Claims

1. Compound of the general formula (I):

$$A[L—CH—CA]_p$$
(I)

wherein
A represents a carbohydrate antigen of 1 to 10.000 carbohydrate monomers, wherein the carbohydrate monomers of the carbohydrate antigen are optionally modified to carry amide, carbonate, carbamate, carbonyl, thiocarbonyl, carboxy, thiocarboxy, ester, thioester, ether, epoxy, hydroxyalkyl, alkylenyl, phenylene, alkenyl, imino, imide, isourea, thiocarbamate, thiourea and/or urea moieties,
p is the number of residues **–L–CH–CA** which are bound to the carbohydrate antigen **A**, and

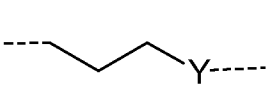
p is an integer defined as follows:

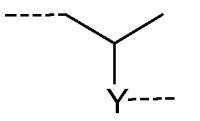
p is 1 or 2		if u is 1
p is 1, 2, 3 or 4		if u is 2
p is 1, 2, 3, 4, 5 or 6		if u is 3
p is 1, 2, 3, 4, 5, 6, 7 or 8		if u is 4
$1 \leq p \leq 10$	if	$5 \leq u \leq 10$
$2 \leq p \leq 50$	if	$11. \leq u \leq 100$
$20 \leq p \leq 200$	if	$101 \leq u \leq 1000$
$50 \leq p \leq 400$	if	$1001 \leq u \leq 10000$

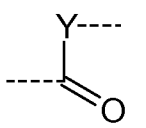
u is the number of carbohydrate monomers of the carbohydrate antigen **A**

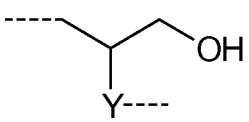
L represents $–L^1–L^2–$, $–L^2–$, $–L^2–L^3–$ or $–L^1–L^2–L^3–$;

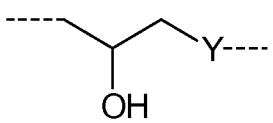
L^1 represents one of the following residues:

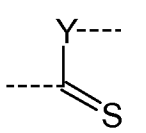


,


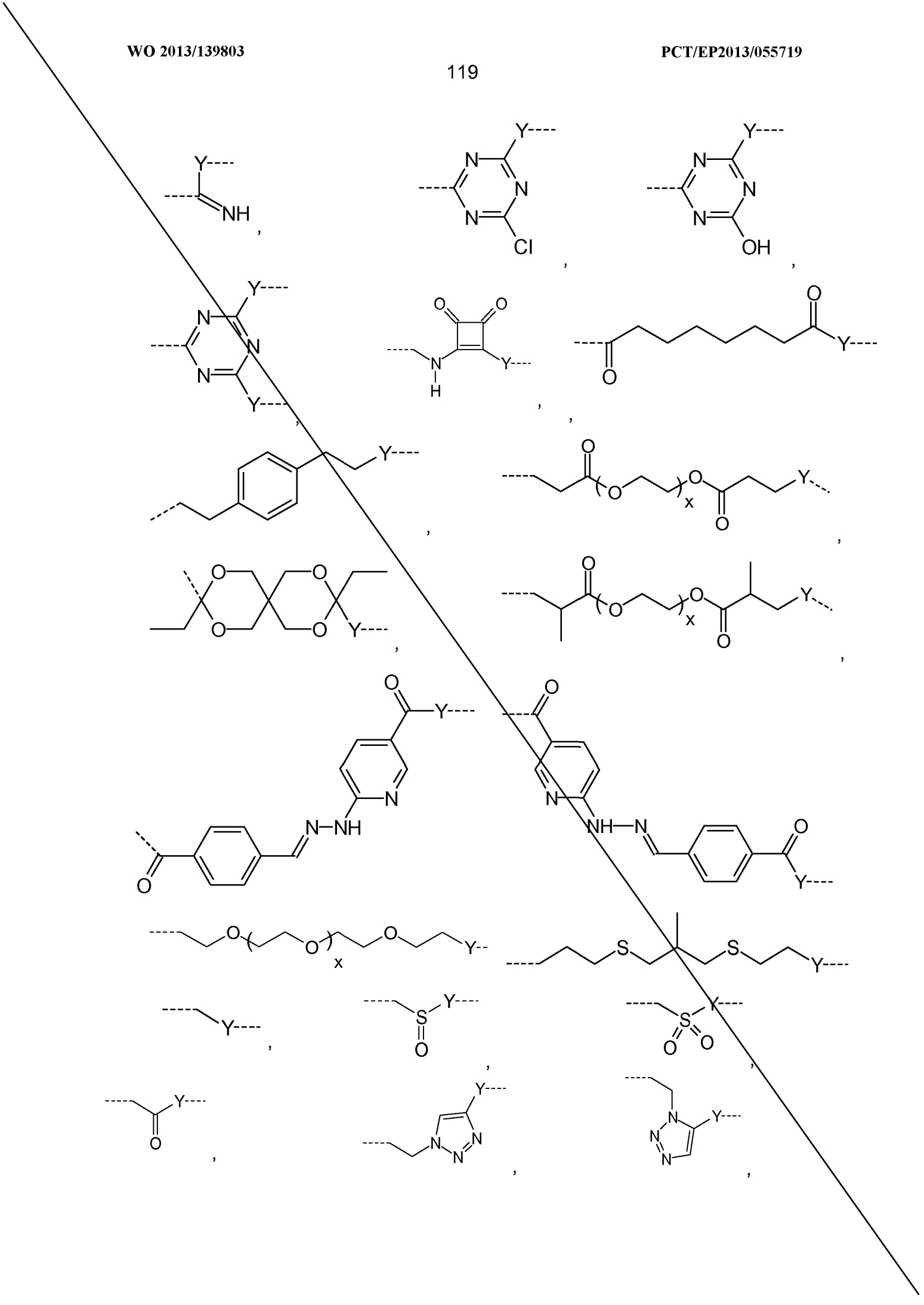
,


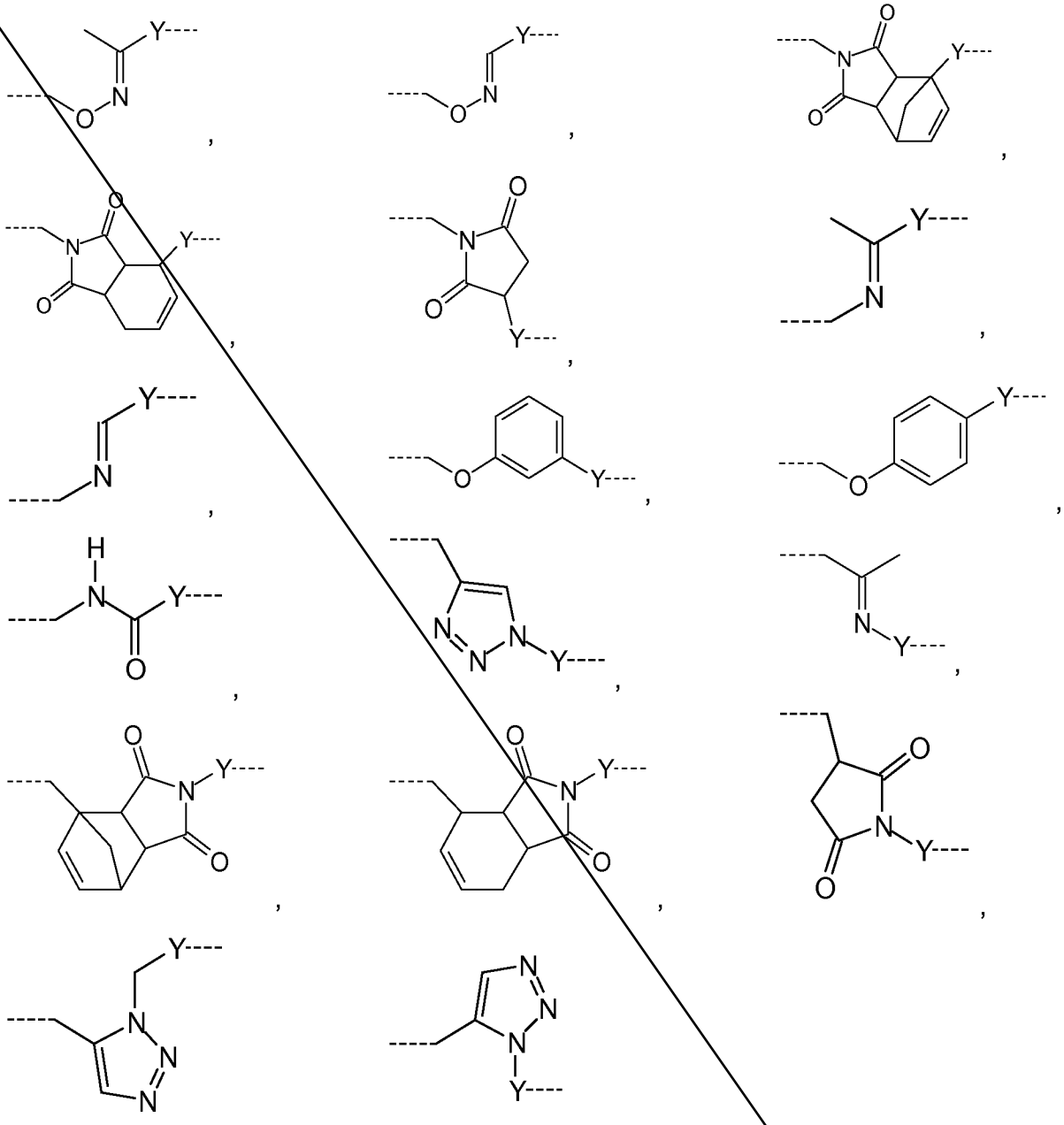
,


,


,


,





wherein x is in integer from 1 to 60;

