

SEQUENCE LISTING

<110> GRIFFITH UNIVERSITY

<120> COMPOSITIONS, METHODS AND USES FOR ELICITING AN IMMUNE RESPONSE

<130> 35536982/TKU

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<151> 2018-12-21

<160> 39

<170> PatentIn version 3.5

<210> 1

<211> 522

<212> PRT

<213> Neisseria gonorrhoeae

<400> 1

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

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

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

Ala Ser Val Tyr Leu Lys Lys Asp Lys Pro Thr Leu Ile Lys Phe Trp
50 55 60

Ala Ser Trp Cys Pro Leu Cys Leu Ser Glu Leu Gly Gln Ala Glu Lys
65 70 75 80

Trp Ala Gln Asp Ala Lys Phe Ser Ser Ala Asn Leu Ile Thr Val Ala
85 90 95

Ser Pro Gly Phe Leu His Glu Lys Lys Asp Gly Glu Phe Gln Lys Trp

100

105

110

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

Gly Thr Ile Ala Gln Asn Leu Asn Ile Ser Val Tyr Pro Ser Trp Ala
 130 135 140

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

Asn Glu Ala Gln Ala Leu Ala Leu Ile Arg Asn Pro Asn Ala Asp Leu
 165 170 175

Gly Ser Leu Lys His Ser Phe Tyr Lys Pro Asp Thr Gln Lys Lys Asp
 180 185 190

Ser Ala Ile Met Asn Thr Arg Thr Ile Tyr Leu Ala Gly Gly Cys Phe
 195 200 205

Trp Gly Leu Glu Ala Tyr Phe Gln Arg Ile Asp Gly Val Val Asp Ala
 210 215 220

Val Ser Gly Tyr Ala Asn Gly Asn Thr Glu Asn Pro Ser Tyr Glu Asp
 225 230 235 240

Val Ser Tyr Arg His Thr Gly His Ala Glu Thr Val Lys Val Thr Tyr
 245 250 255

Asp Ala Asp Lys Leu Ser Leu Asp Asp Ile Leu Gln Tyr Tyr Phe Arg
 260 265 270

Val Val Asp Pro Thr Ser Leu Asn Lys Gln Gly Asn Asp Thr Gly Thr
 275 280 285

Gln Tyr Arg Ser Gly Val Tyr Tyr Thr Asp Pro Ala Glu Lys Ala Val
 290 295 300

Ile Ala Ala Ala Leu Lys Arg Glu Gln Gln Lys Tyr Gln Leu Pro Leu
305 310 315 320

Val Val Glu Asn Glu Pro Leu Lys Asn Phe Tyr Asp Ala Glu Glu Tyr
325 330 335

His Gln Asp Tyr Leu Ile Lys Asn Pro Asn Gly Tyr Cys His Ile Asp
340 345 350

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

Gln Gly Lys Gly Phe Asp Ala Ala Thr Tyr Lys Lys Pro Ser Asp Ala
370 375 380

Glu Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val Thr Gln Asn
385 390 395 400

Ser Ala Thr Glu Tyr Ala Phe Ser His Glu Tyr Asp His Leu Phe Lys
405 410 415

Pro Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu Phe Ser Ser
420 425 430

Ala Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe Thr Arg Pro
435 440 445

Ile Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser Phe Asn Met
450 455 460

Arg Arg Thr Glu Val Arg Ser Arg Ala Ala Asp Ser His Leu Gly His
465 470 475 480

Val Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg Tyr Cys Ile
485 490 495

Asn Gly Ala Ser Leu Lys Phe Ile Pro Leu Glu Gln Met Asp Ala Ala

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505

510

Gly Tyr Gly Ala Leu Lys Gly Lys Val Lys
 515 520

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<211> 182

<212> PRT

<213> *Neisseria gonorrhoeae*

<400> 2

His Ser Phe Tyr Lys Pro Asp Thr Gln Lys Lys Asp Ser Ala Ile Met
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Asn Thr Arg Thr Ile Tyr Leu Ala Gly Gly Cys Phe Trp Gly Leu Glu
 20 25 30

Ala Tyr Phe Gln Arg Ile Asp Gly Val Val Asp Ala Val Ser Gly Tyr
 35 40 45

Ala Asn Gly Asn Thr Glu Asn Pro Ser Tyr Glu Asp Val Ser Tyr Arg
 50 55 60

His Thr Gly His Ala Glu Thr Val Lys Val Thr Tyr Asp Ala Asp Lys
 65 70 75 80

Leu Ser Leu Asp Asp Ile Leu Gln Tyr Tyr Phe Arg Val Val Asp Pro
 85 90 95

Thr Ser Leu Asn Lys Gln Gly Asn Asp Thr Gly Thr Gln Tyr Arg Ser
 100 105 110

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

Leu Lys Arg Glu Gln Gln Lys Tyr Gln Leu Pro Leu Val Val Glu Asn
 130 135 140

Glu Pro Leu Lys Asn Phe Tyr Asp Ala Glu Glu Tyr His Gln Asp Tyr
145 150 155 160

Leu Ile Lys Asn Pro Asn Gly Tyr Cys His Ile Asp Ile Arg Lys Ala
165 170 175

Asp Glu Pro Leu Pro Gly
180

<210> 3
<211> 156
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<213> Neisseria gonorrhoeae

<400> 3

Arg Thr Ile Tyr Leu Ala Gly Gly Cys Phe Trp Gly Leu Glu Ala Tyr
1 5 10 15

Phe Gln Arg Ile Asp Gly Val Val Asp Ala Val Ser Gly Tyr Ala Asn
20 25 30

Gly Asn Thr Glu Asn Pro Ser Tyr Glu Asp Val Ser Tyr Arg His Thr
35 40 45

Gly His Ala Glu Thr Val Lys Val Thr Tyr Asp Ala Asp Lys Leu Ser
50 55 60

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

Leu Asn Lys Gln Gly Asn Asp Thr Gly Thr Gln Tyr Arg Ser Gly Val
85 90 95

Tyr Tyr Thr Asp Pro Ala Glu Lys Ala Val Ile Ala Ala Ala Leu Lys
100 105 110

Arg Glu Gln Gln Lys Tyr Gln Leu Pro Leu Val Val Glu Asn Glu Pro
115 120 125

Leu Lys Asn Phe Tyr Asp Ala Glu Glu Tyr His Gln Asp Tyr Leu Ile
130 135 140

Lys Asn Pro Asn Gly Tyr Cys His Ile Asp Ile Arg
145 150 155

<210> 4

<211> 148

<212> PRT

<213> Neisseria gonorrhoeae

<400> 4

Ala Ala Thr Tyr Lys Lys Pro Ser Asp Ala Glu Leu Lys Arg Thr Leu
1 5 10 15

Thr Glu Glu Gln Tyr Gln Val Thr Gln Asn Ser Ala Thr Glu Tyr Ala
20 25 30

Phe Ser His Glu Tyr Asp His Leu Phe Lys Pro Gly Ile Tyr Val Asp
35 40 45

Val Val Ser Gly Glu Pro Leu Phe Ser Ser Ala Asp Lys Tyr Asp Ser
50 55 60

Gly Cys Gly Trp Pro Ser Phe Thr Arg Pro Ile Asp Ala Lys Ser Val
65 70 75 80

Thr Glu His Asp Asp Phe Ser Phe Asn Met Arg Arg Thr Glu Val Arg
85 90 95

Ser Arg Ala Ala Asp Ser His Leu Gly His Val Phe Pro Asp Gly Pro
100 105 110

Arg Asp Lys Gly Gly Leu Arg Tyr Cys Ile Asn Gly Ala Ser Leu Lys
115 120 125

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

Gly Lys Val Lys
145

<210> 5
<211> 124
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<213> *Neisseria gonorrhoeae*

