DOI: 10.1002/ejoc.200801170

Click Multivalent Homogeneous Neoglycoconjugates – Synthesis and Evaluation of Their Binding Affinities

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Dedicated to Professor Hans Helmut Baer

Keywords: Carbohydrates / Glycoconjugates / Multivalency / Cycloaddition / Click chemistry / Ligand design

Mannose (α-Man)-containing neoglycoconjugates possessing aliphatic-, aromatic-, and carbohydrate-centered architectures and differing in structural characteristics such as valency, topology, and nature of the linker have been synthesized using click chemistry that shows its value as an efficient and versatile methodology for accessing tailor-made multivalent neoglycoconjugates. The binding behaviour of these glycomimics toward Concanavalin A (Con A) has been evaluated to determine the influence of the structural parameters.

Introduction

The efficient construction of molecular systems bearing multiple carbohydrate appendages has become a necessity in the Glycobiology and Glycomic fields. The main reason for this requirement is based on the prevalence of the multivalent principle[1] in the ligand-receptor interactions in which carbohydrates are involved.[2] This effort to emulate Nature has led to the development of multivalent glycomimics[3] with different architectures (glycocluster,[4] glycodendrimers,[4,5] glycocyclodextrins,[6,7] glycocalixarenes,[7] glycopolymers,[8] and liposomes[9]) and carbohydrate densities to endow them with binding power greater than that of their monovalent analogues. These glycomimics have attracted attention because of their great potential not only to gain insight into the molecular recognition events in which carbohydrates participate but also for their capabilities in biotechnology, pharmaceutical and medical applications.[10] A second reason has been the demand of reliable techniques for the immobilization of carbohydrates in the preparation of carbohydrate-based surfaces. This driving force has led to the development of a variety of glycofunctionalized solid supports (microarrays, microbeads, biosensor chips, and self-assembled monolayers) as valuable tools with important applications in the "omic" sciences.[11]

Among the different reported methodologies for the covalent assembling of the constitutive modules of these polyvalent carbohydrate systems, the Cu^{I}-catalyzed 1,3-dipolar cycloaddition of azides and alkynes (CuAAC),[12] nowadays the best example under the "click-chemistry" concept,[13] has reached a relevant place in recent times as a powerful ligation method for glycoconjugation.[14] Owing to its reliability, efficiency, robustness, chemoselectivity, and tolerance to a variety of reaction conditions, this highly modular coupling reaction is especially useful for the effective construction of complex glycosylated structures. In addition, carbohydrates can easily be outfitted with an azido group, either on the anomeric center or by a spacer and, similarly, the introduction of an alkyne group is straightforward. In common with other ligating methodologies, monofunctionalized sugars are normally grafted onto polyfunctionalized scaffolds or solid supports giving rise to molecular glycosystems containing multiple 1,2,3-triazole rings as tethering groups.

For the synthesis of multivalent glycomimetics by means of click-chemistry reactions, diverse polyalkyne- as well as polyazide-functionalized scaffolds have been reacted with complementary monoazide or monoalkyne sugar derivatives.[14] The number of functions expressed in the scaffolds is the variable that allows access to neoglycoconjugates with different sugar densities and topologies. The scaffold structure and the nature of the spacer between the core and the clicking groups are normally the factors that provide variability to reach structures with diverse cluster presentation and lengths between the sugar moiety and the core. These variables are essential to gaining fundamental insights into the spatial factors regulating the binding of carbohydrates to maximize the individual carbohydrate-receptor interactions.

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In continuing our standing interest in the implementation of the click-chemistry methodology[15] for the preparation of multivalent neoglycoconjugates[16,17] and carbohydrate-based materials,[18] the synthesis of a series of α-Man-containing, homogeneous, multivalent glycoconjugates differing in the nature of the core, valency, topology, and nature of the sugar-core linker was envisaged in order to broaden the structural diversity of the aforementioned glycoconjugates. We sought to gain fundamental insights into the influence of those structural factors when these clicked multivalent systems are used as glycomimics toward natural lectins. This study is complemented by the synthesis of heterogeneous multivalent systems by a modular click strategy and the evaluation of their binding affinities as reported in the next article of this issue.[19]

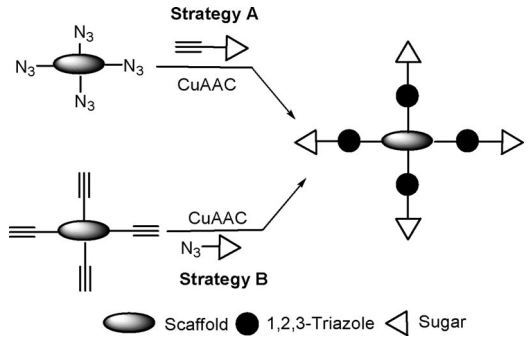


Figure 1. Click strategies for the synthesis of homogeneous multivalent neoglycoconjugates.

Results and Discussion

Chemistry

α-Man was the sugar of choice considering the wide use of Concanavalin A (Con A), the tetrameric plant lectin from *Canavalia ensiformis*, as a suitable model lectin that specifically recognizes α-Man residues.

We used two different chemical strategies for accessing the desired multivalent neoglycoconjugates by means of the CuAAC reaction as the ligating tool for the assembly of the different constitutive building blocks: Strategy A, based in the use of a polyazide scaffold, and Strategy B, based on the use of a polyalkyne scaffold (Figure 1).

In both cases, we treated the functionalized scaffolds with adequate, complementary, monofunctionalized, clickable, α-Man derivatives (Figure 2). Thus, we selected the alkynyl glycoside **1a**, the alkynyl thioglycoside **1b**, the azido α-Man **2c**, and the azido ethyl α-Man **2d** α-Man derivatives considering their easy preparation. We also chose the thioglycoside **1b** to assess the potential influence of the sulfur on the binding affinity and to take advantage of its higher hydrolytic stability relative to the corresponding *O*-glycoside analogs.

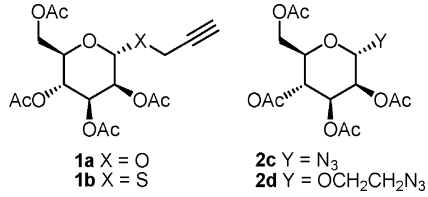


Figure 2. Monofunctionalized clickable alkynyl and azido α-Man derivatives.

We used a variety of aromatic-centered polyazides (**3B**–**3I**, Figure 3) differing in their valency (from two to six), and substitution pattern as scaffolds for strategy A. The azido group was linked to the aromatic ring through a methyl group except in the case of **3E** where the linker was an ethoxy chain. In addition, we also used 1,2-diazidoethane (**3A**) as a simple, homobifunctional, α-Man-contain-

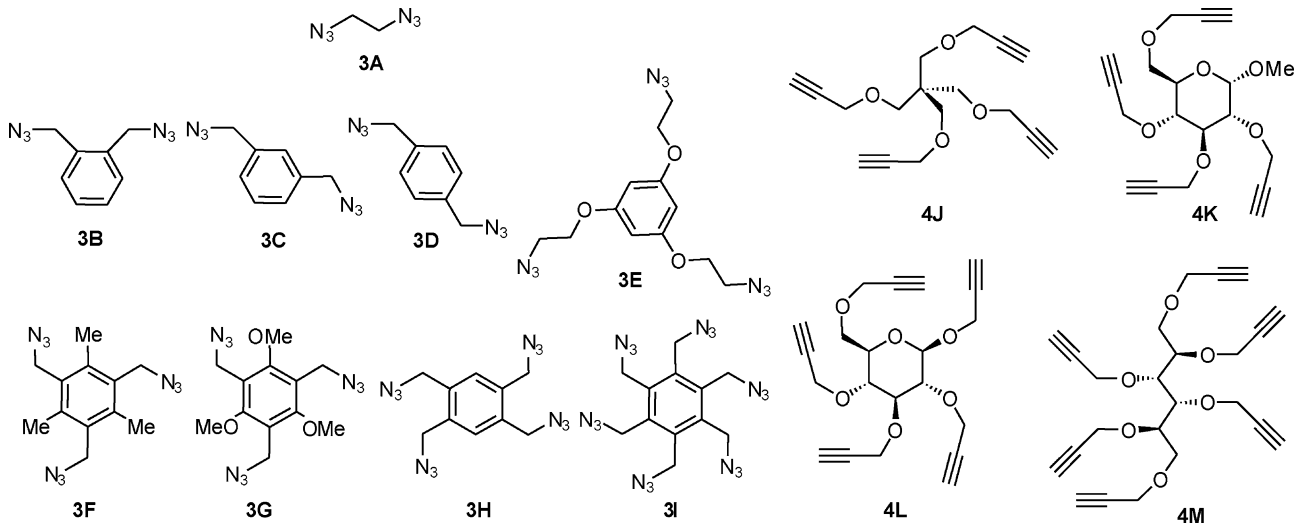
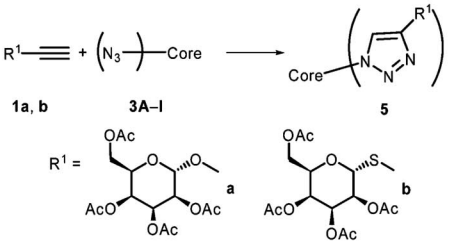
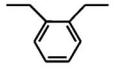
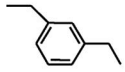
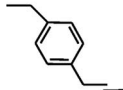
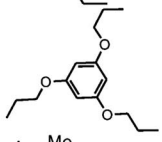
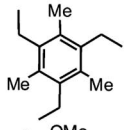
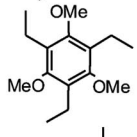
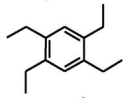
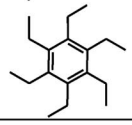


Figure 3. Polyazide (**3A**–**3I**) and polyalkyne scaffolds (**4J**–**4M**).

ing neoglycoconjugate to be used as a model compound together with methyl α-Man in the biological assays. For strategy **B**, we selected pentaerythritol, methyl α-D-glucopyranoside, D-glucose, and D-mannitol as polyhydroxylated compounds and alkylated them to access the corresponding perpropargylated derivatives **4J**–**4M** (Figure 3) to be used as polyalkyne scaffolds with valencies ranging from four to six.

Table 1. Synthesis of multivalent, homogeneous, neoglycoconjugates **5**[a] from polyazide scaffolds and monoalkyne sugars.

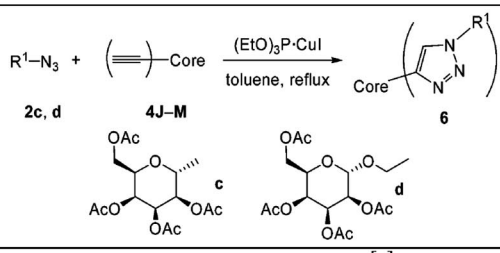


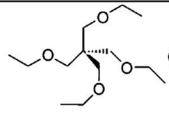
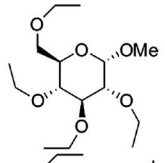
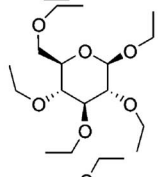
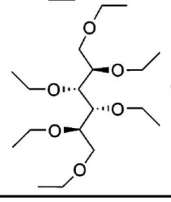
Entry	Core **3**		Compound **5**[b]	R^1	*n*
1	CH_2CH_2	**(3A)**	**5Aa** (A, 11, 93)	**a**	2
2			**5Ab** (B, 20, 77)	**b**	2
3		**(3B)**	**5Ba** (A, 8, 90)	**a**	2
4			**5Bb**(B, 12, 75)	**b**	2
5		**(3C)**	**5Ca** (A, 8, 80)	**a**	2
6			**5Cb** (B, 12, 86)	**b**	2
7		**(3D)**	**5Da** (A, 12, 74)	**a**	2
8			**5Db** (B, 20, 68)	**b**	2
9		**(3E)**	**5Ea** (A, 120, 71)	**a**	3
10			**5Eb** (A, 15, 92)	**b**	3
11		**(3F)**	**5Fa** (B, 14, 80)	**a**	3
12			**5Fb** (B, 20, 78)	**b**	3
13		**(3G)**	**5Ga** (A, 75, 79)	**a**	3
14			**5Gb** (A, 60, 100)	**b**	3
15		**(3H)**	**5Ha** (B, 6, 85)	**a**	4
16			**5Hb** (B, 24, 77)	**b**	4
17		**(3I)**	**5Ia** (B, 20, 77)	**a**	6
18			**5Ib** (C, 40, 65)	**b**	6

[a] Reaction conditions: A: $(EtO)_3P{\cdot}CuI$, toluene, microwave irradiation; B: $(EtO)_3P{\cdot}CuI$, toluene, DIPEA, microwave irradiation; C: $(EtO)_3P{\cdot}CuI$, DIPEA, DMF, 80 °C. [b] Compound (reaction conditions, reaction time [min], % yield).

We carried out the CuAAC reactions using the clickable, α-Man, peracetylated derivatives to facilitate solubility in organic media, where the cycloadditions were performed (Table 1 and Table 2). We conducted these cycloaddition reactions using the Cu catalyst $(EtO)_3P{\cdot}CuI$ (10 mol-%) in toluene under microwave irradiation or at reflux, conditions that we found optimal previously.[16–18] We initially performed the reactions in the absence of any base. However, in some cases (Method B, Table 1) we found that the presence of DIPEA favored the ligation of the complementary clickable counterparts. We note that the reaction of the hexamethylazide benzene **3I** with the alkynyl thioglycoside **1b** under these conditions failed for the complete grafting of all the azidomethyl arms in spite of extended reaction times. In this case, we obtained the hexavalent neoglycoconjugate **5Ib** in DMF by heating the reaction mixture at 80 °C in the presence of DIPEA.

Table 2. Synthesis of multivalent homogeneous neoglycoconjugates **6**[a] from polyalkyne scaffolds and monoazide sugars.



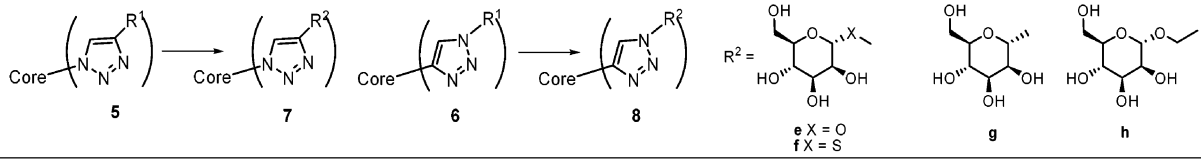
Entry	Core **4**		Compound **6**[a]	R^1	*n*
1		**(4J)**	**6Jc** (24, 79)	**c**	4
2			**6Jd** (2, 80)	**d**	4
3		**(4K)**	**6Kc** (5, 80)	**c**	4
4			**6Kd** (1.5, 88)	**d**	4
5		**(4L)**	**6Lc** (3, 75)	**c**	5
6			**6Ld** (1, 88)	**d**	5
7		**(4M)**	**6Mc** (6, 67)	**c**	6
8			**6Md** (1, 74)	**d**	6

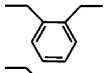
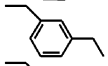
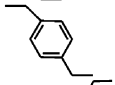
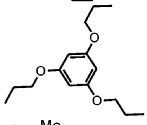
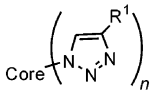
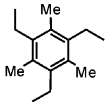
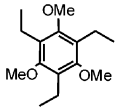
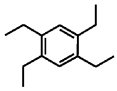
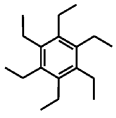
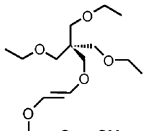
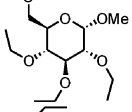
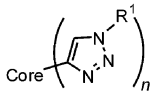
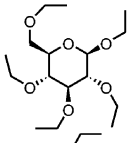
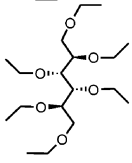
[a] Compound (reaction time [h], % yield).

In the majority of the cases, the reaction were finished in very short reaction times, particularly when we used microwave irradiation, and we isolated the clicked, multivalent, homogeneous neoglycoconjugates in high yields. We per-

formed de-*O*-protection of the peracetylated derivatives obtained using NaOMe or Et_3N in MeOH to obtain the corresponding hydroxylated **7** and **8**, which we evaluated for their relative binding inhibitory properties against peroxidase-labeled Con A (see Table 3). All new compounds were adequately characterized by spectroscopic techniques.

Table 3. Synthesis and binding affinities of multivalent homogeneous hydroxylated neoglycoconjugates **7** and **8**.



Entry	Structure	Core	Acetylated derivative	Compound[a]	R^2	*n*	IC_{50} (mM)	Relative affinity	Rel. potency per Man
1		CH_2CH_2	**5Aa**	**7Ae** (A, 91)	**e**	2	0.692	1.30	0.65
2			**5Ab**	**7Af** (A, 79)	**f**	2	0.682	1.36	0.68
3			**5Ba**	**7Be** (A, 75)	**e**	2	0.441	2.04	1.02
4			**5Bb**	**7Bf** (A, 100)	**f**	2	0.396	2.27	1.13
5			**5Ca**	**7Ce** (A, 78)	**e**	2	0.373	2.41	1.20
6			**5Cb**	**7Cf** (A, 80)	**f**	2	0.256	3.66	1.83
7			**5Da**	**7De** (A, 100)	**e**	2	0.656	1.37	0.68
8			**5Db**	**7Df** (A, 71)	**f**	2	0.306	2.94	1.47
9			**5Ea**	**7Ee** (A, 85)	**e**	3	0.093	9.60	3.20
10			**5Eb**	**7Ef** (A, 81)	**f**	3	0.173	5.20	1.73
11			**5Fa**	**7Fe** (A, 91)	**e**	3	0.153	5.87	1.96
12			**5Fb**	**7Ff** (A, 95)	**f**	3	0.123	7.3	2.43
13			**5Ga**	**7Ge** (A, 76)	**e**	3	0.105	8.54	2.85
14			**5Gb**	**7Gf** (A, 83)	**f**	3	0.130	6.90	2.30
15			**5Ha**	**7He** (A, 95)	**e**	4	0.121	7.45	1.86
16			**5Hb**	**7Hf** (A, 86)	**f**	4	0.077	11.6	2.90
17			**5Ia**	**7Ie** (A, 92)	**e**	6	0.234	3.84	0.64
18			**5Ib**	**7If** (A, 82)	**f**	6	0.083	10.8	1.80
19			**6Jc**	**8Jg** (B, 85)	**g**	4	0.179	5.03	1.26
20			**6Jd**	**8Jh** (B, 87)	**h**	4	0.124	7.23	1.80
21			**6Kc**	**8Kg** (B, 92)	**g**	4	0.197	4.56	1.14
22			**6Kd**	**8Kh** (B, 90)	**h**	4	0.159	5.64	1.41
23			**6Lc**	**8Lg** (B, 94)	**g**	5	0.147	6.10	1.22
24			**6Ld**	**8Lh** (B, 87)	**h**	5	0.111	8.10	1.62
25			**6Mc**	**8Mg** (A, 90)	**g**	6	0.253	3.55	0.59
26			**6Md**	**8Mh** (A, 90)	**h**	6	0.219	4.10	0.68

[a] Compound (Method, % yield). Method A: Et_3N, MeOH, reflux, 2–3 h; Method B: NaOMe, MeOH, room temp., 2–3 h.

Lectin Affinity Evaluation

The affinities of the hydroxylated, homogeneous, multivalent neoglycoconjugates **7** and **8** toward Con A were evaluated by the ELISA-type protocol, ELLA (Table 3). This experiment measures the capacity of a soluble ligand to inhibit lectin binding to a polymeric ligand that is used as a coating material on the microtiter well. In the present case, we carried out competitive experiments using horseradish peroxidase-labeled Con A (HRP-Con A) as the lectin and yeast mannan as the microplate-fixed ligand in triplicate. We included methyl α-Man in the tests as a reference compound. We considered up to six different concentrations of each sample, and the percentage of the inhibition of HRP-Con A-yeast mannan association was determined spectrophotometrically. We determined the IC_{50} values, defined as the concentration of synthetic compound required to achieve 50% inhibition of this association, from the corresponding inhibition curves. We assumed the IC_{50} values to be inversely proportional to the corresponding free energy of binding. The binding affinities of the references and the homo neoglycoconjugates for Con A are summarized in Table 3. The valency-corrected relative binding potencies are expressed per mol of α-Man residue relative to the monovalent methyl α-Man.

An analysis of the binding affinity values found for these novel homo neoglycoconjugates lead to the following conclusions. First, in the case of divalent systems (Table 3, Entries 1–8), we observed that aliphatic-centered systems (**7Ae** and **7Af**) show lower relative affinities than do systems constructed using an aromatic scaffold (**7Be**, **7Bf**, **7Ce**, **7Cf**, **7De**, and **7Df**). In these aromatic-centered glycoconjugates, we also observed an influence of the topology, as *meta*-substituted **7Ce** and **7Cf** showed the highest relative affinity values.

In the case of the trivalent systems (Table 3, Entries 9–14), we bring attention to an influence of the electronic density of the aromatic core on the binding recognition properties. Thus, the thioglycoside-containing **7Ff** was higher in affinity than its *O*-glycoside-containing homologue **7Fe**, but this trend was inverted in the electronic-rich neoglycoconjugates **7Ee**, **7Ef**, **7Ge**, and **7Gf**, where the higher values were observed for the *O*-glycosides **7Ee** and **7Gf**.

In the case of the *O*-glycoside-containing tetravalent systems (**7He**, **8Jh**, and **8Kh**, Table 3, Entries 15, 20, and 22) we observed that the aromatic-centered **7He** had a higher binding affinity than that of the non-aromatic **8Jh** and **8Kh**. This fact is in line with the previously observed tendency for divalent systems, where the aromatic neoglycoconjugates showed better binding properties. These data, together with the higher relative affinity values of the cyclic sugar derivatives **8Lg** and **8Lh** relative to that of the open-chain mannitol derivatives **8Mg** and **8Mh**, indicates that rigid systems are better binders than more conformationally flexible compounds. However, we could not be discard the interactions of the aromatic rings with Con A residues to explain this increased binding.[20] Previous contributions by others have clearly established the positive effect of the presence of an aromatic substituent at the anomeric position of glycoside derivatives upon the binding to Con A and related lectins.[21]

An overall analysis of the relative potency per α-Man unit values allows for the determination of the influence of the valency on the binding properties of the neoglycoconjugates. Thus, we observed a positive effect when the valency increased from two to three. However, we observed no significant increases in affinity on going from trivalent to tetravalent systems, and we even noted a decrease in penta- and hexavalent systems.

Concerning the influence of the anomeric atom, we note that in all the aromatic-centered systems, we observed better binding for the thioglycoside-containing systems in systems of similar substitution than for their *O*-glycoside-containing counterparts, except for the trivalent electronic-rich systems (**7Ee**, **7Ef**, **7Ge**, and **7Gf**), where the tendency was opposite, as mentioned above.

Finally, we note that in all the compounds obtained from polyalkyne scaffolds by the strategy B (Table 3, Entries 21–26) the presence of an ethoxy linker at the anomeric position had a beneficial effect on the inhibitory properties of these multivalent neoglycoconjugates, as we observed higher relative affinities for **8Jh**, **8Kh**, **8Lh**, and **8Mh** than for **8Jg**, **8Kg**, **8Lg**, and **8Mg**, where the anomeric carbon is directly grafted to the triazole ring.

Conclusions

In summary, we performed the synthesis of structurally diverse, α-Man-containing, homogeneous neoglycoconjugates possessing aliphatic-, aromatic-, and carbohydrate-centered architectures using CuAAC reactions as a covalent ligating tool for the assembly of clickable anomeric α-Man derivatives onto suitable, complementary, functionalized scaffolds. The methodology is highly efficient and versatile showing its value as a general and convenient way to connect multiple units of a sugar residue to a central core for the rapid generation of tailor-made neoglycoconjugates differing in structural factors such as the sugar densities (valency), topology (substitution pattern), nature of the linker, and electronic characteristics of the core. The ELISA-type assays performed with the novel, synthesized neoglycoconjugates to evaluate the influence of those structural parameters allowed us to obtain relevant information. Thus, the valency, electronic characteristics of the core, and linker were the most important parameters that determine the inhibitory properties of the neoglycoconjugates.

Experimental Section

General: TLC was performed on Merck Silica Gel 60 F_{254} aluminum sheets. Reagents used for developing plates include ceric sulfate (1% w/v) and ammonium sulfate (2.5% w/v) in 10% (v/v) aqueous sulfuric acid, iodine, ethanolic sulfuric acid (10% v/v), and UV light when applicable. Flash column chromatography was performed on Silica Gel Scharlau (230–400 mesh, ASTM). Melting

points were measured with a Gallenkamp melting point apparatus and are uncorrected. Optical rotations were recorded with a Perkin–Elmer 141 polarimeter at room temp. IR spectra were recorded with a Satellite Mattson FTIR. ^{1}H and ^{13}C NMR spectra were recorded at room temp. with a Bruker (300 or 400 MHz) spectrometer. Chemical shifts are given in ppm and referenced to internal $CDCl_3$. *J* values are given in Hz. FAB mass spectra were recorded with a Fissons VG Autospec-Q spectrometer, using *m*-nitrobenzyl alcohol or thioglycerol as the matrix. MALDI-TOF mass spectra were recorded with a Bruker Autoflex spectrometer using DHB or HCCA as the matrix. Propargyl bromide, α,α-dichloro-*m*-xilene, cyanuric chloride, and 1,2,4,5-tetrakis(bromomethyl)benzene were purchased from Aldrich. Compounds **1a**,[22,23] **1b**,[24] **2c**,[25] **2d**,[26] **3B**–**3D**,[27] **3F**,[28] **3G**,[29] **3H**,[30] **3I**,[31] **4J**,[32] and **4L**[17] were obtained following the procedures described in the literature.

2,4,6-Tris(2-azidoethoxy)-1,3,5-triazine (3E): To a cold solution of cyanuric chloride (1.87 g, 10 mmol) and 2-azido ethanol (5.2 g, 60 mmol) in dry acetonitrile (25 mL) was added dropwise a solution of DIPEA (7 mL) in acetonitrile (10 mL). The reaction mixture was maintained at room temp. for 2 d. After the solvent was evaporated, the crude product was dissolved in chloroform (150 mL) and washed with H_2O (50 mL). The organic phase was dried (Na_2SO_4) and filtered, and the solvents were evaporated. Column chromatography (CH_2Cl_2/diethyl ether, 20:1) gave **3E** (2.34 g, 70%) as a liquid. IR (film): $\tilde{\nu}$ = 2105, 1554, 1329, 1294 cm^{-1}. ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 4.59 (t, *J* = 5.1 Hz, 1 H, CH_2O), 3.68 (t, *J* = 5.1 Hz, 6 H, CH_2N_3) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 171.8, 67.3, 49.4 ppm.

Methyl 2,3,4,6-Tetra-*O*-propargyl-α-D-glucopyranoside (4K): NaH (371 mg, 15.46 mmol) was added to a solution of methyl α-D-glucopyranoside (1 g, 5.49 mmol) in anhydrous DMF (25 mL). The suspension was magnetically stirred for 30 min at room temp. Propargyl bromide (7.7 mL, 103 mmol) was then added dropwise, and the reaction mixture was maintained for 16 h. After the mixture was cooled, MeOH (10 mL) was added, and the solvents were removed after 30 min. The addition of H_2O (20 mL) to the resulting crude material was followed by extraction with toluene/diethyl ether (3:1, 2 × 50 mL). The organic phase was dried (Na_2SO_4) and filtered, and the solvents were evaporated under vacuum The crude material was purified by column chromatography EtOAc/hexane (1:3) giving **4K** as a syrup (752 mg, 85%): $[\alpha]_D^{20}$ = +80 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 3290, 2923, 2867, 2116, 1728, 1446, 1355, 1267, 1158, 1043 cm^{-1}. ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 4.90 (d, *J* = 3.5 Hz, 1 H, H-1), 4.36 (several m, 8 H, $CH_2C{\equiv}CH$), 3.84 (t, *J* = 9.2 Hz, 1 H), 3.82 (m, 2 H, H-6,6), 3.71 (m, 1 H, H-5), 3.62 (dd, *J* = 9.6, 3.6 Hz, 1 H, H-2), 3.51 (m, 1 H, H-4), 3.41 (s, 1 H, OMe), 2.47 (m, 4 H, C≡CH) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 97.9, 81.2, 80.0, 79.7, 79.3, 79.1, 76.5, 75.0, 74.3, 74.2, 69.4, 68.0, 60.3, 60.1, 58.6, 58.6, 55.2 ppm. HRMS (FAB+): calcd. for $C_{19}H_{22}O_6Na$ [M + Na]$^+$ 369.1314; found 369.1315.