Y represents a bond, –NH–, –O–, –S–; –S–S–;

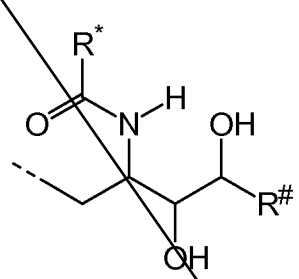
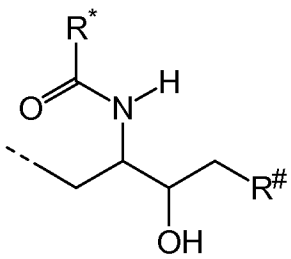
L^2 represents –CH_2–, –C_2H_4–, –C_3H_6–, –C_4H_8–, –C_5H_{10}–, –C_6H_{12}–, –C_7H_{14}–, –C_8H_{16}–, –C_9H_{18}–, –$C_{10}H_{20}$–, –$CH(CH_3)$–, –$C[(CH_3)_2]$–, –CH_2–$CH(CH_3)$–, –$CH(CH_3)$–CH_2–, –$CH(CH_3)$–C_2H_4–, –CH_2–$CH(CH_3)$–CH_2–, –C_2H_4–$CH(CH_3)$–, –CH_2–$C[(CH_3)_2]$–, –$C[(CH_3)_2]$–CH_2–, –$CH(CH_3)$–$CH(CH_3)$–, –$C[(C_2H_5)(CH_3)]$–, –$CH(C_3H_7)$–, –$(CH_2$–CH_2–$O)_n$–CH_2–CH_2–, –CO–CH_2–, –CO–C_2H_4–, –CO–C_3H_6–, –CO–C_4H_8–, –CO–C_5H_{10}–, –CO–C_6H_{12}–, –CO–C_7H_{14}–, –CO–C_8H_{16}–, –CO–C_9H_{18}–, –CO–$C_{10}H_{20}$–, –CO–$CH(CH_3)$–, –CO–$C[(CH_3)_2]$–, –CO–CH_2–$CH(CH_3)$–, –CO–$CH(CH_3)$–CH_2–,

–CO–CH(CH_3)–C_2H_4–, –CO–CH_2–CH(CH_3)–CH_2–, –CO–C_2H_4–CH(CH_3)–, –CO–CH_2–C[(CH_3)$_2$]–, –CO–C[(CH_3)$_2$]–CH_2–, –CO–CH(CH_3)–CH(CH_3)–, –CO–C[(C_2H_5)(CH_3)]–, –CO–CH(C_3H_7)–, –CO–(CH_2–CH_2–O)$_n$–CH_2–CH_2–;

n represents an integer from 1 to 60;

L^3 represents –CO–, –O–CO–, –NH–CO–, –NH(C=NH)–, –SO_2–, –O–SO_2–, –NH–, –NH–CO–CH_2–;

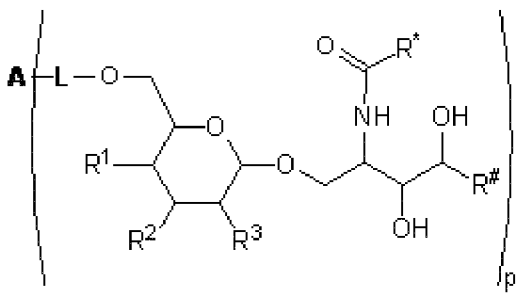
CH represents a monosaccharide, a disaccharide or a trisaccharide;

CA represents  or 

R* and **R$^{\#}$** represent independently of each other a linear or branched or cyclic, substituted or unsubstituted, saturated or unsaturated carbon residue consisting of 1 to 30 carbon atoms;

and enantiomers, stereoisomeric forms, mixtures of enantiomers, diastereomers, mixtures of diastereomers, prodrugs, hydrates, solvates, tautomers, and racemates of the above mentioned compounds and pharmaceutically acceptable salts thereof.

2. Compound according to claim 1 of the general formula (II):



(II)

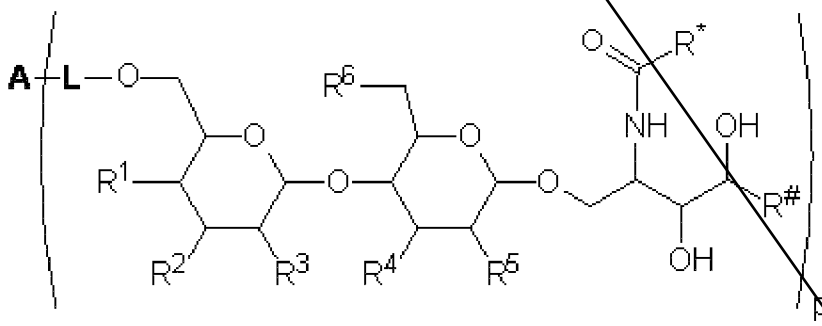
wherein

A, **L** and **p** have the meanings as defined in claim 1;

R^1, R^2, R^3 represent independently of each other:
–H, –OH, $–OCH_3$, $–OC_2H_5$, $–OC_3H_7$, $–O–SO_2–CH_3$, $–O–SO_2–C_2H_5$, $–O–SO_2–C_3H_7$, $–O–COOCH_3$, $–NHCOCH_3$, $–NH_2$;

R^* and $R^\#$ represent independently of each other:
$–CH_3$, $–(CH_2)_r–CH_3$, $–CH(OH)–(CH_2)_s–CH_3$, $–CH=CH–CH_3$, $–CH=CH–(CH_2)_t–CH_3$, $–CH(OH)–(CH_2)_v–CH(CH_3)_2$, $–CH(OH)–(CH_2)_w–CH(CH_3)–CH_2–CH_3$, $–(CH_2)_a–CH=CH–(CH_2)_b–CH_3$, $–(CH_2)_c–CH=CH–(CH_2)_d–CH=CH–(CH_2)_e–CH_3$, $–(CH_2)_f–CH=CH–(CH_2)_g–CH=CH–(CH_2)_h–CH=CH–(CH_2)_i–CH_3$, $–(CH_2)_j–CH=CH–(CH_2)_k–CH=CH–(CH_2)_l–CH=CH–(CH_2)_o–CH=CH–(CH_2)_q–CH_3$, wherein a, b, c, d, e, f, g, h, i, j, k, l, o, q are integers from 1 to 26 with the provisio that: $(a+b) \leq 27$; $(c+d+e) \leq 25$; $(f+g+h+i) \leq 23$; $(j+k+l+o+q) \leq 21$; and wherein r is an integer from 1 to 29, s is an integer from 1 to 28, t is an integer from 1 to 27, v is an integer from 1 to 26, w is an integer from 1 to 26.

3. Compound according to claim 1 of the general formula (VI):



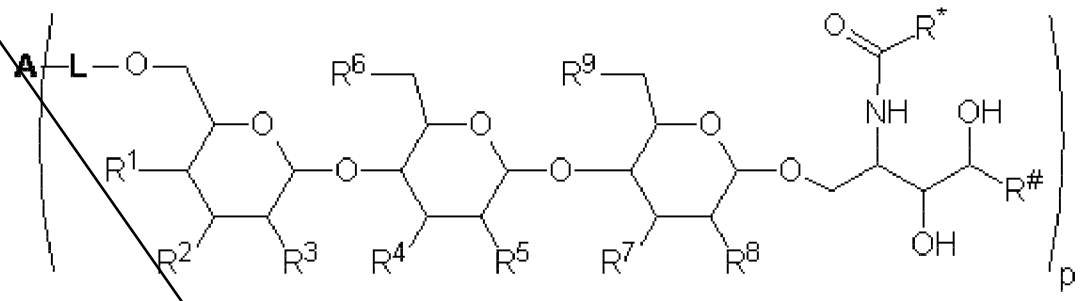
(VI)

wherein

A, **L**, R^*, $R^\#$, and **p** have the meanings as defined in claim 1,

R^1, R^2, R^3, R^4, R^5, R^6 represent independently of each other:
–H, –OH, $–OCH_3$, $–OC_2H_5$, $–OC_3H_7$, $–O–SO_2–CH_3$, $–O–SO_2–C_2H_5$, $–O–SO_2–C_3H_7$, $–O–COOCH_3$, $–NHCOCH_3$, $–NH_2$.