<400> 5

Asp Ala Glu Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val Thr
1 5 10 15

Gln Asn Ser Ala Thr Glu Tyr Ala Phe Ser His Glu Tyr Asp His Leu
20 25 30

Phe Lys Pro Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu Phe
35 40 45

Ser Ser Ala Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe Thr
50 55 60

Arg Pro Ile Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser Phe
65 70 75 80

Asn Met Arg Arg Thr Glu Val Arg Ser Arg Ala Ala Asp Ser His Leu
85 90 95

Gly His Val Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg Tyr
100 105 110

Cys Ile Asn Gly Ala Ser Leu Lys Phe Ile Pro Leu
115 120

<210> 6
<211> 157
<212> PRT
<213> *Neisseria gonorrhoeae*

<400> 6

Ala Leu Gly Ala Cys Ser Pro Lys Ile Val Asp Ala Gly Thr Ala Thr
1 5 10 15

Val Pro His Thr Leu Ser Thr Leu Lys Thr Ala Asp Asn Arg Pro Ala
20 25 30

Ser Val Tyr Leu Lys Lys Asp Lys Pro Thr Leu Ile Lys Phe Trp Ala
35 40 45

Ser Trp Cys Pro Leu Cys Leu Ser Glu Leu Gly Gln Ala Glu Lys Trp
50 55 60

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

Pro Gly Phe Leu His Glu Lys Lys Asp Gly Glu Phe Gln Lys Trp Tyr
85 90 95

Ala Gly Leu Asn Tyr Pro Lys Leu Pro Val Val Thr Asp Asn Gly Gly
100 105 110

Thr Ile Ala Gln Asn Leu Asn Ile Ser Val Tyr Pro Ser Trp Ala Leu
115 120 125

Ile Gly Lys Asp Gly Asp Val Gln Arg Ile Val Lys Gly Ser Ile Asn
130 135 140

Glu Ala Gln Ala Leu Ala Leu Ile Arg Asn Pro Asn Ala
145 150 155

<210> 7

<211> 491

<212> PRT

<213> Neisseria gonorrhoeae

<400> 7

Ala Thr Val Pro His Thr Leu Ser Thr Leu Lys Thr Ala Asp Asn Arg

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

Asp Val Ser Tyr Arg His Thr Gly His Ala Glu Thr Val Lys Val Thr
210 215 220

Tyr Asp Ala Asp Lys Leu Ser Leu Asp Asp Ile Leu Gln Tyr Tyr Phe
225 230 235 240

Arg Val Val Asp Pro Thr Ser Leu Asn Lys Gln Gly Asn Asp Thr Gly
245 250 255

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

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

Leu Val Val Glu Asn Glu Pro Leu Lys Asn Phe Tyr Asp Ala Glu Glu
290 295 300

Tyr His Gln Asp Tyr Leu Ile Lys Asn Pro Asn Gly Tyr Cys His Ile
305 310 315 320

Asp Ile Arg Lys Ala Asp Glu Pro Leu Pro Gly Lys Thr Lys Ala Ala
325 330 335

Pro Gln Gly Lys Gly Phe Asp Ala Ala Thr Tyr Lys Lys Pro Ser Asp
340 345 350

Ala Glu Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val Thr Gln
355 360 365

Asn Ser Ala Thr Glu Tyr Ala Phe Ser His Glu Tyr Asp His Leu Phe
370 375 380

Lys Pro Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu Phe Ser
385 390 395 400

Ser Ala Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe Thr Arg

405

410

415

Pro Ile Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser Phe Asn
 420 425 430

Met Arg Arg Thr Glu Val Arg Ser Arg Ala Ala Asp Ser His Leu Gly
 435 440 445

His Val Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg Tyr Cys
 450 455 460

Ile Asn Gly Ala Ser Leu Lys Phe Ile Pro Leu Glu Gln Met Asp Ala
 465 470 475 480

Ala Gly Tyr Gly Ala Leu Lys Gly Lys Val Lys
 485 490

<210> 8

<211> 493

<212> PRT

<213> Neisseria gonorrhoeae

<400> 8

Gly Thr Ala Thr Val Pro His Thr Leu Ser Thr Leu Lys Thr Ala Asp
 1 5 10 15

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

Lys Phe Trp Ala Ser Trp Cys Pro Leu Cys Leu Ser Glu Leu Gly Gln
 35 40 45

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

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

Gln Lys Trp Tyr Ala Gly Leu Asn Tyr Pro Lys Leu Pro Val Val Thr
85 90 95

Asp Asn Gly Gly Thr Ile Ala Gln Asn Leu Asn Ile Ser Val Tyr Pro
100 105 110

Ser Trp Ala Leu Ile Gly Lys Asp Gly Asp Val Gln Arg Ile Val Lys
115 120 125

Gly Ser Ile Asn Glu Ala Gln Ala Leu Ala Leu Ile Arg Asn Pro Asn
130 135 140

Ala Asp Leu Gly Ser Leu Lys His Ser Phe Tyr Lys Pro Asp Thr Gln
145 150 155 160

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

Gly Cys Phe Trp Gly Leu Glu Ala Tyr Phe Gln Arg Ile Asp Gly Val
180 185 190

Val Asp Ala Val Ser Gly Tyr Ala Asn Gly Asn Thr Glu Asn Pro Ser
195 200 205

Tyr Glu Asp Val Ser Tyr Arg His Thr Gly His Ala Glu Thr Val Lys
210 215 220

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

Tyr Phe Arg Val Val Asp Pro Thr Ser Leu Asn Lys Gln Gly Asn Asp
245 250 255

Thr Gly Thr Gln Tyr Arg Ser Gly Val Tyr Tyr Thr Asp Pro Ala Glu
260 265 270

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

Leu Pro Leu Val Val Glu Asn Glu Pro Leu Lys Asn Phe Tyr Asp Ala
290 295 300

Glu Glu Tyr His Gln Asp Tyr Leu Ile Lys Asn Pro Asn Gly Tyr Cys
305 310 315 320

His Ile Asp Ile Arg Lys Ala Asp Glu Pro Leu Pro Gly Lys Thr Lys
325 330 335

Ala Ala Pro Gln Gly Lys Gly Phe Asp Ala Ala Thr Tyr Lys Lys Pro
340 345 350

Ser Asp Ala Glu Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val
355 360 365

