CLAIMS

1. Use of a composition comprising a polypeptide comprising an amino acid sequence of at least 9 contiguous amino acids from the region of *Mycobacterium avium* subspecies *paratuberculosis* (MAP P900) shown in SEQ ID NO: 2, or a polynucleotide encoding the polypeptide, in the manufacture of a medicament for treating or preventing MAP infection or a condition or symptom associated with MAP infection in a subject.

2. Use according to Claim 1, in which the polypeptide comprises the amino acid sequence shown in any of SEQ ID NOs: 3 to 10.

3. Use according to Claim 1 or 2, in which the composition comprises two or more polypeptides comprising an amino acid sequence of at least 9 contiguous amino acids from the region of MAP P900 shown in SEQ ID NO: 2, or two or more polynucleotides encoding the polypeptides.

4. Use according to Claim 3, in which the composition comprises: (i) a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 3 and a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 5; (ii) at least two of the following polypeptides or polynucleotides: a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 3, or a polynucleotide encoding the polypeptide, a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 7, or a polynucleotide encoding the polypeptide, and a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 9, or a polynucleotide encoding the polypeptide; or (iii) a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 4, a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 8 and/or a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 10.

5. Use according to any preceding claim, in which (i) the polypeptide comprises the amino acid sequence shown in any one of SEQ ID NOs: 11 to 20, 52, 58, 60, 61, 83 and 146; (ii) the polypeptide further comprises the amino acid sequence of at least one additional MAP polypeptide, or a fragment thereof; or (iii) the composition further comprises a polypeptide comprising an amino acid sequence of at least one additional MAP polypeptide, or a fragment thereof, or at least one further polynucleotide encoding an additional MAP polypeptide, or a fragment thereof.

6. Use according to Claim 5, in which the additional MAP polypeptide is at least one of the following:

(a) an ahpC polypeptide comprising the sequence of SEQ ID NO: 22, a variant thereof having more than 70% amino acid sequence identity to SEQ ID NO: 22 across the full length of SEQ ID NO: 22, or a fragment of at least 8 amino acids of SEQ ID NO: 22 which comprises an epitope;

(b) a gsd polypeptide comprising the sequence of SEQ ID NO: 24, a variant thereof having more than 70% amino acid sequence identity to SEQ ID NO: 24 across the full length of SEQ ID NO: 24, or a fragment of at least 8 amino acids of SEQ ID NO: 24 which comprises an epitope;

(c) a pl2 polypeptide comprising the sequence of SEQ ID NO: 26, a variant thereof having more than 70% amino acid sequence identity to SEQ ID NO: 26 across the full length of SEQ ID NO: 26, or a fragment of at least 8 amino acids of SEQ ID NO: 26 which comprises an epitope; and/or

(d) an mpa polypeptide comprising the sequence of SEQ ID NO: 30, a variant thereof having more than 70% amino acid sequence identity to SEQ ID NO: 30 across the full length of SEQ ID NO: 30, or a fragment of at least 8 amino acids of SEQ ID NO: 30 which comprises an epitope.

7. Use according to Claim 6, in which:

(a) the ahpC polypeptide has the amino acid sequence given in SEQ ID NO: 32;

(b) the gsd polypeptide has the amino acid sequence given in SEQ ID NO: 34;

(c) the pl2 polypeptide has the amino acid sequence given in SEQ ID NO: 36 or SEQ ID NO: 38; and/or

(d) the mpa polypeptide has the amino acid sequence given in SEQ ID NO: 40.

8. Use according to Claim 6 or 7, in which (i) the polypeptide comprises the amino acid sequence shown in SEQ ID NO: 41, in which a peptide comprising the amino acid sequence shown in SEQ ID NO: 3 is added at the N-terminus or inserted between: positions 7 and 8, positions 199 and 200, positions 442 and 443, positions 577 and 578, and/or positions 820 and 821; or the amino acid sequence shown in SEQ ID NO: 42, in which a peptide comprising the amino acid sequence shown in SEQ ID NO: 3 is added at the N-terminus or inserted between:

positions 7 and 8, positions 199 and 200, positions 442 and 443, positions 582 and 583,and/or positions 825 and 826; (ii) the polypeptide comprises the amino acid sequence shown in any one of SEQ ID NOs: 62, 63, 64, 65, 67, 68 and 69; and/or (iii) the polynucleotide comprises two or more copies of a nucleotide sequence encoding the polypeptide or at least one of the polypeptides.

9. Use according to any preceding claim in which: (i) the condition or symptom associated with MAP infection is: chronic inflammation of the intestine, Crohn's disease, Johne's disease, Ulcerative Colitis, Psoriasis, Thyroiditis, Sarcoidosis, Parkinson's disease, Multiple Sclerosis, Type 1 Diabetes, arthritis, ankylosing spondylitis, rheumatoid arthritis, irritable bowel syndrome, inflammatory bowel disease, chronic enteritis, Alzheimer's disease, multiple sclerosis, idiopathic pulmonary fibrosis, leprosy and/or chronic fatigue syndrome; and/or (ii) the subject is a human, a livestock animal, a laboratory animal or a domestic animal.

10. Use according to any preceding claim, in which a further therapeutic agent which has activity against MAP or a further therapeutic agent used in the treatment of a condition which is associated with MAP infection are to be administered to the subject.

11. A peptide of up to 100 amino acids, which comprises the amino acid sequence shown in SEQ ID NO: 4.

12. A peptide according to Claim 11, which: (i) further comprises the amino acid sequence shown in SEQ ID NO: 7 or 8, and/or the amino acid sequence shown in SEQ ID NO: 9 or 10; and/or (ii) comprises the amino acid sequence shown in any one of SEQ ID NOs: 6, 11 to 20, 52, 58, 60, 61, 83 and 146.

13. A polypeptide which comprises the amino acid sequence shown in SEQ ID NO: 3 or SEQ ID NO: 5 and (a) an ahpC polypeptide comprising the sequence of SEQ ID NO: 22, a variant thereof having more than 70% amino acid sequence identity to SEQ ID NO: 22 across the full length of SEQ ID NO: 22, or a fragment of at least 8 amino acids of SEQ ID NO: 22 which comprises an epitope; (b) a gsd polypeptide comprising the sequence of SEQ ID NO: 24, a variant thereof having more than 70% amino acid sequence identity to SEQ ID NO: 24 across the full length of SEQ ID NO: 24, or a fragment of at least 8 amino acids of SEQ ID NO: 24 which comprises an epitope; (c) a p12 polypeptide comprising the sequence of SEQ ID NO: 26, a variant thereof having more than 70% amino acid sequence identity to SEQ ID NO: 26 across the full length of SEQ ID NO: 26, or a fragment of at least 8 amino acids of

SEQ ID NO: 26 which comprises an epitope; and/or a mpa polypeptide comprising the sequence of SEQ ID NO: 30, a variant thereof having more than 70% amino acid sequence identity to SEQ ID NO: 30 across the full length of SEQ ID NO: 30, or a fragment of at least 8 amino acids of SEQ ID NO: 30 which comprises an epitope.

14. A polypeptide according to Claim 13, in which:

(i) the ahpC polypeptide has the amino acid sequence given in SEQ ID NO: 32, the gsd polypeptide has the amino acid sequence given in SEQ ID NO: 34, the pl2 polypeptide has the amino acid sequence given in SEQ ID NO: 36, and/or the mpa polypeptide has the amino acid sequence given in SEQ ID NO: 40;

(ii) the polypeptide comprises the amino acid sequence shown in SEQ ID NO: 41, in which a peptide comprising the amino acid sequence MVINDDAQRLLSQR is added at the N-terminus or inserted between: positions 7 and 8, positions 199 and 200, positions 442 and 443, positions 577 and 578, and/or positions 820 and 821; or the amino acid sequence shown in SEQ ID NO: 42, in which a peptide comprising the amino acid sequence MVINDDAQRLLSQR is added at the N-terminus or inserted between: positions 7 and 8, positions 199 and 200, positions 442 and 443, positions 582 and 583,and/or positions 825 and 826;

(iii) the polypeptide comprises the amino acid sequence shown in any one of SEQ ID NOs: 62, 63, 64, 65, 67, 68 and 69; and/or

(iv) the peptide comprising the amino acid sequence shown in SEQ ID NO: 3 (a) further comprises the amino acid sequence shown in SEQ ID NO: 7 or 8, and/or the amino acid sequence shown in SEQ ID NO: 9 or 10; and/or (b) comprises the amino acid sequence shown in any one of SEQ ID NOs: 4, 6, 11 to 20, 52, 58, 60, 61, 83 and 146.

