

SEQUENCE LISTING

<110> European Molecular Biology Laboratory (EMBL)
 <120> SOLUBLE FRAGMENTS OF INFLUENZA VIRUS PB2 PROTEIN
 CAPABLE OF BINDING RNA-CAP
 <130> SG1673A
 <140>
 <141> 2008/10/09
 <160> 27
 <170> PatentIn version 3.4
 <210> 1
 <211> 759
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2
 <222> (1)..(759)

<400> .1

Met Glu Arg Ile Lys Glu Leu Arg Asn Leu Met Ser Gln Ser Arg Thr
 1 5 10 15

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

Lys Tyr Thr Ser Gly Arg Gln Glu Lys Asn Pro Ser Leu Arg Met Lys
 35 40 45

Trp Met Met Ala Met Lys Tyr Pro Ile Thr Ala Asp Lys Arg Ile Thr
 50 55 60

Glu Met Val Pro Glu Arg Asn Glu Gln Gly Gln Thr Leu Trp Ser Lys
 65 70 75 80

Met Ser Asp Ala Gly Ser Asp Arg Val Met Val Ser Pro Leu Ala Val
 85 90 95

Thr Trp Trp Asn Arg Asn Gly Pro Val Thr Ser Thr Val His Tyr Pro
 100 105 110

Lys Val Tyr Lys Thr Tyr Phe Asp Lys Val Glu Arg Leu Lys His Gly
 115 120 125

Thr Phe Gly Pro Val His Phe Arg Asn Gln Val Lys Ile Arg Arg Arg
 130 135 140

Val Asp Ile Asn Pro Gly His Ala Asp Leu Ser Ala Lys Glu Ala Gln
 145 150 155 160

Asp Val Ile Met Glu Val Val Phe Pro Asn Glu Val Gly Ala Arg Ile
 165 170 175

Leu Thr Ser Glu Ser Gln Leu Thr Ile Thr Lys Glu Lys Lys Glu Glu
 180 185 190

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

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

Ser Ser Val Tyr Ile Glu Val Leu His Leu Thr Gln Gly Thr Cys Trp
 225 230 235 240

Glu Gln Met Tyr Thr Pro Gly Gly Glu Val Arg Asn Asp Asp Ile Asp
 245 250 255

Gln Ser Leu Ile Ile Ala Ala Arg Asn Ile Val Arg Arg Ala Ser Val
 260 265 270

Ser Ala Asp Pro Leu Ala Ser Leu Leu Glu Met Cys His Ser Thr Gln
 275 280 285

Ile Gly Gly Thr Arg Met Val Asp Ile Leu Arg Gln Asn Pro Thr Glu
 290 295 300

Glu Gln Ala Val 310 315 - - Ser
 305 320

Ser Ser Phe Ser Phe Gly Gly Phe Thr Phe Lys Arg Thr Ser Gly Ser
 325 330 335

Ser Ile Lys Arg Glu Glu Glu Val Leu Thr Gly Asn Leu Gln Thr Leu
 340 345 350

Lys Ile Arg Val His Glu Gly Tyr Glu Glu Phe Thr Met Val Gly Lys
 355 360 365

Arg Ala Thr Ala Ile Leu Arg Lys Ala Thr Arg Arg Leu Val Gln Leu
 370 375 380

Ile Val Ser Gly Arg Asp Glu Gln Ser Ile Ala Glu Ala Ile Ile Val
 385 390 395 400

Ala Met Val Phe Ser Gln Glu Asp Cys Met Ile Lys Ala Val Arg Gly
 405 410 415

Asp Leu Asn Phe Val Asn Arg Ala Asn Gln Arg Leu Asn Pro Met His
 420 425 430

Gln Leu Leu Arg His Phe Gln Lys Asp Ala Lys Val Leu Phe Gln Asn
 435 440 445
 Trp Gly Ile Glu His Ile Asp Asn Val Met Gly Met Val Gly Val Leu
 450 455 460
 Pro Asp Met Thr Pro Ser Thr Glu Met Ser Met Arg Gly Ile Arg Val
 465 470 475 480
 Ser Lys Met Gly Val Asp Glu Tyr Ser Ser Thr Glu Arg Val Val Val
 485 490 495
 Ser Ile Asp Arg Phe Leu Arg Val Arg Asp Gln Arg Gly Asn Val Leu
 500 505 510
 Leu Ser Pro Glu Glu Val Ser Glu Thr His Gly Thr Glu Arg Leu Thr
 515 520 525
 Ile Thr Tyr Ser Ser Ser Met Met Trp Glu Ile Asn Gly Pro Glu Ser
 530 535 540
 Val Leu Val Asn Thr Tyr Gln Trp Ile Ile Arg Asn Trp Glu Thr Val
 545 550 555 560
 Lys Ile Gln Trp Ser Gln Asn Pro Thr Met Leu Tyr Asn Lys Met Glu
 565 570 575
 Phe Glu Pro Phe Gln Ser Leu Val Pro Lys Ala Ile Arg Gly Gln Tyr
 580 585 590
 Ser Gly Phe Val Arg Thr Leu Phe Gln Gln Met Arg Asp Val Leu Gly
 595 600 605
 Thr Phe Asp Thr Thr Gln Ile Ile Lys Leu Leu Pro Phe Ala Ala Ala
 610 615 620
 Pro Pro Lys Gln Ser Arg Met Gln Phe Ser Ser Leu Thr Val Asn Val
 625 630 635 640
 Arg Gly Ser Gly Met Arg Ile Leu Val Arg Gly Asn Ser Pro Val Phe
 645 650 655
 Asn Tyr Asn Lys Thr Thr Lys Arg Leu Thr Ile Leu Gly Lys Asp Ala
 660 665 670
 Gly Thr Leu Ile Glu Asp Pro Asp Glu Ser Thr Ser Gly Val Glu Ser
 675 680 685
 Ala Val Leu Arg Gly Phe Leu Ile Leu Gly Lys Glu Asp Arg Arg Tyr
 690 695 700

Gly Pro Ala Leu Ser Ile Asn Glu Leu Ser Asn Leu Ala Lys Gly Glu
705 710 715 720

Lys Ala Asn Val Leu Ile Gly Gln Gly Asp Val Val Leu Val Met Lys
725 730 735

Arg Lys Arg Asp Ser Ser Ile Leu Thr Asp Ser Gln Thr Ala Thr Lys
740 745 750

Arg Ile Arg Met Ala Ile Asn
755

<210> 2
<211> 770
<212> PRT
<213> Influenza B virus

<220>
<221> PB2
<222> (1)..(770)

<400> 2

Met Thr Leu Ala Lys Ile Glu Leu Leu Lys Gln Leu Leu Arg Asp Asn
1 5 10 15

Glu Ala Lys Thr Val Leu Lys Gln Thr Thr Val Asp Gln Tyr Asn Ile
20 25 30

Ile Arg Lys Phe Asn Thr Ser Arg Ile Glu Lys Asn Pro Ser Leu Arg
35 40 45

Met Lys Trp Ala Met Cys Ser Asn Phe Pro Leu Ala Leu Thr Lys Gly
50 55 60

Asp Met Ala Asn Arg Ile Pro Leu Glu Tyr Lys Gly Ile Gln Leu Lys
65 70 75 80

Thr Asn Ala Glu Asp Ile Gly Thr Lys Gly Gln Met Cys Ser Ile Ala
85 90 95

Ala Val Thr Trp Trp Asn Thr Tyr Gly Pro Ile Gly Asp Thr Glu Gly
100 105 110

Phe Glu Lys Val Tyr Glu Ser Phe Phe Leu Arg Lys Met Arg Leu Asp
115 120 125

Asn Ala Thr Trp Gly Arg Ile Thr Phe Gly Pro Val Glu Arg Val Arg
130 135 140

Lys Arg Val Leu Leu Asn Pro Leu Thr Lys Glu Met Pro Pro Asp Glu
145 150 155 160

Ala Ser Asn Val Ile Met Glu Ile Leu Phe Pro Lys Glu Ala Gly Ile
 165 170 175
 Pro Arg Glu Ser Thr Trp Ile His Arg Glu Leu Ile Lys Glu Lys Arg
 180 185 190
 Glu Lys Leu Lys Gly Thr Met Ile Thr Pro Ile Val Leu Ala Tyr Met
 195 200 205
 Leu Glu Arg Glu Leu Val Ala Arg Arg Arg Phe Leu Pro Val Ala Gly
 210 215 220
 Ala Thr Ser Ala Glu Phe Ile Glu Met Leu His Cys Leu Gln Gly Glu
 225 230 235 240
 Asn Trp Arg Gln Ile Tyr His Pro Gly Gly Asn Lys Leu Thr Glu Ser
 245 250 255
 Arg Ser Gln Ser Met Ile Val Ala Cys Arg Lys Ile Ile Arg Arg Ser
 260 265 270
 Ile Val Ala Ser Asn Pro Leu Glu Leu Ala Val Glu Ile Ala Asn Lys
 275 280 285
 Thr Val Ile Asp Thr Glu Pro Leu Lys Ser Cys Leu Thr Ala Ile Asp
 290 295 300
 Gly Gly Asp Val Ala Cys Asp Ile Ile Arg Ala Ala Leu Gly Leu Lys
 305 310 315 320
 Ile Arg Gln Arg Gln Arg Phe Gly Arg Leu Glu Leu Lys Arg Ile Ser
 325 330 335
 Gly Arg Gly Phe Lys Asn Asp Glu Glu Ile Leu Ile Gly Asn Gly Thr
 340 345 350
 Ile Gln Lys Ile Gly Ile Trp Asp Gly Glu Glu Glu Phe His Val Arg
 355 360 365
 Cys Gly Glu Cys Arg Gly Ile Leu Lys Lys Ser Lys Met Arg Met Glu
 370 375 380
 Lys Leu Leu Ile Asn Ser Ala Lys Lys Glu Asp Met Lys Asp Leu Ile
 385 390 395 400
 Ile Leu Cys Met Val Phe Ser Gln Asp Thr Arg Met Phe Gln Gly Val
 405 410 415
 Arg Gly Glu Ile Asn Phe Leu Asn Arg Ala Gly Gln Leu Leu Ser Pro
 420 425 430

Met Tyr Gln Leu Gln Arg Tyr Phe Leu Asn Arg Ser Asn Asp Leu Phe
 435 440 445
 Asp Gln Trp Gly Tyr Glu Glu Ser Pro Lys Ala Ser Glu Leu His Gly
 450 455 460
 Ile Asn Glu Leu Met Asn Ala Ser Asp Tyr Thr Leu Lys Gly Val Val
 465 470 475 480
 Val Thr Lys Asn Val Ile Asp Asp Phe Ser Ser Thr Glu Thr Glu Lys
 485 490 495
 Val Ser Ile Thr Lys Asn Leu Ser Leu Ile Lys Arg Thr Gly Glu Val
 500 505 510
 Ile Met Gly Ala Asn Asp Val Ser Glu Leu Glu Ser Gln Ala Gln Leu
 515 520 525
 Met Ile Thr Tyr Asp Thr Pro Lys Met Trp Glu Met Gly Thr Thr Lys
 530 535 540
 Glu Leu Val Gln Asn Thr Tyr Gln Trp Val Leu Lys Asn Leu Val Thr
 545 550 555 560
 Leu Lys Ala Gln Phe Leu Leu Gly Lys Glu Asp Met Phe Gln Trp Asp
 565 570 575
 Ala Phe Glu Ala Phe Glu Ser Ile Ile Pro Gln Lys Met Ala Gly Gln
 580 585 590
 Tyr Ser Gly Phe Ala Arg Ala Val Leu Lys Gln Met Arg Asp Gln Glu
 595 600 605
 Val Met Lys Thr Asp Gln Phe Ile Lys Leu Leu Pro Phe Cys Phe Ser
 610 615 620
 Pro Pro Lys Leu Arg Ser Asn Gly Glu Pro Tyr Gln Phe Leu Arg Leu
 625 630 635 640
 Val Leu Lys Gly Gly Gly Glu Asn Phe Ile Glu Val Arg Lys Gly Ser
 645 650 655
 Pro Leu Phe Ser Tyr Asn Pro Gln Thr Glu Val Leu Thr Ile Cys Gly
 660 665 670
 Arg Met Met Ser Leu Lys Gly Lys Ile Glu Asp Glu Glu Arg Asn Arg
 675 680 685
 Ser Met Gly Asn Ala Val Leu Ala Gly Phe Leu Val Ser Gly Lys Tyr
 690 695 700

Asp Pro Asp Leu Gly Asp Phe Lys Thr Ile Glu Glu Leu Glu Lys Leu
705 710 715 720

Lys Pro Gly Glu Lys Ala Asn Ile Leu Leu Tyr Gln Gly Lys Pro Val
725 730 735

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

Gln Gly Ile Lys Arg Gln Arg Met Thr Val Glu Ser Met Gly Trp Ala
755 760 765

Leu Ser
770

<210> 3
<211> 774
<212> PRT
<213> Influenza C virus

<220>
<221> PB2
<222> (1)..(774)
<400> 3

Met Ser Phe Leu Leu Thr Ile Ala Lys Glu Tyr Lys Arg Leu Cys Gln
1 5 10 15

Asp Ala Lys Ala Ala Gln Met Met Thr Val Gly Thr Val Ser Asn Tyr
20 25 30

Thr Thr Phe Lys Lys Trp Thr Thr Ser Arg Lys Glu Lys Asn Pro Ser
35 40 45

Leu Arg Met Arg Trp Ala Met Ser Ser Lys Phe Pro Ile Ile Ala Asn
50 55 60

Lys Arg Met Leu Glu Glu Ala Gln Ile Pro Lys Glu His Asn Asn Val
65 70 75 80

Ala Leu Trp Glu Asp Thr Glu Asp Val Ser Lys Arg Asp His Val Leu
85 90 95

Ala Ser Ala Ser Cys Ile Asn Tyr Trp Asn Phe Cys Gly Pro Cys Val
100 105 110

Asn Asn Ser Glu Val Ile Lys Glu Val Tyr Lys Ser Arg Phe Gly Arg
115 120 125

Leu Glu Arg Arg Lys Glu Ile Met Trp Lys Glu Leu Arg Phe Thr Leu
130 135 140

Val Asp Arg Gln Arg Arg Arg Val Asp Thr Gln Pro Val Glu Gln Arg
 145 150 155 160
 Leu Arg Thr Gly Glu Ile Lys Asp Leu Gln Met Trp Thr Leu Phe Glu
 165 170 175
 Asp Glu Ala Pro Leu Ala Ser Lys Phe Ile Leu Asp Asn Tyr Gly Leu
 180 185 190
 Val Lys Glu Met Arg Ser Lys Phe Ala Asn Lys Pro Leu Asn Lys Glu
 195 200 205
 Val Val Ala His Met Leu Glu Lys Gln Phe Asn Pro Glu Ser Arg Phe
 210 215 220
 Leu Pro Val Phe Gly Ala Ile Arg Pro Glu Arg Met Glu Leu Ile His
 225 230 235 240
 Ala Leu Gly Gly Glu Thr Trp Ile Gln Glu Ala Asn Thr Ala Gly Ile
 245 250 255
 Ser Asn Val Asp Gln Arg Lys Asn Asp Met Arg Ala Val Cys Arg Lys
 260 265 270
 Val Cys Leu Ala Ala Asn Ala Ser Ile Met Asn Ala Lys Ser Lys Leu
 275 280 285
 Val Glu Tyr Ile Lys Ser Thr Ser Met Arg Ile Gly Glu Thr Glu Arg
 290 295 300
 Lys Leu Glu Glu Leu Ile Leu Glu Thr Asp Asp Val Ser Pro Glu Val
 305 310 315 320
 Thr Leu Cys Lys Ser Ala Leu Gly Gly Pro Leu Gly Lys Thr Leu Ser
 325 330 335
 Phe Gly Pro Met Leu Leu Lys Lys Ile Ser Gly Ser Gly Val Lys Val
 340 345 350
 Lys Asp Thr Val Tyr Ile Gln Gly Val Arg Ala Val Gln Phe Glu Tyr
 355 360 365
 Trp Ser Glu Gln Glu Glu Phe Tyr Gly Glu Tyr Lys Ser Ala Thr Ala
 370 375 380
 Leu Phe Ser Arg Lys Glu Arg Ser Leu Glu Trp Ile Thr Ile Gly Gly
 385 390 395 400
 Gly Ile Asn Glu Asp Arg Lys Arg Leu Leu Ala Met Cys Met Ile Phe
 405 410 415

