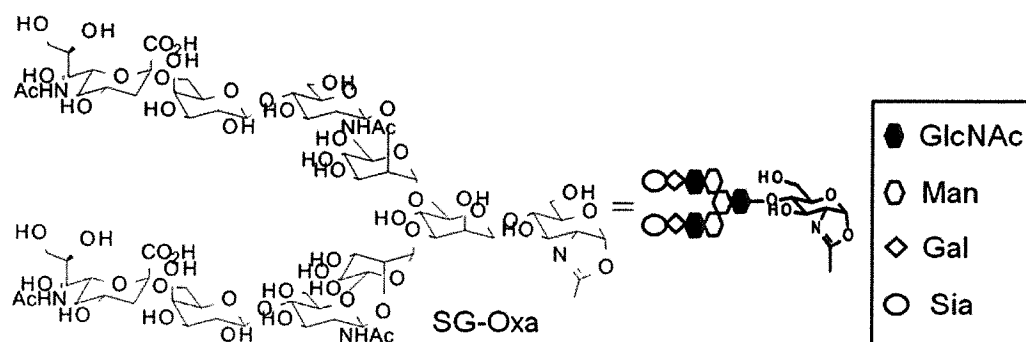
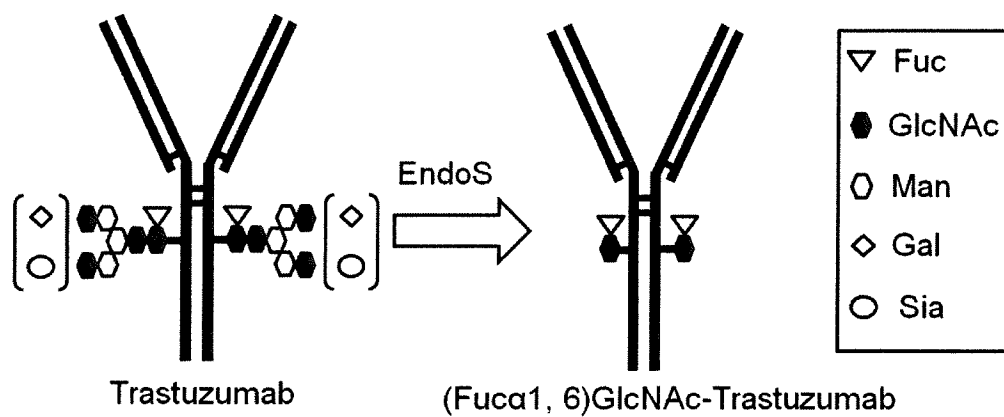


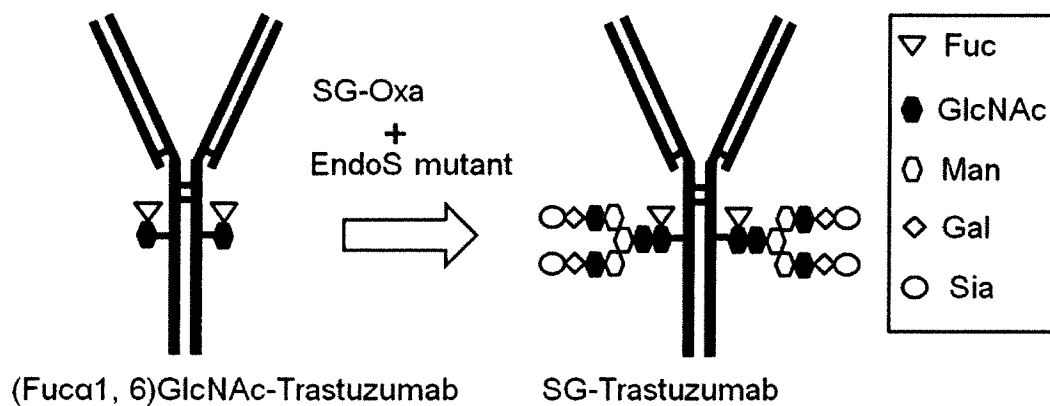
[Figure 1]



[Figure 2]



[Figure 3]



[illegible]

[Figure 4-2]

EndoS D233Q	180	190	200	210	211
EndoS D233Q/Q303L	TRVIRRTIIPWRRFLAGGDNSSGIAEDTSKYYPNTTPEGNK				
EndoS D233Q/Q303L/E350Q	TRVIRRTIIPWRRFLAGGDNSSGIAEDTSKYYPNTTPEGNK				211
EndoS D233Q/Q303L/D405A	TRVIRRTIIPWRRFLAGGDNSSGIAEDTSKYYPNTTPEGNK				211
EndoS D233Q/E350Q	TRVIRRTIIPWRRFLAGGDNSSGIAEDTSKYYPNTTPEGNK				211
EndoS D233Q/D405A	TRVIRRTIIPWRRFLAGGDNSSGIAEDTSKYYPNTTPEGNK				211
EndoS D233Q/Y402F	TRVIRRTIIPWRRFLAGGDNSSGIAEDTSKYYPNTTPEGNK				211
EndoS D233Q	220	230	240		
EndoS D233Q/Q303L	ALAKAIVDEYVYKYNNLDDGLDVQVEHDSIPKVDKKE				246
EndoS D233Q/Q303L/E350Q	ALAKAIVDEYVYKYNNLDDGLDVQVEHDSIPKVDKKE				246
EndoS D233Q/Q303L/D405A	ALAKAIVDEYVYKYNNLDDGLDVQVEHDSIPKVDKKE				246
EndoS D233Q/E350Q	ALAKAIVDEYVYKYNNLDDGLDVQVEHDSIPKVDKKE				246
EndoS D233Q/D405A	ALAKAIVDEYVYKYNNLDDGLDVQVEHDSIPKVDKKE				246
EndoS D233Q/Y402F	ALAKAIVDEYVYKYNNLDDGLDVQVEHDSIPKVDKKE				246
EndoS D233Q	250	260	270	280	
EndoS D233Q/Q303L	DTAGVERSIIQVFEEIGKLLIGPKGVDDKSSRLLFIMDST				281
EndoS D233Q/Q303L/E350Q	DTAGVERSIIQVFEEIGKLLIGPKGVDDKSSRLLFIMDST				281
EndoS D233Q/Q303L/D405A	DTAGVERSIIQVFEEIGKLLIGPKGVDDKSSRLLFIMDST				281
EndoS D233Q/E350Q	DTAGVERSIIQVFEEIGKLLIGPKGVDDKSSRLLFIMDST				281
EndoS D233Q/D405A	DTAGVERSIIQVFEEIGKLLIGPKGVDDKSSRLLFIMDST				281
EndoS D233Q/Y402F	DTAGVERSIIQVFEEIGKLLIGPKGVDDKSSRLLFIMDST				281
EndoS D233Q	290	300	310		
EndoS D233Q/Q303L	YMAADKKNPPLIERGAPYINNLLLVQVYGSQGEKGGWEP				316
EndoS D233Q/Q303L/E350Q	YMAADKKNPPLIERGAPYINNLLLVQVYGSQGEKGGWEP				316
EndoS D233Q/Q303L/D405A	YMAADKKNPPLIERGAPYINNLLLVQVYGSQGEKGGWEP				316
EndoS D233Q/E350Q	YMAADKKNPPLIERGAPYINNLLLVQVYGSQGEKGGWEP				316
EndoS D233Q/D405A	YMAADKKNPPLIERGAPYINNLLLVQVYGSQGEKGGWEP				316
EndoS D233Q/Y402F	YMAADKKNPPLIERGAPYINNLLLVQVYGSQGEKGGWEP				316

