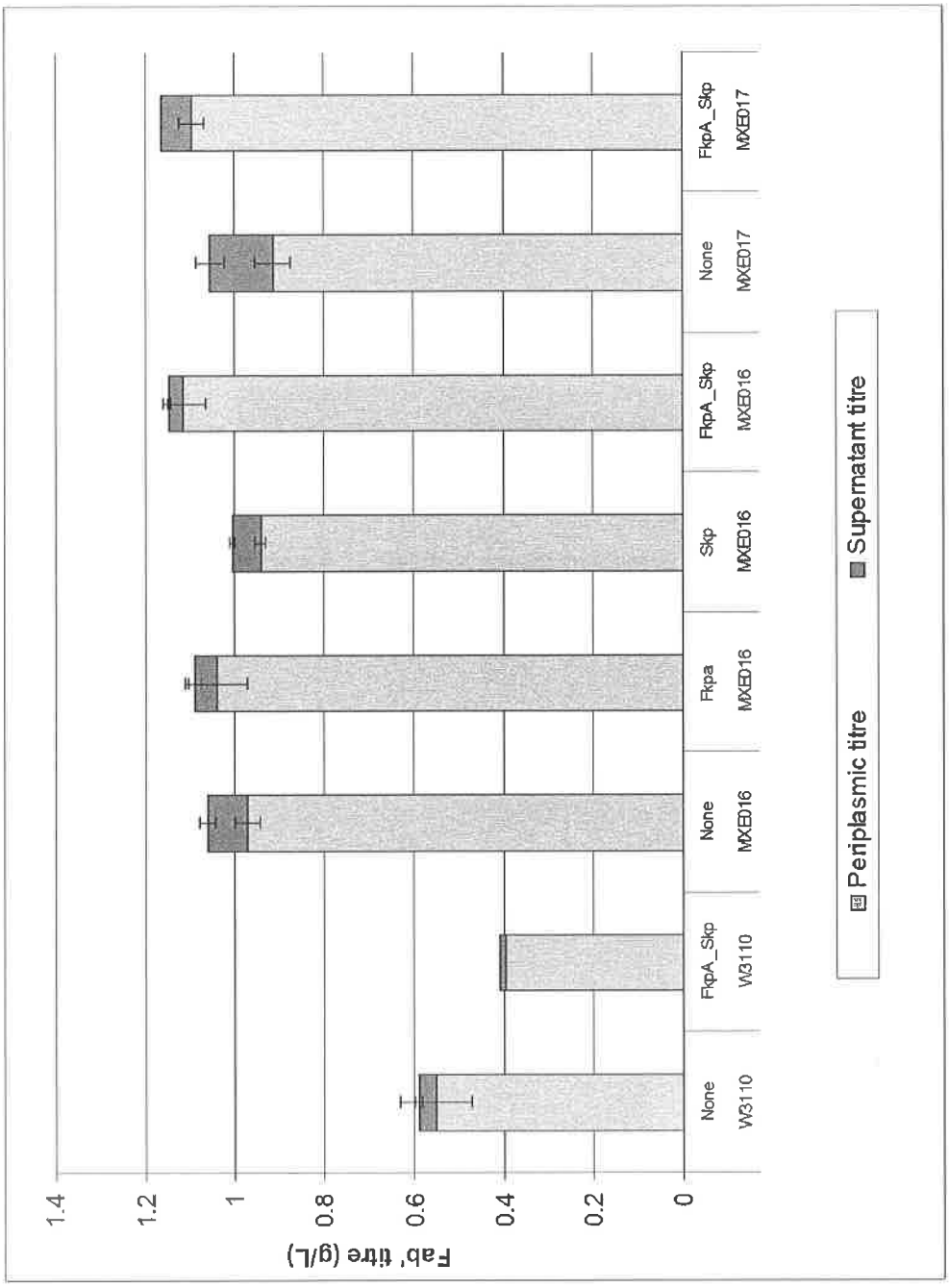

Fab' titre (g/L)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
None W3110
FkpA_Skp W3110
None MXE016
Fkpa MXE016
Skp MXE016
FkpA_Skp MXE016
None MXE017
FkpA_Skp MXE017
Periplasmic titre
Supernatant titre

Figure 1

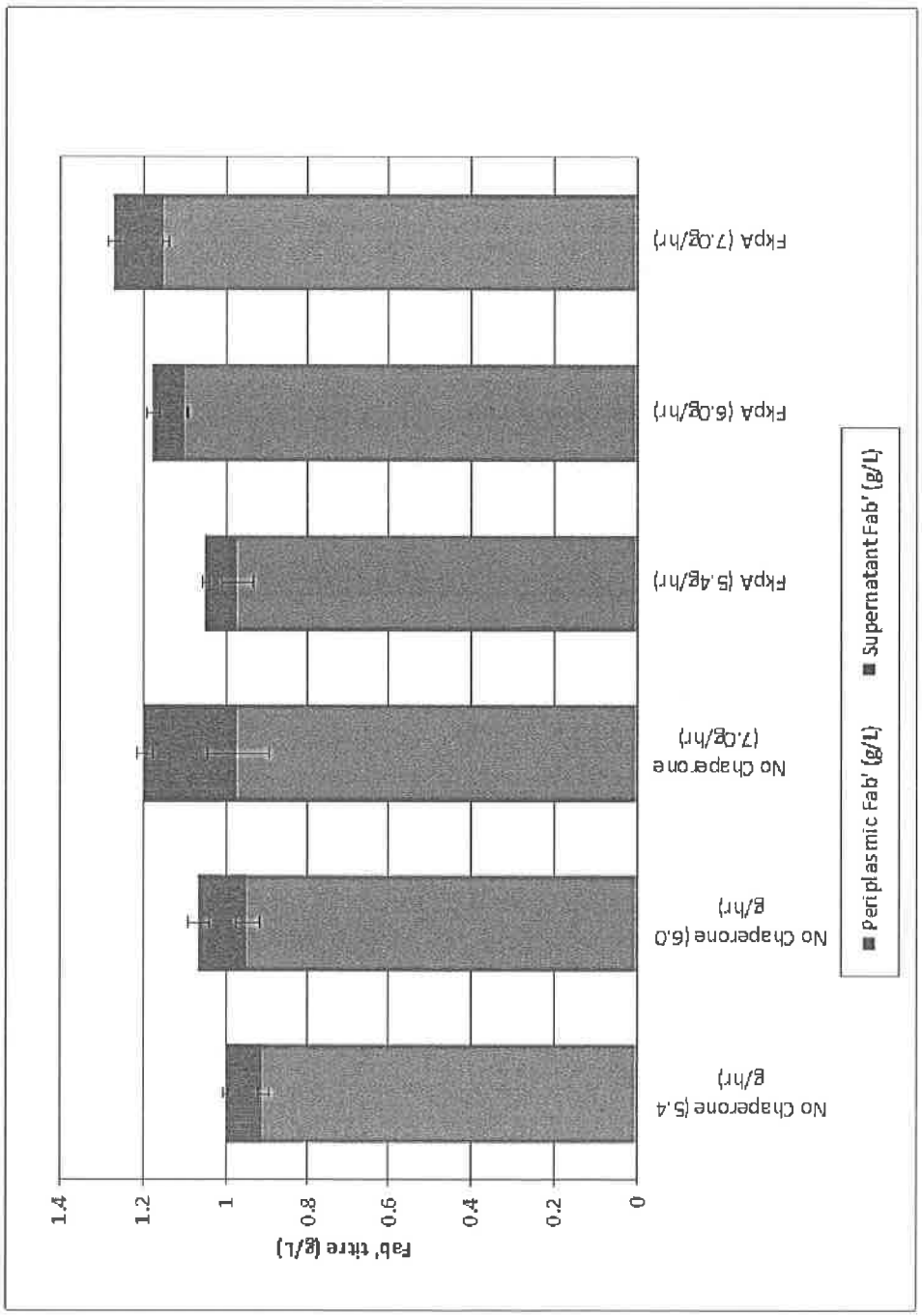


Figure 2 Feed Rate Variation Experiments

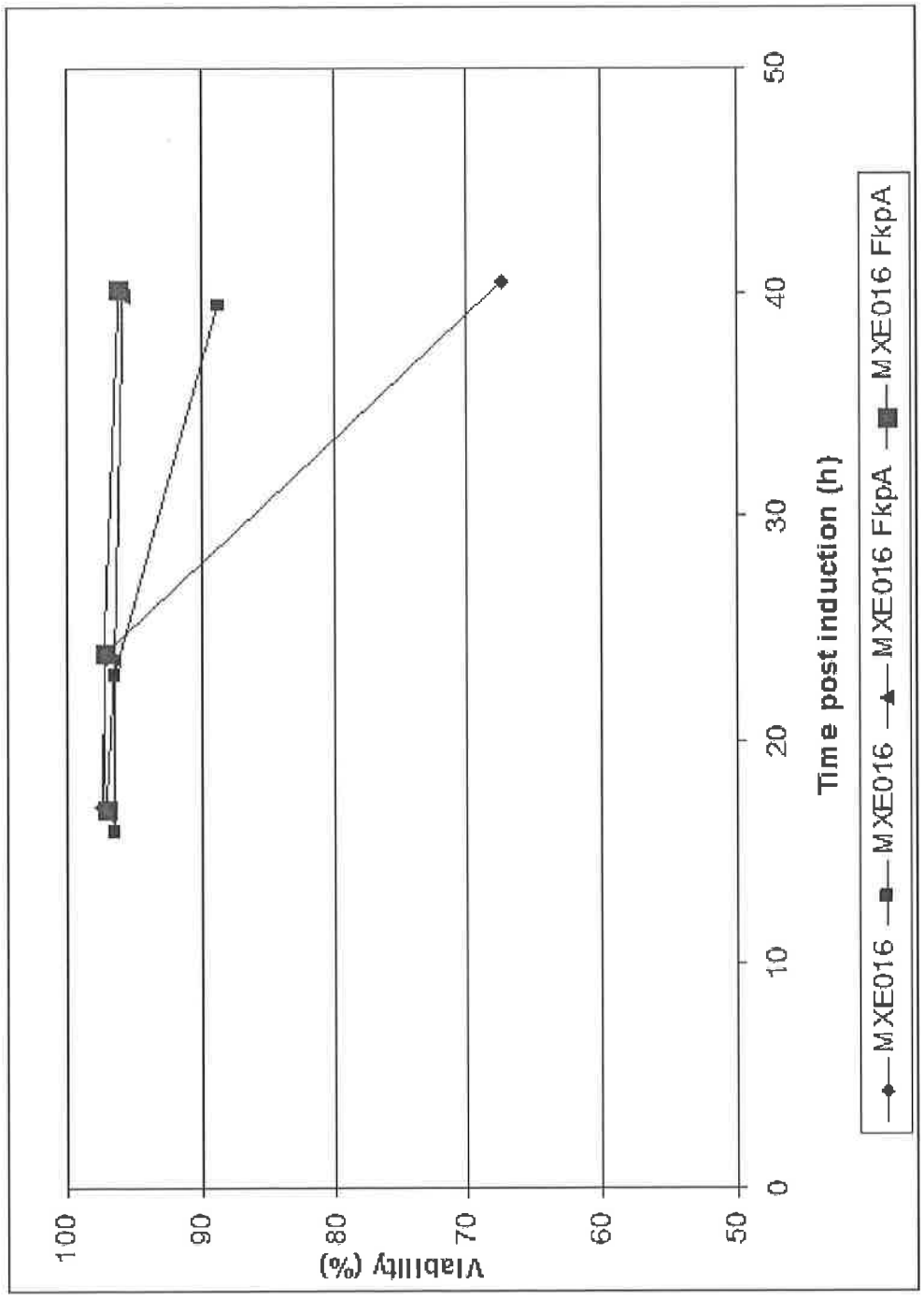


Figure 3A Cell Viability

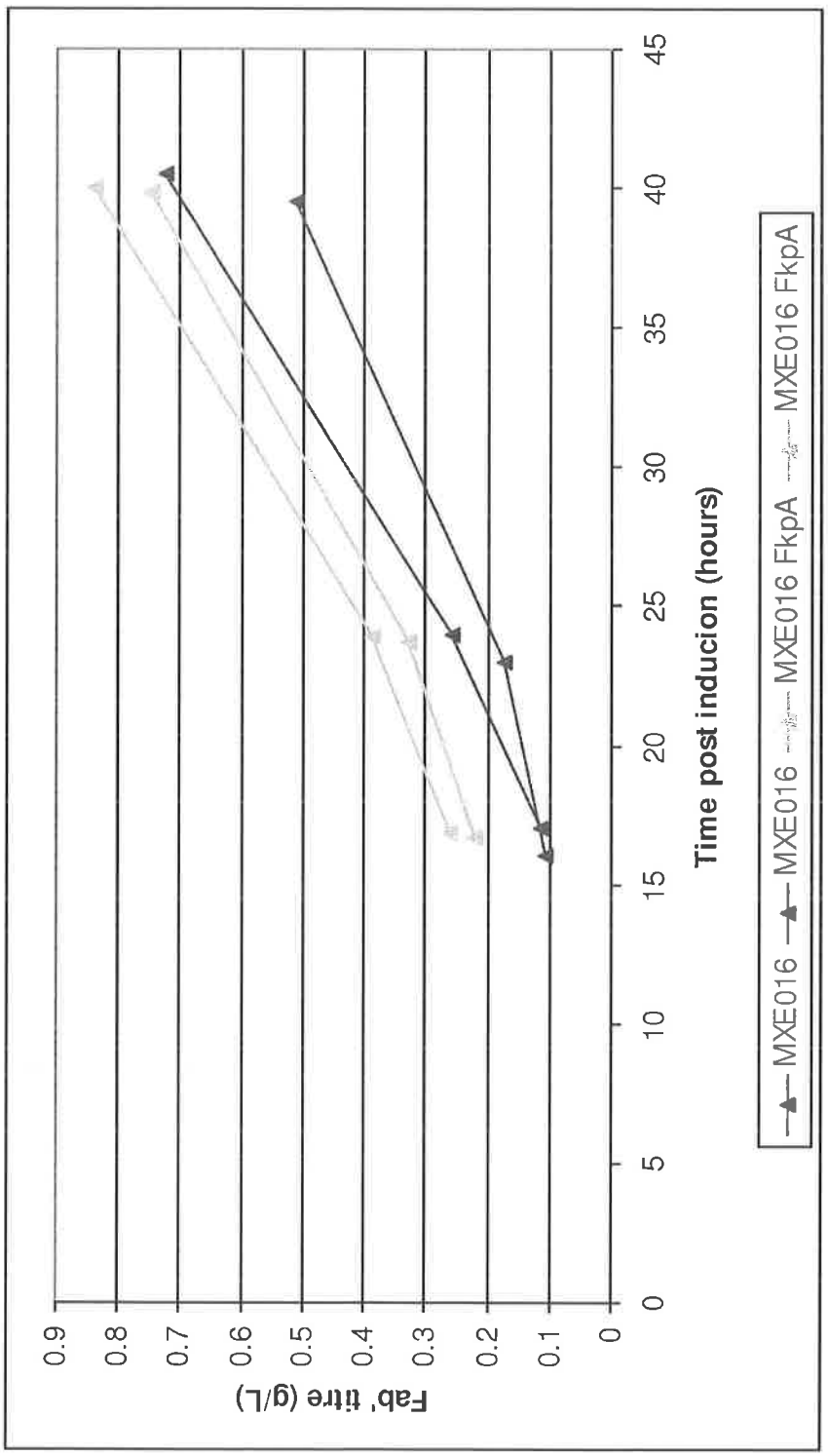

Fab' titre (g/L)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25
30
35
40
45
Time post inducion (hours)
MXE016
MXE016 FkpA
MXE016 FkpA

