CLAIMS

What is claimed is:

1. A vaccine, comprising

(a) a carbohydrate antigen or its immunogenic fragment; and

(b) a toxoid protein,

wherein the ratio of carbohydrate antigen to toxoid protein ranges from 5:1 to 39:1.

2. The vaccine of claim 1, wherein the toxoid protein is diphtheria toxin (DT).

3. The vaccine of claim 2, wherein the ratio of carbohydrate antigen and DT ranges from 8:1 to 24:1.

4. The vaccine of claim 1, wherein the toxoid protein is tetanus toxoid (TT).

5. The vaccine of claim 4, wherein the ratio of carbohydrate antigen and TT ranges from 7:1 to 12:1

6. The vaccine of claim 1, wherein the carbohydrate antigen is selected from Globo H, SSEA-3, SSEA-4 or Gb-4.

7. The vaccine of claim 6, wherein the carbohydrate antigen is Globo H.

8. The vaccine of claim 2, wherein the DT is diphtheria toxin cross-reacting material or diphtheria toxoid.

9. The vaccine of claim 8, wherein the diphtheria toxin cross-reacting material is selected from CRM30, CRM45, CRM 176, CRM 197 or CRM 228.

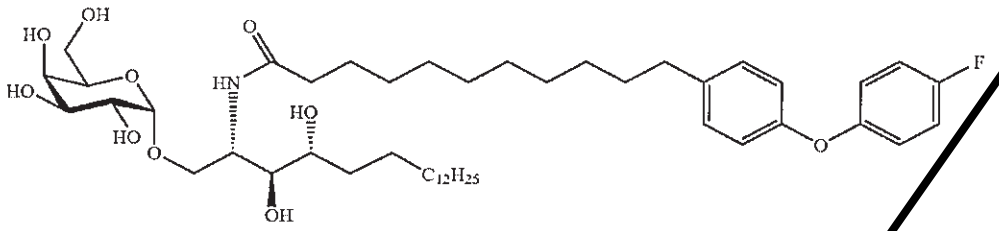
10. The vaccine of claim 1, further comprises a saponin adjuvant.

11. The vaccine of claim 10, wherein the saponin adjuvant is OPT-821 saponin.

12. The vaccine of claim 1, further comprises an α-galactosyl-ceramide (α-GalCer) adjuvant.

13. The vaccine of claim 12, wherein the α-GalCer adjuvant has the following

structure:



14. A pharmaceutical composition, comprising

(a) carbohydrate antigen or its immunogenic fragment;

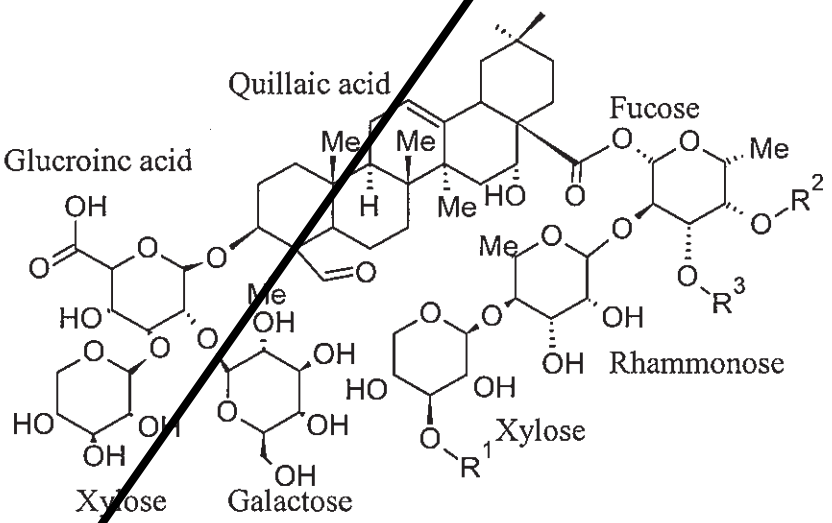
(b) DT; and

(c) a pharmaceutically acceptable carrier,

wherein the ratio of carbohydrate antigen to DT ranges from 5:1 to 39: 1.

15. The pharmaceutical composition of claim 14, wherein the toxoid protein is diphtheria toxin (DT).

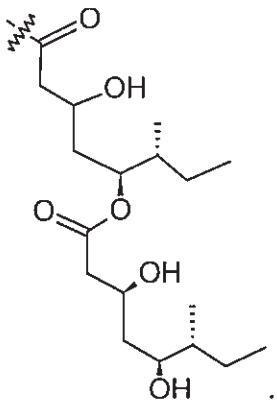
16. An isolated compound of formula (I)



(I)

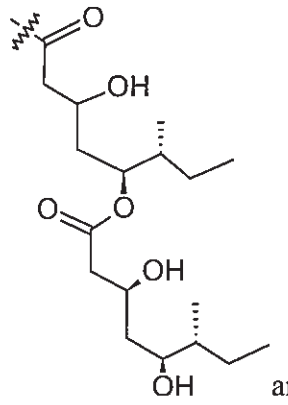
or a pharmaceutically acceptable salt thereof, wherein,

R^1 is selected from β-D-Apiose or β-D-Xylose; and,



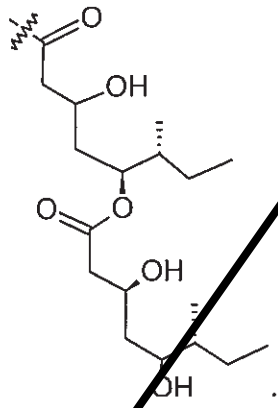
R^2 and R^3 are selected from H, alkyl or .

17. The isolated compound of claim 16, wherein R^1 is β-D-Apiose, R^2



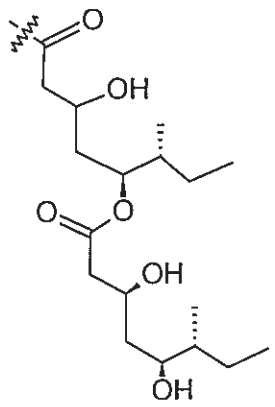
is and R^3 is H.

18. The isolated compound of claim 16, wherein R^1 is β-D-Apiose, R^2 is H and R^3

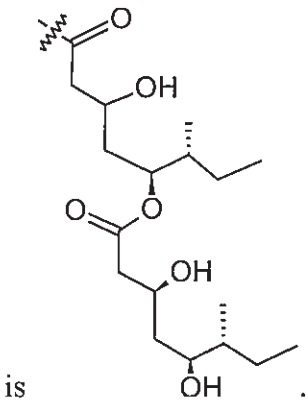


is .

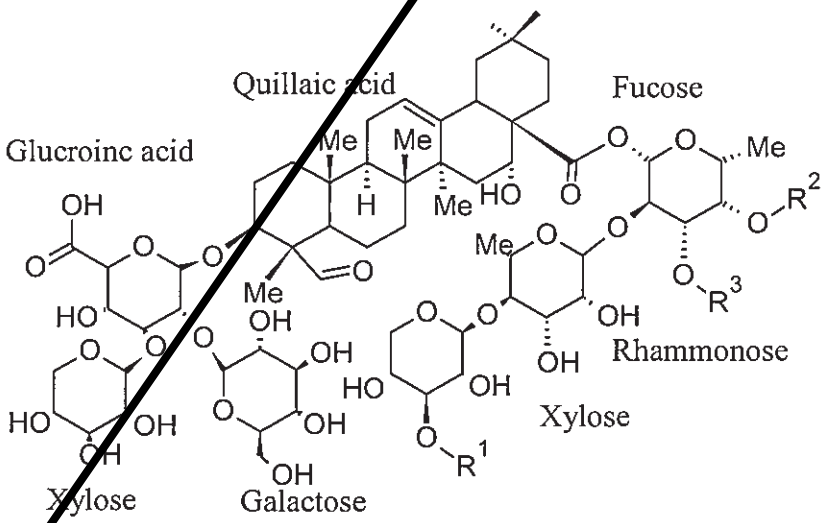
19. The isolated compound of claim 16, wherein R^1 is β-D-Xylose, R^2 is



and R^3 is H.

20. The isolated compound of claim 16, wherein R^1 is β-D-Xylose, R^2 is H and R^3 is .

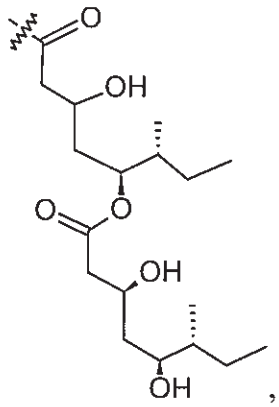
21. A pharmaceutical composition, comprising a compound of formula (I)



(I)

or a pharmaceutically acceptable salt thereof, wherein,

R^1 is selected from β-D-Apiose or β-D-Xylose; and,



R^2 and R^3 are selected from H, alkyl or , and a pharmaceutically acceptable carrier.

22. An OPT-821 saponin, comprising one or more of the following isolated compounds:

1857 compound V1A;

1857 compound V1B;

1857 compound V2A; and

1857 compound V2B.

23. The OPT-821 saponin of claim 22, further comprising one or more of the following isolated compounds:

1989 compound V1A;

1989 compound V1B;

1989 compound V2A; and

1989 compound V2B.

24. An OPT-821 saponin, comprising:

about 1 to about 15 mole % of a 1857 compounds mixture; and

about 85 to about 99 mole % of a 1989 compounds mixture.

25. The OPT-821 saponin of claim 24, wherein the 1857 compounds mixture comprises:

about 60-70 mole % of 1857 compound V1A;

about 1-5 mole % of 1857 compound V1B;

about 30-40 mole % of 1857 compound V2A; and

about 0.1-3 mole % of 1857 compound V2B.

26. The OPT-821 saponin of claim 24, wherein the 1989 compounds mixture comprises:

about 60-70 mole % of 1989 compound V1A;

about 1-5 mole % of 1989 compound V1B;

about 30-40 mole % of 1989 compound V2A; and

about 0.1-3 mole % of 1989 compound V2B.

27. A vaccine, comprising:

(a) a carbohydrate antigen or its immunogenic fragment; and

(b) an OPT-821 saponin.

28. The vaccine of claim 27, wherein the carbohydrate antigen or its immunogenic fragment is selected from Globo H, SSEA-3, SSEA-4, Gb-4 or a mixture thereof.

29. The vaccine of claim 27, further comprises a carrier protein.

30. The vaccine of claim 29, wherein the carrier protein is an inactivated diphtheria toxin (DT).

31. The vaccine of claim 30, wherein the DT is diphtheria toxin cross-reacting material or diphtheria toxoid.

32. The vaccine of claim 31, wherein the diphtheria toxin cross-reacting material is selected from CRM30, CRM45, CRM 176, CRM 197 or CRM 228.

33. The vaccine of claim 29, wherein the carrier protein is KLH.

34. A pharmaceutical composition, comprising

(a) the vaccine of claim 1 or 27; and

(b) a pharmaceutically acceptable carrier.

35. The use of vaccine of claim 1 or 27 in the manufacture of a medicament for the treatment of cancer.

36. The use of claim 35, wherein the cancer is Globo H expressing cancer.

37. The use of claim 36, wherein the Globo H expressing cancer is breast cancer, lung cancer gastric cancer, colon cancer, pancreatic cancer, prostate cancer, ovarian cancer and endometrial cancer.

CLAIMS

What is claimed is:

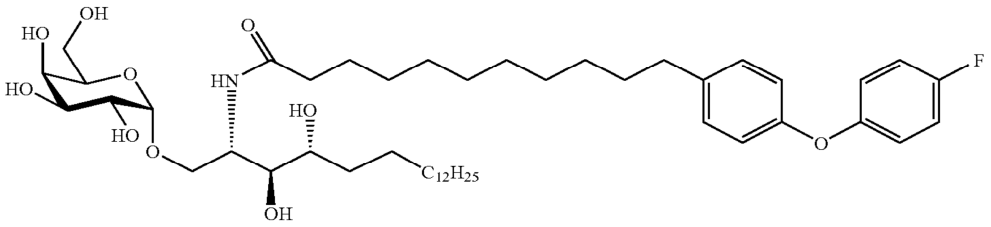
1. A vaccine, comprising

   (a) a carbohydrate antigen or its immunogenic fragment; and

   (b) a toxoid protein,

   wherein the ratio of carbohydrate antigen to toxoid protein ranges from 7:1 to 39:1.

