ala Glu Gly Gln Tyr Phe Tyr Lys Phe Lys Tyr Arg Leu Thr Lys
465                 470                 475                 480

Asp Tyr Pro Trp Gln Val Ser Tyr Ile Pro Val Lys Ile Asp Asn Thr
                485                 490                 495

Ala Pro Lys Ile Val Ser Val Asp Phe Ser Asn Pro Glu Lys Ile Lys
            500                 505                 510

Leu Ile Thr Lys Asp Thr Tyr His Lys Val Lys Asp Gln Tyr Lys Asn
        515                 520                 525

Glu Thr Leu Phe Ala Arg Asp Gln Lys Glu His Pro Glu Lys Phe Asp
    530                 535                 540

Glu Ile Ala Asn Glu Val Trp Tyr Ala Gly Ala Ala Leu Val Asn Glu
545                 550                 555                 560

Asp Gly Glu Val Glu Lys Asn Leu Glu Val Thr Tyr Ala Gly Glu Gly
                565                 570                 575

Gln Gly Arg Asn Arg Lys Leu Asp Lys Asp Gly Asn Thr Ile Tyr Glu
            580                 585                 590

Ile Lys Gly Ala Gly Asp Leu Arg Gly Lys Ile Ile Glu Val Ile Ala
        595                 600                 605

Leu Asp Gly Ser Ser Asn Phe Thr Lys Ile His Arg Ile Lys Phe Ala
    610                 615                 620

Asn Gln Ala Asp Glu Lys Gly Met Ile Ser Tyr Tyr Leu Val Asp Pro
625                 630                 635                 640

Asp Gln Asp Ser Ser Lys Tyr Gln
                645
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<210> 12
<211> 2140

<212> PRT
<213> Streptococcus pneumoniae

<400> 12

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Met Lys Lys Ser Thr Val Leu Ser Leu Thr Thr Ala Ala Val Ile Leu
1               5                  10                  15

Ala Ala Tyr Ala Pro Asn Glu Val Val Leu Ala Asp Thr Ser Ser Ser
            20                  25                  30

Glu Asp Ala Leu Asn Ile Ser Asp Lys Glu Lys Val Ala Glu Asn Lys
        35                  40                  45

Glu Lys His Glu Asn Ile His Ser Ala Met Glu Thr Ser Gln Asp Phe
    50                  55                  60

Lys Glu Lys Lys Thr Ala Val Ile Lys Glu Lys Glu Val Val Ser Lys
65                  70                  75                  80

Asn Pro Val Ile Asp Asn Asn Thr Ser Asn Glu Glu Ala Lys Ile Lys
                85                  90                  95

Glu Glu Asn Ser Asn Lys Ser Gln Gly Asp Tyr Thr Asp Ser Phe Val
            100                 105                 110

Asn Lys Asn Thr Glu Asn Pro Lys Lys Glu Asp Lys Val Val Tyr Ile
        115                 120                 125

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

Ser Ser Leu Lys Asn Thr Lys Val Leu Tyr Thr Tyr Asp Arg Ile Phe
145                 150                 155                 160

Asn Gly Ser Ala Ile Glu Thr Thr Pro Asp Asn Leu Asp Lys Ile Lys
                165                 170                 175

Gln Ile Glu Gly Ile Ser Ser Val Glu Arg Ala Gln Lys Val Gln Pro
            180                 185                 190

Met Met Asn His Ala Arg Lys Glu Ile Gly Val Glu Glu Ala Ile Asp
        195                 200                 205

Tyr Leu Lys Ser Ile Asn Ala Pro Phe Gly Lys Asn Phe Asp Gly Arg
    210                 215                 220

Gly Met Val Ile Ser Asn Ile Asp Thr Gly Thr Asp Tyr Arg His Lys
225                 230                 235                 240

Ala Met Arg Ile Asp Asp Asp Ala Lys Ala Ser Met Arg Phe Lys Lys
                245                 250                 255
```

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

Pro His Ala Phe Asn Tyr Tyr Asn Gly Gly Lys Ile Thr Val Glu Lys
        275                 280                 285

Tyr Asp Asp Gly Arg Asp Tyr Phe Asp Pro His Gly Met His Ile Ala
    290                 295                 300

Gly Ile Leu Ala Gly Asn Asp Thr Glu Gln Asp Ile Lys Asn Phe Asn
305                 310                 315                 320

Gly Ile Asp Gly Ile Ala Pro Asn Ala Gln Ile Phe Ser Tyr Lys Met
                325                 330                 335

Tyr Ser Asp Ala Gly Ser Gly Phe Ala Gly Asp Glu Thr Met Phe His
            340                 345                 350

Ala Ile Glu Asp Ser Ile Lys His Asn Val Asp Val Val Ser Val Ser
        355                 360                 365

Ser Gly Phe Thr Gly Thr Gly Leu Val Gly Glu Lys Tyr Trp Gln Ala
    370                 375                 380

Ile Arg Ala Leu Arg Lys Ala Gly Ile Pro Met Val Val Ala Thr Gly
385                 390                 395                 400

Asn Tyr Ala Thr Ser Ala Ser Ser Ser Ser Trp Asp Leu Val Ala Asn
                405                 410                 415

Asn His Leu Lys Met Thr Asp Thr Gly Asn Val Thr Arg Thr Ala Ala
            420                 425                 430

His Glu Asp Ala Ile Ala Val Ala Ser Ala Lys Asn Gln Thr Val Glu
        435                 440                 445

Phe Asp Lys Val Asn Ile Gly Gly Glu Ser Phe Lys Tyr Arg Asn Ile
    450                 455                 460

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

Lys Ala Pro Ser Lys Leu Lys Phe Val Tyr Ile Gly Lys Gly Gln Asp
                485                 490                 495

Gln Asp Leu Ile Gly Leu Asp Leu Arg Gly Lys Ile Ala Val Met Asp
            500                 505                 510

Arg Ile Tyr Thr Lys Asp Leu Lys Asn Ala Phe Lys Lys Ala Met Asp
        515                 520                 525
```

```
Lys Gly Ala Arg Ala Ile Met Val Val Asn Thr Val Asn Tyr Tyr Asn
    530                 535                 540

Arg Asp Asn Trp Thr Glu Leu Pro Ala Met Gly Tyr Glu Ala Asp Glu
545                 550                 555                 560

Gly Thr Lys Ser Gln Val Phe Ser Ile Ser Gly Asp Asp Gly Val Lys
                565                 570                 575

Leu Trp Asn Met Ile Asn Pro Asp Lys Lys Thr Glu Val Lys Arg Asn
            580                 585                 590

Asn Lys Glu Asp Phe Lys Asp Lys Leu Glu Gln Tyr Tyr Pro Ile Asp
        595                 600                 605

Met Glu Ser Phe Asn Ser Asn Lys Pro Asn Val Gly Asp Glu Lys Glu
    610                 615                 620

Ile Asp Phe Lys Phe Ala Pro Asp Thr Asp Lys Glu Leu Tyr Lys Glu
625                 630                 635                 640

Asp Ile Ile Val Pro Ala Gly Ser Thr Ser Trp Gly Pro Arg Ile Asp
                645                 650                 655

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

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

Thr Ser Met Ala Thr Pro Ile Val Ala Ala Ser Thr Val Leu Ile Arg
    690                 695                 700

Pro Lys Leu Lys Glu Met Leu Glu Arg Pro Val Leu Lys Asn Leu Lys
705                 710                 715                 720

Gly Asp Asp Lys Ile Asp Leu Thr Ser Leu Thr Lys Ile Ala Leu Gln
                725                 730                 735

Asn Thr Ala Arg Pro Met Met Asp Ala Thr Ser Trp Lys Glu Lys Ser
            740                 745                 750

Gln Tyr Phe Ala Ser Pro Arg Gln Gln Gly Ala Gly Leu Ile Asn Val
        755                 760                 765

Ala Asn Ala Leu Arg Asn Glu Val Val Ala Thr Phe Lys Asn Thr Asp
    770                 775                 780

Ser Lys Gly Leu Val Asn Ser Tyr Gly Ser Ile Ser Leu Lys Glu Ile
785                 790                 795                 800
```

```
Lys Gly Asp Lys Lys Tyr Phe Thr Ile Lys Leu His Asn Thr Ser Asn
                805                 810                 815

Arg Pro Leu Thr Phe Lys Val Ser Ala Ser Ala Ile Thr Thr Asp Ser
            820                 825                 830

Leu Thr Asp Arg Leu Lys Leu Asp Glu Thr Tyr Lys Asp Glu Lys Ser
        835                 840                 845

Pro Asp Gly Lys Gln Ile Val Pro Glu Ile His Pro Glu Lys Val Lys
    850                 855                 860

Gly Ala Asn Ile Thr Phe Glu His Asp Thr Phe Thr Ile Gly Ala Asn
865                 870                 875                 880

Ser Ser Phe Asp Leu Asn Ala Val Ile Asn Val Gly Glu Ala Lys Asn
                885                 890                 895

Lys Asn Lys Phe Val Glu Ser Phe Ile His Phe Glu Ser Val Glu Glu
            900                 905                 910

Met Glu Ala Leu Asn Ser Asn Gly Lys Lys Ile Asn Phe Gln Pro Ser
        915                 920                 925

Leu Ser Met Pro Leu Met Gly Phe Ala Gly Asn Trp Asn His Glu Pro
    930                 935                 940

Ile Leu Asp Lys Trp Ala Trp Glu Glu Gly Ser Arg Ser Lys Thr Leu
945                 950                 955                 960

Gly Gly Tyr Asp Asp Asp Gly Lys Pro Lys Ile Pro Gly Thr Leu Asn
                965                 970                 975

Lys Gly Ile Gly Gly Glu His Gly Ile Asp Lys Phe Asn Pro Ala Gly
            980                 985                 990

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

Pro Glu  Leu Phe Ala Phe Asn  Asn Glu Gly Ile Asn  Ala Pro Ser
    1010                1015                1020

Ser Ser  Gly Ser Lys Ile Ala  Asn Ile Tyr Pro Leu  Asp Ser Asn
    1025                1030                1035

Gly Asn  Pro Gln Asp Ala Gln  Leu Glu Arg Gly Leu  Thr Pro Ser
    1040                1045                1050

Pro Leu  Val Leu Arg Ser Ala  Glu Glu Gly Leu Ile  Ser Ile Val
    1055                1060                1065
```

```
Asn Thr  Asn Lys Glu Gly Glu  Asn Gln Arg Asp Leu  Lys Val Ile
    1070                  1075                  1080

Ser Arg  Glu His Phe Ile Arg  Gly Ile Leu Asn Ser  Lys Ser Asn
    1085                  1090                  1095

Asp Ala  Lys Gly Ile Lys Ser  Ser Lys Leu Lys Val  Trp Gly Asp
    1100                  1105                  1110

Leu Lys  Trp Asp Gly Leu Ile  Tyr Asn Pro Arg Gly  Arg Glu Glu
    1115                  1120                  1125

Asn Ala  Pro Glu Ser Lys Asp  Asn Gln Asp Pro Ala  Thr Lys Ile
    1130                  1135                  1140

Arg Gly  Gln Phe Glu Pro Ile  Ala Glu Gly Gln Tyr  Phe Tyr Lys
    1145                  1150                  1155

Phe Lys  Tyr Arg Leu Thr Lys  Asp Tyr Pro Trp Gln  Val Ser Tyr
    1160                  1165                  1170

Ile Pro  Val Lys Ile Asp Asn  Thr Ala Pro Lys Ile  Val Ser Val
    1175                  1180                  1185

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

Tyr His  Lys Val Lys Asp Gln  Tyr Lys Asn Glu Thr  Leu Phe Ala
    1205                  1210                  1215

Arg Asp  Gln Lys Glu His Pro  Glu Lys Phe Asp Glu  Ile Ala Asn
    1220                  1225                  1230

Glu Val  Trp Tyr Ala Gly Ala  Ala Leu Val Asn Glu  Asp Gly Glu
    1235                  1240                  1245

Val Glu  Lys Asn Leu Glu Val  Thr Tyr Ala Gly Glu  Gly Gln Gly
    1250                  1255                  1260

Arg Asn  Arg Lys Leu Asp Lys  Asp Gly Asn Thr Ile  Tyr Glu Ile
    1265                  1270                  1275

Lys Gly  Ala Gly Asp Leu Arg  Gly Lys Ile Ile Glu  Val Ile Ala
    1280                  1285                  1290

Leu Asp  Gly Ser Ser Asn Phe  Thr Lys Ile His Arg  Ile Lys Phe
    1295                  1300                  1305

Ala Asn  Gln Ala Asp Glu Lys  Gly Met Ile Ser Tyr  Tyr Leu Val
    1310                  1315                  1320
```

```
Asp Pro  Asp Gln Asp Ser Ser  Lys Tyr Gln Lys Leu  Gly Glu Ile
    1325                1330                1335

Ala Glu  Ser Lys Phe Lys Asn  Leu Gly Asn Gly Lys  Glu Gly Ser
    1340                1345                1350

Leu Lys  Lys Asp Thr Thr Gly  Val Glu His His His  Gln Glu Asn
    1355                1360                1365

Glu Glu  Ser Ile Lys Glu Lys  Ser Ser Phe Thr Ile  Asp Arg Asn
    1370                1375                1380

Ile Ser  Thr Ile Arg Asp Phe  Glu Asn Lys Asp Leu  Lys Lys Leu
    1385                1390                1395

Ile Lys  Lys Lys Phe Arg Glu  Val Asp Asp Phe Thr  Ser Glu Thr
    1400                1405                1410

Gly Lys  Arg Met Glu Glu Tyr  Asp Tyr Lys Tyr Asp  Asp Lys Gly
    1415                1420                1425

Asn Ile  Ile Ala Tyr Asp Asp  Gly Thr Asp Leu Glu  Tyr Glu Thr
    1430                1435                1440

Glu Lys  Leu Asp Glu Ile Lys  Ser Lys Ile Tyr Gly  Val Leu Ser
    1445                1450                1455

Pro Ser  Lys Asp Gly His Phe  Glu Ile Leu Gly Lys  Ile Ser Asn
    1460                1465                1470

Val Ser  Lys Asn Ala Lys Val  Tyr Tyr Gly Asn Asn  Tyr Lys Ser
    1475                1480                1485

Ile Glu  Ile Lys Ala Thr Lys  Tyr Asp Phe His Ser  Lys Thr Met
    1490                1495                1500

Thr Phe  Asp Leu Tyr Ala Asn  Ile Asn Asp Ile Val  Asp Gly Leu
    1505                1510                1515

Ala Phe  Ala Gly Asp Met Arg  Leu Phe Val Lys Asp  Asn Asp Gln
    1520                1525                1530

Lys Lys  Ala Glu Ile Lys Ile  Arg Met Pro Glu Lys  Ile Lys Glu
    1535                1540                1545

Thr Lys  Ser Glu Tyr Pro Tyr  Val Ser Ser Tyr Gly  Asn Val Ile
    1550                1555                1560

Glu Leu  Gly Glu Gly Asp Leu  Ser Lys Asn Lys Pro  Asp Asn Leu
    1565                1570                1575
```