Figure 3B

Figure 4 Harvest from 20 Litre Pilot Scale Productions and Primary Recovery for "MXE016" Cell Lines

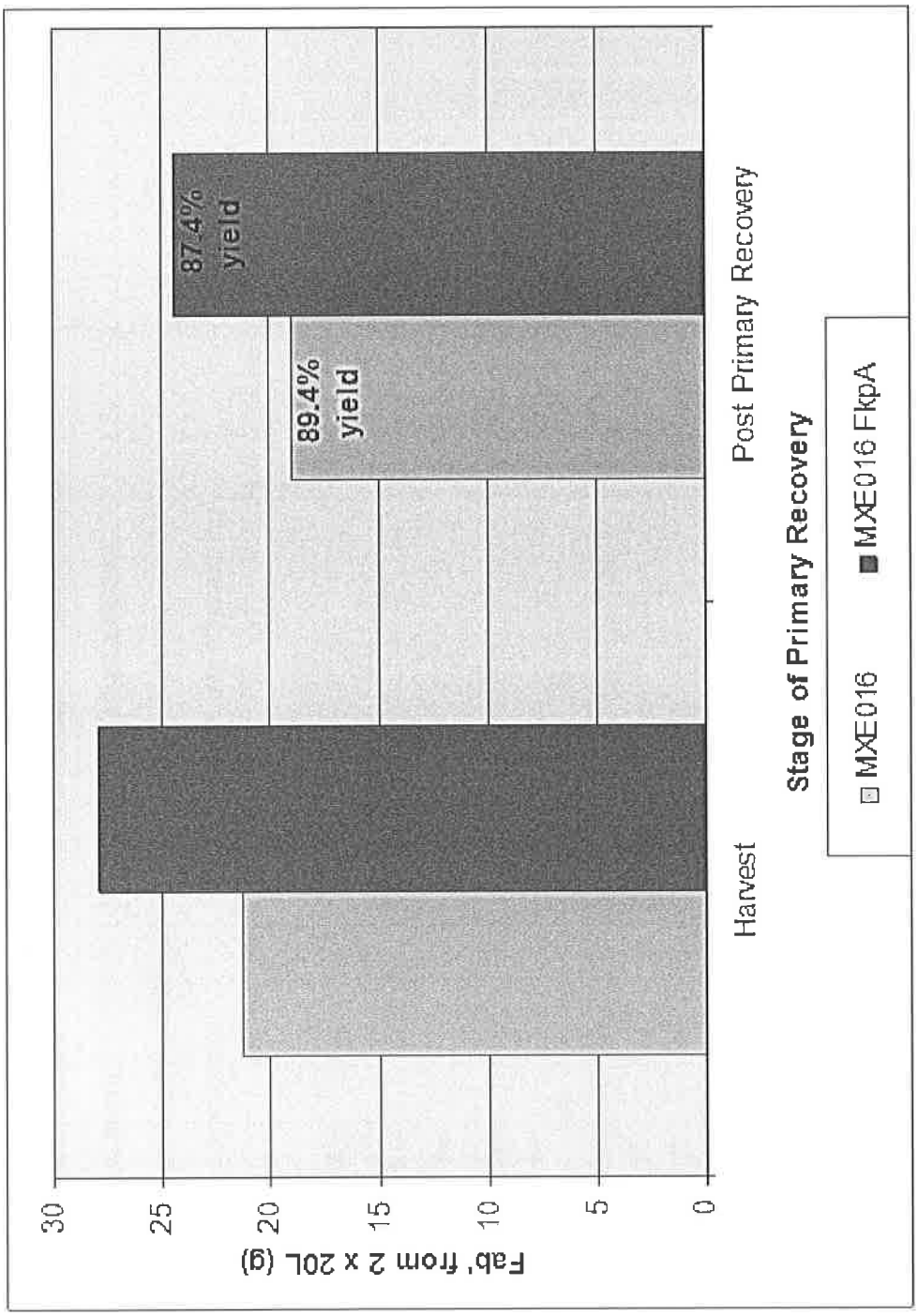
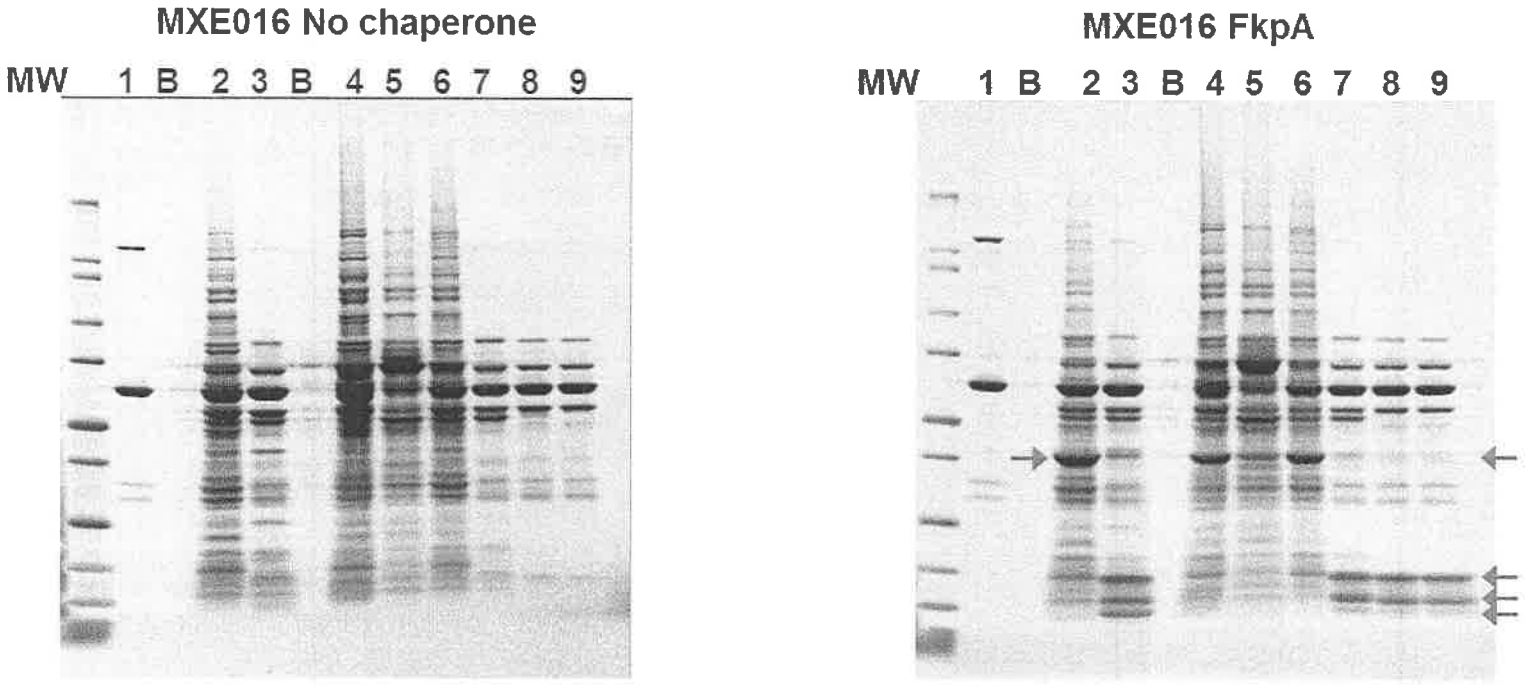


Figure 5 Primary Recovery From 20 Litre Batch Run on SDS-PAGE Stained Gel Under Non-Reducing Conditions



1 – X Fab′ Standard;

2 - 30°C small scale extract;

3 - 60°C small scale extract;

4 – Supernatant of heavy phase;

5 – Light phase

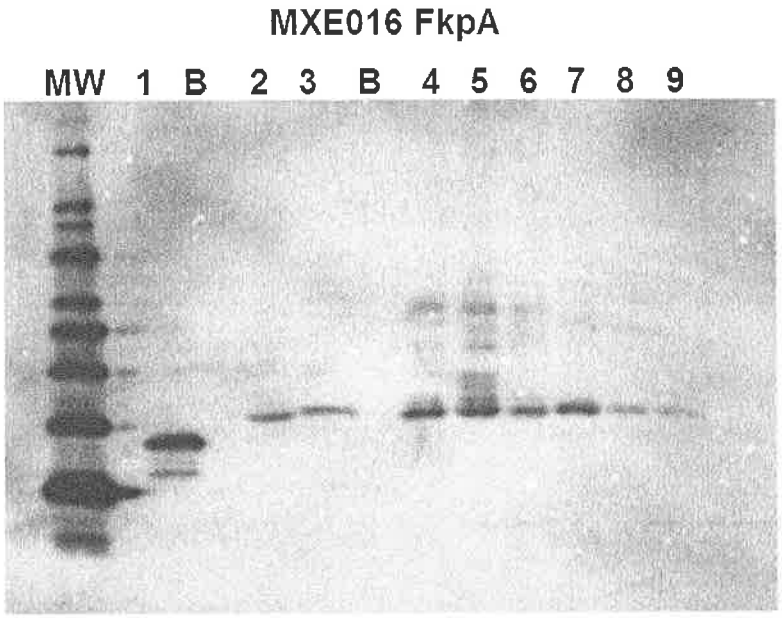
6 – Post buffer addition;

7 – Post extraction;

8 – Post extract centrifugation

9 – Post filtration

Figure 6 Western Blot Under Non-Reducing Conditions for a 20 L Pilot Scale Batch



1 – His-tag positive control (DsbC)

2 - 30°C small scale extract

3 - 60°C small scale extract

4 – Supernatant of heavy phase

5 – Light phase

6 – Post buffer addition

7 – Post extraction

8 – Post extract centrifugation

9 – Post filtration

Figure 7A Mutation in Various Genes

Wild type ptr (protease III) 5' (SEQ ID NOs 81 and 82)

```
  *   M   P   R   S   T   W   F   K   A   L   L   L   L   V
TGA ATG CCC CGC AGC ACC TGG TTC AAA GCA TTA TTG TTG TTA GTT

  A   L   W   A   P   L   S
GCC CTT TGG GCA CCC TTA AGT
```

Mutated Δ ptr (protease III) 5' (SEQ ID NOs 79 and 80)

```
    EcoR I
  ~~~~~~~~
  *   I   P   R   S   T   W   F   K   A   L   L   L   L   V
TGA ATT CCC CGC AGC ACC TGG TTC AAA GCA TTA TTG TTG TTA GTT

                        Ase I
                      ~~~~~~~~
  A   L   W   A   H   *   C
GCC CTT TGG GCA CAT TAA TGT
```

Figure 7B

Wild type Tsp 5' (SEQ ID NOs 75 and 76)

```
  M   N   M   F   F   R   L   T   A   L   A   G   L   L   A
ATG AAC ATG TTT TTT AGG CTT ACC GCG TTA GCT GGC CTG CTT GCA

  I   A   G   Q   T   F   A
ATA GCA GGC CAG ACC TTC GCT
```

Mutated Δ Tsp 5' (SEQ ID NOs 77 and 78)

```
    EcoR I
  ~~~~~~~~
  M   N   S   F   L   G   L   P   R   *   L   A   C   L   Q
ATG AAT TCG TTT TTA GGC TTA CCG CGT TAG CTG GCC TGC TTG CAA

                        Ase I
                      ~~~~~~~~
  *   Q   A   R   H   *   L
TAG CAG GCC AGA CAT TAA TTG
```

Figure 7C

Wild type DegP

202	D	A	A	I	N	R	G	N	**S**	G	G
949	GAT	GCA	GCG	ATC	AAC	CGT	GGT	AAC	***TCC***	GGT	GGT

Mutated DegP S210A

Ase I

202	D	A	A	I	N	R	G	N	**A**	G	G
949	GAT	GCA	GCG	***ATT***	***AAT***	CGT	GGT	AAC	***GCC***	GGT	GGT

Figure 7D Gene Insertion

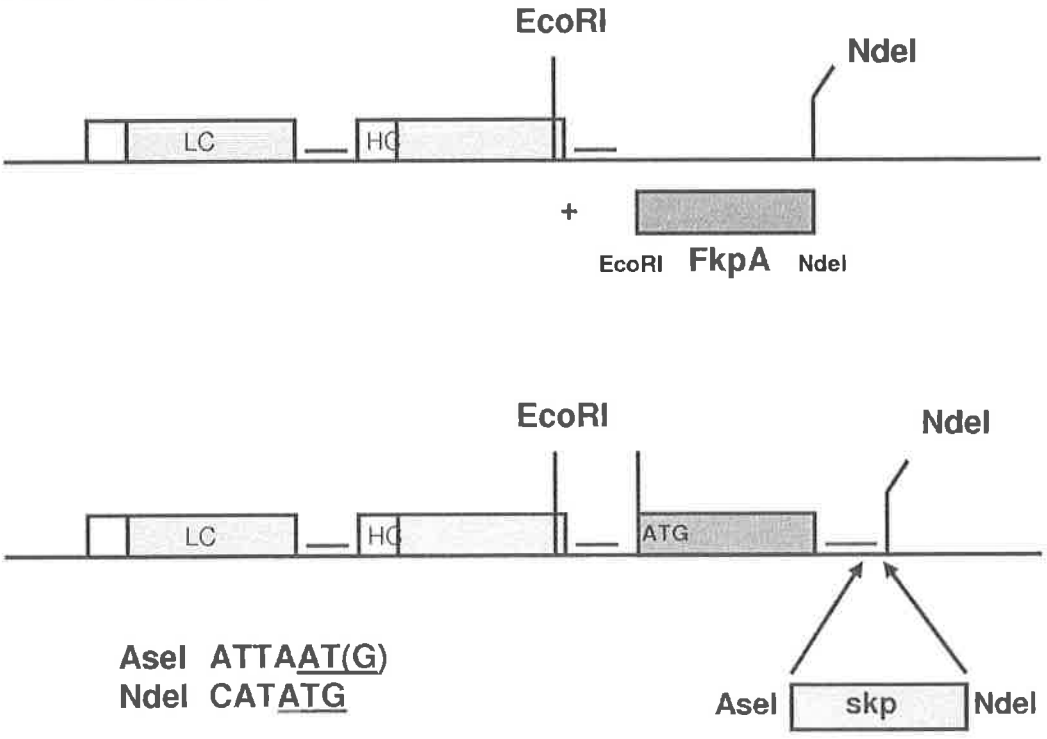


FIGURE 8A SEQ ID NO:1 is the DNA sequence of the wild-type Tsp gene including the 6 nucleotides ATGAAC upstream of the start codon.

