SEQUENCE LISTING

<110> bluebird bio, Inc.
Heffner, Garrett Collins
Bassan, Abraham Isaac

<120> COMPOUNDS FOR IMPROVED VIRAL TRANSDUCTION

<130> BLBD-006/01WO

<150> US 61/541,736
<151> 2011-09-30

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<170> PatentIn version 3.5

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<213> Homo sapiens

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Met Phe Leu Ser Phe Pro Thr Thr Lys Thr Tyr Phe Pro His Phe Asp
35 40 45

Leu Ser His Gly Ser Ala Gln Val Lys Gly His Gly Lys Lys Val Ala
50 55 60

Asp Ala Leu Thr Asn Ala Val Ala His Val Asp Asp Met Pro Asn Ala

65 70 75 80

Leu Ser Ala Leu Ser Asp Leu His Ala His Lys Leu Arg Val Asp Pro
85 90 95

Val Asn Phe Lys Leu Leu Ser His Cys Leu Leu Val Thr Leu Ala Ala
100 105 110

His Leu Pro Ala Glu Phe Thr Pro Ala Val His Ala Ser Leu Asp Lys
115 120 125

Phe Leu Ala Ser Val Ser Thr Val Leu Thr Ser Lys Tyr Arg
130 135 140

<210> 3
<211> 142
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<213> Mus musculus

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Lys Ile Gly Gly His Gly Ala Glu Tyr Gly Ala Glu Ala Leu Glu Arg
20 25 30

Met Phe Ala Ser Phe Pro Thr Thr Lys Thr Tyr Phe Pro His Phe Asp
35 40 45

Val Ser His Gly Ser Ala Gln Val Lys Gly His Gly Lys Lys Val Ala
50 55 60

Asp Ala Leu Ala Asn Ala Ala Gly His Leu Asp Asp Leu Pro Gly Ala
65 70 75 80

Leu Ser Ala Leu Ser Asp Leu His Ala His Lys Leu Arg Val Asp Pro
85 90 95

Val Asn Phe Lys Leu Leu Ser His Cys Leu Leu Val Thr Leu Ala Ser
100 105 110

His His Pro Ala Asp Phe Thr Pro Ala Val His Ala Ser Leu Asp Lys
115 120 125

Phe Leu Ala Ser Val Ser Thr Val Leu Thr Ser Lys Tyr Arg
130 135 140

<210> 4
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<213> Rattus norvegicus

<400> 4

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Lys Ile Gly Gly His Gly Gly Glu Tyr Gly Glu Glu Ala Leu Gln Arg
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Met Phe Ala Ala Phe Pro Thr Thr Lys Thr Tyr Phe Ser His Ile Asp
        35                  40                  45

Val Ser Pro Gly Ser Ala Gln Val Lys Ala His Gly Lys Lys Val Ala
    50                  55                  60

Asp Ala Leu Ala Lys Ala Ala Asp His Val Glu Asp Leu Pro Gly Ala
65                  70                  75                  80

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

Val Asn Phe Lys Phe Leu Ser His Cys Leu Leu Val Thr Leu Ala Cys
            100                 105                 110

His His Pro Gly Asp Phe Thr Pro Ala Met His Ala Ser Leu Asp Lys
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Phe Leu Ala Ser Val Ser Thr Val Leu Thr Ser Lys Tyr Arg
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Gly Lys Val Asn Val Asp Glu Val Gly Gly Glu Ala Leu Gly Arg Leu
            20                  25                  30

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

Leu Ser Thr Pro Asp Ala Val Met Gly Asn Pro Lys Val Lys Ala His
    50                  55                  60

Gly Lys Lys Val Leu Gly Ala Phe Ser Asp Gly Leu Ala His Leu Asp
65                  70                  75                  80

Asn Leu Lys Gly Thr Phe Ala Thr Leu Ser Glu Leu His Cys Asp Lys
                85                  90                  95

Leu His Val Asp Pro Glu Asn Phe Arg Leu Leu Gly Asn Val Leu Val
            100                 105                 110

Cys Val Leu Ala His His Phe Gly Lys Glu Phe Thr Pro Pro Val Gln
        115                 120                 125

Ala Ala Tyr Gln Lys Val Val Ala Gly Val Ala Asn Ala Leu Ala His
    130                 135                 140

Lys Tyr His
145
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Met Val His Leu Thr Pro Glu Glu Lys Ser Ala Val Thr Ala Leu Trp
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Gly Lys Val Asn Val Asp Glu Val Gly Gly Glu Ala Leu Gly Arg Leu
            20                  25                  30