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

Ala Asp Leu Ser Thr Lys Leu Gly Arg Glu Ile Pro Tyr Gln Tyr Val
 435 440 445

Met Met Asn Trp Ile Gln Lys Ser Glu Asp Asn Leu Glu Ala Leu Leu
 450 455 460

Tyr Ser Arg Gly Ile Val Glu Thr Asn Pro Gly Lys Met Gly Ser Ser
 465 470 475 480

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

Thr Ile Gln Ser Gly Lys Ile Asp Met Pro Glu Ser Lys Glu Lys Ile
 500 505 510

His Leu Glu Leu Ser Asp Asn Leu Glu Ala Phe Asp Ser Ser Gly Arg
 515 520 525

Ile Val Ala Thr Ile Leu Asp Leu Pro Ser Asp Lys Lys Val Thr Phe
 530 535 540

Gln Asp Val Ser Phe Gln His Pro Asp Leu Ala Val Leu Arg Asp Glu
 545 550 555 560

Lys Thr Ala Ile Thr Lys Gly Tyr Glu Ala Leu Ile Lys Arg Leu Gly
 565 570 575

Thr Gly Asp Asn Asp Ile Pro Ser Leu Ile Ala Lys Lys Asp Tyr Leu
 580 585 590

Ser Leu Tyr Asn Leu Pro Glu Val Lys Leu Met Ala Pro Leu Ile Arg
 595 600 605

Pro Asn Arg Lys Gly Val Tyr Ser Arg Val Ala Arg Lys Leu Val Ser
 610 615 620

Thr Gln Val Thr Thr Gly His Tyr Ser Leu His Glu Leu Ile Lys Val
 625 630 635 640

Leu Pro Phe Thr Tyr Phe Ala Pro Lys Gln Gly Met Phe Glu Gly Arg
 645 650 655

Leu Phe Phe Ser Asn Asp Ser Phe Val Glu Pro Gly Val Asn Asn Asn
 660 665 670

Val Phe Ser Trp Ser Lys Ala Asp Ser Ser Lys Ile Tyr Cys His Gly
 675 680 685

Ile Ala Ile Arg Val Pro Leu Val Val Gly Asp Glu His Met Asp Thr
690 695 700

Ser Leu Ala Leu Leu Glu Gly Phe Ser Val Cys Glu Asn Asp Pro Arg
705 710 715 720

Ala Pro Met Val Thr Arg Gln Asp Leu Ile Asp Val Gly Phe Gly Gln
725 730 735

Lys Val Arg Leu Phe Val Gly Gln Gly Ser Val Arg Thr Phe Lys Arg
740 745 750

Thr Ala Ser Gln Arg Ala Ala Ser Ser Asp Val Asn Lys Asn Val Lys
755 760 765

Lys Ile Lys Met Ser Asn
770

<210> 4
<211> 262
<212> PRT
<213> Influenza A virus

<220>
<221> PB2 235 to 496
<222> (1)..(262)

<400> 4

Thr Gln Gly Thr Cys Trp Glu Gln Met Tyr Thr Pro Gly Gly Glu Val
1 5 10 15

Arg Asn Asp Asp Ile Asp Gln Ser Leu Ile Ile Ala Ala Arg Asn Ile
20 25 30

Val Arg Arg Ala Ser Val Ser Ala Asp Pro Leu Ala Ser Leu Leu Glu
35 40 45

Met Cys His Ser Thr Gln Ile Gly Gly Thr Arg Met Val Asp Ile Leu
50 55 60

Arg Gln Asn Pro Thr Glu Glu Gln Ala Val Asp Ile Cys Lys Ala Ala
65 70 75 80

Met Gly Leu Arg Ile Ser Ser Ser Phe Ser Phe Gly Gly Phe Thr Phe
85 90 95

Lys Arg Thr Ser Gly Ser Ser Ile Lys Arg Glu Glu Glu Val Leu Thr
100 105 110

Gly Asn Leu Gln Thr Leu Lys Ile Arg Val His Glu Gly Tyr Glu Glu
115 120 125

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

Arg Arg Leu Val Gln Leu Ile Val Ser Gly Arg Asp Glu Gln Ser Ile
 145 150 155 160

Ala Glu Ala Ile Ile Val Ala Met Val Phe Ser Gln Glu Asp Cys Met
 165 170 175

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

Arg Leu Asn Pro Met His Gln Leu Leu Arg His Phe Gln Lys Asp Ala
 195 200 205

Lys Val Leu Phe Gln Asn Trp Gly Ile Glu His Ile Asp Asn Val Met
 210 215 220

Gly Met Val Gly Val Leu Pro Asp Met Thr Pro Ser Thr Glu Met Ser
 225 230 235 240

Met Arg Gly Ile Arg Val Ser Lys Met Gly Val Asp Glu Tyr Ser Ser
 245 250 255

Thr Glu Arg Val Val Val
 260

<210> 5
 <211> 243
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2 241 to 483
 <222> (1)..(243)

<400> 5

Glu Gln Met Tyr Thr Pro Gly Gly Glu Val Arg Asn Asp Asp Ile Asp
 1 5 10 15

Gln Ser Leu Ile Ile Ala Ala Arg Asn Ile Val Arg Arg Ala Ser Val
 20 25 30

Ser Ala Asp Pro Leu Ala Ser Leu Leu Glu Met Cys His Ser Thr Gln
 35 40 45

Ile Gly Gly Thr Arg Met Val Asp Ile Leu Arg Gln Asn Pro Thr Glu
 50 55 60

Glu Gln Ala Val Asp Ile Cys Lys Ala Ala Met Gly Leu Arg Ile Ser
 65 70 75 80

Ser Ser Phe Ser Phe Gly Gly Phe Thr Phe Lys Arg Thr Ser Gly Ser
 85 90 95
 Ser Ile Lys Arg Glu Glu Glu Val Leu Thr Gly Asn Leu Gln Thr Leu
 100 105 110
 Lys Ile Arg Val His Glu Gly Tyr Glu Glu Phe Thr Met Val Gly Lys
 115 120 125
 Arg Ala Thr Ala Ile Leu Arg Lys Ala Thr Arg Arg Leu Val Gln Leu
 130 135 140
 Ile Val Ser Gly Arg Asp Glu Gln Ser Ile Ala Glu Ala Ile Ile Val
 145 150 155 160
 Ala Met Val Phe Ser Gln Glu Asp Cys Met Ile Lys Ala Val Arg Gly
 165 170 175
 Asp Leu Asn Phe Val Asn Arg Ala Asn Gln Arg Leu Asn Pro Met His
 180 185 190
 Gln Leu Leu Arg His Phe Gln Lys Asp Ala Lys Val Leu Phe Gln Asn
 195 200 205
 Trp Gly Ile Glu His Ile Asp Asn Val Met Gly Met Val Gly Val Leu
 210 215 220
 Pro Asp Met Thr Pro Ser Thr Glu Met Ser Met Arg Gly Ile Arg Val
 225 230 235 240
 Ser Lys Met

<210> 6
 <211> 216
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2 268 to 483
 <222> (1)..(216)

