

## SEQUENCE LISTING

&lt;110&gt; VLP THERAPEUTICS, LLC

&lt;120&gt; VIRUS LIKE PARTICLE COMPOSITION

&lt;130&gt; 671358

&lt;150&gt; US61/599, 746

&lt;151&gt; 2012-02-16

&lt;160&gt; 50

&lt;170&gt; PatentIn version 3.5

&lt;210&gt; 1

&lt;211&gt; 1248

&lt;212&gt; PRT

&lt;213&gt; virus

&lt;400&gt; 1

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro  
 1 5 10 15

Arg Pro Trp Thr Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro  
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val  
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn  
 50 55 60

Arg Lys Asn Lys Lys Gln Lys Gln Lys Gln Gln Ala Pro Gln Asn Asn  
 65 70 75 80

Thr Asn Gln Lys Lys Gln Pro Pro Lys Lys Lys Pro Ala Gln Lys Lys  
 85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp  
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Thr Gly Tyr Ala Cys  
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile  
 130 135 140

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

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser  
 165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly  
180 185 190

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

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val  
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu  
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu  
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Ile Pro Val Met Cys Leu Leu Ala  
260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr  
275 280 285

Glu Lys Glu Pro Glu Glu Thr Leu Arg Met Leu Glu Asp Asn Val Met  
290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Gln Ala Ser Leu Thr Cys Ser Pro  
305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala  
325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser  
340 345 350

Cys His Ser Pro Val Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp  
355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp  
370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Asn His Met Pro  
385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Phe Val Arg Thr Ser Ala Pro Cys  
405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys  
420 425 430

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

Ser Cys Thr His Pro Phe His His Asp Pro Pro Val Ile Gly Arg Glu  
450 455 460

Lys Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr  
465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Thr Glu Glu Ile Glu Val His Met  
485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Ser Gln Gln Ser Gly Asn  
500 505 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys  
515 520 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn  
530 535 540

Cys Lys Val Asp Gln Cys His Ala Ala Val Thr Asn His Lys Lys Trp  
545 550 555 560

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

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg  
580 585 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val  
595 600 605

Ile Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn  
610 615 620

Met Gly Glu Glu Pro Asn Tyr Gln Glu Glu Trp Val Met His Lys Lys  
625 630 635 640

Glu Val Val Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly  
645 650 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Leu Ser Thr Asn Gly Thr  
660 665 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr  
675 680 685

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

Ser Met Val Gly Met Ala Ala Gly Met Cys Met Cys Ala Arg Arg Arg  
705 710 715 720

Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu  
725 730 735

Leu Ser Leu Ile Cys Cys Ile Arg Thr Ala Lys Ala Ala Thr Tyr Gln  
740 745 750

Glu Ala Ala Ile Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu  
755 760 765

Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu  
770 775 780

Arg Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met  
785 790 795 800

Ser Val Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile  
805 810 815

Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly  
820 825 830

Tyr Ser Pro Met Val Leu Glu Met Glu Leu Leu Ser Val Thr Leu Glu  
835 840 845

Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile  
850 855 860

Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys  
865 870 875 880

Asn Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe  
885 890 895

Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu  
900 905 910

Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala  
915 920 925

Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val  
930 935 940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Thr Ala Tyr Ala Asn Gly Asp  
945 950 955 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Ile Val Gly Pro Met Ser  
965 970 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp  
980 985 990

Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln  
995 1000 1005

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr  
1010 1015 1020

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Val Gly Thr Val  
1025 1030 1035

His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu  
1040 1045 1050

Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys  
1055 1060 1065

Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly  
1070 1075 1080

Asn Met Pro Ile Ser Ile Asp Ile Pro Glu Ala Ala Phe Thr Arg  
1085 1090 1095

Val Val Asp Ala Pro Ser Leu Thr Asp Met Ser Cys Glu Val Pro  
1100 1105 1110

Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys  
1115 1120 1125

Tyr Ala Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr  
1130 1135 1140

Asn Ala Val Thr Ile Arg Glu Ala Glu Ile Glu Val Glu Gly Asn  
1145 1150 1155

Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu  
1160 1165 1170

Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Glu  
1175 1180 1185

Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His  
1190 1195 1200

Thr Thr Leu Gly Val Gln Asp Ile Ser Ala Thr Ala Met Ser Trp  
1205 1210 1215

Val Gln Lys Ile Thr Gly Gly Val Gly Leu Val Val Ala Val Ala  
1220 1225 1230

Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His  
1235 1240 1245

<210> 2  
<211> 1248  
<212> PRT  
<213> virus

<400> 2

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro  
1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro

|                                                                 |     |     |
|-----------------------------------------------------------------|-----|-----|
| 20                                                              | 25  | 30  |
| Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val |     |     |
| 35                                                              | 40  | 45  |
| Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn |     |     |
| 50                                                              | 55  | 60  |
| Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp |     |     |
| 65                                                              | 70  | 75  |
| Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys |     |     |
| 85                                                              | 90  | 95  |
| Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp |     |     |
| 100                                                             | 105 | 110 |
| Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys |     |     |
| 115                                                             | 120 | 125 |
| Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile |     |     |
| 130                                                             | 135 | 140 |
| Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr |     |     |
| 145                                                             | 150 | 155 |
| Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser |     |     |
| 165                                                             | 170 | 175 |
| Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly |     |     |
| 180                                                             | 185 | 190 |
| Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly |     |     |
| 195                                                             | 200 | 205 |
| Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val |     |     |
| 210                                                             | 215 | 220 |
| Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu |     |     |
| 225                                                             | 230 | 235 |
| Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu |     |     |
| 245                                                             | 250 | 255 |
| Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala |     |     |
| 260                                                             | 265 | 270 |
| Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr |     |     |
| 275                                                             | 280 | 285 |
| Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met |     |     |
| 290                                                             | 295 | 300 |
| Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro |     |     |

305                      310                      315                      320  
 His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala  
                                  325                      330                      335  
 Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser  
                                  340                      345                      350  
 Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp  
                                  355                      360                      365  
 Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp  
                                  370                      375                      380  
 Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro  
 385                                   390                      395                      400  
 Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys  
                                  405                      410                      415  
 Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys  
                                  420                      425                      430  
 Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His  
                                  435                      440                      445  
 Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu  
                                  450                      455                      460  
 Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr  
 465                                   470                      475                      480  
 Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met  
                                  485                      490                      495  
 Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn  
                                  500                      505                      510  
 Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys  
                                  515                      520                      525  
 Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn  
                                  530                      535                      540  
 Cys Lys Ile Asp Gln Cys His Ala Ala Val Thr Asn His Lys Asn Trp  
 545                                   550                      555                      560  
 Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg  
                                  565                      570                      575  
 Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg  
                                  580                      585                      590  
 Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val

|                                                                 |     |         |
|-----------------------------------------------------------------|-----|---------|
| 595                                                             | 600 | 605     |
| Thr Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn |     |         |
| 610                                                             | 615 | 620     |
| Met Gly Gln Glu Pro Asn Tyr His Glu Glu Trp Val Thr His Lys Lys |     |         |
| 625                                                             | 630 | 635 640 |
| Glu Val Thr Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly |     |         |
|                                                                 | 645 | 650 655 |
| Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Met Ser Thr Asn Gly Thr |     |         |
|                                                                 | 660 | 665 670 |
| Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr |     |         |
|                                                                 | 675 | 680 685 |
| Pro Thr Met Thr Val Val Ile Val Ser Val Ala Ser Phe Val Leu Leu |     |         |
|                                                                 | 690 | 695 700 |
| Ser Met Val Gly Thr Ala Val Gly Met Cys Val Cys Ala Arg Arg Arg |     |         |
| 705                                                             | 710 | 715 720 |
| Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu |     |         |
|                                                                 | 725 | 730 735 |
| Leu Ser Leu Leu Cys Cys Val Arg Thr Thr Lys Ala Ala Thr Tyr Tyr |     |         |
|                                                                 | 740 | 745 750 |
| Glu Ala Ala Ala Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu |     |         |
|                                                                 | 755 | 760 765 |
| Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu |     |         |
|                                                                 | 770 | 775 780 |
| Lys Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met |     |         |
| 785                                                             | 790 | 795 800 |
| Ser Ile Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile |     |         |
|                                                                 | 805 | 810 815 |
| Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly |     |         |
|                                                                 | 820 | 825 830 |
| Tyr Ser Pro Met Val Leu Glu Met Glu Leu Gln Ser Val Thr Leu Glu |     |         |
|                                                                 | 835 | 840 845 |
| Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile |     |         |
|                                                                 | 850 | 855 860 |
| Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys |     |         |
| 865                                                             | 870 | 875 880 |
| Ser Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe |     |         |

|                                                                 |      |      |
|-----------------------------------------------------------------|------|------|
| 885                                                             | 890  | 895  |
| Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu |      |      |
| 900                                                             | 905  | 910  |
| Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala |      |      |
| 915                                                             | 920  | 925  |
| Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val |      |      |
| 930                                                             | 935  | 940  |
| Leu Tyr Gln Gly Asn Asn Ile Thr Val Ala Ala Tyr Ala Asn Gly Asp |      |      |
| 945                                                             | 950  | 955  |
| His Ala Val Thr Val Lys Asp Ala Lys Phe Val Val Gly Pro Met Ser |      |      |
| 965                                                             | 970  | 975  |
| Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp |      |      |
| 980                                                             | 985  | 990  |
| Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln |      |      |
| 995                                                             | 1000 | 1005 |
| Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr     |      |      |
| 1010                                                            | 1015 | 1020 |
| Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val     |      |      |
| 1025                                                            | 1030 | 1035 |
| His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu     |      |      |
| 1040                                                            | 1045 | 1050 |
| Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys     |      |      |
| 1055                                                            | 1060 | 1065 |
| Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly     |      |      |
| 1070                                                            | 1075 | 1080 |
| Asn Ile Pro Ile Ser Ile Asp Ile Pro Asp Ala Ala Phe Thr Arg     |      |      |
| 1085                                                            | 1090 | 1095 |
| Val Val Asp Ala Pro Ser Val Thr Asp Met Ser Cys Glu Val Pro     |      |      |
| 1100                                                            | 1105 | 1110 |
| Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys     |      |      |
| 1115                                                            | 1120 | 1125 |
| Tyr Thr Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr     |      |      |
| 1130                                                            | 1135 | 1140 |
| Asn Ala Val Thr Ile Arg Glu Ala Asp Val Glu Val Glu Gly Asn     |      |      |
| 1145                                                            | 1150 | 1155 |
| Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu     |      |      |

|                                                             |      |      |
|-------------------------------------------------------------|------|------|
| 1160                                                        | 1165 | 1170 |
| Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Ala |      |      |
| 1175                                                        | 1180 | 1185 |
| Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His |      |      |
| 1190                                                        | 1195 | 1200 |
| Thr Thr Leu Gly Val Gln Asp Ile Ser Thr Thr Ala Met Ser Trp |      |      |
| 1205                                                        | 1210 | 1215 |
| Val Gln Lys Ile Thr Gly Gly Val Gly Leu Ile Val Ala Val Ala |      |      |
| 1220                                                        | 1225 | 1230 |
| Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His |      |      |
| 1235                                                        | 1240 | 1245 |

<210> 3  
 <211> 1255  
 <212> PRT  
 <213> virus

<400> 3

|                                                                 |     |         |
|-----------------------------------------------------------------|-----|---------|
| Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg |     |         |
| 1                                                               | 5   | 10 15   |
| Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro |     |         |
| 20                                                              | 25  | 30      |
| Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu |     |         |
| 35                                                              | 40  | 45      |
| Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Ala |     |         |
| 50                                                              | 55  | 60      |
| Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly |     |         |
| 65                                                              | 70  | 75 80   |
| Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro |     |         |
| 85                                                              | 90  | 95      |
| Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro |     |         |
| 100                                                             | 105 | 110     |
| Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe |     |         |
| 115                                                             | 120 | 125     |
| Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly |     |         |
| 130                                                             | 135 | 140     |
| Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp |     |         |
| 145                                                             | 150 | 155 160 |

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu  
165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr  
180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln  
195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly  
210 215 220

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

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val  
245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys  
260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr  
275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu  
290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu  
305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr  
325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg  
340 345 350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu  
355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser  
370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met  
385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val  
405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr  
420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe  
435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys  
 450 455 460

Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly  
 465 470 475 480

Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly  
 485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu  
 500 505 510

Val Ser Leu Ser Gly Ser Ser Val Thr Val Thr Pro Pro Asp Gly Thr  
 515 520 525

Ser Ala Leu Val Glu Cys Glu Cys Gly Gly Thr Lys Ile Ser Glu Thr  
 530 535 540

Ile Asn Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys Lys Glu Gln Cys  
 545 550 555 560

Arg Ala Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr Asn Ser Asp Lys  
 565 570 575

Leu Pro Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys Leu His Val Pro  
 580 585 590

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

Met Ile Thr Phe Gly Phe Arg Ser Val Ser Leu Lys Leu His Pro Lys  
 610 615 620

Asn Pro Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp Glu Pro His Tyr  
 625 630 635 640

Thr His Glu Leu Ile Ser Glu Pro Ala Val Arg Asn Phe Thr Val Thr  
 645 650 655

Glu Lys Gly Trp Glu Phe Val Trp Gly Asn His Pro Pro Lys Arg Phe  
 660 665 670

Trp Ala Gln Glu Thr Ala Pro Gly Asn Pro His Gly Leu Pro His Glu  
 675 680 685

Val Ile Thr His Tyr Tyr His Arg Tyr Pro Met Ser Thr Ile Leu Gly  
 690 695 700

Leu Ser Ile Cys Ala Ala Ile Ala Thr Val Ser Val Ala Ala Ser Thr  
 705 710 715 720

Trp Leu Phe Cys Arg Ser Arg Val Ala Cys Leu Thr Pro Tyr Arg Leu  
 725 730 735

Thr Pro Asn Ala Arg Ile Pro Phe Cys Leu Ala Val Leu Cys Cys Ala  
740 745 750

Arg Thr Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu Asp His Leu Trp  
755 760 765

Asn Asn Asn Gln Gln Met Phe Trp Ile Gln Leu Leu Ile Pro Leu Ala  
770 775 780

Ala Leu Ile Val Val Thr Arg Leu Leu Arg Cys Val Cys Cys Val Val  
785 790 795 800

Pro Phe Leu Val Met Ala Gly Ala Ala Gly Ala Gly Ala Tyr Glu His  
805 810 815

Ala Thr Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr Asn Thr Ile Val  
820 825 830

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

Ile Lys Leu Ile Pro Thr Val Asn Leu Glu Tyr Val Thr Cys His Tyr  
850 855 860

Lys Thr Gly Met Asp Ser Pro Ala Ile Lys Cys Cys Gly Ser Gln Glu  
865 870 875 880

Cys Thr Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys Val Phe Thr Gly  
885 890 895

Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Thr Glu  
900 905 910

Asn Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser Asp Asp Cys Leu  
915 920 925

Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala Ser Val Gln Ala  
930 935 940

Phe Leu Asn Ile Thr Val Gly Glu His Ser Ile Val Thr Thr Val Tyr  
945 950 955 960

Val Asn Gly Glu Thr Pro Val Asn Phe Asn Gly Val Lys Ile Thr Ala  
965 970 975

Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg Lys Ile Val Gln  
980 985 990

Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu Tyr Gly Ala Gly  
995 1000 1005

Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg Thr Val Ser Ser  
1010 1015 1020

Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu Gln Arg Pro Lys  
1025 1030 1035

Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala Pro Ser Gly Phe  
1040 1045 1050

Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu Lys Phe Thr Ala  
1055 1060 1065

Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile Arg Ala Glu Asn  
1070 1075 1080

Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp Ile Pro Asp Ala  
1085 1090 1095

Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu Ser Ala Ala Glu  
1100 1105 1110

Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp Phe Gly Gly Ile  
1115 1120 1125

Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly Lys Cys Ala Val  
1130 1135 1140

His Val Pro Ser Gly Thr Ala Thr Leu Lys Glu Ala Ala Val Glu  
1145 1150 1155

Leu Thr Glu Gln Gly Ser Ala Thr Ile His Phe Ser Thr Ala Asn  
1160 1165 1170

Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr Ser Tyr Val Thr  
1175 1180 1185

Cys Lys Gly Asp Cys His Pro Pro Lys Asp His Ile Val Thr His  
1190 1195 1200

Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala Val Ser Lys Thr  
1205 1210 1215

Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly Ser Ala Val Ile  
1220 1225 1230

Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val Ala Met Tyr Val  
1235 1240 1245

Leu Thr Asn Gln Lys His Asn  
1250 1255

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<211> 1405

<212> PRT

<213> Artificial

<220>

&lt;223&gt; CHIKV+TNFalpha

&lt;400&gt; 4

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro  
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Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro  
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val  
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn  
 50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp  
 65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys  
 85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp  
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys  
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile  
 130 135 140

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

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser  
 165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly  
 180 185 190

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

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val  
 210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu  
 225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu  
 245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala  
 260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr  
275 280 285

Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met  
290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro  
305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala  
325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser  
340 345 350

Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp  
355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp  
370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro  
385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys  
405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys  
420 425 430

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

Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu  
450 455 460

Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr  
465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met  
485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn  
500 505 510

Val Lys Ile Thr Val Asn Gly Ser Gly Gly Lys Pro Val Ala His Val  
515 520 525

Val Ala Asn Pro Gln Ala Glu Gly Gln Leu Gln Trp Leu Asn Arg Arg  
530 535 540

Ala Asn Ala Leu Leu Ala Asn Gly Val Glu Leu Arg Asp Asn Gln Leu  
545 550 555 560