15. A polynucleotide encoding a peptide according to Claim 11 or 12 or a polypeptide according to Claim 13 or 14.

16. A vector comprising a comprising a polynucleotide encoding a polypeptide comprising an amino acid sequence of at least 9 contiguous amino acids from the region of MAP P900 shown in SEQ ID NO: 2.

17. A vector according to Claim 16, in which: (i) the polynucleotide encodes a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 3 or is a polynucleotide according to Claim 13; (ii) the vector is a viral vector; and/or (iii) the vector is an adenoviral vector or a poxvirus vector.

18. A peptide consisting of the amino acid sequence shown in SEQ ID NO: 3, a peptide according to Claim 11 or 12, a polypeptide according to Claim 13 or 14, a polynucleotide according to Claim 15, or a vector according to Claim 16 or 17 for use in a method of treating the human or animal body by therapy.

19. Use of a peptide consisting of the amino acid sequence shown in SEQ ID NO: 3, a peptide according to Claim 11 or 12, a polypeptide according to Claim 13 or 14, a polynucleotide according to Claim 15, or a vector according to Claim 16 or 17 in the manufacture of a medicament for treating or preventing MAP infection or a condition or symptom associated with MAP infection in a subject.

20. Use of a kit in the manufacture of a medicament for treating or preventing MAP infection or a condition or symptom associated with MAP infection, the kit comprising (i) at least one of a polypeptide comprising an amino acid sequence of at least 9 contiguous amino acids from the region of MAP P900 shown in SEQ ID NO: 2, or a polynucleotide encoding the polypeptide, a peptide consisting of the amino acid sequence shown in SEQ ID NO: 3, a peptide according to Claim 11 or 12, a polypeptide according to Claim 13 or 14, a polynucleotide according to Claim 15, or a vector according to Claim 16 or 17 and (ii) at least one other therapeutic agent, for simultaneous, sequential or separate use.

CLAIMS

1. Use of a composition comprising a polypeptide comprising an amino acid sequence of at least 9 contiguous amino acids from the region of *Mycobacterium avium* subspecies *paratuberculosis* (MAP P900) shown in SEQ ID NO: 2, or a polynucleotide encoding the polypeptide, in which the polypeptide comprises the amino acid sequence shown in any of SEQ ID NOs: 3 to 10 and 50, in the manufacture of a medicament for treating or preventing MAP infection or a condition or symptom associated with MAP infection in a subject, in which the condition or symptom associated with MAP infection is: chronic inflammation of the intestine, Crohn's disease, Johne's disease, Ulcerative Colitis, Psoriasis, Thyroiditis, Sarcoidosis, Parkinson's disease, Multiple Sclerosis, Type 1 Diabetes, arthritis, ankylosing spondylitis, rheumatoid arthritis, irritable bowel syndrome, inflammatory bowel disease, chronic enteritis, Alzheimer's disease, multiple sclerosis, idiopathic pulmonary fibrosis, leprosy and/or chronic fatigue syndrome.

2. Use according to Claim 1, in which the composition comprises two or more polypeptides selected from polypeptides comprising the amino acid sequence shown in any of SEQ ID NOs: 3 to 10 and 50, or two or more polynucleotides encoding the polypeptides.

3. Use according to Claim 2, in which the composition comprises:

(i) a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 3 and a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 5;

(ii) at least two of the following polypeptides or polynucleotides: a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 3, or a polynucleotide encoding the polypeptide, a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 7, or a polynucleotide encoding the polypeptide, and a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 9, or a polynucleotide encoding the polypeptide; or

(iii) a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 4, a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 8 and/or a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 10.

4. Use according to any preceding claim, in which:

(i) the polypeptide comprises the amino acid sequence shown in any of SEQ ID NOs: 11 to 20, 52, 58, 60, 61, 83 and 146;

(ii) the polypeptide further comprises the amino acid sequence of at least one additional MAP polypeptide; or

(iii) the composition further comprises a polypeptide comprising an amino acid sequence of at least one additional MAP polypeptide, or at least one further polynucleotide encoding an additional MAP polypeptide.