[Figure 4-3]

EndoS D233Q
EndoS D233Q/Q303L
EndoS D233Q/Q303L/E350Q
EndoS D233Q/Q303L/D405A
EndoS D233Q/E350Q
EndoS D233Q/D405A
EndoS D233Q/Y402F

320 V S N R P P E K T M E E E R W Q G Y S K Y I R P P E Q Y M I G F S F Y E E N 350
V S N R P P E K T M E E E R W Q G Y S K Y I R P P E Q Y M I G F S F Y E E N 351
V S N R P P E K T M E E E R W Q G Y S K Y I R P P E Q Y M I G F S F Y E E N 351
V S N R P P E K T M E E E R W Q G Y S K Y I R P P E Q Y M I G F S F Y E E N 351
V S N R P P E K T M E E E R W Q G Y S K Y I R P P E Q Y M I G F S F Y E E N 351
V S N R P P E K T M E E E R W Q G Y S K Y I R P P E Q Y M I G F S F Y E E N 351

EndoS D233Q
EndoS D233Q/Q303L
EndoS D233Q/Q303L/E350Q
EndoS D233Q/Q303L/D405A
EndoS D233Q/E350Q
EndoS D233Q/D405A
EndoS D233Q/Y402F

360 A Q E G N L W Y D I N S R K D E D K A N G I N T D I T G T R A E R Y A 386
A Q E G N L W Y D I N S R K D E D K A N G I N T D I T G T R A E R Y A 386
A Q E G N L W Y D I N S R K D E D K A N G I N T D I T G T R A E R Y A 386
A Q E G N L W Y D I N S R K D E D K A N G I N T D I T G T R A E R Y A 386
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A Q E G N L W Y D I N S R K D E D K A N G I N T D I T G T R A E R Y A 386

EndoS D233Q
EndoS D233Q/Q303L
EndoS D233Q/Q303L/E350Q
EndoS D233Q/Q303L/D405A
EndoS D233Q/E350Q
EndoS D233Q/D405A
EndoS D233Q/Y402F

390 R W Q P K T G G V K G G I F S Y A I D R D G V A H Q P K K Y A K Q K E 421
R W Q P K T G G V K G G I F S Y A I D R D G V A H Q P K K Y A K Q K E 421
R W Q P K T G G V K G G I F S Y A I D R D G V A H Q P K K Y A K Q K E 421
R W Q P K T G G V K G G I F S Y A I A R D G V A H Q P K K Y A K Q K E 421
R W Q P K T G G V K G G I F S Y A I D R D G V A H Q P K K Y A K Q K E 421
R W Q P K T G G V K G G I F S Y A I A R D G V A H Q P K K Y A K Q K E 421
R W Q P K T G G V K G G I F S F A I D R D G V A H Q P K K Y A K Q K E 421

EndoS D233Q
EndoS D233Q/Q303L
EndoS D233Q/Q303L/E350Q
EndoS D233Q/Q303L/D405A
EndoS D233Q/E350Q
EndoS D233Q/D405A
EndoS D233Q/Y402F

430 F K D A T D N I F H S D Y S V S K A L K T V M L K D K S Y D L I D E K 456
F K D A T D N I F H S D Y S V S K A L K T V M L K D K S Y D L I D E K 456
F K D A T D N I F H S D Y S V S K A L K T V M L K D K S Y D L I D E K 456
F K D A T D N I F H S D Y S V S K A L K T V M L K D K S Y D L I D E K 456
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F K D A T D N I F H S D Y S V S K A L K T V M L K D K S Y D L I D E K 456

[Figure 4-4]

