

10-0150-WO-1-SEQ
SEQUENCE LISTING

<110> BOEHRINGER INGELHEIM VETMEDICA, INC.

<120> PORCINE PARVOVIRUS 5A, METHODS OF USE AND VACCINE

<130> 10-0150-PCT

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<150> 13/796,621

<151> 2013-03-12

<150> 61/738,110

<151> 2012-12-17

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<170> PatentIn version 3.5

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<212> PRT

<213> Porcine parvovirus 5A

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Gly Arg Cys Ala Gly Cys Arg Lys Thr Pro His Leu Phe Phe Gln Leu
35 40 45

Glu Lys Val Asp Ser Lys Gly Gly Leu His Leu His Phe Cys Ile Ser
50 55 60

Val Ala Ala Gly Thr Pro Arg Asp Val Ser Ser Met Phe Lys Ala Ile
65 70 75 80

Glu Arg Arg Val Ser Phe Tyr Tyr Phe Gly Val Glu Gly Leu Thr Phe
85 90 95

Phe Thr Pro His Lys Asn Lys His Gly Ala Trp Lys Ser Asn Asp Glu
100 105 110

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

Val Tyr Ala Trp Thr Asn Met Asp Gly Val Ile Gly Asp Ala Cys Leu
130 135 140

Asn Glu Asp Lys Arg Arg Glu Leu Leu Ser Glu Arg Gln Asp Gln Gly
145 150 155 160

Val Ile Lys Glu Leu Thr Ala Pro Thr Phe Lys Ala Ala Thr Gly Asp
165 170 175

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Lys Met Leu Ser Val Val Asp Trp Met Cys Asp Asn Asp Val Thr Thr
 180 185 190
 Glu Arg Arg Trp Glu Glu Ile Ser Ala Ala Ser Leu Tyr Ser Phe Leu
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 Ala Thr Pro Ala Gly Thr His Leu Ala Lys Gln Cys Leu Arg Ala Ala
 210 215 220
 Asn Gln Arg Ile Val Ser Thr Lys Thr Ser Trp Leu Ser Leu Cys Lys
 225 230 235 240
 Phe Ala Ser Glu Lys Glu Leu Arg Ala Phe Gln Asn Gly Asp Pro Glu
 245 250 255
 Leu Ser Ser Asp Asn Asn Arg Ile Tyr Tyr Leu Phe Ala Met Asn Asn
 260 265 270
 Tyr Cys Pro Asp Met Ala Ser Met Ile Phe Phe Trp Trp Ser Met Arg
 275 280 285
 Gln Thr Gly Lys Arg Asn Ser Ile Trp Leu Phe Gly Pro Ala Thr Thr
 290 300
 Gly Lys Thr Asn Leu Ala Ser Ala Ile Ala His Thr Ala Ala Ser Tyr
 305 310 315 320
 Gly Cys Val Asn Trp Asn Asn Ala Asn Phe Pro Phe Gln Asp Ile Val
 325 330 335
 Asn Val Gln Leu Gly Trp Trp Glu Glu Gly Lys Met Thr Glu Asp Val
 340 345 350
 Val Glu Cys Ala Lys Ala Leu Leu Gly Gly Ser Asn Val Arg Val Asp
 355 360 365
 Arg Lys Cys Met Gln Ser Ala Glu Val Gln Ser Pro Pro Phe Ile Ile
 370 375 380
 Thr Ser Asn Thr Asp Met Cys Leu Val Ser Gln Gly Ser Tyr Ile Ser
 385 390 395 400
 Phe Glu His Gln Gln Pro Leu Gln Asp Arg Met Ile Lys Phe Glu Phe
 405 410 415
 Asn His Val Leu Pro Gly Asn Phe Gly Leu Ile Ser Glu Asp Glu Val
 420 425 430
 Val Ala Phe Phe Arg Asn Gly Ala Tyr Asn Val Leu Lys His Ala Tyr
 435 440 445

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Met Arg Lys Ala Gln Leu Phe Ala Leu Gly Pro Ala Ser Leu Pro Tyr
450 455 460

