

SEQUENCE LISTING

<110> UBI IP Holdings
 UBI US Holdings, LLC
 Wang, Chang Yi

<120> PEPTIDE IMMUNOGENS OF IL-31 AND FORMULATIONS THEREOF FOR THE
 TREATMENT AND/OR PREVENTION OF ATOPIC DERMATITIS

<130> 2037-WO

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<160> 110

<170> PatentIn version 3.5

<210> 1
 <211> 159
 <212> PRT
 <213> Canis lupus

<220>
 <221> PEPTIDE
 <222> (1)..(159)
 <223> Canine IL-31 1-159 (Uniprot C7G0W1-1; GenBank: BAH97742.1)

<400> 1

Met Leu Ser His Thr Gly Pro Ser Arg Phe Ala Leu Phe Leu Leu Cys
 1 5 10 15

Ser Met Glu Thr Leu Leu Ser Ser His Met Ala Pro Thr His Gln Leu
 20 25 30

Pro Pro Ser Asp Val Arg Lys Ile Ile Leu Glu Leu Gln Pro Leu Ser
 35 40 45

Arg Gly Leu Leu Glu Asp Tyr Gln Lys Lys Glu Thr Gly Val Pro Glu
 50 55 60

Ser Asn Arg Thr Leu Leu Leu Cys Leu Thr Ser Asp Ser Gln Pro Pro
 65 70 75 80

Arg Leu Asn Ser Ser Ala Ile Leu Pro Tyr Phe Arg Ala Ile Arg Pro
 85 90 95

Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys
 100 105 110

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

Thr Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
 130 135 140

Ala Cys Leu Glu Ser Val Phe Lys Ser Leu Asn Ser Gly Pro Gln
145 150 155

<210> 2
<211> 164
<212> PRT
<213> Homo sapiens

<220>
<221> PEPTIDE
<222> (1)..(164)
<223> Human IL-31 1-164 (GenBank: AAS86448.1)

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Met Ala Ser His Ser Gly Pro Ser Thr Ser Val Leu Phe Leu Phe Cys
1 5 10 15

Cys Leu Gly Gly Trp Leu Ala Ser His Thr Leu Pro Val Arg Leu Leu
20 25 30

Arg Pro Ser Asp Asp Val Gln Lys Ile Val Glu Glu Leu Gln Ser Leu
35 40 45

Ser Lys Met Leu Leu Lys Asp Val Glu Glu Glu Lys Gly Val Leu Val
50 55 60

Ser Gln Asn Tyr Thr Leu Pro Cys Leu Ser Pro Asp Ala Gln Pro Pro
65 70 75 80

Asn Asn Ile His Ser Pro Ala Ile Arg Ala Tyr Leu Lys Thr Ile Arg
85 90 95

Gln Leu Asp Asn Lys Ser Val Ile Asp Glu Ile Ile Glu His Leu Asp
100 105 110

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

Asp Thr His Glu Cys Lys Arg Phe Ile Leu Thr Ile Ser Gln Gln Phe
130 135 140

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

Gln Ala Thr Thr

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<223> canine IL-31 97-144

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Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys
1 5 10 15

Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp
20 25 30

Thr Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
35 40 45

<210> 4

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<213> Canis lupus

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<222> (1)..(37)

<223> canine IL-31 97-133

<400> 4

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1 5 10 15

Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp
20 25 30

Thr Phe Glu Cys Lys
35

<210> 5

<211> 26

<212> PRT

<213> Canis lupus

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<222> (1)..(26)

<223> canine IL-31 97-122

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Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys
1 5 10 15

Leu Lys Phe Gln His Glu Pro Glu Thr Glu
20 25

<210> 6

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<212> PRT

<213> Canis lupus

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<222> (1)..(18)
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Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys
1 5 10 15

Leu Lys

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Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn Ile Ile Asp Lys
1 5 10 15

Ile Ile Glu Gln Leu
20

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Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn Ile Ile Asp Lys
1 5 10 15

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
20 25 30

Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys Ser Phe Ile Leu
35 40 45

Thr Ile Leu Gln Gln Phe Ser
50 55

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Ala Ile Leu Pro Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
1 5 10 15

Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His
20 25 30

Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
35 40 45

Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
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Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys
1 5 10 15

Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp
20 25 30

Thr Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
35 40 45

Ala Ser Leu Glu Ser
50

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<223> canine IL-31 90-149, C146 to S146

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Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn Ile Ile Asp Lys
1 5 10 15

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
20 25 30

Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys Ser Phe Ile Leu
35 40 45

Thr Ile Leu Gln Gln Phe Ser Ala Ser Leu Glu Ser
50 55 60

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<212> PRT
<213> Canis lupus

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<221> PEPTIDE
<222> (1)..(64)
<223> canine IL-31 86-149, C146 to S146

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Ala Ile Leu Pro Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
1 5 10 15

Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His
20 25 30

Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
35 40 45

Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser Ala Ser Leu Glu Ser
50 55 60

<210> 13
<211> 48
<212> PRT
<213> Homo sapiens

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<221> PEPTIDE
<222> (1)..(48)
<223> human IL-31 98-145

<400> 13

Leu Asp Asn Lys Ser Val Ile Asp Glu Ile Ile Glu His Leu Asp Lys
1 5 10 15

Leu Ile Phe Gln Asp Ala Pro Glu Thr Asn Ile Ser Val Pro Thr Asp
20 25 30

Thr His Glu Cys Lys Arg Phe Ile Leu Thr Ile Ser Gln Gln Phe Ser
35 40 45

<210> 14
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<212> PRT
<213> Clostridium tetani

<220>
<221> PEPTIDE
<222> (1)..(17)
<223> Clostridium tetani 1 Th

<400> 14

Lys Lys Gln Tyr Ile Lys Ala Asn Ser Lys Phe Ile Gly Ile Thr Glu
1 5 10 15

Leu

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<211> 15
<212> PRT
<213> Measles virus