ATGAACATGTTTTTTAGGCTTACCGCGTTAGCTGGCCTGCTTGCAATAGCAGGCCAGACCTTCGCTGTAGAA
GATATCACGCGTGCTGATCAAATTCCGGTATTAAAGGAAGAGACGCAGCATGCGACGGTAAGTGAGCGCGTA
ACGTCGCGCTTCACCCGTTCTCATTATCGCCAGTTCGACCTCGATCAGGCATTTTCGGCCAAAATCTTTGAC
CGCTACCTGAATCTGCTCGATTACAGCCACAACGTGCTGCTGGCAAGCGATGTTGAACAGTTCGCGAAAAAG
AAAACCGAGTTAGGCGATGAACTGCGTTCAGGCAAACTCGACGTTTTCTACGATCTCTACAATCTGGCGCAA
AAGCGCCGTTTTGAGCGTTACCAGTACGCTTTGTCGGTACTGGAAAAGCCGATGGATTTCACCGGCAACGAC
ACTTATAACCTTGACCGCAGCAAAGCGCCCTGGCCGAAAAACGAGGCTGAGTTGAACGCGCTGTGGGACAGT
AAAGTCAAATTCGACGAGTTAAGCCTGAAGCTGACAGGAAAAACGGATAAAGAAATTCGTGAAACCCTGACT
CGCCGCTACAAATTTGCCATTCGTCGTCTGGCGCAAACCAACAGCGAAGATGTTTTCTCGCTGGCAATGACG
GCGTTTGCGCGTGAAATCGACCCGCATACCAACTATCTTTCCCCGCGTAATACCGAACAGTTCAACACTGAA
ATGAGTTTGTCGCTGGAAGGTATTGGCGCAGTGCTGCAAATGGATGATGACTACACCGTTATCAATTCGATG
GTGGCAGGTGGTCCGGCAGCGAAGAGTAAAGCTATCAGCGTTGGTGACAAAATTGTCGGTGTTGGTCAAACA
GGCAAGCCGATGGTTGACGTGATTGGCTGGCGTCTTGATGATGTGGTTGCCTTAATTAAAGGGCCGAAGGGC
AGTAAAGTTCGTCTGGAAATTTTACCTGCTGGTAAAGGGACCAAGACCCGTACTGTAACGTTGACCCGTGAA
CGTATTCGTCTCGAAGACCGCGCGGTTAAAATGTCGGTGAAGACCGTCGGTAAAGAGAAAGTCGGCGTGCTG
GATATTCCGGGCTTCTATGTGGGTTTGACAGACGATGTCAAAGTGCAACTGCAGAAACTGGAAAAACAGAAT
GTCAGCAGCGTCATCATCGACCTGCGTAGCAATGGCGGTGGGGCGTTAACTGAAGCCGTATCGCTCTCCGGT
CTGTTTATTCCTGCGGGTCCCATTGTTCAGGTCCGCGATAACAACGGCAAGGTTCGTGAAGATAGCGATACC
GACGGACAGGTTTTCTATAAAGGCCCGCTGGTGGTGCTGGTTGACCGCTTCAGTGCTTCGGCTTCAGAAATC
TTTGCCGCGGCAATGCAGGATTACGGTCGTGCGCTGGTTGTGGGTGAACCGACGTTTGGTAAAGGCACCGTT
CAGCAATACCGTTCATTGAACCGTATTTACGATCAGATGTTACGTCCTGAATGGCCAGCGCTGGGTTCTGTG
CAGTACACGATCCAGAAATTCTATCGCGTTAACGGCGGCAGTACGCAACGTAAAGGCGTAACGCCAGACATC
ATCATGCCGACGGGTAATGAAGAAACGGAAACGGGTGAGAAATTCGAAGATAACGCGCTGCCGTGGGATAGC
ATTGATGCCGCGACTTATGTGAAATCAGGAGATTTAACGGCCTTTGAACCGGAGCTGCTGAAGGAACATAAT
GCGCGTATCGCGAAAGATCCTGAGTTCCAGAACATCATGAAGGATATCGCGCGCTTCAACGCTATGAAGGAC
AAGCGCAATATCGTTTCTCTGAATTACGCTGTGCGTGAGAAAGAGAATAATGAAGATGATGCGACGCGTCTG
GCGCGTTTGAACGAACGCTTTAAACGCGAAGGTAAACCGGAGTTGAAGAAACTGGATGATCTACCGAAAGAT
TACCAGGAGCCGGATCCTTATCTGGATGAGACGGTGAATATCGCACTCGATCTGGCGAAGCTTGAAAAAGCC
AGACCCGCGGAACAACCCGCTCCCGTCAAGTAA

FIGURE 8B SEQ ID NO:2 is the amino acid sequence of the wild-type Tsp protein.

MFFRLTALAGLLAIAGQTFAVEDITRADQIPVLKEETQHATVSERVTSRFTRSHYRQFDLDQAFSAKIFDRY
LNLLDYSHNVLLASDVEQFAKKKTELGDELRSGKLDVFYDLYNLAQKRRFERYQYALSVLEKPMDFTGNDTY
NLDRSKAPWPKNEAELNALWDSKVKFDELSLKLTGKTDKEIRETLTRRYKFAIRRLAQTNSEDVFSLAMTAF
AREIDPHTNYLSPRNTEQFNTEMSLSLEGIGAVLQMDDDYTVINSMVAGGPAAKSKAISVGDKIVGVGQTGK
PMVDVIGWRLDDVVALIKGPKGSKVRLEILPAGKGTKTRTVTLTRERIRLEDRAVKMSVKTVGKEKVGVLDI
PGFYVGLTDDVKVQLQKLEKQNVSSVIIDLRSNGGGALTEAVSLSGLFIPAGPIVQVRDNNGKVREDSDTDG
QVFYKGPLVVLVDRFSASASEIFAAAMQDYGRALVVGEPTFGKGTVQQYRSLNRIYDQMLRPEWPALGSVQY
TIQKFYRVNGGSTQRKGVTPDIIMPTGNEETETGEKFEDNALPWDSIDAATYVKSGDLTAFEPELLKEHNAR
IAKDPEFQNIMKDIARFNAMKDKRNIVSLNYAVREKENNEDDATRLARLNERFKREGKPELKKLDDLPKDYQ
EPDPYLDETVNIALDLAKLEKARPAEQPAPVK*

FIGURE 8C

SEQ ID NO:3 is the DNA sequence of a mutated knockout Tsp gene including the 6 nucleotides ATGAAT upstream of the start codon.

ATGAATTCGTTTTTAGGCTTACCGCGTTAGCTGGCCTGCTTGCAATAGCAGGCCAGACATTAATTGTAGAAG
ATATCACGCGTGCTGATCAAATTCCGGTATTAAAGGAAGAGACGCAGCATGCGACGGTAAGTGAGCGCGTAA
CGTCGCGCTTCACCCGTTCTCATTATCGCCAGTTCGACCTCGATCAGGCATTTTCGGCCAAAATCTTTGACC
GCTACCTGAATCTGCTCGATTACAGCCACAACGTGCTGCTGGCAAGCGATGTTGAACAGTTCGCGAAAAAGA
AAACCGAGTTAGGCGATGAACTGCGTTCAGGCAAACTCGACGTTTTCTACGATCTCTACAATCTGGCGCAAA
AGCGCCGTTTTGAGCGTTACCAGTACGCTTTGTCGGTACTGGAAAAGCCGATGGATTTCACCGGCAACGACA
CTTATAACCTTGACCGCAGCAAAGCGCCCTGGCCGAAAAACGAGGCTGAGTTGAACGCGCTGTGGGACAGTA
AAGTCAAATTCGACGAGTTAAGCCTGAAGCTGACAGGAAAAACGGATAAAGAAATTCGTGAAACCCTGACTC
GCCGCTACAAATTTGCCATTCGTCGTCTGGCGCAAACCAACAGCGAAGATGTTTTCTCGCTGGCAATGACGG
CGTTTGCGCGTGAAATCGACCCGCATACCAACTATCTTTCCCCGCGTAATACCGAACAGTTCAACACTGAAA
TGAGTTTGTCGCTGGAAGGTATTGGCGCAGTGCTGCAAATGGATGATGACTACACCGTTATCAATTCGATGG
TGGCAGGTGGTCCGGCAGCGAAGAGTAAAGCTATCAGCGTTGGTGACAAAATTGTCGGTGTTGGTCAAACAG
GCAAGCCGATGGTTGACGTGATTGGCTGGCGTCTTGATGATGTGGTTGCCTTAATTAAAGGGCCGAAGGGCA
GTAAAGTTCGTCTGGAAATTTTACCTGCTGGTAAAGGGACCAAGACCCGTACTGTAACGTTGACCCGTGAAC
GTATTCGTCTCGAAGACCGCGCGGTTAAAATGTCGGTGAAGACCGTCGGTAAAGAGAAAGTCGGCGTGCTGG
ATATTCCGGGCTTCTATGTGGGTTTGACAGACGATGTCAAAGTGCAACTGCAGAAACTGGAAAAACAGAATG
TCAGCAGCGTCATCATCGACCTGCGTAGCAATGGCGGTGGGGCGTTAACTGAAGCCGTATCGCTCTCCGGTC
TGTTTATTCCTGCGGGTCCCATTGTTCAGGTCCGCGATAACAACGGCAAGGTTCGTGAAGATAGCGATACCG
ACGGACAGGTTTTCTATAAAGGCCCGCTGGTGGTGCTGGTTGACCGCTTCAGTGCTTCGGCTTCAGAAATCT
TTGCCGCGGCAATGCAGGATTACGGTCGTGCGCTGGTTGTGGGTGAACCGACGTTTGGTAAAGGCACCGTTC
AGCAATACCGTTCATTGAACCGTATTTACGATCAGATGTTACGTCCTGAATGGCCAGCGCTGGGTTCTGTGC
AGTACACGATCCAGAAATTCTATCGCGTTAACGGCGGCAGTACGCAACGTAAAGGCGTAACGCCAGACATCA
TCATGCCGACGGGTAATGAAGAAACGGAAACGGGTGAGAAATTCGAAGATAACGCGCTGCCGTGGGATAGCA
TTGATGCCGCGACTTATGTGAAATCAGGAGATTTAACGGCCTTTGAACCGGAGCTGCTGAAGGAACATAATG
CGCGTATCGCGAAAGATCCTGAGTTCCAGAACATCATGAAGGATATCGCGCGCTTCAACGCTATGAAGGACA
AGCGCAATATCGTTTCTCTGAATTACGCTGTGCGTGAGAAAGAGAATAATGAAGATGATGCGACGCGTCTGG
CGCGTTTGAACGAACGCTTTAAACGCGAAGGTAAACCGGAGTTGAAGAAACTGGATGATCTACCGAAAGATT
ACCAGGAGCCGGATCCTTATCTGGATGAGACGGTGAATATCGCACTCGATCTGGCGAAGCTTGAAAAAGCCA
GACCCGCGGAACAACCCGCTCCCGTCAAGTAA

SEQ ID NO:4 is the DNA sequence of the wild-type Protease III gene.