4. Compound according to claim 1 of the general formula (VIII):

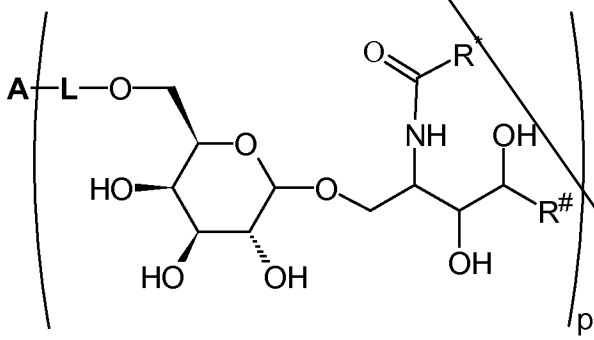


wherein

A, **L**, **R*** , **R#**, and **p** have the meanings as defined in claim 1,

R1, **R2**, **R3**, **R4**, **R5**, **R6**, **R7**, **R8**, **R9** represent independently of each other: –H, –OH, $-OCH_3$, $-OC_2H_5$, $-OC_3H_7$, $-O-SO_2-CH_3$, $-O-SO_2-C_2H_5$, $-O-SO_2-C_3H_7$, $-O-COOCH_3$, $-NHCOCH_3$, $-NH_2$.

5. Compound according to claim 1 of the general formula (XIV):

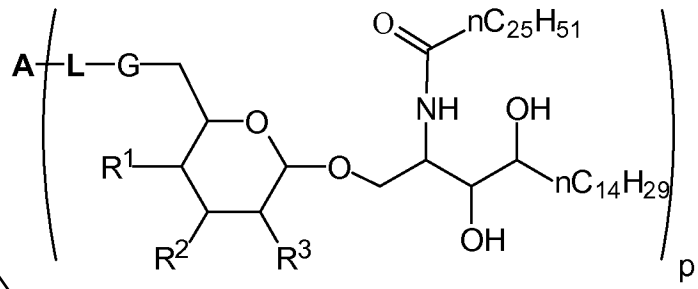


(XIV)

wherein

A, **L**, **R*** , **R#** and **p** have the meanings as defined in claim 1.

6. Compound according to claim 1 of the general formula (XVIII):

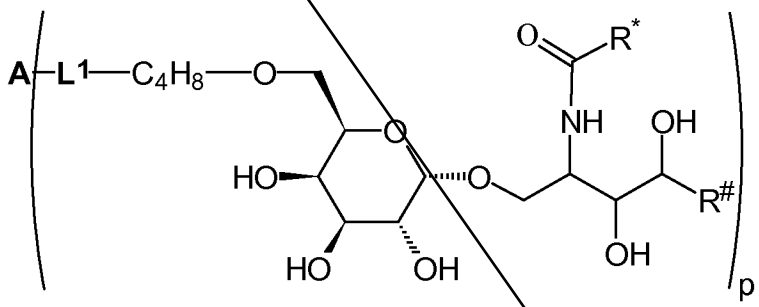


(XVIII)

wherein

A, **L**, R^1, R^2, R^3 and **p** have the meanings as defined in claim 1.

7. Compound according to claim 1 of the general formula (XXV):

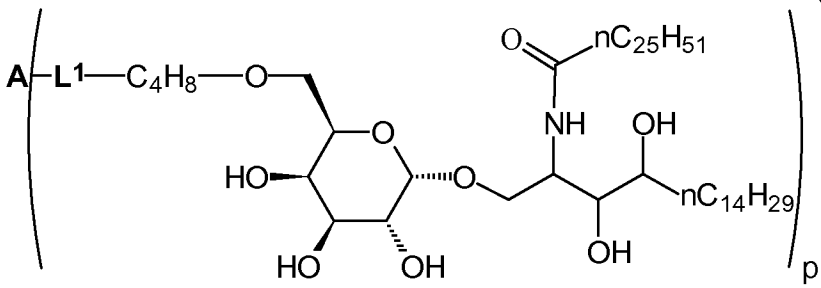


(XXV)

wherein

A, L^1, R^*, $R^\#$ and **p** have the meanings as defined in claim 1.

8. Compound according to claim 1 of the general formula (**XXVI**):



(XXVI)

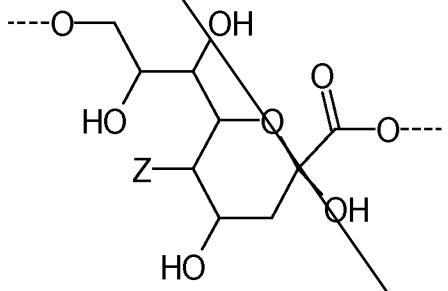
wherein

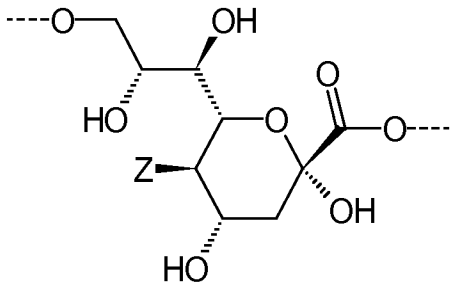
A, L^1 and **p** have the meanings as defined in claim 1.

9. Compound according to any one of claims 1 – 8 wherein the carbohydrate monomers of the carbohydrate antigen belong to the group of carbohydrates comprising:
α-D-ribopyranose, α-D-arabinopyranose, α-D-xylopyranose, α-D-lyxopyranose, α-D-allopyranose, α-D-altropyranose, α-D-glucopyranose, α-D-mannpyranose, α-D-glucopyranose, α-D-idopyranose, α-D-galactopyranose, α-D-talopyranose, α-D-psicopyranose, α-D-fructopyranose, α-D-sorbopyranose, α-D-tagatopyranose, α-D-ribofuranose, α-D-arabinofuranose, α-D-xylofuranose, α-D-lyxofuranose, α-D-Allofuranose, α-D-Altrofuranose, α-D-Glucofuranose, α-D-Mannofuranose, α-D-gulofuranose, α-D-idofuranose, α-D-galactofuranose, α-D-talofuranose, α-D-psicofuranose, α-D-fructofuranose, α-D-sorbofuranose, α-D-tagatofuranose, α-D-xylulofuranose, α-D-ribulofuranose, α-D-threofuranose, α-D-rhamnopyranose, α-D-erythrofuranose, α-D-glucosamine, α-D-glucopyranuronic acid, β-D-ribopyranose, β-D-arabinopyranose, β-D-xylopyranose, β-D-lyxopyranose, β-D-allopyranose, β-D-altropyranose, β-D-glucopyranose, β-D-mannpyranose, β-D-glucopyranose, β-D-idopyranose, β-D-galactopyranose, β-D-talopyranose, β-D-psicopyranose, β-D-fructopyranose, β-D-sorbopyranose, β-D-tagatopyranose, β-D-ribofuranose, β-D-arabinofuranose, β-D-xylofuranose, β-D-lyxofuranose, β-D-rhamnopyranose, β-D-allofuranose, β-D-altrofuranose, β-D-glucofuranose, β-D-mannofuranose, β-D-gulofuranose, β-D-idofuranose, β-D-galactofuranose, β-D-talofuranose, β-D-psicofuranose, β-D-fructofuranose, β-D-sorbofuranose, β-D-tagatofuranose, β-D-xylulofuranose, β-D-ribulofuranose, β-D-threofuranose, β-D-erythrofuranose, β-D-glucosamine, β-D-glucopyranuronic acid, α-L-ribopyranose, α-L-arabinopyranose, α-L-xylopyranose, α-L-lyxopyranose, α-L-allopyranose, α-L-altropyranose, α-L-glucopyranose, α-L-mannpyranose, α-L-glucopyranose, α-L-idopyranose, α-L-galactopyranose, α-L-talopyranose, α-L-psicopyranose, α-L-fructopyranose, α-L-sorbopyranose, α-L-tagatopyranose, α-L-rhamnopyranose, α-L-ribofuranose, α-L-arabinofuranose, α-L-xylofuranose, α-L-lyxofuranose, α-L-Allofuranose, α-L-Altrofuranose, α-L-Glucofuranose, α-L-Mannofuranose, α-L-gulofuranose, α-L-idofuranose, α-L-galactofuranose, α-L-talofuranose, α-L-psicofuranose, α-L-fructofuranose, α-L-sorbofuranose, α-L-tagatofuranose, α-L-xylulofuranose, α-L-ribulofuranose, α-L-threofuranose, α-L-erythrofuranose, α-L-glucosamine, α-L-glucopyranuronic acid, β-L-ribopyranose, β-L-arabinopyranose, β-L-xylopyranose, β-L-lyxopyranose, β-L-allopyranose, β-L-altropyranose, β-L-glucopyranose, β-L-mannpyranose, β-L-glucopyranose, β-L-idopyranose, β-L-galactopyranose, β-L-

talopyranose, β-L-psicopyranose, β-L-fructopyranose, β-L-sorbopyranose, β-L-tagatopyranose, β-L-ribofuranose, β-L-arabinofuranose, β-L-xylofuranose, β-L-lyxofuranose, β-L-allofuranose, β-L-altrofuranose, β-L-glucofuranose, β-L-mannofuranose, β-L-gulofuranose, β-L-idofuranose, β-L-galactofuranose, β-L-talofuranose, β-L-psicofuranose, β-L-fructofuranose, β-L-sorbofuranose, β-L-tagatofuranose, β-L-xylulofuranose, β-L-ribulofuranose, β-L-threofuranose, β-L-erythrofuranose, β-L-glucosamine, β-L-glucopyranuronic acid, β-L-rhamnopyranose,

or N- or O-substituted derivatives of neuraminic acid of the following formula:





wherein Z represents $–NH_2$, –NHAc, or –OH. ;