Thr Lys Met Glu Ser Gly Lys Ile Tyr Ser Asp Ser Glu Lys Gln
1580 1585 1590

Gln Tyr Leu Leu Lys Asp Asn Ile Ile Leu Arg Lys Gly Tyr Ala
1595 1600 1605

Leu Lys Val Thr Thr Tyr Asn Pro Gly Lys Thr Asp Met Leu Glu
1610 1615 1620

Gly Asn Gly Val Tyr Ser Lys Glu Asp Ile Ala Lys Ile Gln Lys
1625 1630 1635

Ala Asn Pro Asn Leu Arg Ala Leu Ser Glu Thr Thr Ile Tyr Ala
1640 1645 1650

Asp Ser Arg Asn Val Glu Asp Gly Arg Ser Thr Gln Ser Val Leu
1655 1660 1665

Met Ser Ala Leu Asp Gly Phe Asn Ile Ile Arg Tyr Gln Val Phe
1670 1675 1680

Thr Phe Lys Met Asn Asp Lys Gly Glu Ala Ile Asp Lys Asp Gly
1685 1690 1695

Asn Leu Val Thr Asp Ser Ser Lys Leu Val Leu Phe Gly Lys Asp
1700 1705 1710

Asp Lys Glu Tyr Thr Gly Glu Asp Lys Phe Asn Val Glu Ala Ile
1715 1720 1725

Lys Glu Asp Gly Ser Met Leu Phe Ile Asp Thr Lys Pro Val Asn
1730 1735 1740

Leu Ser Met Asp Lys Asn Tyr Phe Asn Pro Ser Lys Ser Asn Lys
1745 1750 1755

Ile Tyr Val Arg Asn Pro Glu Phe Tyr Leu Arg Gly Lys Ile Ser
1760 1765 1770

Asp Lys Gly Gly Phe Asn Trp Glu Leu Arg Val Asn Glu Ser Val
1775 1780 1785

Val Asp Asn Tyr Leu Ile Tyr Gly Asp Leu His Ile Asp Asn Thr
1790 1795 1800

Arg Asp Phe Asn Ile Lys Leu Asn Val Lys Asp Gly Asp Ile Met
1805 1810 1815

Asp Trp Gly Met Lys Asp Tyr Lys Ala Asn Gly Phe Pro Asp Lys
1820 1825 1830

```
Val Thr  Asp Met Asp Gly Asn  Val Tyr Leu Gln Thr  Gly Tyr Ser
    1835                  1840                  1845

Asp Leu  Asn Ala Lys Ala Val  Gly Val His Tyr Gln  Phe Leu Tyr
    1850                  1855                  1860

Asp Asn  Val Lys Pro Glu Val  Asn Ile Asp Pro Lys  Gly Asn Thr
    1865                  1870                  1875

Ser Ile  Glu Tyr Ala Asp Gly  Lys Ser Val Val Phe  Asn Ile Asn
    1880                  1885                  1890

Asp Lys  Arg Asn Asn Gly Phe  Asp Gly Glu Ile Gln  Glu Gln His
    1895                  1900                  1905

Ile Tyr  Ile Asn Gly Lys Glu  Tyr Thr Ser Phe Asn  Asp Ile Lys
    1910                  1915                  1920

Gln Ile  Ile Asp Lys Thr Leu  Asn Ile Lys Ile Val  Val Lys Asp
    1925                  1930                  1935

Phe Ala  Arg Asn Thr Thr Val  Lys Glu Phe Ile Leu  Asn Lys Asp
    1940                  1945                  1950

Thr Gly  Glu Val Ser Glu Leu  Lys Pro His Arg Val  Thr Val Thr
    1955                  1960                  1965

Ile Gln  Asn Gly Lys Glu Met  Ser Ser Thr Ile Val  Ser Glu Glu
    1970                  1975                  1980

Asp Phe  Ile Leu Pro Val Tyr  Lys Gly Glu Leu Glu  Lys Gly Tyr
    1985                  1990                  1995

Gln Phe  Asp Gly Trp Glu Ile  Ser Gly Phe Glu Gly  Lys Lys Asp
    2000                  2005                  2010

Ala Gly  Tyr Val Ile Asn Leu  Ser Lys Asp Thr Phe  Ile Lys Pro
    2015                  2020                  2025

Val Phe  Lys Lys Ile Glu Glu  Lys Lys Glu Glu Glu  Asn Lys Pro
    2030                  2035                  2040

Thr Phe  Asp Val Ser Lys Lys  Lys Asp Asn Pro Gln  Val Asn His
    2045                  2050                  2055

Ser Gln  Leu Asn Glu Ser His  Arg Lys Glu Asp Leu  Gln Arg Glu
    2060                  2065                  2070

Glu His  Ser Gln Lys Ser Asp  Ser Thr Lys Asp Val  Thr Ala Thr
    2075                  2080                  2085
```

```
Val Leu  Asp Lys Asn Asn Ile  Ser Ser Lys Ser Thr  Thr Asn Asn
    2090                 2095                 2100

Pro Asn  Lys Leu Pro Lys Thr  Gly Thr Ala Ser Gly  Ala Gln Thr
    2105                 2110                 2115

Leu Leu  Ala Ala Gly Ile Met  Phe Ile Val Gly Ile  Phe Leu Gly
    2120                 2125                 2130

Leu Lys  Lys Lys Asn Gln Asp
    2135                 2140
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<210> 13
<211> 662
<212> PRT
<213> Streptococcus pneumoniae

<400> 13

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Met Val Val Leu Ala Asp Thr Ser Ser Ser Glu Asp Ala Leu Asn Ile
1               5                  10                  15

Ser Asp Lys Glu Lys Val Ala Glu Asn Lys Glu Lys His Glu Asn Ile
            20                  25                  30

His Ser Ala Met Glu Thr Ser Gln Asp Phe Lys Glu Lys Lys Thr Ala
        35                  40                  45

Val Ile Lys Glu Lys Glu Val Val Ser Lys Asn Pro Val Ile Asp Asn
    50                  55                  60

Asn Thr Ser Asn Glu Glu Ala Lys Ile Lys Glu Glu Asn Ser Asn Lys
65                  70                  75                  80

Ser Gln Gly Asp Tyr Thr Asp Ser Phe Val Asn Lys Asn Thr Glu Asn
                85                  90                  95

Pro Lys Lys Glu Asp Lys Val Val Tyr Ile Ala Glu Phe Lys Asp Lys
            100                 105                 110

Glu Ser Gly Glu Lys Ala Ile Lys Glu Leu Ser Ser Leu Lys Asn Thr
        115                 120                 125

Lys Val Leu Tyr Thr Tyr Asp Arg Ile Phe Asn Gly Ser Ala Ile Glu
    130                 135                 140

Thr Thr Pro Asp Asn Leu Asp Lys Ile Lys Gln Ile Glu Gly Ile Ser
145                 150                 155                 160

Ser Val Glu Arg Ala Gln Lys Val Gln Pro Met Met Asn His Ala Arg
                165                 170                 175

Lys Glu Ile Gly Val Glu Glu Ala Ile Asp Tyr Leu Lys Ser Ile Asn
            180                 185                 190
```

```
Ala Pro Phe Gly Lys Asn Phe Asp Gly Arg Gly Met Val Ile Ser Asn
        195                 200                 205

Ile Asp Thr Gly Thr Asp Tyr Arg His Lys Ala Met Arg Ile Asp Asp
    210                 215                 220

Asp Ala Lys Ala Ser Met Arg Phe Lys Lys Glu Asp Leu Lys Gly Thr
225                 230                 235                 240

Asp Lys Asn Tyr Trp Leu Ser Asp Lys Ile Pro His Ala Phe Asn Tyr
                245                 250                 255

Tyr Asn Gly Gly Lys Ile Thr Val Glu Lys Tyr Asp Asp Gly Arg Asp
            260                 265                 270

Tyr Phe Asp Pro His Gly Met His Ile Ala Gly Ile Leu Ala Gly Asn
        275                 280                 285

Asp Thr Glu Gln Asp Ile Lys Asn Phe Asn Gly Ile Asp Gly Ile Ala
    290                 295                 300

Pro Asn Ala Gln Ile Phe Ser Tyr Lys Met Tyr Ser Asp Ala Gly Ser
305                 310                 315                 320

Gly Phe Ala Gly Asp Glu Thr Met Phe His Ala Ile Glu Asp Ser Ile
                325                 330                 335

Lys His Asn Val Asp Val Val Ser Val Ser Ser Gly Phe Thr Gly Thr
            340                 345                 350

Gly Leu Val Gly Glu Lys Tyr Trp Gln Ala Ile Arg Ala Leu Arg Lys
        355                 360                 365

Ala Gly Ile Pro Met Val Val Ala Thr Gly Asn Tyr Ala Thr Ser Ala
    370                 375                 380

Ser Ser Ser Ser Trp Asp Leu Val Ala Asn Asn His Leu Lys Met Thr
385                 390                 395                 400

Asp Thr Gly Asn Val Thr Arg Thr Ala Ala His Glu Asp Ala Ile Ala
                405                 410                 415

Val Ala Ser Ala Lys Asn Gln Thr Val Glu Phe Asp Lys Val Asn Ile
            420                 425                 430

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

Ser Lys Ile Thr Thr Asn Glu Asp Gly Thr Lys Ala Pro Ser Lys Leu
    450                 455                 460
```

```
Lys Phe Val Tyr Ile Gly Lys Gly Gln Asp Gln Asp Leu Ile Gly Leu
465                 470                 475                 480

Asp Leu Arg Gly Lys Ile Ala Val Met Asp Arg Ile Tyr Thr Lys Asp
                485                 490                 495

Leu Lys Asn Ala Phe Lys Lys Ala Met Asp Lys Gly Ala Arg Ala Ile
            500                 505                 510

Met Val Val Asn Thr Val Asn Tyr Tyr Asn Arg Asp Asn Trp Thr Glu