ATGCCCCGCAGCACCTGGTTCAAAGCATTATTGTTGTTAGTTGCCCTTTGGGCACCCTTAAGTCAGGCAGAA
ACGGGATGGCAGCCGATTCAGGAAACCATCCGTAAAAGTGATAAAGATAACCGCCAGTATCAGGCTATACGT
CTGGATAACGGTATGGTGGTCTTGCTGGTTTCTGATCCGCAGGCAGTTAAATCGCTCTCGGCGCTGGTGGTG
CCCGTTGGGTCGCTGGAAGATCCCGAGGCGTACCAGGGGCTGGCACATTACCTTGAACATATGAGTCTGATG
GGGTCGAAAAAGTACCCGCAGGCTGACAGTCTGGCCGAATATCTCAAAATGCACGGCGGTAGTCACAATGCC
AGCACTGCGCCGTATCGCACGGCTTTCTATCTGGAAGTTGAGAACGACGCCTTGCCTGGTGCGGTAGACCGC
CTGGCCGATGCTATTGCTGAACCTTTGCTCGACAAGAAATATGCCGAACGTGAGCGTAATGCGGTGAACGCT
GAATTAACCATGGCGCGTACGCGTGACGGGATGCGCATGGCACAGGTCAGCGCAGAAACCATTAACCCGGCA
CACCCCGGTTCAAAGTTTTCTGGTGGTAACCTCGAAACTTTAAGCGACAAACCTGGTAATCCGGTGCAGCAG
GCGCTGAAAGATTTCCACGAGAAGTACTATTCCGCCAATTTGATGAAGGCGGTTATTTACAGTAATAAACCG
CTGCCGGAGTTGGCAAAAATGGCGGCGGACACCTTTGGTCGCGTGCCGAACAAAGAGAGCAAAAAACCGGAA
ATCACCGTGCCGGTAGTCACCGACGCGCAAAAGGGCATTATCATTCATTACGTCCCTGCGCTGCCGCGTAAA
GTGTTGCGCGTTGAGTTTCGCATCGATAACAACTCAGCGAAGTTCCGTAGTAAAACCGATGAATTGATTACC
TATCTGATTGGCAATCGCAGCCCAGGTACACTTTCTGACTGGCTGCAAAAGCAGGGATTAGTTGAGGGCATT
AGCGCCAACTCCGATCCTATCGTCAACGGCAACAGCGGCGTATTAGCGATCTCTGCGTCTTTAACCGATAAA
GGCCTGGCTAATCGCGATCAGGTTGTGGCGGCAATTTTTAGCTATCTCAATCTGTTACGTGAAAAAGGCATT

FIGURE 8C continued

GATAAACAATACTTCGATGAACTGGCGAATGTGCTGGATATCGACTTCCGTTATCCGTCGATCACCCGTGAT
ATGGATTACGTCGAATGGCTGGCAGATACCATGATTCGCGTTCCTGTTGAGCATACGCTGGATGCAGTCAAT
ATTGCCGATCGGTACGATGCTAAAGCAGTAAAGGAACGTCTGGCGATGATGACGCCGCAGAATGCGCGTATC
TGGTATATCAGCCCGAAAGAGCCGCACAACAAAACGGCTTACTTTGTCGATGCGCCGTATCAGGTCGATAAA
ATCAGCGCACAAACTTTCGCCGACTGGCAGAAAAAAGCCGCCGACATTGCGCTCTCTTTGCCAGAGCTTAAC
CCTTATATTCCTGATGATTTCTCGCTGATTAAGTCAGAGAAGAAATACGACCATCCAGAGCTGATTGTTGAT
GAGTCGAATCTGCGCGTGGTGTATGCGCCAAGCCGTTATTTTGCCAGCGAGCCCAAAGCTGATGTCAGCCTG
ATTTTGCGTAATCCGAAAGCCATGGACAGCGCCCGCAATCAGGTGATGTTTGCGCTCAATGATTATCTCGCA
GGGCTGGCGCTTGATCAGTTAAGCAACCAGGCGTCGGTTGGTGGCATAAGTTTTTCCACCAACGCTAACAAC
GGCCTTATGGTTAATGCTAATGGTTACACCCAGCGTCTGCCGCAGCTGTTCCAGGCATTGCTCGAGGGGTAC
TTTAGCTATACCGCTACGGAAGATCAGCTTGAGCAGGCGAAGTCCTGGTATAACCAGATGATGGATTCCGCA
GAAAAGGGTAAAGCGTTTGAGCAGGCGATTATGCCCGCGCAGATGCTCTCGCAAGTGCCGTACTTCTCGCGA
GATGAACGGCGTAAAATTTTGCCCTCCATTACGTTGAAAGAGGTGCTGGCCTATCGCGACGCCTTAAAATCA
GGGGCTCGACCAGAGTTTATGGTTATCGGCAACATGACCGAGGCCCAGGCAACAACGCTGGCACGCGATGTG
CAAAAACAGTTGGGCGCTGATGGTTCAGAGTGGTGTCGAAACAAAGATGTAGTGGTCGATAAAAAACAATCC
GTCATCTTTGAAAAAGCCGGTAACAGCACCGACTCCGCACTGGCAGCGGTATTTGTACCGACTGGCTACGAT
GAATACACCAGCTCAGCCTATAGCTCTCTGTTGGGGCAGATCGTACAGCCGTGGTTCTACAATCAGTTGCGT
ACCGAAGAACAATTGGGCTATGCCGTGTTTGCGTTTCCAATGAGCGTGGGGCGTCAGTGGGGCATGGGCTTC
CTTTTGCAAAGCAATGATAAACAGCCTTCATTCTTGTGGGAGCGTTACAAGGCGTTTTTCCCAACCGCAGAG
GCAAAATTGCGAGCGATGAAGCCAGATGAGTTTGCGCAAATCCAGCAGGCGGTAATTACCCAGATGCTGCAG
GCACCGCAAACGCTCGGCGAAGAAGCATCGAAGTTAAGTAAAGATTTCGATCGCGGCAATATGCGCTTCGAT
TCGCGTGATAAAATCGTGGCCCAGATAAAACTGCTGACGCCGCAAAAACTTGCTGATTTCTTCCATCAGGCG
GTGGTCGAGCCGCAAGGCATGGCTATTCTGTCGCAGATTTCCGGCAGCCAGAACGGGAAAGCCGAATATGTA
CACCCTGAAGGCTGGAAAGTGTGGGAGAACGTCAGCGCGTTGCAGCAAACAATGCCCCTGATGAGTGAAAAG
AATGAGTGA

SEQ ID NO:5 is the amino acid sequence of the wild-type Protease III protein.

MPRSTWFKALLLLVALWAPLSQAETGWQPIQETIRKSDKDNRQYQAIRLDNGMVVLLVSDPQAVKSLSALVV
PVGSLEDPEAYQGLAHYLEHMSLMGSKKYPQADSLAEYLKMHGGSHNASTAPYRTAFYLEVENDALPGAVDR
LADAIAEPLLDKKYAERERNAVNAELTMARTRDGMRMAQVSAETINPAHPGSKFSGGNLETLSDKPGNPVQQ
ALKDFHEKYYSANLMKAVIYSNKPLPELAKMAADTFGRVPNKESKKPEITVPVVTDAQKGIIIHYVPALPRK
VLRVEFRIDNNSAKFRSKTDELITYLIGNRSPGTLSDWLQKQGLVEGISANSDPIVNGNSGVLAISASLTDK
GLANRDQVVAAIFSYLNLLREKGIDKQYFDELANVLDIDFRYPSITRDMDYVEWLADTMIRVPVEHTLDAVN
IADRYDAKAVKERLAMMTPQNARIWYISPKEPHNKTAYFVDAPYQVDKISAQTFADWQKKAADIALSLPELN
PYIPDDFSLIKSEKKYDHPELIVDESNLRVVYAPSRYFASEPKADVSLILRNPKAMDSARNQVMFALNDYLA
GLALDQLSNQASVGGISFSTNANNGLMVNANGYTQRLPQLFQALLEGYFSYTATEDQLEQAKSWYNQMMDSA
EKGKAFEQAIMPAQMLSQVPYFSRDERRKILPSITLKEVLAYRDALKSGARPEFMVIGNMTEAQATTLARDV
QKQLGADGSEWCRNKDVVVDKKQSVIFEKAGNSTDSALAAVFVPTGYDEYTSSAYSSLLGQIVQPWFYNQLR
TEEQLGYAVFAFPMSVGRQWGMGFLLQSNDKQPSFLWERYKAFFPTAEAKLRAMKPDEFAQIQQAVITQMLQ
APQTLGEEASKLSKDFDRGNMRFDSRDKIVAQIKLLTPQKLADFFHQAVVEPQGMAILSQISGSQNGKAEYV
HPEGWKVWENVSALQQTMPLMSEKNE*

FIGURE 8D

SEQ ID NO:6 is the DNA sequence of a mutated knockout Protease III gene.

ATTCCCCGCAGCACCTGGTTCAAAGCATTATTGTTGTTAGTTGCCCTTTGGGCACATTAATGTCAGGCAGAA
ACGGGATGGCAGCCGATTCAGGAAACCATCCGTAAAAGTGATAAAGATAACCGCCAGTATCAGGCTATACGT
CTGGATAACGGTATGGTGGTCTTGCTGGTTTCTGATCCGCAGGCAGTTAAATCGCTCTCGGCGCTGGTGGTG
CCCGTTGGGTCGCTGGAAGATCCCGAGGCGTACCAGGGGCTGGCACATTACCTTGAACATATGAGTCTGATG
GGGTCGAAAAAGTACCCGCAGGCTGACAGTCTGGCCGAATATCTCAAAATGCACGGCGGTAGTCACAATGCC
AGCACTGCGCCGTATCGCACGGCTTTCTATCTGGAAGTTGAGAACGACGCCTTGCCTGGTGCGGTAGACCGC
CTGGCCGATGCTATTGCTGAACCTTTGCTCGACAAGAAATATGCCGAACGTGAGCGTAATGCGGTGAACGCT
GAATTAACCATGGCGCGTACGCGTGACGGGATGCGCATGGCACAGGTCAGCGCAGAAACCATTAACCCGGCA
CACCCCGGTTCAAAGTTTTCTGGTGGTAACCTCGAAACTTTAAGCGACAAACCTGGTAATCCGGTGCAGCAG
GCGCTGAAAGATTTCCACGAGAAGTACTATTCCGCCAATTTGATGAAGGCGGTTATTTACAGTAATAAACCG
CTGCCGGAGTTGGCAAAAATGGCGGCGGACACCTTTGGTCGCGTGCCGAACAAAGAGAGCAAAAAACCGGAA
ATCACCGTGCCGGTAGTCACCGACGCGCAAAAGGGCATTATCATTCATTACGTCCCTGCGCTGCCGCGTAAA
GTGTTGCGCGTTGAGTTTCGCATCGATAACAACTCAGCGAAGTTCCGTAGTAAAACCGATGAATTGATTACC
TATCTGATTGGCAATCGCAGCCCAGGTACACTTTCTGACTGGCTGCAAAAGCAGGGATTAGTTGAGGGCATT
AGCGCCAACTCCGATCCTATCGTCAACGGCAACAGCGGCGTATTAGCGATCTCTGCGTCTTTAACCGATAAA
GGCCTGGCTAATCGCGATCAGGTTGTGGCGGCAATTTTTAGCTATCTCAATCTGTTACGTGAAAAAGGCATT
GATAAACAATACTTCGATGAACTGGCGAATGTGCTGGATATCGACTTCCGTTATCCGTCGATCACCCGTGAT
ATGGATTACGTCGAATGGCTGGCAGATACCATGATTCGCGTTCCTGTTGAGCATACGCTGGATGCAGTCAAT
ATTGCCGATCGGTACGATGCTAAAGCAGTAAAGGAACGTCTGGCGATGATGACGCCGCAGAATGCGCGTATC
TGGTATATCAGCCCGAAAGAGCCGCACAACAAAACGGCTTACTTTGTCGATGCGCCGTATCAGGTCGATAAA
ATCAGCGCACAAACTTTCGCCGACTGGCAGAAAAAAGCCGCCGACATTGCGCTCTCTTTGCCAGAGCTTAAC
CCTTATATTCCTGATGATTTCTCGCTGATTAAGTCAGAGAAGAAATACGACCATCCAGAGCTGATTGTTGAT
GAGTCGAATCTGCGCGTGGTGTATGCGCCAAGCCGTTATTTTGCCAGCGAGCCCAAAGCTGATGTCAGCCTG
ATTTTGCGTAATCCGAAAGCCATGGACAGCGCCCGCAATCAGGTGATGTTTGCGCTCAATGATTATCTCGCA
GGGCTGGCGCTTGATCAGTTAAGCAACCAGGCGTCGGTTGGTGGCATAAGTTTTTCCACCAACGCTAACAAC
GGCCTTATGGTTAATGCTAATGGTTACACCCAGCGTCTGCCGCAGCTGTTCCAGGCATTGCTCGAGGGGTAC
TTTAGCTATACCGCTACGGAAGATCAGCTTGAGCAGGCGAAGTCCTGGTATAACCAGATGATGGATTCCGCA
GAAAAGGGTAAAGCGTTTGAGCAGGCGATTATGCCCGCGCAGATGCTCTCGCAAGTGCCGTACTTCTCGCGA
GATGAACGGCGTAAAATTTTGCCCTCCATTACGTTGAAAGAGGTGCTGGCCTATCGCGACGCCTTAAAATCA
GGGGCTCGACCAGAGTTTATGGTTATCGGCAACATGACCGAGGCCCAGGCAACAACGCTGGCACGCGATGTG
CAAAAACAGTTGGGCGCTGATGGTTCAGAGTGGTGTCGAAACAAAGATGTAGTGGTCGATAAAAAACAATCC
GTCATCTTTGAAAAAGCCGGTAACAGCACCGACTCCGCACTGGCAGCGGTATTTGTACCGACTGGCTACGAT
GAATACACCAGCTCAGCCTATAGCTCTCTGTTGGGGCAGATCGTACAGCCGTGGTTCTACAATCAGTTGCGT
ACCGAAGAACAATTGGGCTATGCCGTGTTTGCGTTTCCAATGAGCGTGGGGCGTCAGTGGGGCATGGGCTTC
CTTTTGCAAAGCAATGATAAACAGCCTTCATTCTTGTGGGAGCGTTACAAGGCGTTTTTCCCAACCGCAGAG
GCAAAATTGCGAGCGATGAAGCCAGATGAGTTTGCGCAAATCCAGCAGGCGGTAATTACCCAGATGCTGCAG
GCACCGCAAACGCTCGGCGAAGAAGCATCGAAGTTAAGTAAAGATTTCGATCGCGGCAATATGCGCTTCGAT
TCGCGTGATAAAATCGTGGCCCAGATAAAACTGCTGACGCCGCAAAAACTTGCTGATTTCTTCCATCAGGCG
GTGGTCGAGCCGCAAGGCATGGCTATTCTGTCGCAGATTTCCGGCAGCCAGAACGGGAAAGCCGAATATGTA
CACCCTGAAGGCTGGAAAGTGTGGGAGAACGTCAGCGCGTTGCAGCAAACAATGCCCCTGATGAGTGAAAAG
AATGAGTGA

FIGURE 8E

SEQ ID NO:7 is the DNA sequence of the wild-type DegP gene.

