



1 GAGCTTGGCCATTGCATACGTTGTATCCATATCATAATATGTACATTTATATTGGCTCATGTCCAACATTACGCCATGTTGACATTGATTATTGACTA
101 GTTATTAATAGTAATCAATTACGGGGTCATTAGTTCATAGCCCATATATGGAGTTCGCGTTACATAACTTACGGTAAATGGCCCGCTGGCTGACCGCC
201 CAACGACCCCGCCATTGACGTCAATAATGACGTATGTTCCCATAGTAACGCCAATAGGGACTTTCCATTGACGTCAATGGTGGAGTATTTACGGTAA
301 ACTGCCCACTTGGCAGTACATCAAGTGTATCATATGCCAAGTACGCCCTATTGACGTCAATGACGGTAAATGGCCCGCTGGCATTATGCCAGTACA
401 TGACCTTATGGGACTTTCTACTTGGCAGTACATCTACGTATTAGTCATCGCTATTACCATGGTGTATGCGGTTTTGGCAGTACATCAATGGCGTGGATA
501 GCGGTTTGACTCACGGGGATTTC AAGTCTCCACCCATTGACGTCAATGGGAGTTTGT TTTGGCACCAAATCAACGGGACTTTCCAAAATGTCGTAAC
601 AACTCCGCCCATGACGCAAATGGCGGTAGCGGTGTACGGTGGGAGTCTATATAAGCAGAGCTCGTTTAGTGAACCGTCAGATCGCCTGGAGACGCC
701 ATCCACGCTGTTTTGACCTCCATAGAAGACACCGGGACCGATCCAGCTCCGGTGCACCGATCCTGAGAACTCAGGgtgagtttggggacccttgattg
801 ttctttcttttctgctattgtaaaattcatgttatatggagggggcaaagttttcagggtgttgttagaatgggaagatgtcccttgatcacctatgga
901 ccctcatgataattttgtttctttcactttctactctgttgacaaccattgtctcctcttattttcttttcattttctgtaacttttctgtaaaccttta
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1101 atattgtacttcagcacagtttagagaacaattgttataattaaatgataaggtagaatattttctgcatataaattctggctggcgtggaatatctt
1201 attggtagaacaactacaccctggtcatcatcctgcctttctctttatggttacaatgatatacactgtttgagatgaggataaaaactctgagtcca
1301 aaccgggcccctctgtaacatgttcatgcctttctctttctacagCTCCTGGCAACGTGCTGGTTGTGTGCTGTCTCATATTTGGCAAAGA

Agel (1416)

1401 ATTCTCGACGGATCCACCGTCAACATGTTTGTGTTCTTGGTGTGCTTCCACTGGTCAGTCCCAATGCGTTAATCTCACACCCGAACCTCAACTCCC
1501 ACCCGCATATACAAATTCCTTACCAGAGGAGTACTATCCTGACAAAGTGTTCGGTCAAGTGTCTCCACTCTACTCAGGACCTCTTTCTGCCTTTC
1601 TTTTCTAACGTTACATGGTTTCATGCAATCCATGTGTCTGGGACAAACGGCACAAACGCTTCGACAAACCTGTATTGCCATTCAATGATGGGGTGTACT
1701 TTGCTCCATCGAGAAATCCAACATCATTGAGGATGGATTTTCGGGACTACTCTGGACTCAAAGACACAGAGCCTGCTGATCGTTAAACAACGCCACAAA

T951 (1708)

1701 TTGCTCCATCGAGAAATCCAACATCATTGAGGATGGATTTTCGGGACTACTCTGGACTCAAAGACACAGAGCCTGCTGATCGTTAAACAACGCCACAAA
1801 CGTTGTCATCAAAGTGTGCGAATTCAGTTTTGCAATGATCCCTTCTGGGAGTGACACAAGAATAACAAGTCTGGATGGAGAGCGAATTT