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

Leu Ser Thr Pro Asp Ala Val Met Gly Asn Pro Lys Val Lys Ala His
    50                  55                  60
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Gly Lys Lys Val Leu Gly Ala Phe Ser Asp Gly Leu Ala His Leu Asp
65 70 75 80

Asn Leu Lys Gly Thr Phe Ala Gln Leu Ser Glu Leu His Cys Asp Lys
85 90 95

Leu His Val Asp Pro Glu Asn Phe Arg Leu Leu Gly Asn Val Leu Val
100 105 110

Cys Val Leu Ala His His Phe Gly Lys Glu Phe Thr Pro Pro Val Gln
115 120 125

Ala Ala Tyr Gln Lys Val Val Ala Gly Val Ala Asn Ala Leu Ala His
130 135 140

Lys Tyr His
145

<210> 8
<211> 147
<212> PRT
<213> Mus musculus

<400> 8

Met Val His Leu Thr Asp Ala Glu Lys Ala Ala Val Ser Gly Leu Trp
1 5 10 15

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

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

Leu Ser Ser Ala Ser Ala Ile Met Gly Asn Ala Lys Val Lys Ala His
50 55 60

Gly Lys Lys Val Ile Thr Ala Phe Asn Asp Gly Leu Asn His Leu Asp
65 70 75 80

Ser Leu Lys Gly Thr Phe Ala Ser Leu Ser Glu Leu His Cys Asp Lys
85 90 95

Leu His Val Asp Pro Glu Asn Phe Arg Leu Leu Gly Asn Met Ile Val
100 105 110

Ile Val Leu Gly His His Leu Gly Lys Asp Phe Thr Pro Ala Ala Gln
115 120 125

Ala Ala Phe Gln Lys Val Val Ala Gly Val Ala Ala Ala Leu Ala His
130 135 140

Lys Tyr His

145

<210> 9
<211> 147
<212> PRT
<213> Rattus norvegicus

<400> 9

Met Val His Leu Thr Asp Ala Glu Lys Ala Ala Val Asn Gly Leu Trp
1 5 10 15

Gly Lys Val Asn Pro Asp Asp Val Gly Gly Glu Ala Leu Gly Arg Leu
20 25 30

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

Leu Ser Ser Ala Ser Ala Ile Met Gly Asn Pro Lys Val Lys Ala His
50 55 60

Gly Lys Lys Val Ile Asn Ala Phe Asn Asp Gly Leu Lys His Leu Asp
65 70 75 80

Asn Leu Lys Gly Thr Phe Ala His Leu Ser Glu Leu His Cys Asp Lys
85 90 95

Leu His Val Asp Pro Glu Asn Phe Arg Leu Leu Gly Asn Met Ile Val
100 105 110

Ile Val Leu Gly His His Leu Gly Lys Glu Phe Thr Pro Cys Ala Gln
115 120 125

Ala Ala Phe Gln Lys Val Val Ala Gly Val Ala Ser Ala Leu Ala His
130 135 140

Lys Tyr His
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<211> 147
<212> PRT
<213> Homo sapiens

<400> 11

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

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

Leu Ser Ser Ala Ser Ala Ile Met Gly Asn Pro Lys Val Lys Ala His
50 55 60

Gly Lys Lys Val Leu Thr Ser Leu Gly Asp Ala Ile Lys His Leu Asp
65 70 75 80

Asp Leu Lys Gly Thr Phe Ala Gln Leu Ser Glu Leu His Cys Asp Lys
85 90 95

Leu His Val Asp Pro Glu Asn Phe Lys Leu Leu Gly Asn Val Leu Val
100 105 110

Thr Val Leu Ala Ile His Phe Gly Lys Glu Phe Thr Pro Glu Val Gln
115 120 125

Ala Ser Trp Gln Lys Met Val Thr Gly Val Ala Ser Ala Leu Ser Ser
130 135 140

Arg Tyr His
145

<210> 12
<211> 147
<212> PRT
<213> Mus musculus

<400> 12

Met Val His Phe Thr Ala Glu Glu Lys Ala Ala Ile Thr Ser Ile Trp
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Asp Lys Val Asp Leu Glu Lys Val Gly Gly Glu Thr Leu Gly Arg Leu