EndoS D233Q	460	D F P D K A L R E A V M A Q V G T R K G D L E R F N G T L R L D N P A	490	491
EndoS D233Q/Q303L		D F P D K A L R E A V M A Q V G T R K G D L E R F N G T L R L D N P A		491
EndoS D233Q/Q303L/E350Q		D F P D K A L R E A V M A Q V G T R K G D L E R F N G T L R L D N P A		491
EndoS D233Q/Q303L/D405A		D F P D K A L R E A V M A Q V G T R K G D L E R F N G T L R L D N P A		491
EndoS D233Q/E350Q		D F P D K A L R E A V M A Q V G T R K G D L E R F N G T L R L D N P A		491
EndoS D233Q/D405A		D F P D K A L R E A V M A Q V G T R K G D L E R F N G T L R L D N P A		491
EndoS D233Q/Y402F		D F P D K A L R E A V M A Q V G T R K G D L E R F N G T L R L D N P A		491
EndoS D233Q	500	I Q S L E G L N K F F K K L A Q L D L I G L S R I T T K L D R S V L P A N	520	526
EndoS D233Q/Q303L		I Q S L E G L N K F F K K L A Q L D L I G L S R I T T K L D R S V L P A N		526
EndoS D233Q/Q303L/E350Q		I Q S L E G L N K F F K K L A Q L D L I G L S R I T T K L D R S V L P A N		526
EndoS D233Q/Q303L/D405A		I Q S L E G L N K F F K K L A Q L D L I G L S R I T T K L D R S V L P A N		526
EndoS D233Q/E350Q		I Q S L E G L N K F F K K L A Q L D L I G L S R I T T K L D R S V L P A N		526
EndoS D233Q/D405A		I Q S L E G L N K F F K K L A Q L D L I G L S R I T T K L D R S V L P A N		526
EndoS D233Q/Y402F		I Q S L E G L N K F F K K L A Q L D L I G L S R I T T K L D R S V L P A N		526
EndoS D233Q	530	M K P G K D T L E T V L E T Y K K D N K K E E P A T I P P V S L K V S G	560	561
EndoS D233Q/Q303L		M K P G K D T L E T V L E T Y K K D N K K E E P A T I P P V S L K V S G		561
EndoS D233Q/Q303L/E350Q		M K P G K D T L E T V L E T Y K K D N K K E E P A T I P P V S L K V S G		561
EndoS D233Q/Q303L/D405A		M K P G K D T L E T V L E T Y K K D N K K E E P A T I P P V S L K V S G		561
EndoS D233Q/E350Q		M K P G K D T L E T V L E T Y K K D N K K E E P A T I P P V S L K V S G		561
EndoS D233Q/D405A		M K P G K D T L E T V L E T Y K K D N K K E E P A T I P P V S L K V S G		561
EndoS D233Q/Y402F		M K P G K D T L E T V L E T Y K K D N K K E E P A T I P P V S L K V S G		561
EndoS D233Q	570	L T G L K E L D L S G F D R E T L A G L D A A T L T S L E K K V D I S G	590	596
EndoS D233Q/Q303L		L T G L K E L D L S G F D R E T L A G L D A A T L T S L E K K V D I S G		596
EndoS D233Q/Q303L/E350Q		L T G L K E L D L S G F D R E T L A G L D A A T L T S L E K K V D I S G		596
EndoS D233Q/Q303L/D405A		L T G L K E L D L S G F D R E T L A G L D A A T L T S L E K K V D I S G		596
EndoS D233Q/E350Q		L T G L K E L D L S G F D R E T L A G L D A A T L T S L E K K V D I S G		596
EndoS D233Q/D405A		L T G L K E L D L S G F D R E T L A G L D A A T L T S L E K K V D I S G		596
EndoS D233Q/Y402F		L T G L K E L D L S G F D R E T L A G L D A A T L T S L E K K V D I S G		596

[Figure 4-5]

EndoS D233Q	NK L D L A P G G T E N R Q I F F D T M L S T I S N H V G S N E Q T V K F	600	610	620	630	631
EndoS D233Q/Q303L	NK L D L A P G G T E N R Q I F F D T M L S T I S N H V G S N E Q T V K F					631
EndoS D233Q/Q303L/E350Q	NK L D L A P G G T E N R Q I F F D T M L S T I S N H V G S N E Q T V K F					631
EndoS D233Q/Q303L/D405A	NK L D L A P G G T E N R Q I F F D T M L S T I S N H V G S N E Q T V K F					631
EndoS D233Q/E350Q	NK L D L A P G G T E N R Q I F F D T M L S T I S N H V G S N E Q T V K F					631
EndoS D233Q/D405A	NK L D L A P G G T E N R Q I F F D T M L S T I S N H V G S N E Q T V K F					631
EndoS D233Q/Y402F	NK L D L A P G G T E N R Q I F F D T M L S T I S N H V G S N E Q T V K F					631
EndoS D233Q	D K Q K P T G H Y P D T Y G K T S L R L P V A N E K V D L Q S Q L L F	640	650	660		666
EndoS D233Q/Q303L	D K Q K P T G H Y P D T Y G K T S L R L P V A N E K V D L Q S Q L L F					666
EndoS D233Q/Q303L/E350Q	D K Q K P T G H Y P D T Y G K T S L R L P V A N E K V D L Q S Q L L F					666
EndoS D233Q/Q303L/D405A	D K Q K P T G H Y P D T Y G K T S L R L P V A N E K V D L Q S Q L L F					666
EndoS D233Q/E350Q	D K Q K P T G H Y P D T Y G K T S L R L P V A N E K V D L Q S Q L L F					666
EndoS D233Q/D405A	D K Q K P T G H Y P D T Y G K T S L R L P V A N E K V D L Q S Q L L F					666
EndoS D233Q/Y402F	D K Q K P T G H Y P D T Y G K T S L R L P V A N E K V D L Q S Q L L F					666
EndoS D233Q	G T V T N Q G T L I N S E A D Y K A Y Q N H K I A G R S F V D S N Y H	670	680	690	700	701
EndoS D233Q/Q303L	G T V T N Q G T L I N S E A D Y K A Y Q N H K I A G R S F V D S N Y H					701
EndoS D233Q/Q303L/E350Q	G T V T N Q G T L I N S E A D Y K A Y Q N H K I A G R S F V D S N Y H					701
EndoS D233Q/Q303L/D405A	G T V T N Q G T L I N S E A D Y K A Y Q N H K I A G R S F V D S N Y H					701
EndoS D233Q/E350Q	G T V T N Q G T L I N S E A D Y K A Y Q N H K I A G R S F V D S N Y H					701
EndoS D233Q/D405A	G T V T N Q G T L I N S E A D Y K A Y Q N H K I A G R S F V D S N Y H					701
EndoS D233Q/Y402F	G T V T N Q G T L I N S E A D Y K A Y Q N H K I A G R S F V D S N Y H					701
EndoS D233Q	Y N N F K V S Y E N Y T V K V T D S T L G T T T D K T L A T D K E E T	710	720	730		736
EndoS D233Q/Q303L	Y N N F K V S Y E N Y T V K V T D S T L G T T T D K T L A T D K E E T					736
EndoS D233Q/Q303L/E350Q	Y N N F K V S Y E N Y T V K V T D S T L G T T T D K T L A T D K E E T					736
EndoS D233Q/Q303L/D405A	Y N N F K V S Y E N Y T V K V T D S T L G T T T D K T L A T D K E E T					736
EndoS D233Q/E350Q	Y N N F K V S Y E N Y T V K V T D S T L G T T T D K T L A T D K E E T					736
EndoS D233Q/D405A	Y N N F K V S Y E N Y T V K V T D S T L G T T T D K T L A T D K E E T					736
EndoS D233Q/Y402F	Y N N F K V S Y E N Y T V K V T D S T L G T T T D K T L A T D K E E T					736