        515                 520                 525

Leu Pro Ala Met Gly Tyr Glu Ala Asp Glu Gly Thr Lys Ser Gln Val
    530                 535                 540

Phe Ser Ile Ser Gly Asp Asp Gly Val Lys Leu Trp Asn Met Ile Asn
545                 550                 555                 560

Pro Asp Lys Lys Thr Glu Val Lys Arg Asn Asn Lys Glu Asp Phe Lys
                565                 570                 575

Asp Lys Leu Glu Gln Tyr Tyr Pro Ile Asp Met Glu Ser Phe Asn Ser
            580                 585                 590

Asn Lys Pro Asn Val Gly Asp Glu Lys Glu Ile Asp Phe Lys Phe Ala
        595                 600                 605

Pro Asp Thr Asp Lys Glu Leu Tyr Lys Glu Asp Ile Ile Val Pro Ala
    610                 615                 620

Gly Ser Thr Ser Trp Gly Pro Arg Ile Asp Leu Leu Leu Lys Pro Asp
625                 630                 635                 640

Val Ser Ala Pro Gly Lys Asn Ile Lys Ser Thr Leu Asn Val Ile Asn
                645                 650                 655

Gly Lys Ser Thr Tyr Gly
            660
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<210> 14
<211> 274
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<220>
<221> MOD_RES
<222> (1)..(1)
<223> Met or Ile

<220>
<221> MOD_RES
<222> (55)..(55)
<223> Asn or Tyr

<220>
<221> MOD_RES
<222> (63)..(63)
<223> His or Tyr

<220>
<221> MOD_RES
<222> (79)..(79)
<223> Arg or His

<220>
<221> MOD_RES
<222> (97)..(97)
<223> Ala or Glu

<220>
<221> MOD_RES
<222> (108)..(108)
<223> Gly or Glu

<220>
<221> MOD_RES
<222> (164)..(164)
<223> Asp or Glu

<220>
<221> MOD_RES
<222> (165)..(165)
<223> Gln or Lys

<220>
<221> MOD_RES
<222> (187)..(187)
<223> Phe or Ile

<220>
<221> MOD_RES
<222> (197)..(197)
<223> Arg or His

<220>
<221> MOD_RES
<222> (238)..(238)
<223> Gly or Arg

<400> 14
Xaa Asn Gln Ser Tyr Phe Tyr Leu Lys Met Lys Glu His Lys Leu Lys
1 5 10 15

Val Pro Tyr Thr Gly Lys Glu Arg Arg Val Arg Ile Leu Leu Pro Lys
20 25 30

Asp Tyr Glu Lys Asp Thr Asp Arg Ser Tyr Pro Val Val Tyr Phe His
35 40 45

Asp Gly Gln Asn Val Phe Xaa Ser Lys Glu Ser Phe Ile Gly Xaa Ser
50 55 60

```
Trp Lys Ile Ile Pro Ala Ile Lys Arg Asn Pro Asp Ile Ser Xaa Met
65                  70                  75                  80

Ile Val Val Ala Ile Asp Asn Asp Gly Met Gly Arg Met Asn Glu Tyr
                85                  90                  95

Xaa Ala Trp Lys Phe Gln Glu Ser Pro Ile Pro Xaa Gln Gln Phe Gly
            100                 105                 110

Gly Lys Gly Val Glu Tyr Ala Glu Phe Val Met Glu Val Val Lys Pro
        115                 120                 125

Phe Ile Asp Glu Thr Tyr Arg Thr Lys Ala Asp Cys Gln His Thr Ala
    130                 135                 140

Met Ile Gly Ser Ser Leu Gly Gly Asn Ile Thr Gln Phe Ile Gly Leu
145                 150                 155                 160

Glu Tyr Gln Xaa Xaa Ile Gly Cys Leu Gly Val Phe Ser Ser Ala Asn
                165                 170                 175

Trp Leu His Gln Glu Ala Phe Asn Arg Tyr Xaa Glu Cys Gln Lys Leu
            180                 185                 190

Ser Pro Asp Gln Xaa Ile Phe Ile Tyr Val Gly Thr Glu Glu Ala Asp
        195                 200                 205

Asp Thr Asp Lys Thr Leu Met Asp Gly Asn Ile Lys Gln Ala Tyr Ile
    210                 215                 220

Asp Ser Ser Leu Cys Tyr Tyr His Asp Leu Ile Ala Gly Xaa Val His
225                 230                 235                 240

Leu Asp Asn Leu Val Leu Lys Val Gln Ser Gly Ala Ile His Ser Glu
                245                 250                 255

Ile Pro Trp Ser Glu Asn Leu Pro Asp Cys Leu Arg Phe Phe Ala Glu
            260                 265                 270

Lys Trp
```

<210> 15
<211> 130
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<220>
<221> MOD_RES

<222> (1)..(1)
<223> Met or Ile

<220>
<221> MOD_RES
<222> (55)..(55)
<223> Asn or Tyr

<220>
<221> MOD_RES
<222> (63)..(63)
<223> His or Tyr

<220>
<221> MOD_RES
<222> (79)..(79)
<223> Arg or His

<220>
<221> MOD_RES
<222> (97)..(97)
<223> Ala or Glu

<220>
<221> MOD_RES
<222> (108)..(108)
<223> Gly or Glu

<400> 15
Xaa Asn Gln Ser Tyr Phe Tyr Leu Lys Met Lys Glu His Lys Leu Lys
1 5 10 15

Val Pro Tyr Thr Gly Lys Glu Arg Arg Val Arg Ile Leu Leu Pro Lys
20 25 30

Asp Tyr Glu Lys Asp Thr Asp Arg Ser Tyr Pro Val Val Tyr Phe His
35 40 45

Asp Gly Gln Asn Val Phe Xaa Ser Lys Glu Ser Phe Ile Gly Xaa Ser
50 55 60

Trp Lys Ile Ile Pro Ala Ile Lys Arg Asn Pro Asp Ile Ser Xaa Met
65 70 75 80

Ile Val Val Ala Ile Asp Asn Asp Gly Met Gly Arg Met Asn Glu Tyr
85 90 95

Xaa Ala Trp Lys Phe Gln Glu Ser Pro Ile Pro Xaa Gln Gln Phe Gly
100 105 110

Gly Lys Gly Val Glu Tyr Ala Glu Phe Val Met Glu Val Val Lys Pro
115 120 125

Phe Ile
130

<210> 16
<211> 299
<212> PRT

<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<220>
<221> MOD_RES
<222> (6)..(6)
<223> Met or Thr

<220>
<221> MOD_RES
<222> (9)..(9)
<223> Ala or Thr

<220>
<221> MOD_RES
<222> (15)..(15)
<223> Ala or Val

<220>
<221> MOD_RES
<222> (26)..(26)
<223> Met or Ile

<220>
<221> MOD_RES
<222> (80)..(80)
<223> Asn or Tyr

<220>
<221> MOD_RES
<222> (88)..(88)
<223> His or Tyr

<220>
<221> MOD_RES
<222> (104)..(104)
<223> Arg or His

<220>
<221> MOD_RES
<222> (122)..(122)
<223> Ala or Glu

<220>
<221> MOD_RES
<222> (133)..(133)
<223> Gly or Glu

<220>
<221> MOD_RES
<222> (189)..(189)
<223> Asp or Glu

<220>
<221> MOD_RES
<222> (190)..(190)
<223> Gln or Lys

<220>
<221> MOD_RES
<222> (212)..(212)
<223> Phe or Ile

<220>

<221> MOD_RES
<222> (222)..(222)
<223> Arg or His

<220>
<221> MOD_RES
<222> (263)..(263)
<223> Arg or His

<400> 16

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

Leu Ala Ser Leu Leu Leu Val Ala Cys Xaa Asn Gln Ser Tyr Phe Tyr
            20                  25                  30

Leu Lys Met Lys Glu His Lys Leu Lys Val Pro Tyr Thr Gly Lys Glu
        35                  40                  45

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

Arg Ser Tyr Pro Val Val Tyr Phe His Asp Gly Gln Asn Val Phe Xaa
65                  70                  75                  80

Ser Lys Glu Ser Phe Ile Gly Xaa Ser Trp Lys Ile Ile Pro Ala Ile
                85                  90                  95

Lys Arg Asn Pro Asp Ile Ser Xaa Met Ile Val Val Ala Ile Asp Asn
            100                 105                 110

Asp Gly Met Gly Arg Met Asn Glu Tyr Xaa Ala Trp Lys Phe Gln Glu
        115                 120                 125

Ser Pro Ile Pro Xaa Gln Gln Phe Gly Gly Lys Gly Val Glu Tyr Ala
    130                 135                 140

Glu Phe Val Met Glu Val Val Lys Pro Phe Ile Asp Glu Thr Tyr Arg
145                 150                 155                 160

Thr Lys Ala Asp Cys Gln His Thr Ala Met Ile Gly Ser Ser Leu Gly
                165                 170                 175

Gly Asn Ile Thr Gln Phe Ile Gly Leu Glu Tyr Gln Xaa Xaa Ile Gly
            180                 185                 190

Cys Leu Gly Val Phe Ser Ser Ala Asn Trp Leu His Gln Glu Ala Phe
        195                 200                 205

Asn Arg Tyr Xaa Glu Cys Gln Lys Leu Ser Pro Asp Gln Xaa Ile Phe
    210                 215                 220

Ile Tyr Val Gly Thr Glu Glu Ala Asp Asp Thr Asp Lys Thr Leu Met
225                 230                 235                 240
```

```
Asp Gly Asn Ile Lys Gln Ala Tyr Ile Asp Ser Ser Leu Cys Tyr Tyr
                245                 250                 255

His Asp Leu Ile Ala Gly Xaa Val His Leu Asp Asn Leu Val Leu Lys
            260                 265                 270

Val Gln Ser Gly Ala Ile His Ser Glu Ile Pro Trp Ser Glu Asn Leu
        275                 280                 285

Pro Asp Cys Leu Arg Phe Phe Ala Glu Lys Trp
    290                 295
```

