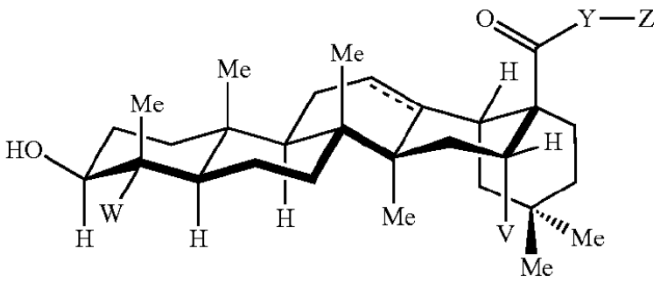
CLAIMS

1. An immunogenic composition comprising:

a varicella zoster virus antigen, and

a compound of Formula I:



(I)

or a pharmaceutically acceptable salt thereof, wherein

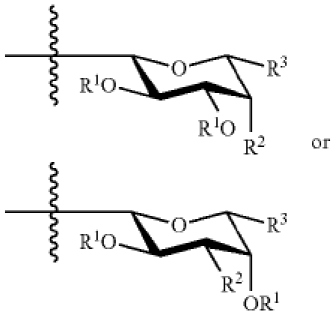
$\equiv$ is a single or double bond;

W is —CHO;

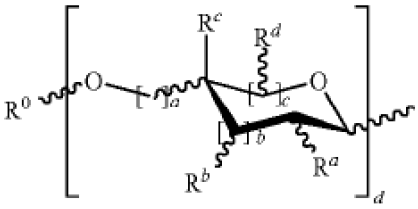
V is hydrogen or OR^x;

Y is CH_2, —O—, —NR-, or —NH—;

Z is hydrogen; a cyclic or acyclic, optionally substituted moiety selected from the group consisting of acyl, aliphatic, heteroaliphatic, aryl, arylalkyl, heteroacyl, and heteroaryl; or a carbohydrate domain having the structure:



wherein each occurrence of R^1 is R^x or a carbohydrate domain having the structure:



wherein:

each occurrence of a, b, and c is independently 0, 1, or 2;

d is an integer from 1-5, wherein each d bracketed structure may be the same or different; with the proviso that the d bracketed structure represents a furanose or a pyranose moiety, and the sum of b and c is 1 or 2;

R^0 is hydrogen; an oxygen protecting group selected from the group consisting of alkyl ethers, benzyl ethers, silyl ethers, acetals, ketals, esters, carbamates, and carbonates; or an optionally substituted moiety selected from the group consisting of acyl, C_{1-10} aliphatic, C_{1-6} heteroaliphatic, 6-10-membered aryl, arylalkyl, 5-10 membered heteroaryl having 1-4 heteroatoms independently selected from nitrogen, oxygen, or sulfur, 4-7 membered heterocyclyl having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur;

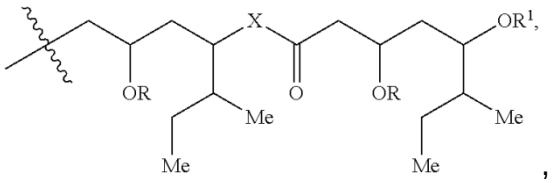
each occurrence of R^a, R^b, R^c, and R^d is independently hydrogen, halogen, OH, OR, OR^x, NR_2, NHCOR, or an optionally substituted group selected from acyl, C_{1-10} aliphatic, C_{1-6} heteroaliphatic, 6-10-membered aryl, arylalkyl, 5-10-membered heteroaryl having 1-4 heteroatoms independently selected from nitrogen, oxygen, sulfur; 4-7-membered heterocyclyl having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur;

R^2 is hydrogen, halogen, OH, OR, $OC(O)R^4$, $OC(O)OR^4$, $OC(O)NHR^4$, $OC(O)NRR^4$, $OC(O)SR^4$, $NHC(O)R^4$, $NRC(O)R^4$, $NHC(O)OR^4$, $NHC(O)NHR^4$, $NHC(O)NRR^4$, NHR^4, $N(R^4)_2$, NHR^4, NRR^4, N_3, or an optionally substituted group selected from C_{1-10} aliphatic, C_{1-6} heteroaliphatic, 6-10-membered aryl, arylalkyl, 5-10 membered heteroaryl having 1-4 heteroatoms independently selected from the group consisting

of nitrogen, oxygen, and sulfur, 4-7-membered heterocyclyl having 1–2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur;

