

SEQUENCE LISTING

<110> DSM IP Assets B.V.
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Perkins, John
Schyns, Ghislain

<120> ALTERNATIVE BUTANOL PRODUCTION PROCESS IN A MICROBIAL CELL

<130> 26631-WO-PCT

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<170> PatentIn version 3.5

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<223> P15icmAB overexpression cassette

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<223> P15-adhE codon pair optimised overexpression cassette

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aaactaactc aattaagata gttgatggat aaacttg ttc acttaaatca aagggggaaa	180
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	Ser	Ser		
Ile 350	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 355	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 360	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 365	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 370	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 375	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 380	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 385	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 390	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 395	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 400	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 405	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 410	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 415	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 420	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 425	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 430	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 435	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 440	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 445	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 450	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 455	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 460	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 465	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 470	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 475	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 480	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 485	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 490	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 495	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 500	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 505	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 510	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 515	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 520	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		
Ile 525	Val	Gly	Asp	Ser 340
	Lys	Gln	Ser	Asp 345
	Ser	Ser		

Glu Ala Lys Glu Lys Leu Glu Glu Ala Leu Thr Ser Arg Glu Pro Val
530 535 540

Val Ile Asp Val Arg Val Ala Ser Glu Glu Lys Val Phe Pro Met Val
545 550 555 560

Ala Pro Gly Lys Gly Leu His Glu Met Val Gly Val Lys Pro
565 570

<210> 31
<211> 172
<212> PRT
<213> Artificial Sequence

<220>
<223> mutant NCgl1223

<400> 31

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

Asp Val Asp Asp Asp Phe Ser Arg Val Ser Gly Met Phe Thr Arg Arg
20 25 30

Ala Phe Asn Leu Val Ser Leu Val Ser Ala Lys Thr Glu Thr His Gly
35 40 45

Ile Asn Arg Ile Thr Val Val Val Asp Ala Asp Glu Leu Asn Ile Glu
50 55 60

Gln Ile Thr Lys Gln Leu Asn Lys Leu Ile Pro Val Leu Lys Val Val
65 70 75 80

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

Val Ser Ala Asp Ser Thr Asn Arg Pro Gln Ile Val Asp Ala Ala Asn
100 105 110

Ile Phe Arg Ala Arg Val Val Asp Val Ala Pro Asp Ser Val Val Ile
115 120 125

Glu Ser Thr Gly Thr Pro Gly Lys Leu Arg Ala Leu Leu Asp Val Met

130		135		140
Glu Pro Phe Gly Ile Arg Glu Leu Ile Gln Ser Gly Gln Ile Ala Leu				
145		150	155	160
Asn Arg Gly Pro Lys Thr Met Ala Pro Ala Lys Ile				
	165	170		
<210> 32				
<211> 694				
<212> PRT				
<213> Penicillium chrysogenum				
<400> 32				
Met Met Pro Leu Arg Pro Ser Lys Ser Ala Leu Arg Ala Phe His Leu				
1	5	10		15
Gln Lys Gln Leu Ala Gly Arg Arg Pro Phe Ser Thr Ser Phe Val Ala				
	20	25		30
Ser Ala Ala Ser Pro His Arg Ser Ser Val Gln Lys Arg Thr Gln Ser				
	35	40	45	
Thr Ala Thr Ala Ser Asn Pro Glu Ser Arg Pro Val Pro Ser Pro Ala				
	50	55	60	
Phe Asn Gln Glu Pro His Arg Asn Glu Ile Ser Pro Leu Gln His Arg				
65	70	75		80
Gln Leu Pro Glu Leu Asp Asp Ser Met Val Gly Met Ser Gly Gly Glu				
	85	90		95
Ile Phe His Glu Met Met Leu Arg Gln Gly Val Lys His Val Phe Gly				
	100	105		110
Tyr Pro Gly Gly Ala Ile Leu Pro Val Phe Asp Ala Ile Tyr Asn Ser				
	115	120	125	
Lys His Phe Glu Phe Ile Leu Pro Lys His Glu Gln Gly Ala Gly His				
	130	135	140	
Met Ala Glu Gly Tyr Ala Arg Ala Ser Gly Lys Pro Gly Val Val Leu				
145	150	155		160

Val Thr Ser Gly Pro Gly Ala Thr Asn Val Ile Thr Pro Met Gln Asp
165 170 175

Ala Met Ser Asp Gly Thr Pro Met Val Val Phe Cys Gly Gln Val Pro
180 185 190

Thr Ser Ala Ile Gly Thr Asp Ser Phe Gln Glu Ala Asp Val Ile Gly
195 200 205

Ile Ser Arg Ala Cys Thr Lys Trp Asn Val Met Val Lys Ser Val Gly
210 215 220

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

Arg Pro Gly Pro Val Leu Val Asp Leu Pro Lys Asp Val Thr Ala Gly
245 250 255

Ile Leu Arg Asn Pro Ile Pro Met His Ser Thr Ile Pro Ser Leu Pro
260 265 270

Ser Ala Ala Thr Val Ala Ala Arg Glu Met Ser Arg Lys Gln Leu Glu
275 280 285

Gly Thr Ile Asn Arg Val Ala Asn Leu Val Asn Val Ala Lys Lys Pro
290 295 300

Ile Leu Tyr Val Gly Gln Gly Leu Leu Ala Arg Pro Asp Gly Pro Glu
305 310 315 320

Ile Leu Lys Glu Phe Ala Asp Lys Ala Cys Ile Pro Val Thr Thr Thr
325 330 335

Leu Gln Gly Leu Gly Gly Phe Asp Glu Leu Asp Pro Lys Ala Leu His
340 345 350

Met Leu Gly Met His Gly Ser Ala Tyr Ala Asn Met Ala Met Gln Glu
355 360 365

Ala Asp Leu Ile Ile Ala Val Gly Ala Arg Phe Asp Asp Arg Val Thr
370 375 380

Leu Ser Ile Pro Lys Phe Ala Pro Gln Ala Lys Leu Ala Ala Thr Glu
 385 390 395 400
 Gly Arg Gly Gly Ile Val His Phe Glu Ile Met Pro Lys Asn Ile Asn
 405 410 415
 Lys Val Val Gln Ala Asn Glu Ala Val Glu Gly Asp Cys Ala Asp Asn
 420 425 430
 Leu Arg Leu Leu Leu Pro His Val Lys Ala Val Ser Glu Arg Pro Glu
 435 440 445
 Trp Phe Glu Gln Ile Asn Asp Trp Lys Gln Arg Phe Pro Leu Ser Leu
 450 455 460
 Tyr Asp Arg Gln Thr Glu Asp Gly Pro Ile Lys Pro Gln Ala Val Ile
 465 470 475 480
 Glu Lys Leu Ser Glu Leu Thr Ala Asp Arg Lys Glu Lys Thr Ile Ile
 485 490 495
 Thr Thr Gly Val Gly Gln His Gln Met Trp Thr Ala Gln His Phe Arg
 500 505 510
 Trp Arg His Pro Arg Thr Met Ile Thr Ser Gly Gly Leu Gly Thr Met
 515 520 525
 Gly Tyr Gly Leu Pro Ala Ala Leu Gly Ala Lys Val Ala Arg Pro Asp
 530 535 540
 Cys Leu Val Ile Asp Ile Asp Gly Asp Ala Ser Phe Asn Met Thr Leu
 545 550 555 560
 Thr Glu Leu Ser Thr Ala Ala Gln Phe Asn Ile Gly Val Lys Val Leu
 565 570 575
 Leu Ile Asn Asn Glu Glu Gln Gly Met Val Thr Gln Trp Gln Asn Leu
 580 585 590
 Phe Tyr Glu Asp Arg Tyr Ser His Thr His Gln Gln Asn Pro Asp Phe
 595 600 605
 Val Pro Leu Ala Lys Ala Met Arg Ile Gly Ala Asp Thr Cys Phe Lys

610 615 620
 Pro Ser Glu Leu Glu Glu Lys Leu Lys Trp Leu Ile Glu His Asp Gly
 625 630 635 640
 Pro Ala Leu Leu Glu Val Ile Thr Asp Arg Lys Val Pro Val Leu Pro
 645 650 655
 Met Val Pro Ser Gly Arg Gly Leu His Glu Phe Leu Val Tyr Asp Glu
 660 665 670
 Ala Lys Asp Leu Glu Arg Lys Glu Leu Met Arg Glu Arg Asn Val Asp
 675 680 685
 Phe Ser Val Arg Lys Glu
 690
 <210> 33
 <211> 662
 <212> PRT
 <213> P. chrysogenum
 <400> 33
 Met Ala Arg Phe Ile Arg Gln Gly Ile Ser Ala Leu Ala Lys His Ala
 1 5 10 15
 Val Thr His Pro Pro Lys Lys Arg Leu Ser Ser Met Ala Thr Glu Ala
 20 25 30
 Leu Val Ser Ser Val Glu Pro Asn Ile Leu Pro Arg Ala Ile Pro Lys
 35 40 45
 Val Asn Asp Arg His Pro Tyr Gly Ala Gly Leu Lys Thr Pro Ser Glu
 50 55 60
 Val Glu Arg Pro Leu Ala Ser Arg Met Ala Thr Asp Ala Ser Leu Val
 65 70 75 80
 Gly Lys Thr Gly Gly Gln Ile Phe His Glu Met Met Val Arg His Asp
 85 90 95
 Val Arg His Ile Phe Gly Tyr Pro Gly Gly Cys Ile Leu Pro Val Phe
 100 105 110

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

Glu Gln Gly Gly Gly His Met Ala Gln Gly Tyr Ala Arg Val Ser Gly
130 135 140

Lys Pro Gly Val Val Leu Val Thr Ser Gly Pro Gly Ala Thr Asn Leu
145 150 155 160

Ile Thr Pro Met Met Asp Ala Leu Ala Asp Gly Thr Pro Met Val Val
165 170 175

Phe Cys Gly Gln Val Ser Ala Asp Lys Ile Gly Thr Asp Ala Phe Gln
180 185 190

Glu Ala Asp Ile Leu Ser Met Ser Gln Pro Cys Thr Lys Trp Asn Val
195 200 205

Ser Val Arg Lys Thr Glu Glu Leu Ala Gln Arg Ile Arg Glu Ala Phe
210 215 220

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

Leu Asp Val Thr Ala Gly Ile Leu Ser Lys Val Pro Thr Asn Met Ala
245 250 255

Ile Arg Pro Gln Asn Arg Pro Val Thr Thr Met Ala Ile Lys Asp Ala
260 265 270

Arg Arg Gln Glu Leu Leu Ile Ala Val Lys Glu Ala Ala Asn Leu Ile
275 280 285

Asn Thr Ala Gln Lys Pro Ile Ile Tyr Ala Gly Gln Gly Val Leu Ala
290 295 300

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

Ile Pro Val Thr Thr Ser Leu Gln Gly Leu Gly Ala Phe Asp Glu Arg
325 330 335

Asp Pro Lys Ser Leu His Met Leu Gly Leu His Gly Ser Gly Tyr Ala
 340 345 350

Asn Leu Ala Ile Gln Asn Ala Asp Leu Ile Leu Ala Leu Gly Ala Arg
 355 360 365

Phe Asp Asp Arg Val Thr Gly Tyr Ile Pro Lys Phe Ala Pro Gln Ala
 370 375 380

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

Ser Pro Lys Asn Ile Asn Lys Val Val Glu Ala Thr Ile Pro Val Val
 405 410 415

Gly Asp Cys Ala Glu Ser Leu Glu Leu Leu Leu Pro Tyr Thr Val Pro
 420 425 430

Met His Arg Pro Glu Trp Leu Thr Gln Ile Gln Ala Trp Lys Asp Gln
 435 440 445

Tyr Pro Phe Arg Ala Phe Asn Gln Ser Gly His Asn Asn Asp Met Ile
 450 455 460

Leu Pro Gln His Phe Ile Glu Arg Leu Ser Asp Ala Val Glu His Ile
 465 470 475 480

Lys Glu Arg Thr Ile Ile Thr Thr Gly Val Gly Gln His Gln Met Trp
 485 490 495

Ala Ala Gln His Phe Arg Trp Arg Tyr Pro Arg Thr Met Val Thr Ser
 500 505 510

Gly Gly Leu Gly Thr Met Gly Tyr Gly Leu Pro Ala Ala Ile Gly Ala
 515 520 525

Lys Val Ala Arg Pro Glu Ala Leu Val Ile Asp Ile Asp Gly Asp Ala
 530 535 540

Ser Leu Asn Met Thr Ile Ser Glu Leu Leu Thr Ala Ser Gln Phe Gly
 545 550 555 560

Ile Asp Val Lys Val Val Leu Leu Asn Asn Glu Glu Gln Gly Met Val

Cys Leu Val Gln Asn Glu Pro Gly Val Leu Ser Arg Val Ser Gly Ile
 100 105 110

Leu Ala Ala Arg Gly Phe Asn Ile Asp Ser Leu Val Val Cys Asn Thr
 115 120 125

Glu Val Glu Asp Leu Ser Arg Met Thr Ile Val Leu Gln Gly Gln Asp
 130 135 140

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

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

Leu Leu Ala Lys Val Ser Ile Leu Gly Pro Glu Phe Phe Glu Glu Leu
 180 185 190

Leu Gln His His Arg Glu Ile Thr Thr Ser Pro Asp Ser Leu Asp His
 195 200 205

Lys His His Ser Leu Asp His Thr Ala Gln Gln Tyr His Pro Arg His
 210 215 220

Leu Pro Gln Ser Gln Ala Leu Arg His Lys His Glu His Leu Asp Ala
 225 230 235 240

Ile Thr Arg Leu Thr His Gln Phe Gly Gly Lys Ile Leu Asp Ile Ser
 245 250 255

Thr Asn Asn Cys Ile Val Glu Val Ser Ala Lys Pro Ser Arg Ile Asp
 260 265 270

Ser Phe Leu Lys Leu Ile Gly Pro Phe Gly Ile Leu Glu Ser Thr Arg
 275 280 285

Thr Gly Leu Met Ala Leu Pro Arg Ser Pro Leu Ser Glu Pro Asn Glu
 290 295 300

Asp Ile Glu Lys Asp Ala Ala Asp Val Val Asp Ala Ser Thr Leu Pro
 305 310 315 320

Pro Gly

<210> 35
<211> 398
<212> PRT
<213> P. chrysogenum

<400> 35

Met Ala Ser Arg Gly Leu Pro Arg Ala Leu Arg Leu Ala Arg Val Ala
1 5 10 15

Ala Pro Arg Ser Val Val Thr Ala Ala Leu Pro Arg Pro Ala Val Ala
20 25 30

Ala Ala Ala Ala Leu Pro Arg Val Ser Ser Val Val Thr Pro Val Arg
35 40 45

Gly Ile Lys Thr Ile Asp Phe Ala Gly Val Lys Glu Asp Val Tyr Glu
50 55 60

Arg Ala Asp Trp Pro Arg Glu Lys Leu Gln Glu Tyr Phe Lys Asn Asp
65 70 75 80

Thr Leu Ala Leu Ile Gly Tyr Gly Ser Gln Gly His Gly Gln Gly Leu
85 90 95

Asn Leu Arg Asp Gln Gly Leu Asn Val Ile Val Gly Val Arg Lys Asp
100 105 110

Gly Ala Ser Trp Lys Glu Ala Ile Gln Asp Gly Trp Val Pro Gly Lys
115 120 125

Asn Leu Phe Asp Val Thr Thr Ala Ile Glu Lys Gly Thr Val Ile Met
130 135 140

Asn Leu Leu Ser Asp Ala Ala Gln Ser Glu Thr Trp Pro Thr Ile Lys
145 150 155 160

Pro Leu Leu Thr Lys Gly Lys Thr Leu Tyr Phe Ser His Gly Phe Ser
165 170 175

Pro Val Phe Lys Asp Leu Thr Lys Val Asp Val Pro Lys Asp Ile Asp
180 185 190

Val Ile Leu Val Ala Pro Lys Gly Ser Gly Arg Thr Val Arg Thr Leu
195 200 205

Phe Arg Glu Gly Arg Gly Ile Asn Ser Ser Ile Ala Val Phe Gln Asp
210 215 220

Val Thr Gly Gln Ala Lys Glu Arg Ala Ile Ala Met Gly Val Ala Val
225 230 235 240

Gly Ser Gly Tyr Leu Tyr Glu Thr Thr Phe Glu Lys Glu Val Tyr Ser
245 250 255

Asp Leu Tyr Gly Glu Arg Gly Cys Leu Met Gly Gly Ile His Gly Met
260 265 270

Phe Leu Ala Gln Tyr Glu Val Leu Arg Glu Arg Gly His Ser Pro Ser
275 280 285

Glu Ala Phe Asn Glu Thr Val Glu Glu Ala Thr Gln Ser Leu Tyr Pro
290 295 300

Leu Ile Gly Gly Asn Gly Met Asp Trp Met Tyr Ala Ala Cys Ser Thr
305 310 315 320

Thr Ala Arg Arg Gly Ala Ile Asp Trp Ser Ser Arg Phe Lys Asp Thr
325 330 335

Leu Lys Pro Val Phe Asn Asp Leu Tyr Asp Ser Val His Asn Gly Thr
340 345 350

Glu Thr Lys Arg Ser Leu Asp Tyr Asn Ser Gln Pro Asp Tyr Arg Glu
355 360 365

Lys Tyr Glu Lys Glu Met Gln Glu Ile Arg Asp Leu Glu Ile Trp Arg
370 375 380

Ala Gly Lys Ala Val Arg Ser Leu Arg Pro Glu Asn Gln Lys
385 390 395

<210> 36
<211> 607
<212> PRT

<213> P. chrysogenum

<400> 36

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

Ser Arg Thr Asn Pro Val Arg Thr Leu Ser Thr Thr Leu Pro Arg Phe
20 25 30

Gln Asn Asp Lys Ala Leu Asn Lys Val Ser Arg His Ile Thr Gln Pro
35 40 45

Lys Ala Gln Gly Ala Ser Gln Ala Met Leu Tyr Ala Val Gly Leu Lys
50 55 60

Glu Glu Asp Met Asn Lys Ala Gln Val Gly Ile Ser Ser Val Trp Phe
65 70 75 80

Asn Gly Asn Pro Cys Asn Met His Leu Leu Asp Leu Asn Asn Lys Val
85 90 95

Arg Gln Gly Val Gln Asp Gln Asp Leu Ile Gly Phe Gln Phe Asn Thr
100 105 110

Val Gly Val Ser Asp Ala Ile Ser Met Gly Thr Ser Gly Met Arg Tyr
115 120 125

Ser Leu Gln Ser Arg Asp Leu Ile Ala Asp Ser Val Glu Thr Val Met
130 135 140

Gly Gly Gln Trp Tyr Asp Ala Asn Ile Ser Ile Pro Gly Cys Asp Lys
145 150 155 160

Asn Met Pro Gly Val Leu Met Ala Met Gly Arg Ile Asn Arg Pro Ser
165 170 175

Leu Met Val Tyr Gly Gly Thr Ile Lys Pro Gly Cys Ala Ala Thr Gln
180 185 190

Asn Asn Ala Asp Ile Asp Ile Val Ser Ala Phe Gln Ala Tyr Gly Gln
195 200 205

Phe Leu Thr Lys Glu Ile Thr Glu Pro Gln Arg Phe Asp Val Ile Arg

Asp Ser Glu Asp Asp Phe Ile Ala Ala Leu Glu Arg Gly Glu Ile Lys
450 455 460

Lys Glu Glu Lys Thr Val Val Val Ile Arg Tyr Cys Gly Pro Lys Gly
465 470 475 480

Gly Pro Gly Met Pro Glu Met Leu Lys Pro Ser Ser Ala Leu Met Gly
485 490 495

Tyr Gly Leu Gly Gln Ser Cys Ala Leu Ile Thr Asp Gly Arg Phe Ser
500 505 510

Gly Gly Ser His Gly Phe Leu Ile Gly His Ile Val Pro Glu Ala Ala
515 520 525

Val Gly Gly Pro Ile Gly Leu Val Asn Asp Gly Asp Ile Ile Thr Ile
530 535 540

Asp Ala Asp Lys Arg Val Leu Asp Val Glu Leu Ser Asp Ala Glu Phe
545 550 555 560

Ala Asp Arg Lys Gln Lys Trp Glu Ala Arg Lys Ala Ala Gly Asp Leu
565 570 575

Pro Glu Thr Gly Leu Thr Met Arg Gly Thr Leu Gly Lys Tyr Ala Arg
580 585 590

Thr Val Gln Asp Ala Ser Gln Gly Cys Ile Thr Asp Ala Leu Glu
595 600 605

<210> 37
<211> 608
<212> PRT
<213> P. chrysogenum

<220>
<221> misc_feature
<223> Xaa can be any naturally occurring amino acid

<220>
<221> misc_feature
<222> (16)..(16)
<223> Xaa can be any naturally occurring amino acid

<400> 37

Met Asp Pro Ser Lys Pro Thr Val Pro Gly Thr Leu Ser Glu Ala Xaa
1 5 10 15

Tyr Ile Asn Phe Pro Ser Leu Pro Thr Asp Ala Lys His Pro Asp Gly
20 25 30

Ser Pro Ala Leu Asn Arg His Ser His Thr Ile Thr Lys Gly His Asp
35 40 45

Phe Pro Gly Ala Arg Ala Met Leu Tyr Ala Ala Gly Val Pro Asp Lys
50 55 60

Glu Ala Met Thr Lys Ser Pro His Val Gly Ile Ala Ser Val Trp Trp
65 70 75 80

Glu Gly Asn Pro Cys Asn Met His Leu Met Asp Leu Ala Lys Thr Val
85 90 95

Lys Lys Ser Val Val Gly Gln Gly Met Leu Gly Trp Gln Tyr Asn Thr
100 105 110

Ile Gly Val Ser Asp Ala Ile Thr Met Gly Ser Glu Gly Met Arg Phe
115 120 125

Ser Leu Gln Thr Arg Glu Val Ile Ala Asp Ser Ile Glu Thr Val Thr
130 135 140

Cys Ala Gln Tyr His Asp Ala Cys Ile Ala Ile Pro Gly Cys Asp Lys
145 150 155 160

Asn Met Pro Gly Val Val Met Gly Met Ala Arg His Asn Arg Pro Ser
165 170 175

Ile Met Ile Tyr Gly Gly Thr Ile Gly Ile Gly Tyr Ser Glu His Leu
180 185 190

Arg Lys Pro Ile Asn Val Ser Thr Cys Phe Glu Ala Ala Gly Ala Tyr
195 200 205

Ala Tyr Gly Thr Leu Arg Gln Pro Asp Asp Gly Gly Asp Gln Thr Lys
210 215 220

Ser Gln Asp Glu Ile Met Asp Asp Leu Glu Gln His Ala Cys Pro Gly
 225 230 235 240

Ala Gly Ala Cys Gly Gly Met Phe Thr Ala Asn Thr Met Ala Thr Ala
 245 250 255

Ile Glu Ser Met Gly Leu Ser Leu Pro Gly Ser Ser Ser Thr Pro Ala
 260 265 270

Glu Ser Pro Ser Lys Met Arg Glu Cys Val Arg Ala Ala Asp Ala Ile
 275 280 285

Lys Val Cys Leu Glu Lys Asn Ile Arg Pro Arg Asp Leu Leu Thr Lys
 290 295 300

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

Thr Asn Gly Val Leu His Phe Leu Ala Met Ala Arg Thr Ala Gly Val
 325 330 335

Asp Leu Thr Leu Asp Asp Ile Gln Arg Val Ser Asn Lys Ile Pro Phe
 340 345 350

Ile Ala Asn Leu Ser Pro Ser Gly Lys Tyr Tyr Met Ala Asp Leu Tyr
 355 360 365

Glu Ile Gly Gly Val Pro Ser Val Gln Lys Leu Leu Ile Ala Ala Gly
 370 375 380

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

Asn Val Ala Ser Phe Pro Ser Leu Thr Glu Gly Gln Asp Leu Ile Arg
 405 410 415

Pro Leu Asp Asn Pro Ile Lys Ala Ser Gly His Leu Gln Ile Leu Arg
 420 425 430

Gly Asn Leu Ala Pro Gly Gly Ala Val Ala Lys Ile Thr Gly Lys Glu
 435 440 445

Gly Leu Arg Phe Val Gly Lys Ala Arg Val Phe Asp Lys Glu His Gln
 450 455 460

Leu Asn Asp Ala Leu Asn Glu Gly His Ile Pro Arg Gly Glu Asn Leu
 465 470 475 480

Val Ile Ile Val Arg Tyr Glu Gly Pro Lys Gly Gly Pro Gly Met Pro
 485 490 495

Glu Gln Leu Lys Ala Ser Ala Ala Leu Met Gly Ala Lys Leu Thr Asn
 500 505 510

Val Ala Leu Ile Thr Asp Gly Arg Tyr Ser Gly Ala Ser His Gly Phe
 515 520 525

Ile Val Gly His Ile Val Pro Glu Ala Ala Val Gly Gly Pro Ile Ala
 530 535 540

Leu Val Arg Asp Gly Asp Val Val Thr Ile Asp Ala Glu Thr Asn Ser
 545 550 555 560

Leu Ser Met Asp Val Ser Asp Lys Glu Leu Gln Glu Arg Arg Ser Leu
 565 570 575

Trp Thr Pro Pro Ser Pro Gln Ile Thr Arg Gly Val Leu Ala Lys Tyr
 580 585 590

Ala Arg Leu Val Ser Asp Ala Ser Gln Gly Ala Met Thr Asp Leu Phe
 595 600 605

<210> 38
 <211> 386
 <212> PRT
 <213> P. chrysogenum

<400> 38

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

Arg Phe Tyr Ser Gly Ala Pro Ser Thr Ala Ala Lys Leu Asn Leu Pro
 20 25 30

Val Asp Tyr Lys Thr Thr Pro Ile Leu His His Thr Ser Ser Ser Leu
 35 40 45

Ser Asn Thr Glu Tyr Pro Ala Gly Ala Thr Ser Lys Arg Leu Asn Leu
50 55 60

Tyr Gln Ala Ile Asn Ser Ala Leu Arg Thr Ala Leu Ser Lys Ser Asp
65 70 75 80

Arg Thr Ile Val Phe Gly Glu Asp Val Gly Phe Gly Gly Val Phe Arg
85 90 95

Cys Thr Met Asp Leu Gln Thr Glu Phe Gly Ser Asp Arg Val Phe Asn
100 105 110

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

Val Glu Gly Met Lys Pro Ile Ala Glu Ile Gln Phe Ala Asp Tyr Val
130 135 140

Phe Pro Ala Phe Asp Gln Ile Val Asn Glu Ala Ala Lys Phe Arg Tyr
145 150 155 160

Arg Glu Gly Gly Thr Gly Ile Asn Ala Gly Gly Leu Val Ile Arg Met
165 170 175

Pro Cys Gly Ala Val Gly His Gly Ala Leu Tyr His Ser Gln Ser Pro
180 185 190

Glu Ser Leu Phe Ala His Ile Pro Gly Leu Arg Val Val Met Pro Arg
195 200 205

Ser Pro Ala Gln Ala Lys Gly Leu Leu Leu Ser Ser Ile Phe Glu His
210 215 220

Asn Asp Pro Val Val Phe Met Glu Pro Lys Ile Leu Tyr Arg Ala Ala
225 230 235 240

Val Glu Tyr Val Pro Asn Glu Tyr Tyr Thr Ile Pro Leu Ser Lys Ala
245 250 255

Glu Val Ile Lys Pro Gly Asn Asp Leu Thr Ile Ile Ser Tyr Gly Gln
260 265 270

Pro Leu Tyr Leu Cys Ser Ser Ala Ile Ser Ala Val Glu Lys Ala Met
 275 280 285

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

Asp Arg Gln Thr Val Ile Asp Ser Val Lys Lys Thr Gly Arg Ala Ile
 305 310 315 320

Val Val His Glu Ser Met Val Asn Tyr Gly Val Gly Ala Glu Val Ala
 325 330 335

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

Arg Val Ala Gly Trp Ser Thr His Thr Gly Leu Ser Tyr Glu Gln Phe
 355 360 365

Ile Leu Pro Asp Val Ala Arg Ile Tyr Asp Ala Ile Lys Gln Thr Leu
 370 375 380

Glu Tyr
 385

<210> 39
 <211> 448
 <212> PRT
 <213> P. chrysogenum

<400> 39

Met Ser Leu Lys Leu Leu Ser Arg Asn Gly Leu Arg Ser Gln Pro Val
 1 5 10 15

Thr Thr Ala Arg Ile Val Pro Ala Arg Arg Trp Ser Ser Ser Ile Ser
 20 25 30

Gln Arg Pro Gly Ser Asp Ser Val Arg Phe Pro Gly Ala Val Asn Ser
 35 40 45

Lys Phe Thr Ser Glu Met Ala Phe Leu Lys Ala Ser Asp Leu Pro Ala
 50 55 60

Ile Pro Thr Tyr Arg Val Met Asp Ser Asp Gly Tyr Gln Ile Asp Lys

65					70					75					80
Thr	Arg	Pro	Ala	Pro	Asn	Val	Thr	Asn	Glu	Glu	Val	Leu	Thr	Trp	Tyr
				85					90					95	
Lys	Asn	Met	Leu	Ser	Val	Ser	Val	Met	Asp	Val	Val	Met	Phe	Glu	Ala
			100					105					110		
Gln	Arg	Gln	Gly	Arg	Leu	Ser	Phe	Tyr	Met	Val	Ser	Ala	Gly	Glu	Glu
			115				120					125			
Gly	Ile	Thr	Val	Gly	Ser	Ala	Ala	Ala	Leu	Thr	Pro	Asp	Asp	Val	Val
	130					135					140				
Phe	Ala	Gln	Tyr	Arg	Glu	Ala	Gly	Val	Phe	Gln	Gln	Arg	Gly	Phe	Thr
145					150					155					160
Leu	Lys	Asn	Phe	Met	Ser	Gln	Leu	Phe	Ala	Asn	Ala	Asn	Asp	Thr	Gly
				165					170					175	
Arg	Gly	Arg	Asn	Met	Pro	Val	His	Tyr	Gly	Gln	Asn	Tyr	Pro	Arg	Thr
			180					185					190		
His	Thr	Ile	Ser	Ser	Pro	Leu	Ala	Thr	Gln	Ile	Pro	Gln	Ala	Ala	Gly
		195					200					205			
Ala	Ala	Tyr	Ala	Leu	Lys	Leu	Gln	Asp	Leu	Gln	Asn	Pro	Asn	Arg	Asp
	210					215					220				
Pro	Arg	Ile	Val	Ala	Cys	Tyr	Phe	Gly	Glu	Gly	Ala	Ala	Ser	Glu	Gly
225					230					235					240
Asp	Phe	His	Ala	Ala	Leu	Asn	Ile	Ala	Ala	Thr	Arg	Ser	Cys	Pro	Val
			245					250						255	
Val	Phe	Ile	Cys	Arg	Asn	Asn	Gly	Tyr	Ala	Ile	Ser	Thr	Pro	Thr	Leu
			260					265					270		
Glu	Gln	Tyr	Arg	Gly	Asp	Gly	Ile	Ala	Ser	Arg	Gly	Val	Gly	Tyr	Gly
		275					280					285			
Ile	Asp	Thr	Ile	Arg	Val	Asp	Gly	Asn	Asp	Val	Phe	Ala	Val	Asn	Glu
	290					295					300				