<210> 17
<211> 155
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<220>
<221> MOD_RES
<222> (6)..(6)
<223> Met or Thr

<220>
<221> MOD_RES
<222> (9)..(9)
<223> Ala or Thr

<220>
<221> MOD_RES
<222> (15)..(15)
<223> Ala or Val

<220>
<221> MOD_RES
<222> (26)..(26)
<223> Met or Ile

<220>
<221> MOD_RES
<222> (80)..(80)
<223> Asn or Tyr

<220>
<221> MOD_RES
<222> (88)..(88)
<223> His or Tyr

<220>
<221> MOD_RES
<222> (104)..(104)
<223> Arg or His

<220>
<221> MOD_RES
<222> (122)..(122)
<223> Ala or Glu

<220>
<221> MOD_RES
<222> (133)..(133)
<223> Gly or Glu

<400> 17
Met Ser Ser Lys Phe Xaa Lys Ser Xaa Ala Val Leu Gly Thr Xaa Thr
1 5 10 15

Leu Ala Ser Leu Leu Leu Val Ala Cys Xaa Asn Gln Ser Tyr Phe Tyr
20 25 30

Leu Lys Met Lys Glu His Lys Leu Lys Val Pro Tyr Thr Gly Lys Glu
35 40 45

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

Arg Ser Tyr Pro Val Val Tyr Phe His Asp Gly Gln Asn Val Phe Xaa
65 70 75 80

Ser Lys Glu Ser Phe Ile Gly Xaa Ser Trp Lys Ile Ile Pro Ala Ile
85 90 95

Lys Arg Asn Pro Asp Ile Ser Xaa Met Ile Val Val Ala Ile Asp Asn
100 105 110

Asp Gly Met Gly Arg Met Asn Glu Tyr Xaa Ala Trp Lys Phe Gln Glu
115 120 125

Ser Pro Ile Pro Xaa Gln Gln Phe Gly Gly Lys Gly Val Glu Tyr Ala
130 135 140

Glu Phe Val Met Glu Val Val Lys Pro Phe Ile
145 150 155

<210> 18
<211> 254
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<220>
<221> MOD_RES
<222> (11)..(11)
<223> Gly or Glu

<220>
<221> MOD_RES
<222> (24)..(24)
<223> Gly or Ser

<220>
<221> MOD_RES

<222> (27)..(27)
<223> Lys or Arg

<220>
<221> MOD_RES
<222> (30)..(30)
<223> Ile or Asn

<220>
<221> MOD_RES
<222> (56)..(56)
<223> Asp or Asn

<220>
<221> MOD_RES
<222> (58)..(58)
<223> Any amino acid

<220>
<221> MOD_RES
<222> (83)..(83)
<223> Leu or Ile

<220>
<221> MOD_RES
<222> (111)..(111)
<223> Asp or Glu

<220>
<221> MOD_RES
<222> (159)..(159)
<223> Leu or Phe

<220>
<221> MOD_RES
<222> (192)..(192)
<223> Asn or Tyr

<220>
<221> MOD_RES
<222> (199)..(199)
<223> Pro or Ser

<400> 18
Met Cys Ser Gly Gly Ala Lys Lys Glu Gly Xaa Ala Ala Ser Lys Lys
1 5 10 15

Glu Ile Ile Val Ala Thr Asn Xaa Ser Pro Xaa Pro Phe Xaa Tyr Glu
20 25 30

Glu Asn Gly Glu Leu Thr Gly Tyr Glu Ile Glu Val Val Arg Ala Ile
35 40 45

Phe Lys Asp Ser Asp Lys Tyr Xaa Val Xaa Phe Glu Lys Thr Glu Trp
50 55 60

Ser Gly Val Phe Ala Gly Leu Asp Ala Asp Arg Tyr Asn Met Ala Val
65 70 75 80

Asn Asn Xaa Ser Tyr Thr Lys Glu Arg Ala Glu Lys Tyr Leu Tyr Ala
85 90 95

Ala Pro Ile Ala Gln Asn Pro Asn Val Leu Val Val Lys Lys Xaa Asp
100 105 110

Ser Ser Ile Lys Ser Leu Asp Asp Ile Gly Gly Lys Ser Thr Glu Val
115 120 125

Val Gln Ala Thr Thr Ser Ala Lys Gln Leu Glu Ala Tyr Asn Ala Glu
130 135 140

His Thr Asp Asn Pro Thr Ile Leu Asn Tyr Thr Lys Ala Asp Xaa Gln
145 150 155 160

Gln Ile Met Val Arg Leu Ser Asp Gly Gln Phe Asp Tyr Lys Ile Phe
165 170 175

Asp Lys Ile Gly Val Glu Thr Val Ile Lys Asn Gln Gly Leu Asp Xaa
180 185 190

Leu Lys Val Ile Glu Leu Xaa Ser Asp Gln Gln Pro Tyr Val Tyr Pro
195 200 205

Leu Leu Ala Gln Gly Gln Asp Glu Leu Lys Ser Phe Val Asp Lys Arg
210 215 220

Ile Lys Glu Leu Tyr Lys Asp Gly Thr Leu Glu Lys Leu Ser Lys Gln
225 230 235 240

Phe Phe Gly Asp Thr Tyr Leu Pro Ala Glu Ala Asp Ile Lys
245 250

<210> 19
<211> 276
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<220>
<221> MOD_RES
<222> (14)..(14)
<223> Ala or Gly

<220>
<221> MOD_RES
<222> (20)..(20)
<223> Val or Leu

<220>
<221> MOD_RES
<222> (33)..(33)
<223> Glu or Gln

<220>
<221> MOD_RES
<222> (46)..(46)

<223> Gly or Ser

<220>
<221> MOD_RES
<222> (49)..(49)
<223> Lys or Arg

<220>
<221> MOD_RES
<222> (52)..(52)
<223> Ile or Asn

<220>
<221> MOD_RES
<222> (78)..(78)
<223> Asp or Asn

<220>
<221> MOD_RES
<222> (80)..(80)
<223> Any amino acid

<220>
<221> MOD_RES
<222> (105)..(105)
<223> Leu or Ile

<220>
<221> MOD_RES
<222> (133)..(133)
<223> Asp or Glu

<220>
<221> MOD_RES
<222> (181)..(181)
<223> Asp or Glu

<220>
<221> MOD_RES
<222> (214)..(214)
<223> Asn or Tyr

<220>
<221> MOD_RES
<222> (221)..(221)
<223> Pro or Ser

<400> 19
Met Lys Lys Ile Val Lys Tyr Ser Ser Leu Ala Ala Leu Xaa Leu Val
1 5 10 15

Ala Ala Gly Xaa Leu Ala Ala Cys Ser Gly Gly Ala Lys Lys Glu Gly
20 25 30

Xaa Ala Ala Ser Lys Lys Glu Ile Ile Val Ala Thr Asn Xaa Ser Pro
35 40 45

Xaa Pro Phe Xaa Tyr Glu Glu Asn Gly Glu Leu Thr Gly Tyr Glu Ile
50 55 60

Glu Val Val Arg Ala Ile Phe Lys Asp Ser Asp Lys Tyr Xaa Val Xaa
65 70 75 80

Phe Glu Lys Thr Glu Trp Ser Gly Val Phe Ala Gly Leu Asp Ala Asp
85 90 95

Arg Tyr Asn Met Ala Val Asn Asn Xaa Ser Tyr Thr Lys Glu Arg Ala
100 105 110

Glu Lys Tyr Leu Tyr Ala Ala Pro Ile Ala Gln Asn Pro Asn Val Leu
115 120 125

Val Val Lys Lys Xaa Asp Ser Ser Ile Lys Ser Leu Asp Asp Ile Gly
130 135 140

Gly Lys Ser Thr Glu Val Val Gln Ala Thr Thr Ser Ala Lys Gln Leu
145 150 155 160

Glu Ala Tyr Asn Ala Glu His Thr Asp Asn Pro Thr Ile Leu Asn Tyr
165 170 175

Thr Lys Ala Asp Xaa Gln Gln Ile Met Val Arg Leu Ser Asp Gly Gln
180 185 190

Phe Asp Tyr Lys Ile Phe Asp Lys Ile Gly Val Glu Thr Val Ile Lys
195 200 205

Asn Gln Gly Leu Asp Xaa Leu Lys Val Ile Glu Leu Xaa Ser Asp Gln
210 215 220

Gln Pro Tyr Val Tyr Pro Leu Leu Ala Gln Gly Gln Asp Glu Leu Lys
225 230 235 240

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

Glu Lys Leu Ser Lys Gln Phe Phe Gly Asp Thr Tyr Leu Pro Ala Glu
260 265 270

Ala Asp Ile Lys
275

<210> 20
<211> 400
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<220>
<221> MOD_RES
<222> (18)..(18)
<223> Val or Ala

<220>

<221> MOD_RES
<222> (48)..(48)
<223> Val or Ile

<220>
<221> MOD_RES
<222> (74)..(74)
<223> Val or Ile

<220>
<221> MOD_RES
<222> (83)..(83)
<223> Any amino acid
<220>
<221> MOD_RES
<222> (100)..(100)
<223> Ala or Thr