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

Ser Pro Ser Ala Ser Arg Arg Ser Val Arg Asn Trp Met Thr Cys Pro
485 490 495

Pro Asp Pro Val Gln Asp Asp Pro Ala Glu Leu Asp Glu Tyr Phe Pro
500 505 510

Pro Asp Thr Pro Pro Glu Asp Cys Pro Cys Pro Ile Ser Pro Val Arg
515 520 525

Glu Ser Cys Pro Ser Pro Gly Pro Cys Pro Thr Pro Pro Arg Lys Lys
530 535 540

Gln Arg Lys Ser Lys His Cys Ser Leu Ser Val Ser Ala Gly Lys Val
545 550 555 560

Pro Val Val Val Val Gly Asp Ser Asp Ser Val Pro Pro Glu Glu Lys
565 570 575

Glu Lys Glu Glu Val Ser Val Gly Glu Ser Gln Asp Pro Gln Leu Tyr
580 585 590

Trp Asp Leu Thr Leu Ser Gln Ser Asp Val Pro Val Pro Glu Asp Glu
595 600 605

Ser Thr Gln Phe Pro Asp Asp Ala Val Asp Ala Ser Asp Leu Ile Ala
610 615 620

Glu Gln
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<210> 3
<211> 290
<212> PRT
<213> Porcine parvovirus 5A

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

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

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Asp Pro Pro Thr Val Lys Phe Asp Lys Pro Tyr Gln Asp Val Asp Arg
50 55 60

Phe Trp Phe Pro Thr Asp Asp Tyr Thr Asp Trp Tyr Val Trp His Gly
65 70 75 80

Glu Asp Arg Pro Pro Arg Phe Thr Glu His Ser Gly Val Gln Gly Phe
85 90 95

Lys Thr Arg Cys Glu Gly Gly Leu Pro Leu Met Pro Ser Asp Pro Lys
100 105 110

Phe Cys Pro Ile Gln Asn Phe Trp Asp Gln Phe Ala Asn Phe Asp Glu
115 120 125

Gly Ser Pro Ser Thr Gln Ile Gly Glu Ser Val Ser Trp Ser Asp His
130 135 140

Phe Gly Ser Pro Asp Pro Ser His His Gln Glu Val Arg Asp Ala Asp
145 150 155 160

Glu Val Thr Ser Glu Arg Gln Gln Tyr Lys Asn Arg Ile Val Thr Leu
165 170 175

Leu Arg Lys Val Tyr Trp Ala Lys Gln Trp Ser Gly Lys Leu Gln Ile
180 185 190

Asn Val Pro Ser Leu Glu Ser Leu Tyr Glu Gln Ile Pro Tyr Met Leu
195 200 205

Ala Tyr Met Asp Ala Asp Asn Trp Arg Gln Asn Leu Leu Ala Ala Lys
210 215 220

Thr Leu Arg Thr Thr Leu Glu Ala Phe Ser Cys Val Pro Asp Pro Ser
225 230 235 240

Thr Cys Asp Val Thr Ile Ser Thr Pro Leu Ser Gly Glu Thr Asp Pro
245 250 255

Ala Ser Phe Ala Lys Tyr Leu Cys Ser Leu Val Cys Asn Arg Ser Gln
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Glu Lys Glu Gln Ala Gln Thr Pro Ser Leu Ser Pro Ser Lys Gln Lys
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Gly Gln
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<210> 4

<211> 792

<212> PRT

<213> Porcine parvovirus 5A

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<400> 4

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Val Leu Pro Ser His His Tyr Thr Gly Pro Arg Asn Pro Val Pro Ala
20 25 30

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

Arg Tyr Gly Gln Arg Leu Lys His Gly Asp Trp Pro Tyr Leu Trp Gly
50 55 60

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

Ser His Val Lys Val Gly Thr Gln Leu Ala Gly Asn Ile Val Arg Ser
85 90 95

Ile Trp Lys Ala Lys Glu Leu Leu Thr Glu Pro Val Tyr Glu Leu Leu
100 105 110

Lys Ser Ile Leu Pro Pro Ser Asp Leu Ser Lys Val Pro Leu Pro His
115 120 125

Ser Gln Gln Thr Asp Arg Thr Glu Asp Pro Glu Thr Pro Gly Glu Thr
130 135 140

Arg Gly Thr Gly Ser Asp Ser Pro Arg Ser Pro Arg Pro Ser Gly Ser
145 150 155 160

Thr Glu Asp Gly Gly Gly Pro Ser Ser Glu Ser Arg Leu Pro Gly Ser
165 170 175

Lys Val Pro Val Asp Pro Ser Ala Thr Thr Ser Glu Ala Lys Arg Gln
180 185 190

Arg Thr Glu Glu Gly Met Asp Ile Ser Ser Cys Gly Pro Gly Gly Ile
195 200 205

Ser Ala Ser Gly Ala Ala Ser Asn Asn Ser Gly Leu Ala Cys Gly Gly
210 215 220

Gly Gly Gly Thr Asn Leu Gly Thr Glu Ser Leu Val Ser Gly Cys Gln
225 230 235 240

Phe Gly Lys Asn Ser Val Ile Thr Ser Ser Phe Arg Arg Cys Leu Ile
245 250 255

Ser Pro Trp Pro Asp Lys Tyr Cys Cys Ser Ser Ala His Asp Leu Ile
260 265 270

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Pro Gly Val Val Tyr Glu Thr Pro Trp Cys Tyr Tyr Asp Leu Asn Val
275 280 285

