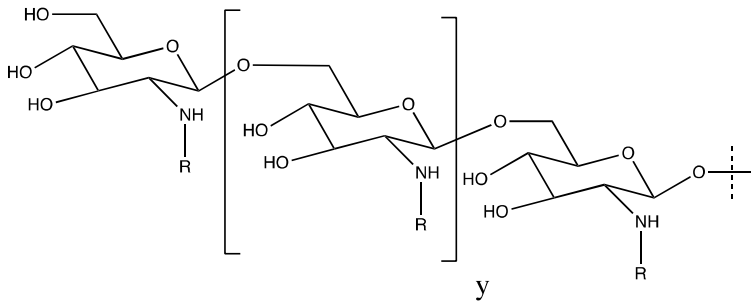
[0009] Accordingly, in one example, this disclosure provides for a vaccine composition that comprises at least 25 and preferably from about 31 to about 39 oligomeric-β-(1→6)-glucosamine groups linked units onto a tetanus toxoid carrier via a linker wherein the oligomer comprises from 3 to 12 repeating β-(1→6)-glucosamine units provided that less than about 40 number percent of the total number of such units are N-acetylated and further wherein said tetanus toxoid comprises at least 25 and preferably at least 31 reactive amino functionalities and at least 85 percent of the toxoid components are in monomeric form, or in some examples, at least 90%. Such vaccine compositions provide effective immunity to a patient against microbial infections wherein said microbe comprises oligomeric N-acetyl-β-(1→6)-glucosamine structures in its cell walls.

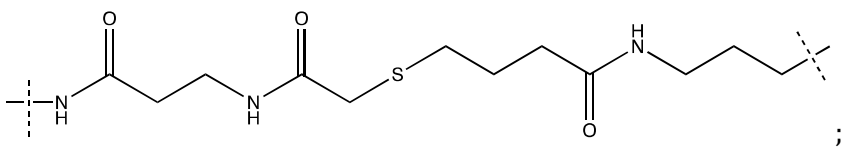
[0010] In one example, the present disclosure refers to a compound represented by formula I:

$$(A\text{-}B)_x\text{-}C \quad I$$

where A comprises from 3 to 12 repeating β-(1→6)-glucosamine units or mixtures thereof having the formula:



B is of the formula:



where the left side of the formula is attached to C and the right side is attached to A;

and C is tetanus toxoid having at least 31 reactive amino functionalities;

x is an integer from about 31 to about 39;

y is an integer from 1 to 10; and

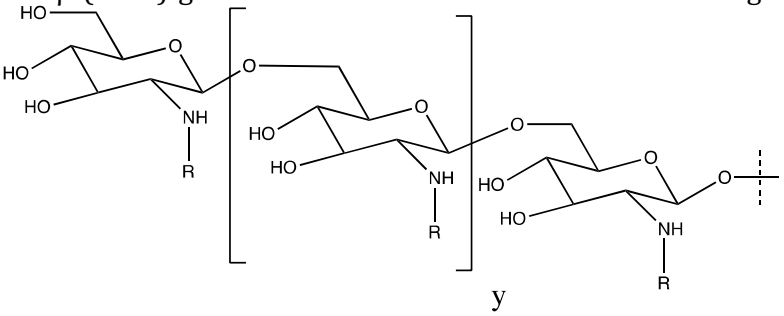
R is hydrogen or acetyl provided that no more than 40% of the R groups are acetyl

wherein said tetanus toxoid comprises at least 31 reactive amino groups and at least 90 percent by number of the toxoid is in monomeric form.

[0010a] In one aspect, the present disclosure refers to a compound represented by formula I:

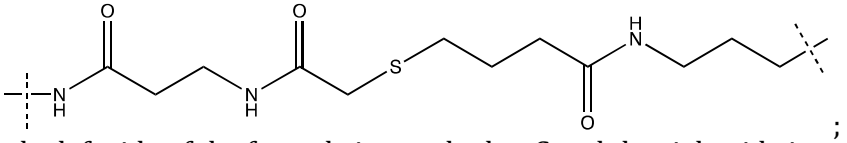
$$(A\text{-}B)_x\text{-}C \quad I$$

where A comprises β-(1→6)-glucosamine units or mixtures thereof having the formula:



y

B is of the formula:



;

where the left side of the formula is attached to C and the right side is attached to A; and C is tetanus toxoid;

x is an integer from 31 to 39;

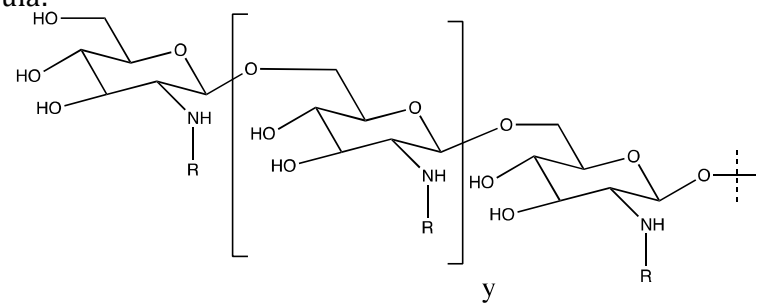
y is 3; and

R is hydrogen or acetyl provided that no more than 40% of the R groups are acetyl wherein said tetanus toxoid comprises at least 31 reactive amino groups and at least 90 percent by number of the toxoid is in monomeric form.

[0011] In one example, this disclosure provides for a vaccine composition that is useful against microbes which comprise oligomeric N-acetyl-β-(1→6)-glucosamine structures in their cell wall wherein said vaccine composition comprises a pharmaceutically acceptable carrier and an effective amount of a vaccine represented by formula I:

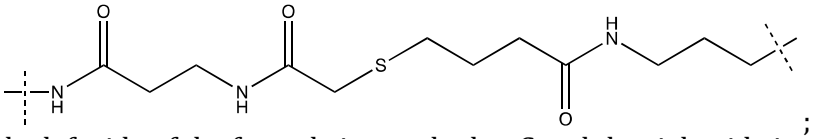
$$(A\text{-}B)_x\text{-}C \quad I$$

where A comprises from 3 to 12 repeating β-(1→6)-glucosamine units or mixtures thereof having the formula:



y

B is of the formula:



;

where the left side of the formula is attached to C and the right side is attached to A; and C is tetanus toxoid having at least 31 reactive amino functionalities;

x is an integer from about 31 to about 39;

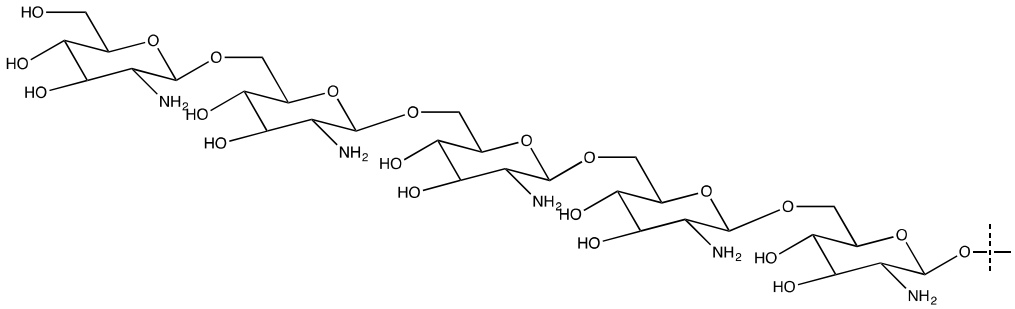
y is an integer from 1 to 10; and

R is hydrogen or acetyl provided that no more than 40% of the R groups are acetyl wherein said tetanus toxoid comprises at least 31 reactive amino groups and at least 90 percent by number of the toxoid is in monomeric form. Such vaccine compositions provide effective immunity to a patient against microbial infections wherein said microbe comprises oligomeric N-acetyl-β-(1→6)-glucosamine structures in its cell walls.