<220>
<221> MOD_RES
<222> (177)..(177)
<223> Thr or Ala

<220>
<221> MOD_RES
<222> (186)..(186)
<223> Ala or Gly

<220>
<221> MOD_RES
<222> (196)..(196)
<223> Ala or Pro

<220>
<221> MOD_RES
<222> (208)..(208)
<223> Val or Ala

<220>
<221> MOD_RES
<222> (214)..(214)
<223> Any amino acid

<220>
<221> MOD_RES
<222> (237)..(237)
<223> Gln or His

<220>
<221> MOD_RES
<222> (298)..(298)
<223> Ser or Ala

<220>
<221> MOD_RES
<222> (307)..(307)
<223> Ala or Ser

<220>
<221> MOD_RES
<222> (313)..(313)
<223> Val or Ala

<220>
<221> MOD_RES
<222> (348)..(348)
<223> Asn or Ser

<400> 20

Met Cys Gly Ser Lys Thr Ala Asp Lys Pro Ala Asp Ser Gly Ser Ser
1 5 10 15

Glu Xaa Lys Glu Leu Thr Val Tyr Val Asp Glu Gly Tyr Lys Ser Tyr
20 25 30

Ile Glu Glu Val Ala Lys Ala Tyr Glu Lys Glu Ala Gly Val Lys Xaa
35 40 45

Thr Leu Lys Thr Gly Asp Ala Leu Gly Gly Leu Asp Lys Leu Ser Leu
50 55 60

Asp Asn Gln Ser Gly Asn Val Pro Asp Xaa Met Met Ala Pro Tyr Asp
65 70 75 80

Arg Val Xaa Ser Leu Gly Ser Asp Gly Gln Leu Ser Glu Val Lys Leu
85 90 95

Ser Asp Gly Xaa Lys Thr Asp Asp Thr Thr Lys Ser Leu Val Thr Ala
100 105 110

Ala Asn Gly Lys Val Tyr Gly Ala Pro Ala Val Ile Glu Ser Leu Val
115 120 125

Met Tyr Tyr Asn Lys Asp Leu Val Lys Asp Ala Pro Lys Thr Phe Ala
130 135 140

Asp Leu Glu Asn Leu Ala Lys Asp Ser Lys Tyr Ala Phe Ala Gly Glu
145 150 155 160

Asp Gly Lys Thr Thr Ala Phe Leu Ala Asp Trp Thr Asn Phe Tyr Tyr
165 170 175

Xaa Tyr Gly Leu Leu Ala Gly Asn Gly Xaa Tyr Val Phe Gly Gln Asn
180 185 190

Gly Lys Asp Xaa Lys Asp Ile Gly Leu Ala Asn Asp Gly Ser Ile Xaa
195 200 205

Gly Ile Asn Tyr Ala Xaa Ser Trp Tyr Glu Lys Trp Pro Lys Gly Met
210 215 220

Gln Asp Thr Glu Gly Ala Gly Asn Leu Ile Gln Thr Xaa Phe Gln Glu
225 230 235 240

Gly Lys Thr Ala Ala Ile Ile Asp Gly Pro Trp Lys Ala Gln Ala Phe
245 250 255

Lys Asp Ala Lys Val Asn Tyr Gly Val Ala Thr Ile Pro Thr Leu Pro
260 265 270

```
Asn Gly Lys Glu Tyr Ala Ala Phe Gly Gly Gly Lys Ala Trp Val Ile
        275                 280                 285

Pro Gln Ala Val Lys Asn Leu Glu Ala Xaa Gln Lys Phe Val Asp Phe
    290                 295                 300

Leu Val Xaa Thr Glu Gln Gln Lys Xaa Leu Tyr Asp Lys Thr Asn Glu
305                 310                 315                 320

Ile Pro Ala Asn Thr Glu Ala Arg Ser Tyr Ala Glu Gly Lys Asn Asp
                325                 330                 335

Glu Leu Thr Thr Ala Val Ile Lys Gln Phe Lys Xaa Thr Gln Pro Leu
            340                 345                 350

Pro Asn Ile Ser Gln Met Ser Ala Val Trp Asp Pro Ala Lys Asn Met
        355                 360                 365

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

Asp Ala Val Thr Leu Ile Lys Glu Thr Ile Lys Gln Lys Phe Gly Glu
385                 390                 395                 400
```

<210> 21
<211> 423
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<220>
<221> MOD_RES
<222> (6)..(6)
<223> Met or Thr

<220>
<221> MOD_RES
<222> (9)..(9)
<223> Ala or Thr

<220>
<221> MOD_RES
<222> (15)..(15)
<223> Ala or Val

<220>
<221> MOD_RES
<222> (41)..(41)
<223> Val or Ala

<220>
<221> MOD_RES
<222> (71)..(71)
<223> Val or Ile

<220>
<221> MOD_RES
<222> (97)..(97)
<223> Val or Ile

<220>
<221> MOD_RES
<222> (106)..(106)
<223> Any amino acid

<220>
<221> MOD_RES
<222> (123)..(123)
<223> Ala or Thr

<220>
<221> MOD_RES
<222> (200)..(200)
<223> Thr or Ala

<220>
<221> MOD_RES
<222> (209)..(209)
<223> Ala or Gly

<220>
<221> MOD_RES
<222> (219)..(219)
<223> Ala or Pro

<220>
<221> MOD_RES
<222> (231)..(231)
<223> Val or Ala

<220>
<221> MOD_RES
<222> (237)..(237)
<223> Any amino acid

<220>
<221> MOD_RES
<222> (260)..(260)
<223> Gln or His

<220>
<221> MOD_RES
<222> (321)..(321)
<223> Ser or Ala

<220>
<221> MOD_RES
<222> (330)..(330)
<223> Ala or Ser

<220>
<221> MOD_RES
<222> (336)..(336)
<223> Val or Ala

<220>
<221> MOD_RES
<222> (371)..(371)
<223> Asn or Ser

<400> 21
Met Ser Ser Lys Phe Xaa Lys Ser Xaa Ala Val Leu Gly Thr Xaa Thr
1 5 10 15

Leu Ala Ser Leu Leu Leu Val Ala Cys Gly Ser Lys Thr Ala Asp Lys
20 25 30

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

Asp Glu Gly Tyr Lys Ser Tyr Ile Glu Glu Val Ala Lys Ala Tyr Glu
50 55 60

Lys Glu Ala Gly Val Lys Xaa Thr Leu Lys Thr Gly Asp Ala Leu Gly
65 70 75 80

Gly Leu Asp Lys Leu Ser Leu Asp Asn Gln Ser Gly Asn Val Pro Asp
85 90 95

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

Gln Leu Ser Glu Val Lys Leu Ser Asp Gly Xaa Lys Thr Asp Asp Thr
115 120 125

Thr Lys Ser Leu Val Thr Ala Ala Asn Gly Lys Val Tyr Gly Ala Pro
130 135 140

Ala Val Ile Glu Ser Leu Val Met Tyr Tyr Asn Lys Asp Leu Val Lys
145 150 155 160

Asp Ala Pro Lys Thr Phe Ala Asp Leu Glu Asn Leu Ala Lys Asp Ser
165 170 175

Lys Tyr Ala Phe Ala Gly Glu Asp Gly Lys Thr Thr Ala Phe Leu Ala
180 185 190

Asp Trp Thr Asn Phe Tyr Tyr Xaa Tyr Gly Leu Leu Ala Gly Asn Gly
195 200 205

Xaa Tyr Val Phe Gly Gln Asn Gly Lys Asp Xaa Lys Asp Ile Gly Leu
210 215 220

Ala Asn Asp Gly Ser Ile Xaa Gly Ile Asn Tyr Ala Xaa Ser Trp Tyr
225 230 235 240

Glu Lys Trp Pro Lys Gly Met Gln Asp Thr Glu Gly Ala Gly Asn Leu
245 250 255

Ile Gln Thr Xaa Phe Gln Glu Gly Lys Thr Ala Ala Ile Ile Asp Gly
260 265 270

Pro Trp Lys Ala Gln Ala Phe Lys Asp Ala Lys Val Asn Tyr Gly Val
275 280 285

```
Ala Thr Ile Pro Thr Leu Pro Asn Gly Lys Glu Tyr Ala Ala Phe Gly
    290                 295                 300

Gly Gly Lys Ala Trp Val Ile Pro Gln Ala Val Lys Asn Leu Glu Ala
305                 310                 315                 320

Xaa Gln Lys Phe Val Asp Phe Leu Val Xaa Thr Glu Gln Gln Lys Xaa
                325                 330                 335

Leu Tyr Asp Lys Thr Asn Glu Ile Pro Ala Asn Thr Glu Ala Arg Ser
            340                 345                 350

Tyr Ala Glu Gly Lys Asn Asp Glu Leu Thr Thr Ala Val Ile Lys Gln
        355                 360                 365

Phe Lys Xaa Thr Gln Pro Leu Pro Asn Ile Ser Gln Met Ser Ala Val
    370                 375                 380

Trp Asp Pro Ala Lys Asn Met Leu Phe Asp Ala Val Ser Gly Gln Lys
385                 390                 395                 400

Asp Ala Lys Thr Ala Ala Asn Asp Ala Val Thr Leu Ile Lys Glu Thr
                405                 410                 415

Ile Lys Gln Lys Phe Gly Glu
            420
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<210> 22
<211> 357
<212> PRT
<213> Streptococcus pneumoniae

<400> 22

```
Met Ala Asn Ile Phe Asp Tyr Leu Lys Asp Val Ala Tyr Asp Ser Tyr
1               5                   10                  15

Tyr Asp Leu Pro Leu Asn Glu Leu Asp Ile Leu Thr Leu Ile Glu Ile
            20                  25                  30

Thr Tyr Leu Ser Phe Asp Asn Leu Val Ser Thr Leu Pro Gln Arg Leu
        35                  40                  45

Leu Asp Leu Ala Pro Gln Val Pro Arg Asp Pro Thr Met Leu Thr Ser
    50                  55                  60

Lys Asn Arg Leu Gln Leu Leu Asp Glu Leu Ala Gln His Lys Arg Phe
65                  70                  75                  80

Lys Asn Cys Lys Leu Ser His Phe Ile Asn Asp Ile Asp Pro Glu Leu
                85                  90                  95
```

```
Gln Lys Gln Phe Ala Ala Met Thr Tyr Arg Val Ser Leu Asp Thr Tyr
            100                 105                 110

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

Asp Phe His Leu Thr Tyr Met Lys Glu Ile Pro Ala Gln Lys His Ala
    130                 135                 140

Leu Arg Tyr Leu Lys Asn Phe Phe Ala His His Pro Lys Gln Lys Val
145                 150                 155                 160

Ile Leu Ala Gly His Ser Lys Gly Gly Asn Leu Ala Ile Tyr Ala Ala
                165                 170                 175