Ile Ser Ser Tyr Ile Phe Ser Pro Ser Ala Trp Gln Arg Leu Leu Glu
290 295 300

Asp Tyr Asp Ala Phe Arg Pro Lys Ser Leu Lys Val Thr Ile Gln Ser
305 310 315 320

Leu Val Leu Lys Met Ser Val Lys Val Gln Lys Lys Gln Thr Thr Val
325 330 335

Gln Asp Ser Gln Ser Ala Thr Ile Ala Ile Phe Glu Asp Lys Asp Tyr
340 345 350

Asp Tyr Pro Tyr Val Met Gly Gly Gly Gln Lys Thr Val Pro Gly His
355 360 365

Leu Pro Gly Gln Pro Tyr Asn Leu Pro Lys Tyr Ser Tyr Arg Thr Leu
370 375 380

Gly Ser Val Lys Glu Ser Asn Arg Ala Ser Met Gly Gly Ser Gly Tyr
385 390 395 400

Thr Phe Lys Ser Asn Gln Asp Thr Glu Leu Phe Leu Leu Glu Thr His
405 410 415

Asp Ala Thr Leu Ile Arg Gly Gly Gly Thr Phe Glu Gln Tyr Tyr Glu
420 425 430

Phe Pro Asn Asp Leu Pro Phe Glu Asn Leu Thr Gln Tyr Pro Trp Asp
435 440 445

Ile Arg Arg Gln Asp Asn Pro Leu Tyr Gln Gln Arg Ile Thr Val Met
450 455 460

Ser Gly Ser Asp Arg Asp Thr Val Gly Ile Leu Asp Gly Asp Phe Tyr
465 470 475 480

Ser Pro Phe Arg Phe Lys Gly His Asp Arg Pro Ala Met Trp Leu Pro
485 490 495

Gly Gln Arg Leu Ile Gln Gly Lys Phe Ile Asp Thr His Pro Ile Pro
500 505 510

Asn Thr Gly Arg Ser Gly Val His Pro Asn Asp Phe His Thr Arg Gly
515 520 525

Asp Gly His Gly Asp Thr His Arg Thr His Glu Glu Arg Ile Tyr Ser
530 535 540

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Leu Asp Thr Gly Leu Ala Ala Met Pro Arg Ala Ala His Arg Pro Thr
 545 550 555 560
 Leu Gln Pro Gly Pro Arg Thr Leu Ser His Ala Val Arg Arg Pro Asp
 565 570 575
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 580 585 590
 Glu Asn Pro His Gln Glu Pro Trp Ser Asp Leu Asn Val Arg His Thr
 595 600 605
 Met Tyr Arg Leu Ala Tyr Gln Arg Gln Lys Gly Phe Gln Gln Pro Gly
 610 615 620
 Asp Pro Leu His Ile Arg Thr His Ala Cys Tyr Gly Asp Gly Asp Val
 625 630 635 640
 Thr Ile Pro Lys Glu Glu Ser Leu Trp Pro Thr Val Leu Gly Ser Cys
 645 650 655
 Thr Glu Lys Ser Pro Ala Cys Leu Glu Ser Gln Ile Trp Cys Lys Thr
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 Pro Asn Val Asp Met Val Tyr Gly Glu His Thr Pro Pro Leu Ala Leu
 675 680 685
 Trp Gly Met His Ala Pro Pro Pro His Val Phe Leu Arg Met Leu Ala
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 740 745 750
 Arg Pro Pro Ile Ser Ile Pro Val Gly Gln Ser Gly Pro Ala Phe Ile
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 770 775 780
 Arg Glu Arg Ile Arg Ser Lys Arg
 785 790

<210> 5
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10-0150-WO-1-SEQ

<212> PRT

<213> Porcine parvovirus 4

<400> 5

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Gln Lys Leu Leu Ala Asn Phe Ile Ile Ala Leu Trp Arg Ala Lys Glu
35 40 45

Lys Ile Gly Ala Pro Ile Tyr Glu Ile Val Lys Gly Val Phe Pro Ser
50 55 60

Val Asp Lys Lys Thr Val Glu Ser Leu Leu Pro His Pro Asp Pro Ile
65 70 75 80

Pro Ala Pro Pro Ser Ser Pro Gln Arg Gly Ser Lys Arg Ala Ser Pro
85 90 95

Pro Gln Ser Pro Asn Ala His Asp Glu Asp Thr Met Ser Gly His Lys
100 105 110

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

Cys Pro Thr Gln Asn Ala Gly Ala Asp Phe Glu Leu Cys Gly Thr Gly
130 135 140

Gly Gly Ala Thr Asn Glu Lys Gly Thr Trp Val Gly Gly Thr Gln Phe
145 150 155 160

Thr Asp Thr Ser Ile Arg Thr Phe Gly Thr Arg Arg Cys Val Leu Ser
165 170 175

Ala Phe Pro Asp Thr Tyr Cys Ser Met Met Ser Gly Asp Ala Ile Pro
180 185 190

Ser Ile Ile Phe Asn Thr Pro Trp Tyr Tyr Tyr Asp Leu Asn Ile Met
195 200 205

Ser Cys His Phe Ser Pro Ser Ala Phe Gln Thr Leu Ile Glu Asp Tyr
210 215 220

Asp Ala Phe Arg Pro Arg Ser Leu Thr Val His Leu Lys Glu Leu Val
225 230 235 240

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

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Pro Gly₂₉₀ Gln Pro Tyr Gln Leu₂₉₅ Pro Lys Tyr Ser Tyr₃₀₀ Arg Thr Val Gly

Lys₃₀₅ Pro Asp Pro Asn Ser₃₁₀ Gly Phe Val Pro Gly₃₁₅ Arg Asn Thr His Pro₃₂₀

Asp Gln Gly Pro Gly₃₂₅ His Pro Lys Ala Ser₃₃₀ Lys Thr Ile Trp Tyr₃₃₅ Ser

Gln Tyr Leu Glu₃₄₀ Thr Gln Asp Thr Glu₃₄₅ Phe Tyr Ile Leu Glu₃₅₀ Asn His

Lys Ala Thr₃₅₅ Ile Leu His Ser Gly₃₆₀ Asn Thr Phe Ser Gln₃₆₅ His Tyr Asn

Phe Pro₃₇₀ Asp Leu Pro Phe Glu₃₇₅ Gln Leu Thr Gln Tyr₃₈₀ Met Trp Asp Ala

Arg₃₈₅ Arg Gln Asp Asn Pro₃₉₀ Leu Ile Asp Gln Arg₃₉₅ Ile Gln Val Met Ser₄₀₀

Arg Met Tyr Asp Asp₄₀₅ Gly Pro Gln Lys Thr₄₁₀ Phe Ala Ile Lys Val₄₁₅ Asn

Pro Tyr Ile Val₄₂₀ Pro Phe Thr Val Lys₄₂₅ Ser Thr Ser Arg Pro₄₃₀ Ala Met

Phe Leu Ala₄₃₅ Gly Gly Arg Phe Lys₄₄₀ Asp Gly Asp Tyr Ser₄₄₅ Ile Thr Gly

Pro Gly₄₅₀ Asp Arg Asp Lys Thr₄₅₅ Ser Phe Lys Tyr Tyr₄₆₀ Asn Asp Pro Pro

Trp₄₆₅ Ile Ile Thr Arg Asp₄₇₀ Thr Tyr Leu Phe Ser₄₇₅ Ser Asp Leu Ala Lys₄₈₀

Thr Glu Arg Glu Gln₄₈₅ Pro Gly Pro Arg Gln₄₉₀ Gly Asp Thr Val Val₄₉₅ Arg

Thr Pro Asp Gly₅₀₀ Thr Leu Ile Val Thr₅₀₅ Thr Asn Ala Leu Ala₅₁₀ Tyr Gly

Tyr Thr Thr₅₁₅ Glu Tyr Leu Lys Asn₅₂₀ Ile Pro Leu Leu Ser₅₂₅ Ser Lys Tyr

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His Gly Val Glu Asn Phe Arg Leu Ala Val Glu Asn Glu Arg Gly Tyr
530 535 540

Ser Met Pro Gly His Pro Ser His Ile Arg Glu Thr Leu Phe Arg Gly
545 550 555 560

Lys Leu Pro Ser Glu Ile Arg Glu Ser Thr Ile Lys Ser Glu Asp Gln
565 570 575

Arg Lys Glu Ile Thr Phe Pro Asp Tyr Met Gly Ser Val Asn Glu Lys
580 585 590

Thr Thr Ala Asn Leu Glu Ser Gln Ile Trp Ser Gln Ile Pro Asn Thr
595 600 605

Asp Ile Thr Glu Lys Cys Thr Thr Pro Pro Leu Ser Ile Trp Gly Met
610 615 620

Lys Asn Pro Pro Pro Met Val Phe Leu Arg Leu Leu Ala Gln Met Gly
625 630 635 640

Pro Pro Arg Arg Ser Ala Cys Ser Gly Ser Ile Pro Ser Asn Thr Tyr
645 650 655

Leu Asn Gln Tyr Cys Gln Phe Leu Leu Thr Tyr Glu Met Glu Trp Asp
660 665 670

Val Ile Lys Arg Thr Arg Lys Thr Val Arg Trp Asn Pro Ile Pro Pro
675 680 685

Pro Gln Ile Pro Met Gly Pro Asn Asn Leu Pro Val Tyr Ile Leu Asn
690 695 700

Lys Glu Gly Gln Tyr Arg Met Pro Thr Glu Val Trp Thr Ala Lys Gln
705 710 715 720

Arg Pro Arg His Arg Arg
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<211> 20
<212> DNA
<213> Artificial Sequence

<220>
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 <213> Artificial Sequence

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<400> 11
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 1 5 10 15

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

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Met Gln Leu Glu Glu Val Asp Ser Lys Gly Gly Leu His Leu His Trp
35 40 45

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

Lys Asn Thr Glu Lys Lys Val Ser Gln Tyr Tyr Phe Gly Val Glu Gly
65 70 75 80

Leu Ser Phe Phe Val Pro His Lys Asn Lys His Gly Ala Trp Lys Ser
85 90 95

Thr Asp Glu Gly Phe Ile Tyr Asn Tyr Leu Leu Lys Lys Leu Pro Leu
100 105 110

Lys Glu Cys Leu Tyr Ala Trp Thr Thr Ile Gly Gly Ala Ile Gly Asp
115 120 125

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

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

Thr Gly Glu Lys Met Leu Asp Ile Val Gln Trp Leu Val Asp Asn Asn
165 170 175

Ile Cys Ser Glu Ser Arg Trp Glu Asn Lys Asn Ala Leu Ser Leu Tyr
180 185 190

Ser Phe Leu Ala Thr Gln Ala Gly Gly Tyr Met Ala Lys Gln Cys Leu
195 200 205

Arg Ile Ala Gln Gln Lys Leu Leu Lys Glu Lys Pro Leu Gly Leu Thr
210 215 220

Leu Met Asp Phe Lys Gly Met Asn Ala Leu Arg Arg Phe Gln Gln Asp
225 230 235 240

Glu Gly Glu Met Thr Phe Asp Asn Asn Arg Met His Tyr Ile Phe Ala
245 250 255

Ile Asn Asn Tyr Asp Pro Lys Ile Ala Ser Val Ile Met Tyr Phe Trp
260 265 270

Ser Met Lys Gln Thr Gly Lys Arg Asn Cys Val Trp Phe Tyr Gly Pro
275 280 285

Ala Thr Thr Gly Lys Thr Asn Met Ala Gln Ala Ile Cys His Ser Ser
290 295 300

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Ala Asn Tyr Gly Asn Val Asn Trp Asn Asn Ala Asn Phe Pro Phe Gln
305 310 315 320

Asp Ile Val Gly Ala Gln Val Gly Trp Trp Glu Glu Gly Lys Met Thr
325 330 335

Gly Asp Met Val Glu Ala Ala Lys Ala Leu Leu Gly Gly Thr Ala Leu
340 345 350

Arg Ile Asp Arg Lys Cys Met Gln Ser Ile Glu Val Asn Ser Pro Pro
355 360 365

Phe Leu Ile Thr Ser Asn Val Asp Met Thr Ile Val Gln Glu Gly Ser
370 375 380

Phe Val Ser Phe Glu His Gln Gln Pro Leu Glu Asp Arg Met Ile Lys
385 390 395 400

Phe Ser Phe Asn Met Thr Leu Pro Gly Asn Phe Gly Leu Ile Thr Ser
405 410 415

Glu Glu Val Lys Ser Phe Phe Arg Met Gly Ala Lys Leu Ala Ala Gln
420 425 430

Pro Asp Ile Met Asn Cys Pro Ile Phe Lys Lys Gly Pro Ala Ser Ile
435 440 445

Arg His Leu Val Pro Val Gly Glu Ile Pro Pro Pro Lys Glu Met Lys
450 455 460

His Lys Arg Gln Pro Leu Tyr Met Arg Ala Glu Pro Asp Glu Ile Gln
465 470 475 480

Asp Asn Pro Glu Glu Leu Asp His Trp Phe Glu Glu Glu Ala Pro
485 490 495