<110> AJOU UNIVERSITY INDUSTRY-ACADEMIC COOPERATION FOUNDATION

<120> Heterodimeric Fc-fused cytokine and pharmaceutical composition comprising the same

<130> PP-B1939

<150> KR 2016-0101823
<151> 2016-08-10

<160> 20

<170> KopatentIn 2.0

<210> 1
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> gamma4-EWRVT

<400> 1

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Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Gln Glu
  1               5                  10                  15

Glu Met Thr Glu Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
             20                  25                  30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35                  40                  45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe
     50                  55                  60

Phe Leu Tyr Ser Trp Leu Thr Val Asp Lys Ser Arg Trp Gln Glu Gly
 65                  70                  75                  80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85                  90                  95

Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly Lys
            100                 105
```

<210> 2
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> gamma4-EWRVT

<400> 2
Gly Gln Pro Arg Glu Pro Arg Val Tyr Thr Leu Pro Pro Ser Gln Glu
  1   5   10   15

Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
             20   25   30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35   40   45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Val Ser Asp Gly Ser Phe
     50   55   60

Thr Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg Trp Gln Glu Gly
 65   70   75   80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85   90   95

Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly Lys
            100   105

<210> 3
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> gamma4-EWRVTs-s

<400> 3
Gly Gln Pro Arg Glu Pro Gln Val Cys Thr Leu Pro Pro Ser Gln Glu
  1   5   10   15

Glu Met Thr Glu Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
             20   25   30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35   40   45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe
     50   55   60

Phe Leu Tyr Ser Trp Leu Thr Val Asp Lys Ser Arg Trp Gln Glu Gly
 65   70   75   80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85   90   95

Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly Lys
            100   105

<210> 4
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> gamma4-EWRVTs-s

<400> 4
Gly Gln Pro Arg Glu Pro Arg Val Tyr Thr Leu Pro Pro Cys Gln Glu
  1   5   10   15

Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
             20   25   30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35   40   45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Val Ser Asp Gly Ser Phe
     50   55   60

Thr Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg Trp Gln Glu Gly
 65   70   75   80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85   90   95

Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly Lys
            100   105

<210> 5
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> gamma4-A107

<400> 5
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Gln Glu
  1   5   10   15

Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Glu Gly Phe
             20   25   30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35   40   45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe

```
     50                  55                  60

Phe Leu Tyr Ser Trp Leu Thr Val Asp Lys Ser Arg Trp Gln Glu Gly
 65                  70                  75                  80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85                  90                  95

Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly Lys
            100                 105


<210>    6
<211>    107
<212>    PRT
<213>    Artificial Sequence

<220>
<223>    gamma4-A107


<400>    6
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Gln Glu
  1               5                  10                  15

Asn Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
             20                  25                  30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35                  40                  45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Val Ser Asp Gly Ser Phe
     50                  55                  60

Thr Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg Trp Gln Glu Gly
 65                  70                  75                  80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85                  90                  95

Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly Lys
            100                 105


<210>    7
<211>    107
<212>    PRT
<213>    Artificial Sequence

<220>
<223>    IgG1


<400>    7
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Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Asp
  1               5                  10                  15

Glu Leu Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
             20                  25                  30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35                  40                  45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe
     50                  55                  60

Phe Leu Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly
 65                  70                  75                  80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85                  90                  95

Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
            100                 105
```

<210> 8
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> gamma1-A107

<400> 8

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Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Asp
  1               5                  10                  15

Glu Leu Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Glu Gly Phe
             20                  25                  30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35                  40                  45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe
     50                  55                  60

Phe Leu Tyr Ser Trp Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly
 65                  70                  75                  80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85                  90                  95

Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
            100                 105
```

<210> 9
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> gamma1-A107

<400> 9
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Asp
1 5 10 15

Asn Leu Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
20 25 30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
35 40 45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Val Ser Asp Gly Ser Phe
50 55 60

Thr Leu Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly
65 70 75 80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
85 90 95

Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
100 105

<210> 10
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> IgG2

<400> 10
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu
1 5 10 15

Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
20 25 30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
35 40 45

Asn Asn Tyr Lys Thr Thr Pro Pro Met Leu Asp Ser Asp Gly Ser Phe
50 55 60

```
Phe Leu Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly
 65                  70                  75                  80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                85                  90                  95

Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
            100                 105


<210>    11
<211>    107
<212>    PRT
<213>    Artificial Sequence

<220>
<223>    gamma2-A107


<400>    11
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu
  1               5                  10                  15

Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Glu Gly Phe
             20                  25                  30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35                  40                  45

Asn Asn Tyr Lys Thr Thr Pro Pro Met Leu Asp Ser Asp Gly Ser Phe
     50                  55                  60

Phe Leu Tyr Ser Trp Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly
 65                  70                  75                  80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                85                  90                  95

Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
            100                 105


<210>    12
<211>    107
<212>    PRT
<213>    Artificial Sequence

<220>
<223>    gamma2-A107


<400>    12
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu
  1               5                  10                  15
```

```
Asn Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
             20                  25                  30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
         35                  40                  45

Asn Asn Tyr Lys Thr Thr Pro Pro Met Leu Val Ser Asp Gly Ser Phe
     50                  55                  60

Thr Leu Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly
 65                  70                  75                  80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85                  90                  95

Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
            100                 105


<210>    13
<211>    107
<212>    PRT
<213>    Artificial Sequence

<220>
<223>    IgG3


<400>    13
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu
  1               5                  10                  15

Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
             20                  25                  30

Tyr Pro Ser Asp Ile Ala Met Glu Trp Glu Ser Ser Gly Gln Pro Glu
         35                  40                  45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe
     50                  55                  60

Phe Leu Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly
 65                  70                  75                  80

Asn Ile Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85                  90                  95

Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
            100                 105


<210>    14
<211>    107
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<212> PRT
<213> Artificial Sequence

<220>
<223> gamma3-A107

<400> 14
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu
  1   5   10   15

Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Glu Gly Phe
             20   25   30

Tyr Pro Ser Asp Ile Ala Met Glu Trp Glu Ser Ser Gly Gln Pro Glu
         35   40   45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe
     50   55   60

Phe Leu Tyr Ser Trp Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly
 65   70   75   80

Asn Ile Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
                 85   90   95

Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
            100   105

<210> 15
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> gamma3-A107

<400> 15
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu
  1   5   10   15

Asn Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
             20   25   30

Tyr Pro Ser Asp Ile Ala Met Glu Trp Glu Ser Ser Gly Gln Pro Glu
         35   40   45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Val Ser Asp Gly Ser Phe
     50   55   60

Thr Leu Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly
 65   70   75   80

Asn Ile Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
85 90 95

Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
100 105

<210> 16
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<223> IgG4

<400> 16
Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Gln Glu
1 5 10 15

Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe
20 25 30

Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu
35 40 45

Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe
50 55 60

Phe Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg Trp Gln Glu Gly
65 70 75 80

Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr
85 90 95

Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly Lys
100 105

<210> 17
<211> 306
<212> PRT
<213> Artificial Sequence

<220>
<223> Mature human IL-12

<400> 17
Ile Trp Glu Leu Lys Lys Asp Val Tyr Val Val Glu Leu Asp Trp Tyr
1 5 10 15

Pro Asp Ala Pro Gly Glu Met Val Val Leu Thr Cys Asp Thr Pro Glu

```
            20                  25                  30

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

Ser Gly Lys Thr Leu Thr Ile Arg Val Lys Glu Phe Gly Asp Ala Gly
     50                  55                  60

Gln Tyr Thr Cys His Lys Gly Gly Glu Val Leu Ser His Ser Leu Leu
 65                  70                  75                  80

Leu Leu His Lys Lys Glu Asp Gly Ile Trp Ser Thr Asp Ile Leu Lys
                 85                  90                  95

