SEQ ID NO: 1 fljB/STF2 amino acid sequence (hinge region underlined)

MAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSAKDDAAGQAIANRFTANIKG
LTQASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSANSTNSQSDLDSIQAEITQRL
NEIDRVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLKQINSQTLGLDSLNVQKAYD
VKDTAVTTKAYANNGTTLDVSGLDDAAIKAATGGTNGTASVTGGAVKFDADNNKYFVTIG
GFTGADAAKNGDYEVNVATDGTVTLAAGATKTTMPAGATTKTEVQELKDTPAVVSADAKN
ALIAGGVDATDANGAELVKMSYTDKNGKTIEGGYALKAGDKYYAADYDEATGAIKAKTTS
YTAADGTTKTAANQLGGVDGKTEVVTIDGKTYNASKAAGHDFKAQPELAEAAAKTTENPL
QKIDAALAQVDALRSDLGAVQNRFNSAITNLGNTVNNLSEARSRIEDSDYATEVSNMSRA
QILQQAGTSVLAQANQVPQNVLSLLR

Figure 1

SEQ ID NO: 2 fljB/STF2 nucleic acid sequence (hinge region underlined)

ATGGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAACAAA
TCCCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATCAACAGC
GCGAAAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGT
CTGACTCAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGC
GCGCTGAACGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCT
AACAGCACCAACTCCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTG
AACGAAATCGACCGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAG
GACAACACCCTGACCATCCAGGTTGGCGCCAACGACGGTGAAACTATCGATATCGATCTG
AAGCAGATCAACTCTCAGACCCTGGGTCTGGACTCACTGAACGTGCAGAAAGCGTATGAT
GTGAAAGATACAGCAGTAACAACGAAAGCTTATGCCAATAATGGTACTACACTGGATGTA
TCGGGTCTTGATGATGCAGCTATTAAAGCGGCTACGGGTGGTACGAATGGTACGGCTTCT
GTAACCGGTGGTGCGGTTAAATTTGACGCAGATAATAACAAGTACTTTGTTACTATTGGT
GGCTTTACTGGTGCTGATGCCGCCAAAAATGGCGATTATGAAGTTAACGTTGCTACTGAC
GGTACAGTAACCCTTGCGGCTGGCGCAACTAAAACCACAATGCCTGCTGGTGCGACAACT
AAAACAGAAGTACAGGAGTTAAAAGATACACCGGCAGTTGTTTCAGCAGATGCTAAAAAT
GCCTTAATTGCTGGCGGCGTTGACGCTACCGATGCTAATGGCGCTGAGTTGGTCAAAATG
TCTTATACCGATAAAAATGGTAAGACAATTGAAGGCGGTTATGCGCTTAAAGCTGGCGAT
AAGTATTACGCCGCAGATTACGATGAAGCGACAGGAGCAATTAAAGCTAAAACTACAAGT
TATACTGCTGCTGACGGCACTACCAAAACAGCGGCTAACCAACTGGGTGGCGTAGACGGT
AAAACCGAAGTCGTTACTATCGACGGTAAAACCTACAATGCCAGCAAAGCCGCTGGTCAT
GATTTCAAAGCACAACCAGAGCTGGCGGAAGCAGCCGCTAAAACCACCGAAAACCCGCTG
CAGAAAATTGATGCCGCGCTGGCGCAGGTGGATGCGCTGCGCTCTGATCTGGGTGCGGTA
CAAAACCGTTTCAACTCTGCTATCACCAACCTGGGCAATACCGTAAACAATCTGTCTGAA
GCGCGTAGCCGTATCGAAGATTCCGACTACGCGACCGAAGTTTCCAACATGTCTCGCGCG
CAGATTCTGCAGCAGGCCGGTACTTCCGTTCTGGCGCAGGCTAACCAGGTCCCGCAGAAC
GTGCTGTCTCTGTTACGT

Figure 2

SEQ ID NO: 3 fljB/STF2Δ amino acid sequence

MAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSAKDDAAGQAIANRFTANIKGLT
QASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSANSTNSQSDLDSIQAEITQRLNEID
RVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLKQINSQTLGLDSLNVHGAPVDPASPW
TENPLQKIDAALAQVDALRSDLGAVQNRFNSAITNLGNTVNNLSEARSRIEDSDYATEVSNM
SRAQILQQAGTSVLAQANQVPQNVLSLLR

Figure 3

SEQ ID NO: 4 fljB/STF2Δ nucleic acid sequence

ATGGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAACAAATC
CCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATCAACAGCGCGA
AAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGTCTGACT
CAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGCGCGCTGAA
CGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCTAACAGCACCA
ACTCCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTGAACGAAATCGAC
CGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAGGACAACACCCTGAC
CATCCAGGTTGGCGCCAACGACGGTGAAACTATCGATATCGATCTGAAGCAGATCAACTCTC
AGACCCTGGGTCTGGACTCACTGAACGTGCATGGAGCGCCGGTGGATCCTGCTAGCCCATGG
ACCGAAAACCCGCTGCAGAAAATTGATGCCGCGCTGGCGCAGGTGGATGCGCTGCGCTCTGA
TCTGGGTGCGGTACAAAACCGTTTCAACTCTGCTATCACCAACCTGGGCAATACCGTAAACA
ATCTGTCTGAAGCGCGTAGCCGTATCGAAGATTCCGACTACGCGACCGAAGTTTCCAACATG
TCTCGCGCGCAGATTTTGCAGCAGGCCGGTACTTCCGTTCTGGCGCAGGCTAACCAGGTCCC
GCAGAACGTGCTGTCTCTGTTACGTG

Figure 4

SEQ ID NO: 5 E. coli fliC amino acid sequence (hinge region underlined)

MAQVINTNSLSLITQNNINKNQSALSSSIERLSSGLRINSAKDDAAGQAIANRFTSNIKG
LTQAARNANDGISVAQTTEGALSEINNNLQRIRELTVQASTGTNSDSDLDSIQDEIKSRL
DEIDRVSGQTQFNGVNVLAKDGSMKIQVGANDGQTITIDLKKIDSDTLGLNGFNVNGSGT
IANKAATISDLTAAKMDAATNTITTTNNALTASKALDQLKDGDTVTIKADAAQTATVYTY
NASAGNFSLSNVSNNTSEKAGDVAASLLPPAGQTASGVYKAASGEVNFDVDANGKITIGG
QKAYLTSDGNLTTNDAGGATAATLDGLFKKAGDGQSIGFKKTASVTMGGTTYNFKTGADA
DAATANAGVSFTDTASKETVLNKVATAKQGKAAAAADGDTSATITYKSGVQTYQAVFAAGD
GTASAKYADKADVSNATATYTDADGEMTTIGSYTTKYSIDANNGKVTVDSGTGTGKYAPK
VGAEVYVSANGTLTTDATSEGTVTKDPLKALDEAISSIDKFRSSLGAIQNRLDSAVTNLN
NTTTNLSEAQSRIQDADYATEVSNMSKAQIIQQAGNSVLAKANQVPQQVLSLLQG

Figure 5

SEQ ID NO: 6 E. coli fliC -nucleic acid sequence (hinge region underlined)

ATGGCACAAGTCATTAATACCAACAGCCTCTCGCTGATCACTCAAAATAATATCAACAAG
AACCAGTCTGCGCTGTCGAGTTCTATCGAGCGTCTGTCTTCTGGCTTGCGTATTAACAGC
GCGAAGGATGACGCCGCAGGTCAGGCGATTGCTAACCGTTTTACTTCTAACATTAAAGGC
CTGACTCAGGCTGCACGTAACGCCAACGACGGTATTTCCGTTGCGCAGACCACCGAAGGC
GCGCTGTCCGAAATCAACAACAACTTACAGCGTATCCGTGAACTGACGGTTCAGGCTTCT
ACCGGGACTAACTCCGATTCAGATCTGGACTCCATTCAGGACGAAATCAAATCCCGTCTG
GACGAAATTGACCGCGTATCTGGCCAGACCCAGTTCAACGGCGTGAACGTACTGGCGAAA
GACGGTTCAATGAAAATTCAGGTTGGTGCGAATGACGGCCAGACTATCACGATTGATCTG
AAGAAAATTGACTCAGATACGCTGGGGCTGAATGGTTTTAACGTGAATGGTTCCGGTACG
ATAGCCAATAAAGCGGCGACCATTAGCGACCTGACAGCAGCGAAAATGGATGCTGCAACT
AATACTATAACTACAACAAATAATGCGCTGACTGCATCAAAGGCGCTTGATCAACTGAAA
GATGGTGACACTGTTACTATCAAAGCAGATGCTGCTCAAACTGCCACGGTTTATACATAC
AATGCATCAGCTGGTAACTTCTCACTCAGTAATGTATCGAATAATACTTCAGAAAAAGCA
GGTGATGTAGCAGCTAGCCTTCTCCCGCCGGCTGGGCAAACTGCTAGTGGTGTTTATAAA
GCAGCAAGCGGTGAAGTGAACTTTGATGTTGATGCGAATGGTAAAATCACAATCGGAGGA
CAGAAAGCATATTTAACTAGTGATGGTAACTTAACTACAAACGATGCTGGTGGTGCGACT
GCGGCTACGCTTGATGGTTTATTCAAGAAAGCTGGTGATGGTCAATCAATCGGGTTTAAG
AAGACTGCATCAGTCACGATGGGGGGAACAACTTATAACTTTAAAACGGGTGCTGATGCT
GATGCTGCAACTGCTAACGCAGGGGTATCGTTCACTGATACAGCTAGCAAAGAAACCGTT
TTAAATAAAGTGGCTACAGCTAAACAAGGCAAAGCAGCTGCAGCTGACGGTGATACATCC
GCAACAATTACCTATAAATCTGGCGTTCAGACGTATCAGGCTGTATTTGCCGCAGGTGAC
GGTACTGCTAGCGCAAAATATGCCGATAAAGCTGACGTTTCTAATGCAACAGCAACATAC
ACTGATGCTGATGGTGAAATGACTACAATTGGTTCATACACCACGAAGTATTCAATCGAT
GCTAACAACGGCAAGGTAACTGTTGATTCTGGAACTGGTACGGGTAAATATGCGCCGAAA
GTAGGGGCTGAAGTATATGTTAGTGCTAATGGTACTTTAACAACAGATGCAACTAGCGAA
GGCACAGTAACAAAAGATCCACTGAAAGCTCTGGATGAAGCTATCAGCTCCATCGACAAA
TTCCGTTCTTCCCTGGGTGCTATCCAGAACCGTCTGGATTCCGCAGTCACCAACCTGAAC
AACACCACTACCAACCTGTCCGAAGCGCAGTCCCGTATTCAGGACGCCGACTATGCGACC
GAAGTGTCCAACATGTCGAAAGCGCAGATCATTCAGCAGGCCGGTAACTCCGTGCTGGCA
AAAGCCAACCAGGTACCGCAGCAGGTTCTGTCTCTGCTGCAGGGTTAG

Figure 6

SEQ ID NO: 7 Salmonella muenchen flagellin fliC amino acid sequence (hinge region underlined)

MAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSAKDDAAGQAIANRFTANIKGLT
QASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSANGTNSQSDLDSIQAEITQRLNEID
RVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLKEISSKTLGLDKLNVQDAYTPKETAV
TVDKTTYKNGTDTITAQSNTDIQTAIGGGATGVTGADIKFKDGQYYLDVKGGASAGVYKATY
DETTKKVNIDTTDKTPLATAEATAIRGTATITHNQIAEVTKEGVDTTTVAAQLAAAGVTGAD
KDNTSLVKLSFEDKNGKVIDGGYAVKMGDDFYAATYDEKTGTITAKTTTYTDGAGVAQTGAV
KFGGANGKSEVVTATDGKTYLASDLDKHNFRTGGELKEVNTDKTENPLQKIDAALAQVDTLR
SDLGAVQNRFNSAITNLGNTVNNLSSARSRIEDSDYATEVSNMSRAQILQQAGTSVLAQANQ
VPQNVLSLLR

Figure 7

SEQ ID NO: 8 Salmonella muenchen flagellin fliC nucleic acid sequence (hinge region underlined)

AATGGCACAAGTCATTAATACAAACAGCCTGTCGCTGTTGACCCAGAATAACCTGAACAAAT
CCCAGTCCGCTCTGGGCACCGCTATCGAGCGTCTGTCTTCCGGTCTGCGTATCAACAGCGCG
AAAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGTCTGAC
TCAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGCGCGCTGA
ACGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCTAACGGTACT
AACTCCCAGTCTGACCTTGACTCTATCCAGGCTGAAATCACCCAGCGTCTGAACGAAATCGA
CCGTGTATCCGGTCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAGGACAACACCCTGA
CCATCCAGGTTGGTGCCAACGACGGTGAAACTATTGATATTGATTTAAAAGAAATTAGCTCT
AAAACACTGGGACTTGATAAGCTTAATGTCCAGGATGCCTACACCCCGAAAGAAACTGCTGT
AACCGTTGATAAAACTACCTATAAAAATGGTACAGATACTATTACAGCCCAGAGCAATACTG
ATATCCAAACTGCAATTGGCGGTGGTGCAACGGGGGTTACTGGGGCTGATATCAAATTTAAA
GATGGTCAATACTATTTAGATGTTAAAGGCGGTGCTTCTGCTGGTGTTTATAAAGCCACTTA
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AAGCTACAGCTATTCGGGGAACGGCCACTATAACCCACAACCAAATTGCTGAAGTAACAAAA
GAGGGTGTTGATACGACCACAGTTGCGGCTCAACTTGCTGCTGCAGGGGTTACTGGTGCCGA
TAAGGACAATACTAGCCTTGTAAAACTATCGTTTGAGGATAAAAACGGTAAGGTTATTGATG
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ACAATTACTGCTAAAACAACCACTTATACAGATGGTGCTGGCGTTGCTCAAACTGGAGCTGT
GAAATTTGGTGGCGCAAATGGTAAATCTGAAGTTGTTACTGCTACCGATGGTAAAACTTACT
TAGCAAGCGACCTTGACAAACATAACTTCAGAACAGGCGGTGAGCTTAAAGAGGTTAATACA
GATAAGACTGAAAACCCACTGCAGAAAATTGATGCTGCCTTGGCACAGGTTGATACACTTCG
TTCTGACCTGGGTGCGGTACAGAACCGTTTCAACTCCGCTATCACCAACCTGGGCAATACCG
TAAATAACCTGTCTTCTGCCCGTAGCCGTATCGAAGATTCCGACTACGCGACCGAAGTCTCC
AACATGTCTCGCGCGCAGATTCTGCAGCAGGCCGGTACCTCCGTTCTGGCGCAGGCTAACCA
GGTTCCGCAAAACGTCCTCTCTTTACTGCGTTAA

Figure 8

SEQ ID:9 Amino acid sequence of pMT/STF2 (Linker underlined)

MKLCILLAVVAFVGLSLGRSAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRI
NSAKDDAAGQAIANRFTANIKGLTQASRNANDGISIAQTTEGALNEINNNLQRVREL
AVQSANSTNSQSDLDSIQAEITQRLNEIDRVSGQTQFNGVKVLAQDNTLTIQVGAND
GETIDIDLKQINSQTLGLDSLNVQKAYDVKDTAVTTKAYANNGTTLDVSGLDDAAIK
AATGGTNGTASVTGGAVKFDADNNKYFVTIGGFTGADAAKNGDYEVNVATDGTVTLA
AGATKTTMPAGATTKTEVQELKDTPAVVSADAKNALIAGGVDATDANGAELVKMSYT
DKNGKTIEGGYALKAGDKYYAADYDEATGAIKAKTTSYTAADGTTKTAANQLGGVDG
KTEVVTIDGKTYNASKAAGHDFKAQPELAEAAAKTTENPLQKIDAALAQVDALRSDL
GAVQNRFNSAITNLGNTVNNLSEARSRIEDSDYATEVSNMSRAQILQQAGTSVLAQA
NQVPQNVLSLLRKGNSKLEGQLEFPRTSPVWWNSADIQHSGGRSSLEGPRFEGKPIP
NPLLGLDSTRTGHHHHHH

Figure 9

SEQ ID: 10 Amino acid sequence of pMT/STF2 (Linker underlined)

ATGAAGTTATGCATATTACTGGCCGTCGTGGCCTTTGTTGGCCTCTCGCTCGGGAGATCT
GCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAACAAATCC
CAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATCAACAGCGCG
AAAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGTCTG
ACTCAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGCGCG
CTGAACGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCTAAC
AGCACCAACTCCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTGAAC
GAAATCGACCGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAGGAC
AACACCCTGACCATCCAGGTTGGCGCCAACGACGGTGAAACTATCGATATCGATCTGAAG
CAGATCAACTCTCAGACCCTGGGTCTGGACTCACTGAACGTGCAGAAAGCGTATGATGTG
AAAGATACAGCAGTAACAACGAAAGCTTATGCCAATAATGGTACTACACTGGATGTATCG
GGTCTTGATGATGCAGCTATTAAAGCGGCTACGGGTGGTACGAATGGTACGGCTTCTGTA
ACCGGTGGTGCGGTTAAATTTGACGCAGATAATAACAAGTACTTTGTTACTATTGGTGGC
TTTACTGGTGCTGATGCCGCCAAAAATGGCGATTATGAAGTTAACGTTGCTACTGACGGT
ACAGTAACCCTTGCGGCTGGCGCAACTAAAACCACAATGCCTGCTGGTGCGACAACTAAA
ACAGAAGTACAGGAGTTAAAAGATACACCGGCAGTTGTTTCAGCAGATGCTAAAAATGCC
TTAATTGCTGGCGGCGTTGACGCTACCGATGCTAATGGCGCTGAGTTGGTCAAAATGTCT
TATACCGATAAAAATGGTAAGACAATTGAAGGCGGTTATGCGCTTAAAGCTGGCGATAAG
TATTACGCCGCAGATTACGATGAAGCGACAGGAGCAATTAAAGCTAAAACTACAAGTTAT
ACTGCTGCTGACGGCACTACCAAAACAGCGGCTAACCAACTGGGTGGCGTAGACGGTAAA
ACCGAAGTCGTTACTATCGACGGTAAAACCTACAATGCCAGCAAAGCCGCTGGTCATGAT
TTCAAAGCACAACCAGAGCTGGCGGAAGCAGCCGCTAAAACCACCGAAAACCCGCTGCAG
AAAATTGATGCCGCGCTGGCGCAGGTGGATGCGCTGCGCTCTGATCTGGGTGCGGTACAA
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CTGTCTCTGTTACGTAAGGGCAATTCGAAGCTTGAAGGTCAATTGGAATTCCCTAGGACT
AGTCCAGTGTGGTGGAATTCTGCAGATATCCAGCACAGTGGCGGCCGCTCGAGTCTAGAG
GGCCCGCGGTTCGAAGGTAAGCCTATCCCTAACCCTCTCCTCGGTCTCGATTCTACGCGT
ACCGGTCATCATCACCATCACCAT

Figure 10

SEQ ID NO: 17 4xM2e

AGCTTGCTGACTGAGGTTGAGACCCCGATTCGCAACGAATGGGGTTCCCGTTCCAACGATTC
TTCCGACCCGCTCGAGAGCCTGTTGACCGAGGTTGAAACCCCTATCCGTAATGAATGGGGCT
CCCGTAGCAACGACTCTTCTGACCCAGGATCCTCCCTCTTGACCGAAGTGGAAACGCCTATT
CGTAATGAGTGGGGTTCTCGTAGCAATGACAGCTCGGACCCGGAGCTCTCGCTGCTGACGGA
AGTGGAGACTCCGATCCGTAACGAGTGGGGCTCTCGCTCTAACGATAGCTCAGACCCGTCTA
GATAA

Figure 11

SEQ ID NO: 18 4xM2e

SLLTEVETPIRNEWGSRSNDSSDPLESLLTEVETPIRNEWGSRSNDSSDPGSSLLTEVET
PIRNEWGSRSNDSSDPELSLLTEVETPIRNEWGSRSNDSSDPSR

Figure 12

SEQ ID NO.: 31 fljB/STF2-4xM2e

MAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSAKDDAAGQAIANRFTANIKGLT
QASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSANSTNSQSDLDSIQAEITQRLNEID
RVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLKQINSQTLGLDSLNVQKAYDVKDTAV
TTKAYANNGTTLDVSGLDDAAIKAATGGTNGTASVTGGAVKFDADNNKYFVTIGGFTGADAA
KNGDYEVNVATDGTVTLAAGATKTTMPAGATTKTEVQELKDTPAVVSADAKNALIAGGVDAT
DANGAELVKMSYTDKNGKTIEGGYALKAGDKYYAADYDEATGAIKAKTTSYTAADGTTKTAA
NQLGGVDGKTEVVTIDGKTYNASKAAGHDFKAQPELAEAAAKTTENPLQKIDAALAQVDALR
SDLGAVQNRFNSAITNLGNTVNNLSEARSRIEDSDYATEVSNMSRAQILQQAGTSVLAQANQ
VPQNVLSLLRLSLLTEVETPIRNEWGSRSNDSSDPLESLLTEVETPIRNEWGSRSNDSSDPG
SSLLTEVETPIRNEWGSRSNDSSDPELSLLTEVETPIRNEWGSRSNDSSDPSR

Figure 13

SEQ ID NO: 32 STF2-4xM2e

ATGGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAACAAATC
CCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATCAACAGCGCGA
AAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGTCTGACT
CAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGCGCGCTGAA
CGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCTAACAGCACCA
ACTCCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTGAACGAAATCGAC
CGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAGGACAACACCCTGAC
CATCCAGGTTGGCGCCAACGACGGTGAAACTATCGATATCGATCTGAAGCAGATCAACTCTC
AGACCCTGGGTCTGGACTCACTGAACGTGCAGAAAGCGTATGATGTGAAAGATACAGCAGTA
ACAACGAAAGCTTATGCCAATAATGGTACTACACTGGATGTATCGGGTCTTGATGATGCAGC
TATTAAAGCGGCTACGGGTGGTACGAATGGTACGGCTTCTGTAACCGGTGGTGCGGTTAAAT
TTGACGCAGATAATAACAAGTACTTTGTTACTATTGGTGGCTTTACTGGTGCTGATGCCGCC
AAAAATGGCGATTATGAAGTTAACGTTGCTACTGACGGTACAGTAACCCTTGCGGCTGGCGC
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AGGCGGTTATGCGCTTAAAGCTGGCGATAAGTATTACGCCGCAGATTACGATGAAGCGACAG
GAGCAATTAAAGCTAAAACCACAAGTTATACTGCTGCTGACGGCACTACCAAAACAGCGGCT
AACCAACTGGGTGGCGTAGACGGTAAAACCGAAGTCGTTACTATCGACGGTAAAACCTACAA
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ACATGTCTCGCGCGCAGATTTTGCAGCAGGCCGGTACTTCCGTTCTGGCGCAGGCTAACCAG
GTCCCGCAGAACGTGCTGTCTCTGTTACGTCTGAGCTTGCTGACTGAGGTTGAGACCCCGAT
TCGCAACGAATGGGGTTCCCGTTCCAACGATTCTTCCGACCCGCTCGAGAGCCTGTTGACCG
AGGTTGAAACCCCTATCCGTAATGAATGGGGCTCCCGTAGCAACGACTCTTCTGACCCAGGA
TCCTCCCTCTTGACCGAAGTGGAAACGCCTATTCGTAATGAGTGGGGTTCTCGTAGCAATGA
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Figure 14



Figure 15

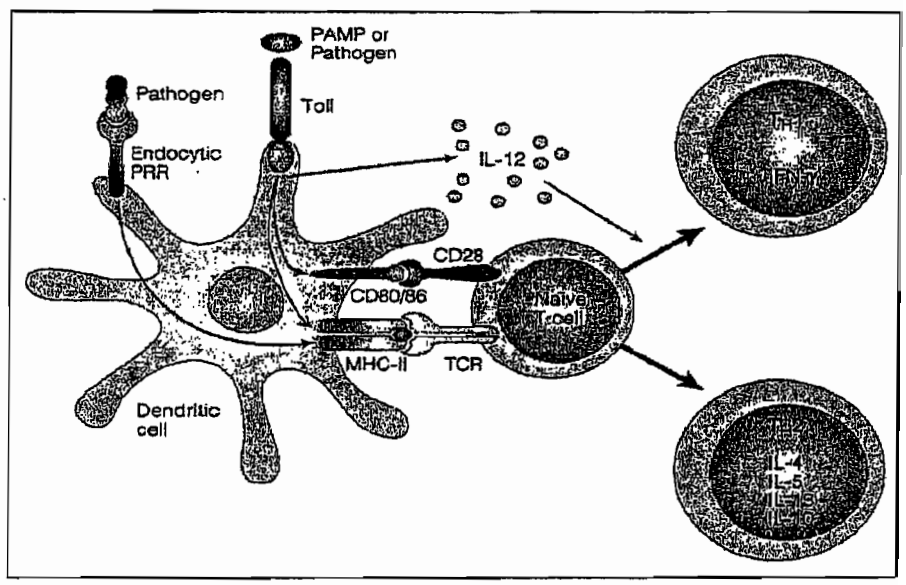

PAMP or
Pathogen
Pathogen
Toll
Endocytic
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IL-12
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CD80/86
MHC-II
TCR
Dendritic
cell
IL-4
IL-5

Figure 16

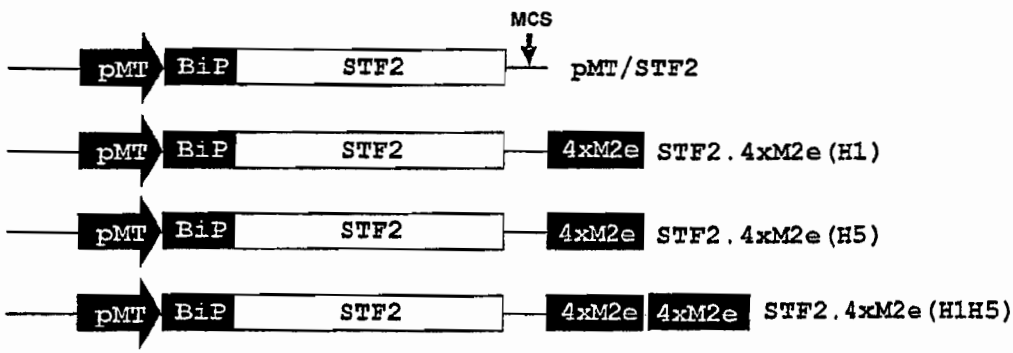

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BiP
STF2
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STF2.4xM2e(H1)
pMT
BiP
STF2
4xM2e
STF2.4xM2e(H5)
pMT
BiP
STF2
4xM2e
4xM2e
STF2.4xM2e(H1H5)