Ala Met Lys Glu Ala Arg Arg Leu Ala Leu Ser Asp Gly Gly Arg Pro
 305 310 315 320

Val Leu Ile Glu Ala Met Ser Tyr Arg Val Ser His His Ser Thr Ser
 325 330 335

Asp Asp Ser Phe Ala Tyr Arg Ala Arg Val Glu Val Glu Asp Trp Lys
 340 345 350

Arg Arg Asp Asn Pro Ile Ile Arg Leu Arg Lys Trp Leu Glu Asn Gln
 355 360 365

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

Lys Ala Val Leu Lys Glu Phe Gly Glu Ala Glu Gln Glu Lys Lys Pro
 385 390 395 400

Ser Leu Arg Asp Ala Phe Thr Asp Val Tyr Glu Glu Val Thr Glu Glu
 405 410 415

Gln Arg Glu Gln Met Ala Glu Leu Lys Arg Ile Leu Glu Thr Tyr Pro
 420 425 430

Asp Glu Tyr Asp Leu Arg Pro Tyr Lys Asp Gly Ile Asn Gly Leu Asp
 435 440 445

<210> 40
 <211> 479
 <212> PRT
 <213> P. chrysogenum

<400> 40

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

Cys Leu Pro Gln Asn Arg Leu Arg Ile Arg Ser Thr Leu Thr Pro Leu
 20 25 30

Leu Ser Arg Arg Phe His Ala Ser Ser Leu Leu Trp Gly Ile Lys Ser
 35 40 45

Gln Val Leu Lys Asp Val Gly Glu Gly Ile Thr Glu Val Gln Ile Ile
 50 55 60

Gln Trp Tyr Val Glu Glu Gly Ala His Ile Glu Glu Trp Lys Pro Leu
 65 70 75 80

Cys Gln Tyr Gln Ser Asp Lys Ala Val Asp Asp Ile Thr Ser Arg Tyr
 85 90 95

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

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

Asp Asp Asn Pro Pro His Glu Ser Arg Ala Glu Ser Ser Glu Pro Thr
 130 135 140

Pro Ala Pro Glu Val Pro Ala Pro Thr Gln Ala Ala Glu Ser Ser Pro
 145 150 155 160

Ile Thr Pro Pro Pro Thr Asn Val Thr Asn Val Pro Glu Glu Thr Pro
 165 170 175

Lys Thr Lys His Ala Ser Leu Ala Val Pro Ala Val Arg Gly Leu Leu
 180 185 190

Lys Ser His Gly Val Asn Ile Leu Glu Val Asn Gly Thr Gly Lys Asp
 195 200 205

Gly Arg Val Met Lys Glu Asp Val Leu Asn Phe Val Ala Gln Arg Asp
 210 215 220

Ser Pro Ala Ala Ser Ala Ser Val Pro Ala Pro Val Ser Gly Ser Pro
 225 230 235 240

Asp Thr Arg Gln Ser Glu Ser Ile Val Asn Leu Thr Pro Ile Gln Ser
 245 250 255

Gln Met Phe Lys Thr Met Thr Lys Ser Leu Asn Thr Pro His Phe Leu
 260 265 270

Tyr Ala Asp Glu Leu Lys Val Asn Asp Ile Thr Ala Ile Arg Lys Lys

275		280		285											
Leu	Ala	Ser	Asp	Lys	Arg	Asp	Pro	Thr	Lys	Ile	Thr	Phe	Leu	Pro	Phe
290						295					300				
Val	Val	Lys	Ala	Val	Ser	Gln	Ala	Leu	Thr	Glu	Phe	Pro	Ile	Leu	Asn
305					310					315					320
Ser	Lys	Val	Asp	Val	Thr	Asp	Pro	Ala	Lys	Pro	Lys	Leu	Val	Met	Arg
				325					330					335	
Ala	Lys	His	Asn	Ile	Gly	Ile	Ala	Met	Asp	Thr	Pro	Asn	Gly	Leu	Ile
			340					345					350		
Val	Pro	Asn	Ile	Lys	Asp	Val	Ala	Ser	Arg	Ser	Ile	Phe	Asp	Ile	Ala
		355					360					365			
Ala	Glu	Ile	Ala	Arg	Leu	Ser	Ala	Leu	Gly	Asn	Ala	Gly	Lys	Leu	Thr
	370					375					380				
Pro	Ala	Asp	Leu	Ser	Gly	Gly	Thr	Ile	Thr	Val	Ser	Asn	Ile	Gly	Asn
385					390					395					400
Ile	Gly	Gly	Thr	Tyr	Val	Ala	Pro	Val	Ile	Val	Pro	Thr	Glu	Val	Ala
				405					410					415	
Ile	Leu	Gly	Val	Gly	Lys	Ser	Arg	Thr	Val	Pro	Val	Phe	Asp	Glu	Asp
			420					425					430		
Gly	Gln	Val	Thr	Arg	Gly	Asp	Met	Val	Asn	Phe	Ser	Trp	Ser	Ala	Asp
		435					440					445			
His	Arg	Val	Ile	Asp	Gly	Ala	Thr	Met	Ala	Arg	Met	Gly	Thr	Arg	Val
	450					455					460				
Lys	Asp	Leu	Val	Glu	Ser	Pro	Glu	Leu	Met	Leu	Leu	Asn	Leu	Arg	
465					470					475					

<210> 41
 <211> 512
 <212> PRT
 <213> P. chrysogenum
 <400> 41

Met	Phe	Arg	Ala	Val	Leu	Pro	Arg	Ala	Thr	Pro	Arg	Ser	Ala	Leu	Arg	1	5	10	15
His	Ala	Gly	Pro	Arg	Ala	Ile	Pro	Asn	Asn	Phe	Ala	Thr	Ser	Met	Ile	20	25	30	
Phe	Ile	Gly	Gln	Ser	Lys	Arg	Gly	Phe	Ala	Ser	Glu	Ala	Gly	Asp	His	35	40	45	
Asp	Leu	Val	Ile	Ile	Gly	Gly	Gly	Val	Ala	Gly	Tyr	Val	Ala	Ala	Ile	50	55	60	
Lys	Ala	Gly	Gln	Glu	Gly	Leu	Lys	Thr	Ala	Cys	Ile	Glu	Lys	Arg	Gly	65	70	75	80
Lys	Leu	Gly	Gly	Thr	Cys	Leu	Asn	Val	Gly	Cys	Ile	Pro	Ser	Lys	Ser	85	90	95	
Leu	Leu	Asn	Asn	Ser	His	Leu	Tyr	His	Gln	Val	Leu	His	Asp	Thr	Lys	100	105	110	
Lys	Arg	Gly	Ile	Glu	Val	Gly	Asp	Val	Lys	Leu	Asn	Leu	Thr	Gln	Met	115	120	125	
Met	Lys	Ala	Lys	Asp	Thr	Ser	Val	Asp	Gly	Leu	Thr	Lys	Gly	Ile	Glu	130	135	140	
Phe	Leu	Leu	Lys	Lys	Asn	Gly	Val	Asp	Tyr	Val	Lys	Gly	Ala	Gly	Ser	145	150	155	160
Phe	Val	Asp	Ala	Asn	Thr	Ile	Lys	Val	Ala	Leu	Asn	Glu	Gly	Gly	Glu	165	170	175	
Gln	Thr	Leu	Arg	Ala	Lys	Asn	Ile	Ile	Ile	Ala	Thr	Gly	Ser	Glu	Ala	180	185	190	
Thr	Gly	Phe	Pro	Gly	Leu	Asn	Ile	Asp	Glu	Lys	Arg	Ile	Ile	Thr	Ser	195	200	205	
Thr	Gly	Ala	Leu	Ala	Leu	Thr	Glu	Val	Pro	Lys	Lys	Met	Thr	Val	Ile	210	215	220	

Gly Gly Gly Ile Ile Gly Leu Glu Met Ala Ser Val Trp Ser Arg Leu
 225 230 235 240

Gly Ala Glu Val Thr Val Val Glu Phe Leu Gly Gln Ile Gly Gly Pro
 245 250 255

Gly Met Asp Ala Glu Ile Ala Lys Gln Ala Gln Lys Ile Leu Gly Lys
 260 265 270

Gln Gly Ile Lys Phe Lys Thr Gly Thr Lys Val Val Ser Gly Asp Asp
 275 280 285

Ser Gly Ser Thr Ile Ser Leu Asn Ile Glu Ala Ala Lys Gly Gly Lys
 290 295 300

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

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

Asp Arg Gly Arg Leu Val Ile Asp Gln Glu Tyr Arg Thr Lys Leu Pro
 340 345 350

His Ile Arg Val Val Gly Asp Cys Thr Phe Gly Pro Met Leu Ala His
 355 360 365

Lys Ala Glu Glu Glu Ala Val Ala Ala Ile Glu Tyr Ile Lys Thr Gly
 370 375 380

Tyr Gly His Val Asn Tyr Ala Ala Ile Pro Ser Val Met Tyr Thr His
 385 390 395 400

Pro Glu Val Ala Trp Val Gly Gln Asn Glu Ala Glu Ile Lys Ala Ser
 405 410 415

Gly Val Lys Tyr Arg Val Gly Ser Phe Pro Phe Ser Ala Asn Ser Arg
 420 425 430

Ala Lys Thr Asn Leu Asp Thr Glu Gly Val Val Lys Phe Ile Ala Asp
 435 440 445

Ala Glu Thr Asp Arg Val Leu Gly Val His Ile Ile Gly Pro Gly Ala

450 455 460
 Gly Glu Met Ile Ala Glu Ala Thr Leu Ala Ile Glu Tyr Gly Ala Ser
 465 470 475 480
 Ser Glu Asp Ile Ala Arg Thr Cys His Ala His Pro Thr Leu Ser Glu
 485 490 495
 Ala Phe Lys Glu Ala Ala Met Ala Thr Tyr Ser Lys Pro Ile His Phe
 500 505 510

 <210> 42
 <211> 570
 <212> PRT
 <213> B subtilis

 <400> 42
 Met Leu Thr Lys Ala Thr Lys Glu Gln Lys Ser Leu Val Lys Asn Arg
 1 5 10 15
 Gly Ala Glu Leu Val Val Asp Cys Leu Val Glu Gln Gly Val Thr His
 20 25 30
 Val Phe Gly Ile Pro Gly Ala Lys Ile Asp Ala Val Phe Asp Ala Leu
 35 40 45
 Gln Asp Lys Gly Pro Glu Ile Ile Val Ala Arg His Glu Gln Asn Ala
 50 55 60
 Ala Phe Met Ala Gln Ala Val Arg Leu Thr Gly Lys Pro Gly Val Val
 65 70 75 80
 Leu Val Thr Ser Gly Pro Gly Ala Ser Asn Leu Ala Thr Gly Leu Leu
 85 90 95
 Thr Ala Asn Thr Glu Gly Asp Pro Val Val Ala Leu Ala Gly Asn Val
 100 105 110
 Ile Arg Ala Asp Arg Leu Lys Arg Thr His Gln Ser Leu Asp Asn Ala
 115 120 125
 Ala Leu Phe Gln Pro Ile Thr Lys Tyr Ser Val Glu Val Gln Asp Val
 130 135 140

Lys Asn Ile Pro Glu Ala Val Thr Asn Ala Phe Arg Ile Ala Ser Ala
145 150 155 160

Gly Gln Ala Gly Ala Ala Phe Val Ser Phe Pro Gln Asp Val Val Asn
165 170 175

Glu Val Thr Asn Thr Lys Asn Val Arg Ala Val Ala Ala Pro Lys Leu
180 185 190

Gly Pro Ala Ala Asp Asp Ala Ile Ser Ala Ala Ile Ala Lys Ile Gln
195 200 205

Thr Ala Lys Leu Pro Val Val Leu Val Gly Met Lys Gly Gly Arg Pro
210 215 220

Glu Ala Ile Lys Ala Val Arg Lys Leu Leu Lys Lys Val Gln Leu Pro
225 230 235 240

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

Asp Gln Tyr Phe Gly Arg Ile Gly Leu Phe Arg Asn Gln Pro Gly Asp
260 265 270

Leu Leu Leu Glu Gln Ala Asp Val Val Leu Thr Ile Gly Tyr Asp Pro
275 280 285

Ile Glu Tyr Asp Pro Lys Phe Trp Asn Ile Asn Gly Asp Arg Thr Ile
290 295 300

Ile His Leu Asp Glu Ile Ile Ala Asp Ile Asp His Ala Tyr Gln Pro
305 310 315 320

Asp Leu Glu Leu Ile Gly Asp Ile Pro Ser Thr Ile Asn His Ile Glu
325 330 335

His Asp Ala Val Lys Val Glu Phe Ala Glu Arg Glu Gln Lys Ile Leu
340 345 350

Ser Asp Leu Lys Gln Tyr Met His Glu Gly Glu Gln Val Pro Ala Asp
355 360 365

Trp Lys Ser Asp Arg Ala His Pro Leu Glu Ile Val Lys Glu Leu Arg
 370 375 380

Asn Ala Val Asp Asp His Val Thr Val Thr Cys Asp Ile Gly Ser His
 385 390 395 400

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

Met Ile Ser Asn Gly Met Gln Thr Leu Gly Val Ala Leu Pro Trp Ala
 420 425 430

Ile Gly Ala Ser Leu Val Lys Pro Gly Glu Lys Val Val Ser Val Ser
 435 440 445

Gly Asp Gly Gly Phe Leu Phe Ser Ala Met Glu Leu Glu Thr Ala Val
 450 455 460

Arg Leu Lys Ala Pro Ile Val His Ile Val Trp Asn Asp Ser Thr Tyr
 465 470 475 480

Asp Met Val Ala Phe Gln Gln Leu Lys Lys Tyr Asn Arg Thr Ser Ala
 485 490 495

Val Asp Phe Gly Asn Ile Asp Ile Val Lys Tyr Ala Glu Ser Phe Gly
 500 505 510

Ala Thr Gly Leu Arg Val Glu Ser Pro Asp Gln Leu Ala Asp Val Leu
 515 520 525

Arg Gln Gly Met Asn Ala Glu Gly Pro Val Ile Ile Asp Val Pro Val
 530 535 540

Asp Tyr Ser Asp Asn Ile Asn Leu Ala Ser Asp Lys Leu Pro Lys Glu
 545 550 555 560

Phe Gly Glu Leu Met Lys Thr Lys Ala Leu
 565 570

<210> 43
 <211> 174
 <212> PRT
 <213> B. subtilis

<400> 43

Met Lys Arg Ile Ile Thr Leu Thr Val Val Asn Arg Ser Gly Val Leu
1 5 10 15

Asn Arg Ile Thr Gly Leu Phe Thr Lys Arg His Tyr Asn Ile Glu Ser
20 25 30

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

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

Leu Asn Lys Gln Ile Asp Val Leu Lys Val Thr Asp Ile Thr Asn Gln
65 70 75 80

Ser Ile Val Gln Arg Glu Leu Ala Leu Ile Lys Val Val Ser Ala Pro
85 90 95

Ser Thr Arg Thr Glu Ile Asn Gly Ile Ile Glu Pro Phe Arg Ala Ser
100 105 110

Val Val Asp Val Ser Arg Asp Ser Ile Val Val Gln Val Thr Gly Glu
115 120 125

Ser Asn Lys Ile Glu Ala Leu Ile Glu Leu Leu Lys Pro Tyr Gly Ile
130 135 140

Lys Glu Ile Ala Arg Thr Gly Thr Thr Ala Phe Ala Arg Gly Thr Ser
145 150 155 160

Lys Arg Arg His Pro Ile Lys Gln Tyr Leu Leu Tyr Lys Thr
165 170

<210> 44

<211> 342

<212> PRT

<213> B. subtilis

<400> 44

Met Val Lys Val Tyr Tyr Asn Gly Asp Ile Lys Glu Asn Val Leu Ala
1 5 10 15

Gly Lys Thr Val Ala Val Ile Gly Tyr Gly Ser Gln Gly His Ala His
 20 25 30

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

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

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

Pro Asp Glu Gln Gln Gln Lys Val Tyr Glu Ala Glu Ile Lys Asp Glu
 85 90 95

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

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

Pro Lys Gly Pro Gly His Leu Val Arg Arg Thr Tyr Glu Gln Gly Ala
 130 135 140

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

Arg Asp Lys Ala Leu Ala Tyr Ala Lys Gly Ile Gly Gly Ala Arg Ala
 165 170 175

Gly Val Leu Glu Thr Thr Phe Lys Glu Glu Thr Glu Thr Asp Leu Phe
 180 185 190

Gly Glu Gln Ala Val Leu Cys Gly Gly Leu Ser Ala Leu Val Lys Ala
 195 200 205

Gly Phe Glu Thr Leu Thr Glu Ala Gly Tyr Gln Pro Glu Leu Ala Tyr
 210 215 220

Phe Glu Cys Leu His Glu Leu Lys Leu Ile Val Asp Leu Met Tyr Glu
 225 230 235 240

Glu Gly Leu Ala Gly Met Arg Tyr Ser Ile Ser Asp Thr Ala Gln Trp

Arg	Glu	Ile	Ile	Ala	Asp	Ser	Val	Glu	Thr	Val	Val	Ser	Ala	His	Trp	100	105	110
Phe	Asp	Gly	Met	Val	Cys	Ile	Pro	Asn	Cys	Asp	Lys	Ile	Thr	Pro	Gly	115	120	125
Met	Leu	Met	Ala	Ala	Met	Arg	Ile	Asn	Ile	Pro	Thr	Ile	Phe	Val	Ser	130	135	140
Gly	Gly	Pro	Met	Ala	Ala	Gly	Arg	Thr	Ser	Tyr	Gly	Arg	Lys	Ile	Ser	145	150	155
Leu	Ser	Ser	Val	Phe	Glu	Gly	Val	Gly	Ala	Tyr	Gln	Ala	Gly	Lys	Ile	165	170	175
Asn	Glu	Asn	Glu	Leu	Gln	Glu	Leu	Glu	Gln	Phe	Gly	Cys	Pro	Thr	Cys	180	185	190
Gly	Ser	Cys	Ser	Gly	Met	Phe	Thr	Ala	Asn	Ser	Met	Asn	Cys	Leu	Ser	195	200	205
Glu	Ala	Leu	Gly	Leu	Ala	Leu	Pro	Gly	Asn	Gly	Thr	Ile	Leu	Ala	Thr	210	215	220
Ser	Pro	Glu	Arg	Lys	Glu	Phe	Val	Arg	Lys	Ser	Ala	Ala	Gln	Leu	Met	225	230	235
Glu	Thr	Ile	Arg	Lys	Asp	Ile	Lys	Pro	Arg	Asp	Ile	Val	Thr	Val	Lys	245	250	255
Ala	Ile	Asp	Asn	Ala	Phe	Ala	Leu	Asp	Met	Ala	Leu	Gly	Gly	Ser	Thr	260	265	270
Asn	Thr	Val	Leu	His	Thr	Leu	Ala	Leu	Ala	Asn	Glu	Ala	Gly	Val	Glu	275	280	285
Tyr	Ser	Leu	Glu	Arg	Ile	Asn	Glu	Val	Ala	Glu	Arg	Val	Pro	His	Leu	290	295	300
Ala	Lys	Leu	Ala	Pro	Ala	Ser	Asp	Val	Phe	Ile	Glu	Asp	Leu	His	Glu	305	310	315
																		320

