

SEQUENCE LISTING

<110> INMED PHARMACEUTICALS INC.

<120> COMPOSITIONS AND METHODS FOR BIOSYNTHESIS OF TERPENOIDS OR CANNABINOIDS IN A HETEROLOGOUS SYSTEM

<130> V815026W0

<140> PCT/CA2020/050309

<141> 2020-03-06

<150> 62/814,823

<151> 2019-03-06

<150> 62/814,816

<151> 2019-03-06

<160> 39

<170> PatentIn version 3.5

<210> 1

<211> 516

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<220>

<223> cannabidiolic-acid synthase; A6P6V9.1; signal peptide removed

<300>

<308> A6P6V9.1

<400> 1

Asn	Pro	Arg	Glu	Asn	Phe	Leu	Lys	Cys	Phe	Ser	Gln	Tyr	Ile	Pro	Asn
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Asn	Ala	Thr	Asn	Leu	Lys	Leu	Val	Tyr	Thr	Gln	Asn	Asn	Pro	Leu	Tyr
			20					25					30		

Met	Ser	Val	Leu	Asn	Ser	Thr	Ile	His	Asn	Leu	Arg	Phe	Thr	Ser	Asp
		35					40					45			

Thr	Thr	Pro	Lys	Pro	Leu	Val	Ile	Val	Thr	Pro	Ser	His	Val	Ser	His
						55					60				

Ile Gln Gly Thr Ile Leu Cys Ser Lys Lys Val Gly Leu Gln Ile Arg
65 70 75 80

Thr Arg Ser Gly Gly His Asp Ser Glu Gly Met Ser Tyr Ile Ser Gln
85 90 95

Val Pro Phe Val Ile Val Asp Leu Arg Asn Met Arg Ser Ile Lys Ile
100 105 110

Asp Val His Ser Gln Thr Ala Trp Val Glu Ala Gly Ala Thr Leu Gly
115 120 125

Glu Val Tyr Tyr Trp Val Asn Glu Lys Asn Glu Asn Leu Ser Leu Ala
130 135 140

Ala Gly Tyr Cys Pro Thr Val Cys Ala Gly Gly His Phe Gly Gly Gly
145 150 155 160

Gly Tyr Gly Pro Leu Met Arg Asn Tyr Gly Leu Ala Ala Asp Asn Ile
165 170 175

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

Ser Met Gly Glu Asp Leu Phe Trp Ala Leu Arg Gly Gly Gly Ala Glu
195 200 205

Ser Phe Gly Ile Ile Val Ala Trp Lys Ile Arg Leu Val Ala Val Pro
210 215 220

Lys Ser Thr Met Phe Ser Val Lys Lys Ile Met Glu Ile His Glu Leu
225 230 235 240

Val Lys Leu Val Asn Lys Trp Gln Asn Ile Ala Tyr Lys Tyr Asp Lys
245 250 255

Asp Leu Leu Leu Met Thr His Phe Ile Thr Arg Asn Ile Thr Asp Asn
260 265 270

Gln Gly Lys Asn Lys Thr Ala Ile His Thr Tyr Phe Ser Ser Val Phe

275

280

285

Leu Gly Gly Val Asp Ser Leu Val Asp Leu Met Asn Lys Ser Phe Pro
 290 295 300

Glu Leu Gly Ile Lys Lys Thr Asp Cys Arg Gln Leu Ser Trp Ile Asp
 305 310 315 320

Thr Ile Ile Phe Tyr Ser Gly Val Val Asn Tyr Asp Thr Asp Asn Phe
 325 330 335

Asn Lys Glu Ile Leu Leu Asp Arg Ser Ala Gly Gln Asn Gly Ala Phe
 340 345 350

Lys Ile Lys Leu Asp Tyr Val Lys Lys Pro Ile Pro Glu Ser Val Phe
 355 360 365

Val Gln Ile Leu Glu Lys Leu Tyr Glu Glu Asp Ile Gly Ala Gly Met
 370 375 380

Tyr Ala Leu Tyr Pro Tyr Gly Gly Ile Met Asp Glu Ile Ser Glu Ser
 385 390 395 400

Ala Ile Pro Phe Pro His Arg Ala Gly Ile Leu Tyr Glu Leu Trp Tyr
 405 410 415

Ile Cys Ser Trp Glu Lys Gln Glu Asp Asn Glu Lys His Leu Asn Trp
 420 425 430

Ile Arg Asn Ile Tyr Asn Phe Met Thr Pro Tyr Val Ser Lys Asn Pro
 435 440 445

Arg Leu Ala Tyr Leu Asn Tyr Arg Asp Leu Asp Ile Gly Ile Asn Asp
 450 455 460

Pro Lys Asn Pro Asn Asn Tyr Thr Gln Ala Arg Ile Trp Gly Glu Lys
 465 470 475 480

Tyr Phe Gly Lys Asn Phe Asp Arg Leu Val Lys Val Lys Thr Leu Val
 485 490 495

Asp Pro Asn Asn Phe Phe Arg Asn Glu Gln Ser Ile Pro Pro Leu Pro
500 505 510

Arg His Arg His
515

<210> 2
<211> 517
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<220>
<223> tetrahydrocannabinolic acid synthase; AB057805.1;
secretion signal removed

<300>
<308> AB057805.1

<400> 2
Asn Pro Arg Glu Asn Phe Leu Lys Cys Phe Ser Lys His Ile Pro Asn
1 5 10 15

Asn Val Ala Asn Pro Lys Leu Val Tyr Thr Gln His Asp Gln Leu Tyr
20 25 30

Met Ser Ile Leu Asn Ser Thr Ile Gln Asn Leu Arg Phe Ile Ser Asp
35 40 45

Thr Thr Pro Lys Pro Leu Val Ile Val Thr Pro Ser Asn Asn Ser His
50 55 60

Ile Gln Ala Thr Ile Leu Cys Ser Lys Lys Val Gly Leu Gln Ile Arg
65 70 75 80

Thr Arg Ser Gly Gly His Asp Ala Glu Gly Met Ser Tyr Ile Ser Gln
85 90 95

Val Pro Phe Val Val Val Asp Leu Arg Asn Met His Ser Ile Lys Ile
100 105 110

Asp Val His Ser Gln Thr Ala Trp Val Glu Ala Gly Ala Thr Leu Gly
115 120 125

Glu Val Tyr Tyr Trp Ile Asn Glu Lys Asn Glu Asn Leu Ser Phe Pro
130 135 140

Gly Gly Tyr Cys Pro Thr Val Gly Val Gly Gly His Phe Ser Gly Gly
145 150 155 160

Gly Tyr Gly Ala Leu Met Arg Asn Tyr Gly Leu Ala Ala Asp Asn Ile
165 170 175

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

Ser Met Gly Glu Asp Leu Phe Trp Ala Ile Arg Gly Gly Gly Gly Glu
195 200 205

Asn Phe Gly Ile Ile Ala Ala Trp Lys Ile Lys Leu Val Ala Val Pro
210 215 220

Ser Lys Ser Thr Ile Phe Ser Val Lys Lys Asn Met Glu Ile His Gly
225 230 235 240

Leu Val Lys Leu Phe Asn Lys Trp Gln Asn Ile Ala Tyr Lys Tyr Asp
245 250 255

Lys Asp Leu Val Leu Met Thr His Phe Ile Thr Lys Asn Ile Thr Asp
260 265 270

Asn His Gly Lys Asn Lys Thr Thr Val His Gly Tyr Phe Ser Ser Ile
275 280 285

Phe His Gly Gly Val Asp Ser Leu Val Asp Leu Met Asn Lys Ser Phe
290 295 300

Pro Glu Leu Gly Ile Lys Lys Thr Asp Cys Lys Glu Phe Ser Trp Ile
305 310 315 320

Asp Thr Thr Ile Phe Tyr Ser Gly Val Val Asn Phe Asn Thr Ala Asn
325 330 335

Phe Lys Lys Glu Ile Leu Leu Asp Arg Ser Ala Gly Lys Lys Thr Ala
340 345 350

Phe Ser Ile Lys Leu Asp Tyr Val Lys Lys Pro Ile Pro Glu Thr Ala
355 360 365

Met Val Lys Ile Leu Glu Lys Leu Tyr Glu Glu Asp Val Gly Ala Gly
370 375 380

Met Tyr Val Leu Tyr Pro Tyr Gly Gly Ile Met Glu Glu Ile Ser Glu
385 390 395 400

Ser Ala Ile Pro Phe Pro His Arg Ala Gly Ile Met Tyr Glu Leu Trp
405 410 415

Tyr Thr Ala Ser Trp Glu Lys Gln Glu Asp Asn Glu Lys His Ile Asn
420 425 430

Trp Val Arg Ser Val Tyr Asn Phe Thr Thr Pro Tyr Val Ser Gln Asn
435 440 445

Pro Arg Leu Ala Tyr Leu Asn Tyr Arg Asp Leu Asp Leu Gly Lys Thr
450 455 460

Asn His Ala Ser Pro Asn Asn Tyr Thr Gln Ala Arg Ile Trp Gly Glu
465 470 475 480

Lys Tyr Phe Gly Lys Asn Phe Asn Arg Leu Val Lys Val Lys Thr Lys
485 490 495

Val Asp Pro Asn Asn Phe Phe Arg Asn Glu Gln Ser Ile Pro Pro Leu
500 505 510

Pro Pro His His His
515

<210> 3

<211> 395

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<220>

<223> CBGAS; AJN57774.1

<300>

<308> AJN57774.1

<400> 3

Met	Gly	Leu	Ser	Ser	Val	Cys	Thr	Phe	Ser	Phe	Gln	Thr	Asn	Tyr	His
1				5					10					15	

Thr	Leu	Leu	Asn	Pro	His	Asn	Asn	Asn	Pro	Lys	Thr	Ser	Leu	Leu	Cys
			20					25					30		

Tyr	Arg	His	Pro	Lys	Thr	Pro	Ile	Lys	Tyr	Ser	Tyr	Asn	Asn	Phe	Pro
		35					40					45			

Ser	Lys	His	Cys	Ser	Thr	Lys	Ser	Phe	His	Leu	Gln	Asn	Lys	Cys	Ser
	50					55					60				

Glu	Ser	Leu	Ser	Ile	Ala	Lys	Asn	Ser	Ile	Arg	Ala	Ala	Thr	Thr	Asn
65					70					75					80

Gln	Thr	Glu	Pro	Pro	Glu	Ser	Asp	Asn	His	Ser	Val	Ala	Thr	Lys	Ile
				85					90					95	

Leu	Asn	Phe	Gly	Lys	Ala	Cys	Trp	Lys	Leu	Gln	Arg	Pro	Tyr	Thr	Ile
			100					105					110		

Ile	Ala	Phe	Thr	Ser	Cys	Ala	Cys	Gly	Leu	Phe	Gly	Lys	Glu	Leu	Leu
		115					120					125			