**ins145N (1861)
Y145S (1858)
Y144T (1855)**

1801 CGTTGTCATCAAAGTGTGCGAATTCAGTTTTGCAATGATCCCTTCTGGGAGTGACACAAGAATAACAAGTCTGGATGGAGAGCGAATTT
1901 CGGTCTACAGCAGCGCAAACAACCTGCACCTTCGAGTACGTGAGTCAACCTTTCTGATGGACCTGGAAGGAAACAGGGAACTTCAAGAACCTGAGAG
2001 AGTTTGTCTTAAAGAACATCGACGGCTATTTAAGATCTATAGTAAGCATACGCCATCAACCTGGTAAGGGATCTTCCCAGGGCTTTTCAGCCCTGGA
2101 ACCTTTGGTTGACTTGCCTATTGGTATCAATATCACCAGATTTTCAGACCCTTCTGGCATTGCAICGGTCTTATCTTACTCCAGGTGATTCTCCTCCGGG
2201 TGGACTGCCGGCGCGCTGCCTACTATGTCGGCTATCTGCAACCAAGAAGTTCCTGCTCAAGTACAACGAAAACGGCACTATTACGGATGCTGTTGATT
2301 GTGCCCTGGACCTCTGTCTGAGACTAAATGCAACCCTCAAGAGCTTTACCGTTGAGAAGGGGATTTACCAAACAGTAATTTCCGGGTCCAACCCACCGA
2401 AAGCATTGTGCGGTTCCCAAATATCACCAATCTGTGTCCCTTTGGCGAAGTGTCAATGCTACAAGTTTGCTTCTGTGTACGCATGGAATAGGAAACGC

R246K (2464)

2401 AAGCATTGTGCGGTTCCCAAATATCACCAATCTGTGTCCCTTTGGCGAAGTGTCAATGCTACAAGTTTGCTTCTGTGTACGCATGGAATAGGAAACGC
2501 ATCTCCAATTGTGTCGCTGATTACTCCGTGCTGTACAATTCGCCTCTTTCTCAACCTTCAAGTGTATGGCGTTTACCTACCAAACCTAACGACCTGT
2601 GCTTCACTAATGTGTATGCCGACTCTTTTGTGATACGAGGCGATGAAGTGAGACAGATTGCACCAGGGCAGACCGGCAAAATGCCGACTACAACCTACAA
2701 GCTTCCAGATGACTTTACCGGATGTGTTATTGCATGGAACCTCAACAATCTGGATTCCAAGTGGGTGGCAACTATAACTACCTGTATAGACTGTTCCAGG

E484K (2878)

2801 AAATCCAACCTGAAACCATTCGAGCGAGATATAAGCACAGAAATCTACCAGGCTGGAAGTACGCCCTGCAACGGCGTGAAGGGTTCAACTGCTACTTCC
459▶ K S N L K P F E R D I S T E I Y Q A G S T P C N G V K G F N C Y F

N501Y (2929)

2901 CATTGCAGAGTTACGGATTCCAGCCTACATAI GGGGTGGGATACCAACCTATCGTGTGCTAGTCTGAGTTTTGAGCTCCTCCATGCCCCAGCCACAGT
492▶ P L Q S Y G F Q P T Y G V G Y Q P Y R V V V L S F E L L H A P A T V

3001 CTGTGGCCCCAAGAAAAGCACCAATCTGGTGAAGAACAATGCGTGAACCTTAACTTTAACGGACTCACAGGAACCGGCGTATTGACGGAGAGTAACAAG
525▶ C G P K K S T N L V K N K C V N F N F N G L T G T G V L T E S N K

3101 AAGTTCCTGCCATTCCAGCAGTTCGGTCGCGATATTGCCGACACTACCAGCGTGTCCGAGATCCCCAGACATTGGAGATTCTTGATATCACACCCTGTA
559▶ K F L P F Q Q F G R D I A D T T D A V R D P Q T L E I L D I T P C

D614G (3268)

3201 GTTTCGGCGGAGTGAGCGTGATTACGCCCGGAACCAATACCAGCAATCAGGTTGCCGTCTGTATCAGGGCTGAATTGCACCGAGGTACCTGTCCGCAT
592▶ S F G G V S V I T P G T N T S N Q V A V L Y Q G V N C T E V P V A I

3301 CCACGCTGACCAACTACACCCACATGGCGAGTATATTCCACCGGCTCCAACGCTTTTCAGACACGTGGATGTCTGATCGGTGACAGAACCGTTAAT
625▶ H A D Q L T P T W R V Y S T G S N V F Q T R A G C L I G A E H V N