1,2,3,4,5,6-Hexakis-*O*-propargyl-D-mannitol (4M): NaH (1.25 g, 49.40 mmol) was added to a solution of D-mannitol (500 mg, 2.56 mmol) in anhydrous DMF (25 mL). The suspension was magnetically stirred for 30 min at room temp. Propargyl bromide (80% toluene solution, 24.5 mL, 165 mmol) was then added dropwise, and the reaction mixture was maintained for 16 h. After the mixture was cooled, MeOH (10 mL) was added, and the solvents were removed after 30 min. The addition of H_2O (20 mL) to the resulting crude material was followed by extraction with toluene/diethyl ether (3:1, 2 × 50 mL). The organic phase was dried (Na_2SO_4) and filtered, and the solvents were evaporated under vacuum The crude material was purified by column chromatography EtOAc/hexane (1:3) giving **4M** as a syrup (1.71 g, 74%): IR (KBr): $\tilde{\nu}$ = 3286, 2889, 2112, 1483, 1327, 1095 cm^{-1}. ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 4.39 (d, *J* = 2.4 Hz, 4 H), 4.35 (d, *J* = 2.4 Hz, 2 H), 4.33 (d, *J* = 2.4 Hz, 2 H), 4.23 (d, *J* = 2.3 Hz, 4 H), 3.85 (several m, 8 H), 2.45 (m, 6 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 80.23, 79.9, 79.6, 78.1, 77.3, 74.5, 68.1, 59.9, 58.5, 56.9 ppm. HRMS (FAB+): calcd. for $C_{24}H_{26}O_6Na$ [M + Na]$^+$ 433.1627; found 433.1621.

General Procedure for the Cycloaddition Reactions. Method A: A solution in toluene (10 mL) of the polyazide scaffold **3A**–**3I** (1 equiv.), the corresponding complementary propargyl sugar **1a**–**b** (1.2 equiv. per reactive group of the scaffold), and the Cu catalyst [$(EtO)_3P{\cdot}CuI$][16] (0.1 equiv. per reactive group of the scaffold) was irradiated at 800 W and 90 °C in a Milestone Star Microwave Labstation until TLC or the IR spectrum of the reaction mixture showed complete disappearance of the starting material (see Table 1 for reaction times). Evaporation of the solvent yielded a crude material that was purified by column chromatography.

Method B: A solution in toluene (10 mL) of the polyazide or polyalkyne **3A**–**3I** (1 equiv.), the propargyl sugar derivative **1a**–**b** (1.2 equiv. per reactive group of the scaffold), the Cu catalyst [$(EtO)_3P{\cdot}CuI$][16] (0.1 equiv. per reactive group of the scaffold), and DIPEA (3.0 equiv. per reactive group of the scaffold) was irradiated at 800 W and 90 °C in a Milestone Star Microwave Labstation until TLC or the IR spectrum of the reaction mixture showed complete disappearance of the starting material (see Table 1 for reaction times). Evaporation of the solvent yielded a crude material that was purified by column chromatography.

Method C: A solution in DMF (10 mL) of the polyazide scaffold **3I** (1 equiv.), the corresponding complementary propargyl sugar derivative **1b** (1.2 equiv. per reactive group of the scaffold), the Cu catalyst [$(EtO)_3P{\cdot}CuI$][16] (0.1 equiv. per reactive group of the scaffold), and DIPEA (3.0 equiv. per reactive group of the scaffold) was heated at 80 °C until TLC and the IR spectrum of the reaction mixture showed complete disappearance of the starting material (see Table 1 for reaction times). Evaporation of the solvent yielded a crude material that was purified by column chromatography.

Method D: A solution in toluene (10 mL) of the polyalkyne scaffold **4J**–**4M** (1 equiv.), the corresponding complementary azide sugar derivative **2c**–**d** (1.2 equiv. per reactive group of the scaffold), and the Cu catalyst [$(EtO)_3P{\cdot}CuI$][16] (0.1 equiv. per reactive group of the scaffold) was refluxed until TLC or the IR spectrum of the reaction mixture showed complete disappearance of the starting material (see Table 2 for reaction times). Evaporation of the solvent yielded a crude material that was purified by column chromatography.

1,2-Bis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-yl}ethane (5Aa): Obtained from **1a** (463 mg) and **3A** (56 mg) following the general procedure (Method A). Column chromatography gave **5Aa** as a solid (411 mg, 93%); m.p. 59–61 °C. $[\alpha]_D^{20}$ = +37 (*c* = 2 in chloroform); IR (KBr): $\tilde{\nu}$ = 3144, 1746, 1372, 1230, 1135, 1048 cm^{-1}. ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 7.43 (s, 2 H, H-5 triazole), 5.30–5.25 (m, 4 H, H-3,4), 5.19 (s, 2 H, H-2), 4.96 (s, 4 H, CH_2N), 4.94 (s, 2 H, H-1), 4.80 (d, *J* = 12.3 Hz, 2 H, CH_2O), 4.65 (d, *J* = 12.3 Hz, 2 H, CH_2O), 4.29 (dd, *J* = 12.2, 5.0 Hz, 2 H, H-6), 4.11 (dd, *J* = 12.3, 2.4 Hz, 2 H, H-6), 4.06 (m, 2 H, H-5), 2.15, 2.12, 2.04, 1.98 (4 s, 24 H, 8 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.7, 170.1, 170.0, 169.8, 144.0, 124.3, 96.9, 69.5, 69.1, 68.8, 66.2, 62.5, 60.7, 49.6, 20.9, 20.8, 20.7, 20.7 ppm. HRMS (FAB+): calcd. for $C_{36}H_{48}N_6O_{20}$ [M + Na]$^+$ 907.2821; found 907.2824.

1,2-Bis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-yl}ethane (5Ab): Obtained from **1b** (482 mg) and **3A** (56 mg) following the general procedure, (Method B). Column chromatography (EtOAc/MeOH, 20:1) gave **5Ab** as a solid (352 mg, 77%); m.p. 88–91 °C. $[\alpha]_D^{20}$ = +158 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1748, 1371, 1228, 1050 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.34 (s, 2 H), 5.33 (t, *J* = 9.8 Hz, 2 H), 5.28 (d, *J* = 3.3 Hz, 2 H), 5.26 (s, 2 H), 5.21 (dd, *J* = 10.0, 3.2 Hz, 2 H), 4.91 (AB system, 4 H), 4.37 (m, 2 H), 4.29 (dd, *J* = 12.2, 5.0 Hz, 2 H), 4.09 (m, 2 H), 3.91 (d, *J* = 14.6 Hz, 2 H) 3.80 (d, *J* = 14.5 Hz, 2 H), 2.15, 2.11, 2.06, 1.99 (4 s, 24 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.5, 169.9, 169.7, 169.6, 144.3, 123.3, 81.4, 70.6, 69.5, 69.2, 66.1, 62.3, 49.5, 24.4, 20.8, 20.7, 20.6, 20.5 ppm. HRMS (MALDI-TOF): calcd. for $C_{36}H_{49}N_6O_{20}S_2$ $[M + H]^+$ 917.2540; found 917.2050.

1,2-Bis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (5Ba): Obtained from **1a** (4623 mg) and **3B** (482 mg) following the general procedure (Method A). Column chromatography (EtOAc) gave **5Ba** as a syrup (432 mg, 90%): $[\alpha]_D^{20}$ = +39 (*c* = 1 in MeOH); IR (KBr): $\tilde{\nu}$ = 1747, 1438, 1372, 1227, 1135, 1048 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.59 (s, 2 H, H-5 triazole), 7.42 (dd, *J* = 5.7, 3.4 Hz, 1 H, C_6H_4), 7.29 (dd, *J* = 5.6, 3.4 Hz, 2 H, C_6H_4), 5.68 (s, 4 H, CH_2N), 5.30–5.25 (m, 4 H, H-3,4), 5.22 (dd, *J* = 2.8, 1.6 Hz, 2 H, H-2), 4.95 (d, *J* = 1.6 Hz, 2 H, H-1), 4.82 (d, *J* = 12.4 Hz, 2 H, CH_2O), 4.67 (d, *J* = 12.4 Hz, 2 H, CH_2O), 4.28 (dd, *J* = 12.4, 5.2 Hz, 2 H, H-6), 4.15–4.00 (m, 4 H, H-5,6), 2.14, 2.11, 2.03, 1.98 (4 s, 24 H, 8 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.6, 169.9, 169.8, 169.6, 143.9, 133.2, 130.4, 129.9, 123.2, 96.9, 69.4, 69.0, 68.7, 66.0, 62.3, 60.9, 51.2, 21.0, 20.8, 20.7, 20.6 ppm. HRMS (FAB+): calcd. for $C_{42}H_{52}N_6O_{20}$ $[M + Na]^+$ 983.3134; found 983.3138.

1,3-Bis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazole-1-ylmethyl}benzene (5Bb): Obtained from **1b** (482 mg) and **3B** (94 mg) following the general procedure (Method C). Column chromatography (EtOAc) gave **5Bb** as a solid (377 mg, 75%); m.p. 88–89 °C. $[\alpha]_D^{20}$ = +185 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1750, 1371, 1229, 1050 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.47 (s, 2 H), 7.40–7.23 (m, 4 H), 5.62 (s, 4 H), 5.36–5.20 (m, 8 H), 4.36 (ddd, *J* = 9.5, 5.0, 2.3 Hz, 2 H), 4.28 (dd, *J* = 12.2, 5.0 Hz, 2 H), 4.06 (dd, *J* = 12.2, 2.2 Hz, 2 H), 3.94 (d, *J* = 14.6 Hz, 2 H), 3.83 (d, *J* = 14.6 Hz, 2 H), 2.13, 2.09, 2.05, 1.98 (4 s, 24 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.5, 169.8, 179.7, 169.6, 144.5, 133.2, 130.4, 129.7, 122.3, 81.6, 70.6, 69.5, 69.2, 66.2, 62.2, 51.2, 24.7, 20.8, 20.7, 20.6, 20.5 ppm. HRMS (MALDI-TOF): calcd. for $C_{42}H_{52}N_6O_{18}S_2$ $[M + Na]^+$ 1015.268; found 1015.295.