His	Asn	Thr	Asn	Leu	Ile	Ser	Trp	Ser	Leu	Met	Phe	Lys	Ala	Phe	Phe
	130					135					140				

Phe	Leu	Val	Ala	Ile	Leu	Cys	Ile	Ala	Ser	Phe	Thr	Thr	Thr	Ile	Asn
145					150					155					160

Gln	Ile	Tyr	Asp	Leu	His	Ile	Asp	Arg	Ile	Asn	Lys	Pro	Asp	Leu	Pro
				165					170					175	

Leu Ala Ser Gly Glu Ile Ser Val Asn Thr Ala Trp Ile Met Ser Ile
180 185 190

Ile Val Ala Leu Phe Gly Leu Ile Ile Thr Ile Lys Met Lys Gly Gly
195 200 205

Pro Leu Tyr Ile Phe Gly Tyr Cys Phe Gly Ile Phe Gly Gly Ile Val
210 215 220

Tyr Ser Val Pro Pro Phe Arg Trp Lys Gln Asn Pro Ser Thr Ala Phe
225 230 235 240

Leu Leu Asn Phe Leu Ala His Ile Ile Thr Asn Phe Thr Phe Tyr Tyr
245 250 255

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

Thr Phe Leu Leu Ala Phe Met Lys Ser Met Gly Ser Ala Leu Ala Leu
275 280 285

Ile Lys Asp Ala Ser Asp Val Glu Gly Asp Thr Lys Phe Gly Ile Ser
290 295 300

Thr Leu Ala Ser Lys Tyr Gly Ser Arg Asn Leu Thr Leu Phe Cys Ser
305 310 315 320

Gly Ile Val Leu Leu Ser Tyr Val Ala Ala Ile Leu Ala Gly Ile Ile
325 330 335

Trp Pro Gln Ala Phe Asn Ser Asn Val Met Leu Leu Ser His Ala Ile
340 345 350

Leu Ala Phe Trp Leu Ile Leu Gln Thr Arg Asp Phe Ala Leu Thr Asn
355 360 365

Tyr Asp Pro Glu Ala Gly Arg Arg Phe Tyr Glu Phe Met Trp Lys Leu
370 375 380

Tyr Tyr Ala Glu Tyr Leu Val Tyr Val Phe Ile
385 390 395

<210> 4

<211> 307

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<220>

<223> NphB; AFD38743.1

<300>

<308> AFD38743.1

<400> 4

Met Ser Glu Ala Ala Asp Val Glu Arg Val Tyr Ala Ala Met Glu Glu
1 5 10 15

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

Leu Leu Ser Thr Phe Gln Asp Thr Leu Val Glu Gly Gly Ser Val Val
35 40 45

Val Phe Ser Met Ala Ser Gly Arg His Ser Thr Glu Leu Asp Phe Ser
50 55 60

Ile Ser Val Pro Thr Ser His Gly Asp Pro Tyr Ala Thr Val Val Glu
65 70 75 80

Lys Gly Leu Phe Pro Ala Thr Gly His Pro Val Asp Asp Leu Leu Ala
85 90 95

Asp Thr Gln Lys His Leu Pro Val Ser Met Phe Ala Ile Asp Gly Glu
100 105 110

Val Thr Gly Gly Phe Lys Lys Thr Tyr Ala Phe Phe Pro Thr Asp Asn
115 120 125

Met Pro Gly Val Ala Glu Leu Ser Ala Ile Pro Ser Met Pro Pro Ala
130 135 140

Val Ala Glu Asn Ala Glu Leu Phe Ala Arg Tyr Gly Leu Asp Lys Val
145 150 155 160

Gln Met Thr Ser Met Asp Tyr Lys Lys Arg Gln Val Asn Leu Tyr Phe
165 170 175

Ser Glu Leu Ser Ala Gln Thr Leu Glu Ala Glu Ser Val Leu Ala Leu
180 185 190

Val Arg Glu Leu Gly Leu His Val Pro Asn Glu Leu Gly Leu Lys Phe
195 200 205

Cys Lys Arg Ser Phe Ser Val Tyr Pro Thr Leu Asn Trp Glu Thr Gly
210 215 220

Lys Ile Asp Arg Leu Cys Phe Ala Val Ile Ser Asn Asp Pro Thr Leu
225 230 235 240

Val Pro Ser Ser Asp Glu Gly Asp Ile Glu Lys Phe His Asn Tyr Ala
245 250 255

Thr Lys Ala Pro Tyr Ala Tyr Val Gly Glu Lys Arg Thr Leu Val Tyr
260 265 270

Gly Leu Thr Leu Ser Pro Lys Glu Glu Tyr Tyr Lys Leu Gly Ala Tyr
275 280 285

Tyr His Ile Thr Asp Val Gln Arg Gly Leu Leu Lys Ala Phe Asp Ser
290 295 300

Leu Glu Asp
305

<210> 5

<211> 397

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<220>

<223> IspDF protein

<400> 5

Met Ile Ala Leu Gln Arg Ser Leu Ser Met His Val Thr Ala Ile Ile
1 5 10 15

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

Leu Leu Asp Ile Gly Gly Arg Ser Ile Leu Glu Arg Ser Val Met Ala
35 40 45

Phe Ala Arg His Glu Arg Ile Asp Asp Val Ile Val Val Leu Pro Pro
50 55 60

Ala Leu Ala Ala Ala Pro Pro Asp Trp Ile Ala Ala Ser Gly Arg Val
65 70 75 80

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

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

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

Ile Asp Gly Ala Met Gln His Gly Ala Ala Ile Val Ala Val Pro Val
130 135 140

Arg Asp Thr Val Lys Arg Val Asp Pro Asp Gly Glu His Pro Val Ile
145 150 155 160

Thr Gly Thr Ile Pro Arg Asp Thr Ile Tyr Leu Ala Gln Thr Pro Gln
165 170 175

Ala Phe Arg Arg Asp Val Leu Gly Ala Ala Val Ala Leu Gly Arg Ser
180 185 190

Gly Val Ser Ala Thr Asp Glu Ala Met Leu Ala Glu Gln Ala Gly His

195

200

205

Arg Val His Val Val Glu Gly Asp Pro Ala Asn Val Lys Ile Thr Thr
 210 215 220

Ser Ala Asp Leu Asp Gln Ala Arg Gln Arg Leu Arg Ser Ala Val Ala
 225 230 235 240

Ala Arg Ile Gly Thr Gly Tyr Asp Leu His Arg Leu Ile Glu Gly Arg
 245 250 255

Pro Leu Ile Ile Gly Gly Val Ala Val Pro Cys Asp Lys Gly Ala Leu
 260 265 270

Gly His Ser Asp Ala Asp Val Ala Cys His Ala Val Ile Asp Ala Leu
 275 280 285

Leu Gly Ala Ala Gly Ala Gly Asn Val Gly Gln His Tyr Pro Asp Thr
 290 295 300

Asp Pro Arg Trp Lys Gly Ala Ser Ser Ile Gly Leu Leu Arg Asp Ala
 305 310 315 320

Leu Arg Leu Val Gln Glu Arg Gly Phe Thr Val Glu Asn Val Asp Val
 325 330 335

Cys Val Val Leu Glu Arg Pro Lys Ile Ala Pro Phe Ile Pro Glu Ile
 340 345 350

Arg Ala Arg Ile Ala Gly Ala Leu Gly Ile Asp Pro Glu Arg Val Ser
 355 360 365

Val Lys Gly Lys Thr Asn Glu Gly Val Asp Ala Val Gly Arg Gly Glu
 370 375 380

Ala Ile Ala Ala His Ala Val Ala Leu Leu Ser Glu Ser
 385 390 395

<210> 6

<211> 448

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<220>

<223> MFS aromatic acid antiporter

<400> 6

Met Asn Gln Ala Gln Thr Asn Val Gly Lys Ser Leu Asp Val Gln Ser
1 5 10 15

Phe Ile Asn Gln Gln Pro Leu Ser Arg Tyr Gln Trp Arg Val Val Leu
20 25 30

Leu Cys Phe Leu Ile Val Phe Leu Asp Gly Leu Asp Thr Ala Ala Met
35 40 45

Gly Phe Ile Ala Pro Ala Leu Ser Gln Glu Trp Gly Ile Asp Arg Ala
50 55 60

Ser Leu Gly Pro Val Met Ser Ala Ala Leu Ile Gly Met Val Phe Gly
65 70 75 80

Ala Leu Gly Ser Gly Pro Leu Ala Asp Arg Phe Gly Arg Lys Gly Val
85 90 95

Leu Val Gly Ala Val Leu Val Phe Gly Gly Phe Ser Leu Ala Ser Ala
100 105 110

Tyr Ala Thr Asn Val Asp Gln Leu Leu Val Leu Arg Phe Leu Thr Gly
115 120 125

Leu Gly Leu Gly Ala Gly Met Pro Asn Ala Thr Thr Leu Leu Ser Glu
130 135 140

Tyr Thr Pro Glu Arg Leu Lys Ser Leu Leu Val Thr Ser Met Phe Cys
145 150 155 160

Gly Phe Asn Leu Gly Met Ala Gly Gly Gly Phe Ile Ser Ala Lys Met
165 170 175

Ile Pro Ala Tyr Gly Trp His Ser Leu Leu Val Ile Gly Gly Val Leu