ATGAAAAAAACCACATTAGCACTGAGTGCACTGGCTCTGAGTTTAGGTTTGGCGTTATCTCCGCTCTCTGCA
ACGGCGGCTGAGACTTCTTCAGCAACGACAGCCCAGCAGATGCCAAGCCTTGCACCGATGCTCGAAAAGGTG
ATGCCTTCAGTGGTCAGCATTAACGTAGAAGGTAGCACAACCGTTAATACGCCGCGTATGCCGCGTAATTTC
CAGCAGTTCTTCGGTGATGATTCTCCGTTCTGCCAGGAAGGTTCTCCGTTCCAGAGCTCTCCGTTCTGCCAG
GGTGGCCAGGGCGGTAATGGTGGCGGCCAGCAACAGAAATTCATGGCGCTGGGTTCCGGCGTCATCATTGAT
GCCGATAAAGGCTATGTCGTCACCAACAACCACGTTGTTGATAACGCGACGGTCATTAAAGTTCAACTGAGC
GATGGCCGTAAGTTCGACGCGAAGATGGTTGGCAAAGATCCGCGCTCTGATATCGCGCTGATCCAAATCCAG
AACCCGAAAAACCTGACCGCAATTAAGATGGCGGATTCTGATGCACTGCGCGTGGGTGATTACACCGTAGCG
ATTGGTAACCCGTTTGGTCTGGGCGAGACGGTAACTTCCGGGATTGTCTCTGCGCTGGGGCGTAGCGGCCTG
AATGCCGAAAACTACGAAAACTTCATCCAGACCGATGCAGCGATCAACCGTGGTAACTCCGGTGGTGCGCTG
GTTAACCTGAACGGCGAACTGATCGGTATCAACACCGCGATCCTCGCACCGGACGGCGGCAACATCGGTATC
GGTTTTGCTATCCCGAGTAACATGGTGAAAAACCTGACCTCGCAGATGGTGGAATACGGCCAGGTGAAACGC
GGTGAGCTGGGTATTATGGGGACTGAGCTGAACTCCGAACTGGCGAAAGCGATGAAAGTTGACGCCCAGCGC
GGTGCTTTCGTAAGCCAGGTTCTGCCTAATTCCTCCGCTGCAAAAGCGGGCATTAAAGCGGGTGATGTGATC
ACCTCACTGAACGGTAAGCCGATCAGCAGCTTTGCCGCACTGCGTGCTCAGGTGGGTACTATGCCGGTAGGC
AGCAAACTGACCCTGGGCTTACTGCGCGACGGTAAGCAGGTTAACGTGAACCTGGAACTGCAGCAGAGCAGC
CAGAATCAGGTTGATTCCAGCTCCATCTTCAACGGCATTGAAGGCGCTGAGATGAGCAACAAAGGCAAAGAT
CAGGGCGTGGTAGTGAACAACGTGAAAACGGGCACTCCGGCTGCGCAGATCGGCCTGAAGAAAGGTGATGTG
ATTATTGGCGCGAACCAGCAGGCAGTGAAAAACATCGCTGAACTGCGTAAAGTTCTCGACAGCAAACCGTCT
GTGCTGGCACTCAACATTCAGCGCGGCGACAGCACCATCTACCTGTTAATGCAGTAA

SEQ ID NO:8 is the amino acid sequence of the wild-type DegP protein.

MKKTTLALSALALSLGLALSPLSATAAETSSATTAQQMPSLAPMLEKVMPSVVSINVEGSTTVNTPRMPRNF
QQFFGDDSPFCQEGSPFQSSPFCQGGQGGNGGGQQQKFMALGSGVIIDADKGYVVTNNHVVDNATVIKVQLS
DGRKFDAKMVGKDPRSDIALIQIQNPKNLTAIKMADSDALRVGDYTVAIGNPFGLGETVTSGIVSALGRSGL
NAENYENFIQTDAAINRGNSGGALVNLNGELIGINTAILAPDGGNIGIGFAIPSNMVKNLTSQMVEYGQVKR
GELGIMGTELNSELAKAMKVDAQRGAFVSQVLPNSSAAKAGIKAGDVITSLNGKPISSFAALRAQVGTMPVG
SKLTLGLLRDGKQVNVNLELQQSSQNQVDSSSIFNGIEGAEMSNKGKDQGVVVNNVKTGTPAAQIGLKKGDV
IIGANQQAVKNIAELRKVLDSKPSVLALNIQRGDSTIYLLMQ

SEQ ID NO:9 is the DNA sequence of a mutated DegP gene.

ATGAAAAAAACCACATTAGCACTGAGTGCACTGGCTCTGAGTTTAGGTTTGGCGTTATCTCCGCTCTCTGCA
ACGGCGGCTGAGACTTCTTCAGCAACGACAGCCCAGCAGATGCCAAGCCTTGCACCGATGCTCGAAAAGGTG
ATGCCTTCAGTGGTCAGCATTAACGTAGAAGGTAGCACAACCGTTAATACGCCGCGTATGCCGCGTAATTTC
CAGCAGTTCTTCGGTGATGATTCTCCGTTCTGCCAGGAAGGTTCTCCGTTCCAGAGCTCTCCGTTCTGCCAG
GGTGGCCAGGGCGGTAATGGTGGCGGCCAGCAACAGAAATTCATGGCGCTGGGTTCCGGCGTCATCATTGAT
GCCGATAAAGGCTATGTCGTCACCAACAACCACGTTGTTGATAACGCGACGGTCATTAAAGTTCAACTGAGC
GATGGCCGTAAGTTCGACGCGAAGATGGTTGGCAAAGATCCGCGCTCTGATATCGCGCTGATCCAAATCCAG
AACCCGAAAAACCTGACCGCAATTAAGATGGCGGATTCTGATGCACTGCGCGTGGGTGATTACACCGTAGCG
ATTGGTAACCCGTTTGGTCTGGGCGAGACGGTAACTTCCGGGATTGTCTCTGCGCTGGGGCGTAGCGGCCTG
AATGCCGAAAACTACGAAAACTTCATCCAGACCGATGCAGCGATTAATCGTGGTAACGCCGGTGGTGCGCTG
GTTAACCTGAACGGCGAACTGATCGGTATCAACACCGCGATCCTCGCACCGGACGGCGGCAACATCGGTATC
GGTTTTGCTATCCCGAGTAACATGGTGAAAAACCTGACCTCGCAGATGGTGGAATACGGCCAGGTGAAACGC
GGTGAGCTGGGTATTATGGGGACTGAGCTGAACTCCGAACTGGCGAAAGCGATGAAAGTTGACGCCCAGCGC
GGTGCTTTCGTAAGCCAGGTTCTGCCTAATTCCTCCGCTGCAAAAGCGGGCATTAAAGCGGGTGATGTGATC
ACCTCACTGAACGGTAAGCCGATCAGCAGCTTTGCCGCACTGCGTGCTCAGGTGGGTACTATGCCGGTAGGC
AGCAAACTGACCCTGGGCTTACTGCGCGACGGTAAGCAGGTTAACGTGAACCTGGAACTGCAGCAGAGCAGC
CAGAATCAGGTTGATTCCAGCTCCATCTTCAACGGCATTGAAGGCGCTGAGATGAGCAACAAAGGCAAAGAT
CAGGGCGTGGTAGTGAACAACGTGAAAACGGGCACTCCGGCTGCGCAGATCGGCCTGAAGAAAGGTGATGTG
ATTATTGGCGCGAACCAGCAGGCAGTGAAAAACATCGCTGAACTGCGTAAAGTTCTCGACAGCAAACCGTCT
GTGCTGGCACTCAACATTCAGCGCGGCGACAGCACCATCTACCTGTTAATGCAGTAA

FIGURE 8F

SEQ ID NO:10 is the amino acid sequence of a mutated DegP protein.

MKKTTLALSALALSLGLALSPLSATAAETSSATTAQQMPSLAPMLEKVMPSVVSINVEGSTTVNTPRMPRNF
QQFFGDDSPFCQEGSPFQSSPFCQGGQGGNGGGQQQKFMALGSGVIIDADKGYVVTNNHVVDNATVIKVQLS
DGRKFDAKMVGKDPRSDIALIQIQNPKNLTAIKMADSDALRVGDYTVAIGNPFGLGETVTSGIVSALGRSGL
NAENYENFIQTDAAINRGNAGGALVNLNGELIGINTAILAPDGGNIGIGFAIPSNMVKNLTSQMVEYGQVKR
GELGIMGTELNSELAKAMKVDAQRGAFVSQVLPNSSAAKAGIKAGDVITSLNGKPISSFAALRAQVGTMPVG
SKLTLGLLRDGKQVNVNLELQQSSQNQVDSSSIFNGIEGAEMSNKGKDQGVVVNNVKTGTPAAQIGLKKGDV
IIGANQQAVKNIAELRKVLDSKPSVLALNIQRGDSTIYLLMQ

SEQ ID NO: 11 is the sequence of the 5' oligonucleotide primer for the region of the mutated DegP gene comprising the Ase I restriction site.

CTGCCTGCGATTTTCGCCGGAACG

SEQ ID NO: 12 is the sequence of the 3' oligonucleotide primer for the region of the mutated DegP gene comprising the Ase I restriction site.

CGCATGGTACGTGCCACGATATCC

SEQ ID NO: 13 is the sequence of the 5' oligonucleotide primer for the region of the mutated Tsp gene comprising the Ase I restriction site.

GGGAAATGAACCTGAGCAAAACGC

SEQ ID NO: 14 is the sequence of the 3' oligonucleotide primer for the region of the mutated Protease III gene comprising the Ase I restriction site.

GGGAAAGGCGGCGGAACCGCCTAG

SEQ ID NO: 15 is the sequence of the 5' oligonucleotide primer for the region of the mutated Protease III gene comprising the Ase I restriction site.

CTACTGTGCCAGCGGTGGTAATGG

SEQ ID NO: 16 is the sequence of the 3' oligonucleotide primer for the region of the mutated Tsp gene comprising the Ase I restriction site.

GCATCATAATTTTCTTTTTACCTC

SEQ ID NO: 17 is the DNA sequence of the wild-type spr gene.

ATGGTCAAATCTCAACCGATTTTGAGATATATCTTGCGCGGGATTCCCGCGATTGCAGTAGCGGTTCTGCTT
TCTGCATGTAGTGCAAATAACACCGCAAAGAATATGCATCCTGAGACACGTGCAGTGGGTAGTGAAACATCA
TCACTGCAAGCTTCTCAGGATGAATTTGAAAACCTGGTTCGTAATGTCGACGTAAAATCGCGAATTATGGAT
CAGTATGCTGACTGGAAAGGCGTACGTTATCGTCTGGGCGGCAGCACTAAAAAAGGTATCGATTGTTCTGGT
TTCGTACAGCGTACATTCCGTGAGCAATTTGGCTTAGAACTTCCGCGTTCGACTTACGAACAGCAGGAAATG
GGTAAATCTGTTTCCCGCAGTAATTTGCGTACGGGTGATTTAGTTCTGTTCCGTGCCGGTTCAACGGGACGC
CATGTCGGTATTTATATCGGCAACAATCAGTTTGTCCATGCTTCCACCAGCAGTGGTGTTATTATTTCCAGC
ATGAATGAACCGTACTGGAAGAAGCGTTACAACGAAGCACGCCGGGTTCTCAGCCGCAGC

FIGURE 8G

SEQ ID NO: 18 is the amino acid sequence of the wild-type spr gene including the signal sequence which is the first 26 amino acid residues.

MVKSQPILRYILRGIPAIAVAVLLSACSANNTAKNMHPETRAVGSETSSLQASQDEFENLVRNVDVKSRIMD
QYADWKGVRYRLGGSTKKGIDCSGFVQRTFREQFGLELPRSTYEQQEMGKSVSRSNLRTGDLVLFRAGSTGR
HVGIYIGNNQFVHASTSSGVIISSMNEPYWKKRYNEARRVLSRS

SEQ ID NO: 19 the non-mutated spr gene without the signal sequence.

CSANNTAKNMHPETRAVGSETSSLQASQDEFENLVRNVDVKSRIMDQYADWKGVRYRLGGSTKKGIDCSGFV
QRTFREQFGLELPRSTYEQQEMGKSVSRSNLRTGDLVLFRAGSTGRHVGIYIGNNQFVHASTSSGVIISSMN
EPYWKKRYNEARRVLSRS

SEQ ID NO: 20 a mutated OmpT sequence comprising D210A and H212A mutations.

ATGCGGGCGAAACTTCTGGGAATAGTCCTGACAACCCCTATTGCGATCAGCTCTTTTGCTTCTACCGAGACT
TTATCGTTTACTCCTGACAACATAAATGCGGACATTAGTCTTGGAACTCTGAGCGGAAAAACAAAAGAGCGT
GTTTATCTAGCCGAAGAAGGAGGCCGAAAAGTCAGTCAACTCGACTGGAAATTCAATAACGCTGCAATTATT
AAAGGTGCAATTAATTGGGATTTGATGCCCCAGATATCTATCGGGGCTGCTGGCTGGACAACTCTCGGCAGC
CGAGGTGGCAATATGGTCGATCAGGACTGGATGGATTCCAGTAACCCCGGAACCTGGACGGATGAAAGTAGA
CACCCTGATACACAACTCAATTATGCCAACGAATTTGATCTGAATATCAAAGGCTGGCTCCTCAACGAACCC
AATTACCGCCTGGGACTCATGGCCGGATATCAGGAAAGCCGTTATAGCTTTACAGCCAGAGGTGGTTCCTAT
ATCTACAGTTCTGAGGAGGGATTCAGAGATGATATCGGCTCCTTCCCGAATGGAGAAAGAGCAATCGGCTAC
AAACAACGTTTTAAAATGCCCTACATTGGCTTGACTGGAAGTTATCGTTATGAAGATTTTGAACTCGGTGGC
ACATTTAAATACAGCGGCTGGGTGGAATCATCTGATAACGCTGAAGCTTATGACCCGGGAAAAAGAATCACT
TATCGCAGTAAGGTCAAAGACCAAAATTACTATTCTGTTGCAGTCAATGCAGGTTATTACGTCACACCTAAC
GCAAAAGTTTATGTTGAAGGCGCATGGAATCGGGTTACGAATAAAAAAGGTAATACTTCACTTTATGATCAC
AATAATAACACTTCAGACTACAGCAAAAATGGAGCAGGTATAGAAAACTATAACTTCATCACTACTGCTGGT
CTTAAGTACACATTTTAA

SEQ ID NO: 21 a mutated OmpT sequence comprising D210A and H212A mutations.

