CLAIMS

1. A mutant SpA antigen, which comprises an amino acid sequence comprising or consisting of SEQ ID NO: 49 wherein all of the XX dipeptides in SEQ ID NO: 49 differ from the corresponding dipeptides within SEQ ID NO: 43.
2. A mutant SpA antigen according to claim 1, wherein the dipeptide at positions 60 and 61 is KK or KR.
3. A mutant SpA antigen according to claim 1 or claim 2, wherein said amino acid sequence is SEQ ID NO: 47.
4. A mutant SpA antigen consisting of the amino acid sequence of SEQ ID NO: 50 wherein the dipeptide at positions 60 and 61 is not QQ, or comprising more than one copy of said amino acid sequence.
5. A mutant SpA antigen according to claim 4, consisting of the amino acid sequence of SEQ ID NO 52, or comprising more than one copy of said amino acid sequence.
6. A mutant SpA antigen according to any of claims 1 to 5, wherein the antigen elicits antibodies in a mammal that recognise SEQ ID NO: 43 and/or SEQ ID NO: 54.
7. A mutant SpA antigen according of any one of claims 1 to 6 which has decreased affinity, relative to unmodified SpA, for the Fcγ portion of human IgG.
8. A mutant SpA antigen according to claim 7 which has decreased affinity, relative to unmodified SpA, for the Fab portion of V_H3-containing human B cell receptors.
9. A mutant SpA antigen according to any one of claims 1 to 8, wherein the mutant SpA antigen is of sequence comprising or consisting of SEQ ID NO :43 mutated in at least 1, particularly at least 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and more particularly 20 amino acids at position 43, 44, 70, 71, 96, 97, 104, 105, 131, 132, 162, 163, 190, 220, 221, 247, 248, 278, 279, 305 and/or 306 of SEQ ID NO: 43; or is of sequence comprising or consisting of SEQ ID NO: 47 or SEQ ID NO: 49.
10. A mutant SpA antigen according to any one of claims 1 to 9, particularly of sequence comprising SEQ ID NO: 52, SEQ ID NO: 47 or SEQ ID NO: 48.
11. A fusion protein comprising a mutant SpA antigen according to any one of claims 1 to 10.
12. An immunogenic composition comprising a mutant SpA antigen according to any one of claims 1 to 10 or a fusion protein according to claim 11.
13. An immunogenic composition according to claim 12, further comprising at least one antigen selected from the group consisting of EsxA, EsxB, FhuD2, Sta011 and Hla antigens.
14. An immunogenic composition comprising:
    (i) a mutant SpA antigen comprising a sequence having 90% or more identity to amino acids 37-325 of SEQ ID NO: 43, wherein at least one QQ dipeptide present in SEQ ID

NO: 43 is mutated to KK, RK or KR and at least one DD dipeptide is mutated to AA, and wherein the QQ dipeptide corresponding to residues 60-61 of SEQ ID NO: 44 is mutated; wherein the mutant SpA antigen has decreased affinity, relative to unmodified SpA, for the Fcγ portion of human IgG and for the Fab portion of V_H3-containing human B cell receptors; and

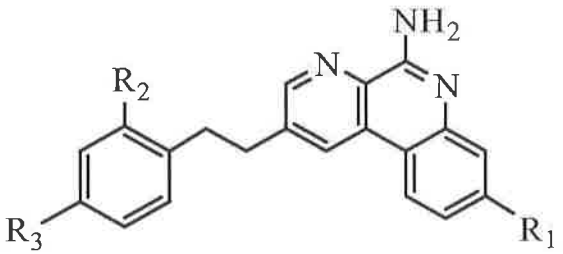
(ii) at least one antigen selected from the group consisting of EsxA, EsxB, FhuD2, Sta011 and Hla antigens.

15. The composition according to any one of claims 12 to 14, wherein the composition also comprises an adjuvant.

16. The composition according to claim 15, wherein said adjuvant is selected from the group consisting of:

- aluminium salts, particularly aluminium hydroxides and aluminium phosphates;
- human TLR agonists, particularly TLR7 agonists;
- an oil-in water emulsion;
- a saponin formulation;
- a non-toxic derivative of enterobacterial LPS, particularly MPL (monophosphoryl lipid A (MPL) or 3d-MPL (3-O-deacetylated monophosphoryl lipid A);
- a Lipid A derivative;
- and
- a mixture thereof.

17. The composition according to claim 16, wherein said TLR7 agonist is a compound of the following formula (K):



(K)

wherein:

R^1 is H, C_1-C_6alkyl, -$C(R^5)_2OH$, -L^1R^5, -L^1R^6, -L^2R^5, -L^2R^6, -OL^2R^5, or -OL^2R^6;

L^1 is –C(O)- or –O-;

L^2 is C_1-C_6alkylene, C_2-C_6alkenylene, arylene, heteroarylene or -$((CR^4R^4)_pO)_q(CH_2)_p$-, wherein the C_1-C_6alkylene and C_2-C_6alkenylene of L^2 are optionally substituted with 1 to 4 fluoro groups;

each L^3 is independently selected from C_1-C_6alkylene and -$((CR^4R^4)_pO)_q(CH_2)_p$-, wherein the C_1-C_6alkylene of L^3 is optionally substituted with 1 to 4 fluoro groups;

L^4 is arylene or heteroarylene;

R^2 is H or C_1-C_6alkyl;

R^3 is selected from C_1-C_4alkyl, $-L^3R^5$, $-L^1R^5$, $-L^3R^7$, $-L^3L^4L^3R^7$, $-L^3L^4R^5$, $-L^3L^4L^3R^5$, $-OL^3R^5$, $-OL^3R^7$, $-OL^3L^4R^7$, $-OL^3L^4L^3R^7$, $-OR^8$, $-OL^3L^4R^5$, $-OL^3L^4L^3R^5$ and $-C(R^5)_2OH$;

each R^4 is independently selected from H and fluoro;

R^5 is $-P(O)(OR^9)_2$,

R^6 is $-CF_2P(O)(OR^9)_2$ or $-C(O)OR^{10}$;

R^7 is $-CF_2P(O)(OR^9)_2$ or $-C(O)OR^{10}$;

R^8 is H or C_1-C_4alkyl;

each R^9 is independently selected from H and C_1-C_6alkyl;

R^{10} is H or C_1-C_4alkyl;

each p is independently selected from 1, 2, 3, 4, 5 and 6, and

q is 1, 2, 3 or 4;

particularly 3-(5-amino-2-(2-methyl-4-(2-(2-(2-phosphonoethoxy) ethoxy)ethoxy)phenethyl) benzo[f][1,7] naphthyridin-8-yl)propanoic acid (K1).

18. The composition according to any one of claims 15 to 17, wherein the adjuvant comprises a human TLR agonist adsorbed to an aluminium salt.

19. The mutant SpA antigen according to any one of claims 1 to 10, the fusion protein according to claim 11, or the immunogenic composition according to any one of claims 12 to 18, for use as a medicament.

20. The mutant SpA antigen according to any one of claims 1 to 10, the fusion protein according to claim 11, or the immunogenic composition according to any one of claims 12 to 18, for use as a medicament in the prevention and/or treatment of a *S. aureus* infection.