[Figure 4-6]

EndoS D233Q	YKVDFFSPADKTKAVHTAKVIVGDEKTMVNLAE	740	750	760	770	771
EndoS D233Q/Q303L	YKVDFFSPADKTKAVHTAKVIVGDEKTMVNLAE					771
EndoS D233Q/Q303L/E350Q	YKVDFFSPADKTKAVHTAKVIVGDEKTMVNLAE					771
EndoS D233Q/Q303L/D405A	YKVDFFSPADKTKAVHTAKVIVGDEKTMVNLAE					771
EndoS D233Q/E350Q	YKVDFFSPADKTKAVHTAKVIVGDEKTMVNLAE					771
EndoS D233Q/D405A	YKVDFFSPADKTKAVHTAKVIVGDEKTMVNLAE					771
EndoS D233Q/Y402F	YKVDFFSPADKTKAVHTAKVIVGDEKTMVNLAE					771
EndoS D233Q	ATVIGGSAADPVNARKKVFDDGGQLGSSETDNISLGWDSK	780	790	800		806
EndoS D233Q/Q303L	ATVIGGSAADPVNARKKVFDDGGQLGSSETDNISLGWDSK					806
EndoS D233Q/Q303L/E350Q	ATVIGGSAADPVNARKKVFDDGGQLGSSETDNISLGWDSK					806
EndoS D233Q/Q303L/D405A	ATVIGGSAADPVNARKKVFDDGGQLGSSETDNISLGWDSK					806
EndoS D233Q/E350Q	ATVIGGSAADPVNARKKVFDDGGQLGSSETDNISLGWDSK					806
EndoS D233Q/D405A	ATVIGGSAADPVNARKKVFDDGGQLGSSETDNISLGWDSK					806
EndoS D233Q/Y402F	ATVIGGSAADPVNARKKVFDDGGQLGSSETDNISLGWDSK					806
EndoS D233Q	QSIIFKLLKEDGLIKHHWRFFFNDDSAARNPEETTNKKPIQE	810	820	830	840	841
EndoS D233Q/Q303L	QSIIFKLLKEDGLIKHHWRFFFNDDSAARNPEETTNKKPIQE					841
EndoS D233Q/Q303L/E350Q	QSIIFKLLKEDGLIKHHWRFFFNDDSAARNPEETTNKKPIQE					841
EndoS D233Q/Q303L/D405A	QSIIFKLLKEDGLIKHHWRFFFNDDSAARNPEETTNKKPIQE					841
EndoS D233Q/E350Q	QSIIFKLLKEDGLIKHHWRFFFNDDSAARNPEETTNKKPIQE					841
EndoS D233Q/D405A	QSIIFKLLKEDGLIKHHWRFFFNDDSAARNPEETTNKKPIQE					841
EndoS D233Q/Y402F	QSIIFKLLKEDGLIKHHWRFFFNDDSAARNPEETTNKKPIQE					841
EndoS D233Q	ASLQIIFNKKDYNNLLLENNPNNKFFDDDEKYYWITVDTY	850	860	870		876
EndoS D233Q/Q303L	ASLQIIFNKKDYNNLLLENNPNNKFFDDDEKYYWITVDTY					876
EndoS D233Q/Q303L/E350Q	ASLQIIFNKKDYNNLLLENNPNNKFFDDDEKYYWITVDTY					876
EndoS D233Q/Q303L/D405A	ASLQIIFNKKDYNNLLLENNPNNKFFDDDEKYYWITVDTY					876
EndoS D233Q/E350Q	ASLQIIFNKKDYNNLLLENNPNNKFFDDDEKYYWITVDTY					876
EndoS D233Q/D405A	ASLQIIFNKKDYNNLLLENNPNNKFFDDDEKYYWITVDTY					876
EndoS D233Q/Y402F	ASLQIIFNKKDYNNLLLENNPNNKFFDDDEKYYWITVDTY					876

[Figure 4-7]