MRAKLLGIVLTTPIAISSFASTETLSFTPDNINADISLGTLSGKTKERVYLAEEGGRKVSQLDWKFNNAAII
KGAINWDLMPQISIGAAGWTTLGSRGGNMVDQDWMDSSNPGTWTDESRHPDTQLNYANEFDLNIKGWLLNEP
NYRLGLMAGYQESRYSFTARGGSYIYSSEEGFRDDIGSFPNGERAIGYKQRFKMPYIGLTGSYRYEDFELGG
TFKYSGWVESSDNAEAYDPGKRITYRSKVKDQNYYSVAVNAGYYVTPNAKVYVEGAWNRVTNKKGNTSLYDH
NNNTSDYSKNGAGIENYNFITTAGLKYTF

SEQ ID NO: 22 is the nucleotide sequence of a mutated knockout OmpT sequence.

ATTCGGGCGAAACTTCTGGGAATAGTCCTGACAACCCCTATTGCGATCAGCTCTTTTGCTTCTACCGAGACT
TTATCGTTTACTCCTGACAACATAAATGCGGACATTAGTCTTGGAACTCTGAGCGGAAAAACAAAAGAGCGT
GTTTATCTAGCCGAAGAAGGAGGCCGAAAAGTCAGTCAACTCGACTGGAAATTCAATAACGCTGCAATTATT
AAAGGTGCAATTAATTGGGATTTGATGCCCCAGATATCTATCGGGGCTGCTGGCTGGACAACTCTCGGCAGC
CGAGGTGGCAATATGGTCGATCAGGACTGGATGGATTCCAGTAACCCCGGAACCTGGACGGATGAAAGTAGA
CACCCTGATACACAACTCAATTATGCCAACGAATTTGATCTGAATATCAAAGGCTGGCTCCTCAACGAACCC
AATTACCGCCTGGGACTCATGGCCGGATATCAGGAAAGCCGTTATAGCTTTACAGCCAGAGGTGGTTCCTAT
ATCTACAGTTCTGAGGAGGGATTCAGAGATGATATCGGCTCCTTCCCGAATGGAGAAAGAGCAATCGGCTAC
AAACAACGTTTTAAAATGCCCTACATTGGCTTGACTGGAAGTTATCGTTATGAAGATTTTGAACTCGGTGGC
ACATTTAAATACAGCGGCTGGGTGGAATCATCTGATAACGATGAACACTATGACCCGGGAAAAAGAATCACT
TATCGCAGTAAGGTCAAAGACCAAAATTACTATTCTGTTGCAGTCAATGCAGGTTATTACGTCACACCTAAC
GCAAAAGTTTATGTTGAAGGCGCATGGAATCGGGTTACGAATAAAAAAGGTAATACTTCACTTTATGATCAC
AATAATAACACTTCAGACTACAGCAAAAATGGAGCAGGTATAGAAAACTATAACTTCATCACTACTGCTGGT
CTTAAGTACACATTTTAA

FIGURE 8H

SEQ ID NO: 23 shows the sequence of the OmpA oligonucleotide adapter.
CGATTGAATGGAGAACTTGAATTCGGGCGAAACTTCTGGGAATAG

SEQ ID NO: 24 shows a cassette encoding intergenic sequence 1 (IGS1) for E. coli Fab expression.
AAGTTTTAATAGAGGAGAGTGTTAATGAAGAAG

SEQ ID NO: 25 shows the oligonucleotide cassette encoding intergenic sequence 2 (IGS2) for E. coli Fab expression.
AAGTTTTAATAGAGGGGAGTGTTAAAATGAAGAAG

SEQ ID NO: 26 shows a cassette encoding intergenic sequence 3 (IGS3) for E. coli Fab expression.
AAGCTTTAATAGAGGAGAGTGTTGAGGAGGAAAAAAAAATGAAGAAA

SEQ ID NO: 27 shows a cassette encoding intergenic sequence 4 (IGS4) for E. coli Fab expression.
AAGCTTTAATAGAGGAGAGTGTTGACGAGGATTATATAATGAAGAAA

SEQ ID NO: 28 is the DNA sequence of the wild-type FkpA gene.
ATGAAATCACTGTTTAAAGTAACGCTGCTGGCGACCACAATGGCCGTTGCCCTGCATGCACCAATCACTTTT
GCTGCTGAAGCTGCAAAACCTGCTACAGCTGCTGACAGCAAAGCAGCGTTCAAAAATGACGATCAGAAATCA
GCTTATGCACTGGGTGCCTCGCTGGGTCGTTACATGGAAAACTCTCTAAAAGAACAAGAAAAACTGGGCATC
AAACTGGATAAAGATCAGCTGATCGCTGGTGTTCAGGATGCATTTGCTGATAAGAGCAAACTCTCCGACCAA
GAGATCGAACAGACTCTACAAGCATTCGAAGCTCGCGTGAAGTCTTCTGCTCAGGCGAAGATGGAAAAAGAC
GCGGCTGATAACGAAGCAAAAGGTAAAGAGTACCGCGAGAAATTTGCCAAAGAGAAAGGTGTGAAAACCTCT
TCAACTGGTCTGGTTTATCAGGTAGTAGAAGCCGGTAAAGGCGAAGCACCGAAAGACAGCGATACTGTTGTA
GTGAACTACAAAGGTACGCTGATCGACGGTAAAGAGTTCGACAACTCTTACACCCGTGGTGAACCGCTTTCT
TTCCGTCTGGACGGTGTTATCCCGGGTTGGACAGAAGGTCTGAAGAACATCAAGAAAGGCGGTAAGATCAAA
CTGGTTATTCCACCAGAACTGGCTTACGGCAAAGCGGGTGTTCCGGGGATCCCACCGAATTCTACCCTGGTG
TTTGACGTAGAGCTGCTGGATGTGAAACCAGCGCCGAAGGCTGATGCAAAGCCGGAAGCTGATGCGAAAGCC
GCAGATTCTGCTAAAAAA

SEQ ID NO: 29 is the protein sequence of the wild-type FkpA gene.
MKSLFKVTLLATTMAVALHAPITFAAEAAKPATAADSKAAFKNDDQKSAYALGASLGRYMENSLKEQEKLGI
KLDKDQLIAGVQDAFADKSKLSDQEIEQTLQAFEARVKSSAQAKMEKDAADNEAKGKEYREKFAKEKGVKTS
STGLVYQVVEAGKGEAPKDSDTVVVNYKGTLIDGKEFDNSYTRGEPLSFRLDGVIPGWTEGLKNIKKGGKIK
LVIPPELAYGKAGVPGIPPNSTLVFDVELLDVKPAPKADAKPEADAKAADSAKK

SEQ ID NO: 30 is the DNA sequence of the FkpA his tagged gene.
ATGAAATCACTGTTTAAAGTAACGCTGCTGGCGACCACAATGGCCGTTGCCCTGCACGCACCAATCACTTTT
GCTGCTGAAGCTGCAAAACCTGCTACTGCTGCTGACAGCAAAGCAGCGTTCAAAAATGACGATCAGAAATCA
GCTTATGCACTGGGTGCCTCGCTGGGTCGTTACATGGAAAACTCTCTAAAAGAACAAGAAAAACTGGGCATC
AAACTGGATAAAGATCAACTGATCGCTGGTGTTCAGGATGCATTTGCTGATAAGAGCAAACTCTCCGACCAA
GAGATCGAACAGACTCTACAAGCATTTGAAGCTCGCGTGAAGTCTTCTGCTCAGGCGAAGATGGAAAAAGAC
GCGGCTGATAACGAAGCAAAAGGTAAAGAGTACCGCGAGAAATTTGCCAAAGAGAAAGGTGTGAAAACCTCT
TCAACTGGTCTGGTTTATCAGGTAGTAGAAGCCGGTAAAGGCGAAGCACCGAAAGACAGCGATACTGTTGTA
GTGAACTACAAAGGTACGCTGATCGACGGTAAAGAGTTCGACAACTCTTACACCCGTGGTGAACCGCTTTCT
TTCCGTCTGGACGGTGTTATCCCGGGTTGGACAGAAGGTCTGAAGAACATCAAGAAAGGCGGTAAGATAAAA
CTGGTTATTCCACCAGAACTGGCTTACGGCAAAGCGGGTGTTCCGGGGATTCCACCAAATTCTACCCTGGTG
TTTGACGTAGAGCTGCTGGATGTGAAACCAGCGCCGAAGGCTGATGCAAAGCCGGAAGCTGATGCGAAAGCC
GCAGATTCTGCTAAAAAACACCATCACCATCACCAC

FIGURE 8I

SEQ ID NO: 31 is the protein sequence of the FkpA his tagged gene.
MKSLFKVTLLATTMAVALHAPITFAAEAAKPATAADSKAAFKNDDQKSAYALGASLGRYMENSLKEQEKLGI
KLDKDQLIAGVQDAFADKSKLSDQEIEQTLQAFEARVKSSAQAKMEKDAADNEAKGKEYREKFAKEKGVKTS
STGLVYQVVEAGKGEAPKDSDTVVVNYKGTLIDGKEFDNSYTRGEPLSFRLDGVIPGWTEGLKNIKKGGKIK
LVIPPELAYGKAGVPGIPPNSTLVFDVELLDVKPAPKADAKPEADAKAADSAKKHHHHHH

SEQ ID NO: 32 is the DNA sequence of the wild-type skp gene.
GTGAAAAAGTGGTTATTAGCTGCAGGTCTCGGTTTAGCACTGGCAACTTCTGCTCAGGCGGCTGACAAAATT
GCAATCGTCAACATGGGCAGCCTGTTCCAGCAGGTAGCGCAGAAAACCGGTGTTTCTAACACGCTGGAAAAT
GAGTTCAAAGGCCGTGCCAGCGAACTGCAGCGTATGGAAACCGATCTGCAGGCTAAAATGAAAAAGCTGCAG
TCCATGAAAGCGGGCAGCGATCGCACTAAGCTGGAAAAAGACGTGATGGCTCAGCGCCAGACTTTTGCTCAG
AAAGCGCAGGCTTTTGAGCAGGATCGCGCACGTCGTTCCAACGAAGAACGCGGCAAACTGGTTACTCGTATC
CAGACTGCTGTGAAATCCGTTGCCAACAGCCAGGATATCGATCTGGTTGTTGATGCAAACGCCGTTGCTTAC
AACAGCAGCGATGTAAAAGACATCACTGCCGACGTACTGAAACAGGTTAAATAA

SEQ ID NO: 33 is the protein sequence of the wild-type skp gene.
MKKWLLAAGLGLALATSAQAADKIAIVNMGSLFQQVAQKTGVSNTLENEFKGRASELQRMETDLQAKMKKLQ
SMKAGSDRTKLEKDVMAQRQTFAQKAQAFEQDRARRSNEERGKLVTRIQTAVKSVANSQDIDLVVDANAVAY
NSSDVKDITADVLKQVK

SEQ ID NO: 34 is the DNA sequence of the skp his tagged gene.
ATGAAAAAGTGGTTATTAGCCGCAGGTCTCGGTTTAGCACTGGCAACTTCTGCTCAGGCGGCTGACAAAATT
GCAATCGTCAACATGGGCAGCCTGTTCCAGCAGGTAGCGCAGAAAACCGGTGTTTCTAACACGCTGGAAAAT
GAGTTCAAAGGCCGTGCCAGCGAACTCCAGCGTATGGAAACCGATCTCCAGGCTAAAATGAAAAAGCTGCAA
TCCATGAAAGCGGGCAGCGATCGCACTAAGCTGGAAAAAGACGTGATGGCTCAGCGCCAGACTTTTGCTCAG
AAAGCGCAGGCTTTTGAGCAGGATCGCGCACGTCGTTCCAACGAAGAACGCGGCAAACTGGTTACTCGTATC
CAGACTGCTGTGAAATCCGTTGCCAACAGCCAGGAAATCGATCTGGTTGTTGATGCAAACGCCGTTGCTTAC
AACAGCAGCGATGTAAAAGACATCACTGCCGACGTACTGAAACAGGTTAAACACCATCACCATCACCAC

SEQ ID NO: 35 is the protein sequence of the skp his tagged gene.
MKKWLLAAGLGLALATSAQAADKIAIVNMGSLFQQVAQKTGVSNTLENEFKGRASELQRMETDLQAKMKKLQ
SMKAGSDRTKLEKDVMAQRQTFAQKAQAFEQDRARRSNEERGKLVTRIQTAVKSVANSQEIDLVVDANAVAY
NSSDVKDITADVLKQVKHHHHHH

CA170_1519 Ab sequences

CDRH1
GFTFSNYGMV SEQ ID NO: 36

CDRH2
YIDSDGDNTYYRDSVKG SEQ ID NO: 37

CDRH3
GIVRPFLY SEQ ID NO: 38

CDRL1
KSSQSLVGASGKTYLY SEQ ID NO: 39

CDRL2
LVSTLDS SEQ ID NO: 40

CDRL3
LQGTHFPHT SEQ ID NO: 41

FIGURE 8J

Rat Ab 1519 VL region SEQ ID NO: 42

DVVMTQTPLS LSVALGQPAS ISCKSSQSLV GASGKTYLYW LFQRSGQSPK RLIYLVSTLD
SGIPDRFSGS GAETDFTLKI RRVEADDLGV YYCLQGTHFP HTFGAGTKLE LK

Rat Ab 1519 VL region SEQ ID NO: 43

gatgttgtga tgacccagac tccactgtct ttgtcggttg cccttggaca accagcctcc
atctcttgca agtcaagtca gagcctcgta ggtgctagtg gaaagacata tttgtattgg
ttatttcaga ggtccggcca gtctccaaag cgactaatct atctggtgtc cacactggac
tctggaattc ctgataggtt cagtggcagt ggagcagaga cagattttac tcttaaaatc
cgcagagtgg aagccgatga tttgggagtt tattactgct tgcaaggtac acattttcct
cacacgtttg gagctgggac caagctggaa ttgaaa

Rat Ab 1519 VL region with signal sequence underlined and italicised SEQ ID NO: 44

*MMSPAQFLFLLMLWIQGTSG*DVVMTQTPLSLSVALGQPASISCKSSQSLVGASGKTYLYWLFQRSGQSPK
RLIYLVSTLDSGIPDRFSGSGAETDFTLKIRRVEADDLGVYYCLQGTHFPHTFGAGTKLELK