<220>
<221> PEPTIDE
<222> (1)..(15)
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Leu Ser Glu Ile Lys Gly Val Ile Val His Arg Leu Glu Gly Val
1 5 10 15

<210> 16
<211> 24
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<213> Bordetella pertussis

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<221> PEPTIDE
<222> (1)..(24)
<223> Bordetella pertussis Th

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Gly Ala Tyr Ala Arg Cys Pro Asn Gly Thr Arg Ala Leu Thr Val Ala
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Glu Leu Arg Gly Asn Ala Glu Leu
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<210> 17
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<220>
<221> PEPTIDE
<222> (1)..(17)
<223> Clostridium tetani 2 Th

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Trp Val Arg Asp Ile Ile Asp Asp Phe Thr Asn Glu Ser Ser Gln Lys
1 5 10 15

Thr

<210> 18
<211> 23
<212> PRT
<213> diphtheria bacilli

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<222> (1)..(23)
<223> Diphtheria Th

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Asp Ser Glu Thr Ala Asp Asn Leu Glu Lys Thr Val Ala Ala Leu Ser
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Ile Leu Pro Gly His Gly Cys
20

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<212> PRT
<213> Plasmodium falciparum

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<221> PEPTIDE
<222> (1)..(21)
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Asp His Glu Lys Lys His Ala Lys Met Glu Lys Ala Ser Ser Val Phe
1 5 10 15

Asn Val Val Asn Ser
20

<210> 20
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<212> PRT
<213> Schistosoma mansoni

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<221> PEPTIDE
<222> (1)..(17)
<223> Schistosoma mansoni Th

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Lys Trp Phe Lys Thr Asn Ala Pro Asn Gly Val Asp Glu Lys His Arg
1 5 10 15

His

<210> 21
<211> 25
<212> PRT

<213> Cholera Toxin

<220>

<221> PEPTIDE

<222> (1)..(25)

<223> Cholera Toxin Th

<400> 21

Ala Leu Asn Ile Trp Asp Arg Phe Asp Val Phe Cys Thr Leu Gly Ala
1 5 10 15

Thr Thr Gly Tyr Leu Lys Gly Asn Ser
20 25

<210> 22

<211> 15

<212> PRT

<213> Measles virus

<220>

<221> PEPTIDE

<222> (1)..(15)

<223> MVF 2 Th

<400> 22

Ile ser Glu Ile Lys Gly val Ile val His Lys Ile Glu Gly Ile
1 5 10 15

<210> 23

<211> 22

<212> PRT

<213> Measles virus

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<223> KKKMVF 3 Th

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<222> (7)..(7)

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<220>

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<222> (10)..(10)

<223> K or R

<220>

<221> SITE

<222> (11)..(11)

<223> G or T

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<222> (15)..(15)

<223> H or T

<220>

<221> SITE

<222> (16)..(16)

<223> K or R

<220>
<221> SITE
<222> (19)..(19)
<223> G or T

<400> 23

Lys Lys Lys Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa
1 5 10 15

Ile Glu Xaa Ile Leu Phe
20

<210> 24
<211> 18
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<222> (1)..(18)
<223> HBsAg 1 Th

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<223> K or R

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<223> K or R

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<223> L or I or V or F

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<223> F or K or R

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<223> L or I or V or F

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<223> L or I or V or F

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Xaa Xaa Xaa Xaa Xaa Xaa Xaa Thr Xaa Xaa Xaa Thr Xaa Pro Xaa Ser
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Xaa Xaa

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<212> PRT

<213> Measles virus

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<222> (1)..(19)

<223> MVF 4 Th

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<221> SITE

<222> (4)..(4)

<223> S or T

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<222> (7)..(7)

<223> K or R

<220>

<221> SITE

<222> (8)..(8)

<223> G or T

<220>

<221> SITE

<222> (12)..(12)

<223> H or T

<220>

<221> SITE

<222> (13)..(13)
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Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe

<210> 26
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<221> PEPTIDE
<222> (1)..(18)
<223> HBSAg 2 Th

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<223> T or L

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<223> I or L

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<223> I or L

<220>
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<222> (14)..(14)
<223> P or I

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<222> (15)..(15)
<223> Q or T

<220>
<221> SITE
<222> (16)..(16)
<223> S or T

<220>
<221> SITE
<222> (17)..(17)
<223> L or I

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Lys Lys Lys Xaa Xaa Xaa Xaa Thr Arg Ile Xaa Thr Ile Xaa Xaa Xaa
1 5 10 15

Xaa Asp

<210> 27
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<213> Measles virus

<220>
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<223> MVF 5 Th

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Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe

<210> 28
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<213> Hepatitis B virus

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<221> PEPTIDE
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<223> HBsAg 3 Th

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Lys Lys Lys Ile Ile Thr Ile Thr Arg Ile Ile Thr Ile Ile Thr Thr
1 5 10 15

Ile Asp

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<223> Influenza Matrix protein 1 _1 Th

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<221> PEPTIDE
<222> (1)..(11)
<223> Influenza Matrix protein 1_1 Th

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Phe Val Phe Thr Leu Thr Val Pro Ser Glu Arg

1 5 10

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<212> PRT
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<223> Influenza Matrix protein 1_2 Th

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Ser Gly Pro Leu Lys Ala Glu Ile Ala Gln Arg Leu Glu Asp Val
1 5 10 15

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<223> Influenza Non-structural protein 1 Th

<400> 31

Asp Arg Leu Arg Arg Asp Gln Lys Ser
1 5

<210> 32
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<212> PRT
<213> Epstein-Barr virus

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<221> PEPTIDE
<222> (1)..(19)
<223> EBV BHRF1 Th