EndoS D233Q	880	SAQGERATAAFSNTLLNNIITSKYWRVVFDTKGGDRYSS	910	911
EndoS D233Q/Q303L		SAQGERATAAFSNTLLNNIITSKYWRVVFDTKGGDRYSS		911
EndoS D233Q/Q303L/E350Q		SAQGERATAAFSNTLLNNIITSKYWRVVFDTKGGDRYSS		911
EndoS D233Q/Q303L/D405A		SAQGERATAAFSNTLLNNIITSKYWRVVFDTKGGDRYSS		911
EndoS D233Q/E350Q		SAQGERATAAFSNTLLNNIITSKYWRVVFDTKGGDRYSS		911
EndoS D233Q/D405A		SAQGERATAAFSNTLLNNIITSKYWRVVFDTKGGDRYSS		911
EndoS D233Q/Y402F		SAQGERATAAFSNTLLNNIITSKYWRVVFDTKGGDRYSS		911
EndoS D233Q	920	PVVPELQILGYPPLPNADTIMKTTVTTAKELSQQKDK	940	946
EndoS D233Q/Q303L		PVVPELQILGYPPLPNADTIMKTTVTTAKELSQQKDK		946
EndoS D233Q/Q303L/E350Q		PVVPELQILGYPPLPNADTIMKTTVTTAKELSQQKDK		946
EndoS D233Q/Q303L/D405A		PVVPELQILGYPPLPNADTIMKTTVTTAKELSQQKDK		946
EndoS D233Q/E350Q		PVVPELQILGYPPLPNADTIMKTTVTTAKELSQQKDK		946
EndoS D233Q/D405A		PVVPELQILGYPPLPNADTIMKTTVTTAKELSQQKDK		946
EndoS D233Q/Y402F		PVVPELQILGYPPLPNADTIMKTTVTTAKELSQQKDK		946
EndoS D233Q	950	FSQKMLEDLKKIKEMALETSLNSKIFDVTAINANAG	980	981
EndoS D233Q/Q303L		FSQKMLEDLKKIKEMALETSLNSKIFDVTAINANAG		981
EndoS D233Q/Q303L/E350Q		FSQKMLEDLKKIKEMALETSLNSKIFDVTAINANAG		981
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SEQUENCE LISTING

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<120> NOVEL ENDOS MUTANT ENZYME

<130> DS2015007

<150> JP2015-141901

<151> 2015-07-16

<160> 3

<170> PatentIn version 3.5

<210> 1

<211> 995

<212> PRT

<213> Artificial Sequence

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<223> D233Q mutant of Endo-S

<400> 1

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Thr Val Lys Ala Glu Glu Lys Thr Val Gln Val Gln Lys Gly Leu Pro
35 40 45

Ser Ile Asp Ser Leu His Tyr Leu Ser Glu Asn Ser Lys Lys Glu Phe
50 55 60

Lys Glu Glu Leu Ser Lys Ala Gly Gln Glu Ser Gln Lys Val Lys Glu
65 70 75 80

Ile Leu Ala Lys Ala Gln Gln Ala Asp Lys Gln Ala Gln Glu Leu Ala
85 90 95

Lys Met Lys Ile Pro Glu Lys Ile Pro Met Lys Pro Leu His Gly Pro
100 105 110

Leu Tyr Gly Gly Tyr Phe Arg Thr Trp His Asp Lys Thr Ser Asp Pro
115 120 125

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

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

Trp Lys Glu Leu Ala Thr Lys His Val Pro Lys Leu Asn Lys Gln Gly
165 170 175

Sequence Listing.TXT

Thr Arg Val Ile Arg Thr Ile Pro Trp Arg Phe Leu Ala Gly Gly Asp
 180 185 190
 Asn Ser Gly Ile Ala Glu Asp Thr Ser Lys Tyr Pro Asn Thr Pro Glu
 195 200 205
 Gly Asn Lys Ala Leu Ala Lys Ala Ile Val Asp Glu Tyr Val Tyr Lys
 210 215 220
 Tyr Asn Leu Asp Gly Leu Asp Val Gln Val Glu His Asp Ser Ile Pro
 225 230 235 240
 Lys Val Asp Lys Lys Glu Asp Thr Ala Gly Val Glu Arg Ser Ile Gln
 245 250 255
 Val Phe Glu Glu Ile Gly Lys Leu Ile Gly Pro Lys Gly Val Asp Lys
 260 265 270
 Ser Arg Leu Phe Ile Met Asp Ser Thr Tyr Met Ala Asp Lys Asn Pro
 275 280 285
 Leu Ile Glu Arg Gly Ala Pro Tyr Ile Asn Leu Leu Leu Val Gln Val
 290 295 300
 Tyr Gly Ser Gln Gly Glu Lys Gly Gly Trp Glu Pro Val Ser Asn Arg
 305 310 315 320
 Pro Glu Lys Thr Met Glu Glu Arg Trp Gln Gly Tyr Ser Lys Tyr Ile
 325 330 335
 Arg Pro Glu Gln Tyr Met Ile Gly Phe Ser Phe Tyr Glu Glu Asn Ala
 340 345 350
 Gln Glu Gly Asn Leu Trp Tyr Asp Ile Asn Ser Arg Lys Asp Glu Asp
 355 360 365
 Lys Ala Asn Gly Ile Asn Thr Asp Ile Thr Gly Thr Arg Ala Glu Arg
 370 375 380
 Tyr Ala Arg Trp Gln Pro Lys Thr Gly Gly Val Lys Gly Gly Ile Phe
 385 390 395 400
 Ser Tyr Ala Ile Asp Arg Asp Gly Val Ala His Gln Pro Lys Lys Tyr
 405 410 415
 Ala Lys Gln Lys Glu Phe Lys Asp Ala Thr Asp Asn Ile Phe His Ser
 420 425 430
 Asp Tyr Ser Val Ser Lys Ala Leu Lys Thr Val Met Leu Lys Asp Lys
 435 440 445

