

SEQUENCE LISTING

<110> GlaxoSmithKline Biologicals SA

<120> Vaccine Composition

<130> VB66961 WO

<150> GB 2013262.7

<151> 2020-08-25

<160> 35

<170> PatentIn version 3.5

<210> 1

<211> 255

<212> PRT

<213> Neisseria meningitidis

<400> 1

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

Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys Asp Lys Gly Leu Gln
20 25 30

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

Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly Asn Gly Asp Ser Leu Asn
50 55 60

Thr Gly Lys Leu Lys Asn Asp Lys Val Ser Arg Phe Asp Phe Ile Arg
65 70 75 80

Gln Ile Glu Val Asp Gly Lys Leu Ile Thr Leu Glu Ser Gly Glu Phe
85 90 95

Gln Val Tyr Lys Gln Ser His Ser Ala Leu Thr Ala Leu Gln Thr Glu
100 105 110

Gln Val Gln Asp Ser Glu Asp Ser Gly Lys Met Val Ala Lys Arg Gln
115 120 125

Phe Arg Ile Gly Asp Ile Ala Gly Glu His Thr Ser Phe Asp Lys Leu
130 135 140

Pro Lys Gly Gly Ser Ala Thr Tyr Arg Gly Thr Ala Phe Gly Ser Asp
145 150 155 160

Asp Ala Gly Gly Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln
165 170 175

Gly His Gly Lys Ile Glu His Leu Lys Ser Pro Glu Leu Asn Val Glu
180 185 190

Leu Ala Thr Ala Tyr Ile Lys Pro Asp Glu Lys Arg His Ala Val Ile
195 200 205

Ser Gly Ser Val Leu Tyr Asn Gln Asp Glu Lys Gly Ser Tyr Ser Leu
210 215 220

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

Glu Thr Ala Asn Gly Ile His His Ile Gly Leu Ala Ala Lys Gln
245 250 255

<210> 2
<211> 248
<212> PRT
<213> Neisseria meningitidis

<400> 2

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

Leu Asp His Lys Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Lys
65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
85 90 95

Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu Asp
100 105 110

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala
115 120 125

Gly Glu His Thr Ser Phe Asp Lys Leu Pro Lys Gly Gly Ser Ala Thr
130 135 140

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
145 150 155 160

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His
165 170 175

Leu Lys Ser Pro Glu Leu Asn Val Glu Leu Ala Thr Ala Tyr Ile Lys
180 185 190

Pro Asp Glu Lys Arg His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn
195 200 205

Gln Asp Glu Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly Gly Gln Ala
210 215 220

Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn Gly Ile His
225 230 235 240

His Ile Gly Leu Ala Ala Lys Gln
245

<210> 3

<211> 248

<212> PRT

<213> Artificial Sequence

<220>

<223> MUTATED fhbp POLYPEPTIDE

<400> 3

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

Leu Asp His Lys Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Lys
65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
85 90 95

Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu Asp
100 105 110

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala
115 120 125

Gly Glu His Thr Ser Phe Asp Lys Leu Pro Lys Gly Gly Ser Ala Thr
130 135 140

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
145 150 155 160

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His
165 170 175

Leu Lys Ser Pro Glu Leu Asn Val Glu Leu Ala Thr Ala Tyr Ile Lys
180 185 190

Pro Asp Glu Lys Arg His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn

195

200

205

Gln Asp Ala Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly Gly Gln Ala
 210 215 220

Gln Glu Val Ala Gly Ser Ala Ala Val Glu Thr Ala Asn Gly Ile His
 225 230 235 240

His Ile Gly Leu Ala Ala Lys Gln
 245

<210> 4

<211> 248

<212> PRT

<213> Artificial Sequence

<220>

<223> MUTATED fhbp POLYPEPTIDE

<400> 4

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

Leu Asp His Lys Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser
 20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
 35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Lys
 65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
 85 90 95

Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu Asp
 100 105 110

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala

115

120

125

Gly Glu His Thr Ser Phe Asp Lys Leu Pro Lys Gly Gly Ser Ala Thr
 130 135 140

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
 145 150 155 160

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His
 165 170 175

Leu Lys Ser Pro Glu Leu Asn Val Glu Leu Ala Thr Ala Tyr Ile Lys
 180 185 190

Pro Asp Glu Lys Arg His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn
 195 200 205

Gln Asp Ala Lys Gly Ser Tyr Arg Leu Gly Ile Phe Gly Gly Gln Ala
 210 215 220

Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn Gly Ile His
 225 230 235 240

His Ile Gly Leu Ala Ala Lys Gln
 245

<210> 5

<211> 263

<212> PRT

<213> Neisseria meningitidis

<400> 5

Cys Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Val Ala Ala Asp
 1 5 10 15

Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys
 20 25 30

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

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

Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys
65 70 75 80

Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln Leu
85 90 95

Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His Ser
100 105 110

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

Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Val Gly
130 135 140

Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val Met Ala Thr Tyr
145 150 155 160

Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr Tyr
165 170 175

Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu
180 185 190

Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala Asp Ile Lys Pro
195 200 205

Asp Glu Lys His His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn Gln
210 215 220

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

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

Ile Gly Leu Ala Ala Lys Gln
260

<210> 6
<211> 251
<212> PRT
<213> Neisseria meningitidis

<400> 6

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

Leu Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser
20 25 30

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

Thr Phe Lys Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu
50 55 60

Lys Asn Asp Lys Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val
65 70 75 80

Asp Gly Gln Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys
85 90 95

Gln Ser His Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp
100 105 110

Ser Glu His Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly
115 120 125

Asp Ile Val Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val
130 135 140

Met Ala Thr Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly
145 150 155 160

Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys
165 170 175

Ile Glu His Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala

180

185

190

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

Leu Tyr Asn Gln Ala Glu Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly
 210 215 220

Gly Gln Ala Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn
 225 230 235 240