Ala Gly Gly Val Ser Ala Ala Leu Asn Glu Leu Ser Lys Lys Glu Gly
325 330 335

Ala Leu His Leu Asp Ala Leu Thr Val Thr Gly Lys Thr Leu Gly Glu
340 345 350

Thr Ile Ala Gly His Glu Val Lys Asp Tyr Asp Val Ile His Pro Leu
355 360 365

Asp Gln Pro Phe Thr Glu Lys Gly Gly Leu Ala Val Leu Phe Gly Asn
370 375 380

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

Ile Thr Arg His Glu Gly Pro Ala Val Val Phe Asp Ser Gln Asp Glu
405 410 415

Ala Leu Asp Gly Ile Ile Asn Arg Lys Val Lys Glu Gly Asp Val Val
420 425 430

Ile Ile Arg Tyr Glu Gly Pro Lys Gly Gly Pro Gly Met Pro Glu Met
435 440 445

Leu Ala Pro Thr Ser Gln Ile Val Gly Met Gly Leu Gly Pro Lys Val
450 455 460

Ala Leu Ile Thr Asp Gly Arg Phe Ser Gly Ala Ser Arg Gly Leu Ser
465 470 475 480

Ile Gly His Val Ser Pro Glu Ala Ala Glu Gly Gly Pro Leu Ala Phe
485 490 495

Val Glu Asn Gly Asp His Ile Ile Val Asp Ile Glu Lys Arg Ile Leu
500 505 510

Asp Val Gln Val Pro Glu Glu Glu Trp Glu Lys Arg Lys Ala Asn Trp
515 520 525

Lys Gly Phe Glu Pro Lys Val Lys Thr Gly Tyr Leu Ala Arg Tyr Ser
530 535 540

Lys Leu Val Thr Ser Ala Asn Thr Gly Gly Ile Met Lys Ile

545 550 555

 <210> 46
 <211> 327
 <212> PRT
 <213> B. subtilis

 <400> 46

 Met Ser Val Met Ser Tyr Ile Asp Ala Ile Asn Leu Ala Met Lys Glu
 1 5 10 15

 Glu Met Glu Arg Asp Ser Arg Val Phe Val Leu Gly Glu Asp Val Gly
 20 25 30

 Arg Lys Gly Gly Val Phe Lys Ala Thr Ala Gly Leu Tyr Glu Gln Phe
 35 40 45

 Gly Glu Glu Arg Val Met Asp Thr Pro Leu Ala Glu Ser Ala Ile Ala
 50 55 60

 Gly Val Gly Ile Gly Ala Ala Met Tyr Gly Met Arg Pro Ile Ala Glu
 65 70 75 80

 Met Gln Phe Ala Asp Phe Ile Met Pro Ala Val Asn Gln Ile Ile Ser
 85 90 95

 Glu Ala Ala Lys Ile Arg Tyr Arg Ser Asn Asn Asp Trp Ser Cys Pro
 100 105 110

 Ile Val Val Arg Ala Pro Tyr Gly Gly Gly Val His Gly Ala Leu Tyr
 115 120 125

 His Ser Gln Ser Val Glu Ala Ile Phe Ala Asn Gln Pro Gly Leu Lys
 130 135 140

 Ile Val Met Pro Ser Thr Pro Tyr Asp Ala Lys Gly Leu Leu Lys Ala
 145 150 155 160

 Ala Val Arg Asp Glu Asp Pro Val Leu Phe Phe Glu His Lys Arg Ala
 165 170 175

 Tyr Arg Leu Ile Lys Gly Glu Val Pro Ala Asp Asp Tyr Val Leu Pro
 180 185 190

Ile Gly Lys Ala Asp Val Lys Arg Glu Gly Asp Asp Ile Thr Val Ile
195 200 205

Thr Tyr Gly Leu Cys Val His Phe Ala Leu Gln Ala Ala Glu Arg Leu
210 215 220

Glu Lys Asp Gly Ile Ser Ala His Val Val Asp Leu Arg Thr Val Tyr
225 230 235 240

Pro Leu Asp Lys Glu Ala Ile Ile Glu Ala Ala Ser Lys Thr Gly Lys
245 250 255

Val Leu Leu Val Thr Glu Asp Thr Lys Glu Gly Ser Ile Met Ser Glu
260 265 270

Val Ala Ala Ile Ile Ser Glu His Cys Leu Phe Asp Leu Asp Ala Pro
275 280 285

Ile Lys Arg Leu Ala Gly Pro Asp Ile Pro Ala Met Pro Tyr Ala Pro
290 295 300

Thr Met Glu Lys Tyr Phe Met Val Asn Pro Asp Lys Val Glu Ala Ala
305 310 315 320

Met Arg Glu Leu Ala Glu Phe
325

<210> 47
<211> 330
<212> PRT
<213> B. subtilis

<400> 47

Met Ser Thr Asn Arg His Gln Ala Leu Gly Leu Thr Asp Gln Glu Ala
1 5 10 15

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

Met Trp Leu Leu Asn Arg Ser Gly Lys Ile Pro Phe Val Ile Ser Cys
35 40 45

Gln Gly Gln Glu Ala Ala Gln Val Gly Ala Ala Phe Ala Leu Asp Arg

50						55						60			
Glu	Met	Asp	Tyr	Val	Leu	Pro	Tyr	Tyr	Arg	Asp	Met	Gly	Val	Val	Leu
65					70					75					80
Ala	Phe	Gly	Met	Thr	Ala	Lys	Asp	Leu	Met	Met	Ser	Gly	Phe	Ala	Lys
				85					90					95	
Ala	Ala	Asp	Pro	Asn	Ser	Gly	Gly	Arg	Gln	Met	Pro	Gly	His	Phe	Gly
			100					105					110		
Gln	Lys	Lys	Asn	Arg	Ile	Val	Thr	Gly	Ser	Ser	Pro	Val	Thr	Thr	Gln
		115					120					125			
Val	Pro	His	Ala	Val	Gly	Ile	Ala	Leu	Ala	Gly	Arg	Met	Glu	Lys	Lys
	130					135					140				
Asp	Ile	Ala	Ala	Phe	Val	Thr	Phe	Gly	Glu	Gly	Ser	Ser	Asn	Gln	Gly
145					150					155					160
Asp	Phe	His	Glu	Gly	Ala	Asn	Phe	Ala	Ala	Val	His	Lys	Leu	Pro	Val
				165					170					175	
Ile	Phe	Met	Cys	Glu	Asn	Asn	Lys	Tyr	Ala	Ile	Ser	Val	Pro	Tyr	Asp
			180					185					190		
Lys	Gln	Val	Ala	Cys	Glu	Asn	Ile	Ser	Asp	Arg	Ala	Ile	Gly	Tyr	Gly
		195					200					205			
Met	Pro	Gly	Val	Thr	Val	Asn	Gly	Asn	Asp	Pro	Leu	Glu	Val	Tyr	Gln
	210					215					220				
Ala	Val	Lys	Glu	Ala	Arg	Glu	Arg	Ala	Arg	Arg	Gly	Glu	Gly	Pro	Thr
225					230					235					240
Leu	Ile	Glu	Thr	Ile	Ser	Tyr	Arg	Leu	Thr	Pro	His	Ser	Ser	Asp	Asp
				245					250					255	
Asp	Asp	Ser	Ser	Tyr	Arg	Gly	Arg	Glu	Glu	Val	Glu	Glu	Ala	Lys	Lys
			260					265					270		
Ser	Asp	Pro	Leu	Leu	Thr	Tyr	Gln	Ala	Tyr	Leu	Lys	Glu	Thr	Gly	Leu
		275					280					285			

Leu Ser Asp Glu Ile Glu Gln Thr Met Leu Asp Glu Ile Met Ala Ile
 290 295 300

Val Asn Glu Ala Thr Asp Glu Ala Glu Asn Ala Pro Tyr Ala Ala Pro
 305 310 315 320

Glu Ser Ala Leu Asp Tyr Val Tyr Ala Lys
 325 330

<210> 48
 <211> 424
 <212> PRT
 <213> B. subtilis

<400> 48

Met Ala Ile Glu Gln Met Thr Met Pro Gln Leu Gly Glu Ser Val Thr
 1 5 10 15

Glu Gly Thr Ile Ser Lys Trp Leu Val Ala Pro Gly Asp Lys Val Asn
 20 25 30

Lys Tyr Asp Pro Ile Ala Glu Val Met Thr Asp Lys Val Asn Ala Glu
 35 40 45

Val Pro Ser Ser Phe Thr Gly Thr Ile Thr Glu Leu Val Gly Glu Glu
 50 55 60

Gly Gln Thr Leu Gln Val Gly Glu Met Ile Cys Lys Ile Glu Thr Glu
 65 70 75 80

Gly Ala Asn Pro Ala Glu Gln Lys Gln Glu Gln Pro Ala Ala Ser Glu
 85 90 95

Ala Ala Glu Asn Pro Val Ala Lys Ser Ala Gly Ala Ala Asp Gln Pro
 100 105 110

Asn Lys Lys Arg Tyr Ser Pro Ala Val Leu Arg Leu Ala Gly Glu His
 115 120 125

Gly Ile Asp Leu Asp Gln Val Thr Gly Thr Gly Ala Gly Gly Arg Ile
 130 135 140

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

Gln Asn Pro Glu Glu Leu Lys Thr Ala Ala Pro Ala Pro Lys Ser Ala
165 170 175

Ser Lys Pro Glu Pro Lys Glu Glu Thr Ser Tyr Pro Ala Ser Ala Ala
180 185 190

Gly Asp Lys Glu Ile Pro Val Thr Gly Val Arg Lys Ala Ile Ala Ser
195 200 205

Asn Met Lys Arg Ser Lys Thr Glu Ile Pro His Ala Trp Thr Met Met
210 215 220

Glu Val Asp Val Thr Asn Met Val Ala Tyr Arg Asn Ser Ile Lys Asp
225 230 235 240

Ser Phe Lys Lys Thr Glu Gly Phe Asn Leu Thr Phe Phe Ala Phe Phe
245 250 255

Val Lys Ala Val Ala Gln Ala Leu Lys Glu Phe Pro Gln Met Asn Ser
260 265 270

Met Trp Ala Gly Asp Lys Ile Ile Gln Lys Lys Asp Ile Asn Ile Ser
275 280 285

Ile Ala Val Ala Thr Glu Asp Ser Leu Phe Val Pro Val Ile Lys Asn
290 295 300

Ala Asp Glu Lys Thr Ile Lys Gly Ile Ala Lys Asp Ile Thr Gly Leu
305 310 315 320

Ala Lys Lys Val Arg Asp Gly Lys Leu Thr Ala Asp Asp Met Gln Gly
325 330 335

Gly Thr Phe Thr Val Asn Asn Thr Gly Ser Phe Gly Ser Val Gln Ser
340 345 350

Met Gly Ile Ile Asn Tyr Pro Gln Ala Ala Ile Leu Gln Val Glu Ser
355 360 365

Ile Val Lys Arg Pro Val Val Met Asp Asn Gly Met Ile Ala Val Arg

370 375 380
 Asp Met Val Asn Leu Cys Leu Ser Leu Asp His Arg Val Leu Asp Gly
 385 390 395 400
 Leu Val Cys Gly Arg Phe Leu Gly Arg Val Lys Gln Ile Leu Glu Ser
 405 410 415
 Ile Asp Glu Lys Thr Ser Val Tyr
 420
 <210> 49
 <211> 457
 <212> PRT
 <213> B. subtilis
 <400> 49
 Met Ala Thr Glu Tyr Asp Val Val Ile Leu Gly Gly Gly Thr Gly Gly
 1 5 10 15
 Tyr Val Ala Ala Ile Arg Ala Ala Gln Leu Gly Leu Lys Thr Ala Val
 20 25 30
 Val Glu Lys Glu Lys Leu Gly Gly Thr Cys Leu His Lys Gly Cys Ile
 35 40 45
 Pro Ser Lys Ala Leu Leu Arg Ser Ala Glu Val Tyr Arg Thr Ala Arg
 50 55 60
 Glu Ala Asp Gln Phe Gly Val Glu Thr Ala Gly Val Ser Leu Asn Phe
 65 70 75 80
 Glu Lys Val Gln Gln Arg Lys Gln Ala Val Val Asp Lys Leu Ala Ala
 85 90 95
 Gly Val Asn His Leu Met Lys Lys Gly Lys Ile Asp Val Tyr Thr Gly
 100 105 110
 Tyr Gly Arg Ile Leu Gly Pro Ser Ile Phe Ser Pro Leu Pro Gly Thr
 115 120 125
 Ile Ser Val Glu Arg Gly Asn Gly Glu Glu Asn Asp Met Leu Ile Pro
 130 135 140