1,3-Bis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazole-1-ylmethyl}benzene (5Ca): Obtained from **1a** (463 mg) and **3C** (99 mg) following the general procedure (Method A). Column chromatography (EtOAc) gave **5Ca** as a solid (384 mg, 80%); m.p. 81–83 °C. $[\alpha]_D^{20}$ = +16 (*c* = 1 in MeOH); IR (KBr): $\tilde{\nu}$ = 1746, 1457, 1371, 1227, 1135, 1048 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.55 (s, 2 H, H-5 triazole), 7.41 (t, *J* = 7.5 Hz, 1 H, C_6H_4), 7.30–7.22 (m, 3 H, C_6H_4), 5.60 (s, 4 H, CH_2N), 5.31–5.26 (m, 4 H, H-3,4), 5.21 (br. d, *J* = 1.7 Hz, 2 H, H-2), 4.94 (d, *J* = 1.7 Hz, 2 H, H-1), 4.84 (d, *J* = 12.4 Hz, 2 H, CH_2O), 4.67 (d, *J* = 12.4 Hz, 2 H, CH_2O), 4.28 (dd, *J* = 12.2, 5.1 Hz, 2 H, H-6), 4.12–4.00 (m, 4 H, H-5,6), 2.14, 2.10, 2.03, 1.99 (4 s, 24 H, 8 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.8, 170.1, 169.8, 144.0, 135.7, 130.2, 128.5, 127.6, 123.1, 97.0, 69.6, 69.1, 68.8, 66.2, 62.4, 61.2, 53.9, 20.9, 20.8, 20.7 ppm. HRMS (FAB+): calcd. for $C_{42}H_{52}N_6O_{20}$ $[M + Na]^+$ 983.3134; found 983.3136.

1,3-Bis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazole-1-ylmethyl}benzene (5Cb): Obtained from **1b** (482 mg) and **3C** (99 mg) following the general procedure (Method B). Column chromatography (EtOAc) gave **5Cb** as a solid (427 mg, 86%); m.p. 87–88 °C. $[\alpha]_D^{20}$ = +112 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1749, 1371, 1228, 1050 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.48 (s, 2 H, H-5 triazole), 7.25, 7.22 (br. s, 4 H, C_6H_4), 5.51 (s, 4 H, CH_2N), 5.36–5.21 (m, 8 H, H-1,2,3,4), 4.36 (ddd, *J* = 9.8, 5.0, 2.4 Hz, 2 H, H-5), 4.28 (dd, *J* = 12.1, 5.1 Hz, 2 H, H-6), 4.04 (dd, *J* = 12.1, 2.1 Hz, 2 H, H-6), 3.95 (d, *J* = 14.6 Hz, 2 H, CH_2S), 3.84 (d, *J* = 14.6 Hz, 2 H, CH_2S), 2.14, 2.09, 2.05, 1.98 (4 s, 24 H, 8 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.6, 169.9, 169.8, 169.6, 144.6, 135.7, 132.1, 130.0, 128.5, 127.5, 122.1, 81.7, 70.7, 69.5, 69.3, 66.2, 62.2, 53.7, 24.8, 20.8, 20.7, 20.6 ppm. HRMS (FAB+): calcd. for $C_{42}H_{52}N_6O_{18}S_2$ $[M + Na]^+$ 1015.2677; found 1015.2670.

1,4-Bis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazole-1-ylmethyl}benzene (5Da): Obtained from **1a** (463 mg) and **3D** (94 mg) following the general procedure (Method A). Column chromatography (EtOAc) gave **5Da** as a solid (355 mg, 74%); m.p. 140–142 °C. $[\alpha]_D^{20}$ = +45 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 3142, 1755, 1373, 1245, 1135, 1079 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.58 (s, 2 H, H-5 triazole), 7.32 (s, 4 H, C_6H_4), 5.56 (s, 4 H, CH_2N), 5.31–5.27 (m, 4 H, H-3,4), 5.22 (br. s, 2 H, H-2), 4.95 (s, 2 H, H-1), 4.82 (d, *J* = 12.3 Hz, 2 H, CH_2O), 4.67 (d, *J* = 12.3 Hz, 2 H, CH_2O), 4.27 (dd, *J* = 12.5, 5.3 Hz, 2 H, H-6), 4.15–4.00 (m, 4 H, H-5,6), 2.15, 2.10, 2.03, 1.98 (4 s, 24 H, 8 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.5, 169.8, 169.7, 169.5, 143.9, 135.1, 128.7, 122.9, 96.8, 69.3, 68.9, 68.6, 66.1, 62.2, 60.9, 53.5, 20.7, 20.6, 20.5 ppm. HRMS (FAB+): calcd. for $C_{42}H_{52}N_6O_{20}$ $[M + Na]^+$ 983.3134; found 983.3140.

1,4-Bis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (5Db): Obtained from **1b** (482 mg) and **3D** (94 mg)following the general procedure (Method B). Column chromatography (EtOAc) gave **5Db** as a solid (337 mg, 68%); m.p. 155–157 °C. $[\alpha]_D^{20}$ = +117 (*c* = 1 in chloroform); IR (film): $\tilde{\nu}$ = 1747, 1370, 1228, 1108, 1050 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.50 (s, 2 H, H-5 triazole), 7.28 (s, 4 H, C_6H_4), 5.52 (s, 4 H, CH_2N), 5.32 (t, *J* = 9.9 Hz, 2 H, H-4), 5.29 (s, 4 H, H-1,2), 5.22 (dd, *J* = 10.0, 2.9 Hz, 2 H, H-3), 4.36 (ddd, *J* = 9.8, 5.0, 2.0 Hz, 2 H, H-5), 4.28 (dd, *J* = 12.2, 5.1 Hz, 2 H, H-6), 4.03 (dd, *J* = 12.1, 2.1 Hz, 2 H, H-6), 3.93 (d, *J* = 14.6 Hz, 2 H, CH_2S), 3.82 (d, *J* = 14.6 Hz, 2 H, CH_2S), 2.13, 2.08, 2.05, 1.98 (4 s, 24 H, 8 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.4, 169.7, 169.6, 144.4, 135.2, 132.0, 131.9, 128.7, 128.6, 128.5, 128.3, 122.1, 81.6, 70.5, 69.4, 69.1, 66.1, 62.1, 53.5, 24.7, 20.9, 20.7, 20.6, 20.4 ppm. HRMS (FAB+): calcd. for $C_{42}H_{52}N_6O_{18}S_2$ $[M + Na]^+$ 1015.2677; found 1015.2679.

1,3,5-Tris{2-[4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-yl]-ethoxy}benzene (5Ea): Obtained from **1a** (695 mg) and **3E** (166 mg) following the general procedure (Method A). Column chromatography (EtOAc → EtOAc/MeOH, 50:1) gave **5Ea** as a syrup (530 mg, 71%): $[\alpha]_D^{20}$ = +55 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1746, 1370, 1226, 1047 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.76 (br. s, 3 H, H-5 triazole), 6.09 (s, 3 H, ArH), 5.35–5.25 (m, 6 H, H-3,4), 5.24 (s, 3 H, H-2), 4.96 (s, 3 H, H-1), 4.85 (d, *J* = 12.5 Hz, 3 H, OCH_2), 4.68 (d, *J* = 12.3 Hz, 3 H, OCH_2), 4.75 (t, *J* = 4.7 Hz, 6 H, OCH_2CH_2N), 4.34 (t, *J* = 4.5 Hz, 6 H, OCH_2CH_2N), 4.29 (dd, *J* = 12.3, 5.1 Hz, 3 H, H-6), 4.10 (d, *J* = 12.3 Hz, 3 H, H-6), 4.08 (m, 3 H, H-5), 2.15, 2.12, 2.03, 1.98 (4 s, 36 H, *Me*CO) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.8, 170.2, 170.0, 169.8 (CO), 159.9 (Ar), 143.6 (C-4 triazole), 124.2 (C-5 triazole), 97.0, (C-1), 94.9 (Ar), 69.4 (C-2), 69.1 (C-3), 68.8 (C-5), 66.4 (C-4), 66.0 (OCH_2CH_2N), 62.4 (C-6), 61.1 (CH_2O), 49.8 (CH_2N), 20.9, 20.8, 20.8 (*Me*CO) ppm. HRMS (FAB+): calcd. for $C_{63}H_{81}N_9O_{33}$ $[M + Na]^+$ 1514.4834; found 1514.5100.

1,3,5-Tris{2-[4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-yl]-ethoxy}benzene (5Eb): Obtained from **1b** (725 mg) and **3E** (166 mg) following the general procedure (Method A). Column chromatography (EtOAc → EtOAc/MeOH, 50:1) gave **5Eb** as a syrup (705 mg, 92%): $[a]_D^{20}$ = +133 (*c* = 1 in chloroform); IR (film): $\tilde{\nu}$ = 1746, 1226, 1049 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.67 (s, 3 H, H-5 triazole), 6.03 (s, 3 H, ArH), 5.36–5.30 (m, 9 H, H-1,2,4), 5.23 (dd, *J* = 10.0, 2.8 Hz, 3 H, H-3), 4.73 (t, *J* = 4.5 Hz, 6 H, OCH_2), 4.40–4.25 (m, 12 H, H-5,6, CH_2N), 4.07 (br. d, *J* = 10.0 Hz, 3 H, H-6), 3.96 (d, *J* = 14.5 Hz, 3 H, CH_2S), 3.68 (d, *J* = 14.5 Hz, 3 H, CH_2S), 2.12, 2.09, 2.05, 1.98 (4 s, 36 H, *Me*CO) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.7, 170.0, 169.9, 169.8 (CO), 159.9 (Ar), 144.2 (C-4 triazole), 123.3 (C-5 triazole), 95.0 (Ar), 81.7 (C-1), 70.6, 69.7, 69.3, 66.3 (C-2,3,4,5), 66.5 (CH_2O), 62.4 (C-6), 49.8 (CH_2N), 24.8 (CH_2S), 20.9, 20.8, 20.7, 20.6 ppm. HRMS (FAB+): calcd. for $C_{63}H_{81}N_9O_{30}S_3$ $[M + Na]^+$ 1562.415; found 1562.4020.