Gly Ile Arg His Ile Gly Leu Ala Ala Lys Gln
 245 250

<210> 7

<211> 251

<212> PRT

<213> Artificial Sequence

<220>

<223> MUTATED fhbp POLYPEPTIDE

<400> 7

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

Leu Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser
 20 25 30

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

Thr Phe Lys Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu
 50 55 60

Lys Asn Asp Lys Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val
 65 70 75 80

Asp Gly Gln Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys
 85 90 95

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

100

105

110

Ser Glu His Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly
 115 120 125

Asp Ile Val Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val
 130 135 140

Met Ala Thr Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly
 145 150 155 160

Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys
 165 170 175

Ile Glu His Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala
 180 185 190

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

Leu Tyr Asn Gln Ala Glu Lys Gly Ser Tyr Arg Leu Gly Ile Phe Gly
 210 215 220

Gly Gln Ala Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn
 225 230 235 240

Gly Ile Arg His Ile Gly Leu Ala Ala Lys Gln
 245 250

<210> 8

<211> 251

<212> PRT

<213> Artificial Sequence

<220>

<223> MUTATED fhbp POLYPEPTIDE

<400> 8

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

Leu Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser

20

25

30

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

Thr Phe Lys Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu
 50 55 60

Lys Asn Asp Lys Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val
 65 70 75 80

Asp Gly Gln Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys
 85 90 95

Gln Ser His Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp
 100 105 110

Ser Glu His Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly
 115 120 125

Asp Ile Val Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val
 130 135 140

Met Ala Thr Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly
 145 150 155 160

Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys
 165 170 175

Ile Glu His Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala
 180 185 190

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

Leu Tyr Asn Gln Ala Ala Lys Gly Ser Tyr Arg Leu Gly Ile Phe Gly
 210 215 220

Gly Gln Ala Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn
 225 230 235 240

Gly Ile Arg His Ile Gly Leu Ala Ala Lys Gln
245 250

<210> 9
<211> 251
<212> PRT
<213> Artificial Sequence

<220>
<223> MUTATED fhbp POLYPEPTIDE

<400> 9

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

Leu Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser
20 25 30

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

Thr Phe Lys Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu
50 55 60

Lys Asn Asp Lys Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val
65 70 75 80

Asp Gly Gln Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys
85 90 95

Gln Ser His Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp
100 105 110

Ser Glu His Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly
115 120 125

Asp Ile Val Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val
130 135 140

Met Ala Thr Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly
145 150 155 160

Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys
165 170 175

Ile Glu His Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala
180 185 190

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

Leu Tyr Asn Gln Ala Ala Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly
210 215 220

Gly Gln Ala Gln Glu Val Ala Gly Ser Ala Ala Val Glu Thr Ala Asn
225 230 235 240

Gly Ile Arg His Ile Gly Leu Ala Ala Lys Gln
245 250

<210> 10
<211> 273
<212> PRT
<213> Neisseria meningitidis

<400> 10

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

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

Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys Asp Lys
35 40 45

Ser Leu Gln Ser Leu Thr Leu Asp Gln Ser Val Arg Lys Asn Glu Lys
50 55 60

Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly Asn Gly Asp
65 70 75 80

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

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

Gly Glu Phe Gln Ile Tyr Lys Gln Asp His Ser Ala Val Val Ala Leu
115 120 125

Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys Ile Asp Ser Leu Ile Asn
130 135 140

Gln Arg Ser Phe Leu Val Ser Gly Leu Gly Gly Glu His Thr Ala Phe
145 150 155 160

Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr His Gly Lys Ala Phe Ser
165 170 175

Ser Asp Asp Ala Gly Gly Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala
180 185 190

Lys Gln Gly His Gly Lys Ile Glu His Leu Lys Thr Pro Glu Gln Asn
195 200 205

Val Glu Leu Ala Ala Ala Glu Leu Lys Ala Asp Glu Lys Ser His Ala
210 215 220

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

His Leu Ala Leu Phe Gly Asp Arg Ala Gln Glu Ile Ala Gly Ser Ala
245 250 255

Thr Val Lys Ile Gly Glu Lys Val His Glu Ile Gly Ile Ala Gly Lys
260 265 270

Gln

<210> 11
<211> 254
<212> PRT
<213> Neisseria meningitidis

<400> 11

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

Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys Asp Lys Ser Leu Gln
20 25 30

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

Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly Asn Gly Asp Ser Leu Asn
50 55 60

Thr Gly Lys Leu Lys Asn Asp Lys Val Ser Arg Phe Asp Phe Ile Arg
65 70 75 80

Gln Ile Glu Val Asp Gly Gln Leu Ile Thr Leu Glu Ser Gly Glu Phe
85 90 95

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

Lys Ile Asn Asn Pro Asp Lys Ile Asp Ser Leu Ile Asn Gln Arg Ser
115 120 125

Phe Leu Val Ser Gly Leu Gly Gly Glu His Thr Ala Phe Asn Gln Leu
130 135 140

Pro Asp Gly Lys Ala Glu Tyr His Gly Lys Ala Phe Ser Ser Asp Asp
145 150 155 160

Ala Gly Gly Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly
165 170 175

His Gly Lys Ile Glu His Leu Lys Thr Pro Glu Gln Asn Val Glu Leu
180 185 190

Ala Ala Ala Glu Leu Lys Ala Asp Glu Lys Ser His Ala Val Ile Leu
195 200 205

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

Leu Phe Gly Asp Arg Ala Gln Glu Ile Ala Gly Ser Ala Thr Val Lys
225 230 235 240

Ile Gly Glu Lys Val His Glu Ile Gly Ile Ala Gly Lys Gln
245 250

<210> 12
<211> 247
<212> PRT
<213> Neisseria meningitidis

<400> 12

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

Leu Asp His Lys Asp Lys Ser Leu Gln Ser Leu Thr Leu Asp Gln Ser
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His
85 90 95

