

PA154565PCT-seq1
SEQUENCE LISTING

<110> University of Cape Town
<120> HPV Chimaeric Particle
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<140> ZA 2011/08841
<141> 2011-12-01
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<170> PatentIn version 3.5
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<213> Artificial sequence
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<223> Human papillomavirus type 16 L1 polypeptide
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Pro Val Ser Lys Val Val Ser Thr Asp Glu Tyr Val Ala Arg Thr Asn
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Ile Tyr Tyr His Ala Gly Thr Ser Arg Leu Leu Ala Val Gly His Pro
35 40 45

Tyr Phe Pro Ile Lys Lys Pro Asn Asn Asn Lys Ile Leu Val Pro Lys
50 55 60

Val Ser Gly Leu Gln Tyr Arg Val Phe Arg Ile His Leu Pro Asp Pro
65 70 75 80

Asn Lys Phe Gly Phe Pro Asp Thr Ser Phe Tyr Asn Pro Asp Thr Gln
85 90 95

Arg Leu Val Trp Ala Cys Val Gly Val Glu Val Gly Arg Gly Gln Pro
100 105 110

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

Thr Glu Asn Ala Ser Ala Tyr Ala Ala Asn Ala Gly Val Asp Asn Arg
130 135 140

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

Cys Lys Pro Pro Ile Gly Glu His Trp Gly Lys Gly Ser Pro Cys Thr
165 170 175

PA154565PCT-seq1

Asn Val Ala Val Asn Pro Gly Asp Cys Pro Pro Leu Glu Leu Ile Asn
 180 185 190
 Thr Val Ile Gln Asp Gly Asp Met Val Asp Thr Gly Phe Gly Ala Met
 195 200 205
 Asp Phe Thr Thr Leu Gln Ala Asn Lys Ser Glu Val Pro Leu Asp Ile
 210 215 220
 Cys Thr Ser Ile Cys Lys Tyr Pro Asp Tyr Ile Lys Met Val Ser Glu
 225 230 235 240
 Pro Tyr Gly Asp Ser Leu Phe Phe Tyr Leu Arg Arg Glu Gln Met Phe
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 Val Arg His Leu Phe Asn Arg Ala Gly Ala Val Gly Glu Asn Val Pro
 260 265 270
 Asp Asp Leu Tyr Ile Lys Gly Ser Gly Ser Thr Ala Asn Leu Ala Ser
 275 280 285
 Ser Asn Tyr Phe Pro Thr Pro Ser Gly Ser Met Val Thr Ser Asp Ala
 290 295 300
 Gln Ile Phe Asn Lys Pro Tyr Trp Leu Gln Arg Ala Gln Gly His Asn
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 Asn Gly Ile Cys Trp Gly Asn Gln Leu Phe Val Thr Val Val Asp Thr
 325 330 335
 Thr Arg Ser Thr Asn Met Ser Leu Cys Ala Ala Ile Ser Thr Ser Glu
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 Thr Thr Tyr Lys Asn Thr Asn Phe Lys Glu Tyr Leu Arg His Gly Glu
 355 360 365
 Glu Tyr Asp Leu Gln Phe Ile Phe Gln Leu Cys Lys Ile Thr Leu Thr
 370 375 380
 Ala Asp Val Met Thr Tyr Ile His Ser Met Asn Ser Thr Ile Leu Glu
 385 390 395 400
 Asp Trp Asn Phe Gly Leu Gln Pro Pro Pro Gly Gly Thr Leu Glu Asp
 405 410 415
 Thr Tyr Arg Phe Val Thr Ser Gln Ala Ile Ala Cys Gln Lys His Thr
 420 425 430
 Pro Pro Ala Pro Lys Glu Asp Pro Leu Lys Lys Tyr Thr Phe Trp Glu
 435 440 445

PA154565PCT-seq1

Val Asn Leu Lys Glu Lys Phe Ser Ala Asp Leu Asp Gln Phe Pro Leu
450 455 460

Gly Arg Lys Phe Leu Leu Gln Ala Gly Leu Lys Ala Lys Pro Lys Phe
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Thr Ala Lys Arg Lys Lys Arg Lys Leu
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ctggtgcccga aggtgagcgg cctgcaatac cgggtgttca gaatccacct gcccgacccc 240
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PA154565PCT-seq1

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 cagttccctc tgggcagaaa gttcctgctg caagccggcc tgaaggccaa gcctaagttc 1440
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 <223> L2 BPV (1-88) epitope