Val Val Pro Ser Glu Gly Leu Tyr Leu Ile Tyr Ser Gln Val Leu Phe  
565 570 575

Lys Gly Gln Gly Cys Pro Ser Thr His Val Leu Leu Thr His Thr Ile  
580 585 590

Ser Arg Ile Ala Val Ser Tyr Gln Thr Lys Val Asn Leu Leu Ser Ala  
595 600 605

Ile Lys Ser Pro Cys Gln Arg Glu Thr Pro Glu Gly Ala Glu Ala Lys  
610 615 620

Pro Trp Tyr Glu Pro Ile Tyr Leu Gly Gly Val Phe Gln Leu Glu Lys  
625 630 635 640

Gly Asp Arg Leu Ser Ala Glu Ile Asn Arg Pro Asp Tyr Leu Asp Phe  
645 650 655

Ala Glu Ser Gly Gln Val Tyr Phe Gly Ile Ile Ala Leu Thr Arg Gly  
660 665 670

Gly Ser Gly Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys Gly Gly Ser  
675 680 685

Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile  
690 695 700

Asp Gln Cys His Ala Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn  
705 710 715 720

Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys  
725 730 735

Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys  
740 745 750

Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu  
755 760 765

Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln  
770 775 780

Glu Pro Asn Tyr His Glu Glu Trp Val Thr His Lys Lys Glu Val Thr  
785 790 795 800

Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu  
805 810 815

Pro Tyr Lys Tyr Trp Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly  
820 825 830

His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met  
835 840 845

18 / 161

Thr Val Val Ile Val Ser Val Ala Ser Phe Val Leu Leu Ser Met Val  
850 855 860

Gly Thr Ala Val Gly Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr  
865 870 875 880

Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu Leu Ser Leu  
885 890 895

Leu Cys Cys Val Arg Thr Thr Lys Ala Ala Thr Tyr Tyr Glu Ala Ala  
900 905 910

Ala Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu Gln Ala Leu  
915 920 925

Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu Lys Leu Leu  
930 935 940

Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met Ser Ile Gly  
945 950 955 960

Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile Pro Asn Thr  
965 970 975

Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly Tyr Ser Pro  
980 985 990

Met Val Leu Glu Met Glu Leu Gln Ser Val Thr Leu Glu Pro Thr Leu  
995 1000 1005

Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile Pro Ser  
1010 1015 1020

Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys Ser  
1025 1030 1035

Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe  
1040 1045 1050

Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln  
1055 1060 1065

Leu Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu  
1070 1075 1080

Phe Ala Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys  
1085 1090 1095

Leu Arg Val Leu Tyr Gln Gly Asn Asn Ile Thr Val Ala Ala Tyr  
1100 1105 1110

Ala Asn Gly Asp His Ala Val Thr Val Lys Asp Ala Lys Phe Val  
1115 1120 1125

|         |         |         |      |         |         |      |         |     |  |
|---------|---------|---------|------|---------|---------|------|---------|-----|--|
| Val Gly | Pro Met | Ser Ser | Ala  | Trp Thr | Pro Phe | Asp  | Asn Lys | Ile |  |
| 1130    |         |         | 1135 |         |         | 1140 |         |     |  |
| Val Val | Tyr Lys | Gly Asp | Val  | Tyr Asn | Met Asp | Tyr  | Pro Pro | Phe |  |
| 1145    |         |         | 1150 |         |         | 1155 |         |     |  |
| Gly Ala | Gly Arg | Pro Gly | Gln  | Phe Gly | Asp Ile | Gln  | Ser Arg | Thr |  |
| 1160    |         |         | 1165 |         |         | 1170 |         |     |  |
| Pro Glu | Ser Lys | Asp Val | Tyr  | Ala Asn | Thr Gln | Leu  | Val Leu | Gln |  |
| 1175    |         |         | 1180 |         |         | 1185 |         |     |  |
| Arg Pro | Ala Ala | Gly Thr | Val  | His Val | Pro Tyr | Ser  | Gln Ala | Pro |  |
| 1190    |         |         | 1195 |         |         | 1200 |         |     |  |
| Ser Gly | Phe Lys | Tyr Trp | Leu  | Lys Glu | Arg Gly | Ala  | Ser Leu | Gln |  |
| 1205    |         |         | 1210 |         |         | 1215 |         |     |  |
| His Thr | Ala Pro | Phe Gly | Cys  | Gln Ile | Ala Thr | Asn  | Pro Val | Arg |  |
| 1220    |         |         | 1225 |         |         | 1230 |         |     |  |
| Ala Val | Asn Cys | Ala Val | Gly  | Asn Ile | Pro Ile | Ser  | Ile Asp | Ile |  |
| 1235    |         |         | 1240 |         |         | 1245 |         |     |  |
| Pro Asp | Ala Ala | Phe Thr | Arg  | Val Val | Asp Ala | Pro  | Ser Val | Thr |  |
| 1250    |         |         | 1255 |         |         | 1260 |         |     |  |
| Asp Met | Ser Cys | Glu Val | Pro  | Ala Cys | Thr His | Ser  | Ser Asp | Phe |  |
| 1265    |         |         | 1270 |         |         | 1275 |         |     |  |
| Gly Gly | Val Ala | Ile Ile | Lys  | Tyr Thr | Ala Ser | Lys  | Lys Gly | Lys |  |
| 1280    |         |         | 1285 |         |         | 1290 |         |     |  |
| Cys Ala | Val His | Ser Met | Thr  | Asn Ala | Val Thr | Ile  | Arg Glu | Ala |  |
| 1295    |         |         | 1300 |         |         | 1305 |         |     |  |
| Asp Val | Glu Val | Glu Gly | Asn  | Ser Gln | Leu Gln | Ile  | Ser Phe | Ser |  |
| 1310    |         |         | 1315 |         |         | 1320 |         |     |  |
| Thr Ala | Leu Ala | Ser Ala | Glu  | Phe Arg | Val Gln | Val  | Cys Ser | Thr |  |
| 1325    |         |         | 1330 |         |         | 1335 |         |     |  |
| Gln Val | His Cys | Ala Ala | Ala  | Cys His | Pro Pro | Lys  | Asp His | Ile |  |
| 1340    |         |         | 1345 |         |         | 1350 |         |     |  |
| Val Asn | Tyr Pro | Ala Ser | His  | Thr Thr | Leu Gly | Val  | Gln Asp | Ile |  |
| 1355    |         |         | 1360 |         |         | 1365 |         |     |  |
| Ser Thr | Thr Ala | Met Ser | Trp  | Val Gln | Lys Ile | Thr  | Gly Gly | Val |  |
| 1370    |         |         | 1375 |         |         | 1380 |         |     |  |
| Gly Leu | Ile Val | Ala Val | Ala  | Ala Leu | Ile Leu | Ile  | Val Val | Leu |  |
| 1385    |         |         | 1390 |         |         | 1395 |         |     |  |

20 / 161

Cys Val Ser Phe Ser Arg His  
1400 1405

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Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro  
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Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro  
20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val  
35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn  
50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp  
65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys  
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp  
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys  
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile  
130 135 140

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

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser  
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly  
180 185 190

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

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val

21 / 161

|                                                                 |     |         |
|-----------------------------------------------------------------|-----|---------|
| 210                                                             | 215 | 220     |
| Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu |     |         |
| 225                                                             | 230 | 235 240 |
| Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu |     |         |
|                                                                 | 245 | 250 255 |
| Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala |     |         |
|                                                                 | 260 | 265 270 |
| Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr |     |         |
|                                                                 | 275 | 280 285 |
| Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met |     |         |
|                                                                 | 290 | 295 300 |
| Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro |     |         |
| 305                                                             | 310 | 315 320 |
| His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala |     |         |
|                                                                 | 325 | 330 335 |
| Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser |     |         |
|                                                                 | 340 | 345 350 |
| Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp |     |         |
|                                                                 | 355 | 360 365 |
| Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp |     |         |
|                                                                 | 370 | 375 380 |
| Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro |     |         |
| 385                                                             | 390 | 395 400 |
| Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys |     |         |
|                                                                 | 405 | 410 415 |
| Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys |     |         |
|                                                                 | 420 | 425 430 |
| Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His |     |         |
|                                                                 | 435 | 440 445 |
| Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu |     |         |
|                                                                 | 450 | 455 460 |
| Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr |     |         |
| 465                                                             | 470 | 475 480 |
| Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met |     |         |
|                                                                 | 485 | 490 495 |
| Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn |     |         |

|                                                                 |     |     |
|-----------------------------------------------------------------|-----|-----|
| 500                                                             | 505 | 510 |
| Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys |     |     |
| 515                                                             | 520 | 525 |
| Gly Gly Ser Gly Gly Ile Tyr Asn Cys Glu Pro Ala Asn Pro Ser Glu |     |     |
| 530                                                             | 535 | 540 |
| Lys Asn Ser Pro Ser Thr Gln Tyr Cys Tyr Ser Ile Gln Gly Ser Asn |     |     |
| 545                                                             | 550 | 555 |
| Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile Asp |     |     |
| 565                                                             | 570 | 575 |
| Gln Cys His Ala Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn Ser |     |     |
| 580                                                             | 585 | 590 |
| Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys Ile |     |     |
| 595                                                             | 600 | 605 |
| His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys Ala |     |     |
| 610                                                             | 615 | 620 |
| Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu Leu |     |     |
| 625                                                             | 630 | 635 |
| Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln Glu |     |     |
| 645                                                             | 650 | 655 |
| Pro Asn Tyr His Glu Glu Trp Val Thr His Lys Lys Glu Val Thr Leu |     |     |
| 660                                                             | 665 | 670 |
| Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu Pro |     |     |
| 675                                                             | 680 | 685 |
| Tyr Lys Tyr Trp Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly His |     |     |
| 690                                                             | 695 | 700 |
| Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met Thr |     |     |
| 705                                                             | 710 | 715 |
| Val Val Ile Val Ser Val Ala Ser Phe Val Leu Leu Ser Met Val Gly |     |     |
| 725                                                             | 730 | 735 |
| Thr Ala Val Gly Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr Pro |     |     |
| 740                                                             | 745 | 750 |
| Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu Leu Ser Leu Leu |     |     |
| 755                                                             | 760 | 765 |
| Cys Cys Val Arg Thr Thr Lys Ala Ala Thr Tyr Tyr Glu Ala Ala Ala |     |     |
| 770                                                             | 775 | 780 |
| Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu Gln Ala Leu Ile |     |     |

|     |     |     |     |     |     |      |
|-----|-----|-----|-----|-----|-----|------|
| 785 |     | 790 |     | 795 |     | 800  |
| Pro | Leu | Ala | Ala | Leu | Ile | Val  |
|     |     | 805 |     |     |     |      |
|     |     |     |     | Asn | Cys | Leu  |
|     |     |     |     | 810 |     |      |
|     |     |     |     |     |     | 815  |
|     |     |     |     |     |     |      |
| Cys | Cys | Cys | Lys | Thr | Leu | Ala  |
|     |     | 820 |     |     |     |      |
|     |     |     |     |     |     | 825  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 830  |
|     |     |     |     |     |     |      |
| His | Thr | Val | Ser | Ala | Tyr | Glu  |
|     |     | 835 |     |     |     |      |
|     |     |     |     |     |     | 840  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 845  |
|     |     |     |     |     |     |      |
| Gly | Val | Pro | Tyr | Lys | Thr | Leu  |
|     |     | 850 |     |     |     |      |
|     |     |     |     |     |     | 855  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 860  |
|     |     |     |     |     |     |      |
| Val | Leu | Glu | Met | Glu | Leu | Gln  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 870  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 875  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 880  |
|     |     |     |     |     |     |      |
| Leu | Asp | Tyr | Ile | Thr | Cys | Glu  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 885  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 890  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 895  |
|     |     |     |     |     |     |      |
| Val | Lys | Cys | Cys | Gly | Thr | Ala  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 900  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 905  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 910  |
|     |     |     |     |     |     |      |
| Tyr | Ser | Cys | Lys | Val | Phe | Thr  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 915  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 920  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 925  |
|     |     |     |     |     |     |      |
| Ala | Tyr | Cys | Phe | Cys | Asp | Ala  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 930  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 935  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 940  |
|     |     |     |     |     |     |      |
| Val | Glu | Lys | Ser | Glu | Ser | Cys  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 945  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 950  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 955  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 960  |
|     |     |     |     |     |     |      |
| Ala | His | Thr | Ala | Ser | Ala | Ser  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 965  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 970  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 975  |
|     |     |     |     |     |     |      |
| Asn | Asn | Ile | Thr | Val | Ala | Ala  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 980  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 985  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 990  |
|     |     |     |     |     |     |      |
| Val | Lys | Asp | Ala | Lys | Phe | Val  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 995  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1000 |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1005 |
|     |     |     |     |     |     |      |
| Pro | Phe | Asp | Asn | Lys | Ile | Val  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1010 |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1015 |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1020 |
|     |     |     |     |     |     |      |
| Met | Asp | Tyr | Pro | Pro | Phe | Gly  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1025 |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1030 |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1035 |
|     |     |     |     |     |     |      |
| Asp | Ile | Gln | Ser | Arg | Thr | Pro  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1040 |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1045 |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1050 |
|     |     |     |     |     |     |      |
| Thr | Gln | Leu | Val | Leu | Gln | Arg  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1055 |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1060 |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | 1065 |
|     |     |     |     |     |     |      |
| Pro | Tyr | Ser | Gln | Ala | Pro | Ser  |
|     |     |     |     |     |     |      |
|     |     |     |     |     |     | Gly  |
|     |     |     |     |     |     | Phe  |
|     |     |     |     |     |     | Lys  |
|     |     |     |     |     |     | Tyr  |
|     |     |     |     |     |     | Trp  |
|     |     |     |     |     |     | Leu  |
|     |     |     |     |     |     | Lys  |
|     |     |     |     |     |     | Glu  |

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg  
1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro  
20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu  
35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn  
50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly  
65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro  
85 90 95

Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro  
100 105 110

Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe  
115 120 125

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly  
130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp  
145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu  
165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr  
180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln  
195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly  
210 215 220

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

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val  
245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys  
260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr  
275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu  
290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu  
305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr  
325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg  
340 345 350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu  
355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser  
370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met  
385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val  
405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr  
420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe  
435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys  
450 455 460

Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly  
465 470 475 480

Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly  
485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu  
500 505 510

Val Ser Leu Ser Gly Ser Ser Gly Gly Lys Pro Val Ala His Val Val  
515 520 525

Ala Asn Pro Gln Ala Glu Gly Gln Leu Gln Trp Leu Asn Arg Arg Ala  
530 535 540

Asn Ala Leu Leu Ala Asn Gly Val Glu Leu Arg Asp Asn Gln Leu Val  
545 550 555 560

Val Pro Ser Glu Gly Leu Tyr Leu Ile Tyr Ser Gln Val Leu Phe Lys  
565 570 575

Gly Gln Gly Cys Pro Ser Thr His Val Leu Leu Thr His Thr Ile Ser  
580 585 590

Arg Ile Ala Val Ser Tyr Gln Thr Lys Val Asn Leu Leu Ser Ala Ile  
595 600 605

Lys Ser Pro Cys Gln Arg Glu Thr Pro Glu Gly Ala Glu Ala Lys Pro  
610 615 620

Trp Tyr Glu Pro Ile Tyr Leu Gly Gly Val Phe Gln Leu Glu Lys Gly  
625 630 635 640

Asp Arg Leu Ser Ala Glu Ile Asn Arg Pro Asp Tyr Leu Asp Phe Ala  
645 650 655

Glu Ser Gly Gln Val Tyr Phe Gly Ile Ile Ala Leu Thr Arg Gly Gly  
660 665 670

Ser Ser Val Thr Val Thr Pro Pro Asp Gly Thr Ser Ala Leu Val Glu  
675 680 685

Cys Glu Cys Gly Gly Thr Lys Ile Ser Glu Thr Ile Asn Lys Thr Lys  
690 695 700

Gln Phe Ser Gln Cys Thr Lys Lys Glu Gln Cys Arg Ala Tyr Arg Leu  
705 710 715 720

Gln Asn Asp Lys Trp Val Tyr Asn Ser Asp Lys Leu Pro Lys Ala Ala  
725 730 735

Gly Ala Thr Leu Lys Gly Lys Leu His Val Pro Phe Leu Leu Ala Asp  
740 745 750

Gly Lys Cys Thr Val Pro Leu Ala Pro Glu Pro Met Ile Thr Phe Gly  
755 760 765

Phe Arg Ser Val Ser Leu Lys Leu His Pro Lys Asn Pro Thr Tyr Leu  
770 775 780

Ile Thr Arg Gln Leu Ala Asp Glu Pro His Tyr Thr His Glu Leu Ile  
785 790 795 800

Ser Glu Pro Ala Val Arg Asn Phe Thr Val Thr Glu Lys Gly Trp Glu  
805 810 815

Phe Val Trp Gly Asn His Pro Pro Lys Arg Phe Trp Ala Gln Glu Thr  
820 825 830

Ala Pro Gly Asn Pro His Gly Leu Pro His Glu Val Ile Thr His Tyr  
835 840 845

Tyr His Arg Tyr Pro Met Ser Thr Ile Leu Gly Leu Ser Ile Cys Ala  
850 855 860

Ala Ile Ala Thr Val Ser Val Ala Ala Ser Thr Trp Leu Phe Cys Arg  
865 870 875 880

Ser Arg Val Ala Cys Leu Thr Pro Tyr Arg Leu Thr Pro Asn Ala Arg  
885 890 895

Ile Pro Phe Cys Leu Ala Val Leu Cys Cys Ala Arg Thr Ala Arg Ala  
900 905 910

Glu Thr Thr Trp Glu Ser Leu Asp His Leu Trp Asn Asn Asn Gln Gln  
915 920 925

Met Phe Trp Ile Gln Leu Leu Ile Pro Leu Ala Ala Leu Ile Val Val  
930 935 940

Thr Arg Leu Leu Arg Cys Val Cys Cys Val Val Pro Phe Leu Val Met  
945 950 955 960