Figure 17A

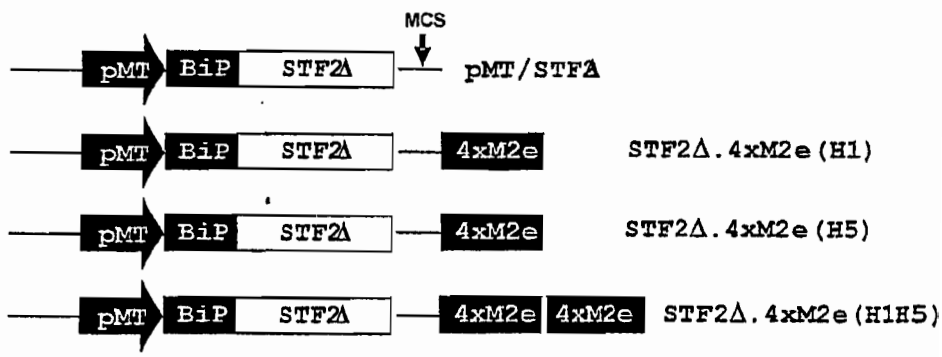

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BiP
STF2Δ
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BiP
STF2Δ
4xM2e
STF2Δ.4xM2e(H5)
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Figure 17B

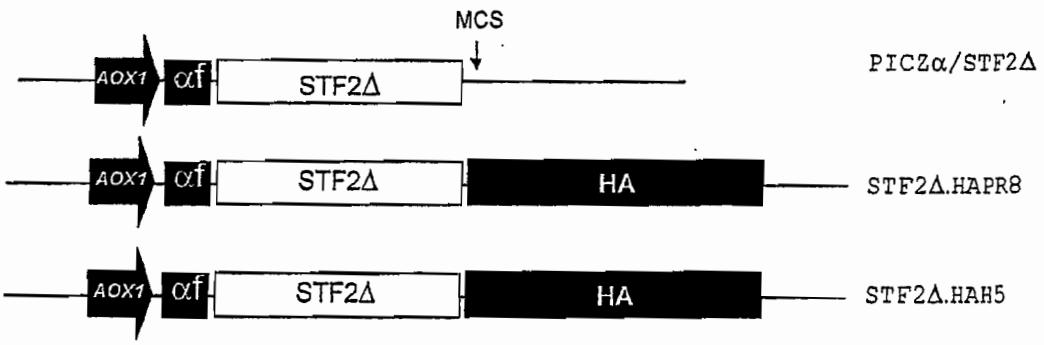

MCS
AOX1
αf
STF2Δ
PICZα/STF2Δ
AOX1
αf
STF2Δ
HA
STF2Δ.HAPR8
AOX1
αf
STF2Δ
HA
STF2Δ.HAH5

Figure 18

SEQ ID NO: 60

MAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSAKDDAAGQAIANRFTANIKG
LTQASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSANSTNSQSDLDSIQAEITQRL
NEIDRVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLKQINSQTLGLDSLNVHGAPV
DPASPWTENPLQKIDAALAQVDALRSDLGAVQNRFNSAITNLGNTVNNLSEARSRIEDSD
YATEVSNMSRAQILQQAGTSVLAQANQVPQNVLSLLREFSRYPAQWRPLDQICIGYHANN
STEQVDTIMEKNVTVTHAQDILEKKHNGKLCDLDGVKPLILRDCSVAGWLLGNPMCDEFI
NVPEWSYIVEKANPVNDLCYPGDFNDYEELKHLLSRINHFEKIQIIPKSSWSSHEASLGV
SSACPYQGKSSFFRNVVWLIKKNSTYPTIKRSYNNTNQEDLLVLWGIHHPNDAAEQTKLY
QNPTTYISVGTSTLNQRLVPRIATRSKVNGQSGRMEFFWTILKPNDAINFESNGNFIAPE
YAYKIVKKGDSTIMKSELEYGNCNTKCQTPMGAINSSMPFHNIHPLTIGECPKYVKSNRL
VLATGLRNSPQRERRRKKRGLFGAIAGFIEGGWQGMVDGWYGYHHSNEQGSGYAADKEST
QKAIDGVTNKVNSIIDKMNTQFEAVGREFNNLERRIENLNKKMEDGFLDVWTYNAELLVL
MENERTLDFHDSNVKNLYDKVRLQLRDNAKELGNGCFEFYHKCDNECMESVRNGTYDYPQ
YSEEARLKREEISGVKLESIGIYQILSIYST

Figure 19

SEQ ID NO: 61

ATGGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAACAAA
TCCCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATCAACAGC
GCGAAAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGT
CTGACTCAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGC
GCGCTGAACGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCT
AACAGCACCAACTCCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTG
AACGAAATCGACCGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAG
GACAACACCCTGACCATCCAGGTTGGCGCCAACGACGGTGAAACTATCGATATCGATCTG
AAGCAGATCAACTCTCAGACCCTGGGTCTGGACTCACTGAACGTGCATGGAGCGCCGGTG
GATCCTGCTAGCCCATGGACCGAAAACCCGCTGCAGAAAATTGATGCCGCGCTGGCGCAG
GTGGATGCGCTGCGCTCTGATCTGGGTGCGGTACAAAACCGTTTCAACTCTGCTATCACC
AACCTGGGCAATACCGTAAACAATCTGTCTGAAGCGCGTAGCCGTATCGAAGATTCCGAC
TACGCGACCGAAGTTTCCAACATGTCTCGCGCGCAGATTTTGCAGCAGGCCGGTACTTCC
GTTCTGGCGCAGGCTAACCAGGTCCCGCAGAACGTGCTGTCTCTGTTACGTGAATTCTCT
AGATATCCAGCACAGTGGCGGCCGCTCGACCAGATCTGTATCGGTTATCATGCTAACAAT
TCTACTGAACAAGTAGATACTATCATGGAGAAGAACGTTACAGTTACACATGCACAAGAT
ATCCTGGAAAAGAAGCATAATGGAAAACTGTGTGACCTTGATGGTGTTAAACCACTAATA
TTGCGTGACTGCTCAGTTGCTGGGTGGTTGTTGGGGAATCCAATGTGCGACGAATTTATC
AACGTTCCAGAATGGAGTTACATTGTTGAAAAAGCTAACCCTGTTAACGACTTGTGTTAC
CCAGGCGATTTTAATGACTACGAGGAACTTAAGCATTTGTTGTCAAGAATTAACCACTTC
GAGAAAATTCAAATTATTCCAAAGTCATCTTGGTCCTCCCATGAAGCATCCCTAGGAGTC
TCTTCCGCTTGCCCTTACCAAGGCAAGAGTTCCTTTTTTCGTAATGTCGTCTGGCTGATC
AAAAAGAACTCCACCTATCCAACTATAAAGAGATCATACAACAACACAAATCAGGAGGAT
CTGCTAGTTCTGTGGGGCATTCACCACCCCAATGACGCAGCTGAGCAGACTAAATTGTAC
CAAAACCCAACTACCTATATATCAGTTGGTACCTCAACTCTTAACCAGCGACTAGTCCCC
CGTATTGCTACTAGGTCAAAGGTTAATGGTCAAAGTGGACGAATGGAGTTTTTCTGGACT
ATTTTGAAGCCCAACGATGCCATCAACTTCGAAAGTAATGGAAATTTCATAGCCCCTGAG
TACGCTTACAAAATCGTTAAAAAGGGTGATTCCACTATCATGAAATCTGAACTGGAATAC
GGAAACTGTAACACCAAATGCCAGACGCCAATGGGTGCCATCAACTCTTCTATGCCTTTT
CACAACATTCATCCTTTGACTATTGGTGAATGCCCAAAGTACGTCAAATCTAACCGTTTG
GTGTTGGCTACTGGTCTAAGGAACTCCCCTCAGCGTGAAAGAAGAAGAAAGAAGAGGGGA
TTATTCGGTGCTATCGCTGGATTTATTGAGGGAGGATGGCAGGGAATGGTCGATGGCTGG
TATGGTTACCATCACTCAAATGAACAGGGAAGTGGATACGCAGCTGATAAAGAATCTACT
CAAAAGGCTATCGACGGTGTTACAAACAAGGTCAATTCTATTATCGATAAGATGAATACA
CAGTTTGAGGCTGTTGGTAGAGAGTTCAATAATCTTGAGAGAAGAATCGAAAACCTGAAC
AAGAAAATGGAAGACGGATTTTTAGATGTATGGACTTACAATGCTGAGTTGTTGGTCTTG
ATGGAGAATGAACGAACGTTGGACTTCCATGACTCCAATGTGAAGAACCTATATGACAAA
GTGAGGCTGCAACTTAGAGACAACGCCAAGGAATTGGGAAACGGGTGCTTCGAGTTTTAC
CACAAATGCGACAACGAATGTATGGAATCAGTGAGAAACGGTACCTATGATTACCCCCAA
TATTCCGAGGAGGCAAGACTGAAGAGAGAAGAGATATCTGGTGTAAAGTTGGAATCCATC
GGTATTTATCAGATTCTATCTATATATTCTACCTAATAG

Figure 20

SEQ ID NO: 62

MAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSAKDDAAGQAIANRFTANIKG
LTQASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSANSTNSQSDLDSIQAEITQRL
NEIDRVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLKQINSQTLGLDSLNVHGAPV
DPASPWTENPLQKIDAALAQVDALRSDLGAVQNRFNSAITNLGNTVNNLSEARSRIEDSD
YATEVSNMSRAQILQQAGTSVLAQANQVPQNVLSLLREFSRYPAQWRPLDTICIGYHANN
STDTVDTVLEKNVTVTHSVNLLEDSHNGKLCRLKGIAPLQLGKCNIAGWLLGNPECDPLL
PVRSWSYIVETPNSENGICYPGDFIDYEELREQLSSVSSFERFEIFPKESSWPNHNTNGV
TAACSHEGKSSFYRNLLWLTEKEGSYPKLKNSYVNKKGKEVLVLWGIHHPPNSKEQQNLY
QNENAYVSVVTSNYNRRFTPEIAERPKVRDQAGRMNYYWTLLKPGDTIIFEANGNLIAPM
YAFALSRGFGSGIITSNASMHECNTKCQTPLGAINSSLPYQNIHPVTIGECPKYVRSAKL
RMVTGLRNIPSIQSRGLFGAIAGFIEGGWTGMIDGWYGYHHQNEQGSGYAADQKSTQNAI
NGITNKVNTVIEKMNIQFTAVGKEFNKLEKRMENLNKKVDDGFLDIWTYNAELLVLLENE
RTLDFHDSNVKNLYEKVKSQLKNNAKEIGNGCFEFYHKCDNECMESVRNGTYDYPKYSEE
SKLNREKVDGVKLESMGIYQ

Figure 21

SEQ ID NO: 63

ATGGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAACAAA
TCCCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATCAACAGC
GCGAAAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGT
CTGACTCAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGC
GCGCTGAACGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCT
AACAGCACCAACTCCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTG
AACGAAATCGACCGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAG
GACAACACCCTGACCATCCAGGTTGGCGCCAACGACGGTGAAACTATCGATATCGATCTG
AAGCAGATCAACTCTCAGACCCTGGGTCTGGACTCACTGAACGTGCATGGAGCGCCGGTG
GATCCTGCTAGCCCATGGACCGAAAACCCGCTGCAGAAAATTGATGCCGCGCTGGCGCAG
GTGGATGCGCTGCGCTCTGATCTGGGTGCGGTACAAAACCGTTTCAACTCTGCTATCACC
AACCTGGGCAATACCGTAAACAATCTGTCTGAAGCGCGTAGCCGTATCGAAGATTCCGAC
TACGCGACCGAAGTTTCCAACATGTCTCGCGCGCAGATTTTGCAGCAGGCCGGTACTTCC
GTTCTGGCGCAGGCTAACCAGGTCCCGCAGAACGTGCTGTCTCTGTTACGTGAATTCTCT
AGATATCCAGCACAGTGGCGGCCGCTCGACCAGATCTGTATCGGTTATCATGCTAACAAT
TCTACTGAACAAGTAGATACTATCATGGAGAAGAACGTTACAGTTACACATGCACAAGAT
ATCCTGGAAAAGAAGCATAATGGAAAACTGTGTGACCTTGATGGTGTTAAACCACTAATA
TTGCGTGACTGCTCAGTTGCTGGGTGGTTGTTGGGGAATCCAATGTGCGACGAATTTATC
AACGTTCCAGAATGGAGTTACATTGTTGAAAAAGCTAACCCTGTTAACGACTTGTGTTAC
CCAGGCGATTTTAATGACTACGAGGAACTTAAGCATTTGTTGTCAAGAATTAACCACTTC
GAGAAAATTCAAATTATTCCAAAGTCATCTTGGTCCTCCCATGAAGCATCCCTAGGAGTC
TCTTCCGCTTGCCCTTACCAAGGCAAGAGTTCCTTTTTTCGTAATGTCGTCTGGCTGATC
AAAAAGAACTCCACCTATCCAACTATAAAGAGATCATACAACAACACAAATCAGGAGGAT
CTGCTAGTTCTGTGGGGCATTCACCACCCCAATGACGCAGCTGAGCAGACTAAATTGTAC
CAAAACCCAACTACCTATATATCAGTTGGTACCTCAACTCTTAACCAGCGACTAGTCCCC
CGTATTGCTACTAGGTCAAAGGTTAATGGTCAAAGTGGACGAATGGAGTTTTTCTGGACT
ATTTTGAAGCCCAACGATGCCATCAACTTCGAAAGTAATGGAAATTTCATAGCCCCTGAG
TACGCTTACAAAATCGTTAAAAAGGGTGATTCCACTATCATGAAATCTGAACTGGAATAC
GGAAACTGTAACACCAAATGCCAGACGCCAATGGGTGCCATCAACTCTTCTATGCCTTTT
CACAACATTCATCCTTTGACTATTGGTGAATGCCCAAAGTACGTCAAATCTAACCGTTTG
GTGTTGGCTACTGGTCTAAGGAACTCCCCTCAGCGTGAAAGAAGAAGAAAGAAGAGGGGA
TTATTCGGTGCTATCGCTGGATTTATTGAGGGAGGATGGCAGGGAATGGTCGATGGCTGG
TATGGTTACCATCACTCAAATGAACAGGGAAGTGGATACGCAGCTGATAAAGAATCTACT
CAAAAGGCTATCGACGGTGTTACAAACAAGGTCAATTCTATTATCGATAAGATGAATACA
CAGTTTGAGGCTGTTGGTAGAGAGTTCAATAATCTTGAGAGAAGAATCGAAAACCTGAAC
AAGAAAATGGAAGACGGATTTTTAGATGTATGGACTTACAATGCTGAGTTGTTGGTCTTG
ATGGAGAATGAACGAACGTTGGACTTCCATGACTCCAATGTGAAGAACCTATATGACAAA
GTGAGGCTGCAACTTAGAGACAACGCCAAGGAATTGGGAAACGGGTGCTTCGAGTTTTAC
CACAAATGCGACAACGAATGTATGGAATCAGTGAGAAACGGTACCTATGATTACCCCCAA
TATTCCGAGGAGGCAAGACTGAAGAGAGAAGAGATATCTGGTGTAAAGTTGGAATCCATC
GGTATTTATCAGATTCTATCTATATATTCTACCTAATAG