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

Ile Asp Ser Leu Ile Asn Gln Arg Ser Phe Leu Val Ser Gly Leu Gly
115 120 125

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr
130 135 140

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

Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu
165 170 175

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

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
195 200 205

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
210 215 220

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
225 230 235 240

Ile Gly Ile Ala Gly Lys Gln
245

<210> 13
<211> 281
<212> PRT
<213> Neisseria meningitidis

<400> 13

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

Leu Thr Ala Cys Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Val
20 25 30

Ala Ala Asp Ile Gly Thr Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu
35 40 45

Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser Ile
50 55 60

Pro Gln Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr

80

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125

140

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175

190

205

220

240

255

270

280

<210> 14
<211> 262
<212> PRT
<213> Neisseria meningitidis

<400> 14

Cys Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Val Ala Ala Asp
1 5 10 15

Ile Gly Thr Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys
20 25 30

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

Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr Phe Lys Ala
50 55 60

Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys
65 70 75 80

Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val Asp Gly Gln Thr
85 90 95

Ile Thr Leu Ala Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asn His Ser
100 105 110

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

Asp Ser Leu Ile Asn Gln Arg Ser Phe Leu Val Ser Gly Leu Gly Gly
130 135 140

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

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

Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile Glu His Leu Lys
180 185 190

Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala Asp
195 200 205

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

Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln Glu
225 230 235 240

Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu Ile
245 250 255

Gly Ile Ala Gly Lys Gln
260

<210> 15
<211> 250
<212> PRT
<213> Neisseria meningitidis

<400> 15

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

Leu Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser
20 25 30

Ile Pro Gln Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys
35 40 45

Thr Phe Lys Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu
50 55 60

Lys Asn Asp Lys Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val
65 70 75 80

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

Gln Asn His Ser Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn

100

105

110

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

Gly Leu Gly Gly Glu His Thr Ala Phe Asn Gln Leu Pro Gly Gly Lys
 130 135 140

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

Leu His Tyr Ser Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile
 165 170 175

Glu His Leu Lys Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu
 180 185 190

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

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

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

Val His Glu Ile Gly Ile Ala Gly Lys Gln
 245 250

<210> 16

<211> 247

<212> PRT

<213> Artificial Sequence

<220>

<223> MUTATED fhbp POLYPEPTIDE

<400> 16

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

Leu Asp His Lys Asp Lys Ser Leu Gln Ser Leu Thr Leu Asp Gln Val

20

25

30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
 35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
 65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His
 85 90 95

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

Ile Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
 115 120 125

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr
 130 135 140

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

Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu
 165 170 175

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

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
 195 200 205

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
 210 215 220

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
 225 230 235 240

Ile Gly Ile Ala Gly Lys Gln
245

<210> 17

<211> 250

<212> PRT

<213> Artificial Sequence

<220>

<223> MUTATED fhbp POLYPEPTIDE

<400> 17

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

Leu Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Val
20 25 30

Ile Pro Gln Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys
35 40 45

Thr Phe Lys Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu
50 55 60

Lys Asn Asp Lys Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val
65 70 75 80

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

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

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

Gly Leu Gly Gly Glu His Thr Ala Phe Asn Gln Leu Pro Gly Gly Lys
130 135 140

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

Leu His Tyr Ser Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile
165 170 175

Glu His Leu Lys Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu
180 185 190

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

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

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

Val His Glu Ile Gly Ile Ala Gly Lys Gln
245 250

<210> 18
<211> 757
<212> PRT
<213> Artificial Sequence

<220>
<223> MUTATED fhbp POLYPEPTIDE

<400> 18

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

Leu Asp His Lys Asp Lys Ser Leu Gln Ser Leu Thr Leu Asp Gln Val
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His
85 90 95

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

Ile Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
115 120 125

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr
130 135 140

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

Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu
165 170 175

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

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
195 200 205

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
210 215 220

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
225 230 235 240

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala
245 250 255

Asp Ile Gly Thr Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His
260 265 270

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

Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr Phe Lys

290

295

300

Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 305 310 315 320

Lys Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val Asp Gly Gln
 325 330 335

Thr Ile Thr Leu Ala Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asn His
 340 345 350

Ser Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys
 355 360 365

Thr Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
 370 375 380

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Gly Gly Lys Ala Glu Tyr
 385 390 395 400

His Gly Lys Ala Phe Ser Ser Asp Asp Pro Asn Gly Arg Leu His Tyr
 405 410 415

Ser Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile Glu His Leu
 420 425 430

Lys Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala
 435 440 445

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
 450 455 460

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
 465 470 475 480

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
 485 490 495

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala
 500 505 510

Asp Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His
515 520 525

Lys Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser Val Arg Lys
530 535 540

Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly
545 550 555 560

Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys Val Ser
565 570 575

Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Lys Leu Ile Thr
580 585 590

Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His Ser Ala Leu
595 600 605

Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu Asp Ser Gly Lys
610 615 620

Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala Gly Glu His
625 630 635 640

Thr Ser Phe Asp Lys Leu Pro Lys Gly Gly Ser Ala Thr Tyr Arg Gly
645 650 655

Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr Tyr Thr Ile
660 665 670

Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu Lys Ser
675 680 685

Pro Glu Leu Asn Val Glu Leu Ala Thr Ala Tyr Ile Lys Pro Asp Glu
690 695 700

Lys Arg His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn Gln Asp Ala
705 710 715 720

Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly Gly Gln Ala Gln Glu Val

725

730

735

Ala Gly Ser Ala Ala Val Glu Thr Ala Asn Gly Ile His His Ile Gly
 740 745 750

Leu Ala Ala Lys Gln
 755

<210> 19
 <211> 757
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> MUTATED fhbp POLYPEPTIDE

<400> 19

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

Leu Asp His Lys Asp Lys Ser Leu Gln Ser Leu Thr Leu Asp Gln Val
 20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
 35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
 65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His
 85 90 95

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

Ile Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
 115 120 125

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr

130

135

140

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

Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu
 165 170 175

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

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
 195 200 205

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
 210 215 220

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
 225 230 235 240

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala
 245 250 255

Asp Ile Gly Thr Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His
 260 265 270