<400> 32

Ala Gly Leu Thr Leu Ser Leu Leu Val Ile Cys Ser Tyr Leu Phe Ile
1 5 10 15

Ser Arg Gly

<210> 33
<211> 15
<212> PRT
<213> Clostridium tetani

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<221> PEPTIDE
<222> (1)..(15)
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Gln Tyr Ile Lys Ala Asn Ser Lys Phe Ile Gly Ile Thr Glu Leu
1 5 10 15

<210> 34
<211> 20
<212> PRT
<213> Epstein-Barr virus

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<222> (1)..(20)
<223> EBV EBNA-1 Th

<400> 34

Pro Gly Pro Leu Arg Glu Ser Ile Val Cys Tyr Phe Met Val Phe Leu
1 5 10 15

Gln Thr His Ile
20

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<213> Clostridium tetani

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<222> (1)..(21)
<223> Clostridium tetani TT2 Th

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Phe Asn Asn Phe Thr Val Ser Phe Trp Leu Arg Val Pro Lys Val Ser
1 5 10 15

Ala Ser His Leu Glu
20

<210> 36
<211> 16
<212> PRT
<213> Clostridium tetani

<220>
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<223> Clostridium tetani TT3 Th

<400> 36

Lys Phe Ile Ile Lys Arg Tyr Thr Pro Asn Asn Glu Ile Asp Ser Phe
1 5 10 15

<210> 37
<211> 16
<212> PRT
<213> Clostridium tetani

<220>
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<400> 37

Val Ser Ile Asp Lys Phe Arg Ile Phe Cys Lys Ala Leu Asn Pro Lys
1 5 10 15

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<212> PRT
<213> Epstein-Barr virus

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<400> 38

Val Pro Gly Leu Tyr Ser Pro Cys Arg Ala Phe Phe Asn Lys Glu Glu
1 5 10 15

Leu Leu

<210> 39
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<213> Human cytomegalovirus

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<223> HCMV IE1 Th

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Asp Lys Arg Glu Met Trp Met Ala Cys Ile Lys Glu Leu His
1 5 10

<210> 40
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<223> EBV GP340 Th

<400> 40

Thr Gly His Gly Ala Arg Thr Ser Thr Glu Pro Thr Thr Asp Tyr
1 5 10 15

<210> 41
<211> 13
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<213> Epstein-Barr virus

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<222> (1)..(13)
<223> EBV BPLF1 Th

<400> 41

Lys Glu Leu Lys Arg Gln Tyr Glu Lys Lys Leu Arg Gln
1 5 10

<210> 42
<211> 11
<212> PRT
<213> Epstein-Barr virus

<220>
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<222> (1)..(11)
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<400> 42

Thr Val Phe Tyr Asn Ile Pro Pro Met Pro Leu
1 5 10

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<223> S or T

<220>
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<223> K or R

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<222> (8)..(8)
<223> G or T

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<222> (20)..(23)
<223> epsilon K-KKK as a spacer

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<222> (24)..(71)
<223> canine IL-31 97-144

<400> 43

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
35 40 45

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

Thr Ile Leu Gln Gln Phe Ser
65 70

<210> 44
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<223> canine IL-31 97-144

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Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
20 25 30

Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser
35 40 45

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

Gln Gln Phe Ser
65

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<211> 71
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<222> (24)..(71)
<223> canine IL-31 97-144

<400> 45

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
35 40 45

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

Thr Ile Leu Gln Gln Phe Ser
65 70

<210> 46
<211> 68
<212> PRT
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<223> Synthetic peptide

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<222> (20)..(20)
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<223> canine IL-31 97-144

<400> 46

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
20 25 30

Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser
35 40 45

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

Gln Gln Phe Ser
65

<210> 47
<211> 60
<212> PRT
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<223> Synthetic peptide

<220>

<221> PEPTIDE

<222> (1)..(19)

<223> MVF 4 Th (UBITH3)

<220>

<221> SITE

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<223> S or T

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<222> (7)..(7)

<223> K or R

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<222> (8)..(8)

<223> G or T

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<223> H or T

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<222> (13)..(13)

<223> K or R

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<221> SITE

<222> (20)..(20)

<223> epsilon-K

<220>

<221> PEPTIDE

<222> (20)..(23)

<223> epsilon K-KKK as a spacer

<220>

<221> PEPTIDE

<222> (24)..(60)

<223> canine IL-31 97-133

<400> 47

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
35 40 45

Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55 60

<210> 48

<211> 57

<212> PRT

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<220>
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<222> (1)..(19)
<223> MVF 4 Th (UBITH3)

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<223> S or T

<220>
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<222> (7)..(7)
<223> K or R

<220>
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<222> (8)..(8)
<223> G or T

<220>
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<222> (12)..(12)
<223> H or T

<220>
<221> SITE
<222> (13)..(13)
<223> K or R

<220>
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<222> (20)..(20)
<223> epsilon-K as a spacer

<220>
<221> PEPTIDE
<222> (21)..(57)
<223> canine IL-31 97-133

<400> 48

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
20 25 30

Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser
35 40 45

Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55

<210> 49
<211> 60
<212> PRT
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<220>
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<220>
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<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(60)
<223> canine IL-31 97-133

<400> 49

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
35 40 45

Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55 60

<210> 50
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<223> epsilon-K as a spacer

<220>
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<222> (21)..(57)
<223> canine IL-31 97-133

<400> 50

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
20 30

Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser
35 40 45

Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55

<210> 51
<211> 49
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<223> K or R

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<223> G or T

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<223> H or T

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<221> PEPTIDE
<222> (24)..(49)
<223> canine IL-31 97-122

<400> 51

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
35 40 45

Glu

<210> 52
<211> 46
<212> PRT
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<222> (4)..(4)
<223> S or T

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<222> (7)..(7)
<223> K or R

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<222> (8)..(8)
<223> G or T

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<222> (12)..(12)
<223> H or T