Ala Gly Ala Ala Gly Ala Gly Ala Tyr Glu His Ala Thr Thr Met Pro  
965 970 975

Ser Gln Ala Gly Ile Ser Tyr Asn Thr Ile Val Asn Arg Ala Gly Tyr  
980 985 990

Ala Pro Leu Pro Ile Ser Ile Thr Pro Thr Lys Ile Lys Leu Ile Pro  
995 1000 1005

Thr Val Asn Leu Glu Tyr Val Thr Cys His Tyr Lys Thr Gly Met  
1010 1015 1020

Asp Ser Pro Ala Ile Lys Cys Cys Gly Ser Gln Glu Cys Thr Pro  
1025 1030 1035

Thr Tyr Arg Pro Asp Glu Gln Cys Lys Val Phe Thr Gly Val Tyr  
1040 1045 1050

Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Thr Glu Asn  
1055 1060 1065

Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser Asp Asp Cys Leu  
1070 1075 1080

Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala Ser Val Gln  
1085 1090 1095

Ala Phe Leu Asn Ile Thr Val Gly Glu His Ser Ile Val Thr Thr  
1100 1105 1110

Val Tyr Val Asn Gly Glu Thr Pro Val Asn Phe Asn Gly Val Lys  
1115 1120 1125

Ile Thr Ala Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg  
1130 1135 1140

Lys Ile Val Gln Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro  
1145 1150 1155

Glu Tyr Gly Ala Gly Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser  
1160 1165 1170

Arg Thr Val Ser Ser Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val  
1175 1180 1185

Leu Gln Arg Pro Lys Ala Gly Ala Ile His Val Pro Tyr Thr Gln  
1190 1195 1200

Ala Pro Ser Gly Phe Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser  
1205 1210 1215

Leu Lys Phe Thr Ala Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro  
1220 1225 1230

Ile Arg Ala Glu Asn Cys Ala Val Gly Ser Ile Pro Leu Ala Phe  
1235 1240 1245

Asp Ile Pro Asp Ala Leu Phe Thr Arg Val Ser Glu Thr Pro Thr  
1250 1255 1260

Leu Ser Ala Ala Glu Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser  
1265 1270 1275

Asp Phe Gly Gly Ile Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser  
1280 1285 1290

Gly Lys Cys Ala Val His Val Pro Ser Gly Thr Ala Thr Leu Lys  
1295 1300 1305

Glu Ala Ala Val Glu Leu Thr Glu Gln Gly Ser Ala Thr Ile His  
1310 1315 1320

Phe Ser Thr Ala Asn Ile His Pro Glu Phe Arg Leu Gln Ile Cys  
1325 1330 1335

Thr Ser Tyr Val Thr Cys Lys Gly Asp Cys His Pro Pro Lys Asp  
1340 1345 1350

His Ile Val Thr His Pro Gln Tyr His Ala Gln Thr Phe Thr Ala  
1355 1360 1365

Ala Val Ser Lys Thr Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly  
1370 1375 1380

Gly Ser Ala Val Ile Ile Ile Ile Gly Leu Val Leu Ala Thr Ile  
1385 1390 1395

Val Ala Met Tyr Val Leu Thr Asn Gln Lys His Asn  
1400 1405 1410

<210> 7

<211> 1284

<212> PRT

&lt;213&gt; Artificial

&lt;220&gt;

&lt;223&gt; VEEV+CD20

&lt;400&gt; 7

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg  
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Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro  
20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu  
35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn  
50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly  
65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro  
85 90 95

Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro  
100 105 110

Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe  
115 120 125

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly  
130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp  
145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu  
165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr  
180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln  
195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly  
210 215 220

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

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val  
245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys  
260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr  
275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu  
290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu  
305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr  
325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg  
340 345 350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu  
355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser  
370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met  
385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val  
405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr  
420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe  
435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys  
450 455 460

Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly  
465 470 475 480

Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly  
485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu  
500 505 510

Val Ser Leu Ser Gly Ser Ser Gly Gly Ile Tyr Asn Cys Glu Pro Ala  
515 520 525

Asn Pro Ser Glu Lys Asn Ser Pro Ser Thr Gln Tyr Cys Tyr Ser Ile  
530 535 540

Gln Gly Ser Ser Val Thr Val Thr Pro Pro Asp Gly Thr Ser Ala Leu  
545 550 555 560

Val Glu Cys Glu Cys Gly Gly Thr Lys Ile Ser Glu Thr Ile Asn Lys  
565 570 575

Thr Lys Gln Phe Ser Gln Cys Thr Lys Lys Glu Gln Cys Arg Ala Tyr  
580 585 590

Arg Leu Gln Asn Asp Lys Trp Val Tyr Asn Ser Asp Lys Leu Pro Lys  
595 600 605

Ala Ala Gly Ala Thr Leu Lys Gly Lys Leu His Val Pro Phe Leu Leu  
610 615 620

Ala Asp Gly Lys Cys Thr Val Pro Leu Ala Pro Glu Pro Met Ile Thr  
625 630 635 640

Phe Gly Phe Arg Ser Val Ser Leu Lys Leu His Pro Lys Asn Pro Thr  
645 650 655

Tyr Leu Ile Thr Arg Gln Leu Ala Asp Glu Pro His Tyr Thr His Glu  
660 665 670

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

Trp Glu Phe Val Trp Gly Asn His Pro Pro Lys Arg Phe Trp Ala Gln  
690 695 700

Glu Thr Ala Pro Gly Asn Pro His Gly Leu Pro His Glu Val Ile Thr  
705 710 715 720

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

Cys Ala Ala Ile Ala Thr Val Ser Val Ala Ala Ser Thr Trp Leu Phe  
740 745 750

Cys Arg Ser Arg Val Ala Cys Leu Thr Pro Tyr Arg Leu Thr Pro Asn  
755 760 765

Ala Arg Ile Pro Phe Cys Leu Ala Val Leu Cys Cys Ala Arg Thr Ala  
770 775 780

Arg Ala Glu Thr Thr Trp Glu Ser Leu Asp His Leu Trp Asn Asn Asn  
785 790 795 800

Gln Gln Met Phe Trp Ile Gln Leu Leu Ile Pro Leu Ala Ala Leu Ile  
805 810 815

Val Val Thr Arg Leu Leu Arg Cys Val Cys Cys Val Val Pro Phe Leu  
820 825 830

Val Met Ala Gly Ala Ala Gly Ala Gly Ala Tyr Glu His Ala Thr Thr  
835 840 845

Met Pro Ser Gln Ala Gly Ile Ser Tyr Asn Thr Ile Val Asn Arg Ala  
850 855 860

Gly Tyr Ala Pro Leu Pro Ile Ser Ile Thr Pro Thr Lys Ile Lys Leu  
865 870 875 880

Ile Pro Thr Val Asn Leu Glu Tyr Val Thr Cys His Tyr Lys Thr Gly  
885 890 895

Met Asp Ser Pro Ala Ile Lys Cys Cys Gly Ser Gln Glu Cys Thr Pro  
900 905 910

Thr Tyr Arg Pro Asp Glu Gln Cys Lys Val Phe Thr Gly Val Tyr Pro  
915 920 925

Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Thr Glu Asn Thr Gln  
930 935 940

Val Ser Lys Ala Tyr Val Met Lys Ser Asp Asp Cys Leu Ala Asp His  
945 950 955 960

Ala Glu Ala Tyr Lys Ala His Thr Ala Ser Val Gln Ala Phe Leu Asn  
965 970 975

Ile Thr Val Gly Glu His Ser Ile Val Thr Thr Val Tyr Val Asn Gly  
980 985 990

Glu Thr Pro Val Asn Phe Asn Gly Val Lys Ile Thr Ala Gly Pro Leu  
995 1000 1005

Ser Thr Ala Trp Thr Pro Phe Asp Arg Lys Ile Val Gln Tyr Ala  
1010 1015 1020

Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu Tyr Gly Ala Gly Gln  
1025 1030 1035

Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg Thr Val Ser Ser Ser  
1040 1045 1050

Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu Gln Arg Pro Lys Ala  
1055 1060 1065

Gly Ala Ile His Val Pro Tyr Thr Gln Ala Pro Ser Gly Phe Glu  
1070 1075 1080

Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu Lys Phe Thr Ala Pro  
1085 1090 1095

Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile Arg Ala Glu Asn Cys  
1100 1105 1110

Ala Val Gly Ser Ile Pro Leu Ala Phe Asp Ile Pro Asp Ala Leu  
1115 1120 1125

Phe Thr Arg Val Ser Glu Thr Pro Thr Leu Ser Ala Ala Glu Cys  
1130 1135 1140

Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp Phe Gly Gly Ile Ala  
1145 1150 1155

Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly Lys Cys Ala Val His  
1160 1165 1170

Val Pro Ser Gly Thr Ala Thr Leu Lys Glu Ala Ala Val Glu Leu  
1175 1180 1185

Thr Glu Gln Gly Ser Ala Thr Ile His Phe Ser Thr Ala Asn Ile  
1190 1195 1200

His Pro Glu Phe Arg Leu Gln Ile Cys Thr Ser Tyr Val Thr Cys  
1205 1210 1215

Lys Gly Asp Cys His Pro Pro Lys Asp His Ile Val Thr His Pro  
1220 1225 1230

Gln Tyr His Ala Gln Thr Phe Thr Ala Ala Val Ser Lys Thr Ala  
1235 1240 1245

Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly Ser Ala Val Ile Ile  
1250 1255 1260

Ile Ile Gly Leu Val Leu Ala Thr Ile Val Ala Met Tyr Val Leu  
1265 1270 1275

Thr Asn Gln Lys His Asn  
1280

<210> 8

<211> 1279

<212> PRT

<213> Artificial

<220>

<223> VEEV+CTLA4

<400> 8

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg  
1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro  
20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu

35

40

45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn  
50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly  
65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro  
85 90 95

Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro  
100 105 110

Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe  
115 120 125

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly  
130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp  
145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu  
165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr  
180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln  
195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly  
210 215 220

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

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val  
245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys  
260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr  
275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu  
290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu  
305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr

36 / 161

|                                                                 |     |     |
|-----------------------------------------------------------------|-----|-----|
| 325                                                             | 330 | 335 |
| Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg |     |     |
| 340                                                             | 345 | 350 |
| Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu |     |     |
| 355                                                             | 360 | 365 |
| Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser |     |     |
| 370                                                             | 375 | 380 |
| Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met |     |     |
| 385                                                             | 390 | 395 |
| Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val |     |     |
| 405                                                             | 410 | 415 |
| Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr |     |     |
| 420                                                             | 425 | 430 |
| Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe |     |     |
| 435                                                             | 440 | 445 |
| Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys |     |     |
| 450                                                             | 455 | 460 |
| Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly |     |     |
| 465                                                             | 470 | 475 |
| Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly |     |     |
| 485                                                             | 490 | 495 |
| Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu |     |     |
| 500                                                             | 505 | 510 |
| Val Ser Leu Ser Gly Ser Ser Gly Gly Gly Cys Lys Val Glu Leu Met |     |     |
| 515                                                             | 520 | 525 |
| Tyr Pro Pro Pro Tyr Tyr Leu Gly Ile Gly Gly Gly Gly Ser Ser Val |     |     |
| 530                                                             | 535 | 540 |
| Thr Val Thr Pro Pro Asp Gly Thr Ser Ala Leu Val Glu Cys Glu Cys |     |     |
| 545                                                             | 550 | 555 |
| Gly Gly Thr Lys Ile Ser Glu Thr Ile Asn Lys Thr Lys Gln Phe Ser |     |     |
| 565                                                             | 570 | 575 |
| Gln Cys Thr Lys Lys Glu Gln Cys Arg Ala Tyr Arg Leu Gln Asn Asp |     |     |
| 580                                                             | 585 | 590 |
| Lys Trp Val Tyr Asn Ser Asp Lys Leu Pro Lys Ala Ala Gly Ala Thr |     |     |
| 595                                                             | 600 | 605 |
| Leu Lys Gly Lys Leu His Val Pro Phe Leu Leu Ala Asp Gly Lys Cys |     |     |

37 / 161

|                                                                 |     |         |
|-----------------------------------------------------------------|-----|---------|
| 610                                                             | 615 | 620     |
| Thr Val Pro Leu Ala Pro Glu Pro Met Ile Thr Phe Gly Phe Arg Ser |     |         |
| 625                                                             | 630 | 635 640 |
| Val Ser Leu Lys Leu His Pro Lys Asn Pro Thr Tyr Leu Ile Thr Arg |     |         |
|                                                                 | 645 | 650 655 |
| Gln Leu Ala Asp Glu Pro His Tyr Thr His Glu Leu Ile Ser Glu Pro |     |         |
|                                                                 | 660 | 665 670 |
| Ala Val Arg Asn Phe Thr Val Thr Glu Lys Gly Trp Glu Phe Val Trp |     |         |
|                                                                 | 675 | 680 685 |
| Gly Asn His Pro Pro Lys Arg Phe Trp Ala Gln Glu Thr Ala Pro Gly |     |         |
|                                                                 | 690 | 695 700 |
| Asn Pro His Gly Leu Pro His Glu Val Ile Thr His Tyr Tyr His Arg |     |         |
| 705                                                             | 710 | 715 720 |
| Tyr Pro Met Ser Thr Ile Leu Gly Leu Ser Ile Cys Ala Ala Ile Ala |     |         |
|                                                                 | 725 | 730 735 |
| Thr Val Ser Val Ala Ala Ser Thr Trp Leu Phe Cys Arg Ser Arg Val |     |         |
|                                                                 | 740 | 745 750 |
| Ala Cys Leu Thr Pro Tyr Arg Leu Thr Pro Asn Ala Arg Ile Pro Phe |     |         |
|                                                                 | 755 | 760 765 |
| Cys Leu Ala Val Leu Cys Cys Ala Arg Thr Ala Arg Ala Glu Thr Thr |     |         |
|                                                                 | 770 | 775 780 |
| Trp Glu Ser Leu Asp His Leu Trp Asn Asn Asn Gln Gln Met Phe Trp |     |         |
| 785                                                             | 790 | 795 800 |
| Ile Gln Leu Leu Ile Pro Leu Ala Ala Leu Ile Val Val Thr Arg Leu |     |         |
|                                                                 | 805 | 810 815 |
| Leu Arg Cys Val Cys Cys Val Val Pro Phe Leu Val Met Ala Gly Ala |     |         |
|                                                                 | 820 | 825 830 |
| Ala Gly Ala Gly Ala Tyr Glu His Ala Thr Thr Met Pro Ser Gln Ala |     |         |
|                                                                 | 835 | 840 845 |
| Gly Ile Ser Tyr Asn Thr Ile Val Asn Arg Ala Gly Tyr Ala Pro Leu |     |         |
|                                                                 | 850 | 855 860 |
| Pro Ile Ser Ile Thr Pro Thr Lys Ile Lys Leu Ile Pro Thr Val Asn |     |         |
| 865                                                             | 870 | 875 880 |
| Leu Glu Tyr Val Thr Cys His Tyr Lys Thr Gly Met Asp Ser Pro Ala |     |         |
|                                                                 | 885 | 890 895 |
| Ile Lys Cys Cys Gly Ser Gln Glu Cys Thr Pro Thr Tyr Arg Pro Asp |     |         |

38 / 161

|                                                                 |      |      |
|-----------------------------------------------------------------|------|------|
| 900                                                             | 905  | 910  |
| Glu Gln Cys Lys Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly |      |      |
| 915                                                             | 920  | 925  |
| Ala Tyr Cys Phe Cys Asp Thr Glu Asn Thr Gln Val Ser Lys Ala Tyr |      |      |
| 930                                                             | 935  | 940  |
| Val Met Lys Ser Asp Asp Cys Leu Ala Asp His Ala Glu Ala Tyr Lys |      |      |
| 945                                                             | 950  | 955  |
| Ala His Thr Ala Ser Val Gln Ala Phe Leu Asn Ile Thr Val Gly Glu |      |      |
| 965                                                             | 970  | 975  |
| His Ser Ile Val Thr Thr Val Tyr Val Asn Gly Glu Thr Pro Val Asn |      |      |
| 980                                                             | 985  | 990  |
| Phe Asn Gly Val Lys Ile Thr Ala Gly Pro Leu Ser Thr Ala Trp Thr |      |      |
| 995                                                             | 1000 | 1005 |
| Pro Phe Asp Arg Lys Ile Val Gln Tyr Ala Gly Glu Ile Tyr Asn     |      |      |
| 1010                                                            | 1015 | 1020 |
| Tyr Asp Phe Pro Glu Tyr Gly Ala Gly Gln Pro Gly Ala Phe Gly     |      |      |
| 1025                                                            | 1030 | 1035 |
| Asp Ile Gln Ser Arg Thr Val Ser Ser Ser Asp Leu Tyr Ala Asn     |      |      |
| 1040                                                            | 1045 | 1050 |
| Thr Asn Leu Val Leu Gln Arg Pro Lys Ala Gly Ala Ile His Val     |      |      |
| 1055                                                            | 1060 | 1065 |
| Pro Tyr Thr Gln Ala Pro Ser Gly Phe Glu Gln Trp Lys Lys Asp     |      |      |
| 1070                                                            | 1075 | 1080 |
| Lys Ala Pro Ser Leu Lys Phe Thr Ala Pro Phe Gly Cys Glu Ile     |      |      |
| 1085                                                            | 1090 | 1095 |
| Tyr Thr Asn Pro Ile Arg Ala Glu Asn Cys Ala Val Gly Ser Ile     |      |      |
| 1100                                                            | 1105 | 1110 |
| Pro Leu Ala Phe Asp Ile Pro Asp Ala Leu Phe Thr Arg Val Ser     |      |      |
| 1115                                                            | 1120 | 1125 |
| Glu Thr Pro Thr Leu Ser Ala Ala Glu Cys Thr Leu Asn Glu Cys     |      |      |
| 1130                                                            | 1135 | 1140 |
| Val Tyr Ser Ser Asp Phe Gly Gly Ile Ala Thr Val Lys Tyr Ser     |      |      |
| 1145                                                            | 1150 | 1155 |
| Ala Ser Lys Ser Gly Lys Cys Ala Val His Val Pro Ser Gly Thr     |      |      |
| 1160                                                            | 1165 | 1170 |
| Ala Thr Leu Lys Glu Ala Ala Val Glu Leu Thr Glu Gln Gly Ser     |      |      |