Lys Gln Val Ile Ile Ala Thr Gly Ser Arg Pro Arg Met Leu Pro Gly
 145 150 155 160

Leu Glu Val Asp Gly Lys Ser Val Leu Thr Ser Asp Glu Ala Leu Gln
 165 170 175

Met Glu Glu Leu Pro Gln Ser Ile Ile Ile Val Gly Gly Gly Val Ile
 180 185 190

Gly Ile Glu Trp Ala Ser Met Leu His Asp Phe Gly Val Lys Val Thr
 195 200 205

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

Ser Lys Glu Met Glu Ser Leu Leu Lys Lys Lys Gly Ile Gln Phe Ile
 225 230 235 240

Thr Gly Ala Lys Val Leu Pro Asp Thr Met Thr Lys Thr Ser Asp Asp
 245 250 255

Ile Ser Ile Gln Ala Glu Lys Asp Gly Glu Thr Val Thr Tyr Ser Ala
 260 265 270

Glu Lys Met Leu Val Ser Ile Gly Arg Gln Ala Asn Ile Glu Gly Ile
 275 280 285

Gly Leu Glu Asn Thr Asp Ile Val Thr Glu Asn Gly Met Ile Ser Val
 290 295 300

Asn Glu Ser Cys Gln Thr Lys Glu Ser His Ile Tyr Ala Ile Gly Asp
 305 310 315 320

Val Ile Gly Gly Leu Gln Leu Ala His Val Ala Ser His Glu Gly Ile
 325 330 335

Ile Ala Val Glu His Phe Ala Gly Leu Asn Pro His Pro Leu Asp Pro
 340 345 350

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

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

Gly Lys Phe Pro Phe Met Ala Ile Gly Lys Ala Leu Val Tyr Gly Glu
 385 390 395 400

Ser Asp Gly Phe Val Lys Ile Val Ala Asp Arg Asp Thr Asp Asp Ile
 405 410 415

Leu Gly Val His Met Ile Gly Pro His Val Thr Asp Met Ile Ser Glu
 420 425 430

Ala Gly Leu Ala Lys Val Leu Asp Ala Thr Pro Trp Glu Val Gly Gln
 435 440 445

Thr Ile Ser Pro Ala Ser Asn Ala Phe
 450 455

<210> 50
 <211> 566
 <212> PRT
 <213> Streptomyces cinnamonensis

<400> 50

Met Asp Ala Asp Ala Ile Glu Glu Gly Arg Arg Arg Trp Gln Ala Arg
 1 5 10 15

Tyr Asp Lys Ala Arg Lys Arg Asp Ala Asp Phe Thr Thr Leu Ser Gly
 20 25 30

Asp Pro Val Asp Pro Val Tyr Gly Pro Arg Pro Gly Asp Thr Tyr Asp
 35 40 45

Gly Phe Glu Arg Ile Gly Trp Pro Gly Glu Tyr Pro Phe Thr Arg Gly
 50 55 60

Leu Tyr Ala Thr Gly Tyr Arg Gly Arg Thr Trp Thr Ile Arg Gln Phe
 65 70 75 80

Ala Gly Phe Gly Asn Ala Glu Gln Thr Asn Glu Arg Tyr Lys Met Ile
 85 90 95

Leu Ala Asn Gly Gly Gly Gly Leu Ser Val Ala Phe Asp Met Pro Thr
 100 105 110

Leu Met Gly Arg Asp Ser Asp Asp Pro Arg Ser Leu Gly Glu Val Gly
115 120 125

His Cys Gly Val Ala Ile Asp Ser Ala Ala Asp Met Glu Val Leu Phe
130 135 140

Lys Asp Ile Pro Leu Gly Asp Val Thr Thr Ser Met Thr Ile Ser Gly
145 150 155 160

Pro Ala Val Pro Val Phe Cys Met Tyr Leu Val Ala Ala Glu Arg Gln
165 170 175

Gly Val Asp Pro Ala Val Leu Asn Gly Thr Leu Gln Thr Asp Ile Phe
180 185 190

Lys Glu Tyr Ile Ala Gln Lys Glu Trp Leu Phe Gln Pro Glu Pro His
195 200 205

Leu Arg Leu Ile Gly Asp Leu Met Glu His Cys Ala Arg Asp Ile Pro
210 215 220

Ala Tyr Lys Pro Leu Ser Val Ser Gly Tyr His Ile Arg Glu Ala Gly
225 230 235 240

Ala Thr Ala Ala Gln Glu Leu Ala Tyr Thr Leu Ala Asp Gly Phe Gly
245 250 255

Tyr Val Glu Leu Gly Leu Ser Arg Gly Leu Asp Val Asp Val Phe Ala
260 265 270

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

Ile Ala Lys Phe Arg Ala Ala Arg Arg Ile Trp Ala Arg Trp Leu Arg
290 295 300

Asp Glu Tyr Gly Ala Lys Thr Glu Lys Ala Gln Trp Leu Arg Phe His
305 310 315 320

Thr Gln Thr Ala Gly Val Ser Leu Thr Ala Gln Gln Pro Tyr Asn Asn
325 330 335

Val Val Arg Thr Ala Val Glu Ala Leu Ala Ala Val Leu Gly Gly Thr
340 345 350

Asn Ser Leu His Thr Asn Ala Leu Asp Glu Thr Leu Ala Leu Pro Ser
355 360 365

Glu Gln Ala Ala Glu Ile Ala Leu Arg Thr Gln Gln Val Leu Met Glu
370 375 380

Glu Thr Gly Val Ala Asn Val Ala Asp Pro Leu Gly Gly Ser Trp Tyr
385 390 395 400

Ile Glu Gln Leu Thr Asp Arg Ile Glu Ala Asp Ala Glu Lys Ile Phe
405 410 415

Glu Gln Ile Arg Glu Arg Gly Arg Arg Ala Cys Pro Asp Gly Gln His
420 425 430

Pro Ile Gly Pro Ile Thr Ser Gly Ile Leu Arg Gly Ile Glu Asp Gly
435 440 445

Trp Phe Thr Gly Glu Ile Ala Glu Ser Ala Phe Gln Tyr Gln Arg Ser
450 455 460

Leu Glu Lys Gly Asp Lys Arg Val Val Gly Val Asn Cys Leu Glu Gly
465 470 475 480

Ser Val Thr Gly Asp Leu Glu Ile Leu Arg Val Ser His Glu Val Glu
485 490 495

Arg Glu Gln Val Arg Glu Leu Ala Gly Arg Lys Gly Arg Arg Asp Asp
500 505 510

Ala Arg Val Arg Ala Ser Leu Asp Ala Met Leu Ala Ala Ala Arg Asp
515 520 525

Gly Ser Asn Met Ile Ala Pro Met Leu Glu Ala Val Arg Ala Glu Ala
530 535 540

Thr Leu Gly Glu Ile Cys Gly Val Leu Arg Asp Glu Trp Gly Val Tyr
545 550 555 560

Val Glu Pro Pro Gly Phe
565

<210> 51
<211> 136
<212> PRT
<213> Streptomyces cinnamomensis

<400> 51

Met Gly Val Ala Ala Gly Pro Ile Arg Val Val Val Ala Lys Pro Gly
1 5 10 15

Leu Asp Gly His Asp Arg Gly Ala Lys Val Ile Ala Arg Ala Leu Arg
20 25 30

Asp Ala Gly Met Glu Val Ile Tyr Thr Gly Leu His Gln Thr Pro Glu
35 40 45

Gln Val Val Asp Thr Ala Ile Gln Glu Asp Ala Asp Ala Ile Gly Leu
50 55 60

Ser Ile Leu Ser Gly Ala His Asn Thr Leu Phe Ala Arg Val Leu Glu
65 70 75 80

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

Ile Ile Pro Glu Ala Asp Ile Ala Pro Leu Lys Glu Lys Gly Val Ala
100 105 110

Glu Ile Phe Thr Pro Gly Ala Thr Thr Thr Ser Ile Val Glu Trp Val
115 120 125

Arg Gly Asn Val Arg Gln Ala Val
130 135

<210> 52
<211> 468
<212> PRT
<213> Clostridium beijerinckii

<400> 52

Met Asn Lys Asp Thr Leu Ile Pro Thr Thr Lys Asp Leu Lys Leu Lys
1 5 10 15

Thr	Asn	Val	Glu	Asn	Ile	Asn	Leu	Lys	Asn	Tyr	Lys	Asp	Asn	Ser	Ser		
			20					25					30				
Cys	Phe	Gly	Val	Phe	Glu	Asn	Val	Glu	Asn	Ala	Ile	Asn	Ser	Ala	Val		
		35					40					45					
His	Ala	Gln	Lys	Ile	Leu	Ser	Leu	His	Tyr	Thr	Lys	Glu	Gln	Arg	Glu		
	50					55					60						
Lys	Ile	Ile	Thr	Glu	Ile	Arg	Lys	Ala	Ala	Leu	Glu	Asn	Lys	Glu	Val		
65					70					75					80		
Leu	Ala	Thr	Met	Ile	Leu	Glu	Glu	Thr	His	Met	Gly	Arg	Tyr	Glu	Asp		
				85					90						95		
Lys	Ile	Leu	Lys	His	Glu	Leu	Val	Ala	Lys	Tyr	Thr	Pro	Gly	Thr	Glu		
			100					105					110				
Asp	Leu	Thr	Thr	Thr	Ala	Trp	Ser	Gly	Asp	Asn	Gly	Leu	Thr	Val	Val		
		115					120					125					
Glu	Met	Ser	Pro	Tyr	Gly	Val	Ile	Gly	Ala	Ile	Thr	Pro	Ser	Thr	Asn		
	130					135					140						
Pro	Thr	Glu	Thr	Val	Ile	Cys	Asn	Ser	Ile	Gly	Met	Ile	Ala	Ala	Gly		
145					150					155					160		
Asn	Ala	Val	Val	Phe	Asn	Gly	His	Pro	Gly	Ala	Lys	Lys	Cys	Val	Ala		
				165					170					175			
Phe	Ala	Ile	Glu	Met	Ile	Asn	Lys	Ala	Ile	Ile	Ser	Cys	Gly	Gly	Pro		
		180						185					190				
Glu	Asn	Leu	Val	Thr	Thr	Ile	Lys	Asn	Pro	Thr	Met	Glu	Ser	Leu	Asp		
		195					200					205					
Ala	Ile	Ile	Lys	His	Pro	Leu	Ile	Lys	Leu	Leu	Cys	Gly	Thr	Gly	Gly		
	210					215					220						
Pro	Gly	Met	Val	Lys	Thr	Leu	Leu	Asn	Ser	Gly	Lys	Lys	Ala	Ile	Gly		
225					230					235					240		

Ala Gly Ala Gly Asn Pro Pro Val Ile Val Asp Asp Thr Ala Asp Ile
 245 250 255
 Glu Lys Ala Gly Lys Ser Ile Ile Glu Gly Cys Ser Phe Asp Asn Asn
 260 265 270
 Leu Pro Cys Ile Ala Glu Lys Glu Val Phe Val Phe Glu Asn Val Ala
 275 280 285
 Asp Asp Leu Ile Ser Asn Met Leu Lys Asn Asn Ala Val Ile Ile Asn
 290 295 300
 Glu Asp Gln Val Ser Lys Leu Ile Asp Leu Val Leu Gln Lys Asn Asn
 305 310 315 320
 Glu Thr Gln Glu Tyr Phe Ile Asn Lys Lys Trp Val Gly Lys Asp Ala
 325 330 335
 Lys Leu Phe Ser Asp Glu Ile Asp Val Glu Ser Pro Ser Asn Ile Lys
 340 345 350
 Cys Ile Val Cys Glu Val Asn Ala Asn His Pro Phe Val Met Thr Glu
 355 360 365
 Leu Met Met Pro Ile Leu Pro Ile Val Arg Val Lys Asp Ile Asp Glu
 370 375 380
 Ala Val Lys Tyr Thr Lys Ile Ala Glu Gln Asn Arg Lys His Ser Ala
 385 390 395 400
 Tyr Ile Tyr Ser Lys Asn Ile Asp Asn Leu Asn Arg Phe Glu Arg Glu
 405 410 415
 Ile Asp Thr Thr Ile Phe Val Lys Asn Ala Lys Ser Phe Ala Gly Val
 420 425 430
 Gly Tyr Glu Ala Glu Gly Phe Thr Thr Phe Thr Ile Ala Gly Ser Thr
 435 440 445
 Gly Glu Gly Ile Thr Ser Ala Arg Asn Phe Thr Arg Gln Arg Arg Cys
 450 455 460
 Val Leu Ala Gly

465

<210> 53
<211> 389
<212> PRT
<213> Clostridium acetobutylicum

<400> 53

Met Leu Ser Phe Asp Tyr Ser Ile Pro Thr Lys Val Phe Phe Gly Lys
1 5 10 15

Gly Lys Ile Asp Val Ile Gly Glu Glu Ile Lys Lys Tyr Gly Ser Arg
20 25 30

Val Leu Ile Val Tyr Gly Gly Gly Ser Ile Lys Arg Asn Gly Ile Tyr
35 40 45

Asp Arg Ala Thr Ala Ile Leu Lys Glu Asn Asn Ile Ala Phe Tyr Glu
50 55 60

Leu Ser Gly Val Glu Pro Asn Pro Arg Ile Thr Thr Val Lys Lys Gly
65 70 75 80

Ile Glu Ile Cys Arg Glu Asn Asn Val Asp Leu Val Leu Ala Ile Gly
85 90 95

Gly Gly Ser Ala Ile Asp Cys Ser Lys Val Ile Ala Ala Gly Val Tyr
100 105 110

Tyr Asp Gly Asp Thr Trp Asp Met Val Lys Asp Pro Ser Lys Ile Thr
115 120 125

Lys Val Leu Pro Ile Ala Ser Ile Leu Thr Leu Ser Ala Thr Gly Ser
130 135 140

Glu Met Asp Gln Ile Ala Val Ile Ser Asn Met Glu Thr Asn Glu Lys
145 150 155 160

Leu Gly Val Gly His Asp Asp Met Arg Pro Lys Phe Ser Val Leu Asp
165 170 175

Pro Thr Tyr Thr Phe Thr Val Pro Lys Asn Gln Thr Ala Ala Gly Thr
180 185 190

Ala Asp Ile Met Ser His Thr Phe Glu Ser Tyr Phe Ser Gly Val Glu
195 200 205

Gly Ala Tyr Val Gln Asp Gly Ile Ala Glu Ala Ile Leu Arg Thr Cys
210 215 220

Ile Lys Tyr Gly Lys Ile Ala Met Glu Lys Thr Asp Asp Tyr Glu Ala
225 230 235 240

Arg Ala Asn Leu Met Trp Ala Ser Ser Leu Ala Ile Asn Gly Leu Leu
245 250 255

Ser Leu Gly Lys Asp Arg Lys Trp Ser Cys His Pro Met Glu His Glu
260 265 270

Leu Ser Ala Tyr Tyr Asp Ile Thr His Gly Val Gly Leu Ala Ile Leu
275 280 285

Thr Pro Asn Trp Met Glu Tyr Ile Leu Asn Asp Asp Thr Leu His Lys
290 295 300

Phe Val Ser Tyr Gly Ile Asn Val Trp Gly Ile Asp Lys Asn Lys Asp
305 310 315 320

Asn Tyr Glu Ile Ala Arg Glu Ala Ile Lys Asn Thr Arg Glu Tyr Phe
325 330 335

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

Asp Lys Leu Glu Leu Met Ala Lys Gln Ala Val Arg Asn Ser Gly Gly
355 360 365

Thr Ile Gly Ser Leu Arg Pro Ile Asn Ala Glu Asp Val Leu Glu Ile
370 375 380

Phe Lys Lys Ser Tyr
385

<210> 54
<211> 856
<212> PRT
<213> Clostridium acetobutylicum

<400> 54

Met Lys Val Thr Asn Gln Lys Glu Leu Lys Gln Lys Leu Asn Glu Leu
1 5 10 15

Arg Glu Ala Gln Lys Lys Phe Ala Thr Tyr Thr Gln Glu Gln Val Asp
20 25 30

Lys Ile Phe Lys Gln Cys Ala Ile Ala Ala Ala Lys Glu Arg Ile Asn
35 40 45

Leu Ala Lys Leu Ala Val Glu Glu Thr Gly Ile Gly Leu Val Glu Asp
50 55 60

Lys Ile Ile Lys Asn His Phe Ala Ala Glu Tyr Ile Tyr Asn Lys Tyr
65 70 75 80

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

Ile Thr Lys Val Ala Glu Pro Ile Gly Ile Val Ala Ala Ile Val Pro
100 105 110

Thr Thr Asn Pro Thr Ser Thr Ala Ile Phe Lys Ser Leu Ile Ser Leu
115 120 125

Lys Thr Arg Asn Ala Ile Phe Phe Ser Pro His Pro Arg Ala Lys Lys
130 135 140

Ser Thr Ile Ala Ala Ala Lys Leu Ile Leu Asp Ala Ala Val Lys Ala
145 150 155 160

Gly Ala Pro Lys Asn Ile Ile Gly Trp Ile Asp Glu Pro Ser Ile Glu
165 170 175

Leu Ser Gln Asp Leu Met Ser Glu Ala Asp Ile Ile Leu Ala Thr Gly
180 185 190

Gly Pro Ser Met Val Lys Ala Ala Tyr Ser Ser Gly Lys Pro Ala Ile
195 200 205

Gly Val Gly Ala Gly Asn Thr Pro Ala Ile Ile Asp Glu Ser Ala Asp
210 215 220

Ile Asp Met Ala Val Ser Ser Ile Ile Leu Ser Lys Thr Tyr Asp Asn
 225 230 235 240

Gly Val Ile Cys Ala Ser Glu Gln Ser Ile Leu Val Met Asn Ser Ile
 245 250 255

Tyr Glu Lys Val Lys Glu Glu Phe Val Lys Arg Gly Ser Tyr Ile Leu
 260 265 270

Asn Gln Asn Glu Ile Ala Lys Ile Lys Glu Thr Met Phe Lys Asn Gly
 275 280 285

Ala Ile Asn Ala Asp Ile Val Gly Lys Ser Ala Tyr Ile Ile Ala Lys
 290 295 300

Met Ala Gly Ile Glu Val Gln Thr Thr Lys Ile Leu Ile Gly Glu Val
 305 310 315 320

Gln Ser Val Glu Lys Ser Glu Leu Phe Ser His Glu Lys Leu Ser Pro
 325 330 335

Val Leu Ala Met Tyr Lys Val Lys Asp Phe Asp Glu Ala Leu Lys Lys
 340 345 350

Ala Gln Arg Leu Ile Glu Leu Gly Gly Ser Gly His Thr Ser Ser Leu
 355 360 365

Tyr Ile Asp Ser Gln Asn Asn Lys Asp Lys Val Lys Glu Phe Gly Leu
 370 375 380

Ala Met Lys Thr Ser Arg Thr Phe Ile Asn Met Pro Ser Ser Gln Gly
 385 390 395 400

Ala Ser Gly Asp Leu Tyr Asn Phe Ala Ile Ala Pro Ser Phe Thr Leu
 405 410 415

Gly Cys Gly Thr Trp Gly Gly Asn Ser Val Ser Gln Asn Val Glu Pro
 420 425 430

Lys His Leu Leu Asn Ile Lys Ser Val Ala Glu Arg Arg Glu Asn Met
 435 440 445

Leu Trp Phe Lys Val Pro Gln Lys Ile Tyr Phe Lys Tyr Gly Cys Leu
450 455 460

Arg Phe Ala Leu Lys Glu Leu Lys Asp Met Asn Lys Lys Arg Ala Phe
465 470 475 480

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

Thr Lys Val Leu Asp Glu Ile Asp Ile Lys Tyr Ser Ile Phe Thr Asp
500 505 510

Ile Lys Ser Asp Pro Thr Ile Asp Ser Val Lys Lys Gly Ala Lys Glu
515 520 525

Met Leu Asn Phe Glu Pro Asp Thr Ile Ile Ser Ile Gly Gly Gly Ser
530 535 540

Pro Met Asp Ala Ala Lys Met His Leu Leu Tyr Glu Tyr Pro Glu Ala
545 550 555 560

Glu Ile Glu Asn Leu Ala Ile Asn Phe Met Asp Ile Arg Lys Arg Ile
565 570 575

Cys Asn Phe Pro Lys Leu Gly Thr Lys Ala Ile Ser Val Ala Ile Pro
580 585 590

Thr Thr Ala Gly Thr Gly Ser Glu Ala Thr Pro Phe Ala Val Ile Thr
595 600 605

Asn Asp Glu Thr Gly Met Lys Tyr Pro Leu Thr Ser Tyr Glu Leu Thr
610 615 620

Pro Asn Met Ala Ile Ile Asp Thr Glu Leu Met Leu Asn Met Pro Arg
625 630 635 640

Lys Leu Thr Ala Ala Thr Gly Ile Asp Ala Leu Val His Ala Ile Glu
645 650 655

Ala Tyr Val Ser Val Met Ala Thr Asp Tyr Thr Asp Glu Leu Ala Leu
660 665 670

Arg Ala Ile Lys Met Ile Phe Lys Tyr Leu Pro Arg Ala Tyr Lys Asn
675 680 685

Gly Thr Asn Asp Ile Glu Ala Arg Glu Lys Met Ala His Ala Ser Asn
690 695 700

Ile Ala Gly Met Ala Phe Ala Asn Ala Phe Leu Gly Val Cys His Ser
705 710 715 720

Met Ala His Lys Leu Gly Ala Met His His Val Pro His Gly Ile Ala
725 730 735

Cys Ala Val Leu Ile Glu Glu Val Ile Lys Tyr Asn Ala Thr Asp Cys
740 745 750

Pro Thr Lys Gln Thr Ala Phe Pro Gln Tyr Lys Ser Pro Asn Ala Lys
755 760 765

Arg Lys Tyr Ala Glu Ile Ala Glu Tyr Leu Asn Leu Lys Gly Thr Ser
770 775 780

Asp Thr Glu Lys Val Thr Ala Leu Ile Glu Ala Ile Ser Lys Leu Lys
785 790 795 800

Ile Asp Leu Ser Ile Pro Gln Asn Ile Ser Ala Ala Gly Ile Asn Lys
805 810 815

Lys Asp Phe Tyr Asn Thr Leu Asp Lys Met Ser Glu Leu Ala Phe Asp
820 825 830

Asp Gln Cys Thr Thr Ala Asn Pro Arg Tyr Pro Leu Ile Ser Glu Leu
835 840 845

Lys Asp Ile Tyr Ile Lys Ser Phe
850 855