Fusion Polypeptide 1

M1	M3.1	M6.4	M2	M18	M28	M12	SPA	M1	451 AA
1-50	**22-71**	**(1-25)2**	**(2-26)2**	**1-50**	**1-50**	**1-50**	**1-50**	**1-50**	

Fusion Polypeptide 2

M4	M5.0	M11	M75	M19	M29.2	M14.3	M24	M4	451 AA
1-50	**(1-25)2**	**1-50**	**1-50**	**(1-25)2**	**1-50**	**1-50**	**1-50**	**1-50**	

Fusion Polypeptide 3

M77	M22	M73	M89	M58	M44	M78	M118	M77	451 AA
1-50	**1-50**	**1-50**	**1-50**	**1-50**	**1-50**	**1-50**	**1-50**	**1-50**	

Fusion Polypeptide 4

M83.1	M82	M81	M87	M49.1	M92	M114	M83.1	401 AA
1-50	**1-50**	**1-50**	**1-50**	**1-50**	**1-50**	**1-50**	**1-50**	

Fig. 1

Polynucleotide Encoding Fusion Polypeptide 1 (SEQ ID NO:17)

AGATCTCGAT CCCGCGAAAT TAATACGACT CACTATAGGG GAATTGTGAG
CGGATAACAA TTCCCCTCTA GAAATAATTT TGTTTAACTT TAAGAAGGAG
ATATCAT**ATG** AACGGTGACG GTAACCCGCG TGAAGTTATC GAAGACCTGG
CTGCTAACAA CCCGGCTATC CAGAACATCC GTCTGCGTCA CGAAAACAAA
GACCTGAAAG CTCGTCTGGA AAACGCTATG GAAGTTGCTG GTCGTGACTT
CAAACGTGCT CTGCTGGACC AGGTTACCCA GCTGTACACC AAACACAACT
CCAACTACCA GCAGTACAAC GCTCAGGCTG GTCGTCTGGA CCTGCGTCAG
AAAGCTGAAT ACCTGAAAGG TCTGAACGAC TGGGCTGAAC GTCTGCTGCA
GGAACTGAAC CGTGTTTTCC

CGCGTGGTAC CGTTGAAAAC CCGGACAAAG CTCGTGAACT GCTGAACAAA
TACGACGTTG AAAACCGTGT TTTCCCGCGT GGTACCGTTG AAAACCCGGA
CAAAGCTCGT GAACTGCTGA ACAAATACGA CGTTGAAAAC TCCAAAAACC
CGGTTCCGGT TAAAAAAGAA GCTAAACTGT CCGAAGCTGA ACTGCACGAC
AAAATCAAAA ACCTGTCCAA AAACCCGGTT CCGGTTAAAA AAGAAGCTAA
ACTGTCCGAA GCTGAACTGC ACGACAAAAT CAAAAACCTG GCTCCGCTGA
CCCGTGCTAC CGCTGACAAC AAAGACGAAC TGATCAAACG TGCTAACGAC
TACGAAATCC AGAACCACCA GCTGACCGTT GAAAACAAAA AACTGAAAAC
CGACAAAGAA CAGCTGACCA

AAGAAAACGA CGACCTGAAA GCTGAATCCC CGAAATCCAC CGAAACCTCC
GCTAACGGTG CTGACAAACT GGCTGACGCT TACAACACCC TGCTGACCGA
ACACGAAAAA CTGCGTGACG AATACTACAC CCTGATCGAC GCTAAAGAAG
AAGAACCGCG TTACAAAGCT GACCACTCCG ACCTGGTTGC TGAAAAACAG
CGTCTGGAAG ACCTGGGTCA GAAATTCGAA CGTCTGAAAC AGCGTTCCGA
ACTGTACCTG CAGCAGTACT ACGACAACAA ATCCAACGGT TACAAAGGTG
ACTGGTACGT TCAGCAGCTG GACTCCGTTT CCGGTCTGGA AGTTGCTGAC
CCGTCCGACT CCAAAAAACT GATCGAACTG GGTCTGGCTA AATACCTGAA
CGACAAACTG CCGTTCAAAA

CCAAAGAAGA CTCCGAAATC CTGTCCGAAC TGCGTGACGT TCTGAAAAAC
AACGGTGACG GTAACCCGCG TGAAGTTATC GAAGACCTGG CTGCTAACAA
CCCGGCTATC CAGAACATCC GTCTGCGTCA CGAAAACAAA GACCTGAAAG
CTCGTCTGGA AAACGCTATG GAAGTTGCTG GTCGTGACTT CAAACGTGCT
CACCACCACC ACCACCACTA G 1481