<400> 6

Arg Arg Ala Ser Val Ser Ala Asp Pro Leu Ala Ser Leu Leu Glu Met
 1 5 10 15
 Cys His Ser Thr Gln Ile Gly Gly Thr Arg Met Val Asp Ile Leu Arg
 20 25 30
 Gln Asn Pro Thr Glu Glu Gln Ala Val Asp Ile Cys Lys Ala Ala Met
 35 40 45

Gly Leu Arg Ile Ser Ser Ser Phe Ser Phe Gly Gly Phe Thr Phe Lys
 50 55 60
 Arg Thr Ser Gly Ser Ser Ile Lys Arg Glu Glu Glu Val Leu Thr Gly
 65 70 75 80
 Asn Leu Gln Thr Leu Lys Ile Arg Val His Glu Gly Tyr Glu Glu Phe
 85 90 95
 Thr Met Val Gly Lys Arg Ala Thr Ala Ile Leu Arg Lys Ala Thr Arg
 100 105 110
 Arg Leu Val Gln Leu Ile Val Ser Gly Arg Asp Glu Gln Ser Ile Ala
 115 120 125
 Glu Ala Ile Ile Val Ala Met Val Phe Ser Gln Glu Asp Cys Met Ile
 130 135 140
 Lys Ala Val Arg Gly Asp Leu Asn Phe Val Asn Arg Ala Asn Gln Arg
 145 150 155 160
 Leu Asn Pro Met His Gln Leu Leu Arg His Phe Gln Lys Asp Ala Lys
 165 170 175
 Val Leu Phe Gln Asn Trp Gly Ile Glu His Ile Asp Asn Val Met Gly
 180 185 190
 Met Val Gly Val Leu Pro Asp Met Thr Pro Ser Thr Glu Met Ser Met
 195 200 205
 Arg Gly Ile Arg Val Ser Lys Met
 210 215

<210> 7
 <211> 204
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2 277 to 480
 <222> (1)..(204)

<400> 7

Leu Ala Ser Leu Leu Glu Met Cys His Ser Thr Gln Ile Gly Gly Thr
 1 5 10 15
 Arg Met Val Asp Ile Leu Arg Gln Asn Pro Thr Glu Glu Gln Ala Val
 20 25 30
 Asp Ile Cys Lys Ala Ala Met Gly Leu Arg Ile Ser Ser Ser Phe Ser
 35 40 45

Phe Gly Gly Phe Thr Phe Lys Arg Thr Ser Gly Ser Ser Ile Lys Arg
 50 55 60
 Glu Glu Glu Val Leu Thr Gly Asn Leu Gln Thr Leu Lys Ile Arg Val
 65 70 75 80
 His Glu Gly Tyr Glu Glu Phe Thr Met Val Gly Lys Arg Ala Thr Ala
 85 90 95
 Ile Leu Arg Lys Ala Thr Arg Arg Leu Val Gln Leu Ile Val Ser Gly
 100 105 110
 Arg Asp Glu Gln Ser Ile Ala Glu Ala Ile Ile Val Ala Met Val Phe
 115 120 125
 Ser Gln Glu Asp Cys Met Ile Lys Ala Val Arg Gly Asp Leu Asn Phe
 130 135 140
 Val Asn Arg Ala Asn Gln Arg Leu Asn Pro Met His Gln Leu Leu Arg
 145 150 155 160
 His Phe Gln Lys Asp Ala Lys Val Leu Phe Gln Asn Trp Gly Ile Glu
 165 170 175
 His Ile Asp Asn Val Met Gly Met Val Gly Val Leu Pro Asp Met Thr
 180 185 190
 Pro Ser Thr Glu Met Ser Met Arg Gly Ile Arg Val
 195 200
 <210> 8
 <211> 202
 <212> PRT
 <213> Influenza A virus
 <220>
 <221> PB2 281 to 482
 <222> (1)..(202)
 <400> 8
 Leu Glu Met Cys His Ser Thr Gln Ile Gly Gly Thr Arg Met Val Asp
 1 5 10 15
 Ile Leu Arg Gln Asn Pro Thr Glu Glu Gln Ala Val Asp Ile Cys Lys
 20 25 30
 Ala Ala Met Gly Leu Arg Ile Ser Ser Ser Phe Ser Phe Gly Gly Phe
 35 40 45
 Thr Phe Lys Arg Thr Ser Gly Ser Ser Ile Lys Arg Glu Glu Glu Val
 50 55 60

Leu Thr Gly Asn Leu Gln Thr Leu Lys Ile Arg Val His Glu Gly Tyr
65 70 75 80

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

Ala Thr Arg Arg Leu Val Gln Leu Ile Val Ser Gly Arg Asp Glu Gln
100 105 110

Ser Ile Ala Glu Ala Ile Ile Val Ala Met Val Phe Ser Gln Glu Asp
115 120 125

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

Asn Gln Arg Leu Asn Pro Met His Gln Leu Leu Arg His Phe Gln Lys
145 150 155 160

Asp Ala Lys Val Leu Phe Gln Asn Trp Gly Ile Glu His Ile Asp Asn
165 170 175

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

Met Ser Met Arg Gly Ile Arg Val Ser Lys
195 200

<210> 9
<211> 194
<212> PRT
<213> Influenza A virus

<220>
<221> PB2 290 to 483
<222> (1)..(194)

<400> 9

Gly Gly Thr Arg Met Val Asp Ile Leu Arg Gln Asn Pro Thr Glu Glu
1 5 10 15

Gln Ala Val Asp Ile Cys Lys Ala Ala Met Gly Leu Arg Ile Ser Ser
20 25 30

Ser Phe Ser Phe Gly Gly Phe Thr Phe Lys Arg Thr Ser Gly Ser Ser
35 40 45

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

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

Ala Thr Ala Ile Leu Arg Lys Ala Thr Arg Arg Leu Val Gln Leu Ile
85 90 95

Val Ser Gly Arg Asp Glu Gln Ser Ile Ala Glu Ala Ile Ile Val Ala
100 105 110

Met Val Phe Ser Gln Glu Asp Cys Met Ile Lys Ala Val Arg Gly Asp
115 120 125

Leu Asn Phe Val Asn Arg Ala Asn Gln Arg Leu Asn Pro Met His Gln
130 135 140

Leu Leu Arg His Phe Gln Lys Asp Ala Lys Val Leu Phe Gln Asn Trp
145 150 155 160

Gly Ile Glu His Ile Asp Asn Val Met Gly Met Val Gly Val Leu Pro
165 170 175

Asp Met Thr Pro Ser Thr Glu Met Ser Met Arg Gly Ile Arg Val Ser
180 185 190

Lys Met

<210> 10
<211> 188
<212> PRT
<213> Influenza A virus

<220>
<221> PB2 295 to 482
<222> (1)..(188)

<400> 10

Val Asp Ile Leu Arg Gln Asn Pro Thr Glu Glu Gln Ala Val Asp Ile
1 5 10 15

Cys Lys Ala Ala Met Gly Leu Arg Ile Ser Ser Ser Phe Ser Phe Gly
20 25 30

Gly Phe Thr Phe Lys Arg Thr Ser Gly Ser Ser Ile Lys Arg Glu Glu
35 40 45

Glu Val Leu Thr Gly Asn Leu Gln Thr Leu Lys Ile Arg Val His Glu
50 55 60

Gly Tyr Glu Glu Phe Thr Met Val Gly Lys Arg Ala Thr Ala Ile Leu
65 70 75 80

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

Glu Gln Ser Ile Ala Glu Ala Ile Ile Val Ala Met Val Phe Ser Gln
100 105 110

Glu Asp Cys Met Ile Lys Ala Val Arg Gly Asp Leu Asn Phe Val Asn
115 120 125

Arg Ala Asn Gln Arg Leu Asn Pro Met His Gln Leu Leu Arg His Phe
130 135 140

Gln Lys Asp Ala Lys Val Leu Phe Gln Asn Trp Gly Ile Glu His Ile
145 150 155 160

Asp Asn Val Met Gly Met Val Gly Val Leu Pro Asp Met Thr Pro Ser
165 170 175

Thr Glu Met Ser Met Arg Gly Ile Arg Val Ser Lys
180 185

<210> 11
<211> 166
<212> PRT
<213> Influenza A virus

<220>
<221> PB2 318 to 483 R389K
<222> (1)..(166)

<400> 11

Arg Ile Ser Ser Ser Phe Ser Phe Gly Gly Phe Thr Phe Lys Arg Thr
1 5 10 15

Ser Gly Ser Ser Ile Lys Arg Glu Glu Glu Val Leu Thr Gly Asn Leu
20 25 30

Gln Thr Leu Lys Ile Arg Val His Glu Gly Tyr Glu Glu Phe Thr Met
35 40 45

Val Gly Lys Arg Ala Thr Ala Ile Leu Arg Lys Ala Thr Arg Arg Leu
50 55 60

Val Gln Leu Ile Val Ser Gly Lys Asp Glu Gln Ser Ile Ala Glu Ala
65 70 75 80

Ile Ile Val Ala Met Val Phe Ser Gln Glu Asp Cys Met Ile Lys Ala
85 90 95

Val Arg Gly Asp Leu Asn Phe Val Asn Arg Ala Asn Gln Arg Leu Asn
100 105 110

Pro Met His Gln Leu Leu Arg His Phe Gln Lys Asp Ala Lys Val Leu
115 120 125

Phe Gln Asn Trp Gly Ile Glu His Ile Asp Asn Val Met Gly Met Val
 130 135 140

Gly Val Leu Pro Asp Met Thr Pro Ser Thr Glu Met Ser Met Arg Gly
 145 150 155 160

Ile Arg Val Ser Lys Met
 165

<210> 12
 <211> 164
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2 320 to 483
 <222> (1)..(164)

<400> 12

Ser Ser Ser Phe Ser Phe Gly Gly Phe Thr Phe Lys Arg Thr Ser Gly
 1 5 10 15

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

Leu Lys Ile Arg Val His Glu Gly Tyr Glu Glu Phe Thr Met Val Gly
 35 40 45

Lys Arg Ala Thr Ala Ile Leu Arg Lys Ala Thr Arg Arg Leu Val Gln
 50 55 60

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

Val Ala Met Val Phe Ser Gln Glu Asp Cys Met Ile Lys Ala Val Arg
 85 90 95

Gly Asp Leu Asn Phe Val Asn Arg Ala Asn Gln Arg Leu Asn Pro Met
 100 105 110

His Gln Leu Leu Arg His Phe Gln Lys Asp Ala Lys Val Leu Phe Gln
 115 120 125

Asn Trp Gly Ile Glu His Ile Asp Asn Val Met Gly Met Val Gly Val
 130 135 140

Leu Pro Asp Met Thr Pro Ser Thr Glu Met Ser Met Arg Gly Ile Arg
 145 150 155 160

Val Ser Lys Met

<210> 13
 <211> 82
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2 323 to 404
 <222> (1)..(82)

<400> 13

Phe Ser Phe Gly Gly Phe Thr Phe Lys Arg Thr Ser Gly Ser Ser Ile
 1 5 10 15

Lys Arg Glu Glu Glu Val Leu Thr Gly Asn Leu Gln Thr Leu Lys Ile
 20 25 30

Arg Val His Glu Gly Tyr Glu Glu Phe Thr Met Val Gly Lys Arg Ala
 35 40 45

Thr Ala Ile Leu Arg Lys Ala Thr Arg Arg Leu Val Gln Leu Ile Val
 50 55 60

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

Val Phe

<210> 14
 <211> 11
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2 320 to 330
 <222> (1)..(11)

<400> 14

Ser Ser Ser Phe Ser Phe Gly Gly Phe Thr Phe
 1 5 10

<210> 15
 <211> 11
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2 330 to 340
 <222> (1)..(11)

<400> 15

Phe Lys Arg Thr Ser Gly Ser Ser Ile Lys Arg
 1 5 10

<210> 16
<211> 11
<212> PRT
<213> Influenza A virus

<220>
<221> PB2 340 to 350
<222> (1)..(11)