Rat Ab 1519 VL region with signal sequence underlined and italicised SEQ ID NO: 45

atgatgagtc ctgcccagtt cctgtttctg ctgatgctct ggattcaggg aaccagtggt
gatgttgtga tgacccagac tccactgtct ttgtcggttg cccttggaca accagcctcc
atctcttgca agtcaagtca gagcctcgta ggtgctagtg gaaagacata tttgtattgg
ttatttcaga ggtccggcca gtctccaaag cgactaatct atctggtgtc cacactggac
tctggaattc ctgataggtt cagtggcagt ggagcagaga cagattttac tcttaaaatc
cgcagagtgg aagccgatga tttgggagtt tattactgct tgcaaggtac acattttcct
cacacgtttg gagctgggac caagctggaa ttgaaa

Rat Ab 1519 VH region SEQ ID NO: 46

EVPLVESGGG SVQPGRSMKL SCVVSGFTFS NYGMVWVRQA PKKGLEWVAY IDSDGDNTYY
RDSVKGRFTI SRNNAKSTLY LQMDSLRSED TATYYCTTGI VRPFLYWGQG TTVTVS

Rat Ab 1519 VH region SEQ ID NO: 47

gaggtgccgc tggtggagtc tgggggcggc tcagtgcagc ctgggaggtc catgaaactc
tcctgtgtag tctcaggatt cactttcagt aattatggca tggtctgggt ccgccaggct
ccaaagaagg gtctggagtg ggtcgcatat attgattctg atggtgataa tacttactac
cgagattccg tgaagggccg attcactatc tccagaaata atgcaaaaag caccctatat
ttgcaaatgg acagtctgag gtctgaggac acggccactt attactgtac aacagggatt
gtccggccct ttctctattg gggccaagga accacggtca ccgtctcg

Rat Ab 1519 VH region with signal sequence underlined and italicised SEQ ID NO: 48

*MDISLSLAFL VLFIKGVRC*E VPLVESGGGS VQPGRSMKLS CVVSGFTFSN YGMVWVRQAP
KKGLEWVAYI DSDGDNTYYR DSVKGRFTIS RNNAKSTLYL QMDSLRSEDT ATYYCTTGIV
RPFLYWGQGT TVTVS

Rat Ab 1519 VH region with signal sequence underlined and italicised SEQ ID NO: 49

*atggacatca gtctcagctt ggctttcctt gtccttttca taaaaggtgt ccggtgt*gag
gtgccgctgg tggagtctgg gggcggctca gtgcagcctg ggaggtccat gaaactctcc
tgtgtagtct caggattcac tttcagtaat tatggcatgg tctgggtccg ccaggctcca
aagaagggtc tggagtgggt cgcatatatt gattctgatg gtgataatac ttactaccga
gattccgtga agggccgatt cactatctcc agaaataatg caaaaagcac cctatatttg
caaatggaca gtctgaggtc tgaggacacg gccacttatt actgtacaac agggattgtc
cggccctttc tctattgggg ccaaggaacc acggtcaccg tctcg

FIGURE 8K

1519 gL20 V-region SEQ ID NO: 50
DIQMTQSPSS LSASVGDRVT ITCKSSQSLV GASGKTYLYW LFQKPGKAPK RLIYLVSTLD
SGIPSRFSGS GSGTEFTLTI SSLQPEDFAT YYCLQGTHFP HTFGQGTKLE IK

1519 gL20 V-region SEQ ID NO: 51
gatatccaga tgacccagag tccaagcagt ctctccgcca gcgtaggcga tcgtgtgact
attacctgta aaagctccca gtccctggtg ggtgcaagcg gcaaaaccta cctgtactgg
ctcttccaga aaccgggcaa agctccgaaa cgcctgatct atctggtgtc taccctggat
agcggtattc cgtctcgttt ctccggtagc ggtagcggta ccgaattcac gctgaccatt
agctccctcc agccggagga ctttgctacc tattactgcc tccagggcac tcattttccg
cacactttcg gccagggtac caaactggaa atcaaa

1519 gL20 V-region with signal sequence underlined and italicized SEQ ID NO: 52
*MKKTAIAIAVALAGFATVAQA*DIQMTQSPSSLSASVGDRVTITCKSSQSLVGASGKTYLYWLFQKPGKAPKR
LIYLVSTLDSGIPSRFSGSGSGTEFTLTISSLQPEDFATYYCLQGTHFPHTFGQGTKLEIK

1519 gL20 V-region with signal sequence underlined and italicized SEQ ID NO: 53
atgaaaaaga cagctatcgc aattgcagtg gccttggctg gtttcgctac cgtagcgcaa
*gct*gatatcc agatgaccca gagtccaagc agtctctccg ccagcgtagg cgatcgtgtg
actattacct gtaaaagctc ccagtccctg gtgggtgcaa gcggcaaaac ctacctgtac
tggctcttcc agaaaccggg caaagctccg aaacgcctga tctatctggt gtctaccctg
gatagcggta ttccgtctcg tttctccggt agcggtagcg gtaccgaatt cacgctgacc
attagctccc tccagccgga ggactttgct acctattact gcctccaggg cactcatttt
ccgcacactt tcggccaggg taccaaactg gaaatcaaa

1519 gL20 light chain (V + constant) SEQ ID NO: 54
DIQMTQSPSS LSASVGDRVT ITCKSSQSLV GASGKTYLYW LFQKPGKAPK RLIYLVSTLD
SGIPSRFSGS GSGTEFTLTI SSLQPEDFAT YYCLQGTHFP HTFGQGTKLE IKRTVAAPSV
FIFPPSDEQL KSGTASVVCL LNNFYPREAK VQWKVDNALQ SGNSQESVTE QDSKDSTYSL
SSTLTLSKAD YEKHKVYACE VTHQGLSSPV TKSFNRGEC

1519 gL20 light chain (V + constant) SEQ ID NO: 55
gatatccaga tgacccagag tccaagcagt ctctccgcca gcgtaggcga tcgtgtgact
attacctgta aaagctccca gtccctggtg ggtgcaagcg gcaaaaccta cctgtactgg
ctcttccaga aaccgggcaa agctccgaaa cgcctgatct atctggtgtc taccctggat
agcggtattc cgtctcgttt ctccggtagc ggtagcggta ccgaattcac gctgaccatt
agctccctcc agccggagga ctttgctacc tattactgcc tccagggcac tcattttccg
cacactttcg gccagggtac caaactggaa atcaaacgta cggtagcggc cccatctgtc
ttcatcttcc cgccatctga tgagcagttg aaatctggaa ctgcctctgt tgtgtgcctg
ctgaataact tctatcccag agaggccaaa gtacagtgga aggtggataa cgccctccaa
tcgggtaact cccaggagag tgtcacagag caggacagca aggacagcac ctacagcctc
agcagcaccc tgacgctgag caaagcagac tacgagaaac acaaagtcta cgcctgcgaa
gtcacccatc agggcctgag ctcaccagta acaaaaagtt ttaatagagg ggagtgt

1519 gL20 light chain with signal sequence underlined and italicized SEQ ID NO: 56
*MKKTAIAIAV ALAGFATVAQ A*DIQMTQSPS SLSASVGDRV TITCKSSQSL VGASGKTYLY
WLFQKPGKAP KRLIYLVSTL DSGIPSRFSG SGSGTEFTLT ISSLQPEDFA TYYCLQGTHF
PHTFGQGTKL EIKRTVAAPS VFIFPPSDEQ LKSGTASVVC LLNNFYPREA KVQWKVDNAL
QSGNSQESVT EQDSKDSTYS LSSTLTLSKA DYEKHKVYAC EVTHQGLSSP VTKSFNRGEC

FIGURE 8L

1519 gL20 light chain with signal sequence underlined and italicized SEQ ID NO: 57

atgaaaaaga cagctatcgc aattgcagtg gccttggctg gtttcgctac cgtagcgcaa
gctgatatcc agatgaccca gagtccaagc agtctctccg ccagcgtagg cgatcgtgtg
actattacct gtaaaagctc ccagtccctg gtgggtgcaa gcggcaaaac ctacctgtac
tggctcttcc agaaaccggg caaagctccg aaacgcctga tctatctggt gtctaccctg
gatagcggta ttccgtctcg tttctccggt agcggtagcg gtaccgaatt cacgctgacc
attagctccc tccagccgga ggactttgct acctattact gcctccaggg cactcatttt
ccgcacactt tcggccaggg taccaaactg gaaatcaaac gtacggtagc ggccccatct
gtcttcatct tcccgccatc tgatgagcag ttgaaatctg gaactgcctc tgttgtgtgc
ctgctgaata acttctatcc cagagaggcc aaagtacagt ggaaggtgga taacgccctc
caatcgggta actcccagga gagtgtcaca gagcaggaca gcaaggacag cacctacagc
ctcagcagca ccctgacgct gagcaaagca gactacgaga aacacaaagt ctacgcctgc
gaagtcaccc atcagggcct gagctcacca gtaacaaaaa gttttaatag aggggagtgt

1519 gH20 V-region SEQ ID NO: 58

EVPLVESGGG LVQPGGSLRL SCAVSGFTFS NYGMVWVRQA PGKGLEWVAY IDSDGDNTYY
RDSVKGRFTI SRDNAKSSLY LQMNSLRAED TAVYYCTTGI VRPFLYWGQG TLVTVS

1519 gH20 V-region SEQ ID NO: 59

gaggttccgc tggtcgagtc tggaggcggg cttgtccagc ctggagggag cctgcgtctc
tcttgtgcag tatctggctt cacgttctcc aactacggta tggtgtgggt tcgtcaggct
ccaggtaaag gtctggaatg ggtggcgtat attgactccg acggcgacaa cacctactat
cgcgactctg tgaaaggtcg cttcaccatt tcccgcgata acgccaaatc cagcctgtac
ctgcagatga acagcctgcg tgctgaagat actgcggtgt actattgcac cactggcatc
gtgcgtccgt ttctgtattg gggtcagggt accctcgtta ctgtctcg

1519 gH20 V-region with signal sequence underlined and italicized SEQ ID NO: 60

MKKTAIAIAV ALAGFATVAQ AEVPLVESGG GLVQPGGSLR LSCAVSGFTF SNYGMVWVRQ
APGKGLEWVA YIDSDGDNTY YRDSVKGRFT ISRDNAKSSL YLQMNSLRAE DTAVYYCTTG
IVRPFLYWGQ GTLVTVS

1519 gH20 V-region with signal sequence underlined and italicized SEQ ID NO: 61

atgaagaaga ctgctatagc aattgcagtg gcgctagctg gtttcgccac cgtggcgcaa
*gct*gaggttc cgctggtcga gtctggaggc gggcttgtcc agcctggagg gagcctgcgt
ctctcttgtg cagtatctgg cttcacgttc tccaactacg gtatggtgtg ggttcgtcag
gctccaggta aaggtctgga atgggtggcg tatattgact ccgacggcga caacacctac
tatcgcgact ctgtgaaagg tcgcttcacc atttcccgcg ataacgccaa atccagcctg
tacctgcaga tgaacagcct gcgtgctgaa gatactgcgg tgtactattg caccactggc
atcgtgcgtc cgtttctgta ttggggtcag ggtaccctcg ttactgtctc g

1519gH20 Fab' heavy chain (V + human gamma-1 CH1 + hinge) SEQ ID NO: 62

EVPLVESGGG LVQPGGSLRL SCAVSGFTFS NYGMVWVRQA PGKGLEWVAY IDSDGDNTYY
RDSVKGRFTI SRDNAKSSLY LQMNSLRAED TAVYYCTTGI VRPFLYWGQG TLVTVSSAST
KGPSVFPLAP SSKSTSGGTA ALGCLVKDYF PEPVTVSWNS GALTSGVHTF PAVLQSSGLY
SLSSVVTVPS SSLGTQTYIC NVNHKPSNTK VDKKVEPKSC DKTHTCAA

FIGURE 8M

1519gH20 Fab' heavy chain (V + human gamma-1 CH1 + hinge) SEQ ID NO: 63

gaggttccgc tggtcgagtc tggaggcggg cttgtccagc ctggagggag cctgcgtctc
tcttgtgcag tatctggctt cacgttctcc aactacggta tggtgtgggt tcgtcaggct
ccaggtaaag gtctggaatg ggtggcgtat attgactccg acggcgacaa cacctactat
cgcgactctg tgaaaggtcg cttcaccatt tcccgcgata acgccaaatc cagcctgtac
ctgcagatga acagcctgcg tgctgaagat actgcggtgt actattgcac cactggcatc
gtgcgtccgt ttctgtattg gggtcagggt accctcgtta ctgtctcgag cgcttctaca
aagggcccat cggtcttccc cctggcaccc tcctccaaga gcacctctgg gggcacagcg
gccctgggct gcctggtcaa ggactacttc cccgaaccgg tgacggtgtc gtggaactca
ggcgccctga ccagcggcgt gcacaccttc ccggctgtcc tacagtcctc aggactctac
tccctcagca gcgtggtgac cgtgccctcc agcagcttgg gcacccagac ctacatctgc
aacgtgaatc acaagcccag caacaccaag gtcgacaaga aagttgagcc caaatcttgt
gacaaaactc acacatgcgc cgcg

1519gH20 Fab' heavy chain with signal sequence underlined and italicized SEQ ID NO: 64

*MKKTAIAIAV ALAGFATVAQ A*EVPLVESGG GLVQPGGSLR LSCAVSGFTF SNYGMVWVRQ APGKGLEWVA
YIDSDGDNTY YRDSVKGRFT ISRDNAKSSL YLQMNSLRAE DTAVYYCTTG IVRPFLYWGQ GTLVTVSSAS
TKGPSVFPLA PSSKSTSGGT AALGCLVKDY FPEPVTVSWN SGALTSGVHT FPAVLQSSGL YSLSSVVTVP
SSSLGTQTYI CNVNHKPSNT KVDKKVEPKS CDKTHTCAA