P681H (3469) Furin cleavage site (3481)

3401 AATAGCTACGAGTGTGATATCCCATCGGTGCTGGAATATGCGCCTTATCAAACCTCAAACCAACTCTCACAGGCGGCACTAGTGTAGCATCCCAAA
659▶ N S Y E C D I P I G A G I C A S Y Q T Q T N S H R R A R S V A S Q

3501 GTATCATTGCCTACACAATGAGCCTCGGTGCTGAGAATCTGTCCGCTACAGCAACCACTCCATTGCTACTAACTCACAATCAGTGTGACAAAC
692▶ S I I A Y T M S L G A E N S V A Y S N N S I A I P T N F T I S V T T

3601 TGAAATTCGCCGTATCTATGACCAAAAACAAGCGTTGACTGCACCATGTACATCTGTGGCGATTCTACCGAATGTAGCAATCTCCTCCTGCAATACGGA
725▶ E I L P V S M T K T S V D C T M Y I C G D S T E C S N L L L Q Y G

3701 TCATTCTGCACTCAGTGAATCGTGCCTCACAGGTATTGCGATTGAGCAGGACAAGAATACGAGGAAGTGTTCGCCAGGTGAAGCAAATCTACAAAA
759▶ S F C T Q L N R A L T G I A V E Q D K N T Q E V F A Q V K Q I Y K

3801 CTCACCCATAAAAGACTTTGGCGGATTCAATTTCTCACAGATCCTGCCCGATCCCTCAAACCTCCAAGCGTAGCTTTATCGAGGATCTGCTCTTCAA
792▶ T P P I K D F G G F N F S Q I L P D P S K P S K R S F I E D L L F N

3901 CAAGTAACCCCTCGCAGATGCCGTTTCATCAAGCAGTATGGCGATTGTCTGGGAGACATCGCCGCTCGGGACCTGATCTGTGCACAGAAATCAATGGA
825▶ K V T L A D A G F I K Q Y G D C L G D I A A R D L I C A Q K F N G

4001 CTGACCGTGTGCTCCTTGTGACCGACGAGATGATAGCCAAATACACTAGCGCCCTGCTGGCCGGCACCATCACTTCTGGGTGGACATTCGGAGCTG
859▶ L T V L P P L L T D E M I A Q Y T S A L L A G T I T S G W T F G A

4101 GCGCTGCCCTTCAGATTCCTTTTGTATGCAGATGGCCTACCGCTTAAACGGCATCGGTGTGACACAAAACGTTCTGTATGAAAACAGAAAACCTCATCGC
892▶ G A A L Q I P F A M Q M A Y R F N G I G V T Q N V L Y E N Q K L I A

D950N (4276)

4201 CAACCAGTTCAACAGTGTATCGGTAAGATACAGGATAGCCTGTCCACTGCCAGCGCATTGGGAAAGTTGCAGAACGTAGTGAACCAGAATGCCAG
925▶ N Q F N S A I G K I Q D S L S S T A S A L G K L Q N V V N Q N A Q

4301 GCACCTAACACCCCTGGTGAACAGCTCTCTTCAAATTTTGGTGCCATTTCTAGCGTGTGAATGACATACTGAGCCGTTGGACAAGTGGAGGCTGAAG
959▶ A L N T L V K Q L S S N F G A I S S V L N D I L S R L D K V E A E

4401 TGCAGATTGATAGGCTGATAACTGGGCGCCTTCACTCTCTTCAAGCCTATGTGACCCAGCAGCTCATCCGCGCTGCTGAAATTCGCGCATCCGCTAACCT
992▶ V Q I D R L I T G R L Q S L Q T Y V T Q Q L I R A A E I R A S A N L

4501 GGCAGCAACAAAATGTCGAGTGTGTGCTGGTCAAGAGAGTGGACTTTTGGCGGAAGGGGTATCACCTGATGTCTTTTCTCAGTCTGACCCC
1025▶ A A T K M S E C V L G D I S G Q S K R V D F C G K G Y H L M S F G S A P

4601 CATGGTGTGGTCTTCTGACGCTGACTTATGTCCAGCTCAGGAAAAGAACTTCACTACAGCCCCAGCCATCTGCCAGTGGGAAAGCCCACTTTCCCA
1059▶ H G V V F L H V T Y V P A Q E K N F T T A P A I C H D G K A H F P

4701 GGGAAAGCGTATTCGTGTCCAATGGTACTCATTGGTTCGCTCACTCAGAGAAATTTCTACGAGCCCCAGATTATAACCACTGACAATACATTTGTATCCGG
1092▶ R E G V F V S N G T H W F V T Q R N F Y E P Q I I T T D N T F V S G

4801 CAATTGTGATGTGGTTATCGGGATTGTGAATAACTGTTTACGATCCTTTGACGCCAGAGCTGGACTCCTTCAAGGAGGAGCTTGACAAAATATTTTAAAG
1125▶ N C D V V I G I V N N T V Y D P L Q P E L D S F K E E L D K Y F K

4901 AATCACACATCACCTGACGCTCGACCTCGGAGATATTTAGGAATCAATGCTCCGTTCAATATTGAGAAGGAGATAGACAGGCTGAATGAGGTGCCA
1159▶ N H T S P D V D L G D I S G I N A S V V N I Q K E I D R L N E V A

5001 AGAACCTCAACGAGTCTCTGATCGATCTGCAGGAGTTGGGCAAGTACGAACAGTATATCAAATGGCCITGGTACATTTGGCTTGGGTTTATTGCTGGGCT
1192▶ K N L N E S L I D L Q E L G K Y E Q Y I K W P W Y I W L G F I A G L

NheI (5195)

5101 GATAGCTATCGTCATGGTGACAATTATGTTGTGTTGCATGACATCCTGCTGTAGTTGTCTGAAGGGCTGCTGCTCATCGGCAGCTGTTGCTAAAGCTAG
1225▶ I A I V M V T I M L C C M T S C C S C L K G C C S C G S C C •