39 / 161

|                             |                     |             |
|-----------------------------|---------------------|-------------|
| 1175                        | 1180                | 1185        |
| Ala Thr Ile His Phe Ser Thr | Ala Asn Ile His Pro | Glu Phe Arg |
| 1190                        | 1195                | 1200        |
| Leu Gln Ile Cys Thr Ser Tyr | Val Thr Cys Lys Gly | Asp Cys His |
| 1205                        | 1210                | 1215        |
| Pro Pro Lys Asp His Ile Val | Thr His Pro Gln Tyr | His Ala Gln |
| 1220                        | 1225                | 1230        |
| Thr Phe Thr Ala Ala Val Ser | Lys Thr Ala Trp Thr | Trp Leu Thr |
| 1235                        | 1240                | 1245        |
| Ser Leu Leu Gly Gly Ser Ala | Val Ile Ile Ile Ile | Gly Leu Val |
| 1250                        | 1255                | 1260        |
| Leu Ala Thr Ile Val Ala Met | Tyr Val Leu Thr Asn | Gln Lys His |
| 1265                        | 1270                | 1275        |

Asn

<210> 9  
 <211> 2964  
 <212> DNA  
 <213> virus

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| ccatactctc aggcaccatc tggctttaag tattggctaa aagaacggg ggcgtcgtg    | 3180 |
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| acacaagtac actgtgcagc cgagtgccac ccccggaagg accacatagt caactaccgc | 3600 |
| gcgtcacata ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag | 3660 |
| aagatcacgg gaggtgtggg actggttggt gctgttgccg cactgattct aatcgtggtg | 3720 |
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| ctcgcccagc tgatctcgc agtcaacaaa ttgacctgc gcgcgtacc tcaacagaag     | 180 |
| cctcgcagaa atcggaacaa caagaagcaa aggcagaaga agcaggcgcc gcaaacgac   | 240 |
| ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc  | 300 |
| cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tcttcgaagt caagcatgaa  | 360 |
| ggcaaagtga tgggctaocg atgcctggtg ggggataaag taatgaaacc agcacatgtg  | 420 |
| aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac  | 480 |
| gatcttgaat gtgcacagat accggtgcac atgaagtctg atgcctcgaa gtttaccac   | 540 |
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| ttcactatcc cgacgggtgc aggcaagccg ggagacagcg gcagaccgat cttcgacaac  | 660 |
| aaaggacggg tgggtggccat cgtcctagga ggggccaacg aaggtgcccg cacggccctc | 720 |
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| tggagcctcg ccctccgggt cttgtgcctg ttggcaacaa ctacattccc ctgctctcag  | 840 |
| ccgccttgca caccctgtg ctacgaaaag gaaccgaaa gcaccttgcg catgcttgag    | 900 |
| gacaacgtga tgagaccggg ataactaccag ctactaaaag catcgtgac ttgctctccc  | 960 |

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| ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcaag  | 1440 |
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| accaaggtca acctctctc tgccatcaag agcccctgcc agaggagac ccagagggg     | 1860 |
| gctgaggcca agccctggta tgagccatc tatctgggag gggctttcca gctggagaag   | 1920 |
| ggtgaccgac tcagcgtga gatcaatcg cccgactatc tcgactttgc cgagtctggg    | 1980 |
| caggtctact ttgggatcat tgccctgacg cgtggaggat ccggcgggca gacggtcgg   | 2040 |
| tacaagtga actgcggtgg ctcaaagag ggactgacaa ccacagacaa agtgatcaat    | 2100 |
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| tcccctttag tcccgcgcaa cgctgaactc ggggaccgta aaggaaagat ccacatccca  | 2220 |
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| ccccgtttct ggttgcaggc tcttatcccg ctggcgcct tgatcgtcct gtgcaactgt  | 2820 |
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| accacccttg ggtccagga tatatccaca acggcaatgt cttgggtgca gaagattacg  | 4140 |
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4215

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| gagtgggtga cacacaagaa ggaggttacc ttgaccgtgc ctactgaggg tctggaggtc  | 2040 |
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&lt;223&gt; VEEV+CTLA4

&lt;400&gt; 17

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| ttaacccgct | cgatggctaa  | cctgacgttc | aagcaacgcc  | gggacgcgcc | acctgagggg | 180  |
| ccatccgcta | ataaacggaa  | gaaggaggcc | tcgcaaaaac  | agaaaggggg | aggccaaggg | 240  |
| aagaagaaga | agaaccaagg  | gaagaagaag | gctaagacag  | ggccgcctaa | tccgaaggca | 300  |
| cagaatggaa | acaagaagaa  | gaccaacaag | aaaccaggca  | agagacagcg | catggtcatg | 360  |
| aaattggaat | ctgacaagac  | gttcccaatc | atgttgggaag | ggaagataaa | cggctacgct | 420  |
| tgtgtggtcg | gagggaagtt  | attcaggccg | atgcatgttg  | aaggcaagat | cgacaacgac | 480  |
| gttctggccg | cgcttaagac  | gaagaaagca | tccaaatacg  | atcttgagta | tgcagatgtg | 540  |
| ccacagaaca | tgcgggccga  | tacattcaaa | tacacccatg  | agaaacccca | aggctattac | 600  |
| agctggcatc | atggagcagt  | ccaatatgaa | aatgggcgtt  | tcacggtgcc | gaaaggagtt | 660  |
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Ala Asn Gly Val Glu Leu Arg Asp Asn Gln Leu Val Val Pro Ser Glu  
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Gly Leu Tyr Leu Ile Tyr Ser Gln Val Leu Phe Lys Gly Gln Gly Cys  
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Pro Ser Thr His Val Leu Leu Thr His Thr Ile Ser Arg Ile Ala Val  
65 70 75 80

Ser Tyr Gln Thr Lys Val Asn Leu Leu Ser Ala Ile Lys Ser Pro Cys  
85 90 95

62 / 161

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

Tyr Leu Ile Tyr Ser Gln Val Leu Phe Lys Gly Gln Gly Cys Pro Ser  
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Thr His Val Leu Leu Thr His Thr Ile Ser Arg Ile Ala Val Ser Tyr  
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Gln Thr Lys Val Asn Leu Leu Ser Ala Ile Lys Ser Pro Cys Gln Arg  
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Glu Thr Pro Glu Gly Ala Glu Ala Lys Pro Trp Tyr Glu Pro Ile Tyr  
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Leu Gly Gly Val Phe Gln Leu Glu Lys Gly Asp Arg Leu Ser Ala Glu  
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Thr Gln Tyr Cys Tyr Ser Ile Gln  
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| acgacccaaa gcaaaagaag caaccaccac aaaagaagcc ggctcaaaag aagaagaaac  | 1200 |
| caggccgtag ggagagaatg tgcatgaaaa ttgaaatga ttgcatcttc gaagtcaagc   | 1260 |
| atgaaggcaa agtgatgggc tacgcatgcc tgggtgggga taaagtaatg aaaccagcac  | 1320 |
| atgtgaaggg aactatcgac aatgcgatc tggctaaact ggcctttaag cgtcgtcta    | 1380 |
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&lt;223&gt; VLP\_CHI 512 vector-CHIKV VLP

&lt;400&gt; 28

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| cctogcagaa atcggaaaaa caagaagcaa aggcagaaga agcaggcgcc gcaaacgac  | 240  |
| ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc | 300  |
| cgtagggaga gaatgtgcat gaaaattgaa aatgattgca ttttcgaagt caagcatgaa | 360  |
| ggcaaagtga tgggtacgc atgcctgggt ggggataaag taatgaaacc agcacatgtg  | 420  |
| aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac | 480  |
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| ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcacg | 1440 |
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Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val  
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Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn  
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Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp  
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Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys  
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Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp  
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys

94 / 161

|                                                                 |     |     |
|-----------------------------------------------------------------|-----|-----|
| 115                                                             | 120 | 125 |
| Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile |     |     |
| 130                                                             | 135 | 140 |
| Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr |     |     |
| 145                                                             | 150 | 155 |
| Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser |     |     |
| 165                                                             | 170 | 175 |
| Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly |     |     |
| 180                                                             | 185 | 190 |
| Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly |     |     |
| 195                                                             | 200 | 205 |
| Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val |     |     |
| 210                                                             | 215 | 220 |
| Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu |     |     |
| 225                                                             | 230 | 235 |
| Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu |     |     |
| 245                                                             | 250 | 255 |
| Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala |     |     |
| 260                                                             | 265 | 270 |
| Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr |     |     |
| 275                                                             | 280 | 285 |
| Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met |     |     |
| 290                                                             | 295 | 300 |
| Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro |     |     |
| 305                                                             | 310 | 315 |
| His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala |     |     |
| 325                                                             | 330 | 335 |
| Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser |     |     |
| 340                                                             | 345 | 350 |
| Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp |     |     |
| 355                                                             | 360 | 365 |
| Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp |     |     |
| 370                                                             | 375 | 380 |
| Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro |     |     |
| 385                                                             | 390 | 395 |
| Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys |     |     |

95 / 161

|                                                                 |     |     |
|-----------------------------------------------------------------|-----|-----|
| 405                                                             | 410 | 415 |
| Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys |     |     |
| 420                                                             | 425 | 430 |
| Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His |     |     |
| 435                                                             | 440 | 445 |
| Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu |     |     |
| 450                                                             | 455 | 460 |
| Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr |     |     |
| 465                                                             | 470 | 475 |
| Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met |     |     |
| 485                                                             | 490 | 495 |
| Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Gly |     |     |
| 500                                                             | 505 | 510 |
| Ser Asn Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys |     |     |
| 515                                                             | 520 | 525 |
| Asn Cys Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile |     |     |
| 530                                                             | 535 | 540 |
| Asn Asn Cys Lys Ile Asp Gln Cys His Ala Ala Val Thr Asn His Lys |     |     |
| 545                                                             | 550 | 555 |
| Asn Trp Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly |     |     |
| 565                                                             | 570 | 575 |
| Asp Arg Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr |     |     |
| 580                                                             | 585 | 590 |
| Cys Arg Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn |     |     |
| 595                                                             | 600 | 605 |
| Gln Val Thr Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr |     |     |
| 610                                                             | 615 | 620 |
| Arg Asn Met Gly Gln Glu Pro Asn Tyr His Glu Glu Trp Val Thr His |     |     |
| 625                                                             | 630 | 635 |
| Lys Lys Glu Val Thr Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr |     |     |
| 645                                                             | 650 | 655 |
| Trp Gly Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Met Ser Thr Asn |     |     |
| 660                                                             | 665 | 670 |
| Gly Thr Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu |     |     |
| 675                                                             | 680 | 685 |
| Leu Tyr Pro Thr Met Thr Val Val Ile Val Ser Val Ala Ser Phe Val |     |     |

96 / 161

|                                                                 |         |         |
|-----------------------------------------------------------------|---------|---------|
| 690                                                             | 695     | 700     |
| Leu Leu Ser Met Val Gly Thr Ala Val Gly Met Cys Val Cys Ala Arg |         |         |
| 705                                                             | 710     | 715 720 |
| Arg Arg Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro |         |         |
|                                                                 | 725     | 730 735 |
| Phe Leu Leu Ser Leu Leu Cys Cys Val Arg Thr Thr Lys Ala Ala Thr |         |         |
|                                                                 | 740 745 | 750     |
| Tyr Tyr Glu Ala Ala Ala Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe |         |         |
|                                                                 | 755 760 | 765     |
| Trp Leu Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn |         |         |
|                                                                 | 770 775 | 780     |
| Cys Leu Lys Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala |         |         |
|                                                                 | 785 790 | 795 800 |
| Val Met Ser Ile Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr |         |         |
|                                                                 | 805     | 810 815 |
| Val Ile Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg |         |         |
|                                                                 | 820     | 825 830 |
| Pro Gly Tyr Ser Pro Met Val Leu Glu Met Glu Leu Gln Ser Val Thr |         |         |
|                                                                 | 835 840 | 845     |
| Leu Glu Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr |         |         |
|                                                                 | 850 855 | 860     |
| Val Ile Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys |         |         |
|                                                                 | 865 870 | 875 880 |
| Asp Lys Ser Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr |         |         |
|                                                                 | 885     | 890 895 |
| Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr |         |         |
|                                                                 | 900     | 905 910 |
| Gln Leu Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu |         |         |
|                                                                 | 915     | 920 925 |
| Phe Ala Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu |         |         |
|                                                                 | 930 935 | 940     |
| Arg Val Leu Tyr Gln Gly Asn Asn Ile Thr Val Ala Ala Tyr Ala Asn |         |         |
|                                                                 | 945 950 | 955 960 |
| Gly Asp His Ala Val Thr Val Lys Asp Ala Lys Phe Val Val Gly Pro |         |         |
|                                                                 | 965     | 970 975 |
| Met Ser Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys |         |         |

97 / 161

| 980     |     |     |     |     | 985  |     |     |     |     | 990  |     |     |     |     |     |
|---------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|
| Gly     | Asp | Val | Tyr | Asn | Met  | Asp | Tyr | Pro | Pro | Phe  | Gly | Ala | Gly | Arg | Pro |
| 995     |     |     |     |     | 1000 |     |     |     |     | 1005 |     |     |     |     |     |
| Gly     | Gln | Phe | Gly | Asp | Ile  | Gln | Ser | Arg | Thr | Pro  | Glu | Ser | Lys | Asp |     |
| 1010    |     |     |     |     | 1015 |     |     |     |     | 1020 |     |     |     |     |     |
| Val     | Tyr | Ala | Asn | Thr | Gln  | Leu | Val | Leu | Gln | Arg  | Pro | Ala | Ala | Gly |     |
| 1025    |     |     |     |     | 1030 |     |     |     |     | 1035 |     |     |     |     |     |
| Thr     | Val | His | Val | Pro | Tyr  | Ser | Gln | Ala | Pro | Ser  | Gly | Phe | Lys | Tyr |     |
| 1040    |     |     |     |     | 1045 |     |     |     |     | 1050 |     |     |     |     |     |
| Trp     | Leu | Lys | Glu | Arg | Gly  | Ala | Ser | Leu | Gln | His  | Thr | Ala | Pro | Phe |     |
| 1055    |     |     |     |     | 1060 |     |     |     |     | 1065 |     |     |     |     |     |
| Gly     | Cys | Gln | Ile | Ala | Thr  | Asn | Pro | Val | Arg | Ala  | Val | Asn | Cys | Ala |     |
| 1070    |     |     |     |     | 1075 |     |     |     |     | 1080 |     |     |     |     |     |
| Val     | Gly | Asn | Ile | Pro | Ile  | Ser | Ile | Asp | Ile | Pro  | Asp | Ala | Ala | Phe |     |
| 1085    |     |     |     |     | 1090 |     |     |     |     | 1095 |     |     |     |     |     |
| Thr     | Arg | Val | Val | Asp | Ala  | Pro | Ser | Val | Thr | Asp  | Met | Ser | Cys | Glu |     |
| 1100    |     |     |     |     | 1105 |     |     |     |     | 1110 |     |     |     |     |     |
| Val     | Pro | Ala | Cys | Thr | His  | Ser | Ser | Asp | Phe | Gly  | Gly | Val | Ala | Ile |     |
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| Met     | Thr | Asn | Ala | Val | Thr  | Ile | Arg | Glu | Ala | Asp  | Val | Glu | Val | Glu |     |
| 1145    |     |     |     |     | 1150 |     |     |     |     | 1155 |     |     |     |     |     |
| Gly     | Asn | Ser | Gln | Leu | Gln  | Ile | Ser | Phe | Ser | Thr  | Ala | Leu | Ala | Ser |     |
| 1160    |     |     |     |     | 1165 |     |     |     |     | 1170 |     |     |     |     |     |
| Ala     | Glu | Phe | Arg | Val | Gln  | Val | Cys | Ser | Thr | Gln  | Val | His | Cys | Ala |     |
| 1175    |     |     |     |     | 1180 |     |     |     |     | 1185 |     |     |     |     |     |
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| 1190    |     |     |     |     | 1195 |     |     |     |     | 1200 |     |     |     |     |     |
| Ser     | His | Thr | Thr | Leu | Gly  | Val | Gln | Asp | Ile | Ser  | Thr | Thr | Ala | Met |     |
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| Ser     | Trp | Val | Gln | Lys | Ile  | Thr | Gly | Gly | Val | Gly  | Leu | Ile | Val | Ala |     |
| 1220    |     |     |     |     | 1225 |     |     |     |     | 1230 |     |     |     |     |     |
| Val     | Ala | Ala | Leu | Ile | Leu  | Ile | Val | Val | Leu | Cys  | Val | Ser | Phe | Ser |     |
| 1235    |     |     |     |     | 1240 |     |     |     |     | 1245 |     |     |     |     |     |
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Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp  
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101 / 161

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Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr  
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Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met  
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Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser  
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Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp  
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Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp  
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Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro  
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Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys  
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Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His  
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Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu  
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Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr  
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Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met  
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Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn  
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Gly Gly Ser Gly Ser Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys  
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His Lys Asn Trp Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu  
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Ser Tyr Arg Asn Met Gly Gln Glu Pro Asn Tyr His Glu Glu Trp Val  
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Thr His Lys Lys Glu Val Thr Leu Thr Val Pro Thr Glu Gly Leu Glu  
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755 760 765

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Cys Asn Cys Leu Lys Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe  
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850 855 860

Lys Thr Val Ile Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu  
865 870 875 880

Cys Lys Asp Lys Ser Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly  
885 890 895

Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu  
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Asn Thr Gln Leu Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys  
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Thr Glu Phe Ala Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala  
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104 / 161

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

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn  
50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly  
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Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro  
85 90 95

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

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly  
130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp  
145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu  
165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr  
180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln  
195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly  
210 215 220

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

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val  
245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys  
260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr  
275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu  
290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu  
305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr  
325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg  
 340 345 350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu  
 355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser  
 370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met  
 385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val  
 405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr  
 420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe  
 435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys  
 450 455 460

Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly  
 465 470 475 480

Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly  
 485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu  
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Val Ser Leu Ser Gly Ser Gly Gly Ser Ser Ser Val Thr Val Thr Pro  
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Pro Asp Gly Thr Ser Ala Leu Val Glu Cys Glu Cys Gly Gly Thr Lys  
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Ile Ser Glu Thr Ile Asn Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys  
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Lys Glu Gln Cys Arg Ala Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr  
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Asn Ser Asp Lys Leu Pro Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys  
 580 585 590

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

Ala Pro Glu Pro Met Ile Thr Phe Gly Phe Arg Ser Val Ser Leu Lys  
 610 615 620

Leu His Pro Lys Asn Pro Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp  
625 630 635 640

Glu Pro His Tyr Thr His Glu Leu Ile Ser Glu Pro Ala Val Arg Asn  
645 650 655

Phe Thr Val Thr Glu Lys Gly Trp Glu Phe Val Trp Gly Asn His Pro  
660 665 670

Pro Lys Arg Phe Trp Ala Gln Glu Thr Ala Pro Gly Asn Pro His Gly  
675 680 685

Leu Pro His Glu Val Ile Thr His Tyr Tyr His Arg Tyr Pro Met Ser  
690 695 700

Thr Ile Leu Gly Leu Ser Ile Cys Ala Ala Ile Ala Thr Val Ser Val  
705 710 715 720

Ala Ala Ser Thr Trp Leu Phe Cys Arg Ser Arg Val Ala Cys Leu Thr  
725 730 735

Pro Tyr Arg Leu Thr Pro Asn Ala Arg Ile Pro Phe Cys Leu Ala Val  
740 745 750

Leu Cys Cys Ala Arg Thr Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu  
755 760 765

Asp His Leu Trp Asn Asn Asn Gln Gln Met Phe Trp Ile Gln Leu Leu  
770 775 780

Ile Pro Leu Ala Ala Leu Ile Val Val Thr Arg Leu Leu Arg Cys Val  
785 790 795 800

Cys Cys Val Val Pro Phe Leu Val Met Ala Gly Ala Ala Gly Ala Gly  
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Ala Tyr Glu His Ala Thr Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr  
820 825 830

Asn Thr Ile Val Asn Arg Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile  
835 840 845

Thr Pro Thr Lys Ile Lys Leu Ile Pro Thr Val Asn Leu Glu Tyr Val  
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Thr Cys His Tyr Lys Thr Gly Met Asp Ser Pro Ala Ile Lys Cys Cys  
865 870 875 880

Gly Ser Gln Glu Cys Thr Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys  
885 890 895

Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe  
900 905 910

Cys Asp Thr Glu Asn Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser  
 915 920 925

Asp Asp Cys Leu Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala  
 930 935 940

Ser Val Gln Ala Phe Leu Asn Ile Thr Val Gly Glu His Ser Ile Val  
 945 950 955 960

Thr Thr Val Tyr Val Asn Gly Glu Thr Pro Val Asn Phe Asn Gly Val  
 965 970 975

Lys Ile Thr Ala Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg  
 980 985 990

Lys Ile Val Gln Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu  
 995 1000 1005

Tyr Gly Ala Gly Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg  
 1010 1015 1020

Thr Val Ser Ser Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu  
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Gln Arg Pro Lys Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala  
 1040 1045 1050

Pro Ser Gly Phe Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu  
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Lys Phe Thr Ala Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile  
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Arg Ala Glu Asn Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp  
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Ile Pro Asp Ala Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu  
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Ser Ala Ala Glu Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp  
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Phe Gly Gly Ile Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly  
 1130 1135 1140

Lys Cys Ala Val His Val Pro Ser Gly Thr Ala Thr Leu Lys Glu  
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Ala Ala Val Glu Leu Thr Glu Gln Gly Ser Ala Thr Ile His Phe  
 1160 1165 1170

Ser Thr Ala Asn Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr  
 1175 1180 1185

Ser Tyr Val Thr Cys Lys Gly Asp Cys His Pro Pro Lys Asp His  
1190 1195 1200

Ile Val Thr His Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala  
1205 1210 1215

Val Ser Lys Thr Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly  
1220 1225 1230

Ser Ala Val Ile Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val  
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Ala Met Tyr Val Leu Thr Asn Gln Lys His Asn  
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|                                                                    |      |
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| gacggcaaat gcaccgtgcc tctagcacca gaacctatga taaccttcgg tticagatca  | 1860 |
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| gaaaaagggt gggagtttgt atggggaaac caccgcgga aaaggttttg ggcacaggaa   | 2040 |
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| tacctatgt ccaccatcct gggtttgtca atttgtgccg ccattgcaac cgtttccgtt   | 2160 |
| gcagcgtcta cctggctgtt ttgcagatca agagttgctg gcctaactcc ttaccggcta  | 2220 |
| acacctaacg ctaggatacc attttgtctg gctgtgcttt gctgcgccg cactgccgg    | 2280 |
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Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg

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| 1                                                               | 5   | 10  | 15  |
| Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro | 20  | 25  | 30  |
| Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu | 35  | 40  | 45  |
| Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn | 50  | 55  | 60  |
| Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly | 65  | 70  | 75  |
| Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro | 85  | 90  | 95  |
| Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro | 100 | 105 | 110 |
| Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe | 115 | 120 | 125 |
| Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly | 130 | 135 | 140 |
| Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp | 145 | 150 | 155 |
| Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu | 165 | 170 | 175 |
| Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr | 180 | 185 | 190 |
| His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln | 195 | 200 | 205 |
| Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly | 210 | 215 | 220 |
| Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile | 225 | 230 | 235 |
| Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val | 245 | 250 | 255 |
| Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys | 260 | 265 | 270 |
| Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr | 275 | 280 | 285 |
| Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu |     |     |     |

|                                                                 |     |     |     |         |
|-----------------------------------------------------------------|-----|-----|-----|---------|
| 290                                                             |     | 295 |     | 300     |
| Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu |     |     |     |         |
| 305                                                             |     | 310 |     | 315 320 |
| Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr |     |     |     |         |
|                                                                 | 325 |     | 330 | 335     |
| Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg |     |     |     |         |
|                                                                 | 340 |     | 345 | 350     |
| Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu |     |     |     |         |
|                                                                 | 355 |     | 360 | 365     |
| Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser |     |     |     |         |
|                                                                 | 370 |     | 375 | 380     |
| Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met |     |     |     |         |
| 385                                                             |     | 390 |     | 395 400 |
| Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val |     |     |     |         |
|                                                                 | 405 |     | 410 | 415     |
| Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr |     |     |     |         |
|                                                                 | 420 |     | 425 | 430     |
| Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe |     |     |     |         |
|                                                                 | 435 |     | 440 | 445     |
| Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys |     |     |     |         |
|                                                                 | 450 |     | 455 | 460     |
| Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly |     |     |     |         |
| 465                                                             |     | 470 |     | 475 480 |
| Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly |     |     |     |         |
|                                                                 | 485 |     | 490 | 495     |
| Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu |     |     |     |         |
|                                                                 | 500 |     | 505 | 510     |
| Val Ser Leu Ser Gly Ser Ser Gly Gly Ser Ser Val Thr Val Thr Pro |     |     |     |         |
|                                                                 | 515 |     | 520 | 525     |
| Pro Asp Gly Thr Ser Ala Leu Val Glu Cys Glu Cys Gly Gly Thr Lys |     |     |     |         |
|                                                                 | 530 |     | 535 | 540     |
| Ile Ser Glu Thr Ile Asn Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys |     |     |     |         |
| 545                                                             |     | 550 |     | 555 560 |
| Lys Glu Gln Cys Arg Ala Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr |     |     |     |         |
|                                                                 | 565 |     | 570 | 575     |
| Asn Ser Asp Lys Leu Pro Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys |     |     |     |         |

|                                                                 |     |         |
|-----------------------------------------------------------------|-----|---------|
| 580                                                             | 585 | 590     |
| Leu His Val Pro Phe Leu Leu Ala Asp Gly Lys Cys Thr Val Pro Leu |     |         |
| 595                                                             | 600 | 605     |
| Ala Pro Glu Pro Met Ile Thr Phe Gly Phe Arg Ser Val Ser Leu Lys |     |         |
| 610                                                             | 615 | 620     |
| Leu His Pro Lys Asn Pro Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp |     |         |
| 625                                                             | 630 | 635 640 |
| Glu Pro His Tyr Thr His Glu Leu Ile Ser Glu Pro Ala Val Arg Asn |     |         |
|                                                                 | 645 | 650 655 |
| Phe Thr Val Thr Glu Lys Gly Trp Glu Phe Val Trp Gly Asn His Pro |     |         |
|                                                                 | 660 | 665 670 |
| Pro Lys Arg Phe Trp Ala Gln Glu Thr Ala Pro Gly Asn Pro His Gly |     |         |
|                                                                 | 675 | 680 685 |
| Leu Pro His Glu Val Ile Thr His Tyr Tyr His Arg Tyr Pro Met Ser |     |         |
|                                                                 | 690 | 695 700 |
| Thr Ile Leu Gly Leu Ser Ile Cys Ala Ala Ile Ala Thr Val Ser Val |     |         |
| 705                                                             | 710 | 715 720 |
| Ala Ala Ser Thr Trp Leu Phe Cys Arg Ser Arg Val Ala Cys Leu Thr |     |         |
|                                                                 | 725 | 730 735 |
| Pro Tyr Arg Leu Thr Pro Asn Ala Arg Ile Pro Phe Cys Leu Ala Val |     |         |
|                                                                 | 740 | 745 750 |
| Leu Cys Cys Ala Arg Thr Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu |     |         |
|                                                                 | 755 | 760 765 |
| Asp His Leu Trp Asn Asn Asn Gln Gln Met Phe Trp Ile Gln Leu Leu |     |         |
|                                                                 | 770 | 775 780 |
| Ile Pro Leu Ala Ala Leu Ile Val Val Thr Arg Leu Leu Arg Cys Val |     |         |
| 785                                                             | 790 | 795 800 |
| Cys Cys Val Val Pro Phe Leu Val Met Ala Gly Ala Ala Gly Ala Gly |     |         |
|                                                                 | 805 | 810 815 |
| Ala Tyr Glu His Ala Thr Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr |     |         |
|                                                                 | 820 | 825 830 |
| Asn Thr Ile Val Asn Arg Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile |     |         |
|                                                                 | 835 | 840 845 |
| Thr Pro Thr Lys Ile Lys Leu Ile Pro Thr Val Asn Leu Glu Tyr Val |     |         |
| 850                                                             | 855 | 860     |
| Thr Cys His Tyr Lys Thr Gly Met Asp Ser Pro Ala Ile Lys Cys Cys |     |         |

|                                                                 |      |     |  |      |  |      |
|-----------------------------------------------------------------|------|-----|--|------|--|------|
| 865                                                             |      | 870 |  | 875  |  | 880  |
| Gly Ser Gln Glu Cys Thr Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys |      |     |  |      |  |      |
|                                                                 | 885  |     |  | 890  |  | 895  |
| Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe |      |     |  |      |  |      |
|                                                                 | 900  |     |  | 905  |  | 910  |
| Cys Asp Thr Glu Asn Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser |      |     |  |      |  |      |
|                                                                 | 915  |     |  | 920  |  | 925  |
| Asp Asp Cys Leu Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala |      |     |  |      |  |      |
|                                                                 | 930  |     |  | 935  |  | 940  |
| Ser Val Gln Ala Phe Leu Asn Ile Thr Val Gly Glu His Ser Ile Val |      |     |  |      |  |      |
|                                                                 | 945  |     |  | 950  |  | 955  |
|                                                                 |      |     |  |      |  | 960  |
| Thr Thr Val Tyr Val Asn Gly Glu Thr Pro Val Asn Phe Asn Gly Val |      |     |  |      |  |      |
|                                                                 |      |     |  | 965  |  | 970  |
|                                                                 |      |     |  |      |  | 975  |
| Lys Ile Thr Ala Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg |      |     |  |      |  |      |
|                                                                 | 980  |     |  | 985  |  | 990  |
| Lys Ile Val Gln Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu |      |     |  |      |  |      |
|                                                                 | 995  |     |  | 1000 |  | 1005 |
| Tyr Gly Ala Gly Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg     |      |     |  |      |  |      |
|                                                                 | 1010 |     |  | 1015 |  | 1020 |
| Thr Val Ser Ser Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu     |      |     |  |      |  |      |
|                                                                 | 1025 |     |  | 1030 |  | 1035 |
| Gln Arg Pro Lys Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala     |      |     |  |      |  |      |
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| Pro Ser Gly Phe Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu     |      |     |  |      |  |      |
|                                                                 | 1055 |     |  | 1060 |  | 1065 |
| Lys Phe Thr Ala Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile     |      |     |  |      |  |      |
|                                                                 | 1070 |     |  | 1075 |  | 1080 |
| Arg Ala Glu Asn Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp     |      |     |  |      |  |      |
|                                                                 | 1085 |     |  | 1090 |  | 1095 |
| Ile Pro Asp Ala Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu     |      |     |  |      |  |      |
|                                                                 | 1100 |     |  | 1105 |  | 1110 |
| Ser Ala Ala Glu Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp     |      |     |  |      |  |      |
|                                                                 | 1115 |     |  | 1120 |  | 1125 |
| Phe Gly Gly Ile Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly     |      |     |  |      |  |      |
|                                                                 | 1130 |     |  | 1135 |  | 1140 |
| Lys Cys Ala Val His Val Pro Ser Gly Thr Ala Thr Leu Lys Glu     |      |     |  |      |  |      |

|                                                             |      |      |
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| 1145                                                        | 1150 | 1155 |
| Ala Ala Val Glu Leu Thr Glu Gln Gly Ser Ala Thr Ile His Phe |      |      |
| 1160                                                        | 1165 | 1170 |
| Ser Thr Ala Asn Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr |      |      |
| 1175                                                        | 1180 | 1185 |
| Ser Tyr Val Thr Cys Lys Gly Asp Cys His Pro Pro Lys Asp His |      |      |
| 1190                                                        | 1195 | 1200 |
| Ile Val Thr His Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala |      |      |
| 1205                                                        | 1210 | 1215 |
| Val Ser Lys Thr Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly |      |      |
| 1220                                                        | 1225 | 1230 |
| Ser Ala Val Ile Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val |      |      |
| 1235                                                        | 1240 | 1245 |
| Ala Met Tyr Val Leu Thr Asn Gln Lys His Asn                 |      |      |
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| aaggagagta ccgtgaagta tactccagag aactgcgagc aatggtcact agtgaccacc  | 840  |
| atgtgtctgc tcgccaatgt gacgttccca tgtgtcaac caccaatttg ctacgacaga   | 900  |
| aaaccagcag agactttggc catgtcagc gttaacgttg acaaccggg ctacgatgag    | 960  |
| ctgctggaag cagctgttaa gtgccccgga aggaaaagga gatccaccga ggagctgttt  | 1020 |
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| taccctatgt ccaccatcct gggtttgtca atttgtgcg ccattgcaac cgtttcogtt   | 2160 |
| gcagcgtcta cctggctgtt ttgcagatca agagttgcgt gcctaactcc ttaccggcta  | 2220 |
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Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn  
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Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly  
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Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro  
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Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro  
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Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe  
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Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly  
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Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp  
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Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu  
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Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr  
180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln  
195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly  
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Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile  
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Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val  
245 250 255

123 / 161

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys  
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Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr  
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Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu  
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Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu  
 305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr  
 325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg  
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Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu  
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Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser  
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Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met  
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Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val  
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Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr  
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Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe  
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Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys  
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Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly  
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Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly  
 485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu  
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Val Ser Leu Ser Gly Ser Ser Val Thr Val Thr Pro Pro Asp Gly Thr  
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Ser Ala Leu Val Glu Cys Glu Cys Gly Ser Gly Gly Ser Gly Thr Lys  
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Lys Glu Gln Cys Arg Ala Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr  
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Asn Ser Asp Lys Leu Pro Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys  
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Leu His Val Pro Phe Leu Leu Ala Asp Gly Lys Cys Thr Val Pro Leu  
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Ala Pro Glu Pro Met Ile Thr Phe Gly Phe Arg Ser Val Ser Leu Lys  
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Leu His Pro Lys Asn Pro Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp  
625 630 635 640

Glu Pro His Tyr Thr His Glu Leu Ile Ser Glu Pro Ala Val Arg Asn  
645 650 655

Phe Thr Val Thr Glu Lys Gly Trp Glu Phe Val Trp Gly Asn His Pro  
660 665 670

Pro Lys Arg Phe Trp Ala Gln Glu Thr Ala Pro Gly Asn Pro His Gly  
675 680 685

Leu Pro His Glu Val Ile Thr His Tyr Tyr His Arg Tyr Pro Met Ser  
690 695 700

Thr Ile Leu Gly Leu Ser Ile Cys Ala Ala Ile Ala Thr Val Ser Val  
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Ala Ala Ser Thr Trp Leu Phe Cys Arg Ser Arg Val Ala Cys Leu Thr  
725 730 735

Pro Tyr Arg Leu Thr Pro Asn Ala Arg Ile Pro Phe Cys Leu Ala Val  
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Leu Cys Cys Ala Arg Thr Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu  
755 760 765

Asp His Leu Trp Asn Asn Asn Gln Gln Met Phe Trp Ile Gln Leu Leu  
770 775 780

Ile Pro Leu Ala Ala Leu Ile Val Val Thr Arg Leu Leu Arg Cys Val  
785 790 795 800

Cys Cys Val Val Pro Phe Leu Val Met Ala Gly Ala Ala Gly Ala Gly  
805 810 815

Ala Tyr Glu His Ala Thr Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr  
820 825 830

125 / 161

Asn Thr Ile Val Asn Arg Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile  
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Thr Cys His Tyr Lys Thr Gly Met Asp Ser Pro Ala Ile Lys Cys Cys  
865 870 875 880

Gly Ser Gln Glu Cys Thr Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys  
885 890 895

Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe  
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Cys Asp Thr Glu Asn Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser  
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Asp Asp Cys Leu Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala  
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965 970 975

Lys Ile Thr Ala Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg  
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Lys Ile Val Gln Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu  
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Tyr Gly Ala Gly Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg  
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Gln Arg Pro Lys Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala  
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Pro Ser Gly Phe Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu  
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Ile Pro Asp Ala Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu  
1100 1105 1110

126 / 161

Ser Ala Ala Glu Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp  
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Phe Gly Gly Ile Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly  
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Ser Thr Ala Asn Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr  
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Ser Tyr Val Thr Cys Lys Gly Asp Cys His Pro Pro Lys Asp His  
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Ile Val Thr His Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala  
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Val Ser Lys Thr Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly  
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| acagccccat ggtgttgag atggagctac aatcagtcac cttggaacca aactgtcac   | 3480 |
| ttgactacat cacgtgogag taaaaactg tcatccctc ccgtacgtg aagtgtgtg     | 3540 |
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| ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc   | 300  |
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Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn  
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Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp  
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Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys  
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Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp  
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135 / 161

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys  
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Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile  
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Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr  
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Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser  
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Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly  
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Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly  
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Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val  
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Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu  
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Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu  
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Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala  
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Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met  
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Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro  
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Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser  
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Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp  
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Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp  
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Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro  
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Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His  
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Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met  
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Val Lys Ile Thr Val Asn Gly Ser Gly Gly Ser Gly Gly Gln Thr Val  
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Arg Tyr Lys Cys Asn Cys Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr  
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Thr Asn His Lys Asn Trp Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn  
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Leu Leu Ser Tyr Arg Asn Met Gly Gln Glu Pro Asn Tyr His Glu Glu  
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Trp Val Thr His Lys Lys Glu Val Thr Leu Thr Val Pro Thr Glu Gly  
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Met Ser Thr Asn Gly Thr Ala His Gly His Pro His Glu Ile Ile Leu  
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137 / 161

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Ala Thr Val Pro Phe Leu Leu Ser Leu Leu Cys Cys Val Arg Thr Thr  
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Lys Ala Ala Thr Tyr Tyr Glu Ala Ala Ala Tyr Leu Trp Asn Glu Gln  
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Gln Pro Leu Phe Trp Leu Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile  
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835 840 845

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850 855 860

Glu Tyr Lys Thr Val Ile Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr  
865 870 875 880

Ala Glu Cys Lys Asp Lys Ser Leu Pro Asp Tyr Ser Cys Lys Val Phe  
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Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp  
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Cys Lys Thr Glu Phe Ala Ser Ala Tyr Arg Ala His Thr Ala Ser Ala  
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Ala Leu Ala Ser Ala Glu Phe Arg Val Gln Val Cys Ser Thr Gln  
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Val His Cys Ala Ala Ala Cys His Pro Pro Lys Asp His Ile Val  
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Asn Tyr Pro Ala Ser His Thr Thr Leu Gly Val Gln Asp Ile Ser  
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Leu Ile Val Ala Val Ala Ala Leu Ile Leu Ile Val Val Leu Cys  
           1235                                  1240                                  1245

Val Ser Phe Ser Arg His  
1250

<210> 41  
<211> 22  
<212> PRT  
<213> Artificial

<220>  
<223> CD20

<400> 41

Tyr Asp Cys Glu Pro Ser Asn Ser Ser Glu Lys Asn Ser Pro Ser Thr  
1 5 10 15

Gln Tyr Cys Asn Ser Ile  
20

<210> 42  
<211> 29  
<212> PRT  
<213> Artificial

<220>  
<223> CD20+linker

<400> 42

Ser Gly Gly Ile Tyr Asn Cys Glu Pro Ala Asn Pro Ser Glu Lys Asn  
1 5 10 15

Ser Pro Ser Thr Gln Tyr Cys Tyr Ser Ile Gln Gly Ser  
20 25

<210> 43  
<211> 27  
<212> PRT  
<213> Artificial

<220>  
<223> CD20+linker

<400> 43

Ser Gly Tyr Asp Cys Glu Pro Ser Asn Ser Ser Glu Lys Asn Ser Pro  
1 5 10 15

Ser Thr Gln Tyr Cys Asn Ser Ile Gly Gly Ser  
20 25

<210> 44  
<211> 27

140 / 161

<212> PRT  
 <213> Artificial

<220>  
 <223> CD20+linker

<400> 44

Ser Gly Gly Tyr Asp Cys Glu Pro Ser Asn Ser Ser Glu Lys Asn Ser  
 1 5 10 15

Pro Ser Thr Gln Tyr Cys Asn Ser Ile Gly Ser  
 20 25

<210> 45  
 <211> 3828  
 <212> DNA  
 <213> Artificial

<220>  
 <223> VLP\_CHI VLP 532 CD20H

<400> 45

|                                                                    |     |
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| atggagtcca tcccgacgca aactttctat aacagaaggt accaaccocg accctgggcc  | 60  |
| ccacgcccta caattcaagt aattagacct agaccacgtc cacagaggca ggctgggcaa  | 120 |
| ctcgcccagc tgatctccgc agtcaacaaa ttgacctgc ggcggtacc tcaacagaag    | 180 |
| cctcgagaa atcggaacaa caagaagcaa aggcagaaga agcaggcgcc gcaaacgac    | 240 |
| ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc  | 300 |
| cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tttcgaagt caagcatgaa   | 360 |
| ggcaaagtga tgggctacgc atgcctggtg ggggataaag taatgaaacc agcacatgtg  | 420 |
| aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac  | 480 |
| gatcttgaat gtgcacagat accggtgcac atgaagtctg atgcctcgaa gtttaccac   | 540 |
| gagaaaccocg aggggtacta taactggcat cacggagcag tgcagtattc aggaggocgg | 600 |
| ttcactatcc cgacgggtgc aggcaagccg ggagacagcg gcagaccgat cttcgacaac  | 660 |
| aaaggacggg tgggtggccat cgtcctagga ggggccaacg aaggtgcccg cacggccctc | 720 |
| tccgtggtga cgtggaacaa agacatcgtc aaaaaatta cccctgaggg agccgaagag   | 780 |
| tggagcctcg cctcccggt cttgtgcctg ttggcaacaa ctacattccc ctgctctcag   | 840 |
| ccgccttgca caccctgtg ctacgaaaag gaaccggaaa gcaccttgcg catgcttgag   | 900 |
| gacaacgtga tgagaccocg atactaccag ctactaaaag catcgctgac ttgctctccc  | 960 |

|                                                                    |      |
|--------------------------------------------------------------------|------|
| caccgccaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat  | 1020 |
| ctagctcatt gtcctgactg cggagaaggg cattcgtgcc acagccctat cgcattggag  | 1080 |
| cgcatcagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg  | 1140 |
| ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca  | 1200 |
| gcgagcggg agcgagccgg attgcttgta aggacttcag caccgtgcac gatcaccggg   | 1260 |
| accatgggac actttattct cgcccgatgc ccgaaaggag agacgctgac agtgggattt  | 1320 |
| acggacagca gaaagatcag ccacacatgc acacaccgt tccatcatga accacctgtg   | 1380 |
| ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcacg  | 1440 |
| tacgtgcaga gcaccgtgc cactgctgag gagatagagg tgcatatgcc ccagatact    | 1500 |
| cctgaccgca cgctgatgac gcagcagtct ggcaacgtga agatcacagt taatgggcag  | 1560 |
| acgggtcggg acaagtgcaa ctgcggtggc tccggaggta tatacaactg tgaaccagct  | 1620 |
| aatccctctg agaaaaactc cccatctacc caatactgtt acagcataca aggatccaac  | 1680 |
| gagggactga caaccacaga caaagtgatc aataactgca aaattgatca gtgccatgct  | 1740 |
| gcagtcacta atcacaagaa ttggcaatac aactccctt tagtcccgcg caacgctgaa   | 1800 |
| ctcggggacc gtaaaggaag gatccacatc ccattcccat tggcaaacgt gacttgcaga  | 1860 |
| gtgccaaaag caagaaacc tacagtaact tacggaaaaa accaagtcac catgtgtctg   | 1920 |
| tatccctgacc atccgacact cttgtcttac cgtaacatgg gacaggaacc aaattaccac | 1980 |
| gaggagtggg tgacacacaa gaaggaggtt accttgaccg tgcctactga gggctctggag | 2040 |
| gtcacttggg gcaacaacga accatacaag tactggccgc agatgtctac gaacggtact  | 2100 |
| gtcatggtc acccatga gataatcttg tactattatg agctgtacc cactatgact      | 2160 |
| gtagtcattg tgtcggtggc ctctgtctg cttctgtcga tgggtgggac agcagtggga   | 2220 |
| atgtgtgtgt gcgcacggcg cagatgcatt acaccatatg aattaacacc aggagccact  | 2280 |
| gtcccttcc tgctcagcct gctatgctgc gtcagaacga ccaaggcggc cacatattac   | 2340 |
| gaggctcgg catatctatg gaacgaacag cagcccctgt tctggttgca ggctcttacc   | 2400 |
| ccgtggccg ccttgatcgt cctgtgcaac tgtctgaaac tcttgccatg ctgctgtaag   | 2460 |
| accctggctt ttttagccgt aatgagcatc ggtgcccaca ctgtgagcgc gtacgaacac  | 2520 |
| gtaacagtga tccgaacac ggtgggagta ccgtataaga ctcttgtaa cagaccgggt    | 2580 |

tacagcccca tgggtgttga gatggagcta caatcagtca ccttggaacc aacactgtca 2640  
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 ggtacagcag agtgcaagga caagagccta ccagactaca gctgcaaggt ctttactgga 2760  
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 agcgaggcac atgtagagaa atctgaatct tgcaaaacag agtttgcac gcctacaga 2880  
 gccacaccg catcggcgtc ggcaagctc cgcgtccttt accaaggaaa caacattacc 2940  
 gtagctgcct acgctaacgg tgaccatgcc gtcacagtaa aggacgcaa gtttgcgtg 3000  
 ggcccaatgt cctccgcctg gacacctttt gacaacaaaa tcgtggtgta caaaggcgac 3060  
 gtctacaaca tggactaccc accttttggc gcaggaagac caggacaatt tggtagacatt 3120  
 caaagtcgta caccgaaaag taaagacgtt tatgccaaca ctcagtttgt actacagagg 3180  
 ccagcagcag gcacggtaca tgtaccatac tctcaggcac catctggctt caagtattgg 3240  
 ctgaaggaaac gaggagcatc gctacagcac acggcacctg togtttgcca gattgcgaca 3300  
 aacccggtaa gagctgtaaa ttgcgtgtg gggaacatac caatttccat cgacataccg 3360  
 gatcgggcct ttactagggt tgcgatgca ccctctgtaa cggacatgtc atgcgaagta 3420  
 ccagcctgca ctactcctc cgactttggg ggcgtcgcca tcataaata cacagctagc 3480  
 aagaaaggta aatgtgcagt acattcgatg accaaccggc ttaccattcg agaagccgac 3540  
 gtagaagtag aggggaactc ccagctgcaa atatccttct caacagccct ggcaagcgcc 3600  
 gagtttcgag tgcaagtgtg ctccacacaa gtacactgag cagccgcatg ccacctoca 3660  
 aaggaccaca tagtcaatta cccagcatca cacaccacc ttgggttcca ggatatatcc 3720  
 acaacggcaa tgtcttgggt gcagaagatt acgggaggag taggattaat tgttgcgtgt 3780  
 gctgccttaa ttttaattgt ggtgctatgc gtgtgttta gcaggcac 3828

<210> 46  
 <211> 1276  
 <212> PRT  
 <213> Artificial

<220>  
 <223> VLP\_CHI VLP 532 CD20H

<400> 46

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro

143 / 161

|                                                                 |     |     |     |
|-----------------------------------------------------------------|-----|-----|-----|
| 1                                                               | 5   | 10  | 15  |
| Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro | 20  | 25  | 30  |
| Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val | 35  | 40  | 45  |
| Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn | 50  | 55  | 60  |
| Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp | 65  | 70  | 75  |
| Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys | 85  | 90  | 95  |
| Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp | 100 | 105 | 110 |
| Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys | 115 | 120 | 125 |
| Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile | 130 | 135 | 140 |
| Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr | 145 | 150 | 155 |
| Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser | 165 | 170 | 175 |
| Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly | 180 | 185 | 190 |
| Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly | 195 | 200 | 205 |
| Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val | 210 | 215 | 220 |
| Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu | 225 | 230 | 235 |
| Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu | 245 | 250 | 255 |
| Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala | 260 | 265 | 270 |
| Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr | 275 | 280 | 285 |
| Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met |     |     |     |

144 / 161

|                                                                 |     |             |
|-----------------------------------------------------------------|-----|-------------|
| 290                                                             | 295 | 300         |
| Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro |     |             |
| 305                                                             | 310 | 315 320     |
| His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala |     |             |
|                                                                 | 325 | 330 335     |
| Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser |     |             |
|                                                                 | 340 | 345 350     |
| Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp |     |             |
|                                                                 | 355 | 360 365     |
| Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp |     |             |
|                                                                 | 370 | 375 380     |
| Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro |     |             |
|                                                                 | 385 | 390 395 400 |
| Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys |     |             |
|                                                                 | 405 | 410 415     |
| Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys |     |             |
|                                                                 | 420 | 425 430     |
| Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His |     |             |
|                                                                 | 435 | 440 445     |
| Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu |     |             |
|                                                                 | 450 | 455 460     |
| Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr |     |             |
|                                                                 | 465 | 470 475 480 |
| Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met |     |             |
|                                                                 | 485 | 490 495     |
| Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn |     |             |
|                                                                 | 500 | 505 510     |
| Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys |     |             |
|                                                                 | 515 | 520 525     |
| Gly Gly Ser Gly Gly Ile Tyr Asn Cys Glu Pro Ala Asn Pro Ser Glu |     |             |
|                                                                 | 530 | 535 540     |
| Lys Asn Ser Pro Ser Thr Gln Tyr Cys Tyr Ser Ile Gln Gly Ser Asn |     |             |
|                                                                 | 545 | 550 555 560 |
| Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile Asp |     |             |
|                                                                 | 565 | 570 575     |
| Gln Cys His Ala Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn Ser |     |             |

145 / 161

|                                                                 |                                                     |         |
|-----------------------------------------------------------------|-----------------------------------------------------|---------|
| 580                                                             | 585                                                 | 590     |
| Pro Leu Val                                                     | Pro Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys Ile |         |
| 595                                                             | 600                                                 | 605     |
| His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys Ala |                                                     |         |
| 610                                                             | 615                                                 | 620     |
| Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu Leu |                                                     |         |
| 625                                                             | 630                                                 | 635 640 |
| Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln Glu |                                                     |         |
| 645                                                             | 650                                                 | 655     |
| Pro Asn Tyr His Glu Glu Trp Val Thr His Lys Lys Glu Val Thr Leu |                                                     |         |
| 660                                                             | 665                                                 | 670     |
| Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu Pro |                                                     |         |
| 675                                                             | 680                                                 | 685     |
| Tyr Lys Tyr Trp Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly His |                                                     |         |
| 690                                                             | 695                                                 | 700     |
| Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met Thr |                                                     |         |
| 705                                                             | 710                                                 | 715 720 |
| Val Val Ile Val Ser Val Ala Ser Phe Val Leu Leu Ser Met Val Gly |                                                     |         |
| 725                                                             | 730                                                 | 735     |
| Thr Ala Val Gly Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr Pro |                                                     |         |
| 740                                                             | 745                                                 | 750     |
| Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu Leu Ser Leu Leu |                                                     |         |
| 755                                                             | 760                                                 | 765     |
| Cys Cys Val Arg Thr Thr Lys Ala Ala Thr Tyr Tyr Glu Ala Ala Ala |                                                     |         |
| 770                                                             | 775                                                 | 780     |
| Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu Gln Ala Leu Ile |                                                     |         |
| 785                                                             | 790                                                 | 795 800 |
| Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu Lys Leu Leu Pro |                                                     |         |
| 805                                                             | 810                                                 | 815     |
| Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met Ser Ile Gly Ala |                                                     |         |
| 820                                                             | 825                                                 | 830     |
| His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile Pro Asn Thr Val |                                                     |         |
| 835                                                             | 840                                                 | 845     |
| Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly Tyr Ser Pro Met |                                                     |         |
| 850                                                             | 855                                                 | 860     |
| Val Leu Glu Met Glu Leu Gln Ser Val Thr Leu Glu Pro Thr Leu Ser |                                                     |         |

