What is claimed:

1. A modified mycoplasma protein M or a functional fragment thereof, having one or more amino acid mutations that increase or maintain thermostability of the mycoplasma protein M or a functional fragment thereof relative to wild-type mycoplasma protein M or a functional fragment thereof.

2. The modified mycoplasma protein M or a functional fragment thereof of claim 1, derived from protein M of *Mycoplasma genitalium* or *Mycoplasma pneumoniae*, optionally being a fragment from about residue 74 to about residue 479 of *M. genitalium* protein M (SEQ ID NO:3) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23).

3. The modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-2, wherein the one or more mutations are not at a residue within 5 Å of the antibody-binding site of protein M (residues 95, 99, 102, 103, 105, 106, 107, 109, 110, 114, 116, 117, 118, 119, 120, 144, 158, 160, 161, 162, 163, 177, 178, 179, 180, 181, 186, 187, 188, 191, 321, 338, 340, 341, 345, 381, 384, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 426, 427, 429, 436, 438, 439, 440, 441, 442, 444, 445, 446, 447, 448, 449, 452, 453, 455, 456, 457, 462, 466) or any of residues 469-479 of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23).

4. The modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-3, wherein the one or more mutations are at residue 78, 81, 83, 84, 85, 89, 90, 91, 92, 93, 94, 96, 97, 100, 101, 108, 111, 112, 113, 122, 123, 125, 126, 127, 128, 130, 131, 133, 134, 136, 137, 139, 141, 142, 146, 147, 148, 149, 150, 153, 154, 155, 156, 164, 167, 170, 175, 176, 184, 185, 189, 192, 193, 196, 198, 201, 202, 204, 205, 206, 207, 209, 211, 215, 218, 220, 224, 225, 226, 227, 231, 232, 234, 235, 236, 237, 239, 241, 243, 244, 245, 246, 247, 249, 250, 252, 253, 254, 255, 256, 257, 258, 259, 264, 269, 270, 272, 274, 275, 276, 279, 282, 284, 286, 287, 288, 291, 297, 299, 300, 302, 303, 304, 305, 307, 308, 309, 310, 311, 313, 317, 318, 319, 320, 322, 326, 327, 329, 331, 332, 333, 335, 337, 342, 343, 347, 348, 351, 354, 355, 357, 358, 359, 360, 361, 362, 363, 367, 369, 370, 371, 372, 373, 374, 375, 378, 385, 399, 400, 401, 402, 405,

406, 407, 408, 409, 411, 413, 414, 417, 418, 419, 424, 428, 434, 435, 443, 450, 459, 460, 463, 464, 465, 468, or any combination thereof of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23), optionally wherein the one or more mutations is a mutation listed in Table 4 or any combination thereof, optionally wherein the one or more mutations are at residue 83, 90, 92, 94, 137, 142, 147, 150, 156, 184, 196, 198, 205, 211, 215, 225, 231, 232, 234, 235, 236, 237, 239, 243, 245, 250, 255, 256, 259, 264, 272, 274, 275, 276, 279, 282, 297, 300, 302, 310, 320, 326, 331, 332, 335, 342, 343, 347, 348, 355, 357, 361, 371, 374, 378, 385, 401, 402, 409, 413, 424, 460, 463, 464, 468, or any combination thereof of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23), optionally wherein the one or more mutations is a mutation listed in Table 5 or any combination thereof.