5201 CCTCGAGGGATCCGTCGAGGAATCACTCCTCAGGTGCAGGCTGCCTATCAGAAGGTGGTGGCTGGTGGCCAATGCCCTGGCTCACAATACCACTGA

5301 GATCTTTTCCCTCTGCCAAAATTATGGGACATCATGAAGCCCTTGAGCATCTGACTTCTGGCTAATAAAGGAAATTTATTTTCATTGCAATAGTGT

5401 GTTGAATTTTTTGTCTCTCACTCGGAAGGACATATGGGAGGGCAAATCATTTAAACATCAGAATGAGTATTTGGTTTAGAGTTGGCAACATATGC

5501 CCATATGCTGGCTGCCATGAACAAAGGTTGGCTATAAAGAGGTCATCAGTATATGAAACAGCCCCCTGCTGTCCATTCCTTATTCATAGAAAAGCCTTG

5601 ACTTGAGGTTAGATTTTTTTTATATTTTGTGTTTATTTTTTCTTTAACATCCCTAAAATTTCTTACATGTTTTACTAGCCAGATTTTTCTCTC

5701 TCTCTGACTACTCCAGTCATAGCTGTCCCTCTTCTTATGGAGATCCCTCGACGGATCGGCCGAATTCGTAATCATGTATAGCTGTTTCTGTGT

5801 GAAATTTGTTATCCGCTCACAAATTCACACAAACATACGAGCGGGAAGCATAAAGTGTAAAGCCTGGGGTGCCTAATGAGTGAGCTAACTACATTAATTGC

5901 GTTGGCTCACTGCCGCTTCCAGTCGGGAAACCTGTCGTGCCAGCTGCATTAATGAATCGGCCAACGCGCGGGGAGAGGCGGTTTGCATTGGGCGC
6001 TCTTCGCTTCTCGCTCACTGACTCGCTGCGCTCGGTCGTTCCGGCTGCGGCGAGCGGTATCAGCTCACTCAAAGGCGGTAATACGGTTATCCACAGAAT
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6201 CCCTGACGAGCATCACAAAAATCGACGCTCAAGTCAGAGGTGGCGAAACCCGACAGGACTATAAAGATACCAGGCGTTTTCCCCTGGAAGCTCCCTCGTG
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6701 AAACCACCGCTGGTAGCGGTGGTTTTTTTGTGTTGCAAGCAGCAGATTACGCGCAGAAAAAAGGATCTCAAGAAGATCCTTTGATCTTTTCTACGGGGTC
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6901 AAATCAATCTAAAGTATATATGAGTAAACTTGGTCTGACAGTTACCAATGCTTAATCAGTGAGGCACCTATCTCAGCGATCTGTCTATTTTCGTTTCATCCA
7001 TAGTTGCCTGACTCCCCGTCGTGTAGATAACTACGATACGGGAGGGCTTACCATCTGGCCCCAGTGCTGCAATGATACCGGAGACCCAGCTCACCGGC
287 • W H K I L S A G I E A I Q R N R E D M
267 T A Q S G T T Y I V V I R S P K G D P G L A A I I G R S G R E G A
7101 TCCAGATTTATCAGCAATAAACCCAGCCAGCCGGAAGGGCCGAGCGCAGAAGTGGTCTGCAACTTTATCCGCTCCATCCAGTCTATTAATTTGTTGCCG
234 G S K D A I F W G A P L A S R L L P G A V K D A E M W D I L Q Q R
7201 GAAGCTAGAGTAAGTAGTTCGCCAGTTAATAGTTTGCACAACGTTGTTGCCATTGCTACAGGCATCGTGGTGTACGCTCGCTTTGGTATGGCTTCAT
200 S A L T L L E G T L L K R L T T A M A V P M T T D R E D N P I A E N
7301 TCAGTCCGGTCCCAACGATCAAGGCGAGTTACATGATCCCCATGTTGTGCAAAAAAGCGGTTAGCTCCTTCGGTCTCCGATCGTTGTGAGAAGTAA
167 L E P E W R D L R T V H D G M N H L F A T L E K P G G I T T L L L
7401 GTTGGCCGAGTGTATCACTCATGGTTATGGCAGCACTGCATAATTCTTACTGTCATGCCATCCGTAAGATGCTTTTCTGTGACTGGTGTAGTACTCA
134 N A A T N D S M T I A A S C L E R V T M G D T L H K E T V P S Y E
7501 ACCAAGTCATTCTGAGAATAGTGTATGCGGCGACCGAGTTGCTCTTGCCTGGCGTCAATACGGGATAATACCGGCCACATAGCAGAAGTAAAAAGTGC
100 V L D N Q S Y H I R R G L Q E Q G A D I R S L V A G C L L V K F T S
7601 TCATCATTGAAAACGTTCTTCGGGGCGAAAACCTCAAGGATCTTACCGCTGTTGAGATCCAGTTCGATGTAACCCACTCGTGCACCAACTGATCTTC
67 M M P F R E E P R F S E L I K G S N L D L E I Y G V R A G L Q D E
7701 AGCATCTTTTACTTTTACCAGCGTTTCTGGGTGAGCAAAAACAGGAAGGCAAAATGCCGAAAAAGGGAATAAGGGCGACACGGAATGTTGAATACTC
34 A D K V K V L T E P H A F V P L C F A A F F P I L A V R F H Q I S
7801 ATACTTTCCTTTTCAATATTATTGAAGCATTATCAGGGTATTGTCTCATGAGCGGATACATATTTGAATGTATTTAGAAAAATAACAATAGGGG
0 M
7901 TTCGGGCACATTTCCCCGAAAAGTGCCACCTAAATTTGTAAGCGTAAATATTTTGTAAAAATTCGCGTAAATTTTTGTTAAATCAGCTATTTTTTAAC
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8201 TAAAGCACTAAATCGGAACCTAAAGGGAGCCCCGATTTAGAGCTTGACGGGAAAAGCCGGCAACGTGGCGAGAAAAGGAAGGAAGAAAGCGAAAGGA
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8501 AACGCCAGGGTTTTCCAGTCACGACGTTGTA AACGACGCGCCAGTGAGCGCGGTAATACGACTCACTATAGGGCGAATTGGAGCTCACCGCGGTGGC
8601 GGCCGCTCTAGA