146 / 161

|                                                                 |      |     |  |      |  |      |
|-----------------------------------------------------------------|------|-----|--|------|--|------|
| 865                                                             |      | 870 |  | 875  |  | 880  |
| Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile Pro Ser Pro Tyr |      |     |  |      |  |      |
|                                                                 | 885  |     |  | 890  |  | 895  |
| Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys Ser Leu Pro Asp |      |     |  |      |  |      |
|                                                                 | 900  |     |  | 905  |  | 910  |
| Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly |      |     |  |      |  |      |
|                                                                 | 915  |     |  | 920  |  | 925  |
| Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu Ser Glu Ala His |      |     |  |      |  |      |
|                                                                 | 930  |     |  | 935  |  | 940  |
| Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala Ser Ala Tyr Arg |      |     |  |      |  |      |
|                                                                 | 945  |     |  | 950  |  | 955  |
|                                                                 |      |     |  |      |  | 960  |
| Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val Leu Tyr Gln Gly |      |     |  |      |  |      |
|                                                                 |      |     |  |      |  |      |
|                                                                 | 965  |     |  | 970  |  | 975  |
| Asn Asn Ile Thr Val Ala Ala Tyr Ala Asn Gly Asp His Ala Val Thr |      |     |  |      |  |      |
|                                                                 | 980  |     |  | 985  |  | 990  |
| Val Lys Asp Ala Lys Phe Val Val Gly Pro Met Ser Ser Ala Trp Thr |      |     |  |      |  |      |
|                                                                 | 995  |     |  | 1000 |  | 1005 |
| Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp Val Tyr Asn     |      |     |  |      |  |      |
|                                                                 | 1010 |     |  | 1015 |  | 1020 |
| Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln Phe Gly     |      |     |  |      |  |      |
|                                                                 | 1025 |     |  | 1030 |  | 1035 |
| Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr Ala Asn     |      |     |  |      |  |      |
|                                                                 | 1040 |     |  | 1045 |  | 1050 |
| Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val His Val     |      |     |  |      |  |      |
|                                                                 | 1055 |     |  | 1060 |  | 1065 |
| Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu Lys Glu     |      |     |  |      |  |      |
|                                                                 | 1070 |     |  | 1075 |  | 1080 |
| Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys Gln Ile     |      |     |  |      |  |      |
|                                                                 | 1085 |     |  | 1090 |  | 1095 |
| Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly Asn Ile     |      |     |  |      |  |      |
|                                                                 | 1100 |     |  | 1105 |  | 1110 |
| Pro Ile Ser Ile Asp Ile Pro Asp Ala Ala Phe Thr Arg Val Val     |      |     |  |      |  |      |
|                                                                 | 1115 |     |  | 1120 |  | 1125 |
| Asp Ala Pro Ser Val Thr Asp Met Ser Cys Glu Val Pro Ala Cys     |      |     |  |      |  |      |
|                                                                 | 1130 |     |  | 1135 |  | 1140 |
| Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys Tyr Thr     |      |     |  |      |  |      |

147 / 161

|                             |                     |             |
|-----------------------------|---------------------|-------------|
| 1145                        | 1150                | 1155        |
| Ala Ser Lys Lys Gly Lys Cys | Ala Val His Ser Met | Thr Asn Ala |
| 1160                        | 1165                | 1170        |
| Val Thr Ile Arg Glu Ala Asp | Val Glu Val Glu Gly | Asn Ser Gln |
| 1175                        | 1180                | 1185        |
| Leu Gln Ile Ser Phe Ser Thr | Ala Leu Ala Ser Ala | Glu Phe Arg |
| 1190                        | 1195                | 1200        |
| Val Gln Val Cys Ser Thr Gln | Val His Cys Ala Ala | Ala Cys His |
| 1205                        | 1210                | 1215        |
| Pro Pro Lys Asp His Ile Val | Asn Tyr Pro Ala Ser | His Thr Thr |
| 1220                        | 1225                | 1230        |
| Leu Gly Val Gln Asp Ile Ser | Thr Thr Ala Met Ser | Trp Val Gln |
| 1235                        | 1240                | 1245        |
| Lys Ile Thr Gly Gly Val Gly | Leu Ile Val Ala Val | Ala Ala Leu |
| 1250                        | 1255                | 1260        |
| Ile Leu Ile Val Val Leu Cys | Val Ser Phe Ser Arg | His         |
| 1265                        | 1270                | 1275        |

<210> 47  
 <211> 3822  
 <212> DNA  
 <213> Artificial

<220>  
 <223> VLP\_CHI VLP 532 CD20-2 mouse

<400> 47

|                                                                   |     |
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| ccacgcccta caattcaagt aattagacct agaccacgtc cacagaggca ggctgggcaa | 120 |
| ctcgcccagc tgatctccgc agtcaacaaa ttgaccatgc gcgcggtacc tcaacagaag | 180 |
| cctgcagaa atcggaacaaa caagaagcaa aggcagaaga agcaggcgcc gcaaacgac  | 240 |
| ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc | 300 |
| cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tcttcgaagt caagcatgaa | 360 |
| ggcaaagtga tgggctaagc atgcctggtg ggggataaag taatgaaacc agcacatgtg | 420 |
| aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac | 480 |
| gatcttgaat gtgcacagat accggtgcac atgaagtctg atgcctcgaa gtttaccac  | 540 |
| gagaaaccog aggggtacta taactggcat cacggagcag tgcagtattc aggaggccgg | 600 |

|                                                                    |      |
|--------------------------------------------------------------------|------|
| ttcactatcc cgacgggtgc aggcaagccg ggagacagcg gcagaccgat cttcgacaac  | 660  |
| aaaggacggg tgggtggccat cgtcctagga ggggccaacg aaggtgcccg cacggccctc | 720  |
| tccgtggtga cgtggaacaa agacatcgtc aaaaaatta cccctgaggg agccgaagag   | 780  |
| tggagcctcg cctcccggt cttgtgcctg ttggcaaaca ctacattccc ctgctctcag   | 840  |
| ccgccttgca caccctgctg ctacgaaaag gaaccggaaa gcaccttgcg catgcttgag  | 900  |
| gacaacgtga tgagaccggg atactaccag ctactaaaag catcgctgac ttgctctccc  | 960  |
| caccgcaaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat  | 1020 |
| ctagctcatt gtctgactg cggagaaggg cattcgtgcc acagccctat cgcattggag   | 1080 |
| cgcatcagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg  | 1140 |
| ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca  | 1200 |
| gcgagcggg agcgagcgg attgcttgta aggacttcag caccgtgcac gatcaccggg    | 1260 |
| accatgggac actttattct cgccgatgc ccgaaaggag agacgctgac agtgggattt   | 1320 |
| acggacagca gaaagatcag ccacacatgc acacaccgtg tccatcatga accacctgtg  | 1380 |
| ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcaag  | 1440 |
| tacgtgcaga gcaccgtgc cactgotgag gagatagagg tgcatatgcc ccagatact    | 1500 |
| cctgaccgca cgctgatgac gcagcagtct ggcaacgtga agatcacagt taatgggcag  | 1560 |
| acggtgcggt acaagtgcaa ctgcggtggc tccggatacg actgtgaacc atctaattcc  | 1620 |
| tcagagaaaa actccccatc tacacagtac tgtaacagca ttggaggatc caacgaggga  | 1680 |
| ctgacaacca cagacaaagt gatcaataac tgcaaaattg atcagtgcc tgctgcagtc   | 1740 |
| actaatcaca agaattggca atacaactcc cctttagtcc cgcgcaacgc tgaactcggg  | 1800 |
| gaccgtaaag gaaagatcca catcccatc ccattggcaa acgtgacttg cagagtgcc    | 1860 |
| aaagcaagaa accctacagt aacttacgga aaaaaccaag tcaccatgct gctgtatcct  | 1920 |
| gaaccatcca cactcttgtc ttaccgtaac atgggacagg aaccaaatta ccacgaggag  | 1980 |
| tgggtgacac acaagaagga ggttaccttg accgtgccta ctgagggtct ggaggtcact  | 2040 |
| tggggcaaca acgaaccata caagtactgg ccgcagatgt ctacgaacgg tactgctcat  | 2100 |
| ggtcaccac atgagataat cttgtactat tatgagctgt accccactat gactgtagtc   | 2160 |
| attgtgtcgg tggcctcgtt cgtgcttctg togatggtgg gcacagcagt gggaatgtgt  | 2220 |

gtgtgcgcac ggcgagatg cattacacca tatgaattaa caccaggagc cactgttccc 2280  
 ttctgtctca gcctgctatg ctgcgtcaga acgaccaagg cggccacata ttacagggt 2340  
 gggcatatc tatggaacga acagcagccc ctgttctggt tgcaggctct tatcccgtg 2400  
 gccgccttga tcgtcctgtg caactgtctg aaactcttgc catgctgctg taagaccctg 2460  
 gcttttttag ccgtaatgag catcgggtgcc cacactgtga ggcggtacga acacgtaaca 2520  
 gtgatccga acacgggtggg agtaccgtat aagactcttg tcaacagacc gggttacagc 2580  
 cccatggtgt tggagatgga gctacaatca gtcaccttgg aaccaacact gtcacttgac 2640  
 tacatcacgt gcgagtacaa aactgtcatc cctccccgt acgtgaagtg ctgtggtaca 2700  
 gcagagtga aggacaagag cctaccagac tacagctgca aggtctttac tggagtctac 2760  
 ccatttatgt ggggcggcgc ctactgcttt tgcgacgccg aaaatacgca attgagcgag 2820  
 gcacatgtag agaaatctga atcttgcaaa acagagtttg catcggccta cagagcccac 2880  
 accgcatcgg cgtcggcgaa gctcgcgctc ctttaccaag gaaacaacat taccgtagct 2940  
 gcctacgcta acggtgacca tgccgtcaca gtaaaggacg ccaagtttgt cgtgggcccc 3000  
 atgtcctcgg cctggacacc ttttgacaac aaaatcgtgg tgtacaaagg cgacgtctac 3060  
 aacatggact accacacctt tggcgcagga agaccaggac aatttggtga cattcaaagt 3120  
 cgtacaccgg aaagtaaaga cgtttatgcc aacactcagt tgggtactaca gaggccagca 3180  
 gcaggcacgg tacatgtacc atactctcag gcaccatctg gottcaagta ttggctgaag 3240  
 gaacgaggag catcgttaca gcacacggca cgttccggtt gccagattgc gacaaacccg 3300  
 gtaagagctg taaattgcgc tgtggggaac ataccaattt ccatcgacat accggatgcg 3360  
 gcctttacta gggttgtcga tgcacctct gtaacggaca tgtcatgcga agtaccagcc 3420  
 tgcaactact cctccgactt tgggggcgtc gccatcatca aatacacagc tagcaagaaa 3480  
 ggtaaattgt cagtacattc gatgaccaac gccgttacca ttcgagaagc cgacgtagaa 3540  
 gtagaggga actcccagct gcaaatatcc ttctcaacag ccttggaag cgccgagttt 3600  
 cgcgtgcaag tgtgtccac acaagtacac tgcgcagccg catgccacc tccaaaggac 3660  
 cacatagtca attaccagc atcacacacc acccttgggg tccaggatat atccacaacg 3720  
 gcaatgtctt ggggtgcagaa gattacggga ggagtaggat taattgttgc tgttgcgtcc 3780  
 ttaattttaa ttgtggtgct atgcgtgtcg tttagcaggc ac 3822

<210> 48  
 <211> 1274  
 <212> PRT  
 <213> Artificial

<220>  
 <223> VLP\_CHI VLP 532 CD20-2 mouse

<400> 48

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro  
 1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro  
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val  
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn  
 50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp  
 65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys  
 85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp  
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys  
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile  
 130 135 140

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

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser  
 165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly  
 180 185 190

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

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val  
 210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu

225                      230                      235                      240  
 Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu  
                                  245                      250                      255  
 Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala  
                                  260                      265                      270  
 Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr  
                                  275                      280                      285  
 Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met  
                                  290                      295                      300  
 Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro  
 305                      310                      315                      320  
 His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala  
                                  325                      330                      335  
 Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser  
                                  340                      345                      350  
 Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp  
                                  355                      360                      365  
 Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp  
                                  370                      375                      380  
 Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro  
 385                      390                      395                      400  
 Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys  
                                  405                      410                      415  
 Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys  
                                  420                      425                      430  
 Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His  
                                  435                      440                      445  
 Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu  
                                  450                      455                      460  
 Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr  
 465                      470                      475                      480  
 Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met  
                                  485                      490                      495  
 Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn  
                                  500                      505                      510  
 Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys

152 / 161

|                                                                 |  |     |  |     |
|-----------------------------------------------------------------|--|-----|--|-----|
| 515                                                             |  | 520 |  | 525 |
| Gly Gly Ser Gly Tyr Asp Cys Glu Pro Ser Asn Ser Ser Glu Lys Asn |  |     |  |     |
| 530                                                             |  | 535 |  | 540 |
| Ser Pro Ser Thr Gln Tyr Cys Asn Ser Ile Gly Gly Ser Asn Glu Gly |  |     |  |     |
| 545                                                             |  | 550 |  | 555 |
| Leu Thr Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile Asp Gln Cys |  |     |  |     |
|                                                                 |  | 565 |  | 570 |
| His Ala Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn Ser Pro Leu |  |     |  |     |
|                                                                 |  | 580 |  | 585 |
| Val Pro Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys Ile His Ile |  |     |  |     |
|                                                                 |  | 595 |  | 600 |
| Pro Phe Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys Ala Arg Asn |  |     |  |     |
|                                                                 |  | 610 |  | 615 |
| Pro Thr Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu Leu Tyr Pro |  |     |  |     |
| 625                                                             |  | 630 |  | 635 |
| Asp His Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln Glu Pro Asn |  |     |  |     |
|                                                                 |  | 645 |  | 650 |
| Tyr His Glu Glu Trp Val Thr His Lys Lys Glu Val Thr Leu Thr Val |  |     |  |     |
|                                                                 |  | 660 |  | 665 |
| Pro Thr Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu Pro Tyr Lys |  |     |  |     |
|                                                                 |  | 675 |  | 680 |
| Tyr Trp Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly His Pro His |  |     |  |     |
|                                                                 |  | 690 |  | 695 |
| Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met Thr Val Val |  |     |  |     |
| 705                                                             |  | 710 |  | 715 |
| Ile Val Ser Val Ala Ser Phe Val Leu Leu Ser Met Val Gly Thr Ala |  |     |  |     |
|                                                                 |  | 725 |  | 730 |
| Val Gly Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr Pro Tyr Glu |  |     |  |     |
|                                                                 |  | 740 |  | 745 |
| Leu Thr Pro Gly Ala Thr Val Pro Phe Leu Leu Ser Leu Leu Cys Cys |  |     |  |     |
|                                                                 |  | 755 |  | 760 |
| Val Arg Thr Thr Lys Ala Ala Thr Tyr Tyr Glu Ala Ala Ala Tyr Leu |  |     |  |     |
|                                                                 |  | 770 |  | 775 |
| Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu Gln Ala Leu Ile Pro Leu |  |     |  |     |
| 785                                                             |  | 790 |  | 795 |
| Ala Ala Leu Ile Val Leu Cys Asn Cys Leu Lys Leu Leu Pro Cys Cys |  |     |  |     |

153 / 161

|                                                                 |      |      |
|-----------------------------------------------------------------|------|------|
| 805                                                             | 810  | 815  |
| Cys Lys Thr Leu Ala Phe Leu Ala Val Met Ser Ile Gly Ala His Thr |      |      |
| 820                                                             | 825  | 830  |
| Val Ser Ala Tyr Glu His Val Thr Val Ile Pro Asn Thr Val Gly Val |      |      |
| 835                                                             | 840  | 845  |
| Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly Tyr Ser Pro Met Val Leu |      |      |
| 850                                                             | 855  | 860  |
| Glu Met Glu Leu Gln Ser Val Thr Leu Glu Pro Thr Leu Ser Leu Asp |      |      |
| 865                                                             | 870  | 875  |
| Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile Pro Ser Pro Tyr Val Lys |      |      |
| 885                                                             | 890  | 895  |
| Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys Ser Leu Pro Asp Tyr Ser |      |      |
| 900                                                             | 905  | 910  |
| Cys Lys Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr |      |      |
| 915                                                             | 920  | 925  |
| Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu Ser Glu Ala His Val Glu |      |      |
| 930                                                             | 935  | 940  |
| Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala Ser Ala Tyr Arg Ala His |      |      |
| 945                                                             | 950  | 955  |
| Thr Ala Ser Ala Ser Ala Lys Leu Arg Val Leu Tyr Gln Gly Asn Asn |      |      |
| 965                                                             | 970  | 975  |
| Ile Thr Val Ala Ala Tyr Ala Asn Gly Asp His Ala Val Thr Val Lys |      |      |
| 980                                                             | 985  | 990  |
| Asp Ala Lys Phe Val Val Gly Pro Met Ser Ser Ala Trp Thr Pro Phe |      |      |
| 995                                                             | 1000 | 1005 |
| Asp Asn Lys Ile Val Val Tyr Lys Gly Asp Val Tyr Asn Met Asp     |      |      |
| 1010                                                            | 1015 | 1020 |
| Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln Phe Gly Asp Ile     |      |      |
| 1025                                                            | 1030 | 1035 |
| Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr Ala Asn Thr Gln     |      |      |
| 1040                                                            | 1045 | 1050 |
| Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val His Val Pro Tyr     |      |      |
| 1055                                                            | 1060 | 1065 |
| Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu Lys Glu Arg Gly     |      |      |
| 1070                                                            | 1075 | 1080 |
| Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys Gln Ile Ala Thr     |      |      |

154 / 161

|                         |                         |             |
|-------------------------|-------------------------|-------------|
| 1085                    | 1090                    | 1095        |
| Asn Pro Val Arg Ala Val | Asn Cys Ala Val Gly Asn | Ile Pro Ile |
| 1100                    | 1105                    | 1110        |
| Ser Ile Asp Ile Pro Asp | Ala Ala Phe Thr Arg Val | Val Asp Ala |
| 1115                    | 1120                    | 1125        |
| Pro Ser Val Thr Asp Met | Ser Cys Glu Val Pro Ala | Cys Thr His |
| 1130                    | 1135                    | 1140        |
| Ser Ser Asp Phe Gly Gly | Val Ala Ile Ile Lys Tyr | Thr Ala Ser |
| 1145                    | 1150                    | 1155        |
| Lys Lys Gly Lys Cys Ala | Val His Ser Met Thr Asn | Ala Val Thr |
| 1160                    | 1165                    | 1170        |
| Ile Arg Glu Ala Asp Val | Glu Val Glu Gly Asn Ser | Gln Leu Gln |
| 1175                    | 1180                    | 1185        |
| Ile Ser Phe Ser Thr Ala | Leu Ala Ser Ala Glu Phe | Arg Val Gln |
| 1190                    | 1195                    | 1200        |
| Val Cys Ser Thr Gln Val | His Cys Ala Ala Ala Cys | His Pro Pro |
| 1205                    | 1210                    | 1215        |
| Lys Asp His Ile Val Asn | Tyr Pro Ala Ser His Thr | Thr Leu Gly |
| 1220                    | 1225                    | 1230        |
| Val Gln Asp Ile Ser Thr | Thr Ala Met Ser Trp Val | Gln Lys Ile |
| 1235                    | 1240                    | 1245        |
| Thr Gly Gly Val Gly Leu | Ile Val Ala Val Ala Ala | Leu Ile Leu |
| 1250                    | 1255                    | 1260        |
| Ile Val Val Leu Cys Val | Ser Phe Ser Arg His     |             |
| 1265                    | 1270                    |             |