PA154565PCT-seq1

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Val Glu Gly Asp Thr Ile Ala Asp Lys Ile Leu Lys Phe Gly Gly Leu
35 40 45

Ala Ile Tyr Leu Gly Gly Leu Gly Ile Gly Thr Trp Ser Thr Gly Arg
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<223> Human codon optimised nucleotide sequence encoding L2(108-120)
epitope

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<212> DNA

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<223> Human codon optimised nucleotide sequence encoding L2(56-81)
epitope

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ggcaccagac cccccacc

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<212> DNA

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<223> Human codon optimised nucleotide sequence encoding L2(17-36)
epitope

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PA154565PCT-seq1

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 aagatcctga agttcggcgg cctggccatc tacctgggcg gcctgggcat tggcacctgg 180
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 <223> Oligonucleotide - ModNew Forward

<400> 13
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PA154565PCT-seq1

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 <223> Oligonucleotide - L1 Reverse
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 <223> Oligonucleotide - L2 Forward

PA154565PCT-seq1

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<213> Artificial sequence

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

Ile Tyr Tyr His Ala Gly Thr Ser Arg Leu Leu Ala Val Gly His Pro
35 40 45

Tyr Phe Pro Ile Lys Lys Pro Asn Asn Asn Lys Ile Leu Val Pro Lys
50 55 60

Val Ser Gly Leu Gln Tyr Arg Val Phe Arg Ile His Leu Pro Asp Pro
65 70 75 80

Asn Lys Phe Gly Phe Pro Asp Thr Ser Phe Tyr Asn Pro Asp Thr Gln
85 90 95

Arg Leu Val Trp Ala Cys Val Gly Val Glu Val Gly Arg Gly Gln Pro
100 105 110

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

Thr Glu Asn Ala Ser Ala Tyr Ala Ala Asn Ala Gly Val Asp Asn Arg
130 135 140

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

Cys Lys Pro Pro Ile Gly Glu His Trp Gly Lys Gly Ser Pro Cys Thr
Page 8

PA154565PCT-seq1

165

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Asn Val Ala Val Asn Pro Gly Asp Cys Pro Pro Leu Glu Leu Ile Asn
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Thr Val Ile Gln Asp Gly Asp Met Val Asp Thr Gly Phe Gly Ala Met
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Asp Phe Thr Thr Leu Gln Ala Asn Lys Ser Glu Val Pro Leu Asp Ile
210 215 220

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

Val Arg His Leu Phe Asn Arg Ala Gly Ala Val Gly Glu Asn Val Pro
260 265 270

Asp Asp Leu Tyr Ile Lys Gly Ser Gly Ser Thr Ala Asn Leu Ala Ser
275 280 285

Ser Asn Tyr Phe Pro Thr Pro Ser Gly Ser Met Val Thr Ser Asp Ala
290 295 300

Gln Ile Phe Asn Lys Pro Tyr Trp Leu Gln Arg Ala Gln Gly His Asn
305 310 315 320

Asn Gly Ile Cys Trp Gly Asn Gln Leu Phe Val Thr Val Val Asp Thr
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Thr Arg Ser Thr Asn Met Ser Leu Cys Ala Ala Ile Ser Thr Ser Glu
340 345 350

Thr Thr Tyr Lys Asn Thr Asn Phe Lys Glu Tyr Leu Arg His Gly Glu
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Glu Tyr Asp Leu Gln Phe Ile Phe Gln Leu Cys Lys Ile Thr Leu Thr
370 375 380

Ala Asp Val Met Thr Tyr Ile His Ser Met Asn Ser Thr Ile Leu Glu
385 390 395 400

Asp Trp Asn Phe Gly Leu Gln Pro Pro Pro Gly Gly Thr Leu Val Glu
405 410 415

Glu Thr Ser Phe Ile Asp Ala Gly Ala Pro Ala Cys Gln Lys His Thr
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Pro Pro Ala Pro Lys Glu Asp Pro Leu Lys Lys Tyr Thr Phe Trp Glu

PA154565PCT-seq1

435

440

445

Val Asn Leu Lys Glu Lys Phe Ser Ala Asp Leu Asp Gln Phe Pro Leu
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Gly Arg Lys Phe Leu Leu Gln Ala Gly Leu Lys Ala Lys Pro Lys Phe
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Thr Leu Gly Lys Arg Lys Ala Thr Pro Thr Thr Ser Ser Thr Ser Thr
485 490 495