20 25 30

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

Leu Ser Ser Ala Leu Ala Ile Met Gly Asn Pro Arg Ile Arg Ala His
50 55 60

Gly Lys Lys Val Leu Thr Ser Leu Gly Leu Gly Val Lys Asn Met Asp
65 70 75 80

Asn Leu Lys Glu Thr Phe Ala His Leu Ser Glu Leu His Cys Asp Lys
85 90 95

Leu His Val Asp Pro Glu Asn Phe Lys Leu Leu Gly Asn Met Leu Val
100 105 110

Ile Val Leu Ser Thr His Phe Ala Lys Glu Phe Thr Pro Glu Val Gln
115 120 125

Ala Ala Trp Gln Lys Leu Val Ile Gly Val Ala Asn Ala Leu Ser His
130 135 140

Lys Tyr His
145

<210> 13
<211> 147
<212> PRT
<213> Rattus norvegicus

<400> 13

Met Val His Phe Thr Ala Glu Glu Lys Ala Ala Ile Ile Ser Ile Trp
1 5 10 15

Glu Lys Val Asp Leu Glu Lys Ile Gly Gly Glu Thr Leu Gly Arg Leu
20 25 30

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

Leu Ser Ser Ala Leu Ala Ile Met Gly Asn Pro Arg Ile Arg Ala His
50 55 60

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

Asn Leu Lys Glu Thr Phe Ala His Leu Ser Glu Leu His Cys Asp Lys
85 90 95

Leu His Val Asp Pro Gln Asn Phe Lys Leu Leu Gly Asn Met Leu Val
100 105 110

Ile Val Leu Ser Thr His Phe Ala Lys Glu Phe Thr Pro Glu Val Gln
115 120 125

Ala Ala Trp Gln Lys Leu Val Met Gly Val Ala Asn Ala Leu Ser His
130 135 140

Lys Tyr His
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<210> 15
<211> 147
<212> PRT
<213> Homo sapiens

<400> 15

Met Val His Leu Thr Pro Glu Glu Lys Thr Ala Val Asn Ala Leu Trp
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Gly Lys Val Asn Val Asp Ala Val Gly Gly Glu Ala Leu Gly Arg Leu
20 25 30

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

Leu Ser Ser Pro Asp Ala Val Met Gly Asn Pro Lys Val Lys Ala His
50 55 60

Gly Lys Lys Val Leu Gly Ala Phe Ser Asp Gly Leu Ala His Leu Asp
65 70 75 80

Asn Leu Lys Gly Thr Phe Ser Gln Leu Ser Glu Leu His Cys Asp Lys
85 90 95

Leu His Val Asp Pro Glu Asn Phe Arg Leu Leu Gly Asn Val Leu Val
100 105 110

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

Ala Ala Tyr Gln Lys Val Val Ala Gly Val Ala Asn Ala Leu Ala His
130 135 140

Lys Tyr His
145

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<211> 2297
<212> DNA
<213> Homo sapiens

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<211> 2238
<212> DNA
<213> Homo sapiens

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<400> 18

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1 5 10 15

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            20                  25                  30

Tyr Pro Leu Val Arg Gln Cys Leu Ala Pro Ala Arg Gly Leu Gln Ala
        35                  40                  45

Pro Ala Gly Glu Pro Thr Gln Glu Ala Ser Gly Val Ala Ala Ala Lys
    50                  55                  60

Ala Gly Met Asn Arg Val Phe Leu Gln Arg Leu Leu Trp Leu Leu Arg
65                  70                  75                  80

Leu Leu Phe Pro Arg Val Leu Cys Arg Glu Thr Gly Leu Leu Ala Leu
                85                  90                  95

His Ser Ala Ala Leu Val Ser Arg Thr Phe Leu Ser Val Tyr Val Ala
            100                 105                 110

Arg Leu Asp Gly Arg Leu Ala Arg Cys Ile Val Arg Lys Asp Pro Arg
        115                 120                 125

Ala Phe Gly Trp Gln Leu Leu Gln Trp Leu Leu Ile Ala Leu Pro Ala
    130                 135                 140

Thr Phe Val Asn Ser Ala Ile Arg Tyr Leu Glu Gly Gln Leu Ala Leu
145                 150                 155                 160

Ser Phe Arg Ser Arg Leu Val Ala His Ala Tyr Arg Leu Tyr Phe Ser
                165                 170                 175

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

Pro Asp Gln Ser Leu Thr Glu Asp Val Val Ala Phe Ala Ala Ser Val
        195                 200                 205

Ala His Leu Tyr Ser Asn Leu Thr Lys Pro Leu Leu Asp Val Ala Val
    210                 215                 220

Thr Ser Tyr Thr Leu Leu Arg Ala Ala Arg Ser Arg Gly Ala Gly Thr
225                 230                 235                 240

