CLAIMS

I claim the following:

1. An immunogenic composition comprising at least 31 immunogenic peptides, wherein each immunogenic peptide is different and comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein or a Spa protein, wherein each different M protein is independently selected from the M protein of group A streptococcus (GAS) serotype 1, 2, 3, 4, 5, 6, 11, 12, 14, 18, 19, 22, 24, 28, 29, 44, 49, 58, 73, 75, 77, 78, 81, 82, 83, 87, 89, 92, 114, and 118, and the Spa protein is from GAS serotype 18, and wherein the immunogenic composition induces an immune response against GAS.

2. The immunogenic composition of claim 1, wherein at least four of the different immunogenic peptides are linked in tandem to form a fusion polypeptide.

3. The immunogenic composition of claim 1 or claim 2 comprising a first fusion polypeptide, a second fusion polypeptide, a third fusion polypeptide, and a fourth fusion polypeptide that each comprises at least six of the different immunogenic peptides linked in tandem.

4. The immunogenic composition of claim 3, wherein the first fusion polypeptide comprises eight of the different immunogenic peptides linked in tandem, wherein each of the eight immunogenic peptides comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein or the Spa protein, wherein each different M protein is independently selected from the M protein of GAS serotype 1, 2, 3, 6, 12, 18, and 28, and the Spa protein is from GAS serotype 18.

5. The immunogenic composition of claim 4, wherein the immunogenic peptide located at the carboxy terminal end of the first fusion polypeptide is a duplicate of the immunogenic peptide located at the amino terminal end of the first fusion polypeptide.

6. The immunogenic composition of claim 5, wherein the immunogenic peptide that is duplicated comprises at least 25 contiguous amino acids from the amino terminal portion of the M protein of GAS serotype 1.

7. The immunogenic composition of claim 3, wherein the second fusion polypeptide comprises eight of the different immunogenic peptides linked in tandem, and wherein each of the eight immunogenic peptides comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein independently selected from the M protein of GAS serotype 4, 5, 11, 14, 19, 24, 29, and 75.

8. The immunogenic composition of claim 7, wherein the immunogenic peptide located at the carboxy terminal end of the second fusion polypeptide is a duplicate of the immunogenic peptide located at the amino terminal end of the second fusion polypeptide.

9. The immunogenic composition of claim 8, wherein the immunogenic peptide that is duplicated comprises at least 25 contiguous amino acids from the amino terminal portion of the M protein of GAS serotype 4.

10. The immunogenic composition of claim 3, wherein the third fusion polypeptide comprises eight of the different immunogenic peptides linked in tandem, and wherein each of the eight immunogenic peptides comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein independently selected from the M protein of GAS serotype 22, 44, 58, 73, 77, 78, 89, and 118.

11. The immunogenic composition of claim 10, wherein the immunogenic peptide located at the carboxy terminal end of the third fusion polypeptide is a duplicate of the immunogenic peptide located at the amino terminal end of the third fusion polypeptide.

12. The immunogenic composition of claim 11, wherein the immunogenic peptide that is duplicated comprises at least 25 contiguous amino acids from the amino terminal portion of the M protein of GAS serotype 77.

13. The immunogenic composition of claim 3, wherein the fourth fusion polypeptide comprises seven of the different immunogenic peptides linked in tandem, and wherein each of the seven immunogenic peptides comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein independently selected from the M protein of GAS serotype 49, 81, 82, 83, 87, 92, and 114.

14. The immunogenic composition of claim 13, wherein the immunogenic peptide located at the carboxy terminal end of the fourth fusion polypeptide is a duplicate of the immunogenic peptide located at the amino terminal end of the fourth fusion polypeptide.

15. The immunogenic composition of claim 14, wherein the immunogenic peptide that is duplicated comprises at least 25 contiguous amino acids from the amino terminal portion of the M protein of GAS serotype 83.

16. The immunogenic composition of claim 1 or claim 2, wherein each of the immunogenic peptides comprises (a) the at least 25 contiguous amino acids from the amino terminal portion of the different M protein or the Spa protein in duplicate; (b) at least 40 contiguous amino acids from the amino terminal portion of the different M protein or the Spa protein; (b) at least 45 contiguous amino acids from the amino terminal portion of the different M protein or the Spa protein; or (d) at least 50 contiguous amino acids from the amino terminal portion of the different M protein or the Spa protein.