Fig. 2A

Fusion Polypeptide 1 (MW: 52,782, pI: 6.48) (SEQ ID NO:9)

```
MNGDGNPREV IEDLAANNPA IQNIRLRHEN KDLKARLENA MEVAGRDFKR
ALLDQVTQLY TKHNSNYQQY NAQAGRLDLR QKAEYLKGLN DWAERLLQEL
NRVFPRGTVE NPDKARELLN KYDVENRVFP RGTVENPDKA RELLNKYDVE
NSKNPVPVKK EAKLSEAELH DKIKNLSKNP VPVKKEAKLS EAELHDKIKN
LAPLTRATAD NKDELIKRAN DYEIQNHQLT VENKKLKTDK EQLTKENDDL
KAESPKSTET SANGADKLAD AYNTLLTEHE KLRDEYYTLI DAKEEEPRYK
ADHSDLVAEK QRLEDLGQKF ERLKQRSELY LQQYYDNKSN GYKGDWYVQQ
LDSVSGLEVA DPSDSKKLIE LGLAKYLNDK LPFKTKEDSE ILSELRDVLK
NNGDGNPREV IEDLAANNPA
IQNIRLRHEN KDLKARLENA MEVAGRDFKR AHHHHHH  457
```

Fig. 2B

Polynucleotide Encoding Fusion Polypeptide 2 (SEQ ID NO:18)

```
AGATCTCGAT CCCGCGAAAT TAATACGACT CACTATAGGG GAATTGTGAG
CGGATAACAA TTCCCCTCTA GAAATAATTT TGTTTAACTT TAAGAAGGAG
ATATACCATG GCTGAAATCA AAAAACCGCA GGCTGACTCC GCTTGGAACT
GGCCGAAAGA ATACAACGCT CTGCTGAAAG AAAACGAAGA ACTGAAAGTT
GAACGTGAAA AATACCTGTC CTACGCTGAC GACAAAGAAA AAGACCCGCA
GTACCGTGCT GCTGTTACCC GTGGTACCAT CAACGACCCG CAGCGTGCTA
AAGAAGCTCT GGACAAATAC GAACTGGAAA ACCACGCTGT TACCCGTGGT
ACCATCAACG ACCCGCAGCG TGCTAAAGAA GCTCTGGACA AATACGAACT
GGAAAACCAC ACCGAAGTTA AAGCTGCTGG TCAGTCCGCT CCGAAAGGTA
CCAACGTTTC CGCTGACCTG TACAACTCCC TGTGGGACGA AAACAAAACC
CTGCGTGAAA AACAGGAAGA ATACATCACC AAAATCCAGA ACGAAGAAAC
CAAAAACAAA GAAGAAGAAC GTACCTTCAC CGAACTGCCG TACGAAGCTC
GTTACAAAGC TTGGAAATCC GAAAACGACG AACTGCGTGA AAACTACCGT
CGTACCCTGG ACAAATTCAA CACCGAACAG GGTAAAACCA CCCGTCTGGA
AGAACAGAAC CGTGTTCGTT ACACCCGTCA CACCCCGGAA GACAAACTGA
AAAAAATCAT CGACGACCTG GACGCTAAAG AACACCGTGT TCGTTACACC
CGTCACACCC CGGAAGACAA ACTGAAAAAA ATCATCGACG ACCTGGACGC
TAAAGAACAC CGTGTTTACA TCACCCGTCG TATGACCAAA GAAGACGTTG
AAAAAATCGC TAACGACCTG GACACCGAAA ACCACGGTCT GAAACAGCAG
AACGAACAGC TGTCCACCGA AAAACAGGGT CTGGAAGAAC AGAACAAACA
GCTGTCCACC GACCGTGTTT CCCGTTCCAT GTCCCGTGAC GACCTGCTGA
ACCGTGCTCA GGACCTGGAA GCTAAAAACC ACGGTCTGGA ACACCAGAAC
ACCAAACTGT CCACCGAAAA CAAAACCCTG CAGGAACAGG CTGAAGCTCG
TCAGAAAGAA GTTGCTACCC GTTCCCAGAC CGACACCCTG GAAAAAGTTC
AGGAACGTGC TGACAAATTC GAAATCGAAA ACAACACCCT GAAACTGAAA
AACTCCGACC TGTCCTTCAA CAACAAAGCT CTGAAAGACC ACAACGACGA
ACTGACCGAA GCTGAAATCA AAAAACCGCA GGCTGACTCC GCTTGGAACT
GGCCGAAAGA ATACAACGCT CTGCTGAAAG AAAACGAAGA ACTGAAAGTT
GAACGTGAAA AATACCTGTC CTACGCTGAC GACAAAGAAA AAGACCCGCA
GTACCGTGCT CACCACCACC ACCACCACTA G  1481
```