Sequence Listing.TXT

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

Glu Ala Val Met Ala Gln Val Gly Thr Arg Lys Gly Asp Leu Glu Arg
465 470 475 480

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

Gly Leu Asn Lys Phe Lys Lys Leu Ala Gln Leu Asp Leu Ile Gly Leu
500 505 510

Ser Arg Ile Thr Lys Leu Asp Arg Ser Val Leu Pro Ala Asn Met Lys
515 520 525

Pro Gly Lys Asp Thr Leu Glu Thr Val Leu Glu Thr Tyr Lys Lys Asp
530 535 540

Asn Lys Glu Glu Pro Ala Thr Ile Pro Pro Val Ser Leu Lys Val Ser
545 550 555 560

Gly Leu Thr Gly Leu Lys Glu Leu Asp Leu Ser Gly Phe Asp Arg Glu
565 570 575

Thr Leu Ala Gly Leu Asp Ala Ala Thr Leu Thr Ser Leu Glu Lys Val
580 585 590

Asp Ile Ser Gly Asn Lys Leu Asp Leu Ala Pro Gly Thr Glu Asn Arg
595 600 605

Gln Ile Phe Asp Thr Met Leu Ser Thr Ile Ser Asn His Val Gly Ser
610 615 620

Asn Glu Gln Thr Val Lys Phe Asp Lys Gln Lys Pro Thr Gly His Tyr
625 630 635 640

Pro Asp Thr Tyr Gly Lys Thr Ser Leu Arg Leu Pro Val Ala Asn Glu
645 650 655

Lys Val Asp Leu Gln Ser Gln Leu Leu Phe Gly Thr Val Thr Asn Gln
660 665 670

Gly Thr Leu Ile Asn Ser Glu Ala Asp Tyr Lys Ala Tyr Gln Asn His
675 680 685

Lys Ile Ala Gly Arg Ser Phe Val Asp Ser Asn Tyr His Tyr Asn Asn
690 695 700

Phe Lys Val Ser Tyr Glu Asn Tyr Thr Val Lys Val Thr Asp Ser Thr
705 710 715 720

Sequence Listing.TXT

Leu Gly Thr Thr Thr Asp Lys Thr Leu Ala Thr Asp Lys Glu Glu Thr
 725 730 735
 Tyr Lys Val Asp Phe Phe Ser Pro Ala Asp Lys Thr Lys Ala Val His
 740 745 750
 Thr Ala Lys Val Ile Val Gly Asp Glu Lys Thr Met Met Val Asn Leu
 755 760 765
 Ala Glu Gly Ala Thr Val Ile Gly Gly Ser Ala Asp Pro Val Asn Ala
 770 775 780
 Arg Lys Val Phe Asp Gly Gln Leu Gly Ser Glu Thr Asp Asn Ile Ser
 785 790 795 800
 Leu Gly Trp Asp Ser Lys Gln Ser Ile Ile Phe Lys Leu Lys Glu Asp
 805 810 815
 Gly Leu Ile Lys His Trp Arg Phe Phe Asn Asp Ser Ala Arg Asn Pro
 820 825 830
 Glu Thr Thr Asn Lys Pro Ile Gln Glu Ala Ser Leu Gln Ile Phe Asn
 835 840 845
 Ile Lys Asp Tyr Asn Leu Asp Asn Leu Leu Glu Asn Pro Asn Lys Phe
 850 855 860
 Asp Asp Glu Lys Tyr Trp Ile Thr Val Asp Thr Tyr Ser Ala Gln Gly
 865 870 875 880
 Glu Arg Ala Thr Ala Phe Ser Asn Thr Leu Asn Asn Ile Thr Ser Lys
 885 890 895
 Tyr Trp Arg Val Val Phe Asp Thr Lys Gly Asp Arg Tyr Ser Ser Pro
 900 905 910
 Val Val Pro Glu Leu Gln Ile Leu Gly Tyr Pro Leu Pro Asn Ala Asp
 915 920 925
 Thr Ile Met Lys Thr Val Thr Thr Ala Lys Glu Leu Ser Gln Gln Lys
 930 935 940
 Asp Lys Phe Ser Gln Lys Met Leu Asp Glu Leu Lys Ile Lys Glu Met
 945 950 955 960
 Ala Leu Glu Thr Ser Leu Asn Ser Lys Ile Phe Asp Val Thr Ala Ile
 965 970 975
 Asn Ala Asn Ala Gly Val Leu Lys Asp Cys Ile Glu Lys Arg Gln Leu
 980 985 990

Sequence Listing.TXT

Leu Lys Lys
995

<210> 2
<211> 995
<212> PRT
<213> Artificial Sequence

<220>
<223> Novel mutants of Endo-S D233Q having at least one mutation other than D233Q.

<220>
<221> mutation
<222> (122)..(122)
<223> The amino acid is His in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (184)..(184)
<223> The amino acid is Pro in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (187)..(187)
<223> The amino acid is Phe in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (279)..(279)
<223> The amino acid is Asp in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (281)..(281)
<223> The amino acid is Thr in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (282)..(282)
<223> The amino acid is Tyr in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (303)..(303)
<223> The amino acid is Gln in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (348)..(348)
<223> The amino acid is Tyr in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (350)..(350)
<223> The amino acid is Glu in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (402)..(402)
<223> The amino acid is Tyr in wild type EndoS and can be mutated.

<220>
<221> mutation
<222> (405)..(405)

Sequence Listing.TXT

<223> The amino acid is Asp in wild type EndoS and can be mutated.

<220>

<221> mutation

<222> (406)..(406)

<223> The amino acid is Arg in wild type EndoS and can be mutated.