2. The vaccine of claim 1, wherein the toxoid protein is diphtheria toxin (DT).
3. The vaccine of claim 2, wherein the ratio of carbohydrate antigen and DT ranges from 5:1 to 39:1.
4. The vaccine of claim 1, wherein the toxoid protein is tetanus toxoid (TT).
5. The vaccine of claim 4, wherein the ratio of carbohydrate antigen and TT ranges from 7:1 to 39:1
6. The vaccine of claim 1, wherein the carbohydrate antigen is selected from Globo H, SSEA-3, SSEA-4 or Gb-4.
7. The vaccine of claim 2, wherein the DT is diphtheria toxin cross-reacting material or diphtheria toxoid.
8. The vaccine of claim 7, wherein the diphtheria toxin cross-reacting material is selected from CRM 30, CRM 45, CRM 176, CRM 197 or CRM 228.
9. The vaccine of claim 1, further comprises a saponin adjuvant.
10. The vaccine of claim 1, further comprises an α-galactosyl-ceramide (α-GalCer) adjuvant.
11. The vaccine of claim 10, wherein the α-GalCer adjuvant has the following structure:



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12. A vaccine, comprising

(a) carbohydrate antigen or its immunogenic fragment;

(b) a diphtheria toxin (DT); and

(c) an adjuvant,

wherein the ratio of carbohydrate antigen to DT ranges from 5:1 to 39: 1.

13. The vaccine of claim 12, wherein the carbohydrate antigen is selected from Globo H, SSEA-3, SSEA-4 or Gb-4.

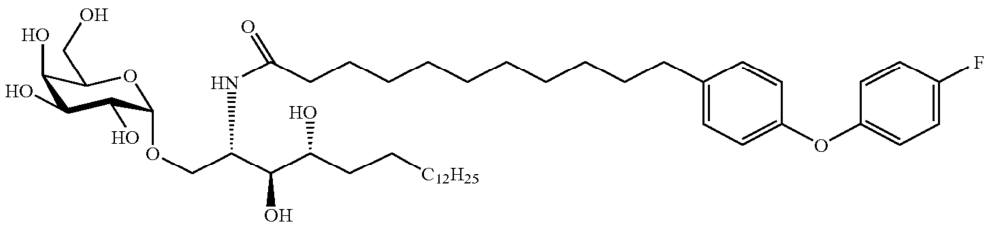
14. The vaccine of claim 12, wherein the DT is diphtheria toxin cross-reacting material or diphtheria toxoid.

15. The vaccine of claim 14, wherein the diphtheria toxin cross-reacting material is selected from CRM 30, CRM 45, CRM 176, CRM 197 or CRM 228.

16. The vaccine of claim 12, wherein the adjuvant is a saponin adjuvant.

17. The vaccine of claim 12, wherein the adjuvant is an α-galactosyl-ceramide (α-GalCer) adjuvant.

18. The vaccine of claim 17, wherein the α-GalCer adjuvant has the following structure:



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19. A pharmaceutical composition, comprising

(a) the vaccine of claim 1 or 12 ; and

(b) a pharmaceutically acceptable carrier.

20. The use of vaccine of claim 1 or 12 in the manufacture of a medicament for the treatment of cancer, wherein the cancer is breast cancer, lung cancer, esophageal cancer, rectal cancer, biliary cancer, liver cancer, buccal cancer, gastric cancer, colon cancer, nasopharyngeal cancer, kidney/renal cancer, prostate cancer, ovarian cancer, cervical cancer, endometrial cancer, pancreatic cancer, testicular cancer, bladder cancer, head and neck cancer, oral cancer, neuroendocrine cancer, adrenal cancer, thyroid cancer, bone cancer, skin cancer, basal cell carcinoma, squamous cell carcinoma, melanoma, or brain tumor.

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