Figure 22

SEQ ID NO: 64

DTICIGYHANNSTDTVDTVLEKNVTVTHSVNLLEDSHNGKLCRLKGIAPLQLGKCNIAGW
LLGNPECDPLLPVRSWSYIVETPNSENGICYPGDFIDYEELREQLSSVSSFERFEIFPKE
SSWPNHNTNGVTAACSHEGKSSFYRNLLWLTEKEGSYPKLKNSYVNKKGKEVLVLWGIHH
PPNSKEQQNLYQNENAYVSVVTSNYNRRFTPEIAERPKVRDQAGRMNYYWTLLKPGDTII
FEANGNLIAPMYAFALSRGFGSGIITSNASMHECNTKCQTPLGAINSSLPYQNIHPVTIG
ECPKYVRSAKLRMVTGLRNIPSIQSRGLFGAIAGFIEGGWTGMIDGWYGYHHQNEQGSGY
AADQKSTQNAINGITNKVNTVIEKMNIQFTAVGKEFNKLEKRMENLNKKVDDGFLDIWTY
NAELLVLLENERTLDFHDSNVKNLYEKVKSQLKNNAKEIGNGCFEFYHKCDNECMESVRN
GTYDYPKYSEESKLNREKVDGVKLESMGIYQ

Figure 23

SEQ ID NO: 65

GACCAGATCTGTATCGGTTATCATGCTAACAATTCTACTGAACAAGTAGATACTATCATG
GAGAAGAACGTTACAGTTACACATGCACAAGATATCCTGGAAAAGAAGCATAATGGAAAA
CTGTGTGACCTTGATGGTGTTAAACCACTAATATTGCGTGACTGCTCAGTTGCTGGGTGG
TTGTTGGGGAATCCAATGTGCGACGAATTTATCAACGTTCCAGAATGGAGTTACATTGTT
GAAAAAGCTAACCCTGTTAACGACTTGTGTTACCCAGGCGATTTTAATGACTACGAGGAA
CTTAAGCATTTGTTGTCAAGAATTAACCACTTCGAGAAAATTCAAATTATTCCAAAGTCA
TCTTGGTCCTCCCATGAAGCATCCCTAGGAGTCTCTTCCGCTTGCCCTTACCAAGGCAAG
AGTTCCTTTTTTCGTAATGTCGTCTGGCTGATCAAAAAGAACTCCACCTATCCAACTATA
AAGAGATCATACAACAACACAAATCAGGAGGATCTGCTAGTTCTGTGGGGCATTCACCAC
CCCAATGACGCAGCTGAGCAGACTAAATTGTACCAAAACCCAACTACCTATATATCAGTT
GGTACCTCAACTCTTAACCAGCGACTAGTCCCCCGTATTGCTACTAGGTCAAAGGTTAAT
GGTCAAAGTGGACGAATGGAGTTTTTCTGGACTATTTTGAAGCCCAACGATGCCATCAAC
TTCGAAAGTAATGGAAATTTCATAGCCCCTGAGTACGCTTACAAAATCGTTAAAAAGGGT
GATTCCACTATCATGAAATCTGAACTGGAATACGGAAACTGTAACACCAAATGCCAGACG
CCAATGGGTGCCATCAACTCTTCTATGCCTTTTCACAACATTCATCCTTTGACTATTGGT
GAATGCCCAAAGTACGTCAAATCTAACCGTTTGGTGTTGGCTACTGGTCTAAGGAACTCC
CCTCAGCGTGAAAGAAGAAGAAAGAAGAGGGGATTATTCGGTGCTATCGCTGGATTTATT
GAGGGAGGATGGCAGGGAATGGTCGATGGCTGGTATGGTTACCATCACTCAAATGAACAG
GGAAGTGGATACGCAGCTGATAAAGAATCTACTCAAAAGGCTATCGACGGTGTTACAAAC
AAGGTCAATTCTATTATCGATAAGATGAATACACAGTTTGAGGCTGTTGGTAGAGAGTTC
AATAATCTTGAGAGAAGAATCGAAAACCTGAACAAGAAAATGGAAGACGGATTTTTAGAT
GTATGGACTTACAATGCTGAGTTGTTGGTCTTGATGGAGAATGAACGAACGTTGGACTTC
CATGACTCCAATGTGAAGAACCTATATGACAAAGTGAGGCTGCAACTTAGAGACAACGCC
AAGGAATTGGGAAACGGGTGCTTCGAGTTTTACCACAAATGCGACAACGAATGTATGGAA
TCAGTGAGAAACGGTACCTATGATTACCCCCAATATTCCGAGGAGGCAAGACTGAAGAGA
GAAGAGATATCTGGTGTAAAGTTGGAATCCATCGGTATTTATCAGATTCTATCTATATAT
TCTACCTAATAG

Figure 24

SEQ ID NO: 66 E. coli fliC Amino Acid sequence (without hinge region)

MAQVINTNSLSLITQNNINKNQSALSSSIERLSSGLRINSAKDDAAGQAIANRFTSNIKG
LTQAARNANDGISVAQTTEGALSEINNNLQRIRELTVQASTGTNSDSDLDSIQDEIKSRL
DEIDRVSGQTQFNGVNVLAKDGSMKIQVGANDGQTITIDLKKIDSDTLGTKDPLKALDEA
ISSIDKFRSSLGAIQNRLDSAVTNLNNTTTNLSEAQSRIQDADYATEVSNMSKAQIIQQA
GNSVLAKANQVPQQVLSLLQG

Figure 25

SEQ ID No: 67 Amino Acid sequence of H5N1 HA

DQICIGYHANNSTEQVDTIMEKNVTVTHAQDILEKKHNGKLCDLDGVKPLILRDCSVAGWLLGNPMC
DEFINVPEWSYIVEKANPVNDLCYPGDFNDYEELKHLLSRINHFEKIQIIPKSSWSSHEASLGVSSA
CPYQGKSSFFRNVVWLIKKNSTYPTIKRSYNNTNQEDLLVLWGIHHPNDAAEQTKLYQNPTTYISVG
TSTLNQRLVPRIATRSKVNGQSGRMEFFWTILKPNDAINFESNGNFIAPEYAYKIVKKGDSTIMKSE
LEYGNCNTKCQTPMGAINSSMPFHNIHPLTIGECPKYVKSNRLVLATGLRNSPQRERRRKKRGLFGA
IAGFIEGGWQGMVDGWYGYHHSNEQGSGYAADKESTQKAIDGVTNKVNSIIDKMNTQFEAVGREFNN
LERRIENLNKKMEDGFLDVWTYNAELLVLMENERTLDFHDSNVKNLYDKVRLQLRDNAKELGNGCFE
FYHKCDNECMESVRNGTYDYPQYSEEARLKREEISGVKLESIGIYQILSIYST

Figure 26

SEQ ID No: 68 Nucleic acid sequence of H5N1 HA

GACCAGATCTGTATCGGTTATCATGCTAACAATTCTACTGAACAAGTAGATACTATCATG
GAGAAGAACGTTACAGTTACACATGCACAAGATATCCTGGAAAAGAAGCATAATGGAAAA
CTGTGTGACCTTGATGGTGTTAAACCACTAATATTGCGTGACTGCTCAGTTGCTGGGTGG
TTGTTGGGGAATCCAATGTGCGACGAATTTATCAACGTTCCAGAATGGAGTTACATTGTT
GAAAAAGCTAACCCTGTTAACGACTTGTGTTACCCAGGCGATTTTAATGACTACGAGGAA
CTTAAGCATTTGTTGTCAAGAATTAACCACTTCGAGAAAATTCAAATTATTCCAAAGTCA
TCTTGGTCCTCCCATGAAGCATCCCTAGGAGTCTCTTCCGCTTGCCCTTACCAAGGCAAG
AGTTCCTTTTTTCGTAATGTCGTCTGGCTGATCAAAAAGAACTCCACCTATCCAACTATA
AAGAGATCATACAACAACACAAATCAGGAGGATCTGCTAGTTCTGTGGGGCATTCACCAC
CCCAATGACGCAGCTGAGCAGACTAAATTGTACCAAAACCCAACTACCTATATATCAGTT
GGTACCTCAACTCTTAACCAGCGACTAGTCCCCCGTATTGCTACTAGGTCAAAGGTTAAT
GGTCAAAGTGGACGAATGGAGTTTTTCTGGACTATTTTGAAGCCCAACGATGCCATCAAC
TTCGAAAGTAATGGAAATTTCATAGCCCCTGAGTACGCTTACAAAATCGTTAAAAAGGGT
GATTCCACTATCATGAAATCTGAACTGGAATACGGAAACTGTAACACCAAATGCCAGACG
CCAATGGGTGCCATCAACTCTTCTATGCCTTTTCACAACATTCATCCTTTGACTATTGGT
GAATGCCCAAAGTACGTCAAATCTAACCGTTTGGTGTTGGCTACTGGTCTAAGGAACTCC
CCTCAGCGTGAAAGAAGAAGAAAGAAGAGGGGATTATTCGGTGCTATCGCTGGATTTATT
GAGGGAGGATGGCAGGGAATGGTCGATGGCTGGTATGGTTACCATCACTCAAATGAACAG
GGAAGTGGATACGCAGCTGATAAAGAATCTACTCAAAAGGCTATCGACGGTGTTACAAAC
AAGGTCAATTCTATTATCGATAAGATGAATACACAGTTTGAGGCTGTTGGTAGAGAGTTC
AATAATCTTGAGAGAAGAATCGAAAACCTGAACAAGAAAATGGAAGACGGATTTTTAGAT
GTATGGACTTACAATGCTGAGTTGTTGGTCTTGATGGAGAATGAACGAACGTTGGACTTC
CATGACTCCAATGTGAAGAACCTATATGACAAAGTGAGGCTGCAACTTAGAGACAACGCC
AAGGAATTGGGAAACGGGTGCTTCGAGTTTTACCACAAATGCGACAACGAATGTATGGAA
TCAGTGAGAAACGGTACCTATGATTACCCCCAATATTCCGAGGAGGCAAGACTGAAGAGA
GAAGAGATATCTGGTGTAAAGTTGGAATCCATCGGTATTTATCAGATTCTATCTATATAT
TCTACCTAATAG

Figure 27

SEQ ID: 83 Amino acid sequence of pMT/STF2.4xM2e (H1)

MKLCILLAVVAFVGLSLGRSAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSAKD
DAAGQAIANRFTANIKGLTQASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSANSTNS
QSDLDSIQAEITQRLNEIDRVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLKQINSQT
LGLDSLNVQKAYDVKDTAVTTKAYANNGTTLDVSGLDDAAIKAATGGTNGTASVTGGAVKFD
ADNNKYFVTIGGFTGADAAKNGDYEVNVATDGTVTLAAGATKTTMPAGATTKTEVQELKDTP
AVVSADAKNALIAGGVDATDANGAELVKMSYTDKNGKTIEGGYALKAGDKYYAADYDEATGA
IKAKTTSYTAADGTTKTAANQLGGVDGKTEVVTIDGKTYNASKAAGHDFKAQPELAEAAAKT
TENPLQKIDAALAQVDALRSDLGAVQNRFNSAITNLGNTVNNLSEARSRIEDSDYATEVSNM
SRAQILQQAGTSVLAQANQVPQNVLSLLRKGNSKLEGQLEFSLLTEVETPIRNEWGSRSNDS
SDPLESLLTEVETPIRNEWGSRSNDSSDPGSSLLTEVETPIRNEWGSRSNDSSDPELSLLTE
VETPIRNEWGSRSNDSSDPSR

Figure 28

SEQ ID: 84 Nucleic acid sequence of pMT/STF2.4xM2e (H1)