17. An immunogenic composition comprising:

(a) a first fusion polypeptide comprising an amino acid sequence at least 85% identical to the amino acid sequence set forth in SEQ ID NO:1;

(b) a second fusion polypeptide comprising an amino acid sequence at least 85% identical to the amino acid sequence set forth in SEQ ID NO:2;

(c) a third fusion polypeptide comprising an amino acid sequence at least 85% identical to the amino acid sequence set forth in SEQ ID NO:3; and

(d) a fourth fusion polypeptide comprising an amino acid sequence at least 85% identical to the amino acid sequence set forth in SEQ ID NO:4,

wherein the immunogenic composition induces an immune response against group A streptococcus.

18. The immunogenic composition of claim 17 wherein (a) the first fusion polypeptide comprises an amino acid sequence at least 90% identical to the amino acid sequence set forth in SEQ ID NO:1; (b) the second fusion polypeptide comprises an amino acid sequence at least 90% identical to the amino acid sequence set forth in SEQ ID NO:2; (c) the third fusion polypeptide comprises an amino acid sequence at least 90% identical to the amino acid sequence set forth in SEQ ID NO:3; and (d) the fourth fusion polypeptide comprises an amino acid sequence at least 90% identical to the amino acid sequence set forth in SEQ ID NO:4.

19. The immunogenic composition of claim 17, wherein (a) the first fusion polypeptide comprises an amino acid sequence at least 95% identical to the amino acid sequence set forth in SEQ ID NO:1; (b) the second fusion polypeptide comprises an amino acid sequence at least 95% identical to the amino acid sequence set forth in SEQ ID NO:2; (c) the third fusion polypeptide comprises an amino acid sequence at least 95% identical to the amino acid sequence set forth in SEQ ID NO:3; and (d) the fourth fusion polypeptide comprises an amino acid sequence at least 95% identical to the amino acid sequence set forth in SEQ ID NO:4.

20. The immunogenic composition of claim 17, wherein (a) the first fusion polypeptide comprises an amino acid sequence at least 97% identical to the amino acid sequence set forth in SEQ ID NO:1; (b) the second fusion polypeptide comprises an amino acid sequence at least 97% identical to the amino acid sequence set forth in SEQ ID NO:2; (c) the third fusion polypeptide comprises an amino acid sequence at least 97% identical to the amino acid sequence set forth in SEQ ID NO:3; and (d) the fourth fusion polypeptide comprises an amino acid sequence at least 97% identical to the amino acid sequence set forth in SEQ ID NO:4.

21. The immunogenic composition of claim 17, wherein (a) the first fusion polypeptide comprises the amino acid sequence set forth in SEQ ID NO:1; (b) the second fusion polypeptide comprises the amino acid sequence set forth in SEQ ID NO:2; (c) the third fusion polypeptide comprises the amino acid sequence set forth in SEQ ID NO:3; and (d) the fourth fusion polypeptide comprises the amino acid sequence set forth in SEQ ID NO:4.

22. The immunogenic composition of any one of claims 1, 2, and 17, further comprising a pharmaceutically acceptable excipient.

23. The immunogenic composition of any one of claims 1, 2, and 17, further comprising a pharmaceutically acceptable adjuvant.

24. The immunogenic composition of any one of claims 1, 2, and 17, wherein the immune response against group A streptococcus comprises an immune response against at least each of GAS 1, 2, 3, 4, 5, 6, 11, 12, 14, 18, 19, 22, 24, 28, 29, 44, 49, 58, 73, 75, 77, 78, 81, 82, 83, 87, 89, 92, 114, and 118 serotypes.

25. A method for inducing an immune response against group A streptococcus in a subject, comprising administering to the subject the immunogenic composition of any one of claims 1, 2, and 17.

26. A method for reducing the likelihood of occurrence of a group A streptococcus infection in a subject, comprising administering to the subject the immunogenic composition of any one of claims 1, 2, and 17.

27. A method for preventing or treating a group A streptococcus infection in a subject, comprising administering to the subject the immunogenic composition of any one of claims 1, 2, and 17.