Thr Gln Asn Ser Ala Thr Glu Tyr Ala Phe Ser His Glu Tyr Asp His
370 375 380

Leu Phe Lys Pro Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu
385 390 395 400

Phe Ser Ser Ala Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe
405 410 415

Thr Arg Pro Ile Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser
420 425 430

Phe Asn Met Arg Arg Thr Glu Val Arg Ser Arg Ala Ala Asp Ser His
435 440 445

Leu Gly His Val Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg
450 455 460

Tyr Cys Ile Asn Gly Ala Ser Leu Lys Phe Ile Pro Leu Glu Gln Met
465 470 475 480

Asp Ala Ala Gly Tyr Gly Ala Leu Lys Gly Lys Val Lys
485 490

<210> 9
<211> 522
<212> PRT
<213> Neisseria gonorrhoeae

<400> 9

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

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

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

Ala Ser Val Tyr Leu Lys Lys Asp Lys Pro Thr Leu Ile Lys Phe Trp
50 55 60

Ala Ser Trp Cys Pro Leu Cys Leu Ser Glu Leu Gly Gln Ala Glu Lys
65 70 75 80

Trp Ala Gln Asp Ala Lys Phe Ser Ser Ala Asn Leu Ile Thr Val Ala
85 90 95

Ser Pro Gly Phe Leu His Glu Lys Lys Asp Gly Glu Phe Gln Lys Trp
100 105 110

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

Gly Thr Ile Ala Gln Asn Leu Asn Ile Ser Val Tyr Pro Ser Trp Ala
130 135 140

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

Asn Glu Ala Gln Ala Leu Ala Leu Ile Arg Asn Pro Asn Ala Asp Leu
165 170 175

Gly Ser Leu Lys His Ser Phe Tyr Lys Pro Asp Thr Gln Lys Lys Asp
180 185 190

Ser Ala Ile Met Asn Thr Arg Thr Ile Tyr Leu Ala Gly Gly Cys Phe
195 200 205

Trp Gly Leu Glu Ala Tyr Phe Gln Arg Ile Asp Gly Val Val Asp Ala
210 215 220

Val Ser Gly Tyr Ala Asn Gly Asn Thr Glu Asn Pro Ser Tyr Glu Asp
225 230 235 240

Val Ser Tyr Arg His Thr Gly His Ala Glu Thr Val Lys Val Thr Tyr
245 250 255

Asp Ala Asp Lys Leu Ser Leu Asp Asp Ile Leu Gln Tyr Tyr Phe Arg
260 265 270

Val Val Asp Pro Thr Ser Leu Asn Lys Gln Gly Asn Asp Thr Gly Thr
275 280 285

Gln Tyr Arg Ser Gly Val Tyr Tyr Thr Asp Pro Ala Glu Lys Ala Val
290 295 300

Ile Ala Ala Ala Leu Lys Arg Glu Gln Gln Lys Tyr Gln Leu Pro Leu
305 310 315 320

Val Val Glu Asn Glu Pro Leu Lys Asn Phe Tyr Asp Ala Glu Glu Tyr
325 330 335

His Gln Asp Tyr Leu Ile Lys Asn Pro Asn Gly Tyr Cys His Ile Asp
340 345 350

Ile Arg Lys Ala Asp Glu Pro Leu Pro Gly Lys Thr Lys Ala Ala Pro

355

360

365

Gln Gly Lys Gly Phe Asp Ala Ala Thr Tyr Lys Lys Pro Ser Asp Ala
 370 375 380

Glu Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val Thr Gln Asn
 385 390 395 400

Ser Ala Thr Glu Tyr Ala Phe Ser His Glu Tyr Asp His Leu Phe Lys
 405 410 415

Pro Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu Phe Ser Ser
 420 425 430

Ala Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe Thr Arg Pro
 435 440 445

Ile Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser Phe Asn Met
 450 455 460

Arg Arg Thr Glu Val Arg Ser Arg Ala Ala Asp Ser His Leu Gly His
 465 470 475 480

Val Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg Tyr Cys Ile
 485 490 495

Asn Gly Ala Ser Leu Lys Phe Ile Pro Leu Glu Gln Met Asp Ala Ala
 500 505 510

Gly Tyr Gly Ala Leu Lys Gly Lys Val Lys
 515 520

<210> 10

<211> 522

<212> PRT

<213> Neisseria gonorrhoeae

<400> 10

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

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

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

Ala Ser Val Tyr Leu Lys Lys Asp Lys Pro Thr Leu Ile Lys Phe Trp
50 55 60

Ala Ser Trp Cys Pro Leu Cys Leu Ser Glu Leu Gly Gln Ala Glu Lys
65 70 75 80

Trp Ala Gln Asp Ala Lys Phe Ser Ser Ala Asn Leu Ile Thr Val Ala
85 90 95

Ser Pro Gly Phe Leu His Glu Lys Lys Asp Gly Glu Phe Gln Lys Trp
100 105 110

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

Gly Thr Ile Ala Gln Asn Leu Asn Ile Ser Val Tyr Pro Ser Trp Ala
130 135 140

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

Asn Glu Ala Gln Ala Leu Ala Leu Ile Arg Asn Pro Asn Ala Asp Leu
165 170 175

Gly Ser Leu Lys His Ser Phe Tyr Lys Pro Asp Thr Gln Lys Lys Asp
180 185 190

Ser Ala Ile Met Asn Thr Arg Thr Ile Tyr Leu Ala Gly Gly Cys Phe
195 200 205

Trp Gly Leu Glu Ala Tyr Phe Gln Arg Ile Asp Gly Val Val Asp Ala
210 215 220

Val Ser Gly Tyr Ala Asn Gly Asn Thr Glu Asn Pro Ser Tyr Glu Asp
225 230 235 240

Val Ser Tyr Arg His Thr Gly His Ala Glu Thr Val Lys Val Thr Tyr
245 250 255

Asp Ala Asp Lys Leu Ser Leu Asp Asp Ile Leu Gln Tyr Tyr Phe Arg
260 265 270

Val Val Asp Pro Thr Ser Leu Asn Lys Gln Gly Asn Asp Thr Gly Thr
275 280 285

Gln Tyr Arg Ser Gly Val Tyr Tyr Thr Asp Pro Ala Glu Lys Ala Val
290 295 300

Ile Ala Ala Ala Leu Lys Arg Glu Gln Gln Lys Tyr Gln Leu Pro Leu
305 310 315 320

Val Val Glu Asn Glu Pro Leu Lys Asn Phe Tyr Asp Ala Glu Glu Tyr
325 330 335

His Gln Asp Tyr Leu Ile Lys Asn Pro Asn Gly Tyr Cys His Ile Asp
340 345 350

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

Gln Gly Lys Gly Phe Asp Ala Ala Thr Tyr Lys Lys Pro Ser Asp Ala
370 375 380

Glu Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val Thr Gln Asn
385 390 395 400