1,3,5-Tris{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-2,4,6-trimethylbenzene (5Fa): Obtained from **1a** (695 mg) and **3F** (143 mg) following the general procedure (Method B). Column chromatography (EtOAc → EtOAc/MeOH, 15:1) gave **5Fa** as a foamy solid (560 mg, 78%): $[a]_D^{20}$ = +41.3 (*c* = 1, chloroform); IR (KBr): $\tilde{\nu}$ = 1749, 1372, 1234, 1049 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.41 (s, 3 H), 5.72 (s, 6 H), 5.40–5.25 (m, 6 H), 5.19 (s, 3 H), 4.94 (s, 1 H), 4.81 (d, *J* = 12.4 Hz, 3 H), 4.64 (d, *J* = 12.3 Hz, 3 H), 4.29 (dd, *J* = 12.2, 5.1 Hz, 3 H), 4.20–4.05 (m, 6 H), 2.47 (s, 9 H), 2.15, 2.11, 2.04, 1.99 (4 s, 36 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.5, 169.9, 169.8, 169.5, 143.5, 139.9, 130.5, 122.3, 96.7, 69.3, 68.9, 68.6, 66.0, 62.2, 60.8, 49.0, 20.9, 20.7, 20.6, 20.5, 16.7 ppm. HRMS (FAB+): calcd. for $C_{63}H_{81}N_9O_{30}$ $[M + Na]^+$ 1466.4987; found 1466.4984.

1,3,5-Tris{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-2,4,6-trimethylbenzene (5Fb): Obtained from **1b** (725 mg) and **3F** (143 mg) following the general procedure (Method B). Column chromatography (EtOAc) gave **5Fb** as a solid (580 mg, 78%); m.p. 102–105 °C. $[a]_D^{20}$ = +143 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1749, 1371, 1229, 1049 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.31 (s, 3 H), 5.66 (s, 6 H), 5.33 (t, *J* = 9.8 Hz, 3 H), 5.28 (s, 1 H), 5.26 (d, *J* = 3.4 Hz, 3 H), 5.21 (dd, *J* = 9.9, 3.3 Hz, 3 H), 4.37 (m, 3 H), 4.30 (dd, *J* = 12.0, 5.1 Hz, 3 H), 4.08 (d, *J* = 12.0 Hz, 3 H), 3.93 (d, *J* = 14.6 Hz, 3 H), 3.80 (d, *J* = 14.6 Hz, 3 H), 2.41 (s, 9 H), 2.14, 2.09, 2.05, 1.99 (4 s, 36 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.5, 169.8, 169.7, 169.5, 144.1, 139.7, 130.5, 121.4, 81.5, 70.6, 69.4, 69.2, 66.0, 62.1, 49.0, 24.6, 20.8, 20.6, 20.5, 20.5, 16.5 ppm. HRMS (MALDI-TOF): calcd. for $C_{63}H_{81}N_9O_{27}S_3$ $[M + H]^+$ 1492.448; found 1492.434.

1,3,5-Tris{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-2,4,6-trimethoxybenzene (5Ga): Obtained from **1a** (695 mg) and **3G** (166 mg) following the general procedure (Method A). Column chromatography (EtOAc → EtOAc/MeOH, 50:1) gave **5Ga** as a syrup (580 mg, 79%): $[a]_D^{20}$ = +39 (*c* = 1 in chloroform); IR (film): $\tilde{\nu}$ = 2948, 1750, 1586, 1456, 1368, 1220, 1330, 1043 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.75 (s, 3 H, H-5 triazole), 5.60 (s, 6 H, CH_2N), 5.31 (m, 6 H, H-3,4), 5.21 (s, 3 H, H-2), 4.96 (s, 3 H, H-1), 4.82 (d, *J* = 12.3 Hz, 3 H, CH_2O), 4.65 (d, *J* = 12.3 Hz, 3 H, CH_2O), 4.30 (dd, *J* = 12.4, 5.0 Hz, 3 H, H-6), 4.10 (m, 6 H, H-5,6), 3.78 (s, 9 H, MeO), 2.15, 2.12, 2.04, 1.98 (4 s, 36 H, *Me*CO) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.6, 170.0, 169.9, 169.67 (CO), 160.8 (Ar), 123.5 (C-5 triazole), 119.8 (Ar), 96.8 (C-1), 69.4, 69.0, 68.7, 66.0 (C-2,3,4,5), 63.1 (OMe), 62.3 (C-6), 60.3 (CH_2O), 43.9 (CH_2N), 21.0, 20.8, 20.7, 20.6 (*Me*CO) ppm. HRMS (FAB+): calcd. for $C_{63}H_{81}N_9O_{33}$ $[M + Na]^+$ 1514.48; found 1514.40.

1,3,5-Tris{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-2,4,6-trimethoxybenzene (5Gb): Obtained from **1b** (725 mg) and **3G** (166 mg) following the general procedure (Method A). Column chromatography (EtOAc → EtOAc/MeOH, 50:1) gave **5Gb** as a foamy solid (765 mg, 100%): $[a]_D^{20}$ = +127 (*c* = 1 in chloroform); IR (film): $\tilde{\nu}$ = 1747, 1226, 1103, 1048 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.61 (s, 3 H, H-5 triazole), 5.55 (s, 6 H, CH_2N), 5.37–5.20 (m, 12 H, H-1,2,3,4), 4.38 (m, 3 H, H-5), 4.33 (dd, *J* = 12.0, 4.9 Hz, 3 H, H-6), 4.09 (dd, *J* = 12.0, 1.8 Hz, 3 H, H-6), 3.96 (d, *J* = 14.5 Hz, 3 H, CH_2S), 3.84 (d, *J* = 14.5 Hz, 3 H, CH_2S), 3.76 (s, 9 H, MeO), 2.15, 2.10, 2.06, 1.98 (4 s, 36 H, *Me*CO) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.7, 170.0, 169.9, 169.7 (CO), 160.8 (Ar), 144.5 (C-4 triazole), 122.6 (Ar), 119.9 (C-5 triazole), 81.8 (C-1), 70.8 (C-3), 69.6 (C-2), 69.4 (C-5), 66.3 (C-4), 63.2 (OMe), 62.4 (C-6), 43.9 (CH_2N), 24.9 (CH_2S), 21.1, 20.9, 20.8 (*Me*CO) ppm. HRMS (FAB+): calcd. for $C_{63}H_{81}N_9O_{30}S_3$ $[M + Na]^+$ 1562.415; found 1562.38.

1,2,4,5-Tetrakis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (5Ha): Obtained from **1a** (925 mg) and **3H** (149 mg) following the general procedure (Method B). Column chromatography (EtOAc → EtOAc/MeOH, 10:1) gave **5Ha** as a solid (780 mg, 85%); m.p. 109–111 °C. $[a]_D^{20}$ = +54 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 3143, 1750, 1438, 1372, 1239, 1134, 1049 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.70 (s, 4 H, H-5 triazole), 7.15 (s, 2 H, Ar), 5.68 (s, 8 H, CH_2N), 5.35–5.25 (m, 8 H, H-3,4), 5.20 (s, 4 H, H-2), 4.98 (s, 4 H, H-1), 4.83 (d, *J* = 12.3 Hz, 4 H, CH_2O), 4.68 (d, *J* = 12.3 Hz, 4 H, CH_2O), 4.29 (dd, *J* = 12.2, 4.9 Hz, 4 H, H-6), 4.15–4.00 (m, 8 H, H-5,6), 2.14, 2.11, 2.04, 1.98 (4 s, 48 H, 16 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.6, 169.9, 169.8, 169.6, 144.0, 134.9, 132.0, 123.6, 96.7, 69.3, 68.9, 68.6, 65.9, 62.2, 60.6, 50.5, 20.7, 20.6, 20.5 ppm. HRMS (FAB+): calcd. for $C_{78}H_{98}N_{12}O_{40}$ $[M + Na]^+$ 1865.5901; found 1865.5856.

1,2,4,5-Tetrakis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-methyl}benzene (5Hb): Obtained from **1b** (965 mg) and **3H** (149 mg) following the general procedure (Method B). Column chromatography (EtOAc/MeOH, 50:1) gave **5Hb** as a solid (735 mg, 77%); m.p. 112–115 °C. $[a]_D^{20}$ = +144 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1748, 1372, 1230, 1050 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.51 (s, 4 H), 4.14 (s, 2 H), 5.60 (s, 8 H), 5.34 (t, *J* = 9.8 Hz, 4 H), 5.31 (s, 4 H), 5.27 (d, *J* = 3.3 Hz, 4 H), 5.21 (dd, *J* = 10.0, 3.3 Hz, 4 H), 4.35 (m, 4 H), 4.28 (dd, *J* = 12.1, 4.8 Hz, 4 H), 4.08 (dd, *J* = 12.1, 2.1 Hz, 4 H), 3.95 (d, *J* = 14.7 Hz, 4 H), 3.83 (d, *J* = 14.6 Hz, 4 H), 2.13, 2.10, 2.06, 1.98 (4 s, 48 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.6, 169.9, 169.7, 169.6, 144.7, 134.8, 132.1, 122.6, 81.5, 70.6, 69.4, 69.2, 66.1, 62.1, 50.4, 24.5, 20.8, 20.7, 20.6, 20.5 ppm. HRMS (FAB+): calcd. for $C_{78}H_{98}N_{12}O_{36}S_4$ $[M + Na]^+$ 1929.499; found 1929.496.