5. The modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-3, wherein the one or more mutations are at residue 150, 196, 198, 201, 205, 224, 232, 237, 274, 282, 342, 355, 373, 400, 402, 407, 409, 413, 135, or any combination thereof of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23), wherein the one or more mutations are at residues selected from:

a) 237;

b) 232;

c) 282;

d) 150, 196, 198, 400, 402, 407, 409;

e) 413, 435;

f) 373, 400;

g) 402, 407, 409, 413;

h) 342;

i) 150, 196, 198, 232, 237, 282, 342, 373, 400, 402, 407, 409, 413, 435;

j) 274;

k) 150, 196, 198, 232, 237, 342, 400, 402, 407, 409;

l) 373, 413, 435;

m) 205;

n) 355;

o) 150, 196, 198, 342, 373, 400, 402, 407, 409;

p) 150, 196, 198, 232, 237, 342, 373, 400, 402, 407, 409;

q) 201, 224;

r) 150, 196, 198, 201, 224, 232, 237, 342, 400, 402, 407, 409;

s) 150, 196, 198, 232, 237, 342, 390, 400, 402, 407, 409, 444;

t) 150, 196, 198, 201, 205, 224, 232, 237, 274, 342, 355, 400, 402, 407, 409; or

u) 150, 196, 198, 232, 237, 342, 391, 400, 402, 407, 409

of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23), optionally wherein the one or more mutations are selected from:

a) F237T;

b) S232Q;

c) Q282D;

d) S150E, S196R, S198P, V400I, N402I, K407P, S409V;

e) L413I, T435I;

f) V373I, V400I;

g) N402L, K407P, S409V, L413I;

h) A342V;

i) S150E, S196R, S198P, S232Q, F237T, Q282D, A342V, V373I, V400I, N402I, K407P, S409V, L413I, T435I;

j) N274D;

k) S150E, S196R, S198P, S232Q, F237T, A342V, V400I, N402I, K407P, S409V;

l) V373I, L413I, T435I;

m) A205P;

n) T355D;

o) T355P;

p) S150E, S196R, S198P, A342V, V373I, V400I, N402I, K407P, S409V;

q) 150, 196, 198, 232, 237, 342, 373, 400, 402, 407, 409;

r) S201C, A224C;

s) S150E, S196R, S198P, S201C, A224C, S232Q, F237T, A342V, V400I, N402I, K407P, S409V;

t) S150E, S196R, S198P, S232Q, F237T, A342V, F390E, V400I, N402I, K407P, S409V Y444K;
u) S150E, S196R, S198P, S201C, A205P, A224C, S232Q, F237T, N274D, A342V, T355P, V400I, N402I, K407P, S409V; or
v) S150E, S196R, S198P, S232Q, F237T, A342V, A391P, V400I, N402I, K407P, S409V
of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23).

6. The modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-3, wherein the one or more mutations are at residues 155, 203, 243, 248, and 358 of *M. pneumoniae* protein M (SEQ ID NO:23), optionally wherein the one or more mutations are A155E, K203R, H243T, V248Q, and A358V of *M. pneumoniae* protein M (SEQ ID NO:23).

7. The modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-3, wherein the one or more mutations are at residues selected from:
a) 468;
b) 150;
c) 147;
d) 272;
e) 355;
f) 276,277,279;
g) 300;
h) 378;
i) 156;
j) 232;
k) 245;
l) 276;
m) 225; or
n) 310
of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23), optionally wherein the one or more mutations are selected from:

a) R468Q;
b) S150E;
c) H147F;
d) S272G;
e) T355G;
f) S276E,Q277L,N279R;
g) N300Q;
h) N378Y;
i) S156K;
j) S232L;
k) A245Q;
l) S276D;
m) K225P; or
n) V310E
of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23).

8. The modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-16, wherein the modified mycoplasma protein M or a functional fragment thereof is further modified to remove one or more glycosylation sites or to add one or more glycosylation sites.

9. The modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-4, further comprising one or more mutations that enhance the affinity of the modified mycoplasma protein M or a functional fragment thereof to antibodies, optionally wherein the one or more mutations are at residue 95, 102, 103, 106, 107, 114, 116, 160, 161, 162, 163, 181, 186, 321, 381, 384, 389, 390, 391, 396, 397, 426, 429, 436, 438, 439, 441, 442, 447, 448, 449, 452, 453, 455, 456, 462, or 466, or any combination thereof of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23), optionally wherein the one or more mutations is a mutation listed in Table 6 or any combination thereof, optionally wherein the one or more mutations are at residue 95, 103, 116, 186, 321, 389, 429,

442, or 466, or any combination thereof of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23), optionally wherein the one or more mutations is a mutation listed in Table 7 or any combination thereof.