ATGAAGTTATGCATATTACTGGCCGTCGTGGCCTTTGTTGGCCTCTCGCTCGGGAGATCT
GCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAACAAATCC
CAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATCAACAGCGCG
AAAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGTCTG
ACTCAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGCGCG
CTGAACGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCTAAC
AGCACCAACTCCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTGAAC
GAAATCGACCGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAGGAC
AACACCCTGACCATCCAGGTTGGCGCCAACGACGGTGAAACTATCGATATCGATCTGAAG
CAGATCAACTCTCAGACCCTGGGTCTGGACTCACTGAACGTGCAGAAAGCGTATGATGTG
AAAGATACAGCAGTAACAACGAAAGCTTATGCCAATAATGGTACTACACTGGATGTATCG
GGTCTTGATGATGCAGCTATTAAAGCGGCTACGGGTGGTACGAATGGTACGGCTTCTGTA
ACCGGTGGTGCGGTTAAATTTGACGCAGATAATAACAAGTACTTTGTTACTATTGGTGGC
TTTACTGGTGCTGATGCCGCCAAAAATGGCGATTATGAAGTTAACGTTGCTACTGACGGT
ACAGTAACCCTTGCGGCTGGCGCAACTAAAACCACAATGCCTGCTGGTGCGACAACTAAA
ACAGAAGTACAGGAGTTAAAAGATACACCGGCAGTTGTTTCAGCAGATGCTAAAAATGCC
TTAATTGCTGGCGGCGTTGACGCTACCGATGCTAATGGCGCTGAGTTGGTCAAAATGTCT
TATACCGATAAAAATGGTAAGACAATTGAAGGCGGTTATGCGCTTAAAGCTGGCGATAAG
TATTACGCCGCAGATTACGATGAAGCGACAGGAGCAATTAAAGCTAAAACTACAAGTTAT
ACTGCTGCTGACGGCACTACCAAAACAGCGGCTAACCAACTGGGTGGCGTAGACGGTAAA
ACCGAAGTCGTTACTATCGACGGTAAAACCTACAATGCCAGCAAAGCCGCTGGTCATGAT
TTCAAAGCACAACCAGAGCTGGCGGAAGCAGCCGCTAAAACCACCGAAAACCCGCTGCAG
AAAATTGATGCCGCGCTGGCGCAGGTGGATGCGCTGCGCTCTGATCTGGGTGCGGTACAA
AACCGTTTCAACTCTGCTATCACCAACCTGGGCAATACCGTAAACAATCTGTCTGAAGCG
CGTAGCCGTATCGAAGATTCCGACTACGCGACCGAAGTTTCCAACATGTCTCGCGCGCAG
ATTCTGCAGCAGGCCGGTACTTCCGTTCTGGCGCAGGCTAACCAGGTCCCGCAGAACGTG
CTGTCTCTGTTACGTAAGGGCAATTCGAAGCTTGAAGGTCAATTGGAATTCAGCTTGCTG
ACTGAGGTTGAGACCCCGATTCGCAACGAATGGGGTTCCCGTTCCAACGATTCTTCCGAC
CCGCTCGAGAGCCTGTTGACCGAGGTTGAAACCCCTATCCGTAATGAATGGGGCTCCCGT
AGCAACGACTCTTCTGACCCAGGATCCTCCCTCTTGACCGAAGTGGAAACGCCTATTCGT
AATGAGTGGGGTTCTCGTAGCAATGACAGCTCGGACCCGGAGCTCTCGCTGCTGACGGAA
GTGGAGACTCCGATCCGTAACGAGTGGGGCTCTCGCTCTAACGATAGCTCAGACCCGTCT
AGATAA

Figure 29

SEQ ID: 85 Amino acid sequence of pMT/STF2.4xM2e (H5)

MKLCILLAVVAFVGLSLGRSAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSA
KDDAAGQAIANRFTANIKGLTQASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSAN
STNSQSDLDSIQAEITQRLNEIDRVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLK
QINSQTLGLDSLNVQKAYDVKDTAVTTKAYANNGTTLDVSGLDDAAIKAATGGTNGTASV
TGGAVKFDADNNKYFVTIGGFTGADAAKNGDYEVNVATDGTVTLAAGATKTTMPAGATTK
TEVQELKDTPAVVSADAKNALIAGGVDATDANGAELVKMSYTDKNGKTIEGGYALKAGDK
YYAADYDEATGAIKAKTTSYTAADGTTKTAANQLGGVDGKTEVVTIDGKTYNASKAAGHD
FKAQPELAEAAAKTTENPLQKIDAALAQVDALRSDLGAVQNRFNSAITNLGNTVNNLSEA
RSRIEDSDYATEVSNMSRAQILQQAGTSVLAQANQVPQNVLSLLRKGNSKLEGQLEFSLL
TEVETPTRNEWESRSSDSSDPLESLLTEVETPTRNEWESRSSDSSDPESSLLTEVETPTR
NEWESRSSDSSDPGSSLLTEVETPTRNEWESRSSDSSDPSR

Figure 30

SEQ ID: 86 Nucleic acid sequence of pMT/STF2.4xM2e (H5)

ATGAAGTTATGCATATTACTGGCCGTCGTGGCCTTTGTTGGCCTCTCGCTCGGGAGA
TCTGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAAC
AAATCCCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATC
AACAGCGCGAAAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAAC
ATCAAAGGTCTGACTCAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAG
ACCACTGAAGGCGCGCTGAACGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTG
GCGGTTCAGTCTGCTAACAGCACCAACTCCCAGTCTGACCTCGACTCCATCCAGGCT
GAAATCACCCAGCGCCTGAACGAAATCGACCGTGTATCCGGCCAGACTCAGTTCAAC
GGCGTGAAAGTCCTGGCGCAGGACAACACCCTGACCATCCAGGTTGGCGCCAACGAC
GGTGAAACTATCGATATCGATCTGAAGCAGATCAACTCTCAGACCCTGGGTCTGGAC
TCACTGAACGTGCAGAAAGCGTATGATGTGAAAGATACAGCAGTAACAACGAAAGCT
TATGCCAATAATGGTACTACACTGGATGTATCGGGTCTTGATGATGCAGCTATTAAA
GCGGCTACGGGTGGTACGAATGGTACGGCTTCTGTAACCGGTGGTGCGGTTAAATTT
GACGCAGATAATAACAAGTACTTTGTTACTATTGGTGGCTTTACTGGTGCTGATGCC
GCCAAAAATGGCGATTATGAAGTTAACGTTGCTACTGACGGTACAGTAACCCTTGCG
GCTGGCGCAACTAAAACCACAATGCCTGCTGGTGCGACAACTAAAACAGAAGTACAG
GAGTTAAAAGATACACCGGCAGTTGTTTCAGCAGATGCTAAAAATGCCTTAATTGCT
GGCGGCGTTGACGCTACCGATGCTAATGGCGCTGAGTTGGTCAAAATGTCTTATACC
GATAAAAATGGTAAGACAATTGAAGGCGGTTATGCGCTTAAAGCTGGCGATAAGTAT
TACGCCGCAGATTACGATGAAGCGACAGGAGCAATTAAAGCTAAAACTACAAGTTAT
ACTGCTGCTGACGGCACTACCAAAACAGCGGCTAACCAACTGGGTGGCGTAGACGGT
AAAACCGAAGTCGTTACTATCGACGGTAAAACCTACAATGCCAGCAAAGCCGCTGGT
CATGATTTCAAAGCACAACCAGAGCTGGCGGAAGCAGCCGCTAAAACCACCGAAAAC
CCGCTGCAGAAAATTGATGCCGCGCTGGCGCAGGTGGATGCGCTGCGCTCTGATCTG
GGTGCGGTACAAAACCGTTTCAACTCTGCTATCACCAACCTGGGCAATACCGTAAAC
AATCTGTCTGAAGCGCGTAGCCGTATCGAAGATTCCGACTACGCGACCGAAGTTTCC
AACATGTCTCGCGCGCAGATTCTGCAGCAGGCCGGTACTTCCGTTCTGGCGCAGGCT
AACCAGGTCCCGCAGAACGTGCTGTCTCTGTTACGT<u>AAGGGCAATTCGAAGCTTGAA</u>
<u>GGTCAATTGGAATTC</u>TCTCTGCTGACTGAAGTAGAAACTCCAACGCGTAATGAATGG
GAATCCCGTTCTAGCGACTCCTCTGATCCTCTCGAGTCCCTGCTGACGGAGGTTGAA
ACCCCGACCCGCAACGAGTGGGAAAGCCGTTCCTCCGATTCCTCTGATCCGGAGAGC
AGCCTGCTGACCGAGGTAGAAACCCCGACCCGTAATGAGTGGGAATCTCGCTCCTCT
GATTCTTCTGACCCGGGATCCTCTCTGCTGACCGAAGTGGAGACTCCGACTCGCAAC
GAATGGGAGAGCCGTTCTTCTGACTCCTCTGACCCGTCTAGATAAT

Figure 31

SEQ ID: 87 Amino acid sequence of pMT/STF2.4xM2e (H1H5)

MKLCILLAVVAFVGLSLGRSAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSA
KDDAAGQAIANRFTANIKGLTQASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSAN
STNSQSDLDSIQAEITQRLNEIDRVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLK
QINSQTLGLDSLNVQKAYDVKDTAVTTKAYANNGTTLDVSGLDDAAIKAATGGTNGTASV
TGGAVKFDADNNKYFVTIGGFTGADAAKNGDYEVNVATDGTVTLAAGATKTTMPAGATTK
TEVQELKDTPAVVSADAKNALIAGGVDATDANGAELVKMSYTDKNGKTIEGGYALKAGDK
YYAADYDEATGAIKAKTTSYTAADGTTKTAANQLGGVDGKTEVVTIDGKTYNASKAAGHD
FKAQPELAEAAAKTTENPLQKIDAALAQVDALRSDLGAVQNRFNSAITNLGNTVNNLSEA
RSRIEDSDYATEVSNMSRAQILQQAGTSVLAQANQVPQNVLSLLRKGNSKLEGQLEFSLL
TEVETPIRNEWGSRSNDSSDPLESLLTEVETPIRNEWGSRSNDSSDPGSSLLTEVETPIR
NEWGSRSNDSSDPELSLLTEVETPIRNEWGSRSNDSSDPSRSREFSLLTEVETPTRNEWE
SRSSDSSDPLESLLTEVETPTRNEWESRSSDSSDPESSLLTEVETPTRNEWESRSSDSSD
PGSSLLTEVETPTRNEWESRSSDSSDPSR

Figure 32

SEQ ID: 88 Nucleic acid sequence of pMT/STF2.4xM2e (H1H5)

ATGAAGTTATGCATATTACTGGCCGTCGTGGCCTTTGTTGGCCTCTCGCTCGGGAGA
TCTGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAAC
AAATCCCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATC
AACAGCGCGAAAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAAC
ATCAAAGGTCTGACTCAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAG
ACCACTGAAGGCGCGCTGAACGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTG
GCGGTTCAGTCTGCTAACAGCACCAACTCCCAGTCTGACCTCGACTCCATCCAGGCT
GAAATCACCCAGCGCCTGAACGAAATCGACCGTGTATCCGGCCAGACTCAGTTCAAC
GGCGTGAAAGTCCTGGCGCAGGACAACACCCTGACCATCCAGGTTGGCGCCAACGAC
GGTGAAACTATCGATATCGATCTGAAGCAGATCAACTCTCAGACCCTGGGTCTGGAC
TCACTGAACGTGCAGAAAGCGTATGATGTGAAAGATACAGCAGTAACAACGAAAGCT
TATGCCAATAATGGTACTACACTGGATGTATCGGGTCTTGATGATGCAGCTATTAAA
GCGGCTACGGGTGGTACGAATGGTACGGCTTCTGTAACCGGTGGTGCGGTTAAATTT
GACGCAGATAATAACAAGTACTTTGTTACTATTGGTGGCTTTACTGGTGCTGATGCC
GCCAAAAATGGCGATTATGAAGTTAACGTTGCTACTGACGGTACAGTAACCCTTGCG
GCTGGCGCAACTAAAACCACAATGCCTGCTGGTGCGACAACTAAAACAGAAGTACAG
GAGTTAAAAGATACACCGGCAGTTGTTTCAGCAGATGCTAAAAATGCCTTAATTGCT
GGCGGCGTTGACGCTACCGATGCTAATGGCGCTGAGTTGGTCAAAATGTCTTATACC
GATAAAAATGGTAAGACAATTGAAGGCGGTTATGCGCTTAAAGCTGGCGATAAGTAT
TACGCCGCAGATTACGATGAAGCGACAGGAGCAATTAAAGCTAAAACTACAAGTTAT
ACTGCTGCTGACGGCACTACCAAAACAGCGGCTAACCAACTGGGTGGCGTAGACGGT
AAAACCGAAGTCGTTACTATCGACGGTAAAACCTACAATGCCAGCAAAGCCGCTGGT
CATGATTTCAAAGCACAACCAGAGCTGGCGGAAGCAGCCGCTAAAACCACCGAAAAC
CCGCTGCAGAAAATTGATGCCGCGCTGGCGCAGGTGGATGCGCTGCGCTCTGATCTG
GGTGCGGTACAAAACCGTTTCAACTCTGCTATCACCAACCTGGGCAATACCGTAAAC
AATCTGTCTGAAGCGCGTAGCCGTATCGAAGATTCCGACTACGCGACCGAAGTTTCC
AACATGTCTCGCGCGCAGATTCTGCAGCAGGCCGGTACTTCCGTTCTGGCGCAGGCT
AACCAGGTCCCGCAGAACGTGCTGTCTCTGTTACGTAAGGGCAATTCGAAGCTTGAA
GGTCAATTGGAATTCAGCTTGCTGACTGAGGTTGAGACCCCGATTCGCAACGAATGG
GGTTCCCGTTCCAACGATTCTTCCGACCCGCTCGAGAGCCTGTTGACCGAGGTTGAA
ACCCCTATCCGTAATGAATGGGGCTCCCGTAGCAACGACTCTTCTGACCCAGGATCC
TCCCTCTTGACCGAAGTGGAAACGCCTATTCGTAATGAGTGGGGTTCTCGTAGCAAT
GACAGCTCGGACCCGGAGCTCTCGCTGCTGACGGAAGTGGAGACTCCGATCCGTAAC
GAGTGGGGCTCTCGCTCTAACGATAGCTCAGACCCGTCTAGATCTAGAGAATTCTCT
CTGCTGACTGAAGTAGAAACTCCAACGCGTAATGAATGGGAATCCCGTTCTAGCGAC
TCCTCTGATCCTCTCGAGTCCCTGCTGACGGAGGTTGAAACCCCGACCCGCAACGAG
TGGGAAAGCCGTTCCTCCGATTCCTCTGATCCGGAGAGCAGCCTGCTGACCGAGGTA
GAAACCCCGACCCGTAATGAGTGGGAATCTCGCTCCTCTGATTCTTCTGACCCGGGA
TCCTCTCTGCTGACCGAAGTGGAGACTCCGACTCGCAACGAATGGGAGAGCCGTTCT
TCTGACTCCTCTGACCCGTCTAGATAA