Fig. 2C

Fusion Polypeptide 2 (MW: 54,174; pI: 5.87) (SEQ ID NO:10)

MAEIKKPQAD SAWNWPKEYN ALLKENEELK VEREKYLSYA DDKEKDPQYR
AAVTRGTIND PQRAKEALDK YELENHAVTR GTINDPQRAK EALDKYELEN
HTEVKAAGQS APKGTNVSAD LYNSLWDENK TLREKQEEYI TKIQNEETKN
KEEERTFTEL PYEARYKAWK SENDELRENY RRTLDKFNTE QGKTTRLEEQ
NRVRYTRHTP EDKLKKIIDD LDAKEHRVRY TRHTPEDKLK KIIDDLDAKE
HRVYITRRMT KEDVEKIAND LDTENHGLKQ QNEQLSTEKQ GLEEQNKQLS
TDRVSRSMSR DDLLNRAQDL EAKNHGLEHQ NTKLSTENKT LQEQAEARQK
EVATRSQTDT LEKVQERADK FEIENNTLKL KNSDLSFNNK ALKDHNDELT
EAEIKKPQAD SAWNWPKEYN
ALLKENEELK VEREKYLSYA DDKEKDPQYR AHHHHHH 457

Fig. 2D

Polynucleotide Encoding Fusion Polypeptide 3 (SEQ ID NO:19)

AGATCTCGAT CCCGCGAAAT TAATACGACT CACTATAGGG GAATTGTGAG
CGGATAACAA TTCCCCTCTA GAAATAATTT TGTTTAACTT TAAGAAGGAG
ATATACC**ATG** GAAGGTGTTT CCGTTGGTTC CGACGCTTCC CTGCACAACC
GTATCACCGA CCTGGAAGAA GAACGTGAAA AACTGCTGAA CAAACTGGAC
AAAGTTGAAG AAGAACACAA AAAAGACCAC GAACAGCTGG AAAAAAAATC
CGAAGACGTT GAATCCTCCA ACAACGCTGA ATCCTCCAAC ATCTCCCAGG
AATCCAAACT GATCAACACC CTGACCGACG AAAACGAAAA ACTGCGTGAA
GAACTGCAGC AGTACTACGC TCTGTCCGAC GCTAAAGAAG AAGAACCGCG
TTACAAAGCT GACAACCAGT

CCCCGGCTCC GGTTAAAAAA GAAGCTAAAA AACTGAACGA AGCTGAACTG
TACAACAAAA TCCAGGAACT GGAAGAAGGT AAAGCTGAAC TGTTCGACAA
ACTGGAAAAA GTTGAAGAAG AAAACAAAAA AGTTAAAGAA GACTCCGACA
ACATCAACCG TTCCGTTTCC GTTAAAGACA ACGAAAAAGA ACTGCACAAC
AAAATCGCTG ACCTGGAAGA AGAACGTGGT GAACACCTGG ACAAAATCGA
CGAACTGAAA GAAGAACTGA AAGCTAAAGA AAAATCCTCC GACTCCTCCC
GTGAAGTTAC CAACGAACTG ACCGCTTCCA TGTGGAAAGC TCAGGCTGAC
TCCGCTAAAG CTAAAGCTAA AGAACTGGAA AAACAGGTTG AAGAATACAA
AAAAAACTAC GAAACCCTGG

AAAAAGGTTA CGACGACCTG GCTGAATCCC GTTCCGTTTC CCAGGGTTCC
GTTTCCCTGG AACTGTACGA CAAACTGTCC GACGAAAACG ACATCCTGCG
TGAAAAACAG GACGAATACC TGACCAAAAT CGACGGTCTG GACAAAGAAA
ACAAAGAATA CGCTTCCCAG GAATCCCAGA ACTCCCGTTC CATCACCAAC
GAACAGCTGA TCGACAAACT GGTTGAAGAA AACAACGACC TGAAAGAAGA
ACGTGCTAAA TACCTGGACC TGCTGGACAA CCGTGAAAAA GACCCGCAGT
ACCGTGCTCT GATGGGTGAA GCTGAAAAAA AAGTTGAAGT TGCTGACTCC
AACGCTTCCT CCGTTGCTAA ACTGTACAAC CAGATCGCTG ACCTGACCGA
CAAAAACGGT GAATACCTGG