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

Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr Phe Lys
 290 295 300

Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 305 310 315 320

Lys Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val Asp Gly Gln
 325 330 335

Thr Ile Thr Leu Ala Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asn His
 340 345 350

Ser Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys
355 360 365

Thr Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
370 375 380

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Gly Gly Lys Ala Glu Tyr
385 390 395 400

His Gly Lys Ala Phe Ser Ser Asp Asp Pro Asn Gly Arg Leu His Tyr
405 410 415

Ser Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile Glu His Leu
420 425 430

Lys Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala
435 440 445

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
450 455 460

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
465 470 475 480

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
485 490 495

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala
500 505 510

Asp Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His
515 520 525

Lys Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser Val Arg Lys
530 535 540

Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly
545 550 555 560

Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys Val Ser

565

570

575

Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Lys Leu Ile Thr
 580 585 590

Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His Ser Ala Leu
 595 600 605

Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu Asp Ser Gly Lys
 610 615 620

Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala Gly Glu His
 625 630 635 640

Thr Ser Phe Asp Lys Leu Pro Lys Gly Gly Ser Ala Thr Tyr Arg Gly
 645 650 655

Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr Tyr Thr Ile
 660 665 670

Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu Lys Ser
 675 680 685

Pro Glu Leu Asn Val Glu Leu Ala Thr Ala Tyr Ile Lys Pro Asp Glu
 690 695 700

Lys Arg His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn Gln Asp Ala
 705 710 715 720

Lys Gly Ser Tyr Arg Leu Gly Ile Phe Gly Gly Gln Ala Gln Glu Val
 725 730 735

Ala Gly Ser Ala Glu Val Glu Thr Ala Asn Gly Ile His His Ile Gly
 740 745 750

Leu Ala Ala Lys Gln
 755

<210> 20

<211> 760

<212> PRT

<213> Artificial Sequence

<220>

<223> MUTATED fhbp POLYPEPTIDE

<400> 20

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

Leu Asp His Lys Asp Lys Ser Leu Gln Ser Leu Thr Leu Asp Gln Val
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His
85 90 95

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

Ile Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
115 120 125

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr
130 135 140

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

Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu
165 170 175

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

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
195 200 205

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
210 215 220

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
225 230 235 240

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala
245 250 255

Asp Ile Gly Thr Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His
260 265 270

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

Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr Phe Lys
290 295 300

Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
305 310 315 320

Lys Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val Asp Gly Gln
325 330 335

Thr Ile Thr Leu Ala Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asn His
340 345 350

Ser Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys
355 360 365

Thr Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
370 375 380

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Gly Gly Lys Ala Glu Tyr
385 390 395 400

His Gly Lys Ala Phe Ser Ser Asp Asp Pro Asn Gly Arg Leu His Tyr

405

410

415

Ser Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile Glu His Leu
 420 425 430

Lys Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala
 435 440 445

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
 450 455 460

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
 465 470 475 480

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
 485 490 495

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala
 500 505 510

Asp Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His
 515 520 525

Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser Ile Ser Gln
 530 535 540

Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Arg Thr Phe Lys
 545 550 555 560

Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 565 570 575

Lys Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
 580 585 590

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
 595 600 605

Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu His
 610 615 620

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Val
625 630 635 640

Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val Met Ala Thr
645 650 655

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
660 665 670

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His
675 680 685

Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala Asp Ile Lys
690 695 700

Pro Asp Glu Lys His His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn
705 710 715 720

Gln Ala Glu Lys Gly Ser Tyr Arg Leu Gly Ile Phe Gly Gly Gln Ala
725 730 735

Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn Gly Ile Arg
740 745 750

His Ile Gly Leu Ala Ala Lys Gln
755 760

<210> 21
<211> 760
<212> PRT
<213> Artificial Sequence

<220>
<223> MUTATED fhbp POLYPEPTIDE

<400> 21

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

Leu Asp His Lys Asp Lys Ser Leu Gln Ser Leu Thr Leu Asp Gln Val
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His
85 90 95

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

Ile Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
115 120 125

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr
130 135 140

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

Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu
165 170 175

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

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
195 200 205

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
210 215 220

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
225 230 235 240

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala

245

250

255

Asp Ile Gly Thr Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His
 260 265 270

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

Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr Phe Lys
 290 295 300

Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 305 310 315 320

Lys Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val Asp Gly Gln
 325 330 335

Thr Ile Thr Leu Ala Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asn His
 340 345 350

Ser Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys
 355 360 365

Thr Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
 370 375 380

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Gly Gly Lys Ala Glu Tyr
 385 390 395 400

His Gly Lys Ala Phe Ser Ser Asp Asp Pro Asn Gly Arg Leu His Tyr
 405 410 415

Ser Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile Glu His Leu
 420 425 430

Lys Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala
 435 440 445

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
 450 455 460

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
465 470 475 480

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
485 490 495

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala
500 505 510

Asp Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His
515 520 525

Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser Ile Ser Gln
530 535 540

Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Arg Thr Phe Lys
545 550 555 560

Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
565 570 575

Lys Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
580 585 590

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
595 600 605

Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu His
610 615 620

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Val
625 630 635 640

Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val Met Ala Thr
645 650 655

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
660 665 670

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His

675

680

685

Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala Asp Ile Lys
 690 695 700

Pro Asp Glu Lys His His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn
 705 710 715 720

Gln Ala Ala Lys Gly Ser Tyr Arg Leu Gly Ile Phe Gly Gly Gln Ala
 725 730 735

Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn Gly Ile Arg
 740 745 750

His Ile Gly Leu Ala Ala Lys Gln
 755 760

<210> 22

<211> 760

<212> PRT

<213> Artificial Sequence

<220>

<223> MUTATED fhbp POLYPEPTIDE

<400> 22

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

Leu Asp His Lys Asp Lys Ser Leu Gln Ser Leu Thr Leu Asp Gln Val
 20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
 35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
 65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His