Ala Trp Pro Ser Ala Ile Ala Gly Leu Val Val Phe Leu Thr Ala Asn
                245                 250                 255

Val Leu Arg Ala Phe Ser Pro Lys Phe Gly Glu Leu Val Ala Glu Glu
            260                 265                 270

Ala Arg Arg Lys Gly Glu Leu Arg Tyr Met His Ser Arg Val Val Ala
        275                 280                 285
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Asn Ser Glu Glu Ile Ala Phe Tyr Gly Gly His Glu Val Glu Leu Ala
    290                 295                 300

Leu Leu Gln Arg Ser Tyr Gln Asp Leu Ala Ser Gln Ile Asn Leu Ile
305                 310                 315                 320

Leu Leu Glu Arg Leu Trp Tyr Val Met Leu Glu Gln Phe Leu Met Lys
                325                 330                 335

Tyr Val Trp Ser Ala Ser Gly Leu Leu Met Val Ala Val Pro Ile Ile
            340                 345                 350

Thr Ala Thr Gly Tyr Ser Glu Ser Asp Ala Glu Ala Val Lys Lys Ala
        355                 360                 365

Ala Leu Glu Lys Lys Glu Glu Glu Leu Val Ser Glu Arg Thr Glu Ala
    370                 375                 380

Phe Thr Ile Ala Arg Asn Leu Leu Thr Ala Ala Ala Asp Ala Ile Glu
385                 390                 395                 400

Arg Ile Met Ser Ser Tyr Lys Glu Val Thr Glu Leu Ala Gly Tyr Thr
                405                 410                 415

Ala Arg Val His Glu Met Phe Gln Val Phe Glu Asp Val Gln Arg Cys
            420                 425                 430

His Phe Lys Arg Pro Arg Glu Leu Glu Asp Ala Gln Ala Gly Ser Gly
        435                 440                 445

Thr Ile Gly Arg Ser Gly Val Arg Val Glu Gly Pro Leu Lys Ile Arg
    450                 455                 460

Gly Gln Val Val Asp Val Glu Gln Gly Ile Ile Cys Glu Asn Ile Pro
465                 470                 475                 480

Ile Val Thr Pro Ser Gly Glu Val Val Val Ala Ser Leu Asn Ile Arg
                485                 490                 495

Val Glu Glu Gly Met His Leu Leu Ile Thr Gly Pro Asn Gly Cys Gly
            500                 505                 510

Lys Ser Ser Leu Phe Arg Ile Leu Gly Gly Leu Trp Pro Thr Tyr Gly
        515                 520                 525

Gly Val Leu Tyr Lys Pro Pro Pro Gln Arg Met Phe Tyr Ile Pro Gln
    530                 535                 540

Arg Pro Tyr Met Ser Val Gly Ser Leu Arg Asp Gln Val Ile Tyr Pro
545                 550                 555                 560
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Asp Ser Val Glu Asp Met Gln Arg Lys Gly Tyr Ser Glu Gln Asp Leu
                565                 570                 575

Glu Ala Ile Leu Asp Val Val His Leu His His Ile Leu Gln Arg Glu
            580                 585                 590

Gly Gly Trp Glu Ala Met Cys Asp Trp Lys Asp Val Leu Ser Gly Gly
        595                 600                 605

Glu Lys Gln Arg Ile Gly Met Ala Arg Met Phe Tyr His Arg Pro Lys
    610                 615                 620

Tyr Ala Leu Leu Asp Glu Cys Thr Ser Ala Val Ser Ile Asp Val Glu
625                 630                 635                 640

Gly Lys Ile Phe Gln Ala Ala Lys Asp Ala Gly Ile Ala Leu Leu Ser
                645                 650                 655

Ile Thr His Arg Pro Ser Leu Trp Lys Tyr His Thr His Leu Leu Gln
            660                 665                 670

Phe Asp Gly Glu Gly Gly Trp Lys Phe Glu Lys Leu Asp Ser Ala Ala
        675                 680                 685

Arg Leu Ser Leu Thr Glu Glu Lys Gln Arg Leu Glu Gln Gln Leu Ala
    690                 695                 700

Gly Ile Pro Lys Met Gln Arg Arg Leu Gln Glu Leu Cys Gln Ile Leu
705                 710                 715                 720

Gly Glu Ala Val Ala Pro Ala His Val Pro Ala Pro Ser Pro Gln Gly
                725                 730                 735

Pro Gly Gly Leu Gln Gly Ala Ser Thr
            740                 745
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