Figure 33

SEQ ID: 89 Amino acid sequence of pMT/STF2Δ

MKLCILLAVVAFVGLSLGRSAQVINTNSLSLLTQNNLNKSQSALGTAIERLS
SGLRINSAKDDAAGQAIANRFTANIKGLTQASRNANDGISIAQTTEGALNEI
NNNLQRVRELAVQSANSTNSQSDLDSIQAEITQRLNEIDRVSGQTQFNGVKV
LAQDNTLTIQVGANDGETIDIDLKQINSQTLGLDSLNVHGAPVDPASPWTEN
PLQKIDAALAQVDALRSDLGAVQNRFNSAITNLGNTVNNLSEARSRIEDSDY
ATEVSNMSRAQILQQAGTSVLAQANQVPQNVLSLLREFSRYPAQWRPLTRTG
HHHHHH

Figure 34

SEQ ID: 90 Nucleic acid sequence of pMT/STF2Δ

ATGAAGTTATGCATATTACTGGCCGTCGTGGCCTTTGTTGGCCTCTCGCTCG
GGAGATCTGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAA
TAACCTGAACAAATCCCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCT
TCTGGTCTGCGTATCAACAGCGCGAAAGACGATGCGGCAGGTCAGGCGATTG
CTAACCGTTTCACCGCGAACATCAAAGGTCTGACTCAGGCTTCCCGTAACGC
TAACGACGGTATCTCCATTGCGCAGACCACTGAAGGCGCGCTGAACGAAATC
AACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCTAACAGCA
CCAACTCCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCT
GAACGAAATCGACCGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTC
CTGGCGCAGGACAACACCCTGACCATCCAGGTTGGCGCCAACGACGGTGAAA
CTATCGATATCGATCTGAAGCAGATCAACTCTCAGACCCTGGGTCTGGACTC
ACTGAACGTGCATGGAGCGCCGGTGGATCCTGCTAGCCCATGGACCGAAAAC
CCGCTGCAGAAAATTGATGCCGCGCTGGCGCAGGTGGATGCGCTGCGCTCTG
ATCTGGGTGCGGTACAAAACCGTTTCAACTCTGCTATCACCAACCTGGGCAA
TACCGTAAACAATCTGTCTGAAGCGCGTAGCCGTATCGAAGATTCCGACTAC
GCGACCGAAGTTTCCAACATGTCTCGCGCGCAGATTTTGCAGCAGGCCGGTA
CTTCCGTTCTGGCGCAGGCTAACCAGGTCCCGCAGAACGTGCTGTCTCTGTT
ACGTGAATTCTCTAGATATCCAGCACAGTGGCGGCCGCTCACGCGTACCGGT
CATCATCACCATCACCATTGA

Figure 35

SEQ ID: 91 Amino acid sequence of pMT/STF2Δ.4xM2e(H1)

MKLCILLAVVAFVGLSLGRSAQVINTNSLSLLTQNNLNKSQSALGTAIERLS
SGLRINSAKDDAAGQAIANRFTANIKGLTQASRNANDGISIAQTTEGALNEI
NNNLQRVRELAVQSANSTNSQSDLDSIQAEITQRLNEIDRVSGQTQFNGVKV
LAQDNTLTIQVGANDGETIDIDLKQINSQTLGLDSLNVHGAPVDPASPWTEN
PLQKIDAALAQVDALRSDLGAVQNRFNSAITNLGNTVNNLSEARSRIEDSDY
ATEVSNMSRAQILQQAGTSVLAQANQVPQNVLSLLREFSLLTEVETPIRNEW
GSRSNDSSDPLESLLTEVETPIRNEWGSRSNDSSDPGSSLLTEVETPIRNEW
GSRSNDSSDPELSLLTEVETPIRNEWGSRSNDSSDPSR

Figure 36

SEQ ID: 92 Nucleic acid sequence of pMT/STF2Δ.4xM2e(H1)

ATGTGCATATTACTGGCCGTCGTGGCCTTTGTTGGCCTCTCGCTCGGGAGAT
CTGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCT
GAACAAATCCCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGT
CTGCGTATCAACAGCGCGAAAGACGATGCGGCAGGTCAGGCGATTGCTAACC
GTTTCACCGCGAACATCAAAGGTCTGACTCAGGCTTCCCGTAACGCTAACGA
CGGTATCTCCATTGCGCAGACCACTGAAGGCGCGCTGAACGAAATCAACAAC
AACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCTAACAGCACCAACT
CCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTGAACGA
AATCGACCGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCG
CAGGACAACACCCTGACCATCCAGGTTGGCGCCAACGACGGTGAAACTATCG
ATATCGATCTGAAGCAGATCAACTCTCAGACCCTGGGTCTGGACTCACTGAA
CGTGCATGGAGCGCCGGTGGATCCTGCTAGCCCATGGACCGAAAACCCGCTG
CAGAAAATTGATGCCGCGCTGGCGCAGGTGGATGCGCTGCGCTCTGATCTGG
GTGCGGTACAAAACCGTTTCAACTCTGCTATCACCAACCTGGGCAATACCGT
AAACAATCTGTCTGAAGCGCGTAGCCGTATCGAAGATTCCGACTACGCGACC
GAAGTTTCCAACATGTCTCGCGCGCAGATTTTGCAGCAGGCCGGTACTTCCG
TTCTGGCGCAGGCTAACCAGGTCCCGCAGAACGTGCTGTCTCTGTTACGTGA
ATTCAGCTTGCTGACTGAGGTTGAGACCCCGATTCGCAACGAATGGGGTTCC
CGTTCCAACGATTCTTCCGACCCGCTCGAGAGCCTGTTGACCGAGGTTGAAA
CCCCTATCCGTAATGAATGGGGCTCCCGTAGCAACGACTCTTCTGACCCAGG
ATCCTCCCTCTTGACCGAAGTGGAAACGCCTATTCGTAATGAGTGGGGTTCT
CGTAGCAATGACAGCTCGGACCCGGAGCTCTCGCTGCTGACGGAAGTGGAGA
CTCCGATCCGTAACGAGTGGGGCTCTCGCTCTAACGATAGCTCAGACCCGTC
TAGATAA

Figure 37

SEQ ID: 93 amino acid sequence of pMT/STF2Δ.4xM2e(H5)

MKLCILLAVVAFVGLSLGRSAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRIN
SAKDDAAGQAIANRFTANIKGLTQASRNANDGISIAQTTEGALNEINNNLQRVRELAVQS
ANSTNSQSDLDSIQAEITQRLNEIDRVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDID
LKQINSQTLGLDSLNVHGAPVDPASPWTENPLQKIDAALAQVDALRSDLGAVQNRFNSAI
TNLGNTVNNLSEARSRIEDSDYATEVSNMSRAQILQQAGTSVLAQANQVPQNVLSLLREF
SLLTEVETPTRNEWESRSSDSSDPLESLLTEVETPTRNEWESRSSDSSDPESSLLTEVET
PTRNEWESRSSDSSDPGSSLLTEVETPTRNEWESRSSDSSDPSR

Figure 38

SEQ ID: 94 Nucleic acid sequence of pMT/STF2Δ.4xM2e(H5) (Linker underlined)

ATGTGCATATTACTGGCCGTCGTGGCCTTTGTTGGCCTCTCGCTCGGGAGAT
CTGCACAAGTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCT
GAACAAATCCCAGTCCGCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGT
CTGCGTATCAACAGCGCGAAAGACGATGCGGCAGGTCAGGCGATTGCTAACC
GTTTCACCGCGAACATCAAAGGTCTGACTCAGGCTTCCCGTAACGCTAACGA
CGGTATCTCCATTGCGCAGACCACTGAAGGCGCGCTGAACGAAATCAACAAC
AACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCTAACAGCACCAACT
CCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTGAACGA
AATCGACCGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCG
CAGGACAACACCCTGACCATCCAGGTTGGCGCCAACGACGGTGAAACTATCG
ATATCGATCTGAAGCAGATCAACTCTCAGACCCTGGGTCTGGACTCACTGAA
CGTGCATGGAGCGCCGGTGGATCCTGCTAGCCCATGGACCGAAAACCCGCTG
CAGAAAATTGATGCCGCGCTGGCGCAGGTGGATGCGCTGCGCTCTGATCTGG
GTGCGGTACAAAACCGTTTCAACTCTGCTATCACCAACCTGGGCAATACCGT
AAACAATCTGTCTGAAGCGCGTAGCCGTATCGAAGATTCCGACTACGCGACC
GAAGTTTCCAACATGTCTCGCGCGCAGATTTTGCAGCAGGCCGGTACTTCCG
TTCTGGCGCAGGCTAACCAGGTCCCGCAGAACGTGCTGTCTCTGTTACGTGA
ATTCTCTCTGCTGACTGAAGTAGAAACTCCAACGCGTAATGAATGGGAATCC
CGTTCTAGCGACTCCTCTGATCCTCTCGAGTCCCTGCTGACGGAGGTTGAAA
CCCCGACCCGCAACGAGTGGGAAAGCCGTTCCTCCGATTCCTCTGATCCGGA
GAGCAGCCTGCTGACCGAGGTAGAAACCCCGACCCGTAATGAGTGGGAATCT
CGCTCCTCTGATTCTTCTGACCCGGGATCCTCTCTGCTGACCGAAGTGGAGA
CTCCGACTCGCAACGAATGGGAGAGCCGTTCTTCTGACTCCTCTGACCCGTC
TAGATAATAA

Figure 39

SEQ ID: 95 Amino acid sequence of pMT/STF2Δ.4xM2e(H1H5)

MKLCILLAVVAFVGLSLGRSAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRIN
SAKDDAAGQAIANRFTANIKGLTQASRNANDGISIAQTTEGALNEINNNLQRVRELAVQS
ANSTNSQSDLDSIQAEITQRLNEIDRVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDID
LKQINSQTLGLDSLNVHGAPVDPASPWTENPLQKIDAALAQVDALRSDLGAVQNRFNSAI
TNLGNTVNNLSEARSRIEDSDYATEVSNMSRAQILQQAGTSVLAQANQVPQNVLSLLREF
SLLTEVETPIRNEWGSRSNDSSDPLESLLTEVETPIRNEWGSRSNDSSDPGSSLLTEVET
PIRNEWGSRSNDSSDPELSLLTEVETPIRNEWGSRSNDSSDPSRQFSLLTEVETPTRNEW
ESRSSDSSDPLESLLTEVETPTRNEWESRSSDSSDPESSLLTEVETPTRNEWESRSSDSS
DPGSSLLTEVETPTRNEWESRSSDSSDPSR

Figure 40

SEQ ID: 96 Nucleic acid sequence of pMT/STF2Δ.4xM2e(H1H5)

ATGTGCATATTACTGGCCGTCGTGGCCTTTGTTGGCCTCTCGCTCGGGAGATCTGCACAA
GTAATCAACACTAACAGTCTGTCGCTGCTGACCCAGAATAACCTGAACAAATCCCAGTCC
GCACTGGGCACCGCTATCGAGCGTCTGTCTTCTGGTCTGCGTATCAACAGCGCGAAAGAC
GATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGTCTGACTCAG
GCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGCGCGCTGAAC
GAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCTAACAGCACC
AACTCCCAGTCTGACCTCGACTCCATCCAGGCTGAAATCACCCAGCGCCTGAACGAAATC
GACCGTGTATCCGGCCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAGGACAACACC
CTGACCATCCAGGTTGGCGCCAACGACGGTGAAACTATCGATATCGATCTGAAGCAGATC
AACTCTCAGACCCTGGGTCTGGACTCACTGAACGTGCATGGAGCGCCGGTGGATCCTGCT
AGCCCATGGACCGAAAACCCGCTGCAGAAAATTGATGCCGCGCTGGCGCAGGTGGATGCG
CTGCGCTCTGATCTGGGTGCGGTACAAAACCGTTTCAACTCTGCTATCACCAACCTGGGC
AATACCGTAAACAATCTGTCTGAAGCGCGTAGCCGTATCGAAGATTCCGACTACGCGACC
GAAGTTTCCAACATGTCTCGCGCGCAGATTTTGCAGCAGGCCGGTACTTCCGTTCTGGCG
CAGGCTAACCAGGTCCCGCAGAACGTGCTGTCTCTGTTACGTGAATTCAGCTTGCTGACT
GAGGTTGAGACCCCGATTCGCAACGAATGGGGTTCCCGTTCCAACGATTCTTCCGACCCG
CTCGAGAGCCTGTTGACCGAGGTTGAAACCCCTATCCGTAATGAATGGGGCTCCCGTAGC
AACGACTCTTCTGACCCAGGATCCTCCCTCTTGACCGAAGTGGAAACGCCTATTCGTAAT
GAGTGGGGTTCTCGTAGCAATGACAGCTCGGACCCGGAGCTCTCGCTGCTGACGGAAGTG
GAGACTCCGATCCGTAACGAGTGGGGCTCTCGCTCTAACGATAGCTCAGACCCGTCTAGA
TCTAGAGAATTCTCTCTGCTGACTGAAGTAGAAACTCCAACGCGTAATGAATGGGAATCC
CGTTCTAGCGACTCCTCTGATCCTCTCGAGTCCCTGCTGACGGAGGTTGAAACCCCGACC
CGCAACGAGTGGGAAAGCCGTTCCTCCGATTCCTCTGATCCGGAGAGCAGCCTGCTGACC
GAGGTAGAAACCCCGACCCGTAATGAGTGGGAATCTCGCTCCTCTGATTCTTCTGACCCG
GGATCCTCTCTGCTGACCGAAGTGGAGACTCCGACTCGCAACGAATGGGAGAGCCGTTCT
TCTGACTCCTCTGACCCGTCTAGATAA