85

90

95

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

Ile Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
 115 120 125

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr
 130 135 140

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

Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu
 165 170 175

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

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
 195 200 205

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
 210 215 220

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
 225 230 235 240

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala
 245 250 255

Asp Ile Gly Thr Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His
 260 265 270

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

Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr Phe Lys
 290 295 300

Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
305 310 315 320

Lys Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val Asp Gly Gln
325 330 335

Thr Ile Thr Leu Ala Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asn His
340 345 350

Ser Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys
355 360 365

Thr Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly
370 375 380

Gly Glu His Thr Ala Phe Asn Gln Leu Pro Gly Gly Lys Ala Glu Tyr
385 390 395 400

His Gly Lys Ala Phe Ser Ser Asp Asp Pro Asn Gly Arg Leu His Tyr
405 410 415

Ser Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile Glu His Leu
420 425 430

Lys Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala
435 440 445

Asp Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser
450 455 460

Glu Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln
465 470 475 480

Glu Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu
485 490 495

Ile Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala
500 505 510

Asp Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His

515

520

525

Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser Ile Ser Gln
 530 535 540

Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Arg Thr Phe Lys
 545 550 555 560

Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 565 570 575

Lys Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
 580 585 590

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
 595 600 605

Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu His
 610 615 620

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Val
 625 630 635 640

Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val Met Ala Thr
 645 650 655

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
 660 665 670

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His
 675 680 685

Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala Asp Ile Lys
 690 695 700

Pro Asp Glu Lys His His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn
 705 710 715 720

Gln Ala Ala Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly Gly Gln Ala
 725 730 735

Gln Glu Val Ala Gly Ser Ala Ala Val Glu Thr Ala Asn Gly Ile Arg
740 745 750

His Ile Gly Leu Ala Ala Lys Gln
755 760

<210> 23
<211> 256
<212> PRT
<213> Artificial Sequence

<220>
<223> fHbp polypeptide with His6 tag

<400> 23

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

Leu Asp His Lys Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln
65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
85 90 95

Ser Ala Leu Thr Ala Phe Gln Thr Glu Gln Ile Gln Asp Ser Glu His
100 105 110

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala
115 120 125

Gly Glu His Thr Ser Phe Asp Lys Leu Pro Glu Gly Gly Arg Ala Thr
130 135 140

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
145 150 155 160

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly Asn Gly Lys Ile Glu His
165 170 175

Leu Lys Ser Pro Glu Leu Gly Leu Ala Ala Lys Gln Leu Asn Val Asp
180 185 190

Leu Ala Ala Ala Asp Ile Lys Pro Asp Gly Lys Arg His Ala Val Ile
195 200 205

Ser Gly Ser Val Leu Tyr Asn Gln Ala Glu Lys Gly Ser Tyr Ser Leu
210 215 220

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

Lys Thr Val Asn Gly Ile Arg His Leu Glu His His His His His His
245 250 255

<210> 24
<211> 256
<212> PRT
<213> Artificial Sequence

<220>
<223> fHbp polypeptide with His6 tag

<400> 24

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

Leu Asp His Lys Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Lys
65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
85 90 95

Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu Asp
100 105 110

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala
115 120 125

Gly Glu His Thr Ser Phe Asp Lys Leu Pro Lys Gly Gly Ser Ala Thr
130 135 140

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
145 150 155 160

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His
165 170 175

Leu Lys Ser Pro Glu Leu Asn Val Glu Leu Ala Thr Ala Tyr Ile Lys
180 185 190

Pro Asp Glu Lys Arg His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn
195 200 205

Gln Asp Glu Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly Gly Gln Ala
210 215 220

Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn Gly Ile His
225 230 235 240

His Ile Gly Leu Ala Ala Lys Gln Leu Glu His His His His His His
245 250 255

<210> 25

<211> 256

<212> PRT

<213> Artificial Sequence

<220>

<223> Mutated fHbp polypeptide

<400> 25

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

Leu Asp His Lys Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Lys
65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
85 90 95

Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu Asp
100 105 110

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala
115 120 125

Gly Glu His Thr Ser Phe Asp Lys Leu Pro Lys Gly Gly Ser Ala Thr
130 135 140

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
145 150 155 160

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His
165 170 175

Leu Lys Ser Pro Glu Leu Asn Val Glu Leu Ala Thr Ala Tyr Ile Lys
180 185 190

Pro Asp Glu Lys Arg His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn

195

200

205

Gln Asp Ala Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly Gly Gln Ala
 210 215 220

Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn Gly Ile His
 225 230 235 240

His Ile Gly Leu Ala Ala Lys Gln Leu Glu His His His His His His
 245 250 255

<210> 26

<211> 256

<212> PRT

<213> Artificial Sequence

<220>

<223> Mutated fHbp polypeptide

<400> 26

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

Leu Asp His Lys Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser
 20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
 35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
 50 55 60

Lys Val Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Lys
 65 70 75 80

Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His
 85 90 95

Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser Glu Asp
 100 105 110

Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala

115

120

125

Gly Glu His Thr Ser Phe Asp Lys Leu Pro Lys Gly Gly Ser Ala Thr
 130 135 140

Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr
 145 150 155 160

Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His
 165 170 175

Leu Lys Ser Pro Glu Leu Asn Val Glu Leu Ala Thr Ala Tyr Ile Lys
 180 185 190

Pro Asp Glu Lys Arg His Ala Val Ile Ser Gly Ser Val Leu Tyr Asn
 195 200 205

Gln Asp Glu Lys Gly Ser Tyr Arg Leu Gly Ile Phe Gly Gly Gln Ala
 210 215 220

Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn Gly Ile His
 225 230 235 240

His Ile Gly Leu Ala Ala Lys Gln Leu Glu His His His His His His
 245 250 255

<210> 27

<211> 259

<212> PRT

<213> Artificial Sequence

<220>

<223> fHbp polypeptide with His6 tag

<400> 27

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

Leu Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser
 20 25 30

Ile Ser Gln Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Arg

35

40

45

Thr Phe Lys Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu
 50 55 60

Lys Asn Asp Lys Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val
 65 70 75 80