<400> 16

Arg Glu Glu Glu Val Leu Thr Gly Asn Leu Gln
1 5 10

<210> 17
<211> 11
<212> PRT
<213> Influenza A virus

<220>
<221> PB2 350 to 360
<222> (1)..(11)

<400> 17

Gln Thr Leu Lys Ile Arg Val His Glu Gly Tyr
1 5 10

<210> 18
<211> 11
<212> PRT
<213> Influenza A virus

<220>
<221> PB2 360 to 370
<222> (1)..(11)

<400> 18

Tyr Glu Glu Phe Thr Met Val Gly Lys Arg Ala
1 5 10

<210> 19
<211> 11
<212> PRT
<213> Influenza A virus

<220>
<221> PB2 370 to 380
<222> (1)..(11)

<400> 19

Ala Thr Ala Ile Leu Arg Lys Ala Thr Arg Arg
1 5 10

<210> 20
<211> 11
<212> PRT
<213> Influenza A virus

<220>
 <221> PB2 380 to 390
 <222> (1)..(11)

<400> 20

Arg Leu Val Gln Leu Ile Val Ser Gly Arg Asp
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<210> 21
 <211> 11
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2 390 to 400
 <222> (1)..(11)

<400> 21

Asp Glu Gln Ser Ile Ala Glu Ala Ile Ile Val
 1 5 10

<210> 22
 <211> 11
 <212> PRT
 <213> Influenza A virus

<220>
 <221> PB2 400 to 410
 <222> (1)..(11)

<400> 22

Val Ala Met Val Phe Ser Gln Glu Asp Cys Met
 1 5 10

<210> 23
 <211> 2277
 <212> DNA
 <213> Influenza A virus

<220>
 <221> PB2 WT
 <222> (1)..(2277)

<400> 23
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 aagaacccgt cacttaggat gaaatggatg atggcaatga aatatccaat tacagctgac 180
 aagaggataa cagaaatggt tcctgagaga aatgagcaag gacaaacct atggagtaaa 240
 atgagtgatg ccgggtcaga tcgagtgatg gtatcacctt tggcagtgac atgggtggaat 300
 agaaatggac cagtgacaag tacggttcat tatccaaaag tctacaagac ttattttgat 360
 aaagtcgaaa gggttaaaaca tggaaccttt ggccctgtcc attttagaaa ccaagtcaaa 420

480 atagccgaa gagtgcacat aaccctgt catgcagacc tcagtgcacaa ggaggacaa
 540 gatgtaatac tggaaagtgt ttccccaat gaagtgggg ccaggtatac aacgtcgaa
 600 tcaaatiga caataaccaa agbaaaaaa gaagaatcc aagatgcacaa aatttctc
 660 ttgattgttg catatagttt agagagaa cttgtccgaa aaacgagatt tctccagtt
 720 gctgtggaa caagcagttg gtacattgaa gtgttacct tgaatcaagg aacgtgttg
 780 gaacagattg acatccagg tggagaagt aggaatgacg atattgacca aagccaat
 840 attgcagcaa ggaacatagt gagaagagca tcagtatac agatccact agcatctta
 900 ttggagattg gccacagcac acaattgac gggaacaagg tggttgacat tcttagacag
 960 aaccgacgg aagaacaagc tgtgatata tgcaggctg caatggact gagaatcagc
 1020 tcatcttca gtttgttg gticacatt aagagaacaa gctgtctac aatcaaaaga
 1080 gggaagaa tgcttaagg caatctcaa acattgaaaa taagggtgca tgaagggtac
 1140 gaggaattca caatgttg gaaagggca acagctatac tcagaaagc aaccaggaga
 1200 ttgttcagc ttatagttag tggaaaggac gacagtcac tagccgaagc gataattga
 1260 gccattgtt ttcaacaga gattgcatg ataaagcag ttagaagtga cctgaattc
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 1380 gatgcgaag tgcctttca gaattggga attgaacata ttgaacattg gatgggaatg
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 1680 ggccttgat cagtgttg caataccat caatgatac tcagaattg ggaactgtt
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 1800 cagtctttag ttcctaaggc cattagagc caatacagtg gattgtcag aactctatc
 1860 caacaatga gggatgtact tgggacatt gataccacc agataataaa gcttctccc
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 1980 agggatcag gtagagaat actgtagg ggcaatttc ctgtatcaa ctacaacaa
 2040 accataaaa gactaacaat tctcggaacaa gatgtgca cttaattga agaccagat
 2100 gaaagcacat ccggagtga gtcctgtt ttgagagat tctcatct aggttaagaa
 2160 gatagaagat acggaccagc attaagcatt aatgaactga gcaaccttg aaaaaggaga
 2220 aaggctaatg tgcataattg gcaaggagac gtgtgttg taatgaacg aaaaaggac
 2277 tctagcatat ttactgacag ccagacagc accaaaagaa ttcgatggc catcaat

<210> 24
 <211> 2277
 <212> DNA
 <213> Influenza A virus

<220>
<221> PB2 Arg389Lys
<222> (1)..(2277)
<400> 24

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acaaaacca cagtggacca atgaagaaat acacatcagg gagacaggaa
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180
aagaagataa cagaatgtgt tccagagaga aatgagcaag gacaacctt atggagtaaa
240
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300
agaaatggac cagtgaagaag tacggttcac tatccaaaag tctacaaga ttaatttgat
360
aaagtccgaa ggttaaaaca tggaaacctt ggccctgtcc atttaagaa ccaagtcaaa
420
atacgcgga gagttgacat aaacctgtgt catgcagacc tcagtgcga ggaaggcaca
480
gatgtaata tgaagtgtgt ttccccaat gaagtggggg ccaggatac aacgtcggaa
540
tcacaattga caataacca agagaaaaaa gaagaacctc aagattgcaa aatttctct
600
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720
gaacagatgt acactccagg tggagaagtg aggaatgacg atatgacca aagcctaatt
780
attgcagcca ggaacatagt gagaagaca tcagtatcag cagatccact agcatcttta
840
ttggagatgt gccacagcac acaattggc gggaacaagg tggtaggacat tcttagcacg
900
aacccgacgg aagaaccaagc tgtgatata tgcgaagctg caatgggact gagaatcagc
960
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1020
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1080
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1200
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1680
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1800
caacaatga gggatgtact tgggacatt gataccacc agataaag gcttctcccc
1860