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<221> SITE
<222> (13)..(13)
<223> K or R

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K as a spacer

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<221> PEPTIDE
<222> (21)..(46)
<223> canine IL-31 97-122

<400> 52

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu

20

25

30

Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu
 35 40 45

<210> 53
 <211> 49
 <212> PRT
 <213> Artificial Sequence

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 <222> (1)..(19)
 <223> MVF5 Th (UBITH1)

<220>
 <221> SITE
 <222> (20)..(20)
 <223> epsilon-K

<220>
 <221> PEPTIDE
 <222> (20)..(23)
 <223> epsilon K-KKK as a spacer

<220>
 <221> PEPTIDE
 <222> (24)..(49)
 <223> canine IL-31 97-122

<400> 53

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
 1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
 20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
 35 40 45

Glu

<210> 54
 <211> 46
 <212> PRT
 <213> Artificial Sequence

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 <222> (1)..(19)
 <223> MVF 5 Th (UBITH1)

<220>
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<222> (20)..(20)
<223> epsilon-K as a spacer

<220>
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<222> (21)..(46)
<223> canine IL-31 97-122

<400> 54

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
20 25 30

Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu
35 40 45

<210> 55
<211> 41
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<223> MVF 4 Th (UBITH3)

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<222> (4)..(4)
<223> S or T

<220>
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<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>
<221> SITE
<222> (12)..(12)
<223> H or T

<220>
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<222> (13)..(13)
<223> K or R

<220>
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<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(41)
<223> canine IL-31 97-114

<400> 55

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys
35 40

<210> 56
<211> 38
<212> PRT
<213> Artificial Sequence

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<223> MVF 4 Th (UBITH3)

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<223> S or T

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<222> (7)..(7)
<223> K or R

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<222> (8)..(8)
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<223> H or T

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<222> (13)..(13)
<223> K or R

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<222> (20)..(20)
<223> epsilon-K as a spacer

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<222> (21)..(38)
<223> canine IL-31 97-114

<400> 56

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
20 25 30

Gln Leu Asp Lys Leu Lys
35

<210> 57
<211> 41
<212> PRT
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<222> (1)..(19)
<223> MVF5 Th (UBITH1)

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<222> (20)..(20)
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<220>
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<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(41)
<223> canine IL-31 97-114

<400> 57

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys
35 40

<210> 58
<211> 38
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<220>
<221> PEPTIDE
<222> (21)..(38)
<223> canine IL-31 97-114

<400> 58

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
20 25 30

Gln Leu Asp Lys Leu Lys
35

<210> 59
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<223> S or T

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<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>
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<222> (12)..(12)
<223> H or T

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<223> K or R

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<223> epsilon-K

<220>
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<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(44)
<223> canine IL-31 90-110

<400> 59

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser
20 25 30

Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu
35 40

<210> 60
<211> 41
<212> PRT
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<223> MVF 4 Th (UBITH3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

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<223> K or R

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<223> G or T

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<222> (12)..(12)
<223> H or T

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<223> K or R

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<222> (20)..(20)
<223> epsilon-K as a spacer

<220>
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<222> (21)..(41)
<223> canine IL-31 90-110

<400> 60

Ile Ser Ile xaa Glu Ile xaa xaa Val Ile Val xaa xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
20 25 30

Ile Ile Asp Lys Ile Ile Glu Gln Leu
35 40

<210> 61

<211> 44

<212> PRT

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<223> MVF5 Th (UBITH1)

<220>

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<223> epsilon-K

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<222> (20)..(23)

<223> epsilon K-KKK as a spacer

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<222> (24)..(44)

<223> canine IL-31 90-110

<400> 61

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser
20 25 30

Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu
35 40

<210> 62

<211> 41

<212> PRT

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<223> MVF 5 Th (UBITH1)

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<222> (20)..(20)

<223> epsilon-K as a spacer

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<221> PEPTIDE

<222> (21)..(41)

<223> canine IL-31 90-110

<400> 62

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
20 25 30

Ile Ile Asp Lys Ile Ile Glu Gln Leu
35 40

<210> 63

<211> 78

<212> PRT

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<223> Synthetic peptide

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<223> K or R

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<222> (24)..(78)
<223> canine IL-31 90-144

<400> 63

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser
20 25 30

Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys
35 40 45

Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe
50 55 60

Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 64
<211> 75
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<223> K or R

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<222> (20)..(20)
<223> epsilon-K as a spacer

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<222> (21)..(75)
<223> canine IL-31 90-144

<400> 64

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
20 25 30

Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His
35 40 45

Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55 60

Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 65
<211> 78
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<223> MVF5 Th (UBIth1)

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<223> epsilon-K

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<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
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<222> (24)..(78)
<223> canine IL-31 90-144

<400> 65

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser
20 25 30

Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys
35 40 45

Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe
50 55 60

Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 66
<211> 75
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<223> canine IL-31 90-144

<400> 66

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
20 25 30

Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His
35 40 45

Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55 60

Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 67
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<223> canine IL-31 90-144

<400> 67

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser
20 25 30

Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys
35 40 45

Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe
50 55 60

Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 68
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<223> G or T

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<222> (21)..(75)
<223> canine IL-31 90-144

<400> 68

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
20 25 30

Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His
35 40 45

Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55 60

Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 69
<211> 78
<212> PRT

<213> Artificial Sequence

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<223> Synthetic peptide

<220>

<221> PEPTIDE

<222> (1)..(19)

<223> MVF5 Th (UBITH1)

<220>

<221> SITE

<222> (20)..(20)

<223> epsilon-K

<220>

<221> PEPTIDE

<222> (20)..(23)

<223> epsilon K-KKK as a spacer

<220>

<221> PEPTIDE

<222> (24)..(78)