Thr Ala Lys Arg Lys Lys Arg Lys Leu
500 505

<210> 23

<211> 505

<212> PRT

<213> Artificial sequence

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<223> Chimaeric HPV L1/L2(56-81) polypeptide

<400> 23

Met Ser Leu Trp Leu Pro Ser Glu Ala Thr Val Tyr Leu Pro Pro Val
1 5 10 15

Pro Val Ser Lys Val Val Ser Thr Asp Glu Tyr Val Ala Arg Thr Asn
20 25 30

Ile Tyr Tyr His Ala Gly Thr Ser Arg Leu Leu Ala Val Gly His Pro
35 40 45

Tyr Phe Pro Ile Lys Lys Pro Asn Asn Asn Lys Ile Leu Val Pro Lys
50 55 60

Val Ser Gly Leu Gln Tyr Arg Val Phe Arg Ile His Leu Pro Asp Pro
65 70 75 80

Asn Lys Phe Gly Phe Pro Asp Thr Ser Phe Tyr Asn Pro Asp Thr Gln
85 90 95

Arg Leu Val Trp Ala Cys Val Gly Val Glu Val Gly Arg Gly Gln Pro
100 105 110

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

Thr Glu Asn Ala Ser Ala Tyr Ala Ala Asn Ala Gly Val Asp Asn Arg
130 135 140

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

PA154565PCT-seq1

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

PA154565PCT-seq1

Leu Gly Thr Arg Pro Pro Thr Pro Leu Lys Lys Tyr Thr Phe Trp Glu
435 440 445

Val Asn Leu Lys Glu Lys Phe Ser Ala Asp Leu Asp Gln Phe Pro Leu
450 455 460

Gly Arg Lys Phe Leu Leu Gln Ala Gly Leu Lys Ala Lys Pro Lys Phe
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20 25 30

Ile Tyr Tyr His Ala Gly Thr Ser Arg Leu Leu Ala Val Gly His Pro
35 40 45

Tyr Phe Pro Ile Lys Lys Pro Asn Asn Asn Lys Ile Leu Val Pro Lys
50 55 60

Val Ser Gly Leu Gln Tyr Arg Val Phe Arg Ile His Leu Pro Asp Pro
65 70 75 80

Asn Lys Phe Gly Phe Pro Asp Thr Ser Phe Tyr Asn Pro Asp Thr Gln
85 90 95

Arg Leu Val Trp Ala Cys Val Gly Val Glu Val Gly Arg Gly Gln Pro
100 105 110

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

Thr Glu Asn Ala Ser Ala Tyr Ala Ala Asn Ala Gly Val Asp Asn Arg
130 135 140

Glu Cys Ile Ser Met Asp Tyr Lys Gln Thr Gln Leu Cys Leu Ile Gly

PA154565PCT-seq1

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PA154565PCT-seq1

420

425

430

Val Pro Ala Pro Lys Glu Asp Pro Leu Lys Lys Tyr Thr Phe Trp Glu
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Val Asn Leu Lys Glu Lys Phe Ser Ala Asp Leu Asp Gln Phe Pro Leu
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Gly Arg Lys Phe Leu Leu Gln Ala Gly Leu Lys Ala Lys Pro Lys Phe
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Thr Ala Lys Arg Lys Lys Arg Lys Leu
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<223> Chimaeric HPV L1/L2 BPV(1-88) polypeptide

<400> 25

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Pro Val Ser Lys Val Val Ser Thr Asp Glu Tyr Val Ala Arg Thr Asn
20 25 30

Ile Tyr Tyr His Ala Gly Thr Ser Arg Leu Leu Ala Val Gly His Pro
35 40 45

Tyr Phe Pro Ile Lys Lys Pro Asn Asn Asn Lys Ile Leu Val Pro Lys
50 55 60

Val Ser Gly Leu Gln Tyr Arg Val Phe Arg Ile His Leu Pro Asp Pro
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Asn Lys Phe Gly Phe Pro Asp Thr Ser Phe Tyr Asn Pro Asp Thr Gln
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Arg Leu Val Trp Ala Cys Val Gly Val Glu Val Gly Arg Gly Gln Pro
100 105 110

Leu Gly Val Gly Ile Ser Gly His Pro Leu Leu Asn Lys Leu Asp Asp
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Thr Glu Asn Ala Ser Ala Tyr Ala Ala Asn Ala Gly Val Asp Asn Arg
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PA154565PCT-seq1