AACGTATCGA AGAACTGGAA GAACGTCAGA AAAACCTGGA AAAACTGGAA
GAAGGTGTTT CCGTTGGTTC CGACGCTTCC CTGCACAACC GTATCACCGA
CCTGGAAGAA GAACGTGAAA AACTGCTGAA CAAACTGGAC AAAGTTGAAG
AAGAACACAA AAAAGACCAC GAACAGCTGG AAAAAAAATC CGAAGACGTT
CACCACCACC ACCACCACTA G 1481

Fig. 2E

Fusion Polypeptide 3 (MW: 53,086; pI: 4.68) (SEQ ID NO:11)

MEGVSVGSDA SLHNRITDLE EEREKLLNKL DKVEEEHKKD HEQLEKKSED
VESSNNAESS NISQESKLIN TLTDENEKLR EELQQYYALS DAKEEEPRYK
ADNQSPAPVK KEAKKLNEAE LYNKIQELEE GKAELFDKLE KVEEENKKVK
EDSDNINRSV SVKDNEKELH NKIADLEEER GEHLDKIDEL KEELKAKEKS
SDSSREVTNE LTASMWKAQA DSAKAKAKEL EKQVEEYKKN YETLEKGYDD
LAESRSVSQG SVSLELYDKL SDENDILREK QDEYLTKIDG LDKENKEYAS
QESQNSRSIT NEQLIDKLVE ENNDLKEERA KYLDLLDNRE KDPQYRALMG
EAEKKVEVAD SNASSVAKLY NQIADLTDKN GEYLERIEEL EERQKNLEKL
EEGVSVGSDA SLHNRITDLE
EEREKLLNKL DKVEEEHKKD HEQLEKKSED VHHHHHH 457

Fig. 2F

Polynucleotide Encoding Fusion Polypeptide 4 (SEQ ID NO:20)

AGATCTCGAT CCCGCGAAAT TAATACGACT CACTATAGGG GAATTGTGAG
CGGATAACAA TTCCCCTCTA GAAATAATTT TGTTTAACTT TAAGAAGGAG
ATATACC**ATG** GACAACCCGC GTTACACCGA CGCTCACAAC GCTGTTACCC
AGGGTCGTAC CGTTCCGCTG CAGAACCTGC TGCACGAAAT GGACAAAAAC
GGTAAACTGC GTTCCGAAAA CGAAGAACTG AAAGCTGACC TGCAGAAAAA
AGAACAGGAA GACTCCTCCT CCCGTGACAT CACCGAAGCT GGTGTTTCCA
AATTCTGGAA ATCCAAATTC GACGCTGAAC AGAACCGTGC TAACGAACTG
GAAAAAAAAC TGTCCGGTTA CGAAAAAGAC TACAAAACCC TGGAACAGGA
ATACGAAAAC GCTGGTTCCG

AAGAAAACGT TCCGAAACAG CAGTACAACG CTCTGTGGGA AGAAAACGAA
GACCTGCGTG GTCGTGAACG TAAATACATC GCTAAACTGG AAAAAGAAGA
AATCCAGAAC GGTGAACTGA ACGAAAAAAA CCGTAAACTG GAATCCCCGC
GTGAAGTTAC CAACGAACTG GCTGCTTCCG TTTGGAAAAA AAAAGTTGAA
GAAGCTAAAG AAAAAGCTTC CAAACTGGAA AAACAGCTGG AAGAAGCTCA
GAAAGACTAC TCCGAAATCG AAGGTAAACT GGAACAGTTC GTTGAAAAAA
AAGTTGAAGC TGCTGAAAAC AACGTTTCCT CCGTTGCTCG TCGTGAAAAA
GAACTGTACG ACCAGATCGC TGACCTGACC GACAAAAACG GTGAATACCT
GGAACGTATC GGTGAACTGG