Asp Gln Lys Glu Pro Lys Asn Lys Thr Phe Leu Arg Cys Glu Ala Lys
            100                 105                 110

Asn Tyr Ser Gly Arg Phe Thr Cys Trp Trp Leu Thr Thr Ile Ser Thr
        115                 120                 125

Asp Leu Thr Phe Ser Val Lys Ser Ser Arg Gly Ser Ser Asp Pro Gln
    130                 135                 140

Gly Val Thr Cys Gly Ala Ala Thr Leu Ser Ala Glu Arg Val Arg Gly
145                 150                 155                 160

Asp Asn Lys Glu Tyr Glu Tyr Ser Val Glu Cys Gln Glu Asp Ser Ala
                165                 170                 175

Cys Pro Ala Ala Glu Glu Ser Leu Pro Ile Glu Val Met Val Asp Ala
            180                 185                 190

Val His Lys Leu Lys Tyr Glu Asn Tyr Thr Ser Ser Phe Phe Ile Arg
        195                 200                 205

Asp Ile Ile Lys Pro Asp Pro Pro Lys Asn Leu Gln Leu Lys Pro Leu
    210                 215                 220

Lys Asn Ser Arg Gln Val Glu Val Ser Trp Glu Tyr Pro Asp Thr Trp
225                 230                 235                 240

Ser Thr Pro His Ser Tyr Phe Ser Leu Thr Phe Cys Val Gln Val Gln
                245                 250                 255

Gly Lys Ser Lys Arg Glu Lys Lys Asp Arg Val Phe Thr Asp Lys Thr
            260                 265                 270

Ser Ala Thr Val Ile Cys Arg Lys Asn Ala Ser Ile Ser Val Arg Ala
        275                 280                 285

Gln Asp Arg Tyr Tyr Ser Ser Ser Trp Ser Glu Trp Ala Ser Val Pro
    290                 295                 300

Cys Ser
```

305

<210> 18
<211> 197
<212> PRT
<213> Artificial Sequence

<220>
<223> Mature human IL-12

<400> 18
Arg Asn Leu Pro Val Ala Thr Pro Asp Pro Gly Met Phe Pro Cys Leu
1 5 10 15

His His Ser Gln Asn Leu Leu Arg Ala Val Ser Asn Met Leu Gln Lys
20 25 30

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

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

Pro Leu Glu Leu Thr Lys Asn Glu Ser Cys Leu Asn Ser Arg Glu Thr
65 70 75 80

Ser Phe Ile Thr Asn Gly Ser Cys Leu Ala Ser Arg Lys Thr Ser Phe
85 90 95

Met Met Ala Leu Cys Leu Ser Ser Ile Tyr Glu Asp Leu Lys Met Tyr
100 105 110

Gln Val Glu Phe Lys Thr Met Asn Ala Lys Leu Leu Met Asp Pro Lys
115 120 125

Arg Gln Ile Phe Leu Asp Gln Asn Met Leu Ala Val Ile Asp Glu Leu
130 135 140

Met Gln Ala Leu Asn Phe Asn Ser Glu Thr Val Pro Gln Lys Ser Ser
145 150 155 160

Leu Glu Glu Pro Asp Phe Tyr Lys Thr Lys Ile Lys Leu Cys Ile Leu
165 170 175

Leu His Ala Phe Arg Ile Arg Ala Val Thr Ile Asp Arg Val Met Ser
180 185 190

Tyr Leu Asn Ala Ser
195

<210> 19

<211> 313
<212> PRT
<213> Artificial Sequence

<220>
<223> Mature mouse IL-12

<400> 19
Met Trp Glu Leu Glu Lys Asp Val Tyr Val Val Glu Val Asp Trp Thr
1 5 10 15

Pro Asp Ala Pro Gly Glu Thr Val Asn Leu Thr Cys Asp Thr Pro Glu
20 25 30

Glu Asp Asp Ile Thr Trp Thr Ser Asp Gln Arg His Gly Val Ile Gly
35 40 45

Ser Gly Lys Thr Leu Thr Ile Thr Val Lys Glu Phe Leu Asp Ala Gly
50 55 60

Gln Tyr Thr Cys His Lys Gly Gly Glu Thr Leu Ser His Ser His Leu
65 70 75 80

Leu Leu His Lys Lys Glu Asn Gly Ile Trp Ser Thr Glu Ile Leu Lys
85 90 95

Asn Phe Lys Asn Lys Thr Phe Leu Lys Cys Glu Ala Pro Asn Tyr Ser
100 105 110

Gly Arg Phe Thr Cys Ser Trp Leu Val Gln Arg Asn Met Asp Leu Lys
115 120 125

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

Cys Gly Met Ala Ser Leu Ser Ala Glu Lys Val Thr Leu Asp Gln Arg
145 150 155 160

Asp Tyr Glu Lys Tyr Ser Val Ser Cys Gln Glu Asp Val Thr Cys Pro
165 170 175

Thr Ala Glu Glu Thr Leu Pro Ile Glu Leu Ala Leu Glu Ala Arg Gln
180 185 190

Gln Asn Lys Tyr Glu Asn Tyr Ser Thr Ser Phe Phe Ile Arg Asp Ile
195 200 205

Ile Lys Pro Asp Pro Pro Lys Asn Leu Gln Met Lys Pro Leu Lys Asn
210 215 220

Ser Gln Val Glu Val Ser Trp Glu Tyr Pro Asp Ser Trp Ser Thr Pro
225 230 235 240