10. Compound according to any one of claims 1 – 9 wherein the carbohydrate monomers of the **CH**-moiety belong to the group of carbohydrates comprising:
α-D-ribopyranose, α-D-arabinopyranose, α-D-xylopyranose, α-D-lyxopyranose, α-D-allopyranose, α-D-altropyranose, α-D-glucopyranose, α-D-mannpyranose, α-D-glucopyranose, α-D-idopyranose, α-D-galactopyranose, α-D-talopyranose, α-D-psicopyranose, α-D-fructopyranose, α-D-sorbopyranose, α-D-tagatopyranose, α-D-ribofuranose, α-D-arabinofuranose, α-D-xylofuranose, α-D-lyxofuranose, α-D-Allofuranose, α-D-Altrofuranose, α-D-Glucofuranose, α-D-Mannofuranose, α-D-gulofuranose, α-D-idofuranose, α-D-galactofuranose, α-D-talofuranose, α-D-psicofuranose, α-D-fructofuranose, α-D-sorbofuranose, α-D-tagatofuranose, α-D-xylulofuranose, α-D-ribulofuranose, α-D-threofuranose, α-D-erythrofuranose, α-D-glucosamine, α-D-glucopyranuronic acid, α-D-rhamnopyranose, β-D-ribopyranose,
β-D-arabinopyranose, β-D-xylopyranose, β-D-lyxopyranose, β-D-allopyranose, β-D-altropyranose, β-D-glucopyranose, β-D-mannpyranose, β-D-glucopyranose, β-D-idopyranose, β-D-galactopyranose, β-D-talopyranose, β-D-psicopyranose, β-D-fructopyranose, β-D-sorbopyranose, β-D-tagatopyranose, β-D-ribofuranose, β-D-arabinofuranose, β-D-xylofuranose, β-D-lyxofuranose, β-D-allofuranose, β-D-altrofuranose, β-D-glucofuranose, β-D-mannofuranose, β-D-gulofuranose, β-D-idofuranose, β-D-galactofuranose, β-D-talofuranose, β-D-psicofuranose, β-D-

fructofuranose, β-D-sorbofuranose, β-D-tagatofuranose, β-D-xylulofuranose, β-D-ribulofuranose, β-D-threofuranose, β-D-erythrofuranose, β-D-rhamnopyranose, β-D-glucosamine, β-D-glucopyranuronic acid, α-L-ribopyranose, α-L-arabinopyranose, α-L-xylopyranose, α-L-lyxopyranose, α-L-allopyranose, α-L-altropyranose, α-L-glucopyranose, α-L-mannpyranose, α-L-glucopyranose, α-L-idopyranose, α-L-galactopyranose, α-L-talopyranose, α-L-psicopyranose, α-L-fructopyranose, α-L-sorbopyranose, α-L-tagatopyranose, α-L-ribofuranose, α-L-arabinofuranose, α-L-xylofuranose, α-L-lyxofuranose, α-L-Allofuranose, α-L-Altrofuranose, α-L-Glucofuranose, α-L-Mannofuranose, α-L-gulofuranose, α-L-idofuranose, α-L-galactofuranose, α-L-talofuranose, α-L-psicofuranose, α-L-fructofuranose, α-L-sorbofuranose, α-L-tagatofuranose, α-L-xylulofuranose, α-L-ribulofuranose, α-L-rhamnopyranose α-L-threofuranose, α-L-erythrofuranose, α-L-glucosamine, α-L-glucopyranuronic acid, β-L-ribopyranose, β-L-arabinopyranose, β-L-xylopyranose, β-L-lyxopyranose, β-L-allopyranose, β-L-altropyranose, β-L-glucopyranose, β-L-mannpyranose, β-L-glucopyranose, β-L-idopyranose, β-L-galactopyranose, β-L-talopyranose, β-L-psicopyranose, β-L-fructopyranose, β-L-sorbopyranose, β-L-tagatopyranose, β-L-ribofuranose, β-L-arabinofuranose, β-L-xylofuranose, β-L-lyxofuranose, β-L-allofuranose, β-L-altrofuranose, β-L-glucofuranose, β-L-mannofuranose, β-L-gulofuranose, β-L-idofuranose, β-L-galactofuranose, β-L-talofuranose, β-L-psicofuranose, β-L-fructofuranose, β-L-sorbofuranose, β-L-tagatofuranose, β-L-xylulofuranose, β-L-ribulofuranose, β-L-threofuranose, β-L-erythrofuranose, β-L-glucosamine, β-L-glucopyranuronic acid, β-L-rhamnopyranose.

11. Compound according to any of claims 1-10 wherein the saccharide antigen **A** is a bacterial capsular saccharide, a saccharide of a viral glycoprotein, a saccharide antigen of sporozoa or parasites, a saccharide antigen of pathogenic fungi, or a saccharide antigen which is specific to cancer cells.

12. Compound according to any of the claims 1 – 10 for use as pharmaceutically active agent in medicine.

13. Compound according to any of the claims 1 – 11 for the use to raise a protective immune response in an animal.

14. Compound according to any of the claims 1 – 11 for use in vaccination against infectious diseases.

15. Compound according to claim 14, wherein the infectious disease is caused by a pathogen selected from the group comprising:
Allochromatium vinosum, Acinetobacter baumanii, Bacillus anthracis, Campylobacter jejuni, Clostridium spp., Citrobacter spp., Escherichia coli, Enterobacter spp., Enterococcus faecalis., Enterococcus faecium, Francisella tularensis, Haemophilus influenzae, Helicobacter pylori, Klebsiella spp., Listeria monocytogenes, Moraxella catharralis, Mycobacterium tuberculosis, Neisseria meningitidis, Neisseria gonorrhoeae, Proteus mirabilis, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella spp., Serratia spp., Shigella spp., Stenotrophomonas maltophilia, Staphyloccocus aureus, Staphyloccocus epidermidis, Streptococcus pneunmoniae, Streptococcus pyogenes, Streptococcus agalactiae, Yersina pestis, Yersina enterocolitica,
influenza virus, human immunodeficiency virus ("HIV"), herpes simplex virus ("HSV", type 1 or 2), human papilloma virus ("HPV", type 16 or 18), human cytomegalovirus ("HCMV") or human hepatitis B or C virus (“HBV”, Type B; "HCV", type C).

16. Compound according to claim 15, wherein the infectious disease is caused by a pathogen selected from Haemophilus influenzae and Streptococcus pneunmoniae.

17. Compound according to claims 11 wherein the bacterial capsular saccharide belongs to bacteria selected from:
Allochromatium vinosum, Acinetobacter baumanii, Bacillus anthracis, Campylobacter jejuni, Clostridium spp., Citrobacter spp., Escherichia coli, Enterobacter spp., Enterococcus faecalis., Enterococcus faecium, Francisella tularensis, Haemophilus influenzae, Helicobacter pylori, Klebsiella spp., Listeria monocytogenes, Moraxella catharralis, Mycobacterium tuberculosis, Neisseria meningitidis, Neisseria gonorrhoeae, Proteus mirabilis, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella spp., Serratia spp., Shigella spp., Stenotrophomonas maltophilia, Staphyloccocus aureus, Staphyloccocus epidermidis, Streptococcus pneunmoniae, Streptococcus pyogenes, Streptococcus agalactiae, Yersina pestis, und Yersina enterocolitica.

18. Compound according to claims 11 wherein the saccharide of viral glycoproteins belongs to viruses selected from:
Adenoviruses, Ebolavirus, Epstein-Barr-virus, Flavivirus, FSME-virus, Influenza virus, Hanta-virus, human immunodeficiency virus ("HIV"), herpes simplex virus ("HSV", type 1 or 2), human herpes virus 6 (HHV-6), human Papilloma virus ("HPV", type 16 or 18), human Cytomegalovirus ("HCMV"), human hepatitis B or C virus (“HBV”, Type B; "HCV", type C), Lassavirus, Lyssavirus (EBL 1 or EBL 2), Marburgvirus, Norovirus, Parvovirus B19, Pestvirus, Poliovirus, Rhinovirus, Rotaviruses, SARS-assciated Coronavirus, Varicella-Zoster virus.

