In an aspect, there is provided the use of photon-irradiated killed streptococcal bacteria subjected to photon-radiation at energies of at least 0.01MeV in the manufacture of a medicament for preventing or treating an infection by streptococcal bacteria in a subject, wherein the streptococcal bacteria are streptococcal derivatives comprising a genetic alteration that reduces pathogenicity, the alteration is in a gene that confers a nutrient/cofactor requirement for growth, and the gene is *S. pneumoniae* psaA or a homologous gene in other streptococcal bacteria.

In another aspect, there is provided a vaccine composition comprising photon-irradiated killed streptococcal bacteria subjected to photon-radiation at energies of at least 0.01MeV and a pharmaceutically-acceptable excipient, diluent and/or carrier, wherein:

(i) the photon-irradiated streptococcal bacteria comprise mutant streptococcal bacteria comprising one or more defective DNA repair proteins, and/or mutant streptococcal bacteria in which at least one type of DNA repair protein is absent; and/or

(ii) the photon-irradiated streptococcal bacteria comprise modified streptococcal bacteria comprising a sequence of DNA encoding an RNA transcript, wherein the RNA transcript comprises a region of self-complementarity capable of forming a double-stranded portion after transcription;

wherein the streptococcal bacteria are streptococcal derivatives comprising a genetic alteration that reduces pathogenicity, the alteration is in a gene that confers a nutrient/cofactor requirement for growth, and the gene is *S. pneumoniae* psaA or a homologous gene in other streptococcal bacteria.

Accordingly, the disclosure relates to at least the following embodiments:

CLAIMS

1. Use of photon-irradiated killed streptococcal bacteria subjected to photon-radiation at energies of at least 0.01MeV in the manufacture of a medicament for preventing or treating an infection by streptococcal bacteria in a subject, wherein the streptococcal bacteria are streptococcal derivatives comprising a genetic alteration that reduces pathogenicity, the alteration is in a gene that confers a nutrient/cofactor requirement for growth, and the gene is *S. pneumoniae* psaA or a homologous gene in other streptococcal bacteria.

2. The use according to claim 1, wherein:

(a) the medicament prevents or treats infection by a plurality of different streptococcal species and/or serotypes; and/or

(b) the photon-irradiated streptococcal bacteria comprise different: *Streptococcus* species, streptococcal serotypes, and/or streptococcal derivatives.

3. The use according to claim 1 or claim 2, wherein:

(a) the streptococcal infection comprises infection by one or more serotypes of *Streptococcus pneumoniae*; and/or

(b) the infection by streptococcal bacteria is any one or more of a respiratory tract infection, pneumonia, an ear infection, an ear-ache, a middle ear infection, otitis media, sinusitis, meningitis, conjunctivitis, bacteraemia, septicaemia, a joint infection, a bone infection, septic arthritis, sepsis, osteomyelitis, a soft tissue infection, cellulitis, myositis, periorbital cellulitis, an abscess, necrotising fasciitis, impetigo, peritonitis, a cardiac infection, endocarditis, and/or pericarditis.

15. The use according to any one of claims 1 to 14, wherein the photon-irradiated streptococcal bacteria comprise gamma-irradiated streptococcal bacteria, X-irradiated streptococcal bacteria, or a combination thereof.

16. The use according to any one of claims 1 to 15, wherein the photon-irradiated streptococcal bacteria comprise streptococcal Rx1 strain derivatives:

(i) comprise a gene encoding a defective LytA protein, a gene encoding defective pneumolysin, and a gene encoding defective PsaA protein;

(ii) comprise a gene encoding a defective LytA protein, a gene encoding defective pneumolysin, and in which a gene encoding PsaA protein is absent;

(iii) comprise a gene encoding a defective PsaA protein, a gene encoding defective pneumolysin, and in which a gene encoding LytA protein is absent; or

(iv) comprise a gene encoding defective pneumolysin, in which a gene encoding LytA protein is absent, and in which a gene encoding PsaA protein is absent.

17. A vaccine composition comprising photon-irradiated killed streptococcal bacteria subjected to photon-radiation at energies of at least 0.01MeV and a pharmaceutically-acceptable excipient, diluent and/or carrier, wherein:

(i) the photon-irradiated streptococcal bacteria comprise mutant streptococcal bacteria comprising one or more defective DNA repair proteins, and/or mutant streptococcal bacteria in which at least one type of DNA repair protein is absent; and/or

(ii) the photon-irradiated streptococcal bacteria comprise modified streptococcal bacteria comprising a sequence of DNA encoding an RNA transcript, wherein the RNA transcript comprises a region of self-complementarity capable of forming a double-stranded portion after transcription;

wherein the streptococcal bacteria are streptococcal derivatives comprising a genetic alteration that reduces pathogenicity, the alteration is in a gene that confers a nutrient/cofactor requirement for growth, and the gene is *S. pneumoniae* psaA or a homologous gene in other streptococcal bacteria.

18. The vaccine composition according to claim 17, wherein:

(a) the mutant streptococcal bacteria are *Streptococcus pneumoniae* mutants comprising a defect in one or more genes selected from. a gene encoding a DNA alkylation repair protein, a gene encoding DNA polymerase 4, *hexA*, *hexB*, *mutS*, *radC*, *recA*, *recF*, *recN*, *recO*, *uvrA*, *uvrB*, *uvrC* or uvrD; and/or

(b) the modified streptococcal bacteria are modified *Streptococcus pneumoniae* bacteria and the portion of the double-stranded RNA transcript is at least. 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65 or 70 base pairs in length; and/or

(c) the photon-irradiated streptococcal bacteria comprise at least one recombinant DNA portion encoding an antigen or a component thereof that:

(i) inactivates or attenuates the bacteria; or

(ii) induces or enhances an immune response in the subject; and/or

(d) the photon-irradiated streptococcal bacteria comprise streptococcal Rx1 strain derivative strains in which: