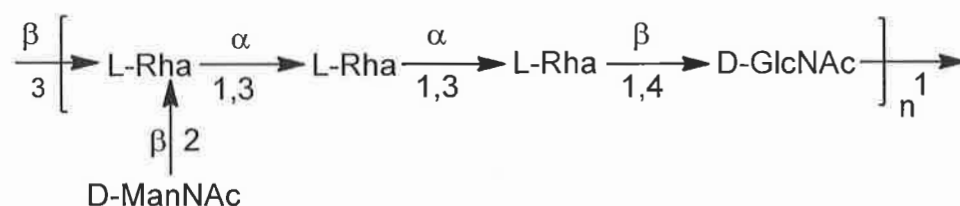
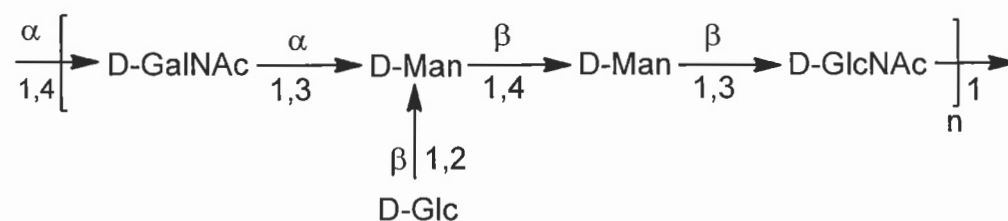


5. The composition of claim 4, wherein the O1A antigen, O6 antigen, and O2 antigen comprise the following formulas, respectively:

a. Formula O1A'

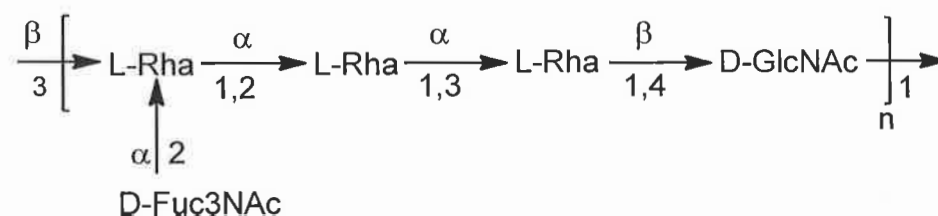


b. Formula O6Glc'



and

c. Formula O2'



6. The composition of any one of claims 1-5, wherein the carrier protein is selected from the group consisting of detoxified Exotoxin A of *P. aeruginosa* (EPA), CRM197, maltose binding protein (MBP), Diphtheria toxoid, Tetanus toxoid, detoxified hemolysin A of *S. aureus*, clumping factor A, clumping factor B, *E. coli* FimH, *E. coli* FimHC, *E. coli* heat labile enterotoxin, detoxified variants of *E. coli* heat labile enterotoxin, Cholera toxin B subunit (CTB), cholera toxin, detoxified variants of cholera toxin, *E. coli* Sat protein, the passenger domain of *E. coli* Sat protein, *Streptococcus pneumoniae* Pneumolysin and detoxified variants thereof, *C. jejuni* AcrA, and *C. jejuni* natural glycoproteins, preferably detoxified EPA.

7. The composition of claim 6, wherein the carrier protein is detoxified EPA.

8.7. The composition of any one of claims 3-76, wherein the Asn residue of the carrier protein is positioned in the consensus sequence Asp(Glu)-X-Asn-Z-Ser(Thr), wherein X and Z are independently selected from any natural amino acid except Pro (SEQ ID NO:15).

9.8. Use of a pharmaceutical composition according to any one of claims 1-7 in the preparation of a medicament A method for vaccinating a subject, preferably a human, against extra-intestinal pathogenic *Escherichia coli*, wherein the method comprises administering to the subject an effective amount of the composition of any one of claims 1-8.