Ser Gln Ile Glu Gln Ser Leu Gln Asn Gln Ile Thr Ala Val Tyr Thr
            180                 185                 190

Phe Asp Ala Pro Gly Leu His Gln Glu Leu Thr Gln Thr Ala Gly Tyr
        195                 200                 205

Gln Arg Ile Met Asp Arg Ser Lys Ile Phe Ile Pro Gln Gly Ser Ile
    210                 215                 220

Ile Gly Met Met Leu Glu Ile Pro Ala His Gln Ile Ile Val Gln Ser
225                 230                 235                 240

Thr Ala Leu Gly Gly Ile Ala Gln His Asp Thr Phe Ser Trp Gln Ile
                245                 250                 255

Glu Asp Lys His Phe Val Gln Leu Asp Lys Thr Asn Ser Asp Ser Gln
            260                 265                 270

Gln Val Asp Thr Thr Phe Lys Glu Trp Val Ala Thr Val Pro Asp Glu
        275                 280                 285

Glu Leu Gln Leu Tyr Phe Asp Leu Phe Phe Gly Thr Ile Leu Asp Ala
    290                 295                 300

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

Ile His His Leu Phe Val Gln Ala Gln Ser Leu Thr Pro Glu Glu Arg
                325                 330                 335

Glu Thr Leu Gly Arg Leu Thr Gln Leu Leu Ile Asp Thr Arg Tyr Gln
            340                 345                 350

Ala Trp Lys Asn Arg
        355
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<210> 23
<211> 1066
<212> PRT
<213> Streptococcus pneumoniae

<400> 23

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

Leu Ser Gly Phe Leu Leu Asn His Tyr Met Thr Ile Gly Ala Glu Glu
            20                  25                  30

Thr Thr Thr Asn Thr Ile Gln Gln Ser Gln Lys Glu Val Gln Tyr Gln
        35                  40                  45

Gln Arg Asp Thr Lys Asn Leu Val Glu Asn Gly Asp Phe Gly Gln Thr
    50                  55                  60

Glu Asp Gly Ser Ser Pro Trp Thr Gly Ser Lys Ala Gln Gly Trp Ser
65                  70                  75                  80

Ala Trp Val Asp Gln Lys Asn Ser Ala Asp Ala Ser Thr Arg Val Ile
                85                  90                  95

Glu Ala Lys Asp Gly Ala Ile Thr Ile Ser Ser His Glu Lys Leu Arg
            100                 105                 110

Ala Ala Leu His Arg Met Val Pro Ile Glu Ala Lys Lys Lys Tyr Lys
        115                 120                 125

Leu Arg Phe Lys Ile Lys Thr Asp Asn Lys Ile Gly Ile Ala Lys Val
    130                 135                 140

Arg Ile Ile Glu Glu Ser Gly Lys Asp Lys Arg Leu Trp Asn Ser Ala
145                 150                 155                 160

Thr Thr Ser Gly Thr Lys Asp Trp Gln Thr Ile Glu Ala Asp Tyr Ser
                165                 170                 175

Pro Thr Leu Asp Val Asp Lys Ile Lys Leu Glu Leu Phe Tyr Glu Thr
            180                 185                 190

Gly Thr Gly Thr Val Ser Phe Lys Asp Ile Glu Leu Val Glu Val Ala
        195                 200                 205

Asp Gln Leu Ser Glu Asp Ser Gln Thr Asp Lys Gln Leu Glu Glu Lys
    210                 215                 220

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

Thr Tyr Lys Val Glu Asn Pro Asp Val Ala Ser Val Lys Asn Gly Ile
                245                 250                 255
```

```
Leu Glu Pro Leu Lys Glu Gly Thr Thr Asn Val Ile Val Ser Lys Asp
            260                 265                 270

Gly Lys Glu Val Lys Lys Ile Pro Leu Lys Ile Leu Ala Ser Val Lys
        275                 280                 285

Asp Ala Tyr Thr Asp Arg Leu Asp Asp Trp Asn Gly Ile Ile Ala Gly
    290                 295                 300

Asn Gln Tyr Tyr Asp Ser Lys Asn Glu Gln Met Ala Lys Leu Asn Gln
305                 310                 315                 320

Glu Leu Glu Gly Lys Val Ala Asp Ser Leu Ser Ser Ile Ser Ser Gln
                325                 330                 335

Ala Asp Arg Thr Tyr Leu Trp Glu Lys Phe Ser Asn Tyr Lys Thr Ser
            340                 345                 350

Ala Asn Leu Thr Ala Thr Tyr Arg Lys Leu Glu Glu Met Ala Lys Gln
        355                 360                 365

Val Thr Asn Pro Ser Ser Arg Tyr Tyr Gln Asp Glu Thr Val Val Arg
    370                 375                 380

Thr Val Arg Asp Ser Met Glu Trp Met His Lys His Val Tyr Asn Ser
385                 390                 395                 400

Glu Lys Ser Ile Val Gly Asn Trp Trp Asp Tyr Glu Ile Gly Thr Pro
                405                 410                 415

Arg Ala Ile Asn Asn Thr Leu Ser Leu Met Lys Glu Tyr Phe Ser Asp
            420                 425                 430

Glu Glu Ile Lys Lys Tyr Thr Asp Val Ile Glu Lys Phe Val Pro Asp
        435                 440                 445

Pro Glu His Phe Arg Lys Thr Thr Asp Asn Pro Phe Lys Ala Leu Gly
    450                 455                 460

Gly Asn Leu Val Asp Met Gly Arg Val Lys Val Ile Ala Gly Leu Leu
465                 470                 475                 480

Arg Lys Asp Asp Gln Glu Ile Ser Ser Thr Ile Arg Ser Ile Glu Gln
                485                 490                 495

Val Phe Lys Leu Val Asp Gln Gly Glu Gly Phe Tyr Gln Asp Gly Ser
            500                 505                 510

Tyr Ile Asp His Thr Asn Val Ala Tyr Thr Gly Ala Tyr Gly Asn Val
        515                 520                 525
```

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

Asn Pro Ile Asp Lys Asp Lys Met Gln Thr Met Tyr His Trp Ile Asp
545 550 555 560

Lys Ser Phe Ala Pro Leu Leu Val Asn Gly Glu Leu Met Asp Met Ser
565 570 575

Arg Gly Arg Ser Ile Ser Arg Ala Asn Ser Glu Gly His Val Ala Ala
580 585 590

Val Glu Val Leu Arg Gly Ile His Arg Ile Ala Asp Met Ser Glu Gly
595 600 605

Glu Thr Lys Gln Cys Leu Gln Ser Leu Val Lys Thr Ile Val Gln Ser
610 615 620

Asp Ser Tyr Tyr Asp Val Phe Lys Asn Leu Lys Thr Tyr Lys Asp Ile
625 630 635 640

Ser Leu Met Gln Ser Leu Leu Ser Asp Ala Gly Val Ala Ser Val Pro
645 650 655

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

Tyr Asn Ala Glu Lys Gly Phe Gly Phe Gly Leu Ser Leu Phe Ser Ser
675 680 685

Arg Thr Leu Asn Tyr Glu His Met Asn Lys Glu Asn Lys Arg Gly Trp
690 695 700

Tyr Thr Ser Asp Gly Met Phe Tyr Leu Tyr Asn Gly Asp Leu Ser His
705 710 715 720

Tyr Ser Asp Gly Tyr Trp Pro Thr Val Asn Pro Tyr Lys Met Pro Gly
725 730 735

Thr Thr Glu Thr Asp Ala Lys Arg Ala Asp Ser Asp Thr Gly Lys Val
740 745 750

Leu Pro Ser Ala Phe Val Gly Thr Ser Lys Leu Asp Asp Ala Asn Ala
755 760 765

Thr Ala Thr Met Asp Phe Thr Asn Trp Asn Gln Thr Leu Thr Ala His
770 775 780

Lys Ser Trp Phe Met Leu Lys Asp Lys Ile Ala Phe Leu Gly Ser Asn
785 790 795 800

```
Ile Gln Asn Thr Ser Thr Asp Thr Ala Ala Thr Thr Ile Asp Gln Arg
                805                 810                 815

Lys Leu Glu Ser Gly Asn Pro Tyr Lys Val Tyr Val Asn Asp Lys Glu
            820                 825                 830

Ala Ser Leu Thr Glu Gln Glu Lys Asp Tyr Pro Glu Thr Gln Ser Val
        835                 840                 845

Phe Leu Glu Ser Phe Asp Ser Lys Lys Asn Ile Gly Tyr Phe Phe Phe
    850                 855                 860

Lys Lys Ser Ser Ile Ser Met Ser Lys Ala Leu Gln Lys Gly Ala Trp
865                 870                 875                 880

Lys Asp Ile Asn Glu Gly Gln Ser Asp Lys Glu Val Glu Asn Glu Phe
                885                 890                 895

Leu Thr Ile Ser Gln Ala His Lys Gln Asn Arg Asp Ser Tyr Gly Tyr
            900                 905                 910

Met Leu Ile Pro Asn Val Asp Arg Ala Thr Phe Asn Gln Met Ile Lys
        915                 920                 925

Glu Leu Glu Ser Ser Leu Ile Glu Asn Asn Glu Thr Leu Gln Ser Val
    930                 935                 940

Tyr Asp Ala Lys Gln Gly Val Trp Gly Ile Val Lys Tyr Asp Asp Ser
945                 950                 955                 960

Val Ser Thr Ile Ser Asn Gln Phe Gln Val Leu Lys Arg Gly Val Tyr
                965                 970                 975

Thr Ile Arg Lys Glu Gly Asp Glu Tyr Lys Ile Ala Tyr Tyr Asn Pro
            980                 985                 990

Glu Thr Gln Glu Ser Ala Pro Asp  Gln Glu Val Phe Lys  Lys Leu Glu
        995                 1000                1005

Gln Ala  Ala Gln Pro Gln Val  Gln Asn Ser Lys Glu  Lys Glu Lys
    1010                1015                1020

Ser Glu  Glu Glu Lys Asn His  Ser Asp Gln Lys Asn  Leu Pro Gln
    1025                1030                1035

Thr Gly  Glu Gly Gln Ser Ile  Leu Ala Ser Leu Gly  Phe Leu Leu
    1040                1045                1050

Leu Gly  Ala Phe Tyr Leu Phe  Arg Arg Gly Lys Asn  Asn
    1055                1060                1065
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<210> 24
<211> 390
<212> DNA
<213> Streptococcus pneumoniae