5. Use according to Claim 4, in which the additional MAP polypeptide is at least one of the following:

(a) an ahpC polypeptide comprising the sequence of SEQ ID NO: 22 or an epitope-containing fragment thereof;

(b) a gsd polypeptide comprising the sequence of SEQ ID NO: 24 or an epitope-containing fragment thereof;

(c) a pl2 polypeptide comprising the sequence of SEQ ID NO: 26 or an epitope-containing fragment thereof; and/or

(d) an mpa polypeptide comprising the sequence of SEQ ID NO: 30 or an epitope-containing fragment thereof.

6. Use according to Claim 5, in which:

(a) the ahpC polypeptide has the amino acid sequence given in SEQ ID NO: 32;

(b) the gsd polypeptide has the amino acid sequence given in SEQ ID NO: 34;

(c) the pl2 polypeptide has the amino acid sequence given in SEQ ID NO: 36 or SEQ ID NO: 38; and/or

(d) the mpa polypeptide has the amino acid sequence given in SEQ ID NO: 40.

7. Use according to Claim 5 or 6, in which:

(i) the polypeptide comprises the amino acid sequence shown in SEQ ID NO: 41, in which a peptide comprising the amino acid sequence shown in SEQ ID NO: 3 is added at the N-terminus or inserted between: positions 7 and 8, positions 199 and 200, positions 442 and 443, positions 577 and 578, and/or positions 820 and 821; or the amino acid sequence shown in SEQ ID NO: 42, in which a peptide comprising the

amino acid sequence shown in SEQ ID NO: 3 is added at the N-terminus or inserted between: positions 7 and 8, positions 199 and 200, positions 442 and 443, positions 582 and 583,and/or positions 825 and 826;

(ii) the polypeptide comprises the amino acid sequence shown in any of SEQ ID NOs: 62, 63, 64, 65, 67, 68 and 69; and/or

(iii) the polynucleotide comprises two or more copies of a nucleotide sequence encoding the polypeptide or at least one of the polypeptides.

8. Use according to any preceding claim in which the subject is a human, a livestock animal, a laboratory animal or a domestic animal.

9. Use according to any preceding claim, in which a further therapeutic agent which has activity against MAP or a further therapeutic agent used in the treatment of a condition which is associated with MAP infection are to be administered to the subject.

10. A peptide of up to 100 amino acids, which comprises the amino acid sequence shown in SEQ ID NO: 4.

11. A peptide according to Claim 10, which: (i) further comprises the amino acid sequence shown in SEQ ID NO: 7 or 8, and/or the amino acid sequence shown in SEQ ID NO: 9 or 10; and/or (ii) comprises the amino acid sequence shown in any of SEQ ID NOs: 6, 11 to 20, 52, 58, 60, 61, 83 and 146.

12. A polypeptide which comprises the amino acid sequence shown in SEQ ID NO: 3 or SEQ ID NO: 5 and (a) an ahpC polypeptide comprising the sequence of SEQ ID NO: 22 or an epitope-containing fragment thereof; (b) a gsd polypeptide comprising the sequence of SEQ ID NO: 24 or an epitope-containing fragment thereof; (c) a p12 polypeptide comprising the sequence of SEQ ID NO: 26 or an epitope-containing fragment thereof; and/or a mpa polypeptide comprising the sequence of SEQ ID NO: 30 or an epitope-containing fragment thereof.

13. A polypeptide according to Claim 12, in which:

(i) the ahpC polypeptide has the amino acid sequence given in SEQ ID NO: 32, the gsd polypeptide has the amino acid sequence given in SEQ ID NO: 34, the pl2

polypeptide has the amino acid sequence given in SEQ ID NO: 36, and/or the mpa polypeptide has the amino acid sequence given in SEQ ID NO: 40;

(ii) the polypeptide comprises the amino acid sequence shown in SEQ ID NO: 41, in which a peptide comprising the amino acid sequence MVINDDAQRLLSQR is added at the N-terminus or inserted between: positions 7 and 8, positions 199 and 200, positions 442 and 443, positions 577 and 578, and/or positions 820 and 821; or the amino acid sequence shown in SEQ ID NO: 42, in which a peptide comprising the amino acid sequence MVINDDAQRLLSQR is added at the N-terminus or inserted between: positions 7 and 8, positions 199 and 200, positions 442 and 443, positions 582 and 583,and/or positions 825 and 826;