AAGAACGTCA GAAAAACCTG GACGACCGTT CCGTTTCCAC CAACTCCGGT
TCCGTTTCCA CCCCGTACAA CAACCTGCTG AACGAATACG ACGACCTGCT
GGCTAAACAC GGTGAACTGC TGTCCGAATA CGACGCTCTG AAAGAAAAAC
AGGACAAAAA CCAGGAAGAA AACTCCAAAA ACCCGGCTCC GGCTCCGGCT
TCCGCTGTTC CGGTTAAAAA AGAAGCTACC AAACTGTCCG AAGCTGAACT
GTACAACAAA ATCCAGGAAC TGGAAGAAGG TAAAGCTGAA CTGTTCGACA
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GCTGTTACCC AGGGTCGTAC CGTTCCGCTG CAGAACCTGC TGCACGAAAT
GGACAAAAAC GGTAAACTGC

GTTCCGAAAA CGAAGAACTG AAAGCTGACC TGCAGAAAAA AGAACAGGAA
CACCACCACC ACCACCACTA G

Fig. 2G

Fusion Polypeptide 4 (MW: 47,136; p I: 4.99) (SEQ ID NO:12)

MDNPRYTDAH NAVTQGRTVP LQNLLHEMDK NGKLRSENEE LKADLQKKEQ
EDSSSRDITE AGVSKFWKSK FDAEQNRANE LEKKLSGYEK DYKTLEQEYE
NAGSEENVPK QQYNALWEEN EDLRGRERKY IAKLEKEEIQ NGELNEKNRK
LESPREVTNE LAASVWKKKV EEAKEKASKL EKQLEEAQKD YSEIEGKLEQ
FVEKKVEAAE NNVSSVARRE KELYDQIADL TDKNGEYLER IGELEERQKN
LDDRSVSTNS GSVSTPYNNL LNEYDDLLAK HGELLSEYDA LKEKQDKNQE
ENSKNPAPAP ASAVPVKKEA TKLSEAELYN KIQELEEGKA ELFDKLEKVE
EDNPRYTDAH NAVTQGRTVP LQNLLHEMDK NGKLRSENEE LKADLQKKEQ
EHHHHHH 407

Fig. 2H

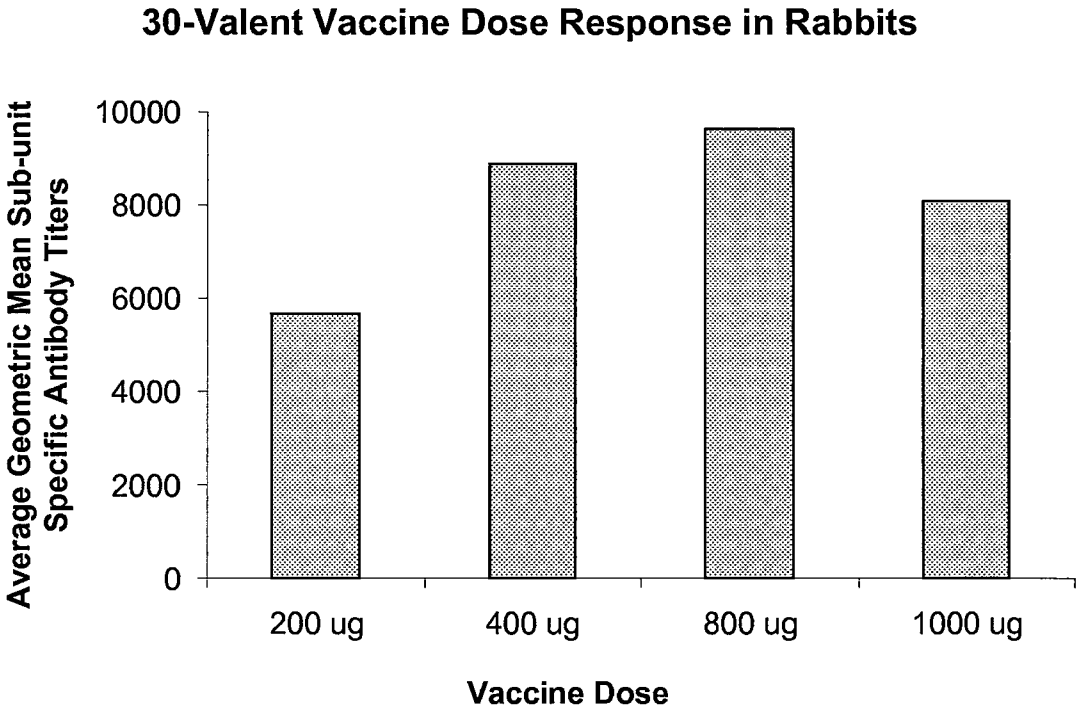

30-Valent Vaccine Dose Response in Rabbits
Average Geometric Mean Sub-unit Specific Antibody Titers
10000
8000
6000
4000
2000
0
200 ug
400 ug
800 ug
1000 ug
Vaccine Dose