<400> 24
atgaatcaat cctactttta tctaaaaatg aaagaacaca aactcaaggt tccttataca 60

ggtaaggagc gccgtgtacg tattcttctt cctaaagatt atgagaaaga tacagaccgt 120

tcctatcctg ttgtatactt tcatgacggg caaaatgttt ttaatagcaa agagtctttc 180

attggacatt catggaagat tatcccagct atcaaacgaa atccggatat cagtcgcatg 240

attgtcgttg ctattgacaa tgatggtatg gggcggatga atgagtatgc ggcttggaag 300

ttccaagaat ctcctatccc agggcagcag tttggtggta agggtgtgga gtatgctgag 360

tttgtcatgg aggtggtcaa gccttttatc 390

<210> 25
<211> 900
<212> DNA
<213> Streptococcus pneumoniae

<400> 25
atgtcatcta aatttatgaa gagcgctgcg gtgcttggaa ctgctacact tgctagcttg 60

cttttggtag cttgcatgaa tcaatcctac ttttatctaa aaatgaaaga acacaaactc 120

aaggttcctt atacaggtaa ggagcgccgt gtacgtattc ttcttcctaa agattatgag 180

aaagatacag accgttccta tcctgttgta tactttcatg acgggcaaaa tgtttttaat 240

agcaaagagt ctttcattgg acattcatgg aagattatcc cagctatcaa acgaaatccg 300

gatatcagtc gcatgattgt cgttgctatt gacaatgatg gtatggggcg gatgaatgag 360

tatgcggctt ggaagttcca agaatctcct atcccagggc agcagtttgg tggtaagggt 420

gtggagtatg ctgagtttgt catggaggtg gtcaagcctt ttatcgatga gacctatcgt 480

acaaaagcag actgccagca tacggctatg attggttcct cactaggagg caatattacc 540

cagtttatcg gtttggaata ccaagaccaa attggttgct tgggcgtttt ttcatctgca 600

aactggctcc accaagaagc ctttaaccgc tatttcgagt gccagaaact atcgcctgac 660

cagcgcatct tcatctatgt aggaacagaa gaagcagatg atacagacaa gaccttgatg 720

gatggcaata tcaaacaagc ctatatcgac tcgtcgcttt gctattacca tgatttgata 780

gcaggggggag tacatctgga taatcttgtg ctaaaagttc agtctggtgc catccatagt 840

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<210> 26
<211> 465
<212> DNA
<213> Streptococcus pneumoniae

<400> 26
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aaggttcctt atacaggtaa ggagcgccgt gtacgtattc ttcttcctaa agattatgag 180

aaagatacag accgttccta tcctgttgta tactttcatg acgggcaaaa tgtttttaat 240

agcaaagagt ctttcattgg acattcatgg aagattatcc cagctatcaa acgaaatccg 300

gatatcagtc gcatgattgt cgttgctatt gacaatgatg gtatggggcg gatgaatgag 360

tatgcggctt ggaagttcca agaatctcct atcccagggc agcagtttgg tggtaagggt 420

gtggagtatg ctgagtttgt catggaggtg gtcaagcctt ttatc 465

<210> 27
<211> 765
<212> DNA
<213> Streptococcus pneumoniae

<400> 27
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gcaaccaatg gatcaccaaa gccatttatc tatgaagaaa atggcgaatt gactggttac 120

gagattgaag tcgttcgcgc tatctttaaa gattctgaca aatatgatgt caagtttgaa 180

aagacagaat ggtcaggtgt ctttgctggt cttgacgctg atcgttacaa tatggctgtc 240

aacaatctta gctacactaa agaacgtgcg gagaaatacc tctatgccgc accaattgcc 300

caaaatccta atgtccttgt cgtgaagaaa gatgactcta gtatcaagtc tctcgatgat 360

atcggtggaa aatcgacgga agtcgttcaa gccactacat cagctaagca gttagaagca 420

tacaatgctg aacacacgga caacccaact atccttaact atactaaggc agacttccaa 480

caaatcatgg tacgtttgag cgatggacaa tttgactata agatttttga taaaatcggt 540

gttgaaacag tgatcaagaa ccaaggtttg gacaacttga aagttatcga acttccaagc 600

gaccaacaac cgtacgttta cccacttctt gctcagggtc aagatgagtt gaaatcgttt 660

gtagacaaac gcatcaaaga actttataaa gatggaactc ttgaaaaatt gtctaaacaa 720

ttcttcggag acacttatct accggcagaa gctgatatta aataa 765

<210> 28
<211> 831
<212> DNA
<213> Streptococcus pneumoniae

<400> 28
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cttgcggctt gctcaggggg tgctaagaaa gaaggagaag cagctagcaa gaaagaaatc 120

atcgttgcaa ccaatggatc accaaagcca tttatctatg aagaaaatgg cgaattgact 180

ggttacgaga ttgaagtcgt tcgcgctatc tttaaagatt ctgacaaata tgatgtcaag 240

tttgaaaaga cagaatggtc aggtgtcttt gctggtcttg acgctgatcg ttacaatatg 300

gctgtcaaca atcttagcta cactaaagaa cgtgcggaga aatacctcta tgccgcacca 360

attgcccaaa atcctaatgt ccttgtcgtg aagaaagatg actctagtat caagtctctc 420

gatgatatcg gtggaaaatc gacggaagtc gttcaagcca ctacatcagc taagcagtta 480

gaagcataca atgctgaaca cacggacaac ccaactatcc ttaactatac taaggcagac 540

ttccaacaaa tcatggtacg tttgagcgat ggacaatttg actataagat ttttgataaa 600

atcggtgttg aaacagtgat caagaaccaa ggtttggaca acttgaaagt tatcgaactt 660

ccaagcgacc aacaaccgta cgtttaccca cttcttgctc agggtcaaga tgagttgaaa 720

tcgtttgtag acaaacgcat caaagaactt tataaagatg gaactcttga aaaattgtct 780

aaacaattct tcggagacac ttatctaccg gcagaagctg atattaaata a 831

<210> 29
<211> 1203
<212> DNA
<213> Streptococcus pneumoniae

<400> 29
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gaaaaagaag ctggagtaaa agtcactctt aaaactggtg atgctctagg aggtcttgat 180

aaactttctc ttgacaacca atctggtaat gtccctgatg ttatgatggc tccatacgac 240

cgtgtaggta gccttggttc tgacggacaa ctttcagaag tgaaattgag cgatggtgct 300

aaaacagacg acacaactaa atctcttgta acagctgcta atggtaaagt ttacggtgct 360

cctgccgtta tcgagtcact tgttatgtac tacaacaaag acttggtgaa agatgctcca 420

aaaacatttg ctgacttgga aaaccttgct aaagatagca aatacgcatt cgctggtgaa 480

gatggtaaaa ctactgcctt cctagctgac tggacaaact tctactatac atatggactt 540

cttgccggta acggtgctta cgtctttggc caaaacggta aagacgctaa agacatcggt 600

cttgcaaacg acggttctat cgtaggtatc aactacgcta aatcttggta cgaaaaatgg 660

cctaaaggta tgcaagatac agaaggtgct ggaaacttaa tccaaactca attccaagaa 720

ggtaaaacag ctgctatcat cgacggacct tggaaagctc aagcctttaa agatgctaaa 780

gtaaactacg gagttgcaac tatcccaact cttccaaatg gaaaagaata tgctgcattc 840

ggtggtggta aagcttgggt cattcctcaa gccgttaaga accttgaagc ttctcaaaaa 900

tttgtagact tccttgttgc aactgaacaa caaaaagtat tatatgataa gactaacgaa 960

atcccagcta atactgaggc tcgttcatac gctgaaggta aaaacgatga gttgacaaca 1020

gctgttatca aacagttcaa gaacactcaa ccactgccaa acatctctca aatgtctgca 1080

gtttgggatc cagcgaaaaa tatgctcttt gatgctgtaa gtggtcaaaa agatgctaaa 1140

acagctgcta acgatgctgt aacattgatc aaagaaacaa tcaaacaaaa atttggtgaa 1200

taa 1203

<210> 30
<211> 1944
<212> DNA
<213> Streptococcus pneumoniae

<400> 30
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aaattaaagg aaatgcttga aagacctgta ttgaaaaatc ttaagggaga tgacaaaata 120

gatcttacaa gtcttacaaa aattgcccta caaaatactg cgcgacctat gatggatgca 180

acttcttgga aagaaaaaag tcaatacttt gcatcaccta gacaacaggg agcaggccta 240

attaatgtgg ccaatgcttt gagaaatgaa gttgtagcaa ctttcaaaaa cactgattct 300

aaaggtttgg taaactcata tggttccatt tctcttaaag aaataaaagg tgataaaaaa 360

tactttacaa tcaagcttca caatacatca aacagacctt tgacttttaa agtttcagca 420

tcagcgataa ctacagattc tctaactgac agattaaaac ttgatgaaac atataaagat 480

gaaaaatctc cagatggtaa gcaaattgtt ccagaaattc acccagaaaa agtcaaagga 540

gcaaatatca catttgagca tgatactttc actataggcg caaattctag ctttgatttg 600

aatgcggtta taaatgttgg agaggccaaa aacaaaaata aatttgtaga atcatttatt 660

cattttgagt cagtggaaga aatggaagct ctaaactcca acgggaagaa aataaacttc 720

caaccttctt tgtcgatgcc tctaatggga tttgctggga attggaacca cgaaccaatc 780

cttgataaat gggcttggga agaagggtca agatcaaaaa cactgggagg ttatgatgat 840

gatggtaaac cgaaaattcc aggaacctta aataagggaa ttggtggaga acatggtata 900

gataaattta atccagcagg agttatacaa aatagaaaag ataaaaatac aacatccctg 960

gatcaaaatc cagaattatt tgctttcaat aacgaaggga tcaacgctcc atcatcaagt 1020

ggttctaaga ttgctaacat ttatccttta gattcaaatg gaaatcctca agatgctcaa 1080

cttgaaagag gattaacacc ttctccactt gtattaagaa gtgcagaaga aggattgatt 1140

tcaatagtaa atacaaataa agagggagaa aatcaaagag acttaaaagt catttcgaga 1200

gaacacttta ttagaggaat tttaaattct aaaagcaatg atgcaaaggg aatcaaatca 1260

tctaaactaa aagtttgggg tgacttgaag tgggatggac tcatctataa tcctagaggt 1320

agagaagaaa atgcaccaga aagtaaggat aatcaagatc ctgctactaa gataagaggt 1380

caatttgaac cgattgcgga aggtcaatat ttctataaat ttaaatatag attaactaaa 1440

gattacccat ggcaggtttc ctatattcct gtaaaaattg ataacaccgc ccctaagatt 1500

gtttcggttg atttttcaaa tcctgaaaaa attaagttga ttacaaagga tacttatcat 1560

aaggtaaaag atcagtataa gaatgaaacg ctatttgcga gagatcaaaa agaacatcct 1620

gaaaaatttg acgagattgc gaacgaagtt tggtatgctg gcgccgctct tgttaatgaa 1680

gatggagagg ttgaaaaaaa tcttgaagta acttacgcag gtgagggtca aggaagaaat 1740

agaaaacttg ataaagacgg aaataccatt tatgaaatta aaggtgcggg agatttaagg 1800

ggaaaaatca ttgaagtcat tgcattagat ggttctagca atttcacaaa gattcataga 1860

attaaatttg ctaatcaggc tgatgaaaag gggatgattt cctattatct agtagatcct 1920

gatcaagatt catctaaata tcaa 1944

<210> 31
<211> 1986
<212> DNA
<213> Streptococcus pneumoniae

<400> 31
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gattttaaag agaagaaaac agcagtcatt aaggaaaaag aagttgttag taaaaatcct 180