Ser Ala Thr Glu Tyr Ala Phe Ser His Glu Tyr Asp His Leu Phe Lys
405 410 415

Pro Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu Phe Ser Ser
420 425 430

Ala Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe Thr Arg Pro
435 440 445

Ile Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser Phe Asn Met
450 455 460

Arg Arg Thr Glu Val Arg Ser Arg Ala Ala Asp Ser His Leu Gly His
465 470 475 480

Val Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg Tyr Cys Ile
485 490 495

Asn Gly Ala Ser Leu Lys Phe Ile Pro Leu Glu Gln Met Asp Ala Ala
500 505 510

Gly Tyr Gly Ala Leu Lys Gly Glu Val Lys
515 520

<210> 11
<211> 522
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<213> Neisseria gonorrhoeae

<400> 11

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

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

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

Ala Ser Val Tyr Leu Lys Lys Asp Lys Pro Thr Leu Ile Lys Phe Trp
50 55 60

Ala Ser Trp Cys Pro Leu Cys Leu Ser Glu Leu Gly Gln Ala Glu Lys
65 70 75 80

Trp Ala Gln Asp Ala Lys Phe Ser Ser Ala Asn Leu Ile Thr Val Ala
85 90 95

Ser Pro Gly Phe Leu His Glu Lys Lys Asp Gly Glu Phe Gln Lys Trp
100 105 110

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

Gly Thr Ile Ala Gln Asn Leu Asn Ile Ser Val Tyr Pro Ser Trp Ala
130 135 140

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

Asn Glu Ala Gln Ala Leu Ala Leu Ile Arg Asn Pro Asn Ala Asp Leu
165 170 175

Gly Ser Leu Lys His Ser Phe Tyr Lys Pro Asp Thr Gln Lys Lys Asp
180 185 190

Ser Ala Ile Met Asn Thr Arg Thr Ile Tyr Leu Ala Gly Gly Cys Phe
195 200 205

Trp Gly Leu Glu Ala Tyr Phe Gln Arg Ile Asp Gly Val Val Asp Ala
210 215 220

Val Ser Gly Tyr Ala Asn Gly Asn Thr Glu Asn Pro Ser Tyr Glu Asp
225 230 235 240

Val Ser Tyr Arg His Thr Gly His Ala Glu Thr Val Lys Val Thr Tyr

245

250

255

Asp Ala Asp Lys Leu Ser Leu Asp Asp Ile Leu Gln Tyr Tyr Phe Arg
 260 265 270

Val Val Asp Pro Thr Ser Leu Asn Lys Gln Gly Asn Asp Thr Gly Thr
 275 280 285

Gln Tyr Arg Ser Gly Val Tyr Tyr Thr Asp Pro Ala Glu Lys Ala Val
 290 295 300

Ile Ala Ala Ala Leu Lys Arg Glu Gln Gln Lys Tyr Gln Leu Pro Leu
 305 310 315 320

Val Val Glu Asn Glu Pro Leu Lys Asn Phe Tyr Asp Ala Glu Glu Tyr
 325 330 335

His Gln Asp Tyr Leu Ile Lys Asn Pro Asn Gly Tyr Cys His Ile Asp
 340 345 350

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

Gln Gly Lys Gly Phe Asp Ala Ala Thr Tyr Lys Lys Pro Ser Asp Ala
 370 375 380

Glu Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val Thr Gln Asn
 385 390 395 400

Ser Ala Thr Glu Tyr Ala Phe Ser His Glu Tyr Asp His Leu Phe Lys
 405 410 415

Pro Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu Phe Ser Ser
 420 425 430

Ala Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe Thr Arg Pro
 435 440 445

Ile Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser Phe Asn Met
450 455 460

Arg Arg Thr Glu Val Arg Ser Arg Ala Ala Asp Ser His Leu Gly His
465 470 475 480

Val Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg Tyr Cys Ile
485 490 495

Asn Gly Ala Ser Leu Lys Phe Ile Pro Leu Glu Gln Met Asp Ala Ala
500 505 510

Gly Tyr Gly Ala Leu Lys Gly Glu Val Lys
515 520

<210> 12
<211> 522
<212> PRT
<213> Neisseria gonorrhoeae

<400> 12

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

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

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

Ala Ser Val Tyr Leu Lys Lys Asp Lys Pro Thr Leu Ile Lys Phe Trp
50 55 60

Ala Ser Trp Cys Pro Leu Cys Leu Ser Glu Leu Gly Gln Thr Glu Lys
65 70 75 80

Trp Ala Gln Asp Ala Lys Phe Ser Ser Ala Asn Leu Ile Thr Val Ala
85 90 95

Ser Pro Gly Phe Leu His Glu Lys Lys Asp Gly Asp Phe Gln Lys Trp
100 105 110

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

Gly Thr Ile Ala Gln Ser Leu Asn Ile Ser Val Tyr Pro Ser Trp Ala
130 135 140

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

Asn Glu Ala Gln Ala Leu Ala Leu Ile Arg Asp Pro Asn Ala Asp Leu
165 170 175

Gly Ser Leu Lys His Ser Phe Tyr Lys Pro Asp Thr Gln Lys Lys Asp
180 185 190

Ser Lys Ile Met Asn Thr Arg Thr Ile Tyr Leu Ala Gly Gly Cys Phe
195 200 205

Trp Gly Leu Glu Ala Tyr Phe Gln Arg Ile Asp Gly Val Val Asp Ala
210 215 220

Val Ser Gly Tyr Ala Asn Gly Asn Thr Lys Asn Pro Ser Tyr Glu Asp
225 230 235 240

Val Ser Tyr Arg His Thr Gly His Ala Glu Thr Val Lys Val Thr Tyr
245 250 255

Asp Ala Asp Lys Leu Ser Leu Asp Asp Ile Leu Gln Tyr Phe Phe Arg
260 265 270

Val Val Asp Pro Thr Ser Leu Asn Lys Gln Gly Asn Asp Thr Gly Thr
275 280 285

Gln Tyr Arg Ser Gly Val Tyr Tyr Thr Asp Pro Ala Glu Lys Ala Val
290 295 300

Ile Ala Ala Ala Leu Lys Arg Glu Gln Gln Lys Tyr Gln Leu Pro Leu
305 310 315 320

Val Val Glu Asn Glu Pro Leu Lys Asn Phe Tyr Asp Ala Glu Glu Tyr
325 330 335

His Gln Asp Tyr Leu Ile Lys Asn Pro Asn Gly Tyr Cys His Ile Asp
340 345 350

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

Gln Gly Lys Gly Phe Asp Ala Ala Thr Tyr Lys Lys Pro Ser Asp Ala
370 375 380

Glu Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val Thr Gln Asn
385 390 395 400