Fig. 3

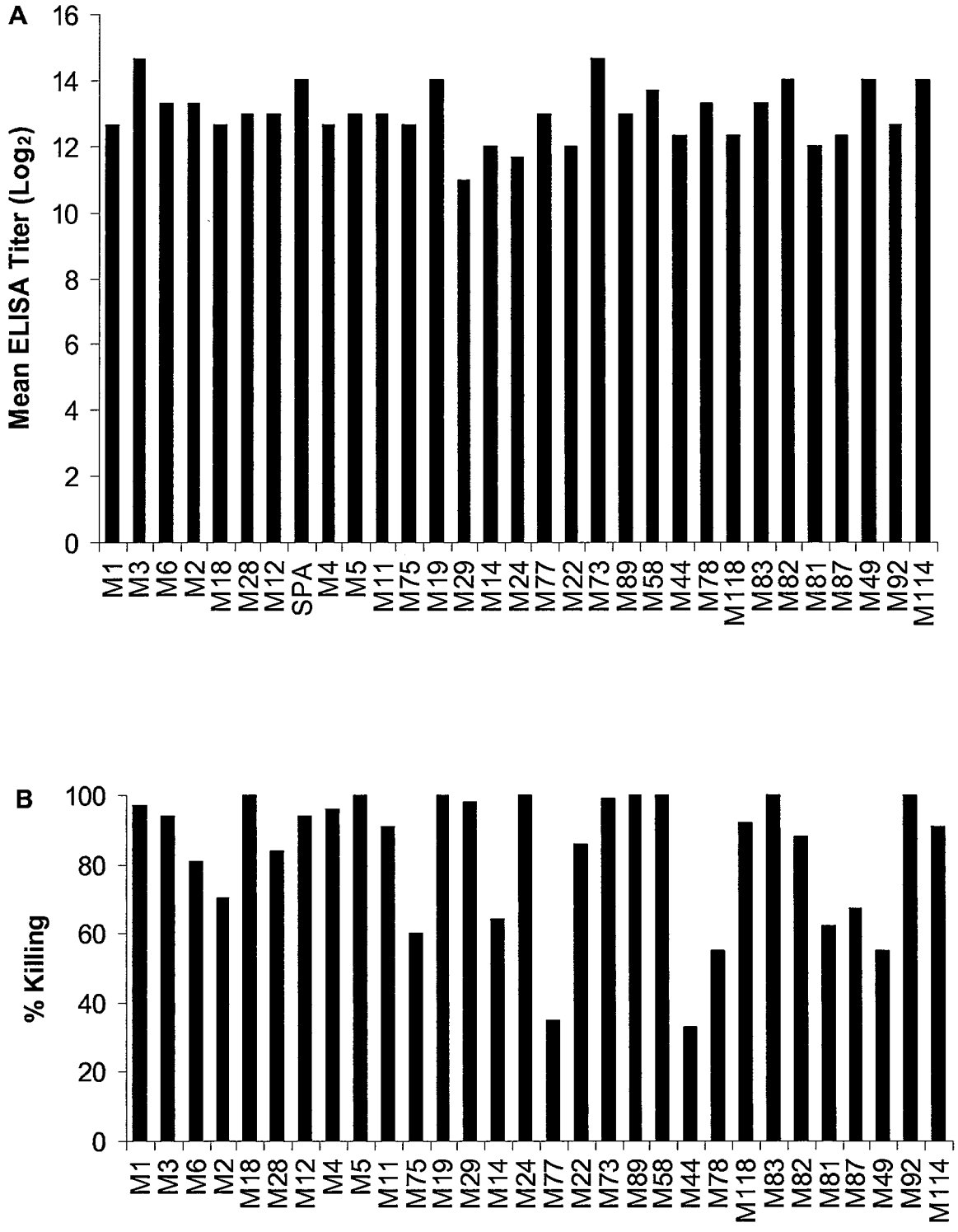

A
Mean ELISA Titer (Log2)
0
2
4
6
8
10
12
14
16
M1
M3
M6
M2
M18
M28
M12
SPA
M4
M5
M11
M75
M19
M29
M14
M24
M77
M22
M73
M89
M58
M44
M78
M118
M83
M82
M81
M87
M49
M92
M114
B
% Killing
0
20
40
60
80
100
M1
M3
M6
M2
M18
M28
M12
M4
M5
M11
M75
M19
M29
M14
M24
M77
M22
M73
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M58
M44
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M118
M83
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M87
M49
M92
M114