1519gH20 Fab' heavy chain with signal sequence underlined and italicized SEQ ID NO:65

atgaagaaga ctgctatagc aattgcagtg gcgctagctg gtttcgccac cgtggcgcaa
*gct*gaggttc cgctggtcga gtctggaggc gggcttgtcc agcctggagg gagcctgcgt
ctctcttgtg cagtatctgg cttcacgttc tccaactacg gtatggtgtg ggttcgtcag
gctccaggta aaggtctgga atgggtggcg tatattgact ccgacggcga caacacctac
tatcgcgact ctgtgaaagg tcgcttcacc atttcccgcg ataacgccaa atccagcctg
tacctgcaga tgaacagcct gcgtgctgaa gatactgcgg tgtactattg caccactggc
atcgtgcgtc cgtttctgta ttggggtcag ggtaccctcg ttactgtctc gagcgcttct
acaaagggcc catcggtctt ccccctggca ccctcctcca agagcacctc tgggggcaca
gcggccctgg gctgcctggt caaggactac ttccccgaac cggtgacggt gtcgtggaac
tcaggcgccc tgaccagcgg cgtgcacacc ttcccggctg tcctacagtc ctcaggactc
tactccctca gcagcgtggt gaccgtgccc tccagcagct tgggcaccca gacctacatc
tgcaacgtga atcacaagcc cagcaacacc aaggtcgaca agaaagttga gcccaaatct
tgtgacaaaa ctcacacatg cgccgcg

1519gH20 IgG4 heavy chain (V + human gamma-4P constant) SEQ ID NO: 66

EVPLVESGGG LVQPGGSLRL SCAVSGFTFS NYGMVWVRQA PGKGLEWVAY IDSDGDNTYY
RDSVKGRFTI SRDNAKSSLY LQMNSLRAED TAVYYCTTGI VRPFLYWGQG TLVTVSSAST
KGPSVFPLAP CSRSTSESTA ALGCLVKDYF PEPVTVSWNS GALTSGVHTF PAVLQSSGLY
SLSSVVTVPS SSLGTKTYTC NVDHKPSNTK VDKRVESKYG PPCPPCPAPE FLGGPSVFLF
PPKPKDTLMI SRTPEVTCVV VDVSQEDPEV QFNWYVDGVE VHNAKTKPRE EQFNSTYRVV
SVLTVLHQDW LNGKEYKCKV SNKGLPSSIE KTISKAKGQP REPQVYTLPP SQEEMTKNQV
SLTCLVKGFY PSDIAVEWES NGQPENNYKT TPPVLDSDGS FFLYSRLTVD KSRWQEGNVF
SCSVMHEALH NHYTQKSLSL SLGK

FIGURE 8N

1519gH20 IgG4 heavy chain (V + human gamma-4P constant, exons underlined) SEQ ID NO:67

gaggtaccacttgtggaaagcggaggaggtcttgtgcagcctggaggaagtttacgtctctcttgtgctgtgtctggctt
caccttctccaattacggaatggtctgggtcagacaagcacctggaaagggtcttgaatgggtggcctatattgactctg
acggggacaacacctactatcgggattccgtgaaaggacgcttcacaatctcccgagataacgccaagagctcactgtac
ctgcagatgaatagcctgagagccgaggatactgccgtgtactattgcacaacgggaatcgttaggccttttctgtactg
gggacagggcaccttggttactgtctcgagcgcttctacaaagggcccatccgtcttccccctggcgccctgctccagga
gcacctccgagagcacagccgccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcgtggaactca
ggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctcaggactctactccctcagcagcgtggtgac
cgtgccctccagcagcttgggcacgaagacctacacctgcacaagcccagcaacaccaaggtggacaagagagttggtga
gaggccagcacagggagggagggtgtctgctggaagccaggctcagccctcctgcctggacgcaccccggctgtgcagcc
ccagcccagggcagcaaggcatgccccatctgtctcctcacccggaggcctctgaccaccccactcatgcccagggagag
ggtcttctggatttttccaccaggctccgggcagccacaggctggatgcccctaccccaggccctgcgcatacaggggca
ggtgctgcgctcagacctgccaagagccatatccgggaggaccctgcccctgacctaagcccaccccaaaggccaaactc
tccactccctcagctcagacaccttctctcctcccagatctgagtaactcccaatcttctctctgcagagtccaaatatg
gtcccccatgcccaccatgcccaggtaagccaacccaggcctcgccctccagctcaaggcgggacaggtgccctagagta
gcctgcatccagggacaggccccagccgggtgctgacgcatccacctccatctcttcctcagcacctgagttcctgggggg
gaccatcagtcttcctgttcccccaaaacccaaggacactctcatgatctcccggaccccctgaggtcacgtgcgtggtg
gtggacgtgagccaggaagaccccgaggtccagttcaactggtacgtggatggcgtggaggtgcataatgccaagacaaa
gccgcgggaggagcagttcaacagcacgtaccgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaacggca
aggagtacaagtgcaaggtctccaacaaaggcctcccgtcctccatcgagaaaaccatctccaaagccaaaggtgggacc
cacggggtgcgagggccacatggacagaggtcagctcggcccaccctctgccctgggagtgaccgctgtgccaacctctg
tccctacagggcagccccgagagccacaggtgtacaccctgccccatcccaggaggagatgaccaagaaccaggtcagc
ctgacctgcctggtcaaaggcttctaccccagcgacatcgccgtggagtgggagagcaatgggcagccggagaacaacta
caagaccacgcctcccgtgctggactccgacggctccttcttcctctacagcaggctaaccgtggacaagagcaggtggc
aggaggggaatgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacacagaagagcctctccctgtct
ctgggtaaa

1519gL20 FabFv light chain SEQ ID NO: 68

DIQMTQSPSS LSASVGDRVT ITCKSSQSLV GASGKTYLYW LFQKPGKAPK RLIYLVSTLD
SGIPSRFSGS GSGTEFTLTI SSLQPEDFAT YYCLQGTHFP HTFGQGTKLE IKRTVAAPSV
FIFPPSDEQL KSGTASVVCL LNNFYPREAK VQWKVDNALQ SGNSQESVTE QDSKDSTYSL
SSTLTLSKAD YEKHKVYACE VTHQGLSSPV TKSFNRGECS GGGGSGGGGS GGGGSDIQMT
QSPSSVSASV GDRVTITCQS SPSVWSNFLS WYQQKPGKAP KLLIYEASKL TSGVPSRFSG
SGSGTDFTLT ISSLQPEDFA TYYCGGGYSS ISDTTFGCGT KVEIKRT

1519gL20 FabFv light chain SEQ ID NO: 69

gatatccaga tgacccagag cccatctagc ttatccgctt ccgttggtga tcgcgtgaca
attacgtgta agagctccca atctctcgtg ggtgcaagtg gcaagaccta tctgtactgg
ctctttcaga agcctggcaa ggcaccaaaa cggctgatct atctggtgtc taccttgac
tctgggatac cgtcacgatt ttccggatct gggagcggaa ctgagttcac actcacgatt
tcatcgctgc aacccgagga ctttgctacc tactactgcc tgcaaggcac tcatttccct
cacactttcg gccaggggac aaaactcgaa atcaaacgta cggtagcggc cccatctgtc
ttcatcttcc cgccatctga tgagcagttg aaatctggaa ctgcctctgt tgtgtgcctg
ctgaataact tctatcccag agaggccaaa gtacagtgga aggtggataa cgccctccaa
tcgggtaact cccaggagag tgtcacagag caggacagca aggacagcac ctacagcctg
agcagcaccc tgacgctgtc taaagcagac tacgagaaac acaaagtgta cgcctgcgaa
gtcacccatc agggcctgag ctcaccagta acaaaaagtt ttaatagagg ggagtgtagc
ggtggcggtg gcagtggtgg gggaggctcc ggaggtggcg gttcagacat acaaatgacc
cagagtcctt catcggtatc cgcgtccgtt ggcgataggg tgactattac atgtcaaagc
tctcctagcg tctggagcaa ttttctatcc tggtatcaac agaaaccggg gaaggctcca
aaacttctga tttatgaagc ctcgaaactc accagtggag ttccgtcaag attcagtggc
tctggatcag ggacagactt cacgttgaca atcagttcgc tgcaaccaga ggactttgcg
acctactatt gtggtggagg ttacagtagc ataagtgata cgacatttgg gtgcggtact
aaggtggaaa tcaaacgtac c

FIGURE 8O

1519gL20 FabFv light chain with signal sequence underlined and italicised SEQ ID NO: 70

*MSVPTQVLGLLLLWLTDARC*DIQMTQSPSSLSASVGDRVTITCKSSQSLVGASGKTYLYWLFQKPGKAPKRLIYLV
STLDSGIPSRFSGSGSGTEFTLTISSLQPEDFATYYCLQGTHFPHTFGQGTKLEIKRTVAAPSVFIFPPSDEQLKS
GTASVVCLLNNFYPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSS
PVTKSFNRGECSGGGGSGGGGSGGGGSDIQMTQSPSSVSASVGDRVTITCQSSPSVWSNFLSWYQQKPGKAPKLLI
YEASKLTSGVPSRFSGSGSGTDFTLTISSLQPEDFATYYCGGGYSSISDTTFGCGTKVEIKRT

1519gL20 FabFv light chain with signal sequence underlined and italicised SEQ ID NO: 71

*atgtctgtccccacccaagtcctcggactcctgctactctggcttacagatgccagatgc*gatatccagatg
acccagagcccatctagcttatccgcttccgttggtgatcgcgtgacaattacgtgtaagagctcccaatct
ctcgtgggtgcaagtggcaagacctatctgtactggctctttcagaagcctggcaaggcaccaaaacggctg
atctatctggtgtctacccttgactctgggataccgtcacgattttccggatctgggagcggaactgagttc
acactcacgatttcatcgctgcaacccgaggactttgctacctactactgcctgcaaggcactcatttccct
cacactttcggccaggggacaaaactcgaaatcaaacgtacggtagcggccccatctgtcttcatcttcccg
ccatctgatgagcagttgaaatctggaactgcctctgttgtgtgcctgctgaataacttctatcccagagag
gccaaagtacagtggaaggtggataacgccctccaatcgggtaactcccaggagagtgtcacagagcaggac
agcaaggacagcacctacagcctgagcagcaccctgacgctgtctaaagcagactacgagaaacacaaagtg
tacgcctgcgaagtcacccatcagggcctgagctcaccagtaacaaaaagttttaatagaggggagtgtagc
ggtggcggtggcagtggtgggggaggctccggaggtggcggttcagacatacaaatgacccagagtccttca
tcggtatccgcgtccgttggcgatagggtgactattacatgtcaaagctctcctagcgtctggagcaatttt
ctatcctggtatcaacagaaaccggggaaggctccaaaacttctgatttatgaagcctcgaaactcaccagt
ggagttccgtcaagattcagtggctctggatcagggacagacttcacgttgacaatcagttcgctgcaacca
gaggactttgcgacctactattgtggtggaggttacagtagcataagtgatacgacatttgggtgcggtact
aaggtggaaatcaaacgtacc

1519gH20 FabFv heavy chain SEQ ID NO: 72

EVPLVESGGGLVQPGGSLRLSCAVSGFTFSNYGMVWVRQAPGKGLEWVAYIDSDGDNTYYRDSVKGRFTISR
DNAKSSLYLQMNSLRAEDTAVYYCTTGIVRPFLYWGQGTLVTVSSASTKGPSVFPLAPSSKSTSGGTAALGC
LVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTQTYICNVNHKPSNTKVDKKVE
PKSCSGGGGSGGGGTGGGGSEVQLLESGGGLVQPGGSLRLSCAVSGIDLSNYAINWVRQAPGKCLEWIGIIW
ASGTTFYATWAKGRFTISRDNSKNTVYLQMNSLRAEDTAVYYCARTVPGYSTAPYFDLWGQGTLVTVSS

1519gH20 FabFv heavy chain SEQ ID NO: 73

gaggtaccacttgtggaaagcggaggaggtcttgtgcagcctggaggaagtttacgtctctcttgtgctgtg
tctggcttcaccttctccaattacggaatggtctgggtcagacaagcacctggaaagggtcttgaatgggtg
gcctatattgactctgacggggacaacacctactatcgggattccgtgaaaggacgcttcacaatctcccga
gataacgccaagagctcactgtacctgcagatgaatagcctgagagccgaggatactgccgtgtactattgc
acaacgggaatcgttaggccttttctgtactggggacagggcaccttggttactgtctcgagcgcgtccaca
aagggcccatcggtcttccccctggcaccctcctccaagagcacctctgggggcacagcggccctgggctgc
ctggtcaaggactacttccccgaaccagtgacggtgtcgtggaactcaggtgccctgaccagcggcgttcac
accttcccggctgtcctacagtcttcaggactctactccctgagcagcgtggtgaccgtgccctccagcagc
ttgggcacccagacctacatctgcaacgtgaatcacaagcccagcaacaccaaggtcgataagaaagttgag
cccaaatcttgtagtggaggtgggggctcaggtggaggcgggaccggtggaggtggcagcgaggttcaactg
cttgagtctggaggaggcctagtccagcctggagggagcctgcgtctctcttgtgcagtaagcggcatcgac
ctgagcaattacgccatcaactgggtgagacaagctccggggaagtgtttagaatggatcggtataatatgg
gccagtgggacgacctttttatgctacatgggcgaaaggaaggtttacaattagccgggacaatagcaaaaac
accgtgtatctccaaatgaactccttgcgagcagaggacacggcggtgtactattgtgctcgcactgtccca
ggttatagcactgcaccctacttcgatctgtggggacaagggaccctggtgactgtttcaagt

1519gH20 FabFv heavy chain with signal sequence underlined and italicised SEQ ID NO: 74

*MEWSWVFLFFLSVTTGVHS*EVPLVESGGGLVQPGGSLRLSCAVSGFTFSNYGMVWVRQAPGKGLEWVAYIDS
DGDNTYYRDSVKGRFTISRDNAKSSLYLQMNSLRAEDTAVYYCTTGIVRPFLYWGQGTLVTVSSASTKGPSV
FPLAPSSKSTSGGTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTQT
YICNVNHKPSNTKVDKKVEPKSCSGGGGSGGGGTGGGGSEVQLLESGGGLVQPGGSLRLSCAVSGIDLSNYA
INWVRQAPGKCLEWIGIIWASGTTFYATWAKGRFTISRDNSKNTVYLQMNSLRAEDTAVYYCARTVPGYSTA
PYFDLWGQGTLVTVSS