<223> canine IL-31 90-144

<400> 69

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser
20 25 30

Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys
35 40 45

Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe
50 55 60

Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 70

<211> 75

<212> PRT

<213> Artificial Sequence

<220>

<223> Synthetic peptide

<220>

<221> PEPTIDE

<222> (1)..(19)

<223> MVF 5 Th (UBITH1)

<220>

<221> SITE

<222> (20)..(20)

<223> epsilon-K as a spacer

<220>

<221> PEPTIDE

<222> (21)..(75)

<223> canine IL-31 90-144

<400> 70

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
20 25 30

Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His
35 40 45

Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55 60

Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 71

<211> 82

<212> PRT

<213> Artificial Sequence

<220>

<223> Synthetic peptide

<220>

<221> PEPTIDE

<222> (1)..(19)

<223> MVF 4 Th (UBITH3)

<220>

<221> SITE

<222> (4)..(4)

<223> S or T

<220>

<221> SITE

<222> (7)..(7)

<223> K or R

<220>

<221> SITE

<222> (8)..(8)

<223> G or T

<220>

<221> SITE

<222> (12)..(12)

<223> H or T

<220>

<221> SITE

<222> (13)..(13)

<223> K or R

<220>

<221> SITE

<222> (20)..(20)

<223> epsilon-K

<220>

<221> PEPTIDE

<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(82)
<223> canine IL-31 86-144

<400> 71

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Ala Ile Leu Pro Tyr Phe Arg Ala Ile
20 25 30

Arg Pro Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu
35 40 45

Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro
50 55 60

Ala Asp Thr Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln
65 70 75 80

Phe Ser

<210> 72
<211> 79
<212> PRT
<213> Artificial Sequence

<220>
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<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF 4 Th (UBITH3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

<220>
<221> SITE
<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>
<221> SITE
<222> (12)..(12)
<223> H or T

<220>
<221> SITE

<222> (13)..(13)

<223> K or R

<220>

<221> SITE

<222> (20)..(20)

<223> epsilon-K as a spacer

<220>

<221> PEPTIDE

<222> (21)..(79)

<223> canine IL-31 86-144

<400> 72

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Ala Ile Leu Pro Tyr Phe Arg Ala Ile Arg Pro Leu
20 25 30

Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu
35 40 45

Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr
50 55 60

Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 73

<211> 82

<212> PRT

<213> Artificial Sequence

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<220>

<221> PEPTIDE

<222> (1)..(19)

<223> MVF5 Th (UBITH1)

<220>

<221> SITE

<222> (20)..(20)

<223> epsilon-K

<220>

<221> PEPTIDE

<222> (20)..(23)

<223> epsilon K-KKK as a spacer

<220>

<221> PEPTIDE

<222> (24)..(82)

<223> canine IL-31 86-144

<400> 73

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Ala Ile Leu Pro Tyr Phe Arg Ala Ile
20 25 30

Arg Pro Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu
35 40 45

Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro
50 55 60

Ala Asp Thr Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln
65 70 75 80

Phe Ser

<210> 74
<211> 79
<212> PRT
<213> Artificial Sequence

<220>
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<222> (1)..(19)
<223> MVF 5 Th (UBITH1)

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K as a spacer

<220>
<221> PEPTIDE
<222> (21)..(79)
<223> canine IL-31 86-144

<400> 74

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Ala Ile Leu Pro Tyr Phe Arg Ala Ile Arg Pro Leu
20 25 30

Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu
35 40 45

Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr
50 55 60

Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser
65 70 75

<210> 75
<211> 76
<212> PRT
<213> Artificial Sequence

<220>
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<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF 4 Th (UBITH3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

<220>
<221> SITE
<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>
<221> SITE
<222> (12)..(12)
<223> H or T

<220>
<221> SITE
<222> (13)..(13)
<223> K or R

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(76)
<223> canine IL-31 97-149, C146 to S146

<400> 75

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
35 40 45

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

Thr Ile Leu Gln Gln Phe Ser Ala Ser Leu Glu Ser
65 70 75

<210> 76
 <211> 73
 <212> PRT
 <213> Artificial Sequence

<220>
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<220>
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 <222> (1)..(19)
 <223> MVF 4 Th (UBITH3)

<220>
 <221> SITE
 <222> (4)..(4)
 <223> S or T

<220>
 <221> SITE
 <222> (7)..(7)
 <223> K or R

<220>
 <221> SITE
 <222> (8)..(8)
 <223> G or T

<220>
 <221> SITE
 <222> (12)..(12)
 <223> H or T

<220>
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 <222> (13)..(13)
 <223> K or R

<220>
 <221> SITE
 <222> (20)..(20)
 <223> epsilon-K as a spacer

<220>
 <221> PEPTIDE
 <222> (21)..(73)
 <223> canine IL-31 97-149, C146 to S146

<400> 76

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
 1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
 20 25 30

Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser
 35 40 45

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

Gln Gln Phe Ser Ala Ser Leu Glu Ser

65

70

<210> 77
 <211> 76
 <212> PRT
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<220>
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 <222> (1)..(19)
 <223> MVF5 Th (UBITH1)

<220>
 <221> SITE
 <222> (20)..(20)
 <223> epsilon-K

<220>
 <221> PEPTIDE
 <222> (20)..(23)
 <223> epsilon K-KKK as a spacer

<220>
 <221> PEPTIDE
 <222> (24)..(76)
 <223> canine IL-31 97-149, C146 to S146

<400> 77

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
 1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys
 20 25 30

Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr
 35 40 45

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

Thr Ile Leu Gln Gln Phe Ser Ala Ser Leu Glu Ser
 65 70 75

<210> 78
 <211> 73
 <212> PRT
 <213> Artificial Sequence

<220>
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 <222> (1)..(19)
 <223> MVF 5 Th (UBITH1)