10. The modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-3, further comprising one or more mutations that reduce the affinity of the modified mycoplasma protein M or a functional fragment thereof to antibodies, optionally wherein the one or more mutations are at residue 390 and/or 444 of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues of *M. pneumoniae* protein M (SEQ ID NO:23), optionally wherein the one or more mutations is 390E and/or Y444K.

11. The modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-10, further comprising a secretion peptide at the N-terminus.

12. A polynucleotide encoding the modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-11.

13. A vector comprising the polynucleotide of claim 12.

14. A transformed cell comprising the polynucleotide of claim 12 and/or the vector of claim 13.

15. Use of mycoplasma protein M, or a functional fragment or derivative thereof, in the manufacture of a medicament for inhibiting neutralization of a heterologous agent by neutralizing antibodies, optionally wherein the heterologous agent is a nucleic acid delivery vector, a gene editing complex, a protein or a nucleic acid.

16. The use of claim 15, wherein the protein M or a functional fragment or derivative thereof is from *Mycoplasma genitalium*, *Mycoplasma pneumoniae,* or *Mycoplasma penetrans*, optionally wherein the protein M or a functional fragment or derivative thereof is a protein M fragment, optionally wherein the protein M functional fragment comprises amino acid residues 17-537, 37-

556, 37-482, 37-468, 37-442, 74-468, 74-479, 74-482, 74-468, 74-442, or 74-556 of *M. genitalium* protein M (SEQ ID NO:1) or the equivalent residues from another protein M.

17. The use of any one of claims 15-16, wherein the protein M or a functional fragment or derivative thereof is the modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-11.

18. Use of a) a nucleic acid delivery vector encoding the polypeptide or functional nucleic acid, and (b) an effective amount of mycoplasma protein M, or a functional fragment or derivative thereof, in the manufacture of a medicament for expressing a polypeptide or functional nucleic acid in a subject..

19. Use of (a) a therapeutically effective amount of a nucleic acid delivery vector encoding the polypeptide or functional nucleic acid, and (b) an effective amount of mycoplasma protein M or a functional fragment or derivative thereof, in the manufacture of a medicament for treating a disorder in a subject in need thereof, wherein the disorder is treatable by expressing a polypeptide or functional nucleic acid in the subject.

20. Use of (a) an effective amount of a gene editing complex, and (b) an effective amount of mycoplasma protein M or a functional fragment or derivative thereof, in the manufacture of a medicament for gene therapy.

21. Use of a therapeutically effective amount of mycoplasma protein M or a functional fragment or derivative thereof in the manufacture of a medicament for treating an autoimmune disease.

22. Use of a therapeutically effective amount of mycoplasma protein M or a functional fragment or derivative thereof in the manufacture of a medicament for treating a disorder associated with excess antibodies.

23. Use of a therapeutically effective amount of mycoplasma protein M or a functional fragment or derivative thereof in the manufacture of a medicament for acutely inhibiting antibodies.

24. The use of any one of claims 18-23, wherein the protein M or a functional fragment or derivative thereof is the modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-11.

25. A method of isolating a compound comprising an antibody light chain variable region and/or heavy chain variable region from a sample, the method comprising contacting the compound with the modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-11 attached to a solid support, then eluting the compound from the modified mycoplasma protein M or a functional fragment thereof.

26. A method of performing an immunoassay, the method comprising using the modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-11 to bind a compound comprising an antibody light chain variable region and/or heavy chain variable region.

27. A kit comprising the modified mycoplasma protein M or a functional fragment thereof of any one of claims 1-11.