1920 ttgcagccg ccccaaaa gcaagtaga atcgattct ctcatgac tgtgaatgtg
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 2040 accataaa gactaacaat tctcggaaa gatgcttgca cttaattga agaccagat
 2100 gaagacacat ccgagtgga gtccgctgtt ttgagagat ttctcatct aggttaaggaa
 2160 gatagaagat acggaccagc attaagcatic aatgaactga gcaacctgc aaaaaggaaa
 2220 aaggctaag tgcataatgg gcaaggagac gtgtgtttgg taatgaaacg aaaaaggagc
 2277 tctagcatat ttactgacag ccagacagcg accaaaagaa ttcgatggc catcaat

<2210> 25
 <2211> 2277
 <212> DNA
 <213> Influenza A virus

<220>
 <221> PB2 synthetic gene, optimized for E.coli codon usage
 <222> (1).(2274)

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 180 aaaaatccga gccctcgcat gaatatggatg atggcgtatg aatatccgat caccgcat
 240 aaacgcata ccgaatgtgt gccggaact aatgaacagg gccagacct gtgagcaaa
 300 atgagcgatg cgggtagcga tctgtttatg gtagcccg cggcggttac ctgttggaat
 360 cgtaatgttc cgtttaccag caccgtgcat taccggaag tgtacaacaac ctatttcgat
 420 aaagtggaac gcctgaaca tggcaccctt ggcctgtgc atttctgtaa ccaggtgaaa
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 540 gacgttata tggaaattgt ttcccgaaac gaagtgttg cgtgtattct gaccagcgaa
 600 agccagctga ccataccaa agaaaaaaa gaagaactgc aggatgcaa aattagcccg
 660 ctgattgttg cgtatatgtt ggaacgtgaa ctgttctgta aaacctgtt tctgcctgtt
 720 gccgggtggca ccagcagctg gtatatgaa gtgctgcatc tgaccaggg cactctgttg
 780 gaacagatgt ataccctggg tggtagaagt cgtaacgatg atatcgata gagccctgat
 840 attgcggcgc gtaacattgt tctcgtgtcg agcgttagcg cgtatccgt ggcgagccgt
 900 ctgaaatgt gtcatagcac ccagattgtt ggcacccgta tgttgtatat tctgcgtcag
 960 aaccgacgg aagaacaggc ggttgatat tgtaaagcgg cgtatggctt gcgtattagc
 1020 agcagcttta gctttggcgg cttaacctt aaacgtacca gcggcagcag cattaacgt
 1080 gaagaagaa tgcctgacgg taatctgacg accttgaaa ttctgttgca cgaaggctat
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 1200 ctgttcagc tgatgtgag cggcaaaagt gaacagagca ttgcgggaagc gattatcgtt
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2160
aaagcgaaag ttcgtattgg tcagggtgat gtgtgtcgtg tcatgaacg taaacgcgat
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2277 agcagcatc tgaaccgatg ccagaccgcg accaaacta ttctgtatgc gattaat

<210> 26
<211> 2313
<212> DNA
<213> Influenza B virus

<220>
<221> PB2
<222> (1)..(2313)
<400> 26

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attgaaaga acccttcatt aaggtgaag tgggcgaatgt gttcctaatt tcccttgcct
180
ttgaaccaag gtgacatggc aaacagaaac ccccttggaat acaaagggaat acaacttaaa
240
acaatgcgtg aagacatagc aaccaaaagc caaatgtgtc caatagcagc agttaaccgtg
300
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360
tttctcagaa agtatgagact tgaacaatgcc acttggggcc gaataaacttt tggcccagtt
420
gaaagagtga gaaaaagggt actgcataaac cctctcacta aggaataatgcc tccagatgaa
480
gcaagttaat tgaataatga aatatgttcc cctaagggaag caggaaatacc aaggaatct
540
acttgatatc atagggaact gataaagaa aaaagagaaa aattgaaag aacgatgata
600
actcccatg tactggcata catgcttgag agggaaatgg ttgcccaggag aagtttccctg
660

ccggttgag gagcaacatc agctgagttc atagaatgc tacactgctt acaagtgaa
720
aatggagac aaatatacca ccgggaggg aataactaa ctgaatctag gtccaatc
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840
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aaaaatgat aagaatatc atcgggaac ggaacaatac agaagattg aatatggac
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ggagaagag agttccatgt aagatgtgt gaatgcagg gaatatataa aagagcaaa
1140
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agtggcaagt atgaccaga tcttggagat tccaacta ttgaagaact tgaagaacta
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2280
acagttagt ccatgggtg ggccttgagc taa
2313

<210> 27
<211> 2325
<212> DNA
<213> Influenza C virus
<220>
<221> PB2
<222> (1) . (2325)

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360 gttataaat ctgatttg aagattagaa agaaaggaaag aataatgtg gaagaactt
420 agatttacct tagttgatg acaacgaaga agagtgtgaca ctgagcctgt agaacaaga
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540 ctgtctagca aattatttt agacaattat ggtctagcca aagaatgag atcaagttt
600 gcaacaaca cctgtaataa agaagtagt gcacacatgt tagaanaaca atcaatccg
660 gaaagttagt tcttgccgt ttctggagct ataaggccag aaagaatgga atgtacctat
720 gcattaggag gagaacttg gatacaagaa gctaacactg cagggtttc caatgttgat
780 caaaggaaaa atgatatag agcagtatgt aggaagtgt gttctgagc aaatgcaagt
840 ataagtgaag ccaaaagcaa actggttgag tatataaaaa gtaacaagtat ggaattgga
900 gaaacagaaa gaaagcttga agaaacttata ctgaaaccg atgatgtctc acctgaagt
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2040

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agcgatgtaa ataagaatgt gaaaaagata aagatgtcta actaa	2325

1/30