<220>
 <221> SITE

<222> (20)..(20)
<223> epsilon-K as a spacer

<220>
<221> PEPTIDE
<222> (21)..(73)
<223> canine IL-31 97-149, C146 to S146

<400> 78

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
20 25 30

Gln Leu Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser
35 40 45

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

Gln Gln Phe Ser Ala Ser Leu Glu Ser
65 70

<210> 79
<211> 83
<212> PRT
<213> Artificial Sequence

<220>
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<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF 4 Th (UBITH3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

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<221> SITE
<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

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<221> SITE
<222> (12)..(12)
<223> H or T

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<221> SITE
<222> (13)..(13)
<223> K or R

<220>

<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(83)
<223> canine IL-31 90-149, C146 to S146

<400> 79

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser
20 25 30

Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys
35 40 45

Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe
50 55 60

Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser Ala Ser
65 70 75 80

Leu Glu Ser

<210> 80
<211> 80
<212> PRT
<213> Artificial Sequence

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<220>
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<222> (1)..(19)
<223> MVF 4 Th (UBIth3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

<220>
<221> SITE
<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>

<221> SITE
<222> (12)..(12)
<223> H or T

<220>
<221> SITE
<222> (13)..(13)
<223> K or R

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K as a spacer

<220>
<221> PEPTIDE
<222> (21)..(80)
<223> canine IL-31 90-149, C146 to S146

<400> 80

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
20 25 30

Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His
35 40 45

Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55 60

Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser Ala Ser Leu Glu Ser
65 70 75 80

<210> 81
<211> 83
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF5 Th (UBITh1)

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(83)
<223> canine IL-31 90-149, C146 to S146

<400> 81

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser
20 25 30

Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys
35 40 45

Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe
50 55 60

Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser Ala Ser
65 70 75 80

Leu Glu Ser

<210> 82

<211> 80

<212> PRT

<213> Artificial Sequence

<220>

<223> Synthetic peptide

<220>

<221> PEPTIDE

<222> (1)..(19)

<223> MVF 5 Th (UBITH1)

<220>

<221> SITE

<222> (20)..(20)

<223> epsilon-K as a spacer

<220>

<221> PEPTIDE

<222> (21)..(80)

<223> canine IL-31 90-149, C146 to S146

<400> 82

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp Lys Asn
20 25 30

Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Lys Phe Gln His
35 40 45

Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr Phe Glu Cys Lys
50 55 60

Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser Ala Ser Leu Glu Ser
65 70 75 80

<210> 83
<211> 87
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF 4 Th (UBITH3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

<220>
<221> SITE
<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>
<221> SITE
<222> (12)..(12)
<223> H or T

<220>
<221> SITE
<222> (13)..(13)
<223> K or R

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(87)
<223> canine IL-31 86-149, C146 to S146

<400> 83

Ile Ser Ile xaa Glu Ile xaa xaa Val Ile Val xaa xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Ala Ile Leu Pro Tyr Phe Arg Ala Ile
20 25 30

Arg Pro Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu
35 40 45

Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro
50 55 60

Ala Asp Thr Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln
65 70 75 80

Phe Ser Ala Ser Leu Glu Ser
85

<210> 84
<211> 84
<212> PRT
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<220>
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<220>
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<222> (1)..(19)
<223> MVF 4 Th (UBITh3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

<220>
<221> SITE
<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>
<221> SITE
<222> (12)..(12)
<223> H or T

<220>
<221> SITE
<222> (13)..(13)
<223> K or R

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K as a spacer

<220>
<221> PEPTIDE
<222> (21)..(84)
<223> canine IL-31 86-149, C146 to S146

<400> 84

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Ala Ile Leu Pro Tyr Phe Arg Ala Ile Arg Pro Leu
20 25 30

Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu
35 40 45

Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr
50 55 60

Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser Ala
65 70 75 80

Ser Leu Glu Ser

<210> 85
<211> 87
<212> PRT
<213> Artificial Sequence

<220>
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<220>
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<222> (1)..(19)
<223> MVF5 Th (UBITH1)

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(87)
<223> canine IL-31 86-149, C146 to S146

<400> 85

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Ala Ile Leu Pro Tyr Phe Arg Ala Ile
20 25 30

Arg Pro Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu
35 40 45

Asp Lys Leu Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro
50 55 60

Ala Asp Thr Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln
65 70 75 80

Phe Ser Ala Ser Leu Glu Ser
85

<210> 86
<211> 84
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF 5 Th (UBITH1)

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K as a spacer

<220>
<221> PEPTIDE
<222> (21)..(84)
<223> canine IL-31 86-149, C146 to S146

<400> 86

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Ala Ile Leu Pro Tyr Phe Arg Ala Ile Arg Pro Leu
20 25 30

Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu
35 40 45

Lys Phe Gln His Glu Pro Glu Thr Glu Ile Ser Val Pro Ala Asp Thr
50 55 60

Phe Glu Cys Lys Ser Phe Ile Leu Thr Ile Leu Gln Gln Phe Ser Ala
65 70 75 80

Ser Leu Glu Ser

<210> 87
<211> 71
<212> PRT
<213> Artificial Sequence

<220>
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<220>
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<222> (1)..(19)
<223> MVF5 Th (UBITH1)

<220>
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<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(71)
<223> human IL-31 98-145

<400> 87

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Asp Asn Lys Ser Val Ile Asp Glu
20 25 30

Ile Ile Glu His Leu Asp Lys Leu Ile Phe Gln Asp Ala Pro Glu Thr
35 40 45

Asn Ile Ser Val Pro Thr Asp Thr His Glu Cys Lys Arg Phe Ile Leu
50 55 60

Thr Ile Ser Gln Gln Phe Ser
65 70

<210> 88
<211> 68
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF 5 Th (UBITH1)

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K as a spacer

<220>
<221> PEPTIDE
<222> (21)..(68)
<223> human IL-31 98-145

<400> 88

Ile Ser Ile Ser Glu Ile Lys Gly Val Ile Val His Lys Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Leu Asp Asn Lys Ser Val Ile Asp Glu Ile Ile Glu
20 25 30