Fig. 4

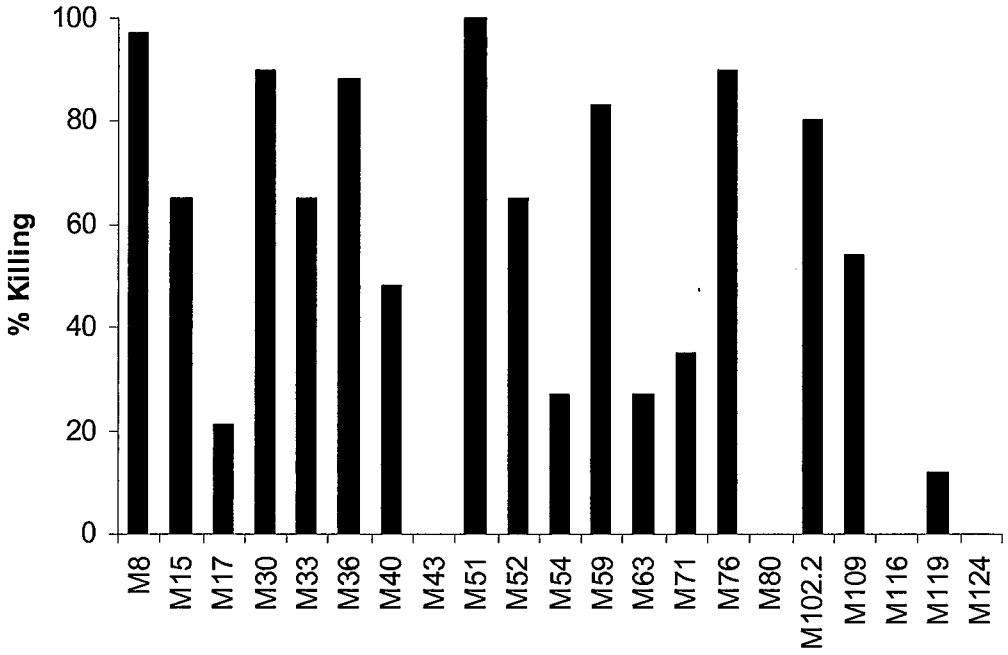

% Killing
100
80
60
40
20
0
M8
M15
M17
M30
M33
M36
M40
M43
M51
M52
M54
M59
M63
M71
M76
M80
M102.2
M109
M116
M119
M124