R^3 is hydrogen, halogen, CH_2OR^1, or an optionally substituted group selected from the group consisting of acyl, C_{1-10} aliphatic, C_{1-6} heteroaliphatic, 6-10-membered aryl, arylalkyl, 5-10-membered heteroaryl having 1-4 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur, 4-7-membered heterocyclyl having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur,

R^4 is $-T-R^z$, $-C(O)-T-R^z$, $-NH-T-R^z$, $-O-T-R^z$, $-S-T-R^z$, $-C(O)NH-T-R^z$, $C(O)O-T-R^z$, $C(O)S-T-R^z$, $C(O)NH-T-O-T-R^z$, $-O-T-R^z$, $-T-O-T-R^z$, $-T-S-T-R^z$, or



,

wherein

X is —O—, —NR—, or $T-R^z$;

T is a covalent bond or a bivalent C_{1-26} saturated or unsaturated, straight or branched, aliphatic or heteroaliphatic chain; and

R^z is hydrogen, halogen, —OR, $—OR^x$, $—OR^1$, —SR, NR_2, —C(O)OR, —C(O)R, -NHC(O)R, -NHC(O)OR, NC(O)OR, or an optionally substituted group selected from acyl, arylalkyl, heteroarylalkyl, C_{1-6} aliphatic, 6-10-membered aryl, 5-10-membered heteroaryl having 1-4 heteroatoms independently selected from nitrogen, oxygen, or sulfur, 4-7-membered heterocyclyl having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur;

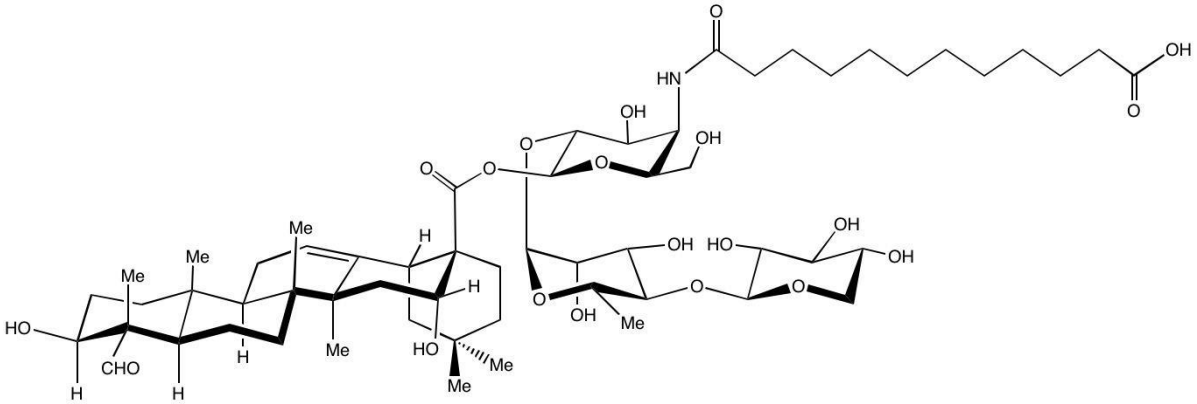
each occurrence of R^x is independently hydrogen or an oxygen protecting group selected from the group consisting of alkyl ethers, benzyl ethers, silyl ethers, acetals, ketals, esters, carbamates, and carbonates;

each occurrence of R is independently hydrogen, an optionally substituted group selected from acyl, arylalkyl, 6-10-membered aryl, C_{1-6} aliphatic, or C_{1-6} heteroaliphatic having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur, or:

two R on the same nitrogen atom are taken with the nitrogen atom to form a 4-7-membered heterocyclic ring having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur.

2. The immunogenic composition of claim 1,

wherein the compound of Formula I is:



, or a pharmaceutically acceptable salt thereof.

3. The immunogenic composition of claim 2,

wherein the compound of Formula I is in free acid form.

4. The immunogenic composition of claim 2,

wherein the compound of Formula I is in choline salt form.