19. Compound according to claims 11 wherein the saccharide antigen of sporozoa or parasites belongs to sporozoa or parasites selected from:
Babesia, Balantidium, Besnoitia, Blastocystis, Coccidia, Cryptosporidium, Cytauxzoon, Cyclospora, Dientamoeba, Eimeria, Entamoeba, Enterocytozoon, Enzephalitozoon, Eperythrozoon, Giardia, Hammondia, Isospora, Leishmania, Microsporidia, Naegleria, Plasmodium, Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae, Plasmodium knowlesi, Pneumocystis, Schistosoma, Sarcocystis, Theileria, Trichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Cestoda, Dipylidium, Dranunculus, Echinococcus, Fasciola, Fasciolopsis, Taenia, Ancylostoma, Ascaris, Brugia, Enterobius, Loa loa, Mansonella, Necator, Oncocerca, Strongyloides, Strongylus, Toxocara, Toxascaris, Trichuris oder Wucheria.

20. Compound according to claims 11 wherein the saccharide antigen of fungi belongs to fungi selected from:
Trichophyton mentagrophytes, Trichophyton rubrum, Trichophyton interdigitale, T. schönleinii, T. verrucosum, T. violaceum, T. tonsurans, Trichophyton spp., M. canis, Candida albicans, C. guillermondii, C. krusei, C. parapsilosis, C. tropicalis, C. glabrata, Candida spp., Microsporum spp., Microsporum canis, Microsporum audonii, Microsporum gypseum, M. ferrugineum, Trichosporum beigelii, Trichosporum inkiin, Aspergillus niger, Alternaria, Acremonium, Fusarium, or Scopulariopsis.

21. Compound according to claims 11 wherein the saccharide antigen which is specific to cancer cells belongs to the group of cancers selected from:
Bladder Cancer, Breast Cancer, Colon and Rectal Cancer, Endometrial Cancer, Kidney (Renal Cell) Cancer, Leukemia, Lung Cancer Melanoma, Non-Hodgkin Lymphoma, Pancreatic Cancer, Prostate Cancer, Thyroid Cancer.

22. Compound according to any of claims 1-10 wherein the average ratio of the carbohydrate antigen **A** to the glycolipid (**L-CH-CA**) is between 1:4 and 1:100 (n/n).

23. Compound according to any of claims 1 – 10 for the preparation of a vaccine formulation for the use in vaccination of an animal.

24. Vaccine formulation comprising one compound or a mixture of different compounds of any one of claims 1 – 22.

25. The vaccine formulation of claim 24, wherein the mixture of different compounds of the general formula (I) comprises a mixture of different serotypes of the used carbohydrate antigen **A**.

26. The vaccine formulation of claim 24 or 25, wherein the mixture of different compounds of the general formula (I) comprises a mixture of different carbohydrate antigens **A**, which are used in different compounds of the general formula (I).

27. The vaccine formulation of claim 24, 25 or 26 further comprising at least one pharmaceutically acceptable carrier, excipient and/or diluents.

Claims

1. Compound of the general formula (I):

$$\mathbf{A[L{-}{-}CH{-}{-}CA]_p}$$
$$\mathbf{(\ I\ )}$$

wherein

A represents a carbohydrate antigen of 1 to 10.000 carbohydrate monomers and the carbohydrate antigen belongs to the class of polysaccharides, wherein the carbohydrate monomers of the carbohydrate antigen are optionally modified to carry amide, carbonate, carbamate, carbonyl, thiocarbonyl, carboxy, thiocarboxy, ester, thioester, ether, epoxy, hydroxyalkyl, alkylenyl, phenylene, alkenyl, imino, imide, isourea, thiocarbamate, thiourea and/or urea moieties,

p is the number of residues **–L–CH–CA** which are bound to the carbohydrate antigen **A**, and

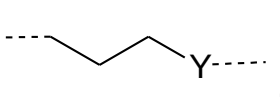
p is an integer defined as follows:

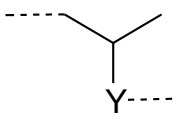
p is 1 or 2		if u is 1
p is 1, 2, 3 or 4		if u is 2
p is 1, 2, 3, 4, 5 or 6		if u is 3
p is 1, 2, 3, 4, 5, 6, 7 or 8		if u is 4
$1 \le p \le 10$	if	$5 \le u \le 10$
$2 \le p \le 50$	if	$11. \le u \le 100$
$20 \le p \le 200$	if	$101 \le u \le 1000$
$50 \le p \le 400$	if	$1001 \le u \le 10000$

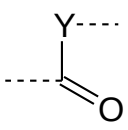
u is the number of carbohydrate monomers of the carbohydrate antigen **A**

L represents $\mathbf{–L^1–L^2–}$, $\mathbf{–L^2–}$, $\mathbf{–L^2–L^3–}$ or $\mathbf{–L^1–L^2–L^3–}$;

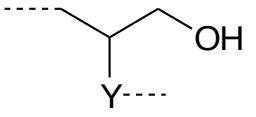
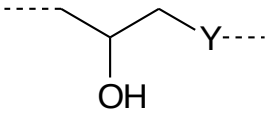
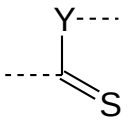
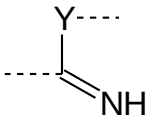
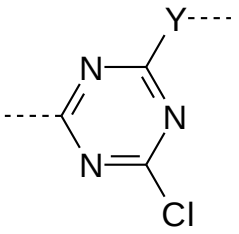
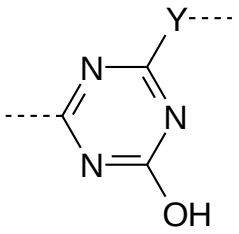
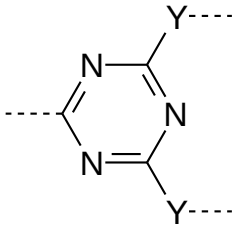
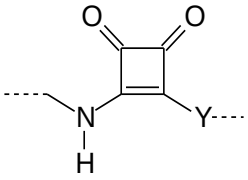
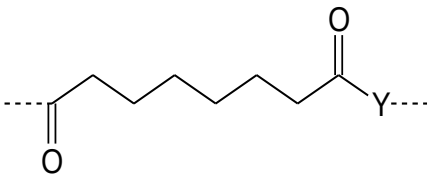
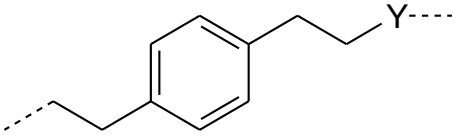
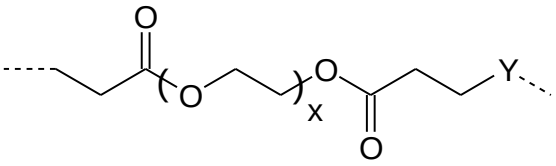
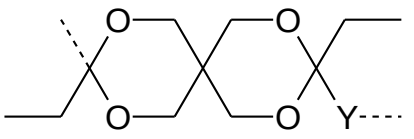
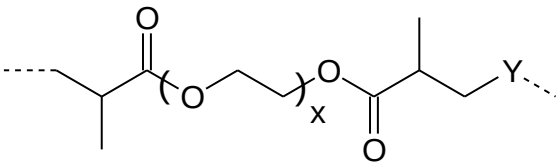
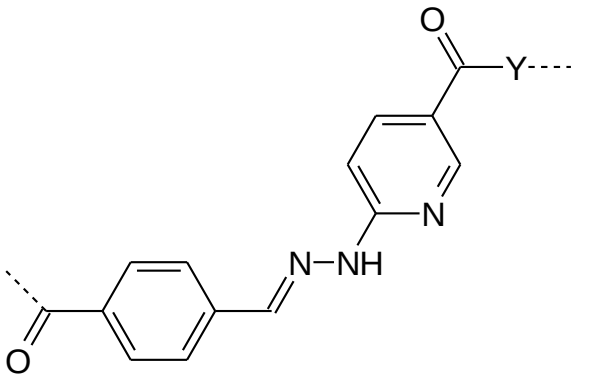
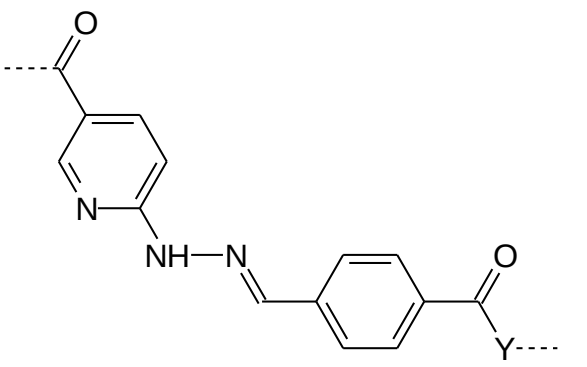
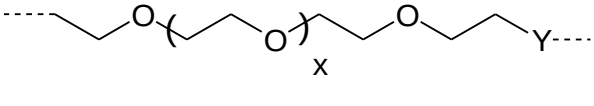
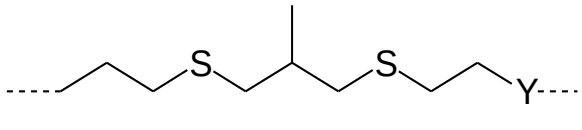
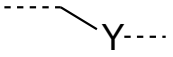
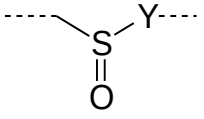
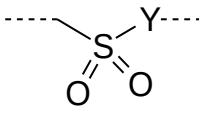
$\mathbf{L^1}$ represents one of the following residues:

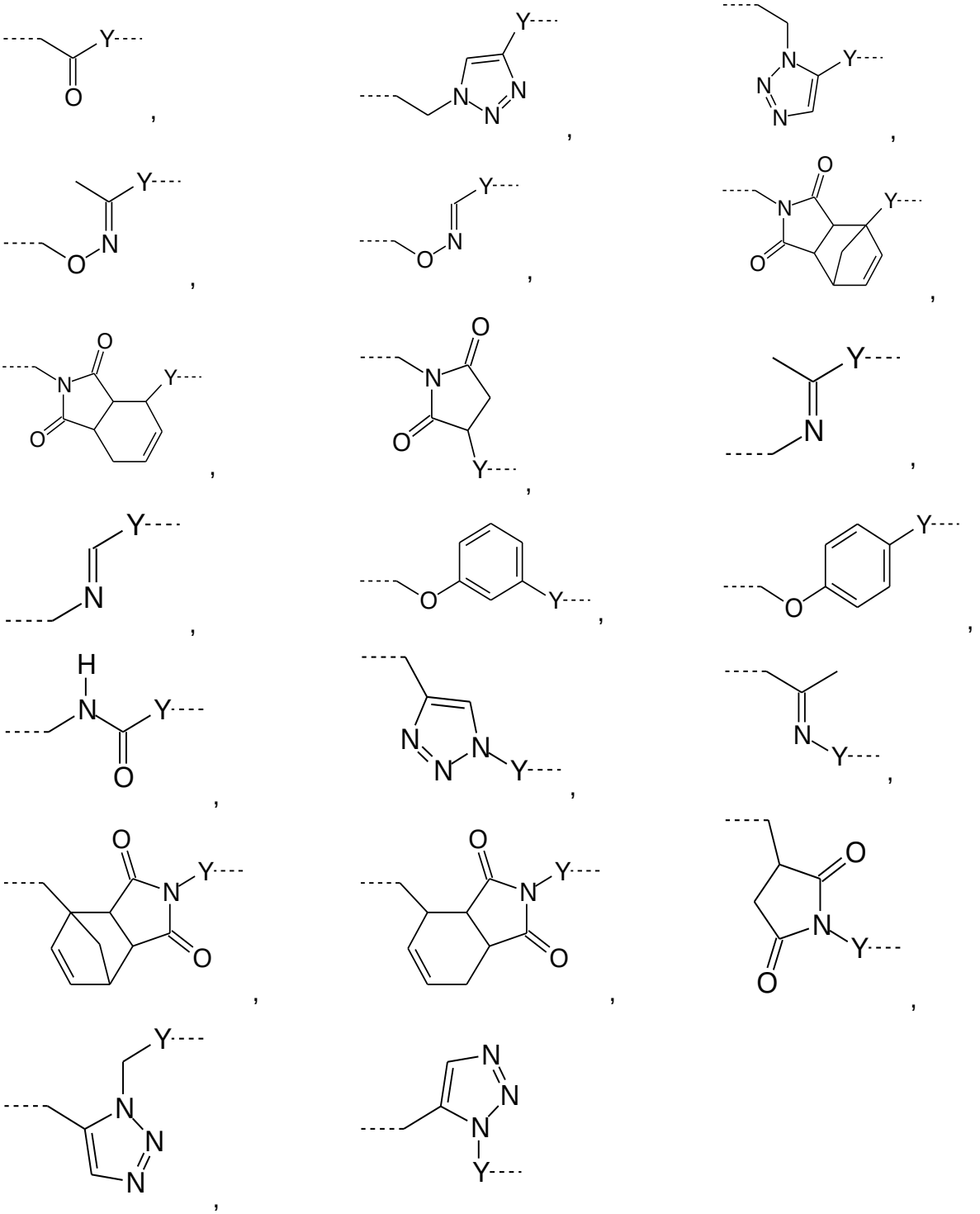


,


,


,



wherein x is in integer from 1 to 60;

Y represents a bond, –NH–, –O–, –S–; –S–S–;

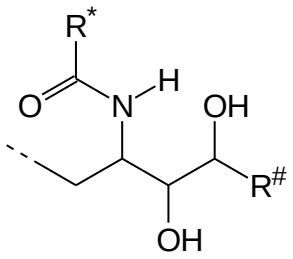
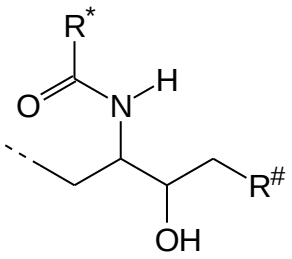
L² represents –CH_2–, –C_2H_4–, –C_3H_6–, –C_4H_8–, –C_5H_{10}–, –C_6H_{12}–, –C_7H_{14}–, –C_8H_{16}–, –C_9H_{18}–, –$C_{10}H_{20}$–, –$CH(CH_3)$–, –$C[(CH_3)_2]$–, –CH_2–$CH(CH_3)$–, –$CH(CH_3)$–CH_2–, –$CH(CH_3)$–C_2H_4–, –CH_2–$CH(CH_3)$–CH_2–, –C_2H_4–$CH(CH_3)$–, –CH_2–$C[(CH_3)_2]$–, –$C[(CH_3)_2]$–CH_2–, –$CH(CH_3)$–$CH(CH_3)$–,

–C[(C_2H_5)(CH_3)]–, –CH(C_3H_7)–, –(CH_2–CH_2–O)$_n$–CH_2–CH_2–, –CO–CH_2–, –CO–C_2H_4–, –CO–C_3H_6–, –CO–C_4H_8–, –CO–C_5H_{10}–, –CO–C_6H_{12}–, –CO–C_7H_{14}–, –CO–C_8H_{16}–, –CO–C_9H_{18}–, –CO–$C_{10}H_{20}$–, –CO–CH(CH_3)–, –CO–C[(CH_3)$_2$]–, –CO–CH_2–CH(CH_3)–, –CO–CH(CH_3)–CH_2–, –CO–CH(CH_3)–C_2H_4–, –CO–CH_2–CH(CH_3)–CH_2–, –CO–C_2H_4–CH(CH_3)–, –CO–CH_2–C[(CH_3)$_2$]–, –CO–C[(CH_3)$_2$]–CH_2–, –CO–CH(CH_3)–CH(CH_3)–, –CO–C[(C_2H_5)(CH_3)]–, –CO–CH(C_3H_7)–, –CO–(CH_2–CH_2–O)$_n$–CH_2–CH_2–;

n represents an integer from 1 to 60;

L^3 represents –CO–, –O–CO–, –NH–CO–, –NH(C=NH)–, –SO_2–, –O–SO_2–, –NH–, –NH–CO–CH_2–;

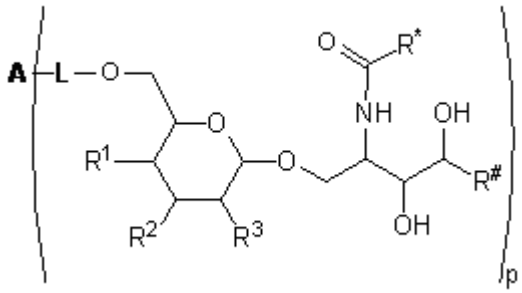
CH represents a monosaccharide, a disaccharide or a trisaccharide;

CA represents  or 

R* and **R**$^{\#}$ represent independently of each other a linear or branched or cyclic, substituted or unsubstituted, saturated or unsaturated carbon residue consisting of 1 to 30 carbon atoms;

and tautomers and pharmaceutically acceptable salts thereof.