Ser Ala Thr Glu Tyr Ala Phe Ser His Glu Tyr Asp His Leu Phe Lys
405 410 415

Pro Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu Phe Ser Ser
420 425 430

Ala Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe Thr Arg Pro
435 440 445

Ile Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser Tyr Asn Met
450 455 460

Arg Arg Thr Glu Val Arg Ser His Ala Ala Asp Ser His Leu Gly His
465 470 475 480

Val Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg Tyr Cys Ile
485 490 495

Asn Gly Ala Ser Leu Lys Phe Ile Pro Leu Glu Gln Met Asp Ala Ala
500 505 510

Gly Tyr Gly Ala Leu Lys Gly Lys Val Lys
515 520

<210> 13
<211> 1569
<212> DNA
<213> Neisseria gonorrhoeae

<400> 13
atgaaacacc gtacttttctt ttccctttgc gccaaagttcg gctgcctgct tgcgctgggc 60
gcttgttcgc ccaaaatcgt cgatgccggg accgcgaccg tgccgcacac tttatccacg 120
ttaaaaaccg cggacaaccg ccccgccagt gtttatttga aaaaagacaa accgacgctg 180
attaaatttt gggcgagctg gtgtccttta tgtttgctcg aattgggaca ggccgagaaa 240
tgggcgcaag atgcaaaaatt cagctccgcc aacctgatta ccgtcgcctc ccccggtttt 300
ttgcacgaga aaaaagacgg cgagtttcaa aaatggtatg ccggtttgaa ctacccaag 360
ctgcccgtcg ttaccgacaa cggcggcacg atcgcccaa acctgaatat cagcgtttat 420
ccttcttggg cgtaaatcgg taaagacggc gacgtgcagc gcatcgtcaa aggcagcatc 480
aacgaagcgc aggcattggc gttaatccgc aaccgaatg ccgatttggg cagtttgaaa 540
cattcgttct acaaaccga cactcagaaa aaggattcag caatcatgaa cacgcgcacc 600
atctacctcg ccggcggctg cttctggggc ttggaagcct atttccaacg catcgacggc 660
gtggttgacg cggatatccg ctacgccaac ggcaacacgg aaaacccgag ctacgaagac 720
gtgtcctacc gccatacggg ccatgccgag accgtcaaag tgacctacga tgccgacaaa 780
ctcagcctgg acgacatcct gcaatattat ttccgcgtcg ttgatccgac cagcctcaac 840
aaacagggtg acgacaccgg cacgcaatac cgcagcggcg tgtactacac cgaccccgcc 900
gaaaaagccg tcatcgccgc cgccctcaaa cgcgagcagc aaaaatacca actgcccctc 960
gttggtgaaa acgaaccgct gaaaaacttc tacgacgccg aggaatacca tcaggactac 1020

ctgattaataaa accccaacgg ctactgccac atcgacatcc gcaaagccga cgaaccgctg	1080
ccgggcaaaaa ccaaagccgc accgcaaggc aaaggcttcg acgcggaac gtataaaaaa	1140
ccgagtgcg ccgaactcaa acgcaccctg accgaagagc aataccaagt gacccaaaac	1200
agcgcgaccg aatacgcctt cagccacgaa tacgaccatt tggtcaaacc cggcatttat	1260
gtggacgttg tcagcggcga acccctgttc agctccgccg acaaatatga ttccggctgc	1320
ggctggccga gcttcacgcg cccgattgat gcaaaatccg ttaccgaaca cgatgatttc	1380
agcttcaata tgcgccgcac cgaagtcaga agccgcgccg ccgattcgca cttgggacac	1440
gtcttccccg acggcccccg cgacaaaggc ggactgcgct actgcatcaa cggcgcgagc	1500
ttgaaattca tcccgtgga acaaatggac gcggcaggct acggcgcgtt gaagggcaaa	1560
gtgaaataa	1569

<210> 14
 <211> 1476
 <212> DNA
 <213> *Neisseria gonorrhoeae*

<400> 14	
gcgaccgtgc cgcacacttt atccacgtta aaaaccgcgg acaaccgccc cgccagtgtt	60
tatttgaaaa aagacaaacc gacgtgatt aaattttggg cgagctgggtg tcctttatgt	120
ttgtccgaat tgggacaggc cgagaaatgg gcgcaagatg caaaattcag ctccgccaac	180
ctgattaccg tcgcctcccc cggctttttg cacgagaaaa aagacggcga gtttcaaaaa	240
tggtatgccg gtttgaacta cccaagctg cccgtcgta cgcacaacgg cggcacgatc	300
gccccaaaacc tgaatatcag cgtttatcct tcttgggcgt taatcggtaa agacggcgac	360
gtgcagcgca tcgtcaaagg cagcatcaac gaagcgcagg cattggcggtt aatccgcaac	420
ccgaatgccg atttgggcag tttgaaacat tcgttctaca aaccgacac tcagaaaaag	480
gattcagcaa tcatgaacac gcgcaccatc tacctcgccg gcggctgctt ctggggcttg	540
gaagcctatt tccaacgcat cgacggcgtg gttgacgcgg tatccggcta cgccaacggc	600
aacacggaaa acccgagcta cgaagacgtg tcctaccgcc atacgggcca tgccgagacc	660
gtcaaagtga cctacgatgc cgacaaactc agcctggacg acatcctgca atattatttc	720

cgcgctcgttg atccgaccag cctcaacaaa cagggtaacg acaccggcac gcaataccgc 780
 agcggcgtgt actacaccga ccccgccgaa aaagccgtca tcgccgccgc cctcaaacgc 840
 gagcagcaaa aataccaact gcccctcgtt gttgaaaacg aaccgctgaa aaacttctac 900
 gacgccgagg aataccatca ggactacctg attaaaaaacc ccaacggcta ctgccacatc 960
 gacatccgca aagccgacga accgctgccg ggcaaaaacca aagccgcacc gcaaggcaaaa 1020
 ggcttcgacg cggcaacgta taaaaaaccg agtgacgccg aactcaaacg caccctgacc 1080
 gaagagcaat accaagtga ccaaaacagc gcgaccgaat acgccttcag ccacgaatac 1140
 gaccatttgt tcaaaccggg catttatgtg gacgttgtca gcggcgaacc cctgttcagc 1200
 tccgccgaca aatatgattc cggctgcggc tggccgagct tcacgcgccc gattgatgca 1260
 aaatccgtta ccgaacacga tgatttcagc ttcaatatgc gccgcaccga agtcagaagc 1320
 cgcgccgccg attcgactt gggacacgtc ttccccgacg gccccgcga caaaggcgga 1380
 ctgcgctact gcatcaacgg cgcgagcttg aaattcatcc cgctggaaca aatggacgcg 1440
 gcaggctacg gcgcgttgaa gggcaaagtg aaataa 1476

<210> 15
 <211> 515
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> MsrA/B/His/linker