180 185 190

Pro Leu Leu Leu Ala Leu Val Leu Met Ile Trp Leu Pro Glu Ser Ala
195 200 205

Arg Phe Leu Val Val Arg Asn Arg Gly Thr Asp Lys Val Arg Lys Thr
210 215 220

Leu Ser Pro Ile Ala Pro Gln Val Val Ala Glu Ala Gly Ser Phe Ser
225 230 235 240

Val Pro Glu Gln Lys Ala Val Ala Ala Arg Asn Val Phe Ala Val Ile
245 250 255

Phe Ser Gly Thr Tyr Gly Leu Gly Thr Val Leu Leu Trp Leu Thr Tyr
260 265 270

Phe Met Gly Leu Val Ile Val Tyr Leu Leu Thr Ser Trp Leu Pro Thr
275 280 285

Leu Met Arg Asp Ser Gly Ala Ser Met Glu Gln Ala Ala Phe Ile Gly
290 295 300

Ala Leu Phe Gln Phe Gly Gly Val Leu Ser Ala Val Gly Val Gly Trp
305 310 315 320

Ala Met Asp Arg Phe Asn Pro His Lys Val Ile Gly Ile Phe Tyr Leu
325 330 335

Leu Ala Gly Val Phe Ala Tyr Ala Val Gly Gln Ser Leu Gly Asn Ile
340 345 350

Thr Leu Leu Ala Thr Leu Val Leu Val Ala Gly Met Cys Val Asn Gly
355 360 365

Ala Gln Ser Ala Met Pro Ser Leu Ala Ala Arg Phe Tyr Pro Thr Gln
370 375 380

Gly Arg Ala Thr Gly Val Ser Trp Met Leu Gly Ile Gly Arg Phe Gly
385 390 395 400

Ala Ile Leu Gly Ala Trp Ser Gly Ala Thr Leu Leu Gly Leu Gly Trp
405 410 415

Ser Phe Glu Gln Val Leu Thr Ala Leu Leu Val Pro Ala Ala Leu Ala
420 425 430

Thr Val Gly Val Val Val Lys Gly Leu Val Ser His Ala Asp Ala Thr
435 440 445

<210> 7

<211> 420

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<220>

<223> OprD family porin

<400> 7

Met Ser Ile Ala Phe Lys Lys Thr Leu Ala Cys Ser Ala Thr Leu Leu
1 5 10 15

Val Ala Pro Tyr Ala Ser Ala Ala Phe Val Glu Asp Phe Lys Gly Ser
20 25 30

Leu Glu Leu Arg Asn Phe Tyr Tyr Asn Arg Asp Phe Arg Asn Asp Gly
35 40 45

Ala Thr Gln Ser Lys Arg Asp Glu Trp Ala Gln Gly Phe Ile Leu Asn
50 55 60

Leu Gln Ser Gly Phe Thr Glu Gly Pro Val Gly Phe Gly Ile Asp Ala
65 70 75 80

Met Gly Leu Leu Gly Val Lys Leu Asp Ser Ser Pro Asp Arg Thr Gly
85 90 95

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

Gly Lys Phe Val Ala Thr Ala Lys Ala Arg Met Gly Lys Thr Glu Leu
115 120 125

Arg Ile Gly Gly Val Asn Pro Leu Met Pro Leu Leu Trp Ser Asn Asn
130 135 140

Ser Arg Leu Leu Pro Gln Val Phe Arg Gly Gly Ser Leu Thr Val Asn
145 150 155 160

Asp Ile Asp Lys Leu Thr Val Thr Ala Thr Arg Ile Asn Ala Val Lys
165 170 175

Gln Arg Asn Ser Thr Asp Phe Glu Ser Leu Thr Ala Thr Gly Tyr Ala
180 185 190

Pro Val Glu Ala Asp His Tyr Asn Tyr Leu Ala Phe Asp Phe Lys Pro
195 200 205

Ala Lys Asp Met Thr Phe Ser Leu His Ala Ala Glu Leu Glu Asp Leu
210 215 220

Tyr Lys Ser Tyr Phe Ala Gly Ile Lys Val Ile Lys Pro Leu Trp Glu
225 230 235 240

Gly Asn Val Ile Ala Asp Val Arg Val Phe Asp Ala Ser Glu Thr Gly
245 250 255

Ser Lys Lys Leu Gly Glu Val Asp Asn Arg Thr Leu Ser Ser Tyr Phe
260 265 270

Ala Tyr Ser Ile Lys Gly His Thr Ile Gly Gly Gly Tyr Gln Lys Ala
275 280 285

Trp Gly Asp Thr Ser Phe Ala Phe Val Asn Gly Thr Asp Thr Tyr Leu
290 295 300

Phe Gly Glu Ser Leu Val Ser Thr Phe Thr Ala Pro Glu Glu Arg Val
305 310 315 320

Trp Phe Ala Arg Tyr Asp Phe Asp Phe Ala Ala Leu Gly Val Pro Gly

325

330

335

Leu Leu Phe Thr Thr Arg Tyr Met Lys Gly Asp Asp Val Asn Pro Asp
 340 345 350

Leu Leu Thr Ser Arg Gln Ala Ala Ser Leu Arg Leu Asn Gly Glu Asp
 355 360 365

Gly Lys Glu Trp Glu Arg Val Thr Asp Ile Ser Tyr Val Ile Gln Ser
 370 375 380

Gly Pro Ala Lys Gly Val Ser Phe Gln Trp Arg Asn Ser Thr Asn Arg
 385 390 395 400

Ser Thr Tyr Ala Asp Ser Ala Asn Glu Asn Arg Leu Ile Met Arg Tyr
 405 410 415

Thr Phe Asn Phe
 420

<210> 8

<211> 448

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<220>

<223> MFS aromatic acid antiporter

<400> 8

Met Asn Gln Ala Gln Thr Asn Val Gly Lys Ser Leu Asp Val Gln Ser
 1 5 10 15

Phe Ile Asn Gln Gln Pro Leu Ser Arg Tyr Gln Trp Arg Val Val Leu
 20 25 30

Leu Cys Phe Leu Ile Val Phe Leu Asp Gly Leu Asp Thr Ala Ala Met
 35 40 45

Gly Phe Ile Ala Pro Ala Leu Ser Gln Glu Trp Gly Ile Asp Arg Ala
 50 55 60

Ser Leu Gly Pro Val Met Ser Ala Ala Leu Ile Gly Met Val Phe Gly
65 70 75 80

Ala Leu Gly Ser Gly Pro Leu Ala Asp Arg Phe Gly Arg Lys Gly Val
85 90 95

Leu Val Gly Ala Val Leu Val Phe Gly Gly Phe Ser Leu Ala Ser Ala
100 105 110

Tyr Ala Thr Asn Val Asp Gln Leu Leu Val Leu Arg Phe Leu Thr Gly
115 120 125

Leu Gly Leu Gly Ala Gly Met Pro Asn Ala Thr Thr Leu Leu Ser Glu
130 135 140

Tyr Thr Pro Glu Arg Leu Lys Ser Leu Leu Val Thr Ser Met Phe Cys
145 150 155 160

Gly Phe Asn Leu Gly Met Ala Gly Gly Gly Phe Ile Ser Ala Lys Met
165 170 175

Ile Pro Ala Tyr Gly Trp His Ser Leu Leu Val Ile Gly Gly Val Leu
180 185 190

Pro Leu Leu Leu Ala Leu Val Leu Met Val Trp Leu Pro Glu Ser Ala
195 200 205

Arg Phe Leu Val Val Arg Asn Arg Gly Thr Asp Lys Val Arg Lys Thr
210 215 220

Leu Ser Pro Ile Ala Pro Gln Val Val Ala Glu Ala Gly Ser Phe Ser
225 230 235 240

Val Pro Glu Gln Lys Ala Val Ala Ala Arg Asn Val Phe Ala Val Ile
245 250 255

Phe Ser Gly Thr Tyr Gly Leu Gly Thr Val Leu Leu Trp Leu Thr Tyr
260 265 270

Phe Met Gly Leu Val Ile Val Tyr Leu Leu Thr Ser Trp Leu Pro Thr
275 280 285

Leu Met Arg Asp Ser Gly Ala Ser Met Glu Gln Ala Ala Phe Ile Gly
290 295 300

Ala Leu Phe Gln Phe Gly Gly Val Leu Ser Ala Val Gly Val Gly Trp
305 310 315 320

Ala Met Asp Arg Phe Asn Pro His Lys Val Ile Gly Ile Phe Tyr Leu
325 330 335

Leu Ala Gly Val Phe Ala Tyr Ala Val Gly Gln Ser Leu Gly Asn Ile
340 345 350

Thr Leu Leu Ala Thr Leu Val Leu Val Ala Gly Met Cys Val Asn Gly
355 360 365

Ala Gln Ser Ala Met Pro Ser Leu Ala Ala Arg Phe Tyr Pro Thr Gln
370 375 380

Gly Arg Ala Thr Gly Val Ser Trp Met Leu Gly Ile Gly Arg Phe Gly
385 390 395 400

Ala Ile Leu Gly Ala Trp Ser Gly Ala Thr Leu Leu Gly Leu Gly Trp
405 410 415

Ser Phe Glu Gln Val Leu Thr Ala Leu Leu Val Pro Ala Ala Leu Ala
420 425 430

Thr Val Gly Val Val Val Lys Gly Leu Val Ser His Ala Asp Ala Thr
435 440 445

<210> 9

<211> 420

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<220>

<223> OprD family porin

<400> 9

Met Ser Ile Ala Phe Lys Lys Thr Leu Ala Cys Ser Ala Thr Leu Leu
1 5 10 15