2. Compound according to claim 1 of the general formula (II):



(II)

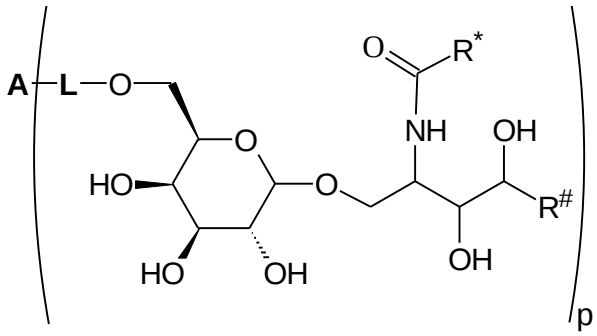
wherein

A, **L** and **p** have the meanings as defined in claim 1;

R^1, **R^2**, **R^3** represent independently of each other:
–H, –OH, –OCH_3, –OC_2H_5, –OC_3H_7, –O–SO_2–CH_3, –O–SO_2–C_2H_5, –O–SO_2–C_3H_7, –O–COOCH_3, –NHCOCH_3, –NH_2;

R* and **R$^\#$** represent independently of each other:
–CH_3, –$(CH_2)_r$–CH_3, –CH(OH)–$(CH_2)_s$–CH_3, –CH=CH–CH_3, –CH=CH–$(CH_2)_t$–CH_3, –CH(OH)–$(CH_2)_v$–$CH(CH_3)_2$, –CH(OH)–$(CH_2)_w$–$CH(CH_3)$–CH_2–CH_3, –$(CH_2)_a$–CH=CH–$(CH_2)_b$–CH_3, –$(CH_2)_c$–CH=CH–$(CH_2)_d$–CH=CH–$(CH_2)_e$–CH_3, –$(CH_2)_f$–CH=CH–$(CH_2)_g$–CH=CH–$(CH_2)_h$–CH=CH–$(CH_2)_i$–CH_3, –$(CH_2)_j$–CH=CH–$(CH_2)_k$–CH=CH–$(CH_2)_l$–CH=CH–$(CH_2)_o$–CH=CH–$(CH_2)_q$–CH_3,
wherein a, b, c, d, e, f, g, h, i, j, k, l, o, q are integers from 1 to 26 with the proviso that: (a+b) ≤ 27; (c+d+e) ≤ 25; (f+g+h+i) ≤ 23; (j+k+l+o+q) ≤ 21; and wherein r is an integer from 1 to 29, s is an integer from 1 to 28, t is an integer from 1 to 27, v is an integer from 1 to 26, w is an integer from 1 to 26.

3. Compound according to claim 1 of the general formula (XIV):



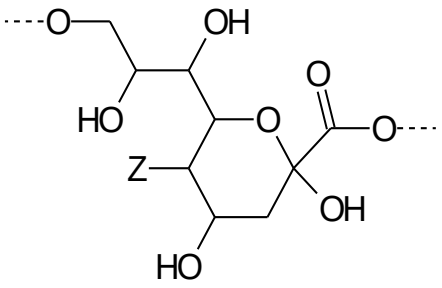
(XIV)

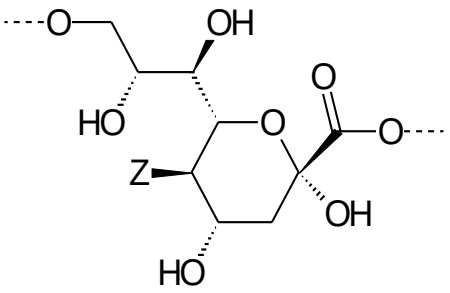
wherein
A, **L**, **R***, **R$^\#$** and **p** have the meanings as defined in claim 1.

4. Compound according to any one of claims 1 – 3, wherein the carbohydrate monomers of the carbohydrate antigen belong to the group of carbohydrates comprising:
α-D-ribopyranose, α-D-arabinopyranose, α-D-xylopyranose, α-D-lyxopyranose, α-D-allopyranose, α-D-altropyranose, α-D-glucopyranose, α-D-mannpyranose, α-D-glucopyranose, α-D-idopyranose, α-D-galactopyranose, α-D-talopyranose,

α-D-psicopyranose, α-D-fructopyranose, α-D-sorbopyranose, α-D-tagatopyranose, α-D-ribofuranose, α-D-arabinofuranose, α-D-xylofuranose, α-D-lyxofuranose, α-D-Allofuranose, α-D-Altrofuranose, α-D-Glucofuranose, α-D-Mannofuranose, α-D-gulofuranose, α-D-idofuranose, α-D-galactofuranose, α-D-talofuranose, α-D-psicofuranose, α-D-fructofuranose, α-D-sorbofuranose, α-D-tagatofuranose, α-D-xylulofuranose, α-D-ribulofuranose, α-D-threofuranose, α-D-rhamnopyranose, α-D-erythrofuranose, α-D-glucosamine, α-D-glucopyranuronic acid, β-D-ribopyranose, β-D-arabinopyranose, β-D-xylopyranose, β-D-lyxopyranose, β-D-allopyranose, β-D-altropyranose, β-D-glucopyranose, β-D-mannpyranose, β-D-glucopyranose, β-D-idopyranose, β-D-galactopyranose, β-D-talopyranose, β-D-psicopyranose, β-D-fructopyranose, β-D-sorbopyranose, β-D-tagatopyranose, β-D-ribofuranose, β-D-arabinofuranose, β-D-xylofuranose, β-D-lyxofuranose, β-D-rhamnopyranose, β-D-allofuranose, β-D-altrofuranose, β-D-glucofuranose, β-D-mannofuranose, β-D-gulofuranose, β-D-idofuranose, β-D-galactofuranose, β-D-talofuranose, β-D-psicofuranose, β-D-fructofuranose, β-D-sorbofuranose, β-D-tagatofuranose, β-D-xylulofuranose, β-D-ribulofuranose, β-D-threofuranose, β-D-erythrofuranose, β-D-glucosamine, β-D-glucopyranuronic acid, α-L-ribopyranose, α-L-arabinopyranose, α-L-xylopyranose, α-L-lyxopyranose, α-L-allopyranose, α-L-altropyranose, α-L-glucopyranose, α-L-mannpyranose, α-L-glucopyranose, α-L-idopyranose, α-L-galactopyranose, α-L-talopyranose, α-L-psicopyranose, α-L-fructopyranose, α-L-sorbopyranose, α-L-tagatopyranose, α-L-rhamnopyranose, α-L-ribofuranose, α-L-arabinofuranose, α-L-xylofuranose, α-L-lyxofuranose, α-L-Allofuranose, α-L-Altrofuranose, α-L-Glucofuranose, α-L-Mannofuranose, α-L-gulofuranose, α-L-idofuranose, α-L-galactofuranose, α-L-talofuranose, α-L-psicofuranose, α-L-fructofuranose, α-L-sorbofuranose, α-L-tagatofuranose, α-L-xylulofuranose, α-L-ribulofuranose, α-L-threofuranose, α-L-erythrofuranose, α-L-glucosamine, α-L-glucopyranuronic acid, β-L-ribopyranose, β-L-arabinopyranose, β-L-xylopyranose, β-L-lyxopyranose, β-L-allopyranose, β-L-altropyranose, β-L-glucopyranose, β-L-mannpyranose, β-L-glucopyranose, β-L-idopyranose, β-L-galactopyranose, β-L-talopyranose, β-L-psicopyranose, β-L-fructopyranose, β-L-sorbopyranose, β-L-tagatopyranose, β-L-ribofuranose, β-L-arabinofuranose, β-L-xylofuranose, β-L-lyxofuranose, β-L-allofuranose, β-L-altrofuranose, β-L-glucofuranose, β-L-mannofuranose, β-L-gulofuranose, β-L-idofuranose, β-L-galactofuranose, β-L-talofuranose, β-L-psicofuranose, β-L-fructofuranose, β-L-sorbofuranose, β-L-tagatofuranose, β-L-xylulofuranose, β-L-ribulofuranose, β-L-threofuranose, β-L-erythrofuranose, β-L-glucosamine, β-L-glucopyranuronic acid, β-L-rhamnopyranose,

or N- or O-substituted derivatives of neuraminic acid of the following formula:





wherein Z represents $–NH_2$, –NHAc, or –OH. ;