[0012] In one example of formula I above, there is provided a compound of formula II:

$(A'\text{-}B)_x\text{-}C$ II

where A′ is a penta-β-(1→6)-glucosamine (carbohydrate ligand) group of the formula:

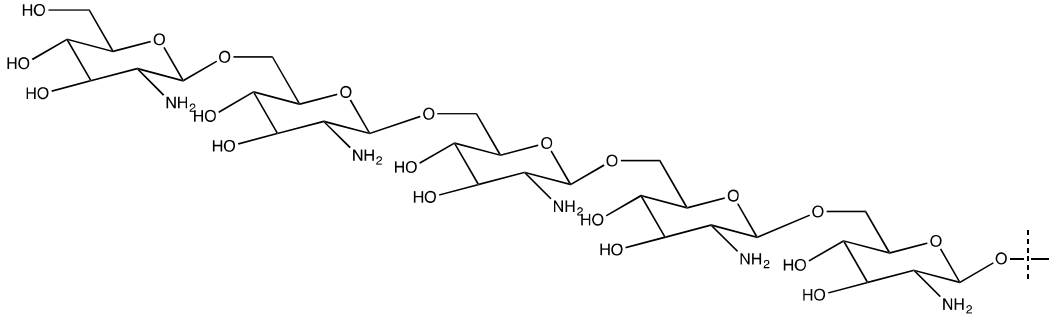


and B, C and *x* are as defined above, provided that at least 85 percent by number of the toxoid is in monomeric form, or in some examples, at least 90%.

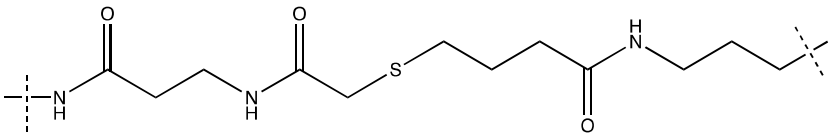
[0012a] In another aspect, the present disclosure refers to a compound represented by formula II:

$(A'\text{-}B)_x\text{-}C$ II

wherein A' is



B is of the formula:



;

where the left side of the formula is attached to C and the right side is attached to A; and C is tetanus toxoid;

x is an integer from 31 to 39;

and

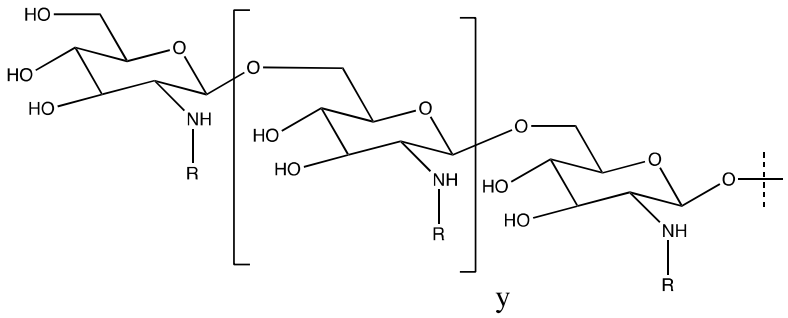
R is hydrogen or acetyl provided that no more than 40% of the R groups are acetyl

WHAT IS CLAIMED IS:

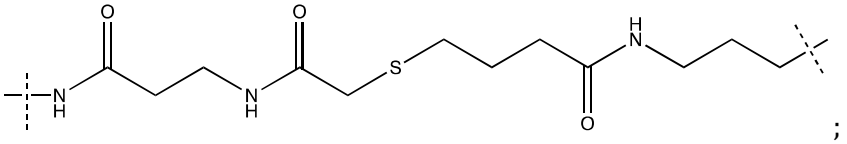
1. A compound represented by formula I:

$$(A\text{-}B)_x\text{-}C \quad I$$

where A comprises β-(1→6)-glucosamine units or mixtures thereof having the formula:



B is of the formula:



;

where the left side of the formula is attached to C and the right side is attached to A; and C is tetanus toxoid;

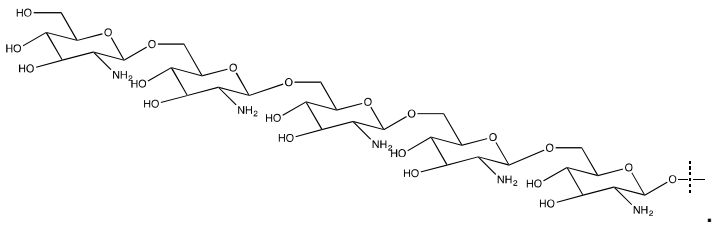
x is an integer from 31 to 39;

y is 3; and

R is hydrogen or acetyl provided that no more than 40% of the R groups are acetyl

wherein said tetanus toxoid comprises at least 31 reactive amino groups and at least 90 percent by number of the toxoid is in monomeric form.

