CLAIMS

1. A process for preparing a conjugate of a *S.aureus* type 5 or type 8 capsular polysaccharide and a carrier molecule, comprising the steps of: (a) depolymerising the capsular polysaccharide, to give a polysaccharide fragment; (b) oxidising the fragment in order to introduce an aldehyde group into at least one saccharide residue in the fragment, to give an oxidised saccharide residue; and (c) coupling the oxidised saccharide residue to a carrier molecule via the aldehyde group, thereby giving the conjugate.

2. A process for treating a *S.aureus* type 5 capsular polysaccharide comprising the step of depolymerising the capsular polysaccharide, to give a polysaccharide fragment having a β-D-FucNAc-(1 → moiety at its non-reducing terminus.

3. A process for treating a *S.aureus* type 8 capsular polysaccharide comprising the step of depolymerising the capsular polysaccharide, to give a polysaccharide fragment having an α-D-FucNAc-(1 → moiety at is non-reducing terminus.

4. The process according to any preceding claim, wherein the depolymerising is carried out by acid hydrolysis using acetic acid.

5. The process according to any preceding claim, wherein the average molecular mass of the fragment is between 5 and 100 kDa.

6. The process according to any preceding claim, wherein the degree of O-acetylation of the fragment is 10-90%.

7. The process of any of claims 1 and 4-6, wherein step (a) is the step defined in claim 2 or claim 3.

8. A process for providing a *S.aureus* type 5 capsular polysaccharide derivative comprising the step of oxidising a *S.aureus* type 5 capsular polysaccharide having a β-D-FucNAc-(1 → moiety at its non-reducing terminus to convert two vicinal hydroxyl groups in the β-D-FucNAc-(1 → moiety into two aldehyde groups.

9. A process for providing a *S.aureus* type 8 capsular polysaccharide derivative comprising the step of oxidising a *S.aureus* type 8 capsular polysaccharide having an α-D-FucNAc-(1 → moiety at is non-reducing terminus to convert two vicinal hydroxyl groups in the α-D-FucNAc-(1 → moiety into two aldehyde groups.

10. The process of claim 7, wherein step (b) is the step defined in claim 8 or claim 9.

11. A process for providing a coupled *S.aureus* type 5 capsular polysaccharide comprising the step of coupling to a carrier molecule a *S.aureus* type 5 capsular polysaccharide having a β-D-FucNAc-1 → moiety at its non-reducing terminus that has been oxidised to convert two

vicinal hydroxyl groups into two aldehyde groups, wherein the coupling is via one of the aldehyde groups.

12. A provides a process for providing a coupled *S.aureus* type 8 capsular polysaccharide comprising the step of coupling to a carrier molecule a *S.aureus* type 8 capsular polysaccharide having an α-D-FucNAc-(1 → moiety at its non-reducing terminus that has been oxidised to convert two vicinal hydroxyl groups into two aldehyde groups, wherein the coupling is via one of the aldehyde groups.

13. The process of claim 10, wherein the process is for preparing a conjugate of a *S.aureus* type 5 capsular polysaccharide and a carrier molecule, comprising the steps of: (a) depolymerising the capsular polysaccharide, to give a polysaccharide fragment having a β-D-FucNAc-(1 → moiety at its non-reducing terminus; (b) oxidising the fragment in order to convert two vicinal hydroxyl groups in the β-D-FucNAc-(1 → moiety into two aldehyde groups; and (c) coupling the oxidised fragment to a carrier molecule via one of the aldehyde groups, thereby giving the conjugate.

14. The process of claim 10, wherein the process is for preparing a conjugate of a *S.aureus* type 8 capsular polysaccharide and a carrier molecule, comprising the steps of: (a) depolymerising the capsular polysaccharide, to give a polysaccharide fragment having a α-D-FucNAc-(1 → moiety at its non-reducing terminus; (b) oxidising the fragment in order to convert two vicinal hydroxyl groups in the α-D-FucNAc-(1 → moiety into two aldehyde groups; and (c) coupling the oxidised fragment to a carrier molecule via one of the aldehyde groups, thereby giving the conjugate.

15. The process of any of claims 1 and 4-7 and 10-14, wherein the coupling is direct coupling by reacting the aldehyde group with an amine group in the carrier by reductive amination.

16. The process of any of claims 1 and 4-7 and 10-14, wherein the coupling is via a linker by reacting the aldehyde group with an amine group in the linker by reductive amination.