<400> 2

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

Ala Thr Leu Met Gly Ala Ala Leu Ala Thr His His Asp Ser Leu Asn
20 25 30

Thr Val Lys Ala Glu Glu Lys Thr Val Gln Val Gln Lys Gly Leu Pro
35 40 45

Ser Ile Asp Ser Leu His Tyr Leu Ser Glu Asn Ser Lys Lys Glu Phe
50 55 60

Lys Glu Glu Leu Ser Lys Ala Gly Gln Glu Ser Gln Lys Val Lys Glu
65 70 75 80

Ile Leu Ala Lys Ala Gln Gln Ala Asp Lys Gln Ala Gln Glu Leu Ala
85 90 95

Lys Met Lys Ile Pro Glu Lys Ile Pro Met Lys Pro Leu His Gly Pro
100 105 110

Leu Tyr Gly Gly Tyr Phe Arg Thr Trp Xaa Asp Lys Thr Ser Asp Pro
115 120 125

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

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

Trp Lys Glu Leu Ala Thr Lys His Val Pro Lys Leu Asn Lys Gln Gly
165 170 175

Thr Arg Val Ile Arg Thr Ile Xaa Trp Arg Xaa Leu Ala Gly Gly Asp
180 185 190

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

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

Tyr Asn Leu Asp Gly Leu Asp Val Gln Val Glu His Asp Ser Ile Pro
225 230 235 240

Sequence Listing.TXT

Lys Val Asp Lys Lys Glu Asp Thr Ala Gly Val Glu Arg Ser Ile Gln
 245 250 255
 Val Phe Glu Glu Ile Gly Lys Leu Ile Gly Pro Lys Gly Val Asp Lys
 260 265 270
 Ser Arg Leu Phe Ile Met Xaa Ser Xaa Xaa Met Ala Asp Lys Asn Pro
 275 280 285
 Leu Ile Glu Arg Gly Ala Pro Tyr Ile Asn Leu Leu Leu Val Xaa Val
 290 295 300
 Tyr Gly Ser Gln Gly Glu Lys Gly Gly Trp Glu Pro Val Ser Asn Arg
 305 310 315 320
 Pro Glu Lys Thr Met Glu Glu Arg Trp Gln Gly Tyr Ser Lys Tyr Ile
 325 330 335
 Arg Pro Glu Gln Tyr Met Ile Gly Phe Ser Phe Xaa Glu Xaa Asn Ala
 340 345 350
 Gln Glu Gly Asn Leu Trp Tyr Asp Ile Asn Ser Arg Lys Asp Glu Asp
 355 360 365
 Lys Ala Asn Gly Ile Asn Thr Asp Ile Thr Gly Thr Arg Ala Glu Arg
 370 375 380
 Tyr Ala Arg Trp Gln Pro Lys Thr Gly Gly Val Lys Gly Gly Ile Phe
 385 390 395 400
 Ser Xaa Ala Ile Xaa Xaa Asp Gly Val Ala His Gln Pro Lys Lys Tyr
 405 410 415
 Ala Lys Gln Lys Glu Phe Lys Asp Ala Thr Asp Asn Ile Phe His Ser
 420 425 430
 Asp Tyr Ser Val Ser Lys Ala Leu Lys Thr Val Met Leu Lys Asp Lys
 435 440 445
 Ser Tyr Asp Leu Ile Asp Glu Lys Asp Phe Pro Asp Lys Ala Leu Arg
 450 455 460
 Glu Ala Val Met Ala Gln Val Gly Thr Arg Lys Gly Asp Leu Glu Arg
 465 470 475 480
 Phe Asn Gly Thr Leu Arg Leu Asp Asn Pro Ala Ile Gln Ser Leu Glu
 485 490 495
 Gly Leu Asn Lys Phe Lys Lys Leu Ala Gln Leu Asp Leu Ile Gly Leu
 500 505 510

Sequence Listing.TXT

Ser Arg Ile Thr Lys Leu Asp Arg Ser Val Leu Pro Ala Asn Met Lys
515 520 525

Pro Gly Lys Asp Thr Leu Glu Thr Val Leu Glu Thr Tyr Lys Lys Asp
530 535 540

Asn Lys Glu Glu Pro Ala Thr Ile Pro Pro Val Ser Leu Lys Val Ser
545 550 555 560

Gly Leu Thr Gly Leu Lys Glu Leu Asp Leu Ser Gly Phe Asp Arg Glu
565 570 575

Thr Leu Ala Gly Leu Asp Ala Ala Thr Leu Thr Ser Leu Glu Lys Val
580 585 590

Asp Ile Ser Gly Asn Lys Leu Asp Leu Ala Pro Gly Thr Glu Asn Arg
595 600 605

Gln Ile Phe Asp Thr Met Leu Ser Thr Ile Ser Asn His Val Gly Ser
610 615 620

Asn Glu Gln Thr Val Lys Phe Asp Lys Gln Lys Pro Thr Gly His Tyr
625 630 635 640

Pro Asp Thr Tyr Gly Lys Thr Ser Leu Arg Leu Pro Val Ala Asn Glu
645 650 655

Lys Val Asp Leu Gln Ser Gln Leu Leu Phe Gly Thr Val Thr Asn Gln
660 665 670

Gly Thr Leu Ile Asn Ser Glu Ala Asp Tyr Lys Ala Tyr Gln Asn His
675 680 685

Lys Ile Ala Gly Arg Ser Phe Val Asp Ser Asn Tyr His Tyr Asn Asn
690 695 700

Phe Lys Val Ser Tyr Glu Asn Tyr Thr Val Lys Val Thr Asp Ser Thr
705 710 715 720

Leu Gly Thr Thr Thr Asp Lys Thr Leu Ala Thr Asp Lys Glu Glu Thr
725 730 735

Tyr Lys Val Asp Phe Phe Ser Pro Ala Asp Lys Thr Lys Ala Val His
740 745 750

Thr Ala Lys Val Ile Val Gly Asp Glu Lys Thr Met Met Val Asn Leu
755 760 765

Ala Glu Gly Ala Thr Val Ile Gly Gly Ser Ala Asp Pro Val Asn Ala
770 775 780

Sequence Listing.TXT

Arg Lys Val Phe Asp Gly Gln Leu Gly Ser Glu Thr Asp Asn Ile Ser
785 790 795 800

Leu Gly Trp Asp Ser Lys Gln Ser Ile Ile Phe Lys Leu Lys Glu Asp
805 810 815

Gly Leu Ile Lys His Trp Arg Phe Phe Asn Asp Ser Ala Arg Asn Pro
820 825 830

Glu Thr Thr Asn Lys Pro Ile Gln Glu Ala Ser Leu Gln Ile Phe Asn
835 840 845

Ile Lys Asp Tyr Asn Leu Asp Asn Leu Leu Glu Asn Pro Asn Lys Phe
850 855 860

Asp Asp Glu Lys Tyr Trp Ile Thr Val Asp Thr Tyr Ser Ala Gln Gly
865 870 875 880

Glu Arg Ala Thr Ala Phe Ser Asn Thr Leu Asn Asn Ile Thr Ser Lys
885 890 895

Tyr Trp Arg Val Val Phe Asp Thr Lys Gly Asp Arg Tyr Ser Ser Pro
900 905 910

Val Val Pro Glu Leu Gln Ile Leu Gly Tyr Pro Leu Pro Asn Ala Asp
915 920 925

Thr Ile Met Lys Thr Val Thr Thr Ala Lys Glu Leu Ser Gln Gln Lys
930 935 940

Asp Lys Phe Ser Gln Lys Met Leu Asp Glu Leu Lys Ile Lys Glu Met
945 950 955 960

Ala Leu Glu Thr Ser Leu Asn Ser Lys Ile Phe Asp Val Thr Ala Ile
965 970 975

Asn Ala Asn Ala Gly Val Leu Lys Asp Cys Ile Glu Lys Arg Gln Leu
980 985 990

Leu Lys Lys
995

<210> 3
<211> 2985
<212> DNA
<213> Artificial sequence

<220>
<223> cDNA of EndoS D233Q

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60

Sequence Listing.TXT						
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gttcagggttc	agaaagggtct	gccgagcatt	gatagtctgc	attatctgag	cgaaaacagc	180
aaaaaagaat	ttaaagaaga	actgagcaaa	gccgggtcaag	aaagccagaa	agttaaagaa	240
attctggcaa	aagcacagca	ggcagataaa	caggcacaag	aactggccaa	aatgaaaatc	300
ccggaaaaaaa	ttccgatgaa	accgctgcat	ggtccgctgt	atggtgggta	ttttcgtagc	360
tggcatgata	aaaccagcga	tccgaccgaa	aaagataaag	ttaatagcat	gggtgaactg	420
ccgaaagaag	ttgatctggc	atttatcttt	cacgactgga	caaagatta	tagcctgttt	480
tggaaagaac	tggcgaccaa	acatgttccg	aaactgaata	aacagggcac	ccgtgttatt	540
cgtaccattc	cgtggcggtt	tctggcaggc	ggtgataata	gcggtattgc	agaagatacc	600
agcaaatatc	cgaatacacc	ggaaggtaat	aaagcactgg	cgaaagcaat	tgtggatgag	660
tatgtgtata	aatacaatct	ggatggcctg	gatgttcaag	ttgaacatga	tagcattccg	720
aaagtggaca	aaaaagagga	taccgcaggc	gttgaacgta	gcattcaggt	ttttgaagaa	780
atcggaac	tgattggtcc	gaaagggtgt	gataaaagcc	gtctgtttat	tatggatagc	840
acctatatgg	ccgataaaaa	cccgtgatt	gaacgtgggtg	caccgtatat	taacctgctg	900
ctggttcagg	tttatggtag	ccagggtgaa	aaagggtggt	gggaaccggt	tagcaatcgt	960
cctgaaaaaa	ccatggaaga	acgttggcag	ggttatagca	aatatatccg	tccggaacag	1020
tatatgatcg	gcttttagctt	ttatgaagaa	aatgccaag	agggaatct	gtggatgat	1080
attaacagcc	gtaaagatga	ggataaagcc	aatggcatta	acaccgatat	caccggtaca	1140
cgtgcagaac	gttatgccc	ttggcagccg	aaaaccgggtg	gtgttaaagg	tggtattttt	1200
agctatgcca	ttgatcgtga	tgggtgtgca	catcaaccga	aaaaatacgc	caaacagaaa	1260
gagttcaaag	acgccaccga	taacattttc	catagcgatt	atagcgtag	caaagccctg	1320
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ctggcaccgg	gtacagaaaa	tcgtcagatc	ttcgatacca	tgctgagcac	cattagcaat	1860
catgttggtg	gcaatgaaca	gaccgtgaaa	tttgataaac	agaaaccgac	cggtcattat	1920
cctgatacct	atggtaaaac	cagtctgcgt	ctgccggttg	caaatgaaaa	agtggatctg	1980
cagagccagc	tgctgtttgg	caccgttacc	aatcagggca	caactgattaa	tagcgaagca	2040
gattataaag	cctatcagaa	ccataaaatt	gccggtcgta	gctttgtgga	tagcaactac	2100

Sequence Listing.TXT						
cattacaaca	acttcaaagt	gagctacgag	aactataccg	tgaaagttac	cgatagcacc	2160
ctgggcacca	ccacagataa	aacactggcc	acggataaag	aggaaaccta	taaagtcgat	2220
tttttcagcc	ctgccgacaa	aaccaaagca	gttcataccg	caaaagttat	cgtgggtgat	2280
gaaaaaacga	tgatgggttaa	tctggcagaa	ggtgcaaccg	ttattggtgg	tagcgcagat	2340
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cattggcgct	tttttaacga	tagcgcacgt	aatccgaaa	ccacaaataa	accgattcaa	2520
gaagcaagcc	tgagatttt	taacatcaaa	gattacaacc	tggaacacct	gctggaaaac	2580
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gaacgtgcaa	ccgcatttag	caataccctg	aataatatca	cgagcaaata	ttggcgtgtg	2700
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ggttatccgc	tgccgaatgc	agataccatt	atgaaaacag	ttaccaccgc	caaagaactg	2820
tcacagcaga	aagacaaatt	tagccagaaa	atgctggacg	aactgaaaat	caaagaaatg	2880
gcactggaaa	ccagcctgaa	ctccaaaatt	ttcgatgtta	ccgccattaa	tgcaaatgcc	2940
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