Asp Gly Gln Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys
 85 90 95

Gln Ser His Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp
 100 105 110

Ser Glu His Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly
 115 120 125

Asp Ile Val Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val
 130 135 140

Met Ala Thr Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly
 145 150 155 160

Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys
 165 170 175

Ile Glu His Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala
 180 185 190

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

Leu Tyr Asn Gln Ala Glu Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly
 210 215 220

Gly Gln Ala Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn
 225 230 235 240

Gly Ile Arg His Ile Gly Leu Ala Ala Lys Gln Leu Glu His His His
 245 250 255

His His His

<210> 28

<211> 259

<212> PRT

<213> Artificial Sequence

<220>

<223> Mutated fHbp polypeptide with His6 tag

<400> 28

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

Leu Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser
20 25 30

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

Thr Phe Lys Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu
50 55 60

Lys Asn Asp Lys Ile Ser Arg Phe Asp Phe Ile Arg Gln Ile Glu Val
65 70 75 80

Asp Gly Gln Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys
85 90 95

Gln Ser His Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp
100 105 110

Ser Glu His Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly
115 120 125

Asp Ile Val Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val
130 135 140

Met Ala Thr Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly
145 150 155 160

Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys
165 170 175

Ile Glu His Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala
180 185 190

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

Leu Tyr Asn Gln Ala Ala Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly
210 215 220

Gly Gln Ala Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn
225 230 235 240

Gly Ile Arg His Ile Gly Leu Ala Ala Lys Gln Leu Glu His His His
245 250 255

His His His

<210> 29
<211> 753
<212> PRT
<213> Artificial Sequence

<220>
<223> fHbp fusion polypeptide

<400> 29

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

Leu Asp His Lys Asp Lys Ser Leu Gln Ser Leu Thr Leu Asp Gln Ser
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln Leu
65 70 75 80

Ile Thr Leu Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His Ser
85 90 95

Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys Ile
100 105 110

Asp Ser Leu Ile Asn Gln Arg Ser Phe Leu Val Ser Gly Leu Gly Gly
115 120 125

Glu His Thr Ala Phe Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr His
130 135 140

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

Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu Lys
165 170 175

Thr Pro Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala Asp
180 185 190

Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser Glu
195 200 205

Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln Glu
210 215 220

Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu Ile
225 230 235 240

Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala Asp
245 250 255

Ile Gly Thr Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys
260 265 270

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

Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr Phe Lys Ala
290 295 300

Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys
305 310 315 320

Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val Asp Gly Gln Thr
325 330 335

Ile Thr Leu Ala Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asn His Ser
340 345 350

Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys Thr
355 360 365

Asp Ser Leu Ile Asn Gln Arg Ser Phe Leu Val Ser Gly Leu Gly Gly
370 375 380

Glu His Thr Ala Phe Asn Gln Leu Pro Gly Gly Lys Ala Glu Tyr His
385 390 395 400

Gly Lys Ala Phe Ser Ser Asp Asp Pro Asn Gly Arg Leu His Tyr Ser
405 410 415

Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile Glu His Leu Lys
420 425 430

Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala Asp
435 440 445

Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser Glu
450 455 460

Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln Glu
465 470 475 480

Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu Ile
485 490 495

Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala Asp
500 505 510

Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys
515 520 525

Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser Val Arg Lys Asn
530 535 540

Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly Asn
545 550 555 560

Gly Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys Val Ser Arg Phe
565 570 575

Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln Leu Ile Thr Leu Glu
580 585 590

Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His Ser Ala Leu Thr Ala
595 600 605

Phe Gln Thr Glu Gln Ile Gln Asp Ser Glu His Ser Gly Lys Met Val
610 615 620

Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala Gly Glu His Thr Ser
625 630 635 640

Phe Asp Lys Leu Pro Glu Gly Gly Arg Ala Thr Tyr Arg Gly Thr Ala
645 650 655

Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr Tyr Thr Ile Asp Phe
660 665 670

Ala Ala Lys Gln Gly Asn Gly Lys Ile Glu His Leu Lys Ser Pro Glu
675 680 685

Leu Asn Val Asp Leu Ala Ala Ala Ile Lys Pro Asp Gly Lys Arg His
690 695 700

Ala Val Ile Ser Gly Ser Val Leu Tyr Asn Gln Ala Glu Lys Gly Ser
705 710 715 720

Tyr Ser Leu Gly Ile Phe Gly Lys Ala Gln Glu Val Ala Gly Ser Ala
725 730 735

Glu Val Lys Thr Val Asn Gly Ile Arg His Ile Gly Leu Ala Ala Lys
740 745 750

Gln

<210> 30
<211> 753
<212> PRT
<213> Artificial Sequence

<220>
<223> fHbp fusion polypeptide

<400> 30

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

Leu Asp His Lys Asp Lys Ser Leu Gln Ser Leu Thr Leu Asp Gln Val
20 25 30

Val Arg Lys Asn Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys
35 40 45

Thr Tyr Gly Asn Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp
50 55 60

Lys Val Ser Phe Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln Leu
65 70 75 80

Ile Thr Leu Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His Ser
85 90 95

Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys Ile
100 105 110

Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly Gly
115 120 125

Glu His Thr Ala Phe Asn Gln Leu Pro Asp Gly Lys Ala Glu Tyr His
130 135 140

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

Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu Lys
165 170 175

Thr Pro Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala Asp
180 185 190

Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser Glu
195 200 205

Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln Glu
210 215 220

Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu Ile
225 230 235 240

Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala Asp
245 250 255

Ile Gly Thr Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys
260 265 270

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

Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr Phe Lys Ala
290 295 300

Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys
305 310 315 320

Ile Ser Arg Phe Asp Phe Val Gln Lys Ile Glu Val Asp Gly Gln Thr
325 330 335

Ile Thr Leu Ala Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asn His Ser
340 345 350