17. The process of claim 16, wherein the linker is attached to the carrier molecule.

18. The process of any of claims 1 and 4-7 and 10-17, wherein the coupling results in a polysaccharide:protein ratio (w/w) of between 1:5 and 1:2.

19. A conjugate, fragment, derivative or coupled polysaccharide obtained or obtainable by the process of any preceding claim.

20. An immunogenic composition comprising a conjugate or coupled polysaccharide according to claim 19.

21. The composition of claim 20 further comprising one or more *S.aureus* protein antigen(s) selected from the group consisting of a clfA antigen; a clfB antigen; a sdrE2 antigen; a sdrC antigen; a sasF antigen; a emp antigen; a sdrD antigen; a spa antigen; a esaC antigen; a esxA antigen; a

esxB antigen; a sta006 antigen; a isdC antigen; a Hla antigen; a sta011 antigen; a isdA antigen; a isdB antigen; and a sta073 antigen.

22. The composition of claim 21, wherein the one or more *S.aureus* protein antigen(s) are selected from the group consisting of a esxA antigen; a esxB antigen; a sta006 antigen; a Hla antigen; a sta011 antigen; and a sta073 antigen.

23. The composition of claim 22, wherein the composition comprises *S.aureus* protein antigens according to one of combinations (1) to (10) below:

(1) a esxA antigen, a esxB antigen, a sta006 antigen and a Hla antigen;

(2) a esxA antigen, a esxB antigen, a sta006 antigen and a sta011 antigen;

(3) a esxA antigen, a esxB antigen and a sta011 antigen;

(4) a esxA antigen, a esxB antigen, a Hla antigen, a sta006 antigen and a sta011 antigen;

(5) a esxA antigen, a esxB antigen and a Hla antigen;

(6) a Hla antigen, a sta006 antigen and a sta011 antigen;

(7) a esxA antigen and a esxB antigen;

(8) a esxA antigen, a esxB antigen and a sta006 antigen;

(9) a esxA antigen, a esxB antigen, a sta011 antigen and a sta073 antigen; and

(10) a sta006 antigen and a sta011 antigen.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A process for preparing a conjugate of a Staphylococcus aureus type 5 or type 8 capsular polysaccharide and a carrier molecule, said process comprising the steps of:
   (a) depolymerising the capsular polysaccharide to provide a polysaccharide fragment;
   (b) oxidising the polysaccharide fragment in order to introduce an aldehyde group into at least one saccharide residue in the polysaccharide fragment to provide an oxidised saccharide residue; and
   (c) coupling the oxidised saccharide residue to a carrier molecule via the aldehyde group, thereby giving the conjugate.

2. A process for treating a Staphylococcus aureus type 5 capsular polysaccharide, said process comprising the step of depolymerising the capsular polysaccharide to provide a polysaccharide fragment having a β-D-FucNAc-(1→ moiety at its non-reducing terminus.

3. A process for treating a Staphylococcus aureus type 8 capsular polysaccharide, said process comprising the step of depolymerising the capsular polysaccharide, to give a polysaccharide fragment having an α-D-FucNAc-(1→ moiety at is non-reducing terminus.

4. The process according to any one of claims 1 to 3, wherein the depolymerising is carried out by acid hydrolysis using acetic acid.

5. The process according to any one of claims 1 to 4, wherein the polysaccharide fragment has an average molecular mass in a range of 5kDa to 100 kDa.

6. The process according to any one of claims 1 to 5, wherein the degree of O-acetylation of the polysaccharide fragment is 10-90%.

7. The process of claim 1 or any one of claims 4 to 6 when dependent on claim 1, wherein step (a) is performed according to the process of claim 2 or claim 3.

8. A process for providing a Staphylococcus aureus type 5 capsular polysaccharide derivative, said process comprising the step of oxidising a S. aureus type 5 capsular polysaccharide having a β -D-FucNAc-(1→ moiety at its non-reducing terminus to convert two vicinal hydroxyl groups in the β -D-FucNAc-(1→ moiety into two aldehyde groups.

9. A process for providing a Staphylococcus aureus type 8 capsular polysaccharide derivative, said process comprising the step of oxidising a S. aureus type 8 capsular polysaccharide having an α-D-FucNAc-(1→ moiety at its non-reducing terminus to convert two vicinal hydroxyl groups in the α-D-FucNAc-(1→ moiety into two aldehyde groups.