28. The immunogenic composition of any one of claims 1, 2, and 17 for use in preventing or treating a group A streptococcus infection.

29. Use of the immunogenic composition of any one of claims 1, 2, and 17 for the manufacture of a vaccine to prevent or treat a group A streptococcus infection.

30. The immunogenic composition of any one of claims 1, 2, and 17 for preventing or treating a group A streptococcus infection.

31. A fusion polypeptide comprising:

(a) an amino acid sequence at least 85% identical to the amino acid sequence set forth in SEQ ID NO:1;

(b) an amino acid sequence at least 85% identical to the amino acid sequence set forth in SEQ ID NO:2;

(c) an amino acid sequence at least 85% identical to the amino acid sequence set forth in SEQ ID NO:3; or

(d) an amino acid sequence at least 85% identical to the amino acid sequence set forth in SEQ ID NO:4,

wherein the fusion polypeptide induces an immune response against group A streptococcus.

32. The fusion polypeptide of claim 31 comprising:

(a) an amino acid sequence at least 90% identical to the amino acid sequence set forth in SEQ ID NO:1;

(b) an amino acid sequence at least 90% identical to the amino acid sequence set forth in SEQ ID NO:2;

(c) an amino acid sequence at least 90% identical to the amino acid sequence set forth in SEQ ID NO:3; or

(d) an amino acid sequence at least 90% identical to the amino acid sequence set forth in SEQ ID NO:4.

33. The fusion polypeptide of claim 31 comprising:

(a) an amino acid sequence at least 95% identical to the amino acid sequence set forth in SEQ ID NO:1;

(b) an amino acid sequence at least 95% identical to the amino acid sequence set forth in SEQ ID NO:2;

(c) an amino acid sequence at least 95% identical to the amino acid sequence set forth in SEQ ID NO:3; or

(d) an amino acid sequence at least 95% identical to the amino acid sequence set forth in SEQ ID NO:4.

34. The fusion polypeptide of claim 31 comprising:

(a) an amino acid sequence at least 97% identical to the amino acid sequence set forth in SEQ ID NO:1;

(b) an amino acid sequence at least 97% identical to the amino acid sequence set forth in SEQ ID NO:2;

(c) an amino acid sequence at least 97% identical to the amino acid sequence set forth in SEQ ID NO:3; or

(d) an amino acid sequence at least 97% identical to the amino acid sequence set forth in SEQ ID NO:4.

35. The fusion polypeptide of claim 31 comprising:
(a) the amino acid sequence set forth in SEQ ID NO:1;
(b) the amino acid sequence set forth in SEQ ID NO:2;
(c) the amino acid sequence set forth in SEQ ID NO:3; or
(d) the amino acid sequence set forth in SEQ ID NO:4.

36. An isolated polynucleotide encoding the fusion polypeptide of any one of claims 31-35.

37. A recombinant expression vector comprising the isolated polynucleotide of claim 36 operatively linked to at least one expression control region.

38. An isolated host cell transfected, transduced, or transformed with the recombinant expression vector of claim 37.

39. A process for producing a fusion polypeptide, said method comprising:
(a) culturing the isolated host cell of claim 38; and
(b) isolating the fusion polypeptide from the host cell culture.

40. A method for detecting an antibody that specifically binds to the fusion polypeptide of any one of claims 31-35 in a biological sample suspected of containing the antibody, said method comprising:
(a) contacting the biological sample with
(i) an immunogenic peptide comprising at least 25 contiguous amino acids of the amino terminal portion of an M protein or a Spa protein, wherein the M protein is selected from the M protein of group A streptococcus (GAS) serotype 1, 2, 3, 4, 5, 6, 11, 12, 14, 18, 19, 22, 24, 28, 29, 44, 49, 58, 73, 75, 77, 78, 81, 82, 83, 87, 89, 92, 114, and 118, and the Spa protein is from GAS serotype 18;
(ii) a dimeric peptide, wherein each peptide of the dimeric peptide is different and comprises at least 25 contiguous amino acids of the amino terminal portion of a different M protein or a Spa protein, wherein each different M protein is independently selected from the M protein of group A streptococcus (GAS) serotype 1, 2, 3, 4, 5, 6, 11, 12, 14, 18, 19, 22, 24, 28, 29, 44, 49, 58, 73, 75, 77, 78, 81, 82, 83, 87, 89, 92, 114, and 118, and the Spa protein is from GAS serotype 18; or
(iii) the fusion polypeptide of any one of claims 31-35; and

(b) detecting specific binding of the immunogenic peptide, dimeric peptide, or fusion polypeptide with the biological sample, thereby indicating that the biological sample contains the antibody.