(iii) the polypeptide comprises the amino acid sequence shown in any of SEQ ID NOs: 62, 63, 64, 65, 67, 68 and 69; and/or

(iv) the peptide comprising the amino acid sequence shown in SEQ ID NO: 3 (a) further comprises the amino acid sequence shown in SEQ ID NO: 7 or 8, and/or the amino acid sequence shown in SEQ ID NO: 9 or 10; and/or (b) comprises the amino acid sequence shown in any of SEQ ID NOs: 4, 6, 11 to 20, 52, 58, 60, 61, 83 and 146.

14. A polynucleotide encoding a peptide according to Claim 10 or 11 or a polypeptide according to Claim 12 or 13.

15. A vector comprising a comprising a polynucleotide encoding a polypeptide comprising an amino acid sequence of at least 9 contiguous amino acids from the region of MAP P900 shown in SEQ ID NO: 2, in which the polypeptide comprises the amino acid sequence shown in any of SEQ ID NOs: 3 to 10 and 50.

16. A vector according to Claim 15, in which:

(i) the polynucleotide encodes a polypeptide comprising the amino acid sequence shown in SEQ ID NO: 3 or is a polynucleotide according to Claim 12;

(ii) the vector is a viral vector; and/or

(iii) the vector is an adenoviral vector or a poxvirus vector.

17. A peptide consisting of the amino acid sequence shown in SEQ ID NO: 3, a peptide according to Claim 10 or 11, a polypeptide according to Claim 12 or 13, a polynucleotide

according to Claim 14, or a vector according to Claim 15 or 16 for use in a method of treating the human or animal body by therapy.

18. Use of a peptide consisting of the amino acid sequence shown in SEQ ID NO: 3, a peptide according to Claim 10 or 11, a polypeptide according to Claim 12 or 13, a polynucleotide according to Claim 14, or a vector according to Claim 15 or 16 in the manufacture of a medicament for treating or preventing MAP infection or a condition or symptom associated with MAP infection in a subject, in which the condition or symptom associated with MAP infection is chronic inflammation of the intestine, Crohn's disease, Johne's disease, Ulcerative Colitis, Psoriasis, Thyroiditis, Sarcoidosis, Parkinson's disease, Multiple Sclerosis, Type 1 Diabetes, arthritis, ankylosing spondylitis, rheumatoid arthritis, irritable bowel syndrome, inflammatory bowel disease, chronic enteritis, Alzheimer's disease, multiple sclerosis, idiopathic pulmonary fibrosis, leprosy and/or chronic fatigue syndrome.

19. Use of a kit in the manufacture of a medicament for treating or preventing MAP infection or a condition or symptom associated with MAP infection, in which the condition or symptom associated with MAP infection is chronic inflammation of the intestine, Crohn's disease, Johne's disease, Ulcerative Colitis, Psoriasis, Thyroiditis, Sarcoidosis, Parkinson's disease, Multiple Sclerosis, Type 1 Diabetes, arthritis, ankylosing spondylitis, rheumatoid arthritis, irritable bowel syndrome, inflammatory bowel disease, chronic enteritis, Alzheimer's disease, multiple sclerosis, idiopathic pulmonary fibrosis, leprosy and/or chronic fatigue syndrome, the kit comprising (i) at least one of a polypeptide comprising an amino acid sequence of at least 9 contiguous amino acids from the region of MAP P900 shown in SEQ ID NO: 2, or a polynucleotide encoding the polypeptide, in which the polypeptide comprises the amino acid sequence shown in any one of SEQ ID NOs: 3 to 10 and 50, a peptide consisting of the amino acid sequence shown in SEQ ID NO: 3, a peptide according to Claim 10 or 11, a polypeptide according to Claim 12 or 13, a polynucleotide according to Claim 14, or a vector according to Claim 15 or 16 and (ii) at least one other therapeutic agent, in which (i) is to be administered simultaneously with, sequentially to or separately to (ii).