gtgatagaca ataacactag caatgaagaa gcaaaaatca aagaagaaaa ttccaataaa 240

tcccaaggag attatacgga ctcatttgtg aataaaaaca cagaaaatcc caaaaaagaa 300

gataaagttg tctatattgc tgaatttaaa gataaagaat ctggagaaaa agcaatcaag 360

gaactatcca gtcttaagaa tacaaaagtt ttatatactt atgatagaat ttttaacggt 420

agtgccatag aaacaactcc agataacttg gacaaaatta aacaaataga aggtatttca 480

tcggttgaaa gggcacaaaa agtccaaccc atgatgaatc atgccagaaa ggaaattgga 540

gttgaggaag ctattgatta cctaaagtct atcaatgctc cgtttgggaa aaattttgat 600

ggtagaggta tggtcatttc aaatatcgat actggaacag attatagaca taaggctatg 660

agaatcgatg atgatgccaa agcctcaatg agatttaaaa aagaagactt aaaaggcact 720

gataaaaatt attggttgag tgataaaatc cctcatgcgt tcaattatta taatggtggc 780

aaaatcactg tagaaaaata tgatgatgga agggattatt ttgacccaca tgggatgcat 840

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gatggaattg cacctaatgc acaaattttc tcttacaaaa tgtattctga cgcaggatct 960

gggtttgcgg gtgatgaaac aatgtttcat gctattgaag attctatcaa acacaacgtt 1020

gatgttgttt cggtatcatc tggttttaca ggaacaggtc ttgtaggtga gaaatattgg 1080

caagctattc gggcattaag aaaagcaggc attccaatgg ttgtcgctac gggtaactat 1140

gcgacttctg cttcaagttc ttcatgggat ttagtagcaa ataatcatct gaaaatgacc 1200

gacactggaa atgtaacacg aactgcagca catgaagatg cgatagcggt cgcttctgct 1260

aaaaatcaaa cagttgagtt tgataaagtt aacataggtg gagaaagttt taaatacaga 1320

aatatagggg ccttttttcga taagagtaaa atcacaacaa atgaagatgg aacaaaagct 1380

cctagtaaat taaaatttgt atatataggc aaggggcaag accaagattt gataggtttg 1440

gatcttaggg gcaaaattgc agtaatggat agaatttata caaaggattt aaaaaatgct 1500

tttaaaaaag ctatggataa gggtgcacgc gccattatgg ttgtaaatac tgtaaattac 1560

tacaatagag ataattggac agagcttcca gctatgggat atgaagcgga tgaaggtact 1620

aaaagtcaag tgttttcaat ttcaggagat gatggtgtaa agctatggaa catgattaat 1680

cctgataaaa aaactgaagt caaaagaaat aataaagaag attttaaaga taaattggag 1740

caatactatc caattgatat ggaaagtttt aattccaaca aaccgaatgt aggtgacgaa 1800

aaagagattg actttaagtt tgcacctgac acagacaaag aactctataa agaagatatc 1860

atcgttccag caggatctac atcttggggg ccaagaatag atttactttt aaaacccgat 1920

gtttcagcac ctggtaaaaa tattaaatcc acgcttaatg ttattaatgg caaatcaact 1980

tatggc 1986

<210> 32
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
6xHis tag

<400> 32
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<210> 33
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

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<210> 34
<211> 9
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<213> Streptococcus pneumoniae

<400> 34
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1 5

<210> 35
<211> 9
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<400> 35
Val Met Met Ala Pro Tyr Asp Arg Val
1 5

<210> 36
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<400> 36
Ser Ile Ala Gly Ile Asn Tyr Ala Lys
1 5

<210> 37
<211> 9

<212> PRT
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<400> 37
Val Trp Asp Pro Ala Lys Asn Met Leu
1 5

<210> 38
<211> 9
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<400> 38
Gln Pro Leu Pro Asn Ile Ser Gln Met
1 5

<210> 39
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<210> 40
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<400> 40
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<210> 41
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<400> 41
Phe Tyr Tyr Thr Tyr Gly Leu Leu Ala
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<210> 42
<211> 8
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<400> 42
Ser Lys Tyr Ala Phe Ala Gly Glu
1 5

<210> 43
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<400> 43
Thr Glu Gly Ala Gly Asn Leu Ile
1 5

<210> 44
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<400> 44
Leu Ala Asp Trp Thr Asn Phe Tyr Tyr
1 5

<210> 45
<211> 9
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<400> 45
Ser Leu Val Met Tyr Tyr Asn Lys Asp
1 5

<210> 46
<211> 9
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<213> Streptococcus pneumoniae

<400> 46
Lys Glu Ala Gly Val Lys Val Thr Leu
1 5

<210> 47
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 47
Lys Ser Thr Ala Val Leu Gly Thr Val
1 5

<210> 48
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 48
Gly Ala Lys Thr Asp Asp Thr Thr Lys
1 5

<210> 49
<211> 9
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<400> 49
Ser Gln Lys Phe Val Asp Phe Leu Val
1 5

<210> 50
<211> 9
<212> PRT
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<400> 50
Gln Ala Phe Lys Asp Ala Lys Val Asn
1 5

<210> 51
<211> 9
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<400> 51
Ala Val Ile Glu Ser Leu Val Met Tyr
1 5

<210> 52
<211> 9
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<400> 52
Asp Ala Lys Thr Ala Ala Asn Asp Ala
1 5

<210> 53
<211> 9
<212> PRT
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<400> 53
Tyr Gly Val Ala Thr Ile Pro Thr Leu
1 5

<210> 54
<211> 9
<212> PRT
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<400> 54
Lys Thr Ala Ala Ile Ile Asp Gly Pro
1 5

<210> 55
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<400> 55
Lys Ala Tyr Glu Lys Glu Ala Gly Val
1 5

<210> 56
<211> 9
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<400> 56
Ala Gly Asn Gly Ala Tyr Val Phe Gly
1 5

<210> 57
<211> 9
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<400> 57

Ala Trp Val Ile Pro Gln Ala Val Lys
1 5

<210> 58
<211> 9
<212> PRT
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<400> 58
Ala Leu Gly Leu Val Ala Ala Gly Val
1 5

<210> 59
<211> 9
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<400> 59
Glu Leu Thr Gly Tyr Glu Ile Glu Val
1 5

<210> 60
<211> 9
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<213> Streptococcus pneumoniae

<400> 60
Ala Val Asn Asn Leu Ser Tyr Thr Lys
1 5

<210> 61
<211> 9
<212> PRT
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<400> 61
Thr Tyr Leu Pro Ala Glu Ala Asp Ile
1 5

<210> 62
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 62
Arg Tyr Asn Met Ala Val Asn Asn Leu
1 5

<210> 63
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 63
Asp Phe Gln Gln Ile Met Val Arg Leu
1 5

<210> 64
<211> 9
<212> PRT
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<400> 64
Glu His Thr Asp Asn Pro Thr Ile Leu
1 5

<210> 65
<211> 9
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<400> 65
Ala Pro Ile Ala Gln Asn Pro Asn Val
1 5

<210> 66
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 66
Leu Pro Ser Asp Gln Gln Pro Tyr Val
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<210> 67
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 67
Tyr Val Tyr Pro Leu Leu Ala Gln Gly
1 5

<210> 68
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 68
Gln Gly Leu Asp Asn Leu Lys Val Ile
1 5

<210> 69
<211> 8
<212> PRT
<213> Streptococcus pneumoniae

<400> 69
Lys Tyr Leu Tyr Ala Ala Pro Ile
1 5

<210> 70
<211> 8
<212> PRT
<213> Streptococcus pneumoniae

<400> 70
Gly Glu Leu Thr Gly Tyr Glu Ile
1 5

<210> 71
<211> 9

<212> PRT
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<400> 71
Asn Pro Asn Val Leu Val Val Lys Lys
1 5

<210> 72
<211> 9
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<400> 72
Lys Leu Ser Lys Gln Phe Phe Gly Asp
1 5

<210> 73
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 73
Gly Ser Pro Arg Pro Phe Ile Tyr Glu
1 5

<210> 74
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 74
Ala Val Asn Asn Leu Ser Tyr Thr Lys
1 5

<210> 75
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 75
Lys Ile Phe Asp Lys Ile Gly Val Glu
1 5

<210> 76
<211> 9
<212> PRT
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<400> 76
Met Val Arg Leu Ser Asp Gly Gln Phe
1 5

<210> 77
<211> 9
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<400> 77
Tyr Val Tyr Pro Leu Leu Ala Gln Gly
1 5

<210> 78
<211> 9
<212> PRT
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<400> 78
Val Val Gln Ala Thr Thr Ser Ala Lys
1 5

<210> 79
<211> 9
<212> PRT
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<400> 79
Thr Leu Glu Lys Leu Ser Lys Gln Phe
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<210> 80
<211> 9
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<400> 80
Val Ala Ala Gly Val Leu Ala Ala Cys
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<210> 81
<211> 9
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<400> 81
Leu Asp Asn Leu Lys Val Ile Glu Leu
1 5

<210> 82
<211> 9
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<400> 82
Asn Met Ala Val Asn Asn Leu Ser Tyr
1 5

<210> 83
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 83
Arg Leu Leu Asp Leu Ala Pro Gln Val
1 5

<210> 84
<211> 9
<212> PRT
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<400> 84
Met Leu Glu Ile Pro Ala His Gln Ile
1 5

<210> 85
<211> 9
<212> PRT
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<400> 85
Lys Asn Phe Phe Ala His His Pro Lys
1 5

<210> 86
<211> 9
<212> PRT
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<400> 86
Lys Val Ile Leu Ala Gly His Ser Lys
1 5

<210> 87
<211> 9
<212> PRT
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<400> 87
Ser Phe Asp Asn Leu Val Ser Thr Leu
1 5

<210> 88
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 88
Tyr Tyr Asp Leu Pro Leu Asn Glu Leu
1 5

<210> 89
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 89
Tyr Phe Asp Leu Phe Phe Gly Thr Ile
1 5

<210> 90
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 90
Ala Leu Glu Tyr Ile His His Leu Phe
1 5

<210> 91
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 91

Leu Pro Leu Asn Glu Leu Asp Ile Leu
1 5

<210> 92
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 92
Ile Pro Gln Gly Ser Ile Ile Gly Met
1 5

<210> 93
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 93
Asp Pro Glu Leu Gln Lys Gln Phe Ala
1 5

<210> 94
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 94
Ala Val Tyr Thr Phe Asp Ala Pro Gly
1 5

<210> 95
<211> 9
<212> PRT
<213> Streptococcus pneumoniae

<400> 95
Gln Ser Leu Thr Pro Glu Glu Arg Glu
1 5

<210> 96
<211> 8
<212> PRT
<213> Streptococcus pneumoniae

<400> 96
Ala Ile Tyr Ala Ala Ser Gln Ile
1 5

<210> 97
<211> 8
<212> PRT
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