```
His Ser Tyr Phe Ser Leu Lys Phe Phe Val Arg Ile Gln Arg Lys Lys
                245                 250                 255

Glu Lys Met Lys Glu Thr Lys Glu Gly Cys Asn Gln Lys Gly Ala Phe
            260                 265                 270

Leu Val Glu Lys Thr Ser Thr Glu Val Gln Cys Lys Gly Gly Asn Val
        275                 280                 285

Cys Val Gln Ala Gln Asp Arg Tyr Tyr Asn Ser Ser Cys Ser Lys Trp
    290                 295                 300

Ala Cys Val Pro Cys Arg Val Arg Ser
305                 310
```

<210> 20
<211> 193
<212> PRT
<213> Artificial Sequence

<220>
<223> Mature mouse IL-12

<400> 20

```
Arg Val Ile Pro Val Ser Gly Pro Ala Arg Cys Leu Ser Gln Ser Arg
  1               5                  10                  15

Asn Leu Leu Lys Thr Thr Asp Asp Met Val Lys Thr Ala Arg Glu Lys
             20                  25                  30

Leu Lys His Tyr Ser Cys Thr Ala Glu Asp Ile Asp His Glu Asp Ile
         35                  40                  45

Thr Arg Asp Gln Thr Ser Thr Leu Lys Thr Cys Leu Pro Leu Glu Leu
     50                  55                  60

His Lys Asn Glu Ser Cys Leu Ala Thr Arg Glu Thr Ser Ser Thr Thr
 65                  70                  75                  80

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

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

Gln Ala Ile Asn Ala Ala Leu Gln Asn His Asn His Gln Gln Ile Ile
        115                 120                 125

Leu Asp Lys Gly Met Leu Val Ala Ile Asp Glu Leu Met Gln Ser Leu
    130                 135                 140

Asn His Asn Gly Glu Thr Leu Arg Gln Lys Pro Pro Val Gly Glu Ala
```

```
145                 150                 155                 160

Asp Pro Tyr Arg Val Lys Met Lys Leu Cys Ile Leu Leu His Ala Phe
                165                 170                 175

Ser Thr Arg Val Val Thr Ile Asn Arg Val Met Gly Tyr Leu Ser Ser
            180                 185                 190

Ala
```