Fig. 5A

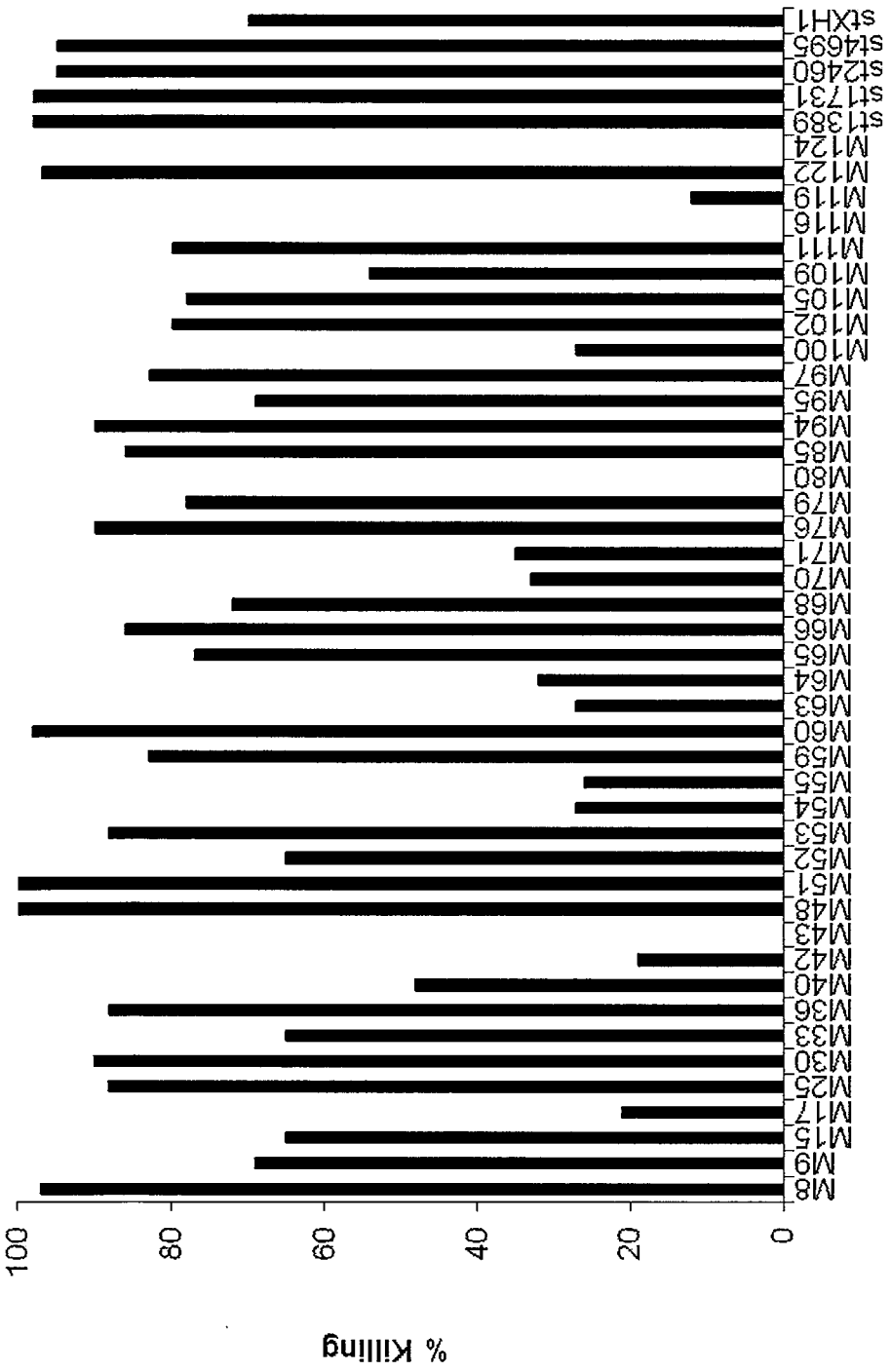

% Killing
0
20
40
60
80
100
M8
M9
M15
M17
M25
M30
M33
M36
M40
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M43
M48
M51
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M100
M102
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stXH1

Fig. 5B

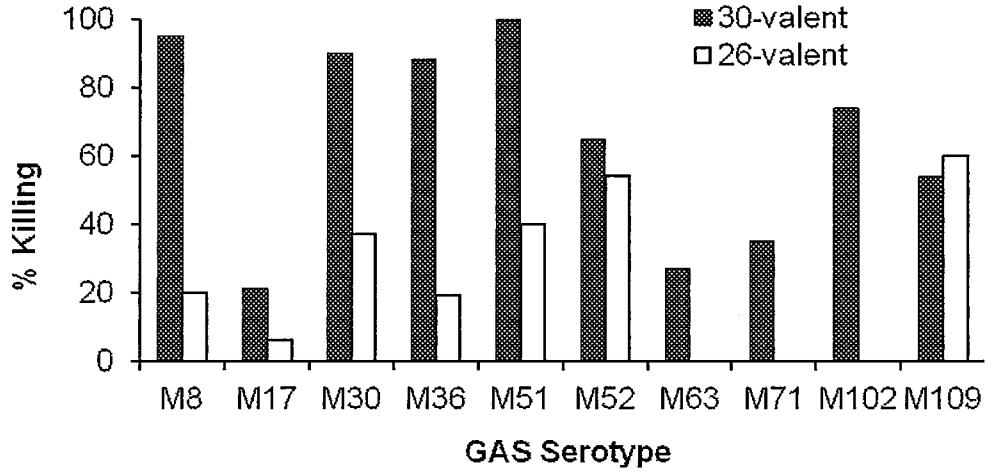

100
80
60
40
20
0
% Killing
30-valent
26-valent
M8
M17
M30
M36
M51
M52
M63
M71
M102
M109
GAS Serotype

Fig. 6