His Leu Asp Lys Leu Ile Phe Gln Asp Ala Pro Glu Thr Asn Ile Ser
35 40 45

Val Pro Thr Asp Thr His Glu Cys Lys Arg Phe Ile Leu Thr Ile Ser
50 55 60

Gln Gln Phe Ser
65

<210> 89
<211> 71
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF 4 Th (UBITH3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

<220>
<221> SITE
<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>
<221> SITE
<222> (12)..(12)
<223> H or T

<220>
<221> SITE
<222> (13)..(13)
<223> K or R

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(71)
<223> human IL-31 98-145

<400> 89

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Leu Asp Asn Lys Ser Val Ile Asp Glu

20

25

30

Ile Ile Glu His Leu Asp Lys Leu Ile Phe Gln Asp Ala Pro Glu Thr
 35 40 45

Asn Ile Ser Val Pro Thr Asp Thr His Glu Cys Lys Arg Phe Ile Leu
 50 55 60

Thr Ile Ser Gln Gln Phe Ser
 65 70

<210> 90
 <211> 68
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Synthetic peptide

<220>
 <221> PEPTIDE
 <222> (1)..(19)
 <223> MVF 4 Th (UBITh3)

<220>
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 <222> (4)..(4)
 <223> S or T

<220>
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 <222> (7)..(7)
 <223> K or R

<220>
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 <222> (8)..(8)
 <223> G or T

<220>
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 <222> (12)..(12)
 <223> H or T

<220>
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 <222> (13)..(13)
 <223> K or R

<220>
 <221> SITE
 <222> (20)..(20)
 <223> epsilon-K as a spacer

<220>
 <221> PEPTIDE
 <222> (21)..(68)
 <223> human IL-31 98-145

<400> 90

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
 1 5 10 15

Ile Leu Phe Lys Leu Asp Asn Lys Ser Val Ile Asp Glu Ile Ile Glu
20 25 30

His Leu Asp Lys Leu Ile Phe Gln Asp Ala Pro Glu Thr Asn Ile Ser
35 40 45

Val Pro Thr Asp Thr His Glu Cys Lys Arg Phe Ile Leu Thr Ile Ser
50 55 60

Gln Gln Phe Ser
65

<210> 91
<211> 4
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> SITE
<222> (1)..(1)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (1)..(4)
<223> epsilon-K-KKK as a spacer

<400> 91

Lys Lys Lys Lys
1

<210> 92
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(6)
<223> Flexible Hinge Spacer

<400> 92

Pro Pro Xaa Pro Xaa Pro
1 5

<210> 93
<211> 64
<212> PRT
<213> Homo sapiens

<220>
<221> PEPTIDE
<222> (1)..(64)

<223> human IL-31 87-150, C147 to S147

<400> 93

Ala Ile Arg Ala Tyr Leu Lys Thr Ile Arg Gln Leu Asp Asn Lys Ser
1 5 10 15

Val Ile Asp Glu Ile Ile Glu His Leu Asp Lys Leu Ile Phe Gln Asp
20 25 30

Ala Pro Glu Thr Asn Ile Ser Val Pro Thr Asp Thr His Glu Cys Lys
35 40 45

Arg Phe Ile Leu Thr Ile Ser Gln Gln Phe Ser Glu Ser Met Asp Leu
50 55 60

<210> 94

<211> 9

<212> PRT

<213> Homo sapiens

<220>

<221> PEPTIDE

<222> (1)..(9)

<223> human IL-31 105-113

<400> 94

Asp Glu Ile Ile Glu His Leu Asp Lys
1 5

<210> 95

<211> 31

<212> PRT

<213> Homo sapiens

<220>

<221> PEPTIDE

<222> (1)..(31)

<223> human IL-31 85-115, S85 to C85, I115 to C115

<400> 95

Cys Pro Ala Ile Arg Ala Tyr Leu Lys Thr Ile Arg Gln Leu Asp Asn
1 5 10 15

Lys Ser Val Ile Asp Glu Ile Ile Glu His Leu Asp Lys Leu Cys
20 25 30

<210> 96

<211> 31

<212> PRT

<213> Canis lupus

<220>

<221> PEPTIDE

<222> (1)..(31)

<223> canine IL-31 84-114, S84 to C84, K114 to C114

<400> 96

Cys Ser Ala Ile Leu Pro Tyr Phe Arg Ala Ile Arg Pro Leu Ser Asp
1 5 10 15

Lys Asn Ile Ile Asp Lys Ile Ile Glu Gln Leu Asp Lys Leu Cys
20 25 30

<210> 97
<211> 32
<212> PRT
<213> Mus musculus

<220>
<221> 1PEPTIDE
<222> (1)..(32)
<223> murine IL-31 86-117, S86 to C86

<400> 97

Cys Val Ile Ile Ala His Leu Glu Lys Val Lys Val Leu Ser Glu Asn
1 5 10 15

Thr Val Asp Thr Ser Trp Val Ile Arg Trp Leu Thr Asn Ile Ser Cys
20 25 30

<210> 98
<211> 30
<212> PRT
<213> Mus musculus

<220>
<221> PEPTIDE
<222> (1)..(30)
<223> murine IL-31 87-116, V87 to C87, S116 to C116

<400> 98

Cys Ile Ile Ala His Leu Glu Lys Val Lys Val Leu Ser Glu Asn Thr
1 5 10 15

Val Asp Thr Ser Trp Val Ile Arg Trp Leu Thr Asn Ile Cys
20 25 30

<210> 99
<211> 87
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF5 Th (UBITH1)

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(87)
<223> human IL-31 87-150, C147 to S147

<400> 99

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Ala Ile Arg Ala Tyr Leu Lys Thr Ile
20 25 30