Val Ala Pro Tyr Ala Ser Ala Ala Phe Val Glu Asp Phe Lys Gly Ser
20 25 30

Leu Glu Leu Arg Asn Phe Tyr Tyr Asn Arg Asp Phe Arg Asn Asp Gly
35 40 45

Ala Thr Gln Ser Lys Arg Asp Glu Trp Ala Gln Gly Phe Thr Leu Asn
50 55 60

Leu Gln Ser Gly Phe Thr Glu Gly Pro Val Gly Phe Gly Ile Asp Ala
65 70 75 80

Met Gly Leu Leu Gly Val Lys Leu Asp Ser Ser Pro Asp Arg Thr Gly
85 90 95

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

Gly Lys Phe Val Ala Thr Ala Lys Ala Arg Met Gly Lys Thr Glu Leu
115 120 125

Arg Ile Gly Gly Val Asn Pro Leu Met Pro Leu Leu Trp Ser Asn Asn
130 135 140

Ser Arg Leu Leu Pro Gln Ile Phe Arg Gly Gly Ser Leu Thr Val Asn
145 150 155 160

Asp Ile Asp Lys Leu Thr Val Thr Ala Thr Arg Val Asn Ala Val Lys
165 170 175

Gln Arg Asn Ser Thr Asp Phe Glu Ser Leu Thr Ala Thr Gly Tyr Ala
180 185 190

Pro Val Glu Ala Asp His Tyr Asn Tyr Leu Ala Phe Asp Phe Lys Pro
195 200 205

Ala Lys Asp Met Thr Phe Ser Leu His Ala Ala Glu Leu Glu Asp Leu
210 215 220

Tyr Lys Ser Tyr Phe Ala Gly Ile Lys Val Ile Lys Pro Leu Trp Glu
225 230 235 240

Gly Asn Val Ile Ala Asp Val Arg Val Phe Asp Ala Ser Glu Thr Gly
245 250 255

Ser Lys Lys Leu Gly Glu Val Asp Asn Arg Thr Leu Ser Ser Tyr Phe
260 265 270

Ala Tyr Ser Ile Lys Gly His Thr Ile Gly Gly Gly Tyr Gln Lys Ala
275 280 285

Trp Gly Asp Thr Ser Phe Ala Phe Val Asn Gly Thr Asp Thr Tyr Leu
290 295 300

Phe Gly Glu Ser Leu Val Ser Thr Phe Thr Ala Pro Glu Glu Arg Val
305 310 315 320

Trp Phe Ala Arg Tyr Asp Phe Asp Phe Ala Ala Leu Gly Val Pro Gly
325 330 335

Leu Leu Phe Thr Thr Arg Tyr Met Glu Gly Asp Asp Val Asn Pro Asp
340 345 350

Leu Leu Thr Ser Arg Gln Ala Ala Ser Leu Arg Leu Asn Gly Glu Asp
355 360 365

Gly Lys Glu Trp Glu Arg Val Thr Asp Ile Ser Tyr Val Ile Gln Ser
370 375 380

Gly Pro Ala Lys Gly Val Ser Phe Gln Trp Arg Asn Ser Thr Asn Arg
385 390 395 400

Ser Thr Tyr Ala Asp Ser Ala Asn Glu Asn Arg Leu Ile Met Arg Tyr
405 410 415

Thr Phe Asn Phe

<210> 10

<211> 529

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<220>

<223> IspDE bifunctional MEP pathway enzyme

<400> 10

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

Phe Gly Arg Arg Met Gln Thr Glu Cys Pro Lys Gln Tyr Leu Ser Ile
 20 25 30

Gly Asn Gln Thr Ile Leu Glu His Ser Val His Ala Leu Leu Ala His
 35 40 45

Pro Arg Val Lys Arg Val Val Ile Ala Ile Ser Pro Gly Asp Ser Arg
 50 55 60

Phe Ala Gln Leu Pro Leu Ala Asn His Pro Gln Ile Thr Val Val Asp
 65 70 75 80

Gly Gly Asp Glu Arg Ala Asp Ser Val Leu Ala Gly Leu Lys Ala Ala
 85 90 95

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

His Gln Asp Asp Leu Ala Arg Leu Leu Ala Leu Ser Glu Thr Ser Arg
 115 120 125

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

Glu Pro Gly Lys Asn Ala Ile Ala His Thr Val Asp Arg Asn Gly Leu
 145 150 155 160

Trp His Ala Leu Thr Pro Gln Phe Phe Pro Arg Glu Leu Leu His Asp
165 170 175

Cys Leu Thr Arg Ala Leu Asn Glu Gly Ala Thr Ile Thr Asp Glu Ala
180 185 190

Ser Ala Leu Glu Tyr Cys Gly Phe His Pro Gln Leu Val Glu Gly Arg
195 200 205

Ala Asp Asn Ile Lys Val Thr Arg Pro Glu Asp Leu Ala Leu Ala Glu
210 215 220

Phe Tyr Leu Thr Arg Thr Ile His Gln Glu Asn Thr Ser Leu Gly Gly
225 230 235 240

Gly Gly Ser Ala Ala Ala Met Arg Thr Gln Trp Pro Ser Pro Ala Lys
245 250 255

Leu Asn Leu Phe Leu Tyr Ile Thr Gly Gln Arg Ala Asp Gly Tyr His
260 265 270

Thr Leu Gln Thr Leu Phe Gln Phe Leu Asp Tyr Gly Asp Thr Ile Ser
275 280 285

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

Gly Val Glu His Glu Asp Asn Leu Ile Val Arg Ala Ala Arg Leu Leu
305 310 315 320

Met Lys Thr Ala Ala Asp Ser Gly Arg Leu Pro Thr Gly Ser Gly Ala
325 330 335

Asn Ile Ser Ile Asp Lys Arg Leu Pro Met Gly Gly Gly Leu Gly Gly
340 345 350

Gly Ser Ser Asn Ala Ala Thr Val Leu Val Ala Leu Asn His Leu Trp
355 360 365

Gln Cys Gly Leu Ser Met Asp Glu Leu Ala Glu Met Gly Leu Thr Leu
370 375 380

Gly Ala Asp Val Pro Val Phe Val Arg Gly His Ala Ala Phe Ala Glu
385 390 395 400

Gly Val Gly Glu Ile Leu Thr Pro Val Asp Pro Pro Glu Lys Trp Tyr
405 410 415

Leu Val Ala His Pro Gly Val Ser Ile Pro Thr Pro Val Ile Phe Lys
420 425 430

Asp Pro Glu Leu Pro Arg Asn Thr Pro Lys Arg Ser Ile Glu Thr Leu
435 440 445

Leu Lys Cys Glu Phe Ser Asn Asp Cys Glu Val Ile Ala Arg Lys Arg
450 455 460

Phe Arg Glu Val Asp Ala Val Leu Ser Trp Leu Leu Glu Tyr Ala Pro
465 470 475 480

Ser Arg Leu Thr Gly Thr Gly Ala Cys Val Phe Ala Glu Phe Asp Thr
485 490 495

Glu Ser Glu Ala Arg Gln Val Leu Glu Gln Ala Pro Glu Trp Leu Asn
500 505 510

Gly Phe Val Ala Lys Gly Ala Asn Leu Ser Pro Leu His Arg Ala Met
515 520 525

Leu

<210> 11

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 11

Ser Leu Gly Gly Gly Gly Ser Ala Ala Ala
1 5 10

<210> 12

<211> 231

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 12

Met Ile Ala Leu Gln Arg Ser Leu Ser Met His Val Thr Ala Ile Ile
1 5 10 15

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

Leu Leu Asp Ile Gly Gly Arg Ser Ile Leu Glu Arg Ser Val Met Ala
35 40 45

Phe Ala Arg His Glu Arg Ile Asp Asp Val Ile Val Val Leu Pro Pro
50 55 60

Ala Leu Ala Ala Ala Pro Pro Asp Trp Ile Ala Ala Ser Gly Arg Val
65 70 75 80

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

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

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

Ile Asp Gly Ala Met Gln His Gly Ala Ala Ile Val Ala Val Pro Val
130 135 140

Arg Asp Thr Val Lys Arg Val Asp Pro Asp Gly Glu His Pro Val Ile
145 150 155 160

Thr Gly Thr Ile Pro Arg Asp Thr Ile Tyr Leu Ala Gln Thr Pro Gln
165 170 175

Ala Phe Arg Arg Asp Val Leu Gly Ala Ala Val Ala Leu Gly Arg Ser
180 185 190

Gly Val Ser Ala Thr Asp Glu Ala Met Leu Ala Glu Gln Ala Gly His
195 200 205

Arg Val His Val Val Glu Gly Asp Pro Ala Asn Val Lys Ile Thr Thr
210 215 220

Ser Ala Asp Leu Asp Gln Ala
225 230

<210> 13
<211> 156
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 13
Arg Ile Gly Thr Gly Tyr Asp Leu His Arg Leu Ile Glu Gly Arg Pro
1 5 10 15