10.9. Use of a pharmaceutical composition according to any one of claims 1-7 in the preparation of a medicament A method for inducing an immune response in a subject, preferably a human, against extra-intestinal pathogenic *Escherichia coli*, wherein the method comprises administering to the subject an effective amount of the composition of any one of claims 1-8.

11.10. Use of a pharmaceutical composition according to any one of claims 1-7 in the preparation of a medicament A method for inducing the production of opsonophagocytic antibodies in a subject, preferably a human, that are specific to extra-intestinal pathogenic *Escherichia coli*, wherein the method comprises administering to the subject an effective amount of the composition of any one of claims 1-8.

12.11. Use according to The method of any one of claims 98-1110, wherein the subject is at risk of developing a urinary tract infection, bacteremia, or sepsis.

13. The method of any one of claims 9-11, wherein the subject is at risk of developing bacteremia.

14. The method of any one of claims 9-11, wherein the subject is at risk of developing sepsis.

15. The method of any one of claims 9-14, wherein the subject is a human.

16.12. A prokaryotic host cell, comprising:

- a. a nucleotide sequence encoding:
 - i. dTDP-Glucose 4,6-dehydratase;
 - ii. dTDP-6-Deoxy-D-glucose 3,5-epimerase;
 - iii. Glucose-1-phosphate thymidyltransferase;
 - iv. dTDP-4-dehydrorhamnose 3,5-epimerase;
 - v. O antigen flippase;
 - vi. dTDP-Rha:Glc-Rha(Ac)-GlcNAc-UPP α -1,3- rhamnosyltransferase;

- vii. UDP-Glc:Glc-Rha(Ac)-GlcNAc-UPP β -1,6- glucosyltransferase;
 - viii. O antigen polymerase;
 - ix. O-acetyl transferase;
 - x. UDP-Glc:Rha-GlcNAc-UPP α -1,3- glucosyltransferase and
 - xi. dTDP-Rha: GlcNAc-UPP α -1,3- rhamnosyltransferase;
- b. a nucleotide sequence encoding an oligosaccharyl transferase; and
 - c. a nucleotide sequence encoding a carrier protein comprising a consensus sequence Asp(Glu)-X-Asn-Z-Ser(Thr), wherein X and Z are independently selected from any natural amino acid except Pro (SEQ ID NO:15), preferably the host cell is an *E. coli* host cell.

~~17.13.~~ The host cell of claim ~~16~~12 wherein at least one of the *waaL* gene, *gtrA* gene, *gtrB* gene, *gtrS* gene, or *rfb* cluster is deleted from or functionally inactivated in the genome of the host cell.

~~18.14.~~ The host cell of claim ~~16~~12 or ~~17~~13, wherein the carrier protein is selected from the group consisting of detoxified Exotoxin A of *P. aeruginosa* (EPA), CRM197, maltose binding protein (MBP), Diphtheria toxoid, Tetanus toxoid, detoxified hemolysin A of *S. aureus*, clumping factor A, clumping factor B, *E. coli* FimH, *E. coli* FimHC, *E. coli* heat labile enterotoxin, detoxified variants of *E. coli* heat labile enterotoxin, Cholera toxin B subunit (CTB), cholera toxin, detoxified variants of cholera toxin, *E. coli* Sat protein, the passenger domain of *E. coli* Sat protein, *Streptococcus pneumoniae* Pneumolysin and detoxified variants thereof, *C. jejuni* AcrA, and *C. jejuni* natural glycoproteins, preferably the carrier protein is detoxified EPA.

~~19.~~ The host cell of any one of claims ~~16-18~~, wherein said host cell is an *E. coli* host cell.

~~20.15.~~ A method of making an *N*-glycosylated carrier protein that comprises an *E. coli* O25B antigen, said method comprising:

- a. culturing the host cell of any one of claims ~~16~~12-19~~14~~; and
- b. purifying an *N*-glycosylated carrier protein that comprises *E. coli* O25B antigen.