CLAIMS

I claim the following:

1. An immunogenic composition comprising at least 31 immunogenic peptides, wherein each immunogenic peptide is different and comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein or a Spa protein, wherein each different M protein is independently selected from the M protein of group A streptococcus (GAS) serotype 1, 2, 3, 4, 5, 6, 11, 12, 14, 18, 19, 22, 24, 28, 29, 44, 49, 58, 73, 75, 77, 78, 81, 82, 83, 87, 89, 92, 114, and 118, and the Spa protein is from GAS serotype 18.

2. The immunogenic composition of claim 1, wherein at least four of the different immunogenic peptides are linked in tandem to form a fusion polypeptide.

3. The immunogenic composition of claim 1 comprising a first fusion polypeptide, a second fusion polypeptide, a third fusion polypeptide, and a fourth fusion polypeptide that each comprises at least six of the different immunogenic peptides linked in tandem.

4. The immunogenic composition of claim 3, wherein the first fusion polypeptide comprises eight of the different immunogenic peptides linked in tandem, wherein each of the eight immunogenic peptides comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein or the Spa protein, wherein each different M protein is independently selected from the M protein of GAS serotype 1, 2, 3, 6, 12, 18, and 28, and the Spa protein is from GAS serotype 18.

5. The immunogenic composition of claim 4, wherein the immunogenic peptide located at the carboxy terminal end of the first fusion polypeptide is a duplicate of the immunogenic peptide located at the amino terminal end of the first fusion polypeptide.

6. The immunogenic composition of claim 3, wherein the second fusion polypeptide comprises eight of the different immunogenic peptides linked in tandem, and wherein each of the eight immunogenic peptides comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein independently selected from the M protein of GAS serotype 4, 5, 11, 14, 19, 24, 29, and 75.

7. The immunogenic composition of claim 6, wherein the immunogenic peptide located at the carboxy terminal end of the second fusion polypeptide is a duplicate of the immunogenic peptide located at the amino terminal end of the second fusion polypeptide.

8. The immunogenic composition of claim 3, wherein the third fusion polypeptide comprises eight of the different immunogenic peptides linked in tandem, and wherein each of the eight immunogenic peptides comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein independently selected from the M protein of GAS serotype 22, 44, 58, 73, 77, 78, 89, and 118.

9. The immunogenic composition of claim 8, wherein the immunogenic peptide located at the carboxy terminal end of the third fusion polypeptide is a duplicate of the immunogenic peptide located at the amino terminal end of the third fusion polypeptide.

10. The immunogenic composition of claim 3, wherein the fourth fusion polypeptide comprises seven of the different immunogenic peptides linked in tandem, and wherein each of the seven immunogenic peptides comprises at least 25 contiguous amino acids from the amino terminal portion of a different M protein independently selected from the M protein of GAS serotype 49, 81, 82, 83, 87, 92, and 114.

11. The immunogenic composition of claim 10, wherein the immunogenic peptide located at the carboxy terminal end of the fourth fusion polypeptide is a duplicate of the immunogenic peptide located at the amino terminal end of the fourth fusion polypeptide.

12. The immunogenic composition of claim 1, wherein each of the immunogenic peptides comprises (a) the at least 25 contiguous amino acids from the amino terminal portion of the different M protein or the Spa protein in duplicate; (b) at least 40 contiguous amino acids from the amino terminal portion of the different M protein or the Spa protein; (b) at least 45 contiguous amino acids from the amino terminal portion of the different M protein or the Spa protein; or (d) at least 50 contiguous amino acids from the amino terminal portion of the different M protein or the Spa protein.

13. The immunogenic composition of claim 1, further comprising a pharmaceutically acceptable excipient.

14. The immunogenic composition of claim 13, further comprising a pharmaceutically acceptable adjuvant.