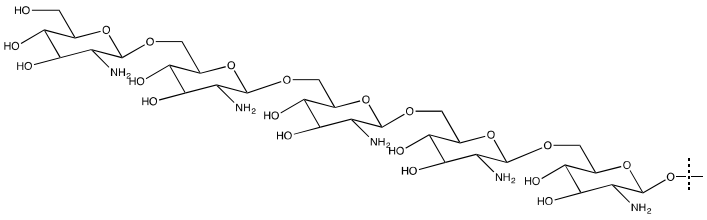
2. A compound according to claim 1, wherein A is:



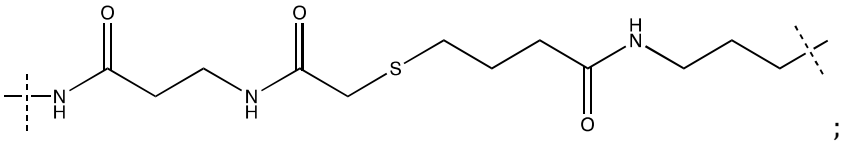
3. A compound represented by formula II:

$$(A'\text{-}B)_x\text{-}C \qquad II$$

wherein A′ is



B is of the formula:



where the left side of the formula is attached to C and the right side is attached to A; and C is tetanus toxoid;

x is an integer from 31 to 39;

and

R is hydrogen or acetyl provided that no more than 40% of the R groups are acetyl

wherein said tetanus toxoid comprises at least 31 reactive amino groups and at least 85 percent by number of the toxoid is in monomeric form.

4. The compound of any one of claims 1 to 3, wherein the amount of non-monomeric toxoid is less than 5 weight percent.

5. The compound of any one of claims 1 to 3, wherein the amount of non-monomeric toxoid is less than 0.5 weight percent.

6. A pharmaceutical composition comprising a pharmaceutically acceptable diluent and an effective amount of the compound of claim 1.

7. A pharmaceutical composition comprising a pharmaceutically acceptable diluent and an effective amount of the compound of claim 2 wherein said composition comprises no more than 3 weight percent of low molecular weight amino compounds.

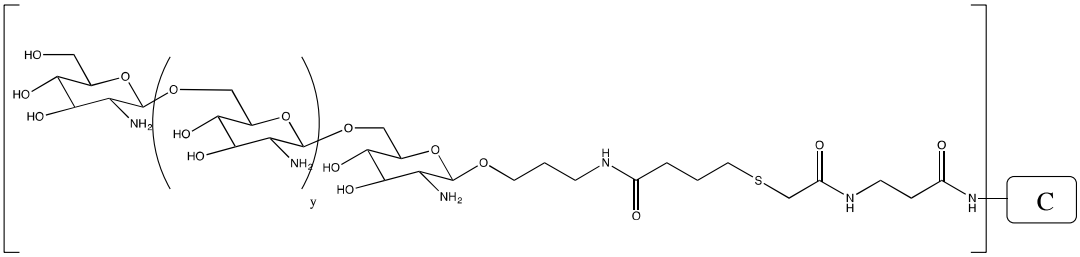
8. A pharmaceutical composition comprising a pharmaceutically acceptable diluent and an effective amount of the compound of claim 3 wherein said composition comprises no more than 3 weight percent of low molecular weight amino compounds.

9. The pharmaceutical composition according to claim 7 or 8, wherein said composition comprises less than 2 weight percent of low molecular weight amino compounds.

10. The pharmaceutical composition according to claim 9, wherein said composition comprises less than 1 weight percent of low molecular weight amino compounds.

11. A compound according to claim 4, wherein the effective amount of the compound of claim 1 is an amount sufficient to kill microbes *in vivo*, when a patient has an effective white blood cell (WBC) count of at least 2,000.

12. A compound according to claim 5 wherein said compound is selected from the group consisting of:



Y	C	Percent N-acetylated	*x*	Percent monomer
3	Tetanus toxoid	0%	36	95%
3	Tetanus toxoid	20% (1 of 5)	34	>95%
3	Tetanus toxoid	0%	35	>99%

13. The pharmaceutical composition according to claim 7 or 8, wherein the low molecular weight amino compounds have a molecular weight of less than 10,000.

14. The pharmaceutical composition according to claim 7 or 8, wherein the low molecular weight amino compounds have a molecular weight of less than 1,000.