Ala Val Val Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys Thr
355 360 365

Asp Ser Leu Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly Gly
370 375 380

Glu His Thr Ala Phe Asn Gln Leu Pro Gly Gly Lys Ala Glu Tyr His
385 390 395 400

Gly Lys Ala Phe Ser Ser Asp Asp Pro Asn Gly Arg Leu His Tyr Ser
405 410 415

Ile Asp Phe Thr Lys Lys Gln Gly Tyr Gly Arg Ile Glu His Leu Lys
420 425 430

Thr Leu Glu Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala Asp
435 440 445

Glu Lys Ser His Ala Val Ile Leu Gly Asp Thr Arg Tyr Gly Ser Glu
450 455 460

Glu Lys Gly Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln Glu
465 470 475 480

Ile Ala Gly Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu Ile
485 490 495

Gly Ile Ala Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala Asp
500 505 510

Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys
515 520 525

Asp Lys Gly Leu Gln Ser Leu Thr Leu Asp Gln Ser Val Ser Lys Asn
530 535 540

Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly Asn
545 550 555 560

Gly Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys Val Ser Arg Phe
565 570 575

Asp Phe Ile Arg Gln Ile Glu Val Asp Gly Gln Leu Ile Thr Leu Glu
580 585 590

Ser Gly Glu Phe Gln Val Tyr Lys Gln Ser His Ser Ala Leu Thr Ala
595 600 605

Phe Gln Thr Glu Gln Ile Gln Asp Ser Glu His Ser Gly Lys Met Val
610 615 620

Ala Lys Arg Gln Phe Arg Ile Gly Asp Ile Ala Gly Glu His Thr Ser
625 630 635 640

Phe Asp Lys Leu Pro Glu Gly Gly Arg Ala Thr Tyr Arg Gly Thr Ala
645 650 655

Phe Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr Tyr Thr Ile Asp Phe
660 665 670

Ala Ala Lys Gln Gly Asn Gly Lys Ile Glu His Leu Lys Ser Pro Glu
675 680 685

Leu Asn Val Asp Leu Ala Ala Ala Ile Lys Pro Asp Gly Lys Arg His
690 695 700

Ala Val Ile Ser Gly Ser Val Leu Tyr Asn Gln Ala Glu Lys Gly Ser
705 710 715 720

Tyr Ser Leu Gly Ile Phe Gly Lys Ala Gln Glu Val Ala Gly Ser Ala
725 730 735

Glu Val Lys Thr Val Asn Gly Ile Arg His Ile Gly Leu Ala Ala Lys
740 745 750

Gln

<210> 31
<211> 274
<212> PRT
<213> Neisseria meningitidis

<400> 31

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

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

Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys Asp Lys
35 40 45

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

Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly Asn Gly Asp
65 70 75 80

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

Phe Ile Arg Gln Ile Glu Val Asp Gly Lys Leu Ile Thr Leu Glu Ser
100 105 110

Gly Glu Phe Gln Val Tyr Lys Gln Ser His Ser Ala Leu Thr Ala Leu
115 120 125

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

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

Asp Lys Leu Pro Lys Gly Gly Ser Ala Thr Tyr Arg Gly Thr Ala Phe
165 170 175

Gly Ser Asp Asp Ala Gly Gly Lys Leu Thr Tyr Thr Ile Asp Phe Ala
180 185 190

Ala Lys Gln Gly His Gly Lys Ile Glu His Leu Lys Ser Pro Glu Leu
195 200 205

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

Ala Val Ile Ser Gly Ser Val Leu Tyr Asn Gln Asp Glu Lys Gly Ser
225 230 235 240

Tyr Ser Leu Gly Ile Phe Gly Gly Gln Ala Gln Glu Val Ala Gly Ser
245 250 255

Ala Glu Val Glu Thr Ala Asn Gly Ile His His Ile Gly Leu Ala Ala
260 265 270

Lys Gln

<210> 32
<211> 282
<212> PRT
<213> Neisseria meningitidis

<400> 32

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

Leu Thr Ala Cys Ser Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Val
20 25 30

Ala Ala Asp Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu
35 40 45

Asp His Lys Asp Lys Gly Leu Lys Ser Leu Thr Leu Glu Asp Ser Ile
50 55 60

Ser Gln Asn Gly Thr Leu Thr Leu Ser Ala Gln Gly Ala Glu Arg Thr
65 70 75 80

Phe Lys Ala Gly Asp Lys Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys
85 90 95

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

Gly Gln Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln Val Tyr Lys Gln
115 120 125

Ser His Ser Ala Leu Thr Ala Leu Gln Thr Glu Gln Val Gln Asp Ser
130 135 140

Glu His Ser Gly Lys Met Val Ala Lys Arg Gln Phe Arg Ile Gly Asp
145 150 155 160

Ile Val Gly Glu His Thr Ser Phe Gly Lys Leu Pro Lys Asp Val Met
165 170 175

Ala Thr Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp Ala Gly Gly Lys
180 185 190

Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly His Gly Lys Ile
195 200 205

Glu His Leu Lys Ser Pro Glu Leu Asn Val Asp Leu Ala Ala Ala Asp
210 215 220

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

Tyr Asn Gln Ala Glu Lys Gly Ser Tyr Ser Leu Gly Ile Phe Gly Gly
245 250 255

Gln Ala Gln Glu Val Ala Gly Ser Ala Glu Val Glu Thr Ala Asn Gly
260 265 270

Ile Arg His Ile Gly Leu Ala Ala Lys Gln
275 280

<210> 33
<211> 254
<212> PRT
<213> Neisseria meningitidis

<400> 33

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

Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys Asp Lys Gly Leu Gln
20 25 30

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

Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly Asn Gly Asp Ser Leu Asn
50 55 60