Leu Ile Ile Gly Gly Val Ala Val Pro Cys Asp Lys Gly Ala Leu Gly
20 25 30

His Ser Asp Ala Asp Val Ala Cys His Ala Val Ile Asp Ala Leu Leu
35 40 45

Gly Ala Ala Gly Ala Gly Asn Val Gly Gln His Tyr Pro Asp Thr Asp
50 55 60

Pro Arg Trp Lys Gly Ala Ser Ser Ile Gly Leu Leu Arg Asp Ala Leu
65 70 75 80

Arg Leu Val Gln Glu Arg Gly Phe Thr Val Glu Asn Val Asp Val Cys
85 90 95

Val Val Leu Glu Arg Pro Lys Ile Ala Pro Phe Ile Pro Glu Ile Arg
100 105 110

Ala Arg Ile Ala Gly Ala Leu Gly Ile Asp Pro Glu Arg Val Ser Val
115 120 125

Lys Gly Lys Thr Asn Glu Gly Val Asp Ala Val Gly Arg Gly Glu Ala
130 135 140

Ile Ala Ala His Ala Val Ala Leu Leu Ser Glu Ser
145 150 155

<210> 14

<211> 234

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 14

Met Gln Val Thr Ala Ile Ile Ala Ala Gly Gly Arg Gly Arg Arg Phe
1 5 10 15

Gly Gly Gly Val Pro Lys Gln Leu Val Gly Val Gly Gly Arg Pro Ile
20 25 30

Leu Glu Arg Thr Val Ala Ala Phe Leu Gly His Pro Ala Ile His Glu
35 40 45

Val Val Val Ala Leu Pro Ala Glu Leu Met Ala Asp Pro Pro Ala Tyr
50 55 60

Leu Arg Ala Ala Pro Lys Pro Ile Arg Leu Val Ala Gly Gly Val Gln
65 70 75 80

Arg Gln Asp Ser Val Arg Gln Ala Phe Gln Ala Ala Asn Glu Gln Ser
85 90 95

Asp Val Ile Val Ile His Asp Ala Ala Arg Pro Phe Ala Ser Ala Asp
100 105 110

Leu Ile Ser Arg Thr Ile Ala Ala Ala Ala Glu Gly Gly Ala Ala Leu
115 120 125

Ala Ala Val Pro Ala Arg Asp Thr Val Lys Arg Gly Ala Phe Ala Ala
130 135 140

Gly Arg Thr Gly Pro Ala Gly Arg Gln Ala Val Glu Gly Ala Pro Leu
145 150 155 160

Leu Val Val Ala Glu Thr Leu Pro Arg Asp Ser Ile Tyr Leu Ala Gln
165 170 175

Thr Pro Gln Ala Phe Arg Arg Asp Val Leu Arg Asp Ala Leu Ala Leu
180 185 190

Gly Glu Ala Gly Ser Glu Ala Thr Asp Glu Ala Thr Leu Ala Glu Arg
195 200 205

Ala Gly His Ile Val Arg Leu Val Glu Gly Glu Pro Ala Asn Ile Lys
210 215 220

Ile Thr Thr Pro Asp Asp Leu Leu Val Ala
225 230

<210> 15

<211> 156

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 15

Phe Arg Ile Gly Ala Gly Tyr Asp Leu His Arg Leu Val Glu Gly Arg
1 5 10 15

Pro Leu Val Leu Gly Gly Val Thr Ile Pro Phe Glu Arg Gly Leu Leu
20 25 30

Gly His Ser Asp Ala Asp Ala Ile Cys His Ala Val Thr Asp Ala Val
35 40 45

Leu Gly Ala Ala Ala Ala Gly Asp Ile Gly Arg His Phe Pro Asp Ser
50 55 60

Asp Pro Lys Trp Arg Asp Trp Ser Ser Ile Asp Leu Leu Arg Arg Ala
65 70 75 80

Ser Ala Ile Val Lys Gly Arg Gly Tyr Ala Ile Ala Asn Val Asp Ala
85 90 95

Val Val Ile Ala Glu Arg Pro Lys Leu Ala Pro Phe Leu Asp Glu Met
100 105 110

Arg Ala Asn Val Ala Gly Ala Ile Gly Ile Ala Val Asp Ala Val Gly
115 120 125

Ile Lys Gly Lys Thr Asn Glu Gly Leu Gly Glu Leu Gly Arg Gly Glu
130 135 140

Ala Ile Ala Val His Ala Val Ala Leu Leu His Leu
145 150 155

<210> 16

<211> 214

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 16

Met Val His Val Ser Ala Ile Ile Ala Ala Gly Gly Arg Gly Glu Arg
1 5 10 15

Phe Gly Gly Pro Gln Pro Lys Gln Leu Leu Leu Leu Gly Gly Val Pro
20 25 30

Ile Leu Lys Arg Thr Val Asp Ala Phe Leu Arg Gly Tyr Pro Phe Ile
35 40 45

Glu Val Ile Val Ala Leu Pro Ala Glu Phe Val Ala Asn Pro Pro Asp
50 55 60

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

Ser Val Ala Asn Ala Phe Arg Ala Val Ala Pro Ser Ala Gln Val Val
85 90 95

Val Ile His Asp Ala Ala Arg Pro Leu Val Thr Pro Ser Leu Ile Glu
100 105 110

Arg Thr Val Asp Ala Ala Val Lys His Gly Ala Ala Ile Ala Ala Leu
115 120 125

Arg Ala Thr Asp Thr Val Lys Arg Gly Asp Ala Ser Arg Val Ile Arg
130 135 140

Gly Thr Leu Pro Arg Asp Glu Ile Phe Leu Ala Gln Thr Pro Gln Ala
145 150 155 160

Phe Arg Ala Gly Val Leu Arg Asp Ala Leu Ala Leu Ala Ala Ser Ala
165 170 175

Ala Asp Ala Thr Asp Glu Ala Met Leu Ala Glu Gln Ala Gly His His
180 185 190

Val Arg Leu Val Asp Gly Asp Pro Arg Asn Leu Lys Ile Thr Thr Pro
195 200 205

Glu Asp Leu Glu Met Ala
210

<210> 17

<211> 156

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 17

Arg Ile Gly Asn Gly Tyr Asp Leu His Arg Leu Val Thr Gly Arg Pro
1 5 10 15

Leu Val Leu Gly Gly Val Thr Ile Pro Phe Glu Lys Gly Leu Gln Gly
20 25 30

His Ser Asp Ala Asp Ala Val Cys His Ala Ile Thr Asp Ala Ile Leu
35 40 45

Gly Ala Ala Ser Ala Gly Asp Ile Gly Arg His Phe Pro Asp Thr Asp
50 55 60

Pro Ala Trp Lys Asp Ala Lys Ser Ile Val Leu Leu Gln Gln Ala Ala
65 70 75 80

Gln Ile Val Ser Arg Ala Gly Tyr Ala Ile Ala Asn Leu Asp Val Val
85 90 95

Val Ile Ala Gln Gln Pro Lys Leu Val Pro His Ile Asp Ala Ile Arg
100 105 110

His Ser Val Ala His Ala Leu Gly Ile Asp Val Gln Gln Val Ser Val
115 120 125

Lys Gly Lys Thr Asn Glu Gly Val Asp Ser Met Gly Ala Gly Glu Ser
130 135 140

Ile Ala Val His Ala Val Ala Leu Leu Gln His Ser
145 150 155

<210> 18

<211> 394

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 18

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

Phe Gly Arg Arg Met Gln Thr Glu Cys Pro Lys Gln Tyr Leu Ser Ile
20 25 30

Gly Asn Gln Thr Ile Leu Glu His Ser Val His Ala Leu Leu Ala His
35 40 45

Pro Arg Val Lys Arg Val Val Ile Ala Ile Ser Pro Gly Asp Ser Arg
50 55 60

Phe Ala Gln Leu Pro Leu Ala Asn His Pro Gln Ile Thr Val Val Asp
65 70 75 80

Gly Gly Asp Glu Arg Ala Asp Ser Val Leu Ala Gly Leu Lys Ala Ala
85 90 95

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

His Gln Asp Asp Leu Ala Arg Leu Leu Ala Leu Ser Glu Thr Ser Arg
115 120 125

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

Glu Pro Gly Lys Asn Ala Ile Ala His Thr Val Asp Arg Asn Gly Leu
145 150 155 160

Trp His Ala Leu Thr Pro Gln Phe Phe Pro Arg Glu Leu Leu His Asp
165 170 175

Cys Leu Thr Arg Ala Leu Asn Glu Gly Ala Thr Ile Thr Asp Glu Ala
180 185 190

Ser Ala Leu Glu Tyr Cys Gly Phe His Pro Gln Leu Val Glu Gly Arg
195 200 205

Ala Asp Asn Ile Lys Val Thr Arg Pro Glu Asp Leu Ala Leu Ala Glu
210 215 220

Phe Tyr Leu Thr Leu Pro Thr Pro Ser Phe Glu Ile Arg Ile Gly His
225 230 235 240

Gly Phe Asp Val His Ala Phe Gly Gly Glu Gly Pro Ile Ile Ile Gly
245 250 255

Gly Val Arg Ile Pro Tyr Glu Lys Gly Leu Leu Ala His Ser Asp Gly
260 265 270

Asp Val Ala Leu His Ala Leu Thr Asp Ala Leu Leu Gly Ala Ala Ala
275 280 285

Leu Gly Asp Ile Gly Lys Leu Phe Pro Asp Thr Asp Pro Ala Phe Lys
290 295 300

Gly Ala Asp Ser Arg Glu Leu Leu Arg Glu Ala Trp Arg Arg Ile Gln
305 310 315 320

Ala Lys Gly Tyr Thr Leu Gly Asn Val Asp Val Thr Ile Ile Ala Gln
325 330 335

Ala Pro Lys Met Leu Pro His Ile Pro Gln Met Arg Val Phe Ile Ala
340 345 350

Glu Asp Leu Gly Cys His Met Asp Asp Val Asn Val Lys Ala Thr Thr
355 360 365

Thr Glu Lys Leu Gly Phe Thr Gly Arg Gly Glu Gly Ile Ala Cys Glu
370 375 380

Ala Val Ala Leu Leu Ile Lys Ala Thr Lys
385 390

<210> 19

<211> 394

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 19

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

Phe Gly Arg Arg Met Gln Thr Glu Cys Pro Lys Gln Tyr Leu Ser Ile
20 25 30

Gly Asn Gln Thr Ile Leu Glu His Ser Val His Ala Leu Leu Ala His
35 40 45

Pro Arg Val Lys Arg Val Val Ile Ala Ile Ser Pro Gly Asp Ser Arg
50 55 60

Phe Ala Gln Leu Pro Leu Ala Asn His Pro Gln Ile Thr Val Val Asp
65 70 75 80

Gly Gly Asp Glu Arg Ala Asp Ser Val Leu Ala Gly Leu Lys Ala Ala
85 90 95

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

His Gln Asp Asp Leu Ala Arg Leu Leu Ala Leu Ser Glu Thr Ser Arg
115 120 125

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

Glu Pro Gly Lys Asn Ala Ile Ala His Thr Val Asp Arg Asn Gly Leu
145 150 155 160

Trp His Ala Leu Thr Pro Gln Phe Phe Pro Arg Glu Leu Leu His Asp
165 170 175

Cys Leu Thr Arg Ala Leu Asn Glu Gly Ala Thr Ile Thr Asp Glu Ala
180 185 190

Ser Ala Leu Glu Tyr Cys Gly Phe His Pro Gln Leu Val Glu Gly Arg
195 200 205

Ala Asp Asn Ile Lys Val Thr Arg Pro Glu Asp Leu Ala Leu Ala Glu
210 215 220

Phe Tyr Leu Ser Leu Gly Gly Gly Gly Ser Ala Ala Ala Ile Gly His
225 230 235 240

Gly Phe Asp Val His Ala Phe Gly Gly Glu Gly Pro Ile Ile Ile Gly
245 250 255

Gly Val Arg Ile Pro Tyr Glu Lys Gly Leu Leu Ala His Ser Asp Gly
260 265 270

Asp Val Ala Leu His Ala Leu Thr Asp Ala Leu Leu Gly Ala Ala Ala
275 280 285

Leu Gly Asp Ile Gly Lys Leu Phe Pro Asp Thr Asp Pro Ala Phe Lys
290 295 300

Gly Ala Asp Ser Arg Glu Leu Leu Arg Glu Ala Trp Arg Arg Ile Gln
305 310 315 320

Ala Lys Gly Tyr Thr Leu Gly Asn Val Asp Val Thr Ile Ile Ala Gln
325 330 335

Ala Pro Lys Met Leu Pro His Ile Pro Gln Met Arg Val Phe Ile Ala
340 345 350

Glu Asp Leu Gly Cys His Met Asp Asp Val Asn Val Lys Ala Thr Thr
355 360 365

Thr Glu Lys Leu Gly Phe Thr Gly Arg Gly Glu Gly Ile Ala Cys Glu
370 375 380

Ala Val Ala Leu Leu Ile Lys Ala Thr Lys
385 390

<210> 20

<211> 413

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 20

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

Phe Gly Arg Arg Met Gln Thr Glu Cys Pro Lys Gln Tyr Leu Ser Ile
20 25 30

Gly Asn Gln Thr Ile Leu Glu His Ser Val His Ala Leu Leu Ala His
35 40 45

Pro Arg Val Lys Arg Val Val Ile Ala Ile Ser Pro Gly Asp Ser Arg
50 55 60

Phe Ala Gln Leu Pro Leu Ala Asn His Pro Gln Ile Thr Val Val Asp
65 70 75 80

Gly Gly Asp Glu Arg Ala Asp Ser Val Leu Ala Gly Leu Lys Ala Ala
85 90 95

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

His Gln Asp Asp Leu Ala Arg Leu Leu Ala Leu Ser Glu Thr Ser Arg
115 120 125

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

Glu Pro Gly Lys Asn Ala Ile Ala His Thr Val Asp Arg Asn Gly Leu
145 150 155 160

Trp His Ala Leu Thr Pro Gln Phe Phe Pro Arg Glu Leu Leu His Asp
165 170 175

Cys Leu Thr Arg Ala Leu Asn Glu Gly Ala Thr Ile Thr Asp Glu Ala
180 185 190

Ser Ala Leu Glu Tyr Cys Gly Phe His Pro Gln Leu Val Glu Gly Arg
195 200 205

Ala Asp Asn Ile Lys Val Thr Arg Pro Glu Asp Leu Ala Leu Ala Glu
210 215 220

Phe Tyr Leu Ala Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala
225 230 235 240

Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Ala Ala Ala
245 250 255

Ile Gly His Gly Phe Asp Val His Ala Phe Gly Gly Glu Gly Pro Ile
260 265 270

Ile Ile Gly Gly Val Arg Ile Pro Tyr Glu Lys Gly Leu Leu Ala His
275 280 285

Ser Asp Gly Asp Val Ala Leu His Ala Leu Thr Asp Ala Leu Leu Gly
290 295 300

Ala Ala Ala Leu Gly Asp Ile Gly Lys Leu Phe Pro Asp Thr Asp Pro
305 310 315 320

Ala Phe Lys Gly Ala Asp Ser Arg Glu Leu Leu Arg Glu Ala Trp Arg
325 330 335

Arg Ile Gln Ala Lys Gly Tyr Thr Leu Gly Asn Val Asp Val Thr Ile
340 345 350

Ile Ala Gln Ala Pro Lys Met Leu Pro His Ile Pro Gln Met Arg Val
355 360 365

Phe Ile Ala Glu Asp Leu Gly Cys His Met Asp Asp Val Asn Val Lys
370 375 380

Ala Thr Thr Thr Glu Lys Leu Gly Phe Thr Gly Arg Gly Glu Gly Ile
385 390 395 400

Ala Cys Glu Ala Val Ala Leu Leu Ile Lys Ala Thr Lys
405 410

<210> 21

<211> 394

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 21

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

Phe Gly Arg Arg Met Gln Thr Glu Cys Pro Lys Gln Tyr Leu Ser Ile
20 25 30

Gly Asn Gln Thr Ile Leu Glu His Ser Val His Ala Leu Leu Ala His
35 40 45

Pro Arg Val Lys Arg Val Val Ile Ala Ile Ser Pro Gly Asp Ser Arg
50 55 60

Phe Ala Gln Leu Pro Leu Ala Asn His Pro Gln Ile Thr Val Val Asp
65 70 75 80

Gly Gly Asp Glu Arg Ala Asp Ser Val Leu Ala Gly Leu Lys Ala Ala
85 90 95

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

His Gln Asp Asp Leu Ala Arg Leu Leu Ala Leu Ser Glu Thr Ser Arg
115 120 125

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

Glu Pro Gly Lys Asn Ala Ile Ala His Thr Val Asp Arg Asn Gly Leu
145 150 155 160

Trp His Ala Leu Thr Pro Gln Phe Phe Pro Arg Glu Leu Leu His Asp
165 170 175

Cys Leu Thr Arg Ala Leu Asn Glu Gly Ala Thr Ile Thr Asp Glu Ala
180 185 190

Ser Ala Leu Glu Tyr Cys Gly Phe His Pro Gln Leu Val Glu Gly Arg
195 200 205

Ala Asp Asn Ile Lys Val Thr Arg Pro Glu Asp Leu Ala Leu Ala Glu
210 215 220

Phe Tyr Leu Arg Gln Arg Leu Arg Ser Ala Val Ala Ala Ile Gly His
225 230 235 240

Gly Phe Asp Val His Ala Phe Gly Gly Glu Gly Pro Ile Ile Ile Gly
245 250 255

Gly Val Arg Ile Pro Tyr Glu Lys Gly Leu Leu Ala His Ser Asp Gly
260 265 270

Asp Val Ala Leu His Ala Leu Thr Asp Ala Leu Leu Gly Ala Ala Ala
275 280 285

Leu Gly Asp Ile Gly Lys Leu Phe Pro Asp Thr Asp Pro Ala Phe Lys
290 295 300

Gly Ala Asp Ser Arg Glu Leu Leu Arg Glu Ala Trp Arg Arg Ile Gln
305 310 315 320

Ala Lys Gly Tyr Thr Leu Gly Asn Val Asp Val Thr Ile Ile Ala Gln
325 330 335

Ala Pro Lys Met Leu Pro His Ile Pro Gln Met Arg Val Phe Ile Ala
340 345 350

Glu Asp Leu Gly Cys His Met Asp Asp Val Asn Val Lys Ala Thr Thr
355 360 365

Thr Glu Lys Leu Gly Phe Thr Gly Arg Gly Glu Gly Ile Ala Cys Glu
370 375 380

Ala Val Ala Leu Leu Ile Lys Ala Thr Lys
385 390

<210> 22

<211> 395

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 22

Met Ile Ala Leu Gln Arg Ser Leu Ser Met His Val Thr Ala Ile Ile
1 5 10 15

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

Leu Leu Asp Ile Gly Gly Arg Ser Ile Leu Glu Arg Ser Val Met Ala
35 40 45

Phe Ala Arg His Glu Arg Ile Asp Asp Val Ile Val Val Leu Pro Pro
50 55 60

Ala Leu Ala Ala Ala Pro Pro Asp Trp Ile Ala Ala Ser Gly Arg Val
65 70 75 80

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

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

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

Ile Asp Gly Ala Met Gln His Gly Ala Ala Ile Val Ala Val Pro Val
130 135 140

Arg Asp Thr Val Lys Arg Val Asp Pro Asp Gly Glu His Pro Val Ile
145 150 155 160

Thr Gly Thr Ile Pro Arg Asp Thr Ile Tyr Leu Ala Gln Thr Pro Gln
165 170 175

Ala Phe Arg Arg Asp Val Leu Gly Ala Ala Val Ala Leu Gly Arg Ser
180 185 190

Gly Val Ser Ala Thr Asp Glu Ala Met Leu Ala Glu Gln Ala Gly His
195 200 205

Arg Val His Val Val Glu Gly Asp Pro Ala Asn Val Lys Ile Thr Thr
210 215 220

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

Ile Gly Thr Gly Tyr Asp Leu His Arg Leu Ile Glu Gly Arg Pro Leu
245 250 255

Ile Ile Gly Gly Val Ala Val Pro Cys Asp Lys Gly Ala Leu Gly His
260 265 270

Ser Asp Ala Asp Val Ala Cys His Ala Val Ile Asp Ala Leu Leu Gly
275 280 285

Ala Ala Gly Ala Gly Asn Val Gly Gln His Tyr Pro Asp Thr Asp Pro
290 295 300

Arg Trp Lys Gly Ala Ser Ser Ile Gly Leu Leu Arg Asp Ala Leu Arg
305 310 315 320

Leu Val Gln Glu Arg Gly Phe Thr Val Glu Asn Val Asp Val Cys Val
325 330 335

Val Leu Glu Arg Pro Lys Ile Ala Pro Phe Ile Pro Glu Ile Arg Ala
340 345 350

Arg Ile Ala Gly Ala Leu Gly Ile Asp Pro Glu Arg Val Ser Val Lys
355 360 365

Gly Lys Thr Asn Glu Gly Val Asp Ala Val Gly Arg Gly Glu Ala Ile
370 375 380

Ala Ala His Ala Val Ala Leu Leu Ser Glu Ser
385 390 395

<210> 23

<211> 397

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 23

Met Ile Ala Leu Gln Arg Ser Leu Ser Met His Val Thr Ala Ile Ile
1 5 10 15

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

Leu Leu Asp Ile Gly Gly Arg Ser Ile Leu Glu Arg Ser Val Met Ala
35 40 45

Phe Ala Arg His Glu Arg Ile Asp Asp Val Ile Val Val Leu Pro Pro
50 55 60

Ala Leu Ala Ala Ala Pro Pro Asp Trp Ile Ala Ala Ser Gly Arg Val
65 70 75 80

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

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

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

Ile Asp Gly Ala Met Gln His Gly Ala Ala Ile Val Ala Val Pro Val
130 135 140

Arg Asp Thr Val Lys Arg Val Asp Pro Asp Gly Glu His Pro Val Ile
145 150 155 160

Thr Gly Thr Ile Pro Arg Asp Thr Ile Tyr Leu Ala Gln Thr Pro Gln
165 170 175

Ala Phe Arg Arg Asp Val Leu Gly Ala Ala Val Ala Leu Gly Arg Ser
180 185 190

Gly Val Ser Ala Thr Asp Glu Ala Met Leu Ala Glu Gln Ala Gly His
195 200 205

Arg Val His Val Val Glu Gly Asp Pro Ala Asn Val Lys Ile Thr Thr
210 215 220

Ser Ala Asp Leu Asp Gln Ala Ser Leu Gly Gly Gly Ser Ala Ala
225 230 235 240

Ala Arg Ile Gly Thr Gly Tyr Asp Leu His Arg Leu Ile Glu Gly Arg
245 250 255

Pro Leu Ile Ile Gly Gly Val Ala Val Pro Cys Asp Lys Gly Ala Leu
260 265 270

Gly His Ser Asp Ala Asp Val Ala Cys His Ala Val Ile Asp Ala Leu
275 280 285

Leu Gly Ala Ala Gly Ala Gly Asn Val Gly Gln His Tyr Pro Asp Thr
290 295 300

Asp Pro Arg Trp Lys Gly Ala Ser Ser Ile Gly Leu Leu Arg Asp Ala
305 310 315 320

Leu Arg Leu Val Gln Glu Arg Gly Phe Thr Val Glu Asn Val Asp Val
325 330 335

Cys Val Val Leu Glu Arg Pro Lys Ile Ala Pro Phe Ile Pro Glu Ile
340 345 350

Arg Ala Arg Ile Ala Gly Ala Leu Gly Ile Asp Pro Glu Arg Val Ser
355 360 365

Val Lys Gly Lys Thr Asn Glu Gly Val Asp Ala Val Gly Arg Gly Glu
370 375 380

Ala Ile Ala Ala His Ala Val Ala Leu Leu Ser Glu Ser
385 390 395

<210> 24
<211> 425

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 24

Met Ile Ala Leu Gln Arg Ser Leu Ser Met His Val Thr Ala Ile Ile
1 5 10 15

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

Leu Leu Asp Ile Gly Gly Arg Ser Ile Leu Glu Arg Ser Val Met Ala
35 40 45

Phe Ala Arg His Glu Arg Ile Asp Asp Val Ile Val Val Leu Pro Pro
50 55 60

Ala Leu Ala Ala Ala Pro Pro Asp Trp Ile Ala Ala Ser Gly Arg Val
65 70 75 80

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

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

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

Ile Asp Gly Ala Met Gln His Gly Ala Ala Ile Val Ala Val Pro Val
130 135 140

Arg Asp Thr Val Lys Arg Val Asp Pro Asp Gly Glu His Pro Val Ile
145 150 155 160

Thr Gly Thr Ile Pro Arg Asp Thr Ile Tyr Leu Ala Gln Thr Pro Gln
165 170 175

Ala Phe Arg Arg Asp Val Leu Gly Ala Ala Val Ala Leu Gly Arg Ser
180 185 190

Gly Val Ser Ala Thr Asp Glu Ala Met Leu Ala Glu Gln Ala Gly His
195 200 205

Arg Val His Val Val Glu Gly Asp Pro Ala Asn Val Lys Ile Thr Thr
210 215 220

Ser Ala Asp Leu Asp Gln Ala Arg Gln Arg Leu Arg Ser Ala Val Leu
225 230 235 240

Ala Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys
245 250 255

Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Ala Ala Ala Arg Ile Gly
260 265 270