10. The process of claim 7, wherein step (b) is performed according to the process of claim 8 or claim 9.

11. A process for providing a coupled Staphylococcus aureus type 5 capsular polysaccharide, said process comprising the step of coupling to a carrier molecule a S. aureus type 5 capsular polysaccharide having a β-D-FucNAc-1→ moiety at its non-reducing terminus that has been oxidised to convert two vicinal hydroxyl groups into two aldehyde groups, wherein the coupling is via one of the aldehyde groups.

12. A process for providing a coupled Staphylococcus aureus type 8 capsular polysaccharide, said process comprising the step of coupling to a carrier molecule a S. aureus type 8 capsular polysaccharide having an α-D-FucNAc-(1 → moiety at its non-reducing terminus that has been oxidised to convert two vicinal hydroxyl groups into two aldehyde groups, wherein the coupling is via one of the aldehyde groups.

13. The process of claim 10, wherein step (a) is performed according to the process of claim 2, and step (b) is performed according to the process of claim 8, such that the conjugate prepared is a conjugate of a S. aureus type 5 capsular polysaccharide and a carrier molecule.

14. The process of claim 10, wherein step (a) is performed according to the process of claim 3, and step (b) is performed according to the process of claim 9, such that the conjugate prepared is a conjugate of a S. aureus type 8 capsular polysaccharide and a carrier molecule.

15. The process according to any one of claims 1, 11 or 12, or any one of claims 4 to 7 or 10, 13 or 14 when dependent on claim 1, wherein the coupling is direct coupling by reacting the aldehyde group with an amine group in the carrier by reductive amination.

16. The process according to any one of claims 1, 11 or 12, or any one of claims 4 to 7 or 10, 13 or 14 when dependent on claim 1, wherein the coupling is via a linker by reacting the aldehyde group with an amine group in the linker by reductive amination.

17. The process of claim 16, wherein the linker is attached to the carrier molecule.

18. The process according to claim 1, 11 or 12, or any one of claims 4 to 7 or 10 or 13 to 17 when dependent on claim 1, 11 or 12, wherein the coupling results in a polysaccharide:protein ratio (w/w) in a range of 1:5 and 1:2.

19. A conjugate when obtained by the process according to claim 1 or any one of claims 4 to 7 or 10 or 13 to 18 when dependent on claim 1, or a polysaccharide fragment when obtained by the process according to claim 2 or 3 or any one of claims 4 to 6 when dependent on claim 2 or 3, or a capsular polysaccharide derivative when obtained by the process according to claim 8 or 9 or a

coupled capsular polysaccharide when obtained by the process of claim 11 or 12 or any one of claims 15 to 18 when dependent on claim 11 or 12.

20. An immunogenic composition comprising a conjugate or coupled polysaccharide according to claim 19.

21. The immunogenic composition of claim 20 further comprising one or more S. aureus protein antigen(s) selected from the group consisting of a clfA antigen; a clfB antigen; a sdrE2 antigen; a sdrC antigen; a sasF antigen; a emp antigen; a sdrD antigen; a spa antigen; a esaC antigen; a esxA antigen; a esxB antigen; a sta006 antigen; a isdC antigen; a Hla antigen; a staOl 1 antigen; a isdA antigen; a isdB antigen; and a sta073 antigen.

22. The immunogenic composition of claim 21, wherein the one or more S. aureus protein antigen(s) are selected from the group consisting of a esxA antigen; a esxB antigen; a sta006 antigen; a Hla antigen; a staOl 1 antigen; and a sta073 antigen.

23. The immunogenic composition of claim 22, wherein the composition comprises S. aureus protein antigens according to one of combinations (1) to (10) below:
    (1) a esxA antigen, a esxB antigen, a sta006 antigen and a Hla antigen;
    (2) a esxA antigen, a esxB antigen, a sta006 antigen and a staOl 1 antigen;
    (3) a esxA antigen, a esxB antigen and a staOl 1 antigen;
    (4) a esxA antigen, a esxB antigen, a Hla antigen, a sta006 antigen and a staOl 1 antigen;
    (5) a esxA antigen, a esxB antigen and a Hla antigen;
    (6) a Hla antigen, a sta006 antigen and a staOl 1 antigen;
    (7) a esxA antigen and a esxB antigen;
    (8) a esxA antigen, a esxB antigen and a sta006 antigen;
    (9) a esxA antigen, a esxB antigen, a staOl 1 antigen and a sta073 antigen; and
    (10) a sta006 antigen and a staOl 1 antigen.