1,2,3,4,5,6-Hexakis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (5Ia): Obtained from **1a** (695 mg) and **3I** (102 mg) following the general procedure (Method B). Column chromatography (Cl_2CH_2/MeOH, 100:1 → 25:1) gave **5Ia** as a solid (547 mg, 77%); m.p. 162–164 °C. $[a]_D^{20}$ = +56 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1749, 1371, 1228, 1135, 1080, 1048 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.56 (s, 1 H, H-5), 5.85 (s, 2 H, CH_2N), 5.27 (m, 2 H, H-3,4), 5.16 (s, 1 H, H-2), 4.90 (s, 1 H, H-1), 4.72 (d, *J* = 12.5 Hz, 1 H, CH_2O), 4.59 (d, *J* = 12.5 Hz, 1 H, CH_2O), 4.25 (dd, *J* = 11.9, 4.1 Hz, 1 H, H-6), 4.05 (m, 2 H, H-5,6), 2.13, 2.10, 2.05, 1.98 (4 s, 12 H, 4 Ac) ppm. ^{13}C NMR (CDCl3, 75 MHz): δ = 170.8, 170.1, 170.0, 169.7, 144.2, 137.5, 123.7, 96.9, 69.5, 69.0, 68.7, 66.1, 62.3, 60.7, 48.2, 20.9, 20.8, 20.7, 20.6 ppm. HRMS (FAB+): calcd. for $C_{114}H_{144}N_{18}O_{60}$ $[M + Na]^+$ 2748.870; found 2748.860.

1,2,3,4,5,6-Hexakis{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (5Ib): Obtained from **1b** (722 mg) and **3I** (102 mg) following the general procedure (Method C). Column chromatography Cl_2CH_2/MeOH (25:1) gave **5Ib** as a solid (457 mg, 65%); m.p. 186–188 °C. $[\alpha]_D^{20}$ = +163 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1749, 1371, 1229, 1050 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.34 (s, 6 H), 5.82 (s, 12 H), 5.32 (t, *J* = 9.5 Hz, 6 H), 5.23–5.17 (m, 18 H), 4.30 (m, 6 H), 4.26 (dd, *J* = 12.1, 4.6 Hz, 6 H), 4.09 (dd, *J* = 11.8, 1.8 Hz, 6 H), 3.85 (d, *J* = 14.8 Hz, 6 H), 3.74 (d, *J* = 14.8 Hz, 6 H), 2.14, 2.10, 2.08, 1.98 (4 s, 72 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.8, 170.1. 169.9, 169.7, 145.0, 137.4, 122.7, 81.7, 70.9, 69.5, 66.2, 62.3, 48.1, 24.7, 21.0, 20.8, 20.7, 20.6 ppm. HRMS (FAB+): calcd. for $C_{114}H_{144}N_{18}O_{54}S_6$ $[M + Na]^+$ 2844.733; found 2844.735.

Tetrakis-*O*-{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyl)-1*H*-1,2,3-triazol-1-ylmethyl}pentaerythritol (6Jc): Obtained from **2c** (447 mg) and **4J** (72 mg) following the general procedure (Method D). Column chromatography (EtOAc/hexane, 5:1 → 10:1) gave **6Jc** as a solid (603 mg, 79%); m.p. 104–106 °C (dec). $[\alpha]_D^{20}$ = +46 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1750, 1370, 1225, 1122, 1041 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.85 (s, 4 H, H-5 triazole), 6.11 (d, *J* = 2.2 Hz, 4 H, H-1), 6.00–5.90 (m, 8 H, H-2,3), 5.39 (t, *J* = 9.0 Hz, 4 H, H-4), 4.60 (s, 8 H, CH_2O), 4.36 (dd, *J* = 12.4, 5.2 Hz, 4 H, H-6), 4.08 (dd, *J* = 12.4, 2.4 Hz, 4 H, H-6), 3.92 (m, 4 H, H-5), 3.50 (s, 8 H, CH_2O), 2.18, 2.08, 2.04, 2.00 (4 s, 48 H, 16 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.4, 169.5, 169.3 (CO), 145.7 (C-4 triazole), 123.0 (C-5 triazole), 83.6 (C-1), 71.9, 68.8, 68.2, 65.9 (C-2,3,4,5), 68.9, 64.5, 61.5 (CH_2O), 49.4 (CH_2N), 45.4 [$C(CH_2)_4$], 20.6, 20.5, 20.4 (*Me*CO) ppm. HRMS (FAB+): calcd. for $C_{73}H_{96}N_{12}O_{40}$ $[M + Na]^+$ 1803.57; found 1803.78.

Tetrakis-*O*-{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-ylmethyl}pentaerythritol (6Jd): Obtained from **2d** (500 mg) and **4J** (72 mg) following the general procedure (Method D). Column chromatography (EtOAc) gave **6Jd** as a solid (390 mg, 80%); m.p. 80–82 °C (dec). $[\alpha]_D^{20}$ = +32 (*c* = 1, chloroform); IR (KBr): $\tilde{\nu}$ = 1744, 1369, 1224, 1136, 1086, 1044 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.77 (s, 4 H, H-5 triazole), 5.30–5.16 (m, 12 H, H-2,3,4), 4.84 (s, 4 H, H-1), 4.63–4.60 (m, 8 H, CH_2N), 4.22 (dd, *J* = 12.4, 5.0 Hz, 4 H, H-6), 4.12 (m, 4 H, NCH_2CH_2O), 4.05 (br. d, *J* = 11.0 Hz, 4 H, H-6), 3.93 (m, 4 H, NCH_2CH_2O), 3.62 (m, 4 H, H-5), 3.50 (s, 8 H, CH_2O), 2.14, 2.09, 2.04, 1.99 (4 s, 48 H, 16 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.4, 169.7, 169.5 (CO), 145.3 (C-4 triazole), 123.7 (C-5 triazole), 97.3 (C-1), 67.1, 68.9, 65.5 (C-2,3,4,5), 68.7, 66.1 64.5, 62.0 (CH_2O), 49.4 (CH_2N), 45.1 [$C(CH_2)_4$], 20.6, 20.5, 20.4 (*Me*CO) ppm. HRMS (FAB+): calcd. for $C_{81}H_{112}N_{12}O_{44}$ $[M + Na]^+$ 1979.68; found 1979.80.

Methyl 2,3,4,6-Tetrakis-*O*-{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyl)-1*H*-1,2,3-triazol-1-yl}-α-D-glucopyranoside (6Kc): Obtained from **2c** (447 mg) and **4K** (87 mg) following the general procedure (Method D). Column chromatography (EtOAc → EtOAc/MeOH, 15:1) gave **6Kc** as a solid (367 mg, 80%); m.p. 105 °C (dec). $[\alpha]_D^{20}$ = +58 (*c* = 0.5 in chloroform); IR (KBr): $\tilde{\nu}$ = 1751, 1371, 1269, 1042 cm^{-1}. ^1H NMR ($CDCl_3$, 500 MHz): δ = 8.16 (s, 1 H), 8.06 (s, 1 H), 8.04 (s, 1 H), 7.83 (s, 1 H), 6.11–5.88 (m, 12 H), 5.40 (m, 4 H), 5.04–4.58 (m, 9 H), 4.34 (m, 4 H), 4.10–3.58 (several m, 14 H), 3.39 (s, 3 H), 2.17, 2.10, 2.08, 2.07, 2.06, 2.05, 2.04, 2.03, 2.02, 2.01 (10 s, 48 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.6, 169.7, 169.7, 169.6, 169.4, 145.5, 145.3, 145.2, 124.3, 124.2, 123.4, 97.8, 84.0, 83.8, 81.4, 80.0, 77.4, 72.1, 72.0, 71.9, 70.0, 69.1, 68.9, 68.4, 68.2, 66.2, 66.1, 66.0, 65.5, 64.5, 61.6, 55.3, 20.8, 20.6 ppm. HRMS (FAB+): calcd. for $C_{75}H_{98}N_{12}O_{42}$ $[M + Na]^+$ 1861.58; found 1861.71.

Methyl 2,3,4,6-Tetrakis-*O*-{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-yl}-α-D-glucopyranoside (6Kd): Obtained from **2d** (500 mg) and **4K** (87 mg) following the general procedure (Method D). Column chromatography (EtOAc/MeOH, 15:1) gave **6Kd** as a solid (442 mg, 88%); m.p. 95 °C (dec). $[\alpha]_D^{20}$ = +46 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1749, 1371, 1226, 1138, 1094, 1046 cm^{-1}. ^1H NMR ($CDCl_3$, 500 MHz): δ = 8.05 (s, 1 H), 7.93 (s, 2 H), 7.81 (s, 1 H), 5.27–5.16 (m, 12 H), 5.01–4.74 (several m, 11 H), 4.80–4.68 (m, 10 H), 4.24–3.59 (several m, 24 H), 3.39 (s, 3 H), 2.14, 2.13, 2.12, 2.09, 2.04, 2.03, 2.02, 1.98, 1.96, 1.96 (10 s, 48 H, 16 Ac) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 170.7, 170.0, 169.9, 169.8, 169.7, 144.9, 124.6, 97.7, 97.6, 81.4, 79.8, 70.0, 79.2, 68.9, 68.9, 68.6, 66.3, 65.7, 64.5, 64.3, 62.2, 55.2, 49.6, 20.9, 20.8, 20.7 ppm. HRMS (FAB+): calcd. for $C_{83}H_{114}N_{12}O_{46}$ $[M + Na]^+$ 2037.68; found 2037.30.