5. The immunogenic composition of claim 2,

wherein the varicella zoster virus antigen is a varicella zoster virus gE antigen truncated to remove the carboxy terminal anchor region.

6. The immunogenic composition of claim 5,

wherein the varicella zoster virus gE antigen is a truncate.

7. The immunogenic composition of claim 6,
wherein the varicella zoster virus gE antigen is a C-terminal truncate.

8. The immunogenic composition of claim 7,
wherein the varicella zoster virus antigen has the sequence of SEQ ID No. 1, SEQ ID No. 2, or SEQ ID No. 9.

9. The immunogenic composition of claim 7,
wherein the varicella zoster virus antigen has the sequence of SEQ ID No. 1.

10. The immunogenic composition of claim 7,
wherein the varicella zoster virus antigen has the sequence of SEQ ID No. 9.

11. The immunogenic composition of claim 5,
further comprising a TLR4 agonist.

12. The immunogenic composition of claim 11,
further comprising a liposome-forming compound.

13. The immunogenic composition of claim 12,
wherein the liposome-forming compound forms liposomes containing the TLR4 agonist.

14. The immunogenic composition of claim 12,
wherein the liposome-forming compound is selected from the group consisting of DOPC, DMPC, DMPG, cholesterol, and combinations thereof.

15. The immunogenic composition according to claim 11,
further comprising an emulsion.

16. The immunogenic composition according to claim 15,
wherein the emulsion is an oil-in-water emulsion.

17. The immunogenic composition according to claim 15,

wherein the emulsion contains the compound of Formula I or pharmaceutically acceptable salt thereof.

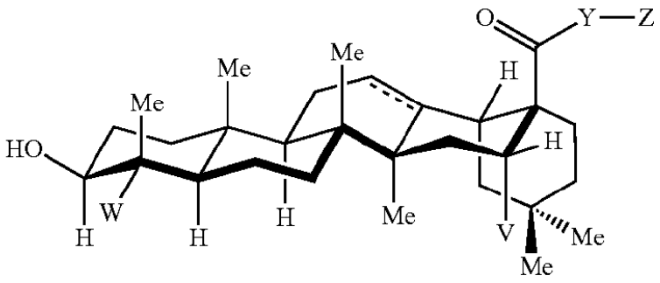
18. The immunogenic composition according to claim 17, wherein the emulsion contains the TLR4 agonist.

19. The immunogenic composition according to claim 13, further comprising an emulsion.

20. The immunogenic composition according to claim 19, wherein the emulsion is an oil-in-water emulsion.

21. The immunogenic composition according to claim 19, wherein the emulsion contains the compound of Formula I or pharmaceutically acceptable salt thereof.

22. ~~A method of increasing cell-mediated immunity in a patient, said method comprising administering to said patient an effective amount~~ Use of an immunogenic composition comprising a varicella zoster virus antigen and a compound of Formula I:

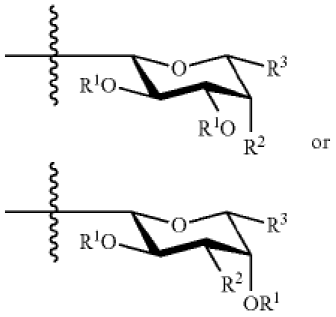


(I)

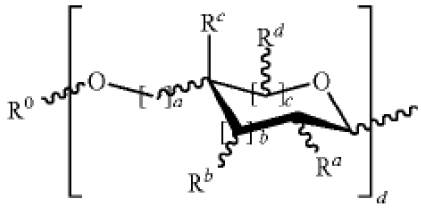
or a pharmaceutically acceptable salt thereof, wherein

- ⚌ is a single or double bond;
- ⚌ W is —CHO;
- V is hydrogen or OR^x;
- Y is CH_2, —O—, —NR-, or —NH—;

Z is hydrogen; a cyclic or acyclic, optionally substituted moiety selected from the group consisting of acyl, aliphatic, heteroaliphatic, aryl, arylalkyl, heteroacyl, and heteroaryl; or a carbohydrate domain having the structure:



wherein each occurrence of R^1 is R^x or a carbohydrate domain having the structure:



wherein:

each occurrence of a, b, and c is independently 0, 1, or 2;

d is an integer from 1-5, wherein each d bracketed structure may be the same or different; with the proviso that the d bracketed structure represents a furanose or a pyranose moiety, and the sum of b and c is 1 or 2;