<400> 15

Met Gly Ser Ser His His His His His Ser Ser Gly Leu Val Pro
 1 5 10 15

Arg Gly Ser His Met Lys Gly Thr Ala Thr Val Pro His Thr Leu Ser
 20 25 30

Thr Leu Lys Thr Ala Asp Asn Arg Pro Ala Ser Val Tyr Leu Lys Lys
 35 40 45

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

Leu Ser Glu Leu Gly Gln Ala Glu Lys Trp Ala Gln Asp Ala Lys Phe
65 70 75 80

Ser Ser Ala Asn Leu Ile Thr Val Ala Ser Pro Gly Phe Leu His Glu
85 90 95

Lys Lys Asp Gly Glu Phe Gln Lys Trp Tyr Ala Gly Leu Asn Tyr Pro
100 105 110

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

Asn Ile Ser Val Tyr Pro Ser Trp Ala Leu Ile Gly Lys Asp Gly Asp
130 135 140

Val Gln Arg Ile Val Lys Gly Ser Ile Asn Glu Ala Gln Ala Leu Ala
145 150 155 160

Leu Ile Arg Asn Pro Asn Ala Asp Leu Gly Ser Leu Lys His Ser Phe
165 170 175

Tyr Lys Pro Asp Thr Gln Lys Lys Asp Ser Ala Ile Met Asn Thr Arg
180 185 190

Thr Ile Tyr Leu Ala Gly Gly Cys Phe Trp Gly Leu Glu Ala Tyr Phe
195 200 205

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

Asn Thr Glu Asn Pro Ser Tyr Glu Asp Val Ser Tyr Arg His Thr Gly
225 230 235 240

His Ala Glu Thr Val Lys Val Thr Tyr Asp Ala Asp Lys Leu Ser Leu
245 250 255

Asp Asp Ile Leu Gln Tyr Tyr Phe Arg Val Val Asp Pro Thr Ser Leu
260 265 270

Asn Lys Gln Gly Asn Asp Thr Gly Thr Gln Tyr Arg Ser Gly Val Tyr
275 280 285

Tyr Thr Asp Pro Ala Glu Lys Ala Val Ile Ala Ala Ala Leu Lys Arg
290 295 300

Glu Gln Gln Lys Tyr Gln Leu Pro Leu Val Val Glu Asn Glu Pro Leu
305 310 315 320

Lys Asn Phe Tyr Asp Ala Glu Glu Tyr His Gln Asp Tyr Leu Ile Lys
325 330 335

Asn Pro Asn Gly Tyr Cys His Ile Asp Ile Arg Lys Ala Asp Glu Pro
340 345 350

Leu Pro Gly Lys Thr Lys Ala Ala Pro Gln Gly Lys Gly Phe Asp Ala
355 360 365

Ala Thr Tyr Lys Lys Pro Ser Asp Ala Glu Leu Lys Arg Thr Leu Thr
370 375 380

Glu Glu Gln Tyr Gln Val Thr Gln Asn Ser Ala Thr Glu Tyr Ala Phe
385 390 395 400

Ser His Glu Tyr Asp His Leu Phe Lys Pro Gly Ile Tyr Val Asp Val
405 410 415

Val Ser Gly Glu Pro Leu Phe Ser Ser Ala Asp Lys Tyr Asp Ser Gly
420 425 430

Cys Gly Trp Pro Ser Phe Thr Arg Pro Ile Asp Ala Lys Ser Val Thr
435 440 445

Glu His Asp Asp Phe Ser Phe Asn Met Arg Arg Thr Glu Val Arg Ser
450 455 460

Arg Ala Ala Asp Ser His Leu Gly His Val Phe Pro Asp Gly Pro Arg
465 470 475 480

Asp Lys Gly Gly Leu Arg Tyr Cys Ile Asn Gly Ala Ser Leu Lys Phe
485 490 495

Ile Pro Leu Glu Gln Met Asp Ala Ala Gly Tyr Gly Ala Leu Lys Gly
500 505 510

Lys Val Lys
515

<210> 16
<211> 1548
<212> DNA
<213> Artificial Sequence

<220>
<223> MsrA/B/His/linker

<400> 16
atgggcagca gccatcatca tcatcatcac agcagcggcc tggtgccgcg cggcagccat 60
atgaaaggga ccgcgaccgt gccgcacact ttatccacgt taaaaaccgc ggacaaccgc 120
cccgccagtg tttatttgaa aaaagacaaa ccgacgctga ttaaattttg ggcgagctgg 180
tgtcctttat gtttgtccga attgggacag gccgagaaat gggcgcaaga tgcaaaattc 240
agctccgcca acctgattac cgtcgcctcc cccggctttt tgcacgagaa aaaagacggc 300
gagtttcaaa aatggtatgc cggtttgaac taccccaagc tgcccgtcgt taccgacaac 360
ggcggcacga tcgccccaaa cctgaatatc agcgtttatc cttcttgggc gttaatcggt 420
aaagacggcg acgtgcagcg catcgtcaaa ggcagcatca acgaagcgca ggcattggcg 480
ttaatccgca acccgaatgc cgatttgggc agtttgaaac attcgttcta caaaccggac 540
actcagaaaa aggattcagc aatcatgaac acgcgcacca tctacctcgc cggcggctgc 600
ttctggggct tggaagccta tttccaacgc atcgacggcg tggttgacgc ggtatccggc 660

tacgccaacg gcaacacgga aaacccgagc tacgaagacg tgtcctaccg ccatacgggc	720
catgccgaga ccgtcaaagt gacctacgat gccgacaaac tcagcctgga cgacatcctg	780
caatattatt tccgcgtcgt tgatccgacc agcctcaaca aacagggtaa cgacaccggc	840
acgcaatacc gcagcggcgt gtactacacc gaccccgccg aaaaagccgt catcgccgcc	900
gccctcaaac gcgagcagca aaaataccaa ctgcccctcg ttgttgaaaa cgaaccgctg	960
aaaaacttct acgacgccga ggaataccat caggactacc tgattaaaaa cccaacggc	1020
tactgccaca tcgacatccg caaagccgac gaaccgctgc cgggcaaaac caaagccgca	1080
ccgcaaggca aaggcttcga cgcggcaacg tataaaaaac cgagtgcgc cgaactcaaa	1140
cgcacctga ccgaagagca ataccaagt acccaaaaaca gcgcgaccga atacgccttc	1200
agccacgaat acgaccattt gttcaaacc ggcatattatg tggacgttgt cagcggcgaa	1260
cccctgttca gctccgccga caaatatgat tccggctgcg gctggccgag cttcacgcgc	1320
ccgattgatg caaaatccgt taccgaacac gatgatttca gcttcaatat gcgccgcacc	1380
gaagtcagaa gccgcgccgc cgattcgac ttgggacacg tcttccccga cggccccgc	1440
gacaaaggcg gactgcgcta ctgcatcaac ggcgcgagct tgaaattcat cccgctggaa	1500
caaatggacg cggcaggcta cggcgcgttg aagggcaaag tgaaataa	1548

<210> 17
 <211> 35
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Primer 1291msrFor

<400> 17	
gccgtctgaa atgaaacacc gtactttctt ttccc	35

<210> 18
 <211> 35
 <212> DNA
 <213> Artificial Sequence

<220>

<223> Primer 1291msrRev

<400> 18
ttcagacggc ttatttcact ttgcccttca acgcg 35

<210> 19
<211> 10
<212> DNA
<213> Neisseria gonorrhoeae

<400> 19
gccgtctgaa 10

<210> 20
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer msrexp_NdeIF

<400> 20
aaaatccata tgaaagggac cgcgaccgtg ccgca 35

<210> 21
<211> 31
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer msrexp_XhoIR

<400> 21
ccctgactcg agttatttca ctttgccctt c 31

<210> 22
<211> 27
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer 15bmsrAFor_NdeI

<400> 22
ttgggccata tgaaacattc gttctac 27

<210> 23
 <211> 32
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Primer 15bmsrARev_XhoI

 <400> 23
 ggctttctcg agttagcccg gcagcgggtc gt 32

<210> 24
 <211> 31
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Primer 15bmsrBFor_NdeI

 <400> 24
 ggcaaacata tgaaagcggc aacgtataaa a 31

<210> 25
 <211> 33
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Primer 15bmsrBRev_XhoI

 <400> 25
 tgcggcctcg agttatttca ctttgccctt caa 33

<210> 26
 <211> 615
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> MsrA/His/linker

 <400> 26
 atgggcagca gccatcatca tcatcatcac agcagcggcc tggtgccgcg cggcagccat 60
 atgaaacatt cgttctacaa acccgacact cagaaaaagg attcagcaat catgaacacg 120

cgcaccatct acctgccgg cggtcttc tggggcttgg aagcctatctt ccaacgcatc 180
 gacggcgtgg ttgacgcggt atccggctac gccaacggca acacggaaaa cccgagctac 240
 gaagacgtgt cctaccgcca tacgggccat gccgagaccg tcaaagtgac ctacgatgcc 300
 gacaaactca gcctggacga catcctgcaa tattatttcc gcgtcgttga tccgaccagc 360
 ctcaacaaac agggtaacga caccggcacg caataccgca gcggcgtgta ctacaccgac 420
 cccgccgaaa aagccgtcat cgccgccgcc ctcaaacgcg agcagcaaaa ataccaactg 480
 cccctcgttg ttgaaaacga accgctgaaa aacttctacg acgccgagga ataccatcag 540
 gactacctga ttaaaaaccc caacggctac tgccacatcg acatccgcaa agccgacgaa 600
 ccgctgccgg gctaa 615

<210> 27
 <211> 204
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> MsrA/His/linker

<400> 27

Met Gly Ser Ser His His His His His His Ser Ser Gly Leu Val Pro
 1 5 10 15

Arg Gly Ser His Met Lys His Ser Phe Tyr Lys Pro Asp Thr Gln Lys
 20 25 30

Lys Asp Ser Ala Ile Met Asn Thr Arg Thr Ile Tyr Leu Ala Gly Gly
 35 40 45

Cys Phe Trp Gly Leu Glu Ala Tyr Phe Gln Arg Ile Asp Gly Val Val
 50 55 60

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

Glu Asp Val Ser Tyr Arg His Thr Gly His Ala Glu Thr Val Lys Val

85

90

95

Thr Tyr Asp Ala Asp Lys Leu Ser Leu Asp Asp Ile Leu Gln Tyr Tyr
 100 105 110

Phe Arg Val Val Asp Pro Thr Ser Leu Asn Lys Gln Gly Asn Asp Thr
 115 120 125

Gly Thr Gln Tyr Arg Ser Gly Val Tyr Tyr Thr Asp Pro Ala Glu Lys
 130 135 140

Ala Val Ile Ala Ala Ala Leu Lys Arg Glu Gln Gln Lys Tyr Gln Leu
 145 150 155 160

Pro Leu Val Val Glu Asn Glu Pro Leu Lys Asn Phe Tyr Asp Ala Glu
 165 170 175

Glu Tyr His Gln Asp Tyr Leu Ile Lys Asn Pro Asn Gly Tyr Cys His
 180 185 190

Ile Asp Ile Arg Lys Ala Asp Glu Pro Leu Pro Gly
 195 200

<210> 28

<211> 187

<212> PRT

<213> Artificial Sequence

<220>

<223> Recombinant MsrA

<400> 28

Gly Ser His Met Lys His Ser Phe Tyr Lys Pro Asp Thr Gln Lys Lys
 1 5 10 15

Asp Ser Ala Ile Met Asn Thr Arg Thr Ile Tyr Leu Ala Gly Gly Cys
 20 25 30

Phe Trp Gly Leu Glu Ala Tyr Phe Gln Arg Ile Asp Gly Val Val Asp

35

40

45

Ala Val Ser Gly Tyr Ala Asn Gly Asn Thr Glu Asn Pro Ser Tyr Glu
50 55 60

Asp Val Ser Tyr Arg His Thr Gly His Ala Glu Thr Val Lys Val Thr
65 70 75 80

Tyr Asp Ala Asp Lys Leu Ser Leu Asp Asp Ile Leu Gln Tyr Tyr Phe
85 90 95

Arg Val Val Asp Pro Thr Ser Leu Asn Lys Gln Gly Asn Asp Thr Gly
100 105 110

Thr Gln Tyr Arg Ser Gly Val Tyr Tyr Thr Asp Pro Ala Glu Lys Ala
115 120 125

Val Ile Ala Ala Ala Leu Lys Arg Glu Gln Gln Lys Tyr Gln Leu Pro
130 135 140

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

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

Asp Ile Arg Lys Ala Asp Glu Pro Leu Pro Gly
180 185

<210> 29

<211> 513

<212> DNA

<213> Artificial Sequence

<220>

<223> MsrB/His tag/linker

<400> 29

atgggcagca gccatcatca tcatcatcac agcagcggcc tgggtgccgcg cggcagccat

60

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atgaaagcgg caacgtataa aaaaccgagt gacgccgaac tcaaacgcac cctgaccgaa      120
gagcaatacc aagtgaccca aaacagcgcg accgaatacg ccttcagcca cgaatacgac      180
catttgttca aacccggcat ttatgtggac gttgtcagcg gcgaaccctt gttcagctcc      240
gccgacaaat atgattccgg ctgctggctgg ccgagcttca cgcgcccgat tgatgcaaaa      300
tccgttaccg aacacgatga tttcagcttc aatatgcgcc gcaccgaagt cagaagccgc      360
gccgccgatt cgcacttggg acacgtcttc cccgacggcc cccgcgacaa aggcggactg      420
cgctactgca tcaacggcgc gagcttgaaa ttcatcccgc tggaacaaat ggacgcggca      480
ggctacggcg cgttgaaggg caaagtgaaa taa                                     513