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 Cys Lys Pro Pro Ile Gly Glu His Trp Gly Lys Gly Ser Pro Cys Thr
 165 170 175
 Asn Val Ala Val Asn Pro Gly Asp Cys Pro Pro Leu Glu Leu Ile Asn
 180 185 190
 Thr Val Ile Gln Asp Gly Asp Met Val Asp Thr Gly Phe Gly Ala Met
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 Asp Phe Thr Thr Leu Gln Ala Asn Lys Ser Glu Val Pro Leu Asp Ile
 210 215 220
 Cys Thr Ser Ile Cys Lys Tyr Pro Asp Tyr Ile Lys Met Val Ser Glu
 225 230 235 240
 Pro Tyr Gly Asp Ser Leu Phe Phe Tyr Leu Arg Arg Glu Gln Met Phe
 245 250 255
 Val Arg His Leu Phe Asn Arg Ala Gly Ala Val Gly Glu Asn Val Pro
 260 265 270
 Asp Asp Leu Tyr Ile Lys Gly Ser Gly Ser Thr Ala Asn Leu Ala Ser
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PA154565PCT-seq1

Arg Lys Arg Val Lys Arg Ala Ser Ala Tyr Asp Leu Tyr Arg Thr Cys
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Lys Gln Ala Gly Thr Cys Pro Pro Asp Val Ile Pro Lys Val Glu Gly
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Asp Thr Ile Ala Asp Lys Ile Leu Lys Phe Gly Gly Leu Ala Ile Tyr
450 455 460

Leu Gly Gly Leu Gly Ile Gly Thr Trp Ser Thr Gly Arg Val Ala Ala
465 470 475 480

Gly Gly Ser Pro Arg Tyr Thr Pro Leu Arg Thr Ala Gly Ser Thr Ser
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Ser Leu Ala Ser Ile
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L1/L2(108-120) polypeptide

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ctggtgcccga aggtgagcgg cctgcaatac cgggtgttca gaatccacct gcccgacccc 240
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gcctgcgtgg gcgtggaggt gggcagaggc cagcctctgg gcgtgggcat cagcggccac 360
cctctgctga acaagctgga cgacaccgag aacgccagcg cctacgccgc caacgccggc 420
gtggataaca gagaatgcat cagcatggac tacaagcaga cccagctgtg cctcatcggc 480
tgcaagcccc ccatcggcga gactggggc aagggcagcc cctgcaccaa cgtggccgtg 540
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accagcgacg cccagatctt caacaagccc tactggctcc agagagccca gggccacaac 960
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PA154565PCT-seq1

aacatgtccc	tgtgcgccgc	catcagcacc	agcgagacca	cctacaagaa	caccaacttc	1080
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atcacccctca	ccgccgacgt	gatgacctac	atccacagca	tgaacagcac	catcctggag	1200
gactggaact	tcggcctgca	gccccctcct	ggcggcacc	tggtggagga	gaccagcttc	1260
atcgacgccg	gagccccgc	atgccagaag	cacaccctc	ccgccctaa	ggaggacccc	1320
ctgaagaagt	acaccttctg	ggagggtgaac	ctgaaggaga	agttcagcgc	cgacctggac	1380
cagttccctc	tgggcagaaa	gttcctgctg	caagccggcc	tgaaggccaa	gcctaagttc	1440
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<210> 27

<211> 1521

<212> DNA

<213> Artificial sequence

<220>

<223> Human-codon optimised nucleotide sequence encoding chimaeric HPV L1/L2(56-81) polypeptide

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agactgctgg	ccgtggggcca	cccctacttc	cccatcaaga	agcccaacaa	caacaagatc	180
ctggtgcca	aggtgagcgg	cctgcaatac	cggtgtttca	gaatccacct	gcccgaacccc	240
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gcctgcgtgg	gcgtggaggt	gggcagaggc	cagcctctgg	gcgtgggcat	cagcggccac	360
cctctgctga	acaagctgga	cgacaccgag	aacgccagcg	cctacgccgc	caacgccggc	420
gtggataaca	gagaatgcat	cagcatggac	tacaagcaga	cccagctgtg	cctcatcggc	480
tgcaagcccc	ccatcggcga	gcactggggc	aagggcagcc	cctgcaccaa	cgtggccgtg	540
aatcctggcg	actgtcctcc	cctggaactc	atcaacaccg	tgatccagga	cggcgacatg	600
gtggacaccg	gcttcggcgc	catggacttc	accaccctcc	aggccaataa	gagcgagggtg	660
cccctggaca	tctgcaccag	catctgcaag	taccccgact	acatcaagat	ggtgagcgag	720
ccctacggcg	atagcctggt	cttctacctg	cggcgggagc	agatgttcgt	gcggcacctg	780
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aatggcatct	gctggggcaa	ccagctgttc	gtgaccgtgg	tggataccac	ccggagcacc	1020
aacatgtccc	tgtgcgccgc	catcagcacc	agcgagacca	cctacaagaa	caccaacttc	1080
aaggagtacc	tgaggcacgg	cgaggagtac	gacctccagt	tcatctttcca	gctgtgcaag	1140