R^0 is hydrogen; an oxygen protecting group selected from the group consisting of alkyl ethers, benzyl ethers, silyl ethers, acetals, ketals, esters, carbamates, and carbonates; or an optionally substituted moiety selected from the group consisting of acyl, C_{1-10} aliphatic, C_{1-6} heteroaliphatic, 6-10-membered aryl, arylalkyl, 5-10 membered heteroaryl having 1-4 heteroatoms independently selected from nitrogen, oxygen, or sulfur, 4-7 membered heterocyclyl having 1-2

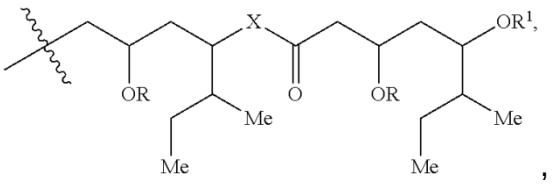
heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur;

each occurrence of R^a, R^b, R^c, and R^d is independently hydrogen, halogen, OH, OR, OR^x, NR_2, NHCOR, or an optionally substituted group selected from acyl, C_{1-10} aliphatic, C_{1-6} heteroaliphatic, 6-10-membered aryl, arylalkyl, 5-10-membered heteroaryl having 1-4 heteroatoms independently selected from nitrogen, oxygen, sulfur; 4-7-membered heterocyclyl having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur;

R^2 is hydrogen, halogen, OH, OR, $OC(O)R^4$, $OC(O)OR^4$, $OC(O)NHR^4$, $OC(O)NRR^4$, $OC(O)SR^4$, $NHC(O)R^4$, $NRC(O)R^4$, $NHC(O)OR^4$, $NHC(O)NHR^4$, $NHC(O)NRR^4$, NHR^4, $N(R^4)_2$, NHR^4, NRR^4, N_3, or an optionally substituted group selected from C_{1-10} aliphatic, C_{1-6} heteroaliphatic, 6-10-membered aryl, arylalkyl, 5-10 membered heteroaryl having 1-4 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur, 4-7-membered heterocyclyl having 1–2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur;

R^3 is hydrogen, halogen, CH_2OR^1, or an optionally substituted group selected from the group consisting of acyl, C_{1-10} aliphatic, C_{1-6} heteroaliphatic, 6-10-membered aryl, arylalkyl, 5-10-membered heteroaryl having 1-4 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur, 4-7-membered heterocyclyl having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur,

R^4 is $-T-R^z$, $-C(O)-T-R^z$, $-NH-T-R^z$, $-O-T-R^z$, $-S-T-R^z$, $-C(O)NH-T-R^z$, $C(O)O-T-R^z$, $C(O)S-T-R^z$, $C(O)NH-T-O-T-R^z$, $-O-T-R^z$, $-T-O-T-R^z$, $-T-S-T-R^z$, or



,

wherein

X is —O—, —NR—, or T-R^z;

T is a covalent bond or a bivalent C_{1-26} saturated or unsaturated, straight or branched, aliphatic or heteroaliphatic chain; and

R^z is hydrogen, halogen, —OR, —OR^x, —OR^1, —SR, NR_2, —C(O)OR, —C(O)R, -NHC(O)R, -NHC(O)OR, NC(O)OR, or an optionally substituted group selected from acyl, arylalkyl, heteroarylalkyl, C_{1-6} aliphatic, 6-10-membered aryl, 5-10-membered heteroaryl having 1-4 heteroatoms independently selected from nitrogen, oxygen, or sulfur, 4-7-membered heterocyclyl having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur;

each occurrence of R^x is independently hydrogen or an oxygen protecting group selected from the group consisting of alkyl ethers, benzyl ethers, silyl ethers, acetals, ketals, esters, carbamates, and carbonates;

each occurrence of R is independently hydrogen, an optionally substituted group selected from acyl, arylalkyl, 6-10-membered aryl, C_{1-6} aliphatic, or C_{1-6} heteroaliphatic having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur, or:

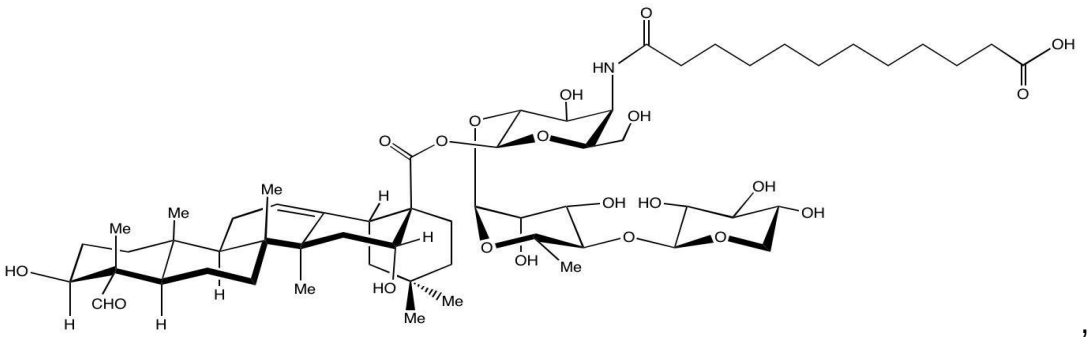
two R on the same nitrogen atom are taken with the nitrogen atom to form a 4-7-membered heterocyclic ring having 1-2 heteroatoms independently selected from the group consisting of nitrogen, oxygen, and sulfur,

for the manufacture of a medicament for increasing cell-mediated immunity in a patient, said medicament comprising an effective amount of the immunogenic composition,

wherein the cell mediated immunity prevents herpes zoster reactivation in the patient.

23. The ~~method~~ use of claim 22,

wherein the compound of Formula I is:



,

or a pharmaceutically acceptable salt thereof.

24. The ~~method~~ use of claim 23,
wherein the compound of Formula I is in free acid form.

25. The ~~method~~ use of claim 23,
wherein the compound of Formula I is in choline salt form.

26. The ~~method~~ use of claim 23,
wherein the varicella zoster virus antigen is a varicella zoster virus gE antigen truncated to remove the carboxy terminal anchor region.

27. The ~~method~~ use of claim 26,
wherein the varicella zoster virus gE antigen is a truncate.

28. The ~~method~~ use of claim 27,
wherein the varicella zoster virus gE antigen is a C-terminal truncate.

29. The ~~method~~ use of claim 28,
wherein the varicella zoster virus antigen has the sequence of SEQ ID No. 1, SEQ ID No. 2, or SEQ ID No. 9.

30. The ~~method~~ use of claim 28,
wherein the varicella zoster virus antigen has the sequence of SEQ ID No. 1.

31. The ~~method~~ use of claim 28,
wherein the varicella zoster virus antigen has the sequence of SEQ ID No. 9.

32. The ~~method~~ use of claim 26,
wherein the medicament further compris~~ing~~es a TLR4 agonist.

33. The ~~method~~ use of claim 32, wherein the medicament further compris~~ing~~es a liposome-forming compound.

34. The ~~method~~ use of claim 33,

wherein the liposome-forming compound forms liposomes containing the TLR4 agonist.

35. The ~~method~~ use of claim 33,

wherein the liposome-forming compound is selected from the group consisting of DOPC, DMPC, DMPG, cholesterol, and combinations thereof.

36. The ~~method~~ use of claim 32,

wherein the medicament further compris~~ing~~es an emulsion.

37. The ~~method~~ use of claim 36,

wherein the emulsion is an oil-in-water emulsion.

38. The ~~method~~ use of claim 36,

wherein the emulsion contains the compound of Formula I or pharmaceutically acceptable salt thereof.

39. The ~~method~~ use of claim 38,

wherein the emulsion contains the TLR4 agonist.

40. The ~~method~~ use of claim 34,

wherein the medicament further compris~~ing~~es an emulsion.

41. The ~~method~~ use of claim 40,

wherein the emulsion is an oil-in-water emulsion.

42. The ~~method~~ use of claim 40,

wherein the emulsion contains the compound of Formula I or pharmaceutically acceptable salt thereof.