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<210> 30
<211> 170
<212> PRT
<213> Artificial Sequence

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<220>
<223> MsrB/His tag/linker

```

```

<400> 30

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```

Met Gly Ser Ser His His His His His His Ser Ser Gly Leu Val Pro
1           5           10           15

```

```

Arg Gly Ser His Met Lys Ala Ala Thr Tyr Lys Lys Pro Ser Asp Ala
          20           25           30

```

```

Glu Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val Thr Gln Asn
          35           40           45

```

```

Ser Ala Thr Glu Tyr Ala Phe Ser His Glu Tyr Asp His Leu Phe Lys
          50           55           60

```

```

Pro Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu Phe Ser Ser
65           70           75           80

```

```

Ala Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe Thr Arg Pro
          85           90           95

```

Ile Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser Phe Asn Met
100 105 110

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

Val Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg Tyr Cys Ile
130 135 140

Asn Gly Ala Ser Leu Lys Phe Ile Pro Leu Glu Gln Met Asp Ala Ala
145 150 155 160

Gly Tyr Gly Ala Leu Lys Gly Lys Val Lys
165 170

<210> 31
<211> 153
<212> PRT
<213> Artificial Sequence

<220>
<223> Recombinant MsrB

<400> 31

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

Leu Lys Arg Thr Leu Thr Glu Glu Gln Tyr Gln Val Thr Gln Asn Ser
20 25 30

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

Gly Ile Tyr Val Asp Val Val Ser Gly Glu Pro Leu Phe Ser Ser Ala
50 55 60

Asp Lys Tyr Asp Ser Gly Cys Gly Trp Pro Ser Phe Thr Arg Pro Ile
65 70 75 80

Asp Ala Lys Ser Val Thr Glu His Asp Asp Phe Ser Phe Asn Met Arg
85 90 95

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

Phe Pro Asp Gly Pro Arg Asp Lys Gly Gly Leu Arg Tyr Cys Ile Asn
115 120 125

Gly Ala Ser Leu Lys Phe Ile Pro Leu Glu Gln Met Asp Ala Ala Gly
130 135 140

Tyr Gly Ala Leu Lys Gly Lys Val Lys
145 150

<210> 32
<211> 100
<212> DNA
<213> Neisseria meningitidis

<400> 32
cagacatgga atcgccgaaa acgtcggcgg taaatgcaaa gctaagcggc ttggaaagcc 60
cggccggctt aaatttctta accaaaaaag gaatacagca 100

<210> 33
<211> 28
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer PmeI_For

<400> 33
gtttaaacat gaaacaccgt acttttctt 28

<210> 34
<211> 24
<212> DNA
<213> Artificial Sequence

<220>

<223> Primer PmeI_Rev

<400> 34
aaacttttga tgtttcctgt gtgg 24

<210> 35
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer pCTS32_porBPromoter_AflIIFor

<400> 35
agtttcctta agcagacatg gaatcgccga aaacg 35

<210> 36
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer pCTS32_porBPromoter_PmeIR

<400> 36
ttcattgttt aaactgctgt attccttttt tgg 33

<210> 37
<211> 32
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer pCTS32_Msr_AflIIFor

<400> 37
ctcgagctta agccggcggt tcctgttttt tc 32

<210> 38
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer pCTS32_Msr_SmaIRev

<400> 38
tgcggcccg ggttatttca ctttgccctt caacg

35

<210> 39
<211> 498
<212> PRT
<213> Artificial Sequence

<220>
<223> Recombinant MsrA/B

<400> 39

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

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

Lys Pro Thr Leu Ile Lys Phe Trp Ala Ser Trp Cys Pro Leu Cys Leu
35 40 45

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

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

Lys Asp Gly Glu Phe Gln Lys Trp Tyr Ala Gly Leu Asn Tyr Pro Lys
85 90 95

Leu Pro Val Val Thr Asp Asn Gly Gly Thr Ile Ala Gln Asn Leu Asn
100 105 110

Ile Ser Val Tyr Pro Ser Trp Ala Leu Ile Gly Lys Asp Gly Asp Val
115 120 125

Gln Arg Ile Val Lys Gly Ser Ile Asn Glu Ala Gln Ala Leu Ala Leu
130 135 140

Ile Arg Asn Pro Asn Ala Asp Leu Gly Ser Leu Lys His Ser Phe Tyr
145 150 155 160

Lys Pro Asp Thr Gln Lys Lys Asp Ser Ala Ile Met Asn Thr Arg Thr
165 170 175

Ile Tyr Leu Ala Gly Gly Cys Phe Trp Gly Leu Glu Ala Tyr Phe Gln
180 185 190

Arg Ile Asp Gly Val Val Asp Ala Val Ser Gly Tyr Ala Asn Gly Asn
195 200 205

Thr Glu Asn Pro Ser Tyr Glu Asp Val Ser Tyr Arg His Thr Gly His
210 215 220

Ala Glu Thr Val Lys Val Thr Tyr Asp Ala Asp Lys Leu Ser Leu Asp
225 230 235 240

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

Lys Gln Gly Asn Asp Thr Gly Thr Gln Tyr Arg Ser Gly Val Tyr Tyr
260 265 270

Thr Asp Pro Ala Glu Lys Ala Val Ile Ala Ala Ala Leu Lys Arg Glu
275 280 285

Gln Gln Lys Tyr Gln Leu Pro Leu Val Val Glu Asn Glu Pro Leu Lys
290 295 300

Asn Phe Tyr Asp Ala Glu Glu Tyr His Gln Asp Tyr Leu Ile Lys Asn
305 310 315 320

Pro Asn Gly Tyr Cys His Ile Asp Ile Arg Lys Ala Asp Glu Pro Leu
325 330 335

Pro Gly Lys Thr Lys Ala Ala Pro Gln Gly Lys Gly Phe Asp Ala Ala
340 345 350

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

Glu Gln Tyr Gln Val Thr Gln Asn Ser Ala Thr Glu Tyr Ala Phe Ser
370 375 380

His Glu Tyr Asp His Leu Phe Lys Pro Gly Ile Tyr Val Asp Val Val
385 390 395 400

Ser Gly Glu Pro Leu Phe Ser Ser Ala Asp Lys Tyr Asp Ser Gly Cys
405 410 415

Gly Trp Pro Ser Phe Thr Arg Pro Ile Asp Ala Lys Ser Val Thr Glu
420 425 430

His Asp Asp Phe Ser Phe Asn Met Arg Arg Thr Glu Val Arg Ser Arg
435 440 445

Ala Ala Asp Ser His Leu Gly His Val Phe Pro Asp Gly Pro Arg Asp
450 455 460

Lys Gly Gly Leu Arg Tyr Cys Ile Asn Gly Ala Ser Leu Lys Phe Ile
465 470 475 480

Pro Leu Glu Gln Met Asp Ala Ala Gly Tyr Gly Ala Leu Lys Gly Lys
485 490 495

Val Lys