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

Ile Glu Val Asp Gly Gln Leu Ile Thr Leu Glu Ser Gly Glu Phe Gln
85 90 95

Val Tyr Lys Gln Ser His Ser Ala Leu Thr Ala Phe Gln Thr Glu Gln
100 105 110

Ile Gln Asp Ser Glu His Ser Gly Lys Met Val Ala Lys Arg Gln Phe
115 120 125

Arg Ile Gly Asp Ile Ala Gly Glu His Thr Ser Phe Asp Lys Leu Pro
130 135 140

Glu Gly Gly Arg Ala Thr Tyr Arg Gly Thr Ala Phe Gly Ser Asp Asp
145 150 155 160

Ala Gly Gly Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala Lys Gln Gly
165 170 175

Asn Gly Lys Ile Glu His Leu Lys Ser Pro Glu Leu Asn Val Asp Leu
180 185 190

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

Gly Ser Val Leu Tyr Asn Gln Ala Glu Lys Gly Ser Tyr Ser Leu Gly
210 215 220

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

Thr Val Asn Gly Ile Arg His Ile Gly Leu Ala Ala Lys Gln
245 250

<210> 34
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> N-terminal sequence

<400> 34

Met Gly Pro Asp Ser Asp Arg Leu Gln Gln Arg Arg
1 5 10

<210> 35
<211> 769
<212> PRT
<213> Artificial Sequence

<220>
<223> MUTATED fhbp POLYPEPTIDE

<400> 35

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

Ile Gly Ala Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys
20 25 30

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

Glu Lys Leu Lys Leu Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly Asn
50 55 60

Gly Asp Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys Val Ser Arg

65

70

75

80

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

Glu Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asp His Ser Ala Val Val
 100 105 110

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

Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly Gly Glu His Thr
 130 135 140

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

Phe Ser Ser Asp Asp Ala Gly Gly Lys Leu Thr Tyr Thr Ile Asp Phe
 165 170 175

Ala Ala Lys Gln Gly His Gly Lys Ile Glu His Leu Lys Thr Pro Glu
 180 185 190

Gln Asn Val Glu Leu Ala Ala Ala Glu Leu Lys Ala Asp Glu Lys Ser
 195 200 205

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

Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln Glu Ile Ala Gly
 225 230 235 240

Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu Ile Gly Ile Ala
 245 250 255

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

Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys Asp Lys Gly
 275 280 285

Leu Lys Ser Leu Thr Leu Glu Asp Val Ile Pro Gln Asn Gly Thr Leu
290 295 300

Thr Leu Ser Ala Gln Gly Ala Glu Lys Thr Phe Lys Ala Gly Asp Lys
305 310 315 320

Asp Asn Ser Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys Ile Ser Arg
325 330 335

Phe Asp Phe Val Gln Lys Ile Glu Val Asp Gly Gln Thr Ile Thr Leu
340 345 350

Ala Ser Gly Glu Phe Gln Ile Tyr Lys Gln Asn His Ser Ala Val Val
355 360 365

Ala Leu Gln Ile Glu Lys Ile Asn Asn Pro Asp Lys Thr Asp Ser Leu
370 375 380

Ile Asn Gln Arg Ser Phe Arg Val Ser Gly Leu Gly Gly Glu His Thr
385 390 395 400

Ala Phe Asn Gln Leu Pro Gly Gly Lys Ala Glu Tyr His Gly Lys Ala
405 410 415

Phe Ser Ser Asp Asp Pro Asn Gly Arg Leu His Tyr Ser Ile Asp Phe
420 425 430

Thr Lys Lys Gln Gly Tyr Gly Arg Ile Glu His Leu Lys Thr Leu Glu
435 440 445

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

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

Thr Tyr His Leu Ala Leu Phe Gly Asp Arg Ala Gln Glu Ile Ala Gly
485 490 495

Ser Ala Thr Val Lys Ile Gly Glu Lys Val His Glu Ile Gly Ile Ala

500

505

510

Gly Lys Gln Gly Ser Gly Gly Gly Gly Val Ala Ala Asp Ile Gly Ala
 515 520 525

Gly Leu Ala Asp Ala Leu Thr Ala Pro Leu Asp His Lys Asp Lys Gly
 530 535 540

Leu Gln Ser Leu Thr Leu Asp Gln Ser Val Arg Lys Asn Glu Lys Leu
 545 550 555 560

Lys Leu Ala Ala Gln Gly Ala Glu Lys Thr Tyr Gly Asn Gly Asp Ser
 565 570 575

Leu Asn Thr Gly Lys Leu Lys Asn Asp Lys Val Ser Arg Phe Asp Phe
 580 585 590

Ile Arg Gln Ile Glu Val Asp Gly Lys Leu Ile Thr Leu Glu Ser Gly
 595 600 605

Glu Phe Gln Val Tyr Lys Gln Ser His Ser Ala Leu Thr Ala Leu Gln
 610 615 620

Thr Glu Gln Val Gln Asp Ser Glu Asp Ser Gly Lys Met Val Ala Lys
 625 630 635 640

Arg Gln Phe Arg Ile Gly Asp Ile Ala Gly Glu His Thr Ser Phe Asp
 645 650 655

Lys Leu Pro Lys Gly Gly Ser Ala Thr Tyr Arg Gly Thr Ala Phe Gly
 660 665 670

Ser Asp Asp Ala Gly Gly Lys Leu Thr Tyr Thr Ile Asp Phe Ala Ala
 675 680 685

Lys Gln Gly His Gly Lys Ile Glu His Leu Lys Ser Pro Glu Leu Asn
 690 695 700

Val Glu Leu Ala Thr Ala Tyr Ile Lys Pro Asp Glu Lys Arg His Ala
 705 710 715 720

Val Ile Ser Gly Ser Val Leu Tyr Asn Gln Asp Ala Lys Gly Ser Tyr
725 730 735

Arg Leu Gly Ile Phe Gly Gly Gln Ala Gln Glu Val Ala Gly Ser Ala
740 745 750

Glu Val Glu Thr Ala Asn Gly Ile His His Ile Gly Leu Ala Ala Lys
755 760 765

Gln