4-(2,3,4,6-Tetra-*O*-acetyl-α-D-mannopyranosyl)-1*H*-1,2,3-triazol-1-ylmethyl 2,3,4,6-Tetrakis-*O*-{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyl)-1*H*-1,2,3-triazol-1-yl}-β-D-glucopyranoside (6Lc): Obtained from **2c** (560 mg) and **4L** (92 mg) following the general procedure (Method D). Column chromatography [EtOAc/hexane (5:1) → EtOAc] gave **6Lc** as a solid (420 mg, 75%); m.p. > 120 °C (dec). $[\alpha]_D^{20}$ = +52 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1750, 1370, 1224, 1122, 1040 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 8.16, 8.12, 8.09, 7.99, 7.84, (5 s, 5 H, H-5 triazole), 6–08 (s, 3 H, H-1 Man), 6.05 (d, *J* = 1.9 Hz, 1 H, H-1 Man), 6.01 (d, *J* = 1.8 Hz, 1 H, H-1 Man), 5.97–5.82 (m, 10 H, H-2,3 Man), 5.39–5.30 (m, 5 H, H-4 Man), 5.03 (d, *J* = 10.7 Hz, 1 H), 4.99 (d, *J* = 11.7 Hz, 1 H), 4.97 (d, *J* = 11.9 Hz, 1 H), 4.94 (d, *J* = 11.0 Hz, 1 H), 4.90 (d, *J* = 11.2 Hz, 1 H), 4.83 (d, *J* = 10.7 Hz, 1 H), 4.80 (d, *J* = 11.3 Hz, 1 H), 4.74 (d, *J* = 12.5 Hz, 1 H), 4.68 (d, *J* = 12.4 Hz, 1 H), 4.66 (d, *J* = 11.3 Hz, 1 H, 5 CH_2O), 4.42 (d, *J* = 10.7 Hz, 1 H, H-1 Glc), 4.35–4.23 (m, 6 H, H-6 Glc, H-6 Man), 4.02 (br. d, *J* = 12.4 Hz, 5 H, H-6 Man), 3.93–3.80 (m, 6 H, H-5 Man, H-6 Glc), 3.53–3.33 (m, 4 H, H-2,3,4,5 Glc), 2.17, 2.08, 2.07, 2.06, 2.04, 2.02 (6 s, 60 H, 20 Ac) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.4, 169.6, 169.5, 169.3 (CO), 145.5, 145.2, 145.1, 144.9 (C-4 triazole), 124.5, 124.2, 123.8, 123.3 (C-5 triazole), 102.5 (C-1 Glc), 83.9, 83.8, 83.6 (C-1 Man), 81.8, 77.1, 74.5, 72.1 (C-2,3,4,5 Glc), 72.1, 72.0, 71.8 (C-5 Man), 69.0 (C-6 Glc), 68.9, 68.8, 68.2, 68.1 (C-2,3 Man), 65.9, 65.8 (C-4 Man), 65.3, 65.2, 64.4, 62.7 (5 CH_2O), 61.5 (C-6 Man), 20.7, 20.5 (*Me*CO) ppm. HRMS (FAB+): calcd. for $C_{91}H_{117}N_{15}O_{51}$ $[M + Na]^+$ 2258.692; found 2258.761.

4-(2,3,4,6-Tetra-*O*-acetyl-α-D-mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-ylmethyl 2,3,4,6-Tetrakis-*O*-{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-yl}-β-D-glucopyranoside (6Ld): Obtained from **2d** (625 mg) and **4L** (92 mg) following the general procedure (Method D). Column chromatography (EtOAc/MeOH, 10:1) gave **6Ld** as a solid (540 MG, 88%); m.p. 93 °C (dec). $[\alpha]_D^{20}$ = +18 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1748, 1370, 1256, 1138, 1046 cm^{-1}. ^1H NMR ($CDCl_3$, 500 MHz): δ = 8.07 (s, 1 H, H-5 triazole), 8.01 (s, 1 H, H-5 triazole), 7.90 (s, 1 H, H-5 triazole), 7.80 (s, 1 H, H-5, triazole), 5.20 (m, 15 H), 5.00–4.76 (m, 12 H), 4.68–4.57 (m, 12 H), 4.47 (d, *J* = 7.2 Hz, 1 H), 4.20 (m, 5 H), 4.14 (m, 5 H), 4.04 (m, 5 H), 3.93 (m, 5 H), 3,80–3.38 (several m, 12 H), 2.11, 2.07, 2.02, 2.07, 2.01, 2.00, 1.96, 1.95 (7 s, 60 H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 170.6, 169.9, 169.9, 169.9, 169.7, 145.3 (C-4 triazole), 145.0, 144.9, 124.7, 124.5, 124.3, 102.6, 97.8, 97.7, 82.1, 81.9, 74.4, 69.3, 69.0, 68.9, 66.4, 65.8, 64.6, 62.3, 49.5, 21.1, 20.9, 20.8, 20.7 ppm. HRMS (FAB+): calcd. for $C_{101}H_{137}N_{15}O_{56}$ $[M + Na]^+$ 2478.82; found 2478.30.

1,2,3,4,5,6-Hexakis-*O*-{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyl)-1*H*-1,2,3-triazol-1-ylmethyl}-D-mannitol (6Mc): Obtained

from **2c** (670 mg) and **4M** (102 mg) following the general procedure (Method D). Column chromatography [EtOAc/hexane (50:1) → EtOAc/MeOH (15:1)] gave **6Mc** as a foamy solid (442 mg, 67%): $[\alpha]_D^{20}$ = +55 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 3143, 2936, 1751, 1628, 1434, 1369, 1225, 1122, 1040 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.99, 7.97, 7.95, (3 s, 6 H), 6.11–6.08 (m, 6 H), 5.98–5.88 (m, 12 H), 5.43–5.35 (m, 6 H), 4.80–3.97 (several m, 38 H), 2.16, 2.15, 2.07, 2.05, 2.00 (5 s, 72 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.5, 169.7, 169.5, 145.3, 124.3, 124.0, 83.9, 78.3, 71.9, 69.2, 68.3, 68.2, 69.5, 61.7, 20.7, 20.5 ppm. HRMS (FAB+): calcd. for $C_{108}H_{140}N_{18}O_{60}$ [M + Na]$^+$ 2673.83; found 2673.73.

1,2,3,4,5,6-Hexakis-*O*-{4-(2,3,4,6-tetra-*O*-acetyl-α-D-mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-D-mannitol (6Md): Obtained from **2d** (750 mg) and **4M** (102 mg) following the general procedure (Method D). Column chromatography (EtOAc/MeOH, 10:1) gave **6Md** as a foamy solid (537 mg, 74%): $[\alpha]_D^{20}$ = +30 (*c* = 1 in chloroform); IR (KBr): $\tilde{\nu}$ = 1745, 1371, 1230, 1139, 1048, 980 cm^{-1}. ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.91 (s, 2 H), 7.90 (s, 2 H), 7.85 (s, 2 H), 5.28–5.22 (m, 18 H), 4.85 (m, 3 H), 4.83 (s, 3 H), 4.77–4.61 (m, 24 H), 4.22 (dd, *J* = 12.3, 4.7 Hz, 6 H); 4.13–4.70 (several m, 32 H), 2.13, 2.08, 2.04, 1.97 (4 s, 72 H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ = 170.5, 169.8, 169.6, 145.0, 144.8, 124.3, 97.5, 78.4, 78.2, 69.1, 68.8, 68.8, 66.1, 65.6, 65.2, 64.2, 62.7, 62.1, 49.5, 49.4, 20.7, 20.6,20.5 ppm. HRMS (FAB+): calcd. for $C_{120}H_{164}N_{18}O_{66}$ [M + Na]$^+$ 2935.99; found 2935.90.

General Procedure for the Zemplen Deacetylation of Peracetylated Neoglycoconjugates. Method A: A solution of the corresponding per-*O*-acetylated neoglycoconjugate (0.1 mmol) in MeOH (8 mL) containing Et_3N (0.8 mL) was refluxed for 2–3 h. The evaporation of the solvent was followed by purification of the crude material by short-column flash chromatography.

Method B: To a solution of the corresponding per-*O*-acetylated neoglycoconjugate (0.1 mmol) in MeOH (15 mL) was added NaOMe (1 M, 0.1 mL). After the solution was maintained overnight at room temp., the solvent was evaporated, and the resulting crude material was purified by short-column flash chromatography.

1,2-Bis{4-(α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-yl}ethane (7Ae): Obtained from **5Aa** (442 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:2) gave **7Ae** (250 mg, 91%) as a syrup: $[\alpha]_D^{20}$ = +60 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3392, 1655, 1411, 1131, 1056 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz): δ = 8.02 (s, 2 H), 4.90 (s, 4 H), 4.86–4.80 (br. s, 8 H), 4.68 (s, 2 H), 4.62 (d, *J* = 12.3 Hz, 2 H), 4.48 (d, *J* = 12.3 Hz, 2 H), 3.7–3.3 (several m, 12 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 145.6, 125.9, 100.6, 75.0, 72.4, 71.9, 68.6, 63.0, 60.4, 50.9 ppm. HRMS (FAB+): calcd. for $C_{20}H_{32}N_6O_{12}$ [M + Na]$^+$ 571.1976; found 571.1980.

1,2-Bis{4-(α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-yl}ethane (7Af): Obtained from **5Aa** (458 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:3) gave **7Af** (229 mg, 79%) as a syrup: $[\alpha]_D^{20}$ = +110 (*c* = 0.5 in DMSO). ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 7.78 (s, 2 H), 5.08 (s, 4 H), 4.84 (s, 6 H), 3.81 (d, *J* = 14.4 Hz, 2 H), 3.72 (d, *J* = 14.4 Hz, 2 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 146.1, 125.1, 84.8, 75.1, 73.1, 73.1, 68.8, 62.7, 50.9, 24.4 ppm. HRMS (FAB+): calcd. for $C_{20}H_{32}N_6O_{10}S_2$ [M + Na]$^+$ 603.1519; found 603.1523.

1,2-Bis{4-(α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (7Be): Obtained from **5Ba** (480 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 2:1 → 1:1) and lyophilization gave **7Be** as a solid (234 mg