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atcacctca	ccgccgacgt	gatgacctac	atccacagca	tgaacagcac	catcctggag	1200
gactggaact	tcggcctgca	gccccctcct	ggcggcacag	gcggcctggg	catcggcacc	1260
ggcagcggca	ccgggggag	gaccggctac	atccccctgg	gcaccagacc	ccccaccccc	1320
ctgaagaagt	acaccttctg	ggagggtgaac	ctgaaagaga	agttcagcgc	cgacctggac	1380
cagttccctc	tgggcccggaa	gttcctgctc	caggctgggc	tgaaggccaa	gcccaagttc	1440
accctgggca	agcggaaggc	cacccccacc	acctccagca	ccagcaccac	cgccaagcgg	1500
aagaaacgga	agctgtgatg	a				1521

<210> 28

<211> 1521

<212> DNA

<213> Artificial sequence

<220>

<223> Human-codon optimised nucleotide sequence encoding chimaeric HPV L1/L2(17-36) polypeptide

<400> 28

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agactgctgg	ccgtggggcca	cccctacttc	cccatcaaga	agcccaacaa	caacaagatc	180
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gcctgcgtgg	gcgtggaggt	gggcagaggc	cagcctctgg	gcgtgggcat	cagcggccac	360
cctctgctga	acaagctgga	cgacaccgag	aacgccagcg	cctacgccgc	caacgccggc	420
gtggataaca	gagaatgcat	cagcatggac	tacaagcaga	cccagctgtg	cctcatcggc	480
tgcaagcccc	ccatcggcga	gcactggggc	aagggcagcc	cctgcaccaa	cgtaggccgtg	540
aatcctggcg	actgtcctcc	cctggaactc	atcaacaccg	tgatccagga	cggcgacatg	600
gtggacaccg	gcttcggcgc	catggacttc	accacctcc	aggccaataa	gagcgaggtg	660
cccctggaca	tctgcaccag	catctgcaag	taccccgact	acatcaagat	ggtgagcgag	720
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aatggcatct	gctggggcaa	ccagctgttc	gtgaccgtgg	tggataccac	ccggagcacc	1020
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aaggagtacc	tgaggcacgg	cgaggagtac	gacctccagt	tcattctcca	gctgtgcaag	1140
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gactggaact	tcggcctgca	gcctcctcct	ggcggcacc	agctgtacaa	gacctgcaag	1260
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PA154565PCT-seq1

ctgaagaagt acaccttctg ggaagtgaac ctgaaagaga agttcagcgc cgatctggac	1380
cagttccccc tcggccggaa gttcctgctc caggctggcc tgaaggccaa gcccaagttc	1440
accctgggca agaggaaggc cccccccacc acaagcagca ccagcaccac cgccaagcgg	1500
aagaaacgga agctgtgatg a	1521

<210> 29
 <211> 1509
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Human-codon optimised nucleotide sequence encoding chimaeric HPV L1/L2 BPV(1-88) polypeptide

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agactgctgg ccgtgggcca cccctacttc cccatcaaga agcccaacaa caacaagatc	180
ctggtgcca aggtgagcgg cctgcaatac cgggtgttca gaatccacct gcccgacccc	240
aataagtctg gcttccccga caccagcttc tacaaccccc acaccagag actggtgtgg	300
gcctgctgg gcgtggaggt gggcagaggc cagcctctgg gcgtgggcat cagcggccac	360
cctctgctga acaagctgga cgacaccgag aacgccagcg cctacgccgc caacgccggc	420
gtggataaca gagaatgcat cagcatggac tacaagcaga cccagctgtg cctcatcggc	480
tgcaagcccc ccatcggcga gactggggc aagggcagcc cctgcaccaa cgtggccgtg	540
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gacgtgatcc ccaaggtgga gggcgacaca atcgccgaca agatcctgaa gttcggcggc	1380
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atctgatga 1509