<210> 49  
 <211> 3822  
 <212> DNA  
 <213> Artificial

<220>  
 <223> VLP\_CHI VLP 532 CD20-3 mouse

|                                                                   |     |
|-------------------------------------------------------------------|-----|
| <400> 49                                                          |     |
| atggagttca tcccgacgca aactttctat aacagaaggt accaaccocg accctgggcc | 60  |
| ccacgcccta caattcaagt aattagacct agaccacgtc cacagaggca ggctgggcaa | 120 |
| ctogcccagc tgatctcgc agtcaacaaa ttgaccatgc gcgcgtacc tcaacagaag   | 180 |
| cctgcagaa atcggaaaaa caagaagcaa aggcagaaga agcaggcgcc gcaaaacgac  | 240 |

|                                                                    |      |
|--------------------------------------------------------------------|------|
| ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc  | 300  |
| cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tottogaagt caagcatgaa  | 360  |
| ggcaaagtga tgggctacgc atgcctgggtg ggggataaag taatgaaacc agcacatgtg | 420  |
| aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac  | 480  |
| gatcttgaat gtgcacagat accggtgcac atgaagtctg atgcctcgaa gtttaccac   | 540  |
| gagaaacccg aggggtacta taactggcat cacggagcag tgcagtattc aggaggccgg  | 600  |
| ttcactatcc cgacgggtgc aggcaagccg ggagacagcg gcagaccgat cttcgacaac  | 660  |
| aaaggacggg tgggtggccat cgtcctagga ggggccaacg aaggtgcccg cacggccctc | 720  |
| tccgtggtga cgtggaacaa agacatcgtc aaaaaatta cccctgaggg agccgaagag   | 780  |
| tggagcctcg ccctcccggt cttgtgcctg ttggcaaaca ctacattccc ctgctctcag  | 840  |
| cgccttgca caccctgctg ctacgaaaag gaaccgaaa gcaccttgcg catgcttgag    | 900  |
| gacaacgtga tgagaccggg atactaccag ctactaaaag catcgctgac ttgctctccc  | 960  |
| caccgcaaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat  | 1020 |
| ctagctcatt gtctgactg cggagaaggg cattcgtgcc acagccctat cgcattggag   | 1080 |
| cgcacagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg   | 1140 |
| ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca  | 1200 |
| gcggacgcgg agcgagccgg attgcttgta aggacttcag caccgtgcac gatcaccggg  | 1260 |
| accatgggac actttattct cgcccgatgc ccgaaaggag agacgctgac agtgggattt  | 1320 |
| acggacagca gaaagatcag ccacacatgc acacaccctg tccatcatga accacctgtg  | 1380 |
| ataggtaggg agaggttoca ctctcgacca caacatggta aagagttacc ttgcagcacg  | 1440 |
| taogtgcaga gcaccgctgc cactgctgag gagatagagg tgcataatgcc ccagatact  | 1500 |
| cctgaccgca cgctgatgac gcagcagtct ggcaacgtga agatcacagt taatgggcag  | 1560 |
| acggtgcggt acaagtgcaa ctgcgggtggc tccggaggat acgactgtga accatcta   | 1620 |
| tcctcagaga aaaactcccc atctacacag tactgtaaca gcattggatc caacgaggga  | 1680 |
| ctgacaacca cagacaaagt gatcaataac tgcaaaattg atcagtgcc              | 1740 |
| actaatcaca agaattggca atacaactcc cctttagtcc cgcgcaacgc tgaactcggg  | 1800 |
| gaccgtaaag gaaagatoca catcccattc ccattggcaa acgtgacttg cagagtgcc   | 1860 |

|                                                                    |      |
|--------------------------------------------------------------------|------|
| aaagcaagaa accctacagt aacttacgga aaaaaccaag tcaccatgct gctgtatcct  | 1920 |
| gaccatccga cactcttgtc ttaccgtaac atgggacagg aaccaaatta ccacgaggag  | 1980 |
| tgggtgacac acaagaagga ggttaccttg accgtgccta ctgagggctt ggaggtcact  | 2040 |
| tggggcaaca acgaaccata caagtactgg ccgcagatgt ctacgaacgg tactgtcat   | 2100 |
| ggtcaccac atgagataat cttgtactat tatgagctgt accccactat gactgtagtc   | 2160 |
| attgtgtcgg tggcctcgtt cgtgcttctg tcgatgggtg gcacagcagt gggaatgtgt  | 2220 |
| gtgtgcgcac ggcgagatg cattacacca tatgaattaa caccaggagc cactgttccc   | 2280 |
| ttcctgctca gctgtctatg ctgcgtcaga acgaccaagg cggccacata ttacgaggct  | 2340 |
| gcggcatatc tatggaacga acagcagccc ctgttctggt tgcaggctct tatcccgtg   | 2400 |
| gccgccttga tcttctgtg caactgtctg aaactcttgc catgtgtctg taagaccctg   | 2460 |
| gcttttttag ccgtaatgag catcgggtgcc cacactgtga gcgcgtacga acacgtaaca | 2520 |
| gtgatccga acacggtggg agtaccgtat aagactcttg tcaacagacc gggttacagc   | 2580 |
| cccatggtgt tggagatgga gctacaatca gtcaccttg aaccaacact gtcacttgac   | 2640 |
| tacatcacgt gogagtacaa aactgtcatc cctccccgt acgtgaagtg ctgtggtaca   | 2700 |
| gcagagtga aggacaagag cctaccagac tacagctgca aggtctttac tggagtctac   | 2760 |
| ccatttatgt ggggcggcgc ctactgcttt tgcgacgccc aaaatacgca attgagcgag  | 2820 |
| gcacatgtag agaaatctga atcttgcaaa acagagtttg catcggccta cagagcccac  | 2880 |
| accgcatcgg cgtcggcgaa gctccgcgtc ctttaccaag gaaacaacat taccgtagct  | 2940 |
| gcctacgcta acggtgacca tgccgtcaca gtaaaggacg ccaagtttgt cgtgggccc   | 3000 |
| atgtcctccg cctggacacc ttttgacaac aaaatcgttg tgtacaaagg cgacgtctac  | 3060 |
| aacatggact acccaccttt tggcgcagga agaccaggac aatttggtga cattcaaagt  | 3120 |
| cgtacaccgg aaagtaaaga cgtttatgcc aacactcagt tgggtactaca gaggccagca | 3180 |
| gcaggcacgg tacatgtacc atactctcag gcaccatctg gcttcaagta ttggctgaag  | 3240 |
| gaacgaggag catcgtaca gcacacggca ccgttcggtt gccagattgc gacaaacccg   | 3300 |
| gtaagagctg taaattgcgc tgtggggaac ataccaattt ccatcgacat accggatgcg  | 3360 |
| gcctttacta gggttgtcga tgcacctct gtaacggaca tgtcatgcga agtaccagcc   | 3420 |
| tgcactcact cctccgactt tggggggcgt gccatcatca aatacacagc tagcaagaaa  | 3480 |

ggtaaattgt cagtacattc gatgaccaac gccgttacca ttogagaagc cgacgtagaa 3540  
 gtagagggga actcccagct gcaaatatcc ttctcaacag ccctggcaag cgccgagttt 3600  
 cgcgtgcaag tgtgtccac acaagtacac tgcgcagccg catgccacc tccaaaggac 3660  
 cacatagtca attaccagc atcacacacc acccttgggg tccaggatat atccacaacg 3720  
 gcaatgtctt ggggtgcagaa gattacggga ggagtaggat taattgttgc tgttgctgcc 3780  
 ttaattttta ttgtggtgct atgcgtgtcg tttagcaggc ac 3822

<210> 50  
 <211> 1274  
 <212> PRT  
 <213> Artificial

<220>  
 <223> VLP\_CHI VLP 532 CD20-3 mouse

<400> 50

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro  
 1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro  
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val  
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn  
 50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp  
 65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys  
 85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp  
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys  
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile  
 130 135 140

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

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser

158 / 161

|                                                                 |     |     |
|-----------------------------------------------------------------|-----|-----|
| 165                                                             | 170 | 175 |
| Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly |     |     |
| 180                                                             | 185 | 190 |
| Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly |     |     |
| 195                                                             | 200 | 205 |
| Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val |     |     |
| 210                                                             | 215 | 220 |
| Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu |     |     |
| 225                                                             | 230 | 235 |
| Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu |     |     |
| 245                                                             | 250 | 255 |
| Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala |     |     |
| 260                                                             | 265 | 270 |
| Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr |     |     |
| 275                                                             | 280 | 285 |
| Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met |     |     |
| 290                                                             | 295 | 300 |
| Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro |     |     |
| 305                                                             | 310 | 315 |
| His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala |     |     |
| 325                                                             | 330 | 335 |
| Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser |     |     |
| 340                                                             | 345 | 350 |
| Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp |     |     |
| 355                                                             | 360 | 365 |
| Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp |     |     |
| 370                                                             | 375 | 380 |
| Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro |     |     |
| 385                                                             | 390 | 395 |
| Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys |     |     |
| 405                                                             | 410 | 415 |
| Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys |     |     |
| 420                                                             | 425 | 430 |
| Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His |     |     |
| 435                                                             | 440 | 445 |
| Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu |     |     |

159 / 161

|                                                                 |     |     |     |         |
|-----------------------------------------------------------------|-----|-----|-----|---------|
| 450                                                             |     | 455 |     | 460     |
| Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr |     |     |     |         |
| 465                                                             |     | 470 |     | 475 480 |
| Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met |     |     |     |         |
|                                                                 | 485 |     | 490 | 495     |
| Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn |     |     |     |         |
|                                                                 | 500 |     | 505 | 510     |
| Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys |     |     |     |         |
|                                                                 | 515 |     | 520 | 525     |
| Gly Gly Ser Gly Gly Tyr Asp Cys Glu Pro Ser Asn Ser Ser Glu Lys |     |     |     |         |
|                                                                 | 530 |     | 535 | 540     |
| Asn Ser Pro Ser Thr Gln Tyr Cys Asn Ser Ile Gly Ser Asn Glu Gly |     |     |     |         |
| 545                                                             |     | 550 |     | 555 560 |
| Leu Thr Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile Asp Gln Cys |     |     |     |         |
|                                                                 | 565 |     | 570 | 575     |
| His Ala Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn Ser Pro Leu |     |     |     |         |
|                                                                 | 580 |     | 585 | 590     |
| Val Pro Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys Ile His Ile |     |     |     |         |
|                                                                 | 595 |     | 600 | 605     |
| Pro Phe Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys Ala Arg Asn |     |     |     |         |
|                                                                 | 610 |     | 615 | 620     |
| Pro Thr Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu Leu Tyr Pro |     |     |     |         |
| 625                                                             |     | 630 |     | 635 640 |
| Asp His Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln Glu Pro Asn |     |     |     |         |
|                                                                 | 645 |     | 650 | 655     |
| Tyr His Glu Glu Trp Val Thr His Lys Lys Glu Val Thr Leu Thr Val |     |     |     |         |
|                                                                 | 660 |     | 665 | 670     |
| Pro Thr Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu Pro Tyr Lys |     |     |     |         |
|                                                                 | 675 |     | 680 | 685     |
| Tyr Trp Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly His Pro His |     |     |     |         |
|                                                                 | 690 |     | 695 | 700     |
| Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met Thr Val Val |     |     |     |         |
| 705                                                             |     | 710 |     | 715 720 |
| Ile Val Ser Val Ala Ser Phe Val Leu Leu Ser Met Val Gly Thr Ala |     |     |     |         |
|                                                                 | 725 |     | 730 | 735     |
| Val Gly Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr Pro Tyr Glu |     |     |     |         |

160 / 161

|                                                                 |                     |                 |
|-----------------------------------------------------------------|---------------------|-----------------|
| 740                                                             | 745                 | 750             |
| Leu Thr Pro Gly Ala Thr Val                                     | Pro Phe Leu Leu Ser | Leu Leu Cys Cys |
| 755                                                             | 760                 | 765             |
| Val Arg Thr Thr Lys Ala Ala Thr Tyr Tyr Glu Ala Ala Ala Tyr Leu |                     |                 |
| 770                                                             | 775                 | 780             |
| Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu Gln Ala Leu Ile Pro Leu |                     |                 |
| 785                                                             | 790                 | 795 800         |
| Ala Ala Leu Ile Val Leu Cys Asn Cys Leu Lys Leu Leu Pro Cys Cys |                     |                 |
| 805                                                             | 810                 | 815             |
| Cys Lys Thr Leu Ala Phe Leu Ala Val Met Ser Ile Gly Ala His Thr |                     |                 |
| 820                                                             | 825                 | 830             |
| Val Ser Ala Tyr Glu His Val Thr Val Ile Pro Asn Thr Val Gly Val |                     |                 |
| 835                                                             | 840                 | 845             |
| Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly Tyr Ser Pro Met Val Leu |                     |                 |
| 850                                                             | 855                 | 860             |
| Glu Met Glu Leu Gln Ser Val Thr Leu Glu Pro Thr Leu Ser Leu Asp |                     |                 |
| 865                                                             | 870                 | 875 880         |
| Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile Pro Ser Pro Tyr Val Lys |                     |                 |
| 885                                                             | 890                 | 895             |
| Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys Ser Leu Pro Asp Tyr Ser |                     |                 |
| 900                                                             | 905                 | 910             |
| Cys Lys Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr |                     |                 |
| 915                                                             | 920                 | 925             |
| Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu Ser Glu Ala His Val Glu |                     |                 |
| 930                                                             | 935                 | 940             |
| Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala Ser Ala Tyr Arg Ala His |                     |                 |
| 945                                                             | 950                 | 955 960         |
| Thr Ala Ser Ala Ser Ala Lys Leu Arg Val Leu Tyr Gln Gly Asn Asn |                     |                 |
| 965                                                             | 970                 | 975             |
| Ile Thr Val Ala Ala Tyr Ala Asn Gly Asp His Ala Val Thr Val Lys |                     |                 |
| 980                                                             | 985                 | 990             |
| Asp Ala Lys Phe Val Val Gly Pro Met Ser Ser Ala Trp Thr Pro Phe |                     |                 |
| 995                                                             | 1000                | 1005            |
| Asp Asn Lys Ile Val Val Tyr Lys Gly Asp Val Tyr Asn Met Asp     |                     |                 |
| 1010                                                            | 1015                | 1020            |
| Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln Phe Gly Asp Ile     |                     |                 |

|                             |                     |             |
|-----------------------------|---------------------|-------------|
| 1025                        | 1030                | 1035        |
| Gln Ser Arg Thr Pro Glu Ser | Lys Asp Val Tyr Ala | Asn Thr Gln |
| 1040                        | 1045                | 1050        |
| Leu Val Leu Gln Arg Pro Ala | Ala Gly Thr Val His | Val Pro Tyr |
| 1055                        | 1060                | 1065        |
| Ser Gln Ala Pro Ser Gly Phe | Lys Tyr Trp Leu Lys | Glu Arg Gly |
| 1070                        | 1075                | 1080        |
| Ala Ser Leu Gln His Thr Ala | Pro Phe Gly Cys Gln | Ile Ala Thr |
| 1085                        | 1090                | 1095        |
| Asn Pro Val Arg Ala Val Asn | Cys Ala Val Gly Asn | Ile Pro Ile |
| 1100                        | 1105                | 1110        |
| Ser Ile Asp Ile Pro Asp Ala | Ala Phe Thr Arg Val | Val Asp Ala |
| 1115                        | 1120                | 1125        |
| Pro Ser Val Thr Asp Met Ser | Cys Glu Val Pro Ala | Cys Thr His |
| 1130                        | 1135                | 1140        |
| Ser Ser Asp Phe Gly Gly Val | Ala Ile Ile Lys Tyr | Thr Ala Ser |
| 1145                        | 1150                | 1155        |
| Lys Lys Gly Lys Cys Ala Val | His Ser Met Thr Asn | Ala Val Thr |
| 1160                        | 1165                | 1170        |
| Ile Arg Glu Ala Asp Val Glu | Val Glu Gly Asn Ser | Gln Leu Gln |
| 1175                        | 1180                | 1185        |
| Ile Ser Phe Ser Thr Ala Leu | Ala Ser Ala Glu Phe | Arg Val Gln |
| 1190                        | 1195                | 1200        |
| Val Cys Ser Thr Gln Val His | Cys Ala Ala Ala Cys | His Pro Pro |
| 1205                        | 1210                | 1215        |
| Lys Asp His Ile Val Asn Tyr | Pro Ala Ser His Thr | Thr Leu Gly |
| 1220                        | 1225                | 1230        |
| Val Gln Asp Ile Ser Thr Thr | Ala Met Ser Trp Val | Gln Lys Ile |
| 1235                        | 1240                | 1245        |
| Thr Gly Gly Val Gly Leu Ile | Val Ala Val Ala Ala | Leu Ile Leu |
| 1250                        | 1255                | 1260        |
| Ile Val Val Leu Cys Val Ser | Phe Ser Arg His     |             |
| 1265                        | 1270                |             |