Thr Gly Tyr Asp Leu His Arg Leu Ile Glu Gly Arg Pro Leu Ile Ile
275 280 285

Gly Gly Val Ala Val Pro Cys Asp Lys Gly Ala Leu Gly His Ser Asp
290 295 300

Ala Asp Val Ala Cys His Ala Val Ile Asp Ala Leu Leu Gly Ala Ala
305 310 315 320

Gly Ala Gly Asn Val Gly Gln His Tyr Pro Asp Thr Asp Pro Arg Trp
325 330 335

Lys Gly Ala Ser Ser Ile Gly Leu Leu Arg Asp Ala Leu Arg Leu Val
340 345 350

Gln Glu Arg Gly Phe Thr Val Glu Asn Val Asp Val Cys Val Val Leu
355 360 365

Glu Arg Pro Lys Ile Ala Pro Phe Ile Pro Glu Ile Arg Ala Arg Ile
370 375 380

Ala Gly Ala Leu Gly Ile Asp Pro Glu Arg Val Ser Val Lys Gly Lys
385 390 395 400

Thr Asn Glu Gly Val Asp Ala Val Gly Arg Gly Glu Ala Ile Ala Ala
405 410 415

His Ala Val Ala Leu Leu Ser Glu Ser
420 425

<210> 25

<211> 246

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 25

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

Phe Gly Arg Arg Met Gln Thr Glu Cys Pro Lys Gln Tyr Leu Ser Ile
20 25 30

Gly Asn Gln Thr Ile Leu Glu His Ser Val His Ala Leu Leu Ala His
35 40 45

Pro Arg Val Lys Arg Val Val Ile Ala Ile Ser Pro Gly Asp Ser Arg
50 55 60

Phe Ala Gln Leu Pro Leu Ala Asn His Pro Gln Ile Thr Val Val Asp
65 70 75 80

Gly Gly Asp Glu Arg Ala Asp Ser Val Leu Ala Gly Leu Lys Ala Ala
85 90 95

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

His Gln Asp Asp Leu Ala Arg Leu Leu Ala Leu Ser Glu Thr Ser Arg
115 120 125

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

Glu Pro Gly Lys Asn Ala Ile Ala His Thr Val Asp Arg Asn Gly Leu
145 150 155 160

Trp His Ala Leu Thr Pro Gln Phe Phe Pro Arg Glu Leu Leu His Asp
165 170 175

Cys Leu Thr Arg Ala Leu Asn Glu Gly Ala Thr Ile Thr Asp Glu Ala
180 185 190

Ser Ala Leu Glu Tyr Cys Gly Phe His Pro Gln Leu Val Glu Gly Arg
195 200 205

Ala Asp Asn Ile Lys Val Thr Arg Pro Glu Asp Leu Ala Leu Ala Glu
210 215 220

Phe Tyr Leu Thr Arg Thr Ile His Gln Glu Asn Thr Ser Leu Gly Gly
225 230 235 240

Gly Gly Ser Ala Ala Ala
245

<210> 26

<211> 283

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 26

Met Arg Thr Gln Trp Pro Ser Pro Ala Lys Leu Asn Leu Phe Leu Tyr
1 5 10 15

Ile Thr Gly Gln Arg Ala Asp Gly Tyr His Thr Leu Gln Thr Leu Phe
20 25 30

Gln Phe Leu Asp Tyr Gly Asp Thr Ile Ser Ile Glu Leu Arg Asp Asp
35 40 45

Gly Asp Ile Arg Leu Leu Thr Pro Val Glu Gly Val Glu His Glu Asp
50 55 60

Asn Leu Ile Val Arg Ala Ala Arg Leu Leu Met Lys Thr Ala Ala Asp
65 70 75 80

Ser Gly Arg Leu Pro Thr Gly Ser Gly Ala Asn Ile Ser Ile Asp Lys
85 90 95

Arg Leu Pro Met Gly Gly Gly Leu Gly Gly Gly Ser Ser Asn Ala Ala
100 105 110

Thr Val Leu Val Ala Leu Asn His Leu Trp Gln Cys Gly Leu Ser Met
115 120 125

Asp Glu Leu Ala Glu Met Gly Leu Thr Leu Gly Ala Asp Val Pro Val
130 135 140

Phe Val Arg Gly His Ala Ala Phe Ala Glu Gly Val Gly Glu Ile Leu
145 150 155 160

Thr Pro Val Asp Pro Pro Glu Lys Trp Tyr Leu Val Ala His Pro Gly
165 170 175

Val Ser Ile Pro Thr Pro Val Ile Phe Lys Asp Pro Glu Leu Pro Arg
180 185 190

Asn Thr Pro Lys Arg Ser Ile Glu Thr Leu Leu Lys Cys Glu Phe Ser
195 200 205

Asn Asp Cys Glu Val Ile Ala Arg Lys Arg Phe Arg Glu Val Asp Ala
210 215 220

Val Leu Ser Trp Leu Leu Glu Tyr Ala Pro Ser Arg Leu Thr Gly Thr
225 230 235 240

Gly Ala Cys Val Phe Ala Glu Phe Asp Thr Glu Ser Glu Ala Arg Gln
245 250 255

Val Leu Glu Gln Ala Pro Glu Trp Leu Asn Gly Phe Val Ala Lys Gly
260 265 270

Ala Asn Leu Ser Pro Leu His Arg Ala Met Leu
275 280

<210> 27

<211> 452

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 27

Met	Arg	Thr	Gln	Trp	Pro	Ser	Pro	Ala	Lys	Leu	Asn	Leu	Phe	Leu	Tyr
1			5					10					15		

Ile	Thr	Gly	Gln	Arg	Ala	Asp	Gly	Tyr	His	Thr	Leu	Gln	Thr	Leu	Phe
		20					25					30			

Gln	Phe	Leu	Asp	Tyr	Gly	Asp	Thr	Ile	Ser	Ile	Glu	Leu	Arg	Asp	Asp
	35					40					45				

Gly	Asp	Ile	Arg	Leu	Leu	Thr	Pro	Val	Glu	Gly	Val	Glu	His	Glu	Asp
	50					55				60					

Asn	Leu	Ile	Val	Arg	Ala	Ala	Arg	Leu	Leu	Met	Lys	Thr	Ala	Ala	Asp
65				70						75					80

Ser	Gly	Arg	Leu	Pro	Thr	Gly	Ser	Gly	Ala	Asn	Ile	Ser	Ile	Asp	Lys
			85					90						95	

Arg	Leu	Pro	Met	Gly	Gly	Gly	Leu	Gly	Gly	Gly	Ser	Ser	Asn	Ala	Ala
		100					105						110		

Thr	Val	Leu	Val	Ala	Leu	Asn	His	Leu	Trp	Gln	Cys	Gly	Leu	Ser	Met
	115					120						125			

Asp	Glu	Leu	Ala	Glu	Met	Gly	Leu	Thr	Leu	Gly	Ala	Asp	Val	Pro	Val
	130					135				140					

Phe	Val	Arg	Gly	His	Ala	Ala	Phe	Ala	Glu	Gly	Val	Gly	Glu	Ile	Leu
145				150					155						160

Thr	Pro	Val	Asp	Pro	Pro	Glu	Lys	Trp	Tyr	Leu	Val	Ala	His	Pro	Gly
			165					170						175	