Arg Gln Leu Asp Asn Lys Ser Val Ile Asp Glu Ile Ile Glu His Leu
35 40 45

Asp Lys Leu Ile Phe Gln Asp Ala Pro Glu Thr Asn Ile Ser Val Pro
50 55 60

Thr Asp Thr His Glu Cys Lys Arg Phe Ile Leu Thr Ile Ser Gln Gln
65 70 75 80

Phe Ser Glu Ser Met Asp Leu
85

<210> 100
<211> 32
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF5 Th (UBITH1)

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(32)
<223> human IL-31 105-113

<400> 100

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Asp Glu Ile Ile Glu His Leu Asp Lys
20 25 30

<210> 101
<211> 54
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MvF5 Th (UBITh1)

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(54)
<223> human IL-31 85-115, S85 to C85, I115 to C115

<400> 101

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Cys Pro Ala Ile Arg Ala Tyr Leu Lys
20 25 30

Thr Ile Arg Gln Leu Asp Asn Lys Ser Val Ile Asp Glu Ile Ile Glu
35 40 45

His Leu Asp Lys Leu Cys
50

<210> 102
<211> 54
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MvF5 Th (UBITh1)

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(54)
<223> canine IL-31 84-114, S84 to C84, K114 to C114

<400> 102

Ile Ser Ile Thr Glu Ile Lys Gly Val Ile Val His Arg Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Cys Ser Ala Ile Leu Pro Tyr Phe Arg
20 25 30

Ala Ile Arg Pro Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
35 40 45

Gln Leu Asp Lys Leu Cys
50

<210> 103
<211> 54
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic peptide

<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF 4 Th (UBITH3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

<220>
<221> SITE
<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>
<221> SITE
<222> (12)..(12)
<223> H or T

<220>
<221> SITE
<222> (13)..(13)
<223> K or R

<220>
<221> SITE

<222> (20)..(20)

<223> epsilon-K

<220>

<221> PEPTIDE

<222> (20)..(23)

<223> epsilon K-KKK as a spacer

<220>

<221> PEPTIDE

<222> (24)..(54)

<223> canine IL-31 84-114, S84 to C84, K114 to C114

<400> 103

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Cys Ser Ala Ile Leu Pro Tyr Phe Arg
20 25 30

Ala Ile Arg Pro Leu Ser Asp Lys Asn Ile Ile Asp Lys Ile Ile Glu
35 40 45

Gln Leu Asp Lys Leu Cys
50

<210> 104

<211> 55

<212> PRT

<213> Artificial Sequence

<220>

<223> Synthetic peptide

<220>

<221> PEPTIDE

<222> (1)..(19)

<223> MVF 4 Th (UBITH3)

<220>

<221> SITE

<222> (4)..(4)

<223> S or T

<220>

<221> SITE

<222> (7)..(7)

<223> K or R

<220>

<221> SITE

<222> (8)..(8)

<223> G or T

<220>

<221> SITE

<222> (12)..(12)

<223> H or T

<220>

<221> SITE

<222> (13)..(13)

<223> K or R

<220>
<221> SITE
<222> (20)..(20)
<223> epsilon-K

<220>
<221> PEPTIDE
<222> (20)..(23)
<223> epsilon K-KKK as a spacer

<220>
<221> PEPTIDE
<222> (24)..(55)
<223> murine IL-31 86-117, S86 to C86

<400> 104

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Cys Val Ile Ile Ala His Leu Glu Lys
20 25 30

Val Lys Val Leu Ser Glu Asn Thr Val Asp Thr Ser Trp Val Ile Arg
35 40 45

Trp Leu Thr Asn Ile Ser Cys
50 55

<210> 105
<211> 53
<212> PRT
<213> Artificial Sequence

<220>
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<220>
<221> PEPTIDE
<222> (1)..(19)
<223> MVF 4 Th (UBITH3)

<220>
<221> SITE
<222> (4)..(4)
<223> S or T

<220>
<221> SITE
<222> (7)..(7)
<223> K or R

<220>
<221> SITE
<222> (8)..(8)
<223> G or T

<220>
<221> SITE
<222> (12)..(12)
<223> H or T

<220>
<221> SITE
<222> (13)..(13)

<223> K or R

<220>

<221> SITE

<222> (20)..(20)

<223> epsilon-K

<220>

<221> PEPTIDE

<222> (20)..(23)

<223> epsilon K-KKK as a spacer

<220>

<221> PEPTIDE

<222> (24)..(53)

<223> murine IL-31 87-116, v87 to c87, s116 to c116

<400> 105

Ile Ser Ile Xaa Glu Ile Xaa Xaa Val Ile Val Xaa Xaa Ile Glu Thr
1 5 10 15

Ile Leu Phe Lys Lys Lys Lys Cys Ile Ile Ala His Leu Glu Lys Val
20 25 30

Lys Val Leu Ser Glu Asn Thr Val Asp Thr Ser Trp Val Ile Arg Trp
35 40 45

Leu Thr Asn Ile Cys
50

<210> 106

<211> 21

<212> DNA

<213> Artificial Sequence

<220>

<223> HPRT forward primer

<400> 106

tgacactggc aaaacaatgc a

21

<210> 107

<211> 21

<212> DNA

<213> Artificial Sequence

<220>

<223> HPRT Reverse Primer

<400> 107

ggtccttttc accagcaagc t

21

<210> 108

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> CpG1 oligonucleotide ODN

<400> 108

tcgtcgtttt gtcgttttgt cgttttgtcg tt

32

<210> 109
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> CpG2 oligonucleotide ODN

<220>
<221> misc_feature
<222> (1)..(1)
<223> phosphorothioate group

<400> 109
tcgtcgtttt gtcgttttgt cgtt

24

<210> 110
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> CpG3 Oligonucleotide ODN

<400> 110
tcgtcgtttt gtcgttttgt cgtt

24