Figure 41

SEQ ID NO: 99 Salmonella muenchen fliC Amino Acid Sequence (Hinge region deleted)

MAQVINTNSLSLLTQNNLNKSQSALGTAIERLSSGLRINSAKDDAAGQAIANRFTANIKG
LTQASRNANDGISIAQTTEGALNEINNNLQRVRELAVQSANGTNSQSDLDSIQAEITQRL
NEIDRVSGQTQFNGVKVLAQDNTLTIQVGANDGETIDIDLKEISSKTLDKHNFRTGGELK
EVNTDKTENPLQKIDAALAQVDTLRSDLGAVQNRFNSAITNLGNTVNNLSSARSRIEDSD
YATEVSNMSRAQILQQAGTSVLAQANQVPQNVLSLLR

Figure 42

SEQ ID NO: 100 Salmonella Muenchen fliC Nucleic Acid Sequence (Hinge region deleted)

ATGGCACAAGTCATTAATACAAACAGCCTGTCGCTGTTGACCCAGAATAACCTGAACAAA
TCCCAGTCCGCTCTGGGCACCGCTATCGAGCGTCTGTCTTCCGGTCTGCGTATCAACAGC
GCGAAAGACGATGCGGCAGGTCAGGCGATTGCTAACCGTTTCACCGCGAACATCAAAGGT
CTGACTCAGGCTTCCCGTAACGCTAACGACGGTATCTCCATTGCGCAGACCACTGAAGGC
GCGCTGAACGAAATCAACAACAACCTGCAGCGTGTGCGTGAACTGGCGGTTCAGTCTGCT
AACGGTACTAACTCCCAGTCTGACCTTGACTCTATCCAGGCTGAAATCACCCAGCGTCTG
AACGAAATCGACCGTGTATCCGGTCAGACTCAGTTCAACGGCGTGAAAGTCCTGGCGCAG
GACAACACCCTGACCATCCAGGTTGGTGCCAACGACGGTGAAACTATTGATATTGATTTA
AAAGAAATTAGCTCTAAAACACTGACAGATAAGACTGAAAACCCACTGCAGAAAATTGAT
GCTGCCTTGGCACAGGTTGATACACTTCGTTCTGACCTGGGTGCGGTACAGAACCGTTTC
AACTCCGCTATCACCAACCTGGGCAATACCGTAAATAACCTGTCTTCTGCCCGTAGCCGT
ATCGAAGATTCCGACTACGCGACCGAAGTCTCCAACATGTCTCGCGCGCAGATTCTGCAG
CAGGCCGGTACCTCCGTTCTGGCGCAGGCTAACCAGGTTCCGCAAAACGTCCTCTCTTTA
CTGCGTTAA

Figure 43

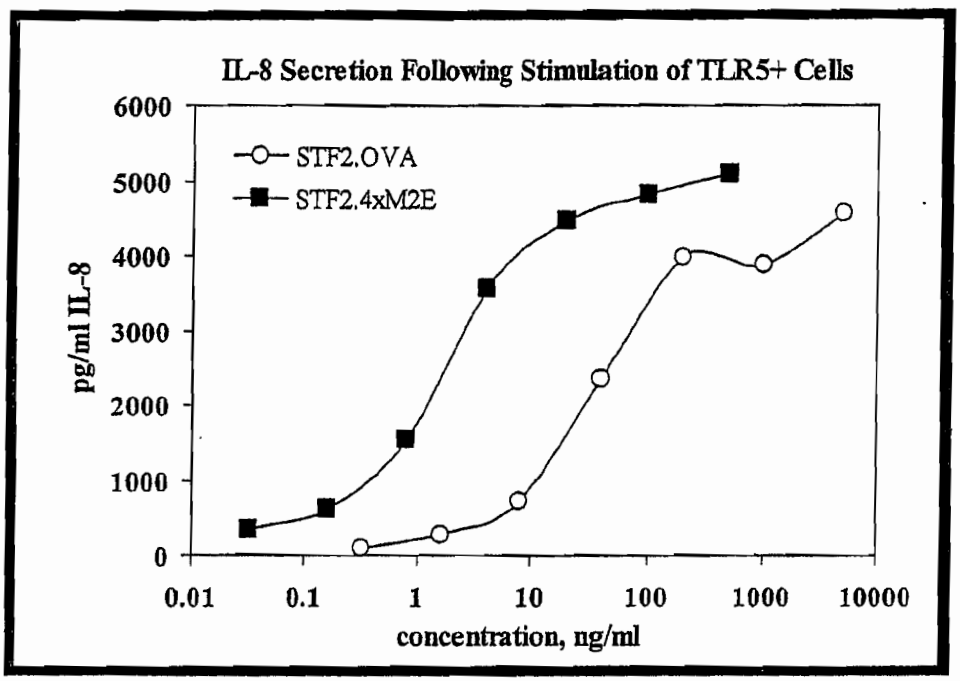

IL-8 Secretion Following Stimulation of TLR5+ Cells
6000
5000
4000
3000
2000
1000
0
pg/ml IL-8
STF2.OVA
STF2.4xM2E
0.01
0.1
1
10
100
1000
10000
concentration, ng/ml

Figure 44

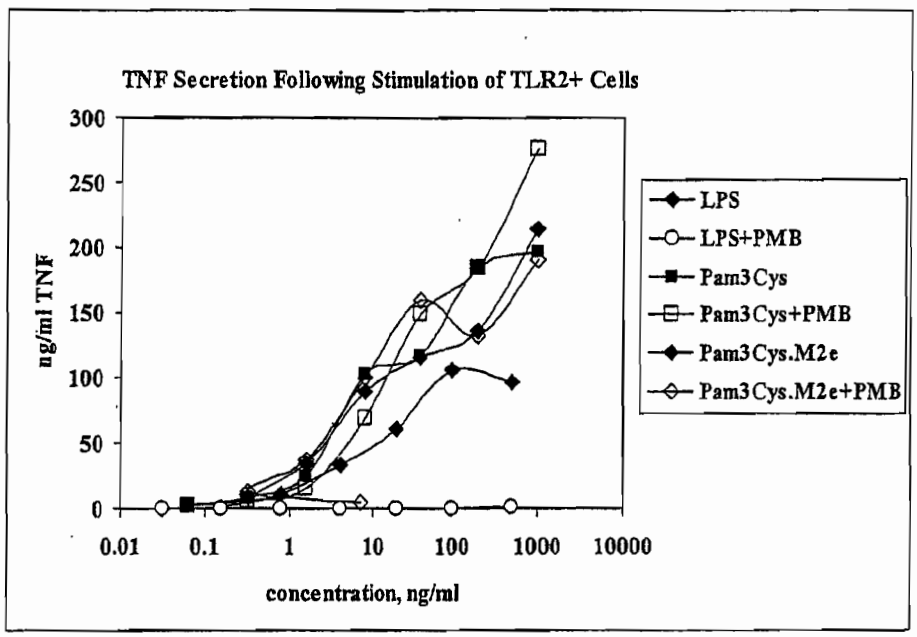

TNF Secretion Following Stimulation of TLR2+ Cells
ng/ml TNF
300
250
200
150
100
50
0
0.01
0.1
1
10
100
1000
10000
concentration, ng/ml
LPS
LPS+PMB
Pam3Cys
Pam3Cys+PMB
Pam3Cys.M2e
Pam3Cys.M2e+PMB

Figure 45

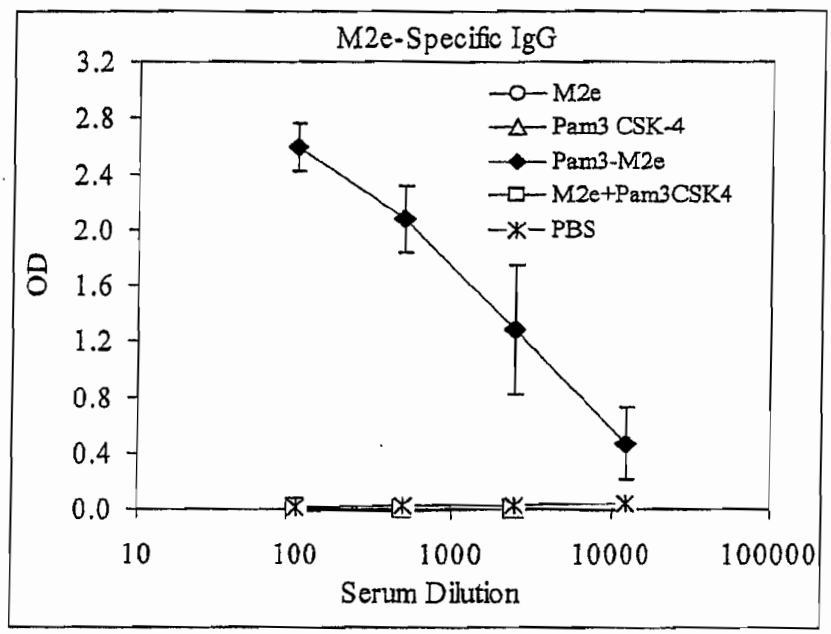

M2e-Specific IgG
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
OD
M2e
Pam3 CSK-4
Pam3-M2e
M2e+Pam3CSK4
PBS
10
100
1000
10000
100000
Serum Dilution

Figure 46

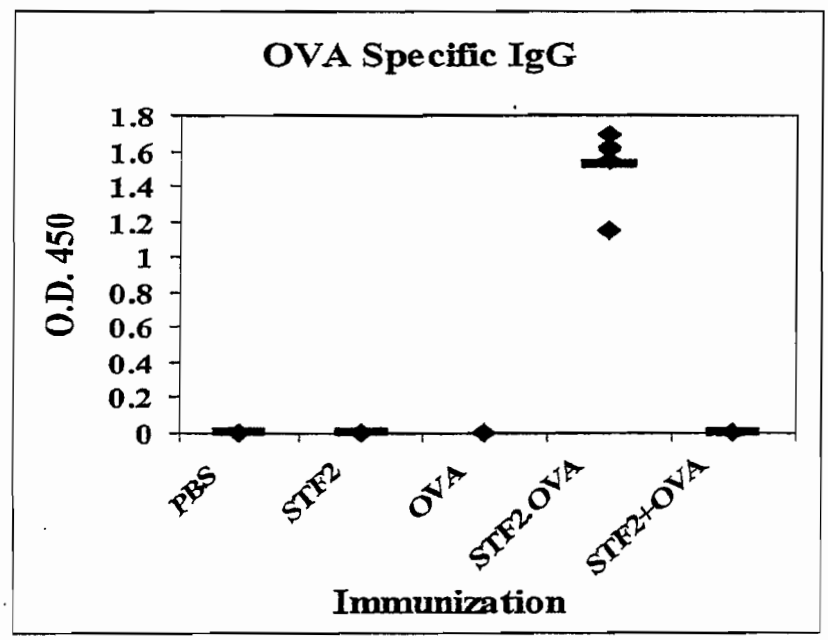

OVA Specific IgG
O.D. 450
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
PBS
STF2
OVA
STF2-OVA
STF2+OVA
Immunization

Figure 47

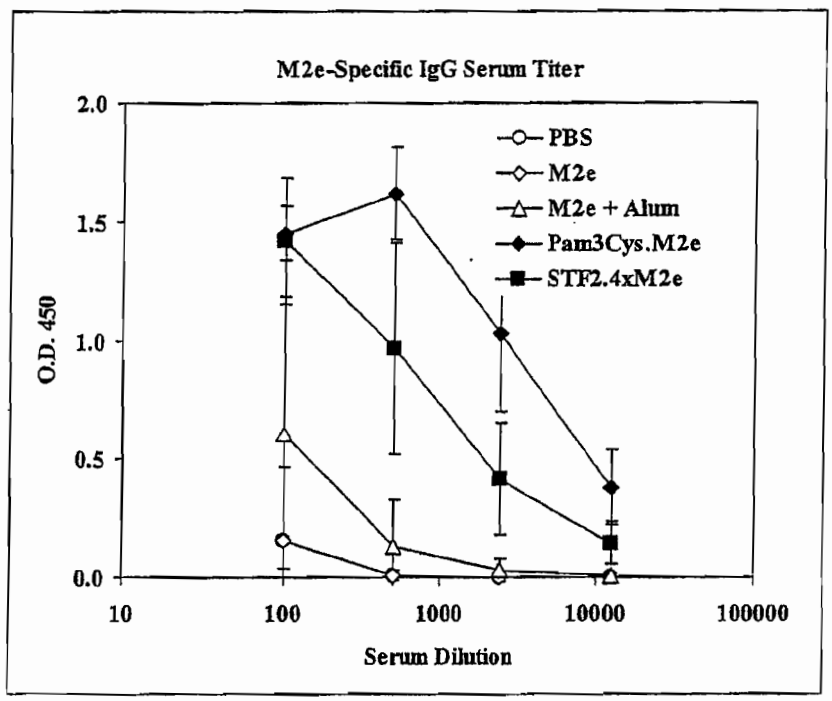

M2e-Specific IgG Serum Titer
2.0
1.5
1.0
0.5
0.0
O.D. 450
10
100
1000
10000
100000
Serum Dilution
PBS
M2e
M2e + Alum
Pam3Cys.M2e
STF2.4xM2e

Figure 48

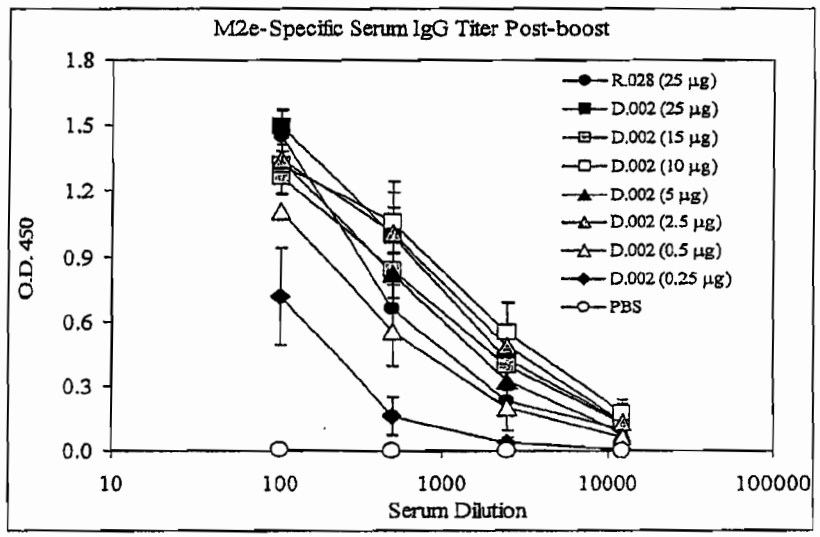

M2e-Specific Serum IgG Titer Post-boost
O.D. 450
1.8
1.5
1.2
0.9
0.6
0.3
0.0
10
100
1000
10000
100000
Serum Dilution
R.028 (25 µg)
D.002 (25 µg)
D.002 (15 µg)
D.002 (10 µg)
D.002 (5 µg)
D.002 (2.5 µg)
D.002 (0.5 µg)
D.002 (0.25 µg)
PBS

Figure 49

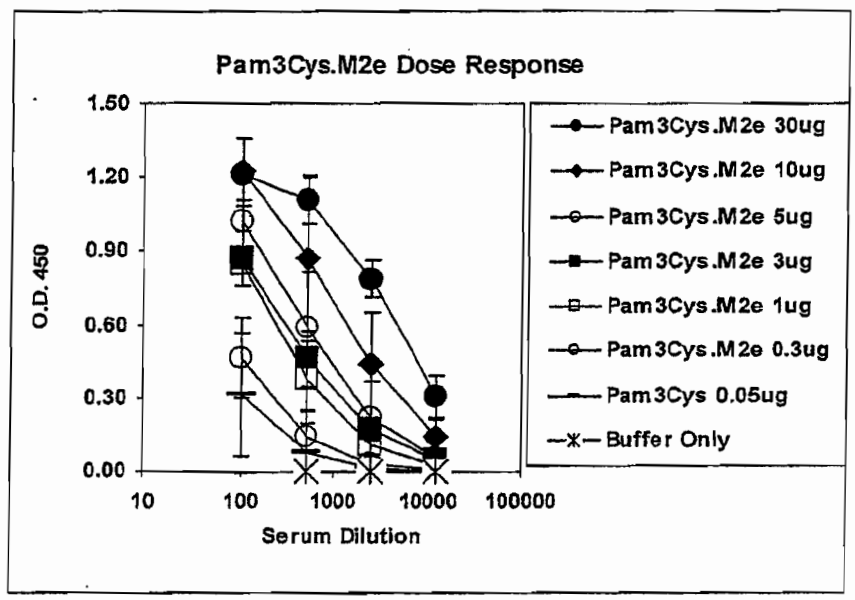

Pam3Cys.M2e Dose Response
1.50
1.20
0.90
0.60
0.30
0.00
O.D. 450
10
100
1000
10000
100000
Serum Dilution
Pam3Cys.M2e 30ug
Pam3Cys.M2e 10ug
Pam3Cys.M2e 5ug
Pam3Cys.M2e 3ug
Pam3Cys.M2e 1ug
Pam3Cys.M2e 0.3ug
Pam3Cys 0.05ug
Buffer Only

Figure 50

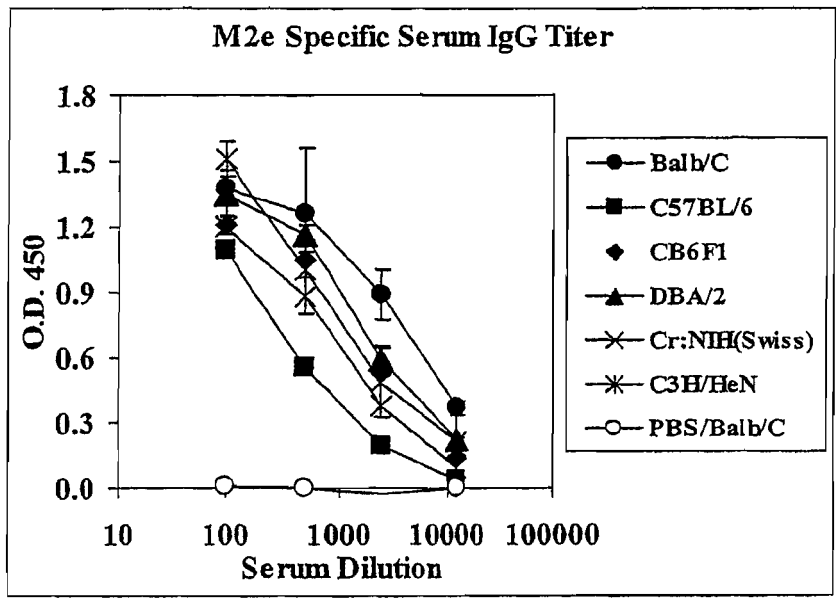

M2e Specific Serum IgG Titer
1.8
1.5
1.2
0.9
0.6
0.3
0.0
O.D. 450
10
100
1000
10000
100000
Serum Dilution
Balb/C
C57BL/6
CB6F1
DBA/2
Cr:NIH(Swiss)
C3H/HeN
PBS/Balb/C

Figure 51

Rabbit IgG to M2e Individual Rabbits Day 49 (Day 7 Post Boost 2) 1:125 Dilution

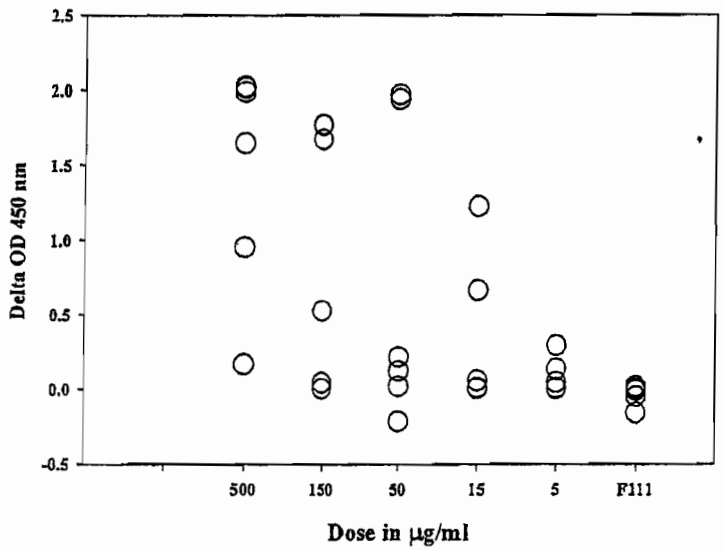


Figure 52

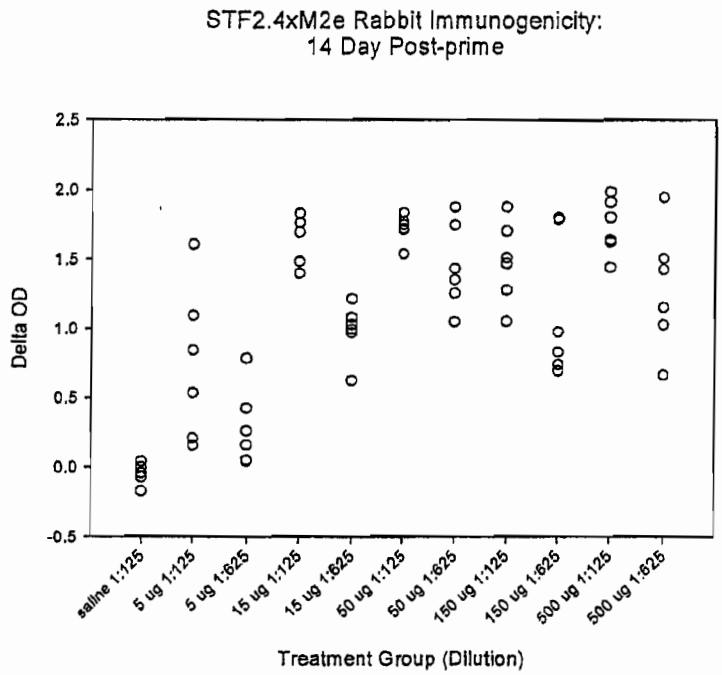

STF2.4xM2e Rabbit Immunogenicity:
14 Day Post-prime
Delta OD
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
saline 1:125
5 ug 1:125
5 ug 1:625
15 ug 1:125
15 ug 1:625
50 ug 1:125
50 ug 1:625
150 ug 1:125
150 ug 1:625
500 ug 1:125
500 ug 1:625
Treatment Group (Dilution)

Figure 53

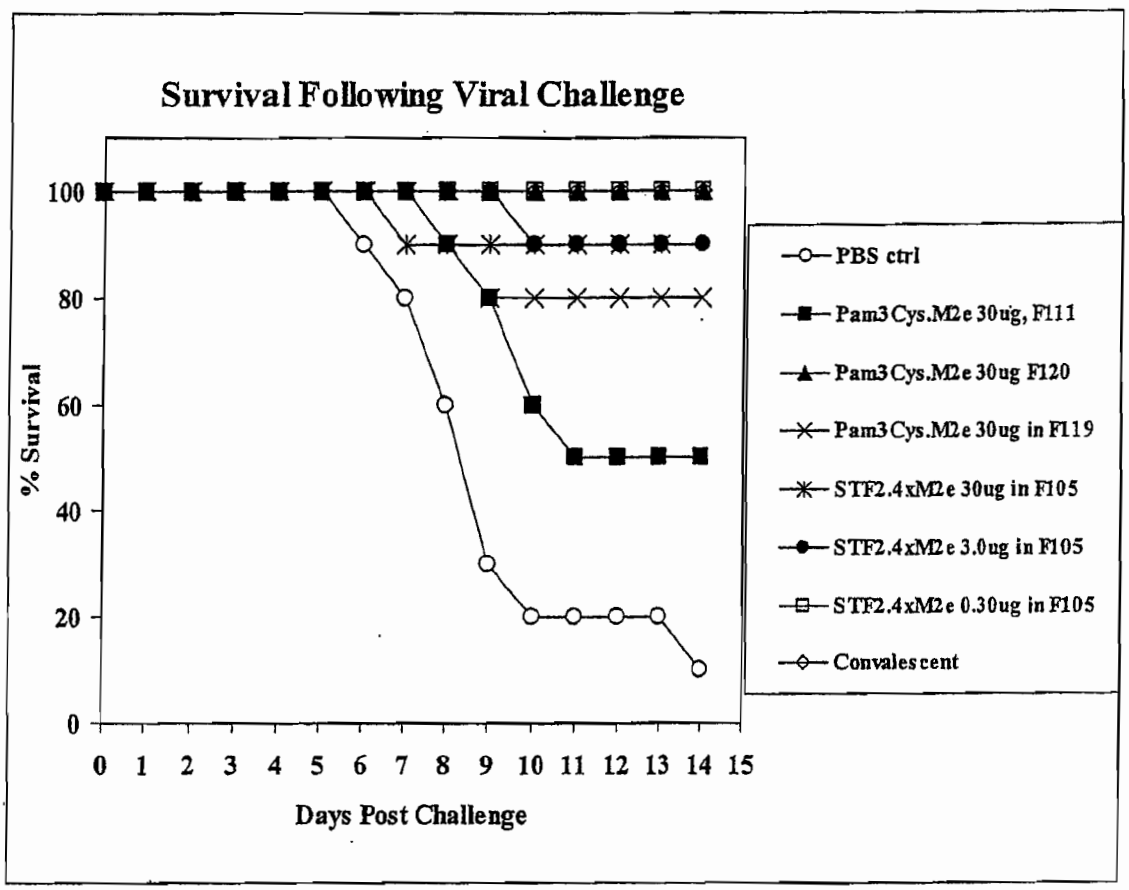

Survival Following Viral Challenge
% Survival
100
80
60
40
20
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Days Post Challenge
PBS ctrl
Pam3Cys.M2e 30ug, F111
Pam3Cys.M2e 30ug F120
Pam3Cys.M2e 30ug in F119
STF2.4xM2e 30ug in F105
STF2.4xM2e 3.0ug in F105
STF2.4xM2e 0.30ug in F105
Convalescent

Figure 54