Val Ser Ile Pro Thr Pro Val Ile Phe Lys Asp Pro Glu Leu Pro Arg
180 185 190

Asn Thr Pro Lys Arg Ser Ile Glu Thr Leu Leu Lys Cys Glu Phe Ser
195 200 205

Asn Asp Cys Glu Val Ile Ala Arg Lys Arg Phe Arg Glu Val Asp Ala
210 215 220

Val Leu Ser Trp Leu Leu Glu Tyr Ala Pro Ser Arg Leu Thr Gly Thr
225 230 235 240

Gly Ala Cys Val Phe Ala Glu Phe Asp Thr Glu Ser Glu Ala Arg Gln
245 250 255

Val Leu Glu Gln Ala Pro Glu Trp Leu Asn Gly Phe Val Ala Lys Gly
260 265 270

Ala Asn Leu Ser Pro Leu His Arg Ala Met Leu Ser Leu Gly Gly Gly
275 280 285

Gly Ser Ala Ala Ala Met Arg Ile Gly His Gly Phe Asp Val His Ala
290 295 300

Phe Gly Gly Glu Gly Pro Ile Ile Ile Gly Gly Val Arg Ile Pro Tyr
305 310 315 320

Glu Lys Gly Leu Leu Ala His Ser Asp Gly Asp Val Ala Leu His Ala
325 330 335

Leu Thr Asp Ala Leu Leu Gly Ala Ala Ala Leu Gly Asp Ile Gly Lys
340 345 350

Leu Phe Pro Asp Thr Asp Pro Ala Phe Lys Gly Ala Asp Ser Arg Glu
355 360 365

Leu Leu Arg Glu Ala Trp Arg Arg Ile Gln Ala Lys Gly Tyr Thr Leu
370 375 380

Gly Asn Val Asp Val Thr Ile Ile Ala Gln Ala Pro Lys Met Leu Pro
385 390 395 400

His Ile Pro Gln Met Arg Val Phe Ile Ala Glu Asp Leu Gly Cys His
405 410 415

Met Asp Asp Val Asn Val Lys Ala Thr Thr Thr Glu Lys Leu Gly Phe
420 425 430

Thr Gly Arg Gly Glu Gly Ile Ala Cys Glu Ala Val Ala Leu Leu Ile
435 440 445

Lys Ala Thr Lys
450

<210> 28
<211> 27
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
primer

<400> 28
ggatgtgctg caaggcgatt aagttgg 27

<210> 29
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
primer

<400> 29
ctcgtatggt gtgtggaatt gtgagc 26

<210> 30
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
6xHis tag

<400> 30

His His His His His His
1 5

<210> 31

<211> 29

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 31

Ala Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys
1 5 10 15

Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Ala Ala Ala
20 25

<210> 32

<211> 7

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 32

Leu Pro Thr Pro Ser Phe Glu
1 5

<210> 33

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 33

Arg Gln Arg Leu Arg Ser Ala Val Ala Ala
1 5 10

<210> 34

<211> 17

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 34

Glu Ala Ile Ala Arg Gly Thr Gly Glu Arg Ala Val Gly Glu Arg Ala
1 5 10 15

Ala

<210> 35

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 35

Glu Arg Leu Ile Gly Ala Arg Asn Thr Ala Gly Ala Met
1 5 10

<210> 36

<211> 395

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 36

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

Phe Gly Arg Arg Met Gln Thr Glu Cys Pro Lys Gln Tyr Leu Ser Ile
20 25 30

Gly Asn Gln Thr Ile Leu Glu His Ser Val His Ala Leu Leu Ala His
35 40 45

Pro Arg Val Lys Arg Val Val Ile Ala Ile Ser Pro Gly Asp Ser Arg
50 55 60

Phe Ala Gln Leu Pro Leu Ala Asn His Pro Gln Ile Thr Val Val Asp
65 70 75 80

Gly Gly Asp Glu Arg Ala Asp Ser Val Leu Ala Gly Leu Lys Ala Ala
85 90 95

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

His Gln Asp Asp Leu Ala Arg Leu Leu Ala Leu Ser Glu Thr Ser Arg
115 120 125

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

Glu Pro Gly Lys Asn Ala Ile Ala His Thr Val Asp Arg Asn Gly Leu
145 150 155 160

Trp His Ala Leu Thr Pro Gln Phe Phe Pro Arg Glu Leu Leu His Asp
165 170 175

Cys Leu Thr Arg Ala Leu Asn Glu Gly Ala Thr Ile Thr Asp Glu Ala
180 185 190

Ser Ala Leu Glu Tyr Cys Gly Phe His Pro Gln Leu Val Glu Gly Arg
195 200 205

Ala Asp Asn Ile Lys Val Thr Arg Pro Glu Asp Leu Ala Leu Ala Glu
210 215 220

Phe Tyr Leu Thr Arg Thr Ile His Gln Glu Asn Thr Met Arg Ile Gly
225 230 235 240

His Gly Phe Asp Val His Ala Phe Gly Gly Glu Gly Pro Ile Ile Ile
245 250 255

Gly Gly Val Arg Ile Pro Tyr Glu Lys Gly Leu Leu Ala His Ser Asp
260 265 270

Gly Asp Val Ala Leu His Ala Leu Thr Asp Ala Leu Leu Gly Ala Ala
275 280 285

Ala Leu Gly Asp Ile Gly Lys Leu Phe Pro Asp Thr Asp Pro Ala Phe
290 295 300

Lys Gly Ala Asp Ser Arg Glu Leu Leu Arg Glu Ala Trp Arg Arg Ile
305 310 315 320

Gln Ala Lys Gly Tyr Thr Leu Gly Asn Val Asp Val Thr Ile Ile Ala
325 330 335

Gln Ala Pro Lys Met Leu Pro His Ile Pro Gln Met Arg Val Phe Ile
340 345 350

Ala Glu Asp Leu Gly Cys His Met Asp Asp Val Asn Val Lys Ala Thr
355 360 365

Thr Thr Glu Lys Leu Gly Phe Thr Gly Arg Gly Glu Gly Ile Ala Cys
370 375 380

Glu Ala Val Ala Leu Leu Ile Lys Ala Thr Lys
385 390 395

<210> 37

<211> 407

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 37

Met Gln Val Thr Ala Ile Ile Ala Ala Gly Gly Arg Gly Arg Arg Phe
1 5 10 15

Gly Gly Gly Val Pro Lys Gln Leu Val Gly Val Gly Gly Arg Pro Ile
20 25 30

Leu Glu Arg Thr Val Ala Ala Phe Leu Gly His Pro Ala Ile His Glu
35 40 45

Val Val Val Ala Leu Pro Ala Glu Leu Met Ala Asp Pro Pro Ala Tyr
50 55 60

Leu Arg Ala Ala Pro Lys Pro Ile Arg Leu Val Ala Gly Gly Val Gln
65 70 75 80

Arg Gln Asp Ser Val Arg Gln Ala Phe Gln Ala Ala Asn Glu Gln Ser
85 90 95

Asp Val Ile Val Ile His Asp Ala Ala Arg Pro Phe Ala Ser Ala Asp
100 105 110

Leu Ile Ser Arg Thr Ile Ala Ala Ala Ala Glu Gly Gly Ala Ala Leu
115 120 125

Ala Ala Val Pro Ala Arg Asp Thr Val Lys Arg Gly Ala Phe Ala Ala
130 135 140

Gly Arg Thr Gly Pro Ala Gly Arg Gln Ala Val Glu Gly Ala Pro Leu
145 150 155 160

Leu Val Val Ala Glu Thr Leu Pro Arg Asp Ser Ile Tyr Leu Ala Gln
165 170 175

Thr Pro Gln Ala Phe Arg Arg Asp Val Leu Arg Asp Ala Leu Ala Leu
180 185 190

Gly Glu Ala Gly Ser Glu Ala Thr Asp Glu Ala Thr Leu Ala Glu Arg
195 200 205

Ala Gly His Ile Val Arg Leu Val Glu Gly Glu Pro Ala Asn Ile Lys
210 215 220

Ile Thr Thr Pro Asp Asp Leu Leu Val Ala Glu Ala Ile Ala Arg Gly
225 230 235 240

Thr Gly Glu Arg Ala Val Gly Glu Arg Ala Ala Phe Arg Ile Gly Ala
245 250 255

Gly Tyr Asp Leu His Arg Leu Val Glu Gly Arg Pro Leu Val Leu Gly
260 265 270

Gly Val Thr Ile Pro Phe Glu Arg Gly Leu Leu Gly His Ser Asp Ala
275 280 285

Asp Ala Ile Cys His Ala Val Thr Asp Ala Val Leu Gly Ala Ala Ala
290 295 300

Ala Gly Asp Ile Gly Arg His Phe Pro Asp Ser Asp Pro Lys Trp Arg
305 310 315 320

Asp Trp Ser Ser Ile Asp Leu Leu Arg Arg Ala Ser Ala Ile Val Lys
325 330 335

Gly Arg Gly Tyr Ala Ile Ala Asn Val Asp Ala Val Val Ile Ala Glu
340 345 350

Arg Pro Lys Leu Ala Pro Phe Leu Asp Glu Met Arg Ala Asn Val Ala
355 360 365

Gly Ala Ile Gly Ile Ala Val Asp Ala Val Gly Ile Lys Gly Lys Thr
370 375 380

Asn Glu Gly Leu Gly Glu Leu Gly Arg Gly Glu Ala Ile Ala Val His
385 390 395 400

Ala Val Ala Leu Leu His Leu
405

<210> 38

<211> 383

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 38

Met Val His Val Ser Ala Ile Ile Ala Ala Gly Gly Arg Gly Glu Arg
1 5 10 15

Phe Gly Gly Pro Gln Pro Lys Gln Leu Leu Leu Leu Gly Gly Val Pro
20 25 30

Ile Leu Lys Arg Thr Val Asp Ala Phe Leu Arg Gly Tyr Pro Phe Ile
35 40 45

Glu Val Ile Val Ala Leu Pro Ala Glu Phe Val Ala Asn Pro Pro Asp
50 55 60

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

Ser Val Ala Asn Ala Phe Arg Ala Val Ala Pro Ser Ala Gln Val Val
85 90 95

Val Ile His Asp Ala Ala Arg Pro Leu Val Thr Pro Ser Leu Ile Glu
100 105 110

Arg Thr Val Asp Ala Ala Val Lys His Gly Ala Ala Ile Ala Ala Leu
115 120 125

Arg Ala Thr Asp Thr Val Lys Arg Gly Asp Ala Ser Arg Val Ile Arg
130 135 140

Gly Thr Leu Pro Arg Asp Glu Ile Phe Leu Ala Gln Thr Pro Gln Ala
145 150 155 160

Phe Arg Ala Gly Val Leu Arg Asp Ala Leu Ala Leu Ala Ala Ser Ala
165 170 175

Ala Asp Ala Thr Asp Glu Ala Met Leu Ala Glu Gln Ala Gly His His
180 185 190

Val Arg Leu Val Asp Gly Asp Pro Arg Asn Leu Lys Ile Thr Thr Pro
195 200 205

Glu Asp Leu Glu Met Ala Glu Arg Leu Ile Gly Ala Arg Asn Thr Ala
210 215 220

Gly Ala Met Arg Ile Gly Asn Gly Tyr Asp Leu His Arg Leu Val Thr
225 230 235 240

Gly Arg Pro Leu Val Leu Gly Gly Val Thr Ile Pro Phe Glu Lys Gly
245 250 255

Leu Gln Gly His Ser Asp Ala Asp Ala Val Cys His Ala Ile Thr Asp
260 265 270

Ala Ile Leu Gly Ala Ala Ser Ala Gly Asp Ile Gly Arg His Phe Pro
275 280 285

Asp Thr Asp Pro Ala Trp Lys Asp Ala Lys Ser Ile Val Leu Leu Gln
290 295 300

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

Asp Val Val Val Ile Ala Gln Gln Pro Lys Leu Val Pro His Ile Asp
325 330 335

Ala Ile Arg His Ser Val Ala His Ala Leu Gly Ile Asp Val Gln Gln
340 345 350

Val Ser Val Lys Gly Lys Thr Asn Glu Gly Val Asp Ser Met Gly Ala
355 360 365

Gly Glu Ser Ile Ala Val His Ala Val Ala Leu Leu Gln His Ser
370 375 380

<210> 39

<211> 371

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 39

Met Ser Glu Met Ser Leu Ile Met Leu Ala Ala Gly Asn Ser Thr Arg
1 5 10 15

Phe Asn Thr Lys Val Lys Lys Gln Phe Leu Arg Leu Gly Asn Asp Pro
20 25 30

Leu Trp Leu Tyr Ala Thr Lys Asn Leu Ser Ser Phe Tyr Pro Phe Lys
35 40 45

Lys Ile Val Val Thr Ser Ser Asn Ile Thr Tyr Met Lys Lys Phe Thr
50 55 60

Lys Asn Tyr Glu Phe Ile Glu Gly Gly Asp Thr Arg Ala Glu Ser Leu
65 70 75 80

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

Val Ala Arg Val Leu Val Ser Lys Asn Leu Phe Asp Arg Leu Ile Glu
100 105 110

Asn Leu Asp Lys Ala Asp Cys Ile Thr Pro Ala Leu Lys Val Ala Asp
115 120 125

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

Ile Gln Thr Pro Gln Ile Ser Lys Thr Lys Leu Leu Lys Lys Ala Leu
145 150 155 160

Asp Gln Asn Leu Glu Phe Thr Asp Asp Ser Thr Ala Ile Ala Ala Met
165 170 175

Gly Gly Lys Ile Trp Phe Val Glu Gly Glu Glu Asn Ala Arg Lys Leu
180 185 190

Thr Phe Lys Glu Asp Leu Lys Lys Leu Asp Leu Pro Thr Pro Ser Phe
195 200 205

Glu Ile Phe Thr Gly Asn Gly Phe Asp Val His Glu Phe Gly Glu Asn
210 215 220

Arg Pro Leu Leu Leu Ala Gly Val Gln Ile His Pro Thr Met Gly Leu
225 230 235 240

Lys Ala His Ser Asp Gly Asp Val Leu Ala His Ser Leu Thr Asp Ala
245 250 255

Ile Leu Gly Ala Ala Gly Leu Gly Asp Ile Gly Glu Leu Tyr Pro Asp
260 265 270

Thr Asp Met Lys Phe Lys Asn Ala Asn Ser Met Glu Leu Leu Lys Gln
275 280 285

Ala Tyr Asp Lys Val Arg Glu Ile Gly Phe Glu Leu Ile Asn Ile Asp
290 295 300

Ile Cys Val Met Ala Gln Ser Pro Lys Leu Lys Asp Phe Lys Gln Ala
305 310 315 320

Met Gln Ser Asn Ile Ala His Thr Leu Asp Leu Asp Glu Phe Arg Ile
325 330 335

Asn Val Lys Ala Thr Thr Thr Glu Lys Leu Gly Phe Ile Gly Arg Lys
340 345 350

Glu Gly Met Ala Val Leu Ser Ser Val Asn Leu Lys Tyr Phe Asp Trp
355 360 365

Thr Arg Leu
370