5. Compound according to any one of claims 1 – 4, wherein the carbohydrate monomers of the **CH**-moiety belong to the group of carbohydrates comprising:
α-D-ribopyranose, α-D-arabinopyranose, α-D-xylopyranose, α-D-lyxopyranose, α-D-allopyranose, α-D-altropyranose, α-D-glucopyranose, α-D-mannpyranose, α-D-glucopyranose, α-D-idopyranose, α-D-galactopyranose, α-D-talopyranose, α-D-psicopyranose, α-D-fructopyranose, α-D-sorbopyranose, α-D-tagatopyranose, α-D-ribofuranose, α-D-arabinofuranose, α-D-xylofuranose, α-D-lyxofuranose, α-D-Allofuranose, α-D-Altrofuranose, α-D-Glucofuranose, α-D-Mannofuranose, α-D-gulofuranose, α-D-idofuranose, α-D-galactofuranose, α-D-talofuranose, α-D-psicofuranose, α-D-fructofuranose, α-D-sorbofuranose, α-D-tagatofuranose, α-D-xylulofuranose, α-D-ribulofuranose, α-D-threofuranose, α-D-erythrofuranose, α-D-glucosamine, α-D-glucopyranuronic acid, α-D-rhamnopyranose, β-D-ribopyranose,
β-D-arabinopyranose, β-D-xylopyranose, β-D-lyxopyranose, β-D-allopyranose, β-D-altropyranose, β-D-glucopyranose, β-D-mannpyranose, β-D-glucopyranose, β-D-idopyranose, β-D-galactopyranose, β-D-talopyranose, β-D-psicopyranose, β-D-fructopyranose, β-D-sorbopyranose, β-D-tagatopyranose, β-D-ribofuranose, β-D-arabinofuranose, β-D-xylofuranose, β-D-lyxofuranose, β-D-allofuranose, β-D-altrofuranose, β-D-glucofuranose, β-D-mannofuranose, β-D-gulofuranose, β-D-idofuranose, β-D-galactofuranose, β-D-talofuranose, β-D-psicofuranose, β-D-fructofuranose, β-D-sorbofuranose, β-D-tagatofuranose, β-D-xylulofuranose, β-D-ribulofuranose, β-D-threofuranose, β-D-erythrofuranose, β-D-rhamnopyranose, β-D-glucosamine, β-D-glucopyranuronic acid, α-L-ribopyranose, α-L-arabinopyranose, α-L-xylopyranose, α-L-lyxopyranose, α-L-allopyranose, α-L-altropyranose, α-L-glucopyranose, α-L-mannpyranose, α-L-glucopyranose, α-L-idopyranose, α-L-galactopyranose, α-L-talopyranose, α-L-psicopyranose, α-L-fructopyranose, α-L-sorbopyranose, α-L-tagatopyranose, α-L-ribofuranose, α-L-arabinofuranose, α-L-xylofuranose, α-L-lyxofuranose, α-L-Allofuranose, α-L-Altrofuranose, α-L-Glucofuranose, α-L-Mannofuranose, α-L-

gulofuranose, α-L-idofuranose, α-L-galactofuranose, α-L-talofuranose, α-L-psicofuranose, α-L-fructofuranose, α-L-sorbofuranose, α-L-tagatofuranose, α-L-xylulofuranose, α-L-ribulofuranose, α-L-rhamnopyranose α-L-threofuranose, α-L-erythrofuranose, α-L-glucosamine, α-L-glucopyranuronic acid, β-L-ribopyranose, β-L-arabinopyranose, β-L-xylopyranose, β-L-lyxopyranose, β-L-allopyranose, β-L-altropyranose, β-L-glucopyranose, β-L-mannpyranose, β-L-glucopyranose, β-L-idopyranose, β-L-galactopyranose, β-L-talopyranose, β-L-psicopyranose, β-L-fructopyranose, β-L-sorbopyranose, β-L-tagatopyranose, β-L-ribofuranose, β-L-arabinofuranose, β-L-xylofuranose, β-L-lyxofuranose, β-L-allofuranose, β-L-altrofuranose, β-L-glucofuranose, β-L-mannofuranose, β-L-gulofuranose, β-L-idofuranose, β-L-galactofuranose, β-L-talofuranose, β-L-psicofuranose, β-L-fructofuranose, β-L-sorbofuranose, β-L-tagatofuranose, β-L-xylulofuranose, β-L-ribulofuranose, β-L-threofuranose, β-L-erythrofuranose, β-L-glucosamine, β-L-glucopyranuronic acid, β-L-rhamnopyranose.

6. Compound according to any of claims 1 – 5, wherein the saccharide antigen **A** is a bacterial capsular saccharide, a saccharide of a viral glycoprotein, a saccharide antigen of sporozoa or parasites, a saccharide antigen of pathogenic fungi, or a saccharide antigen which is specific to cancer cells.

7. Compound according to any of the claims 1 – 6 for use as pharmaceutically active agent in medicine or for use in vaccination against infectious diseases.

8. Compound according to claim 7, wherein the infectious disease is caused by a pathogen selected from the group comprising:
Allochromatium vinosum, Acinetobacter baumanii, Bacillus anthracis, Campylobacter jejuni, Clostridium spp., Citrobacter spp., Escherichia coli, Enterobacter spp., Enterococcus faecalis., Enterococcus faecium, Francisella tularensis, Haemophilus influenzae, Helicobacter pylori, Klebsiella spp., Listeria monocytogenes, Moraxella catharralis, Mycobacterium tuberculosis, Neisseria meningitidis, Neisseria gonorrhoeae, Proteus mirabilis, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella spp., Serratia spp., Shigella spp., Stenotrophomonas maltophilia, Staphyloccocus aureus, Staphyloccocus epidermidis, Streptococcus pneunmoniae, Streptococcus pyogenes, Streptococcus agalactiae, Yersina pestis, Yersina enterocolitica,
influenza virus, human immunodeficiency virus ("HIV"), herpes simplex virus ("HSV", type 1 or 2), human papilloma virus ("HPV", type 16 or 18), human cytomegalovirus ("HCMV") or human hepatitis B or C virus (“HBV”, Type B; "HCV", type C).

9. Compound according to claims 6, wherein the bacterial capsular saccharide belongs to bacteria selected from:
Allochromatium vinosum, Acinetobacter baumanii, Bacillus anthracis, Campylobacter jejuni, Clostridium spp., Citrobacter spp., Escherichia coli, Enterobacter spp., Enterococcus faecalis., Enterococcus faecium, Francisella tularensis, Haemophilus influenzae, Helicobacter pylori, Klebsiella spp., Listeria monocytogenes, Moraxella catharralis, Mycobacterium tuberculosis, Neisseria meningitidis, Neisseria gonorrhoeae, Proteus mirabilis, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella spp., Serratia spp., Shigella spp., Stenotrophomonas maltophilia, Staphyloccocus aureus, Staphyloccocus epidermidis, Streptococcus pneunmoniae, Streptococcus pyogenes, Streptococcus agalactiae, Yersina pestis, und Yersina enterocolitica.

10. Compound according to claims 6, wherein the saccharide of viral glycoproteins belongs to viruses selected from:
Adenoviruses, Ebolavirus, Epstein-Barr-virus, Flavivirus, FSME-virus, Influenza virus, Hanta-virus, human immunodeficiency virus ("HIV"), herpes simplex virus ("HSV", type 1 or 2), human herpes virus 6 (HHV-6), human Papilloma virus ("HPV", type 16 or 18), human Cytomegalovirus ("HCMV"), human hepatitis B or C virus (“HBV”, Type B; "HCV", type C), Lassavirus, Lyssavirus (EBL 1 or EBL 2), Marburgvirus, Norovirus, Parvovirus B19, Pestvirus, Poliovirus, Rhinovirus, Rotaviruses, SARS-assciated Coronavirus, Varicella-Zoster virus.

11. Compound according to claims 6, wherein the saccharide antigen of sporozoa or parasites belongs to sporozoa or parasites selected from:
Babesia, Balantidium, Besnoitia, Blastocystis, Coccidia, Cryptosporidium, Cytauxzoon, Cyclospora, Dientamoeba, Eimeria, Entamoeba, Enterocytozoon, Enzephalitozoon, Eperythrozoon, Giardia, Hammondia, Isospora, Leishmania, Microsporidia, Naegleria, Plasmodium, Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae, Plasmodium knowlesi, Pneumocystis, Schistosoma, Sarcocystis, Theileria, Trichinella, Toxoplasma, Trichomonas, Trypanosoma, Unicaria, Cestoda, Dipylidium, Dranunculus, Echinococcus, Fasciola, Fasciolopsis, Taenia, Ancylostoma, Ascaris, Brugia, Enterobius, Loa loa, Mansonella, Necator, Oncocerca, Strongyloides, Strongylus, Toxocara, Toxascaris, Trichuris oder Wucheria.

12. Compound according to claims 6, wherein the saccharide antigen of fungi belongs to fungi selected from:
Trichophyton mentagrophytes, Trichophyton rubrum, Trichophyton interdigitale, T. schönleinii, T. verrucosum, T. violaceum, T. tonsurans, Trichophyton spp., M. canis, Candida albicans, C. guillermondii, C. krusei, C. parapsilosis, C. tropicalis, C. glabrata, Candida spp., Microsporum spp., Microsporum canis, Microsporum audonii, Microsporum gypseum, M. ferrugineum, Trichosporum beigelii, Trichosporum inkiin, Aspergillus niger, Alternaria, Acremonium, Fusarium, or Scopulariopsis.

13. Compound according to claims 6, wherein the saccharide antigen which is specific to cancer cells belongs to the group of cancers selected from:
Bladder Cancer, Breast Cancer, Colon and Rectal Cancer, Endometrial Cancer, Kidney (Renal Cell) Cancer, Leukemia, Lung Cancer Melanoma, Non-Hodgkin Lymphoma, Pancreatic Cancer, Prostate Cancer, Thyroid Cancer.

14. Compound according to any of claims 1 – 6, wherein the average ratio of the carbohydrate antigen **A** to the glycolipid (**L-CH-CA**) is between 1:4 and 1:100 (n/n).

15. Vaccine formulation comprising one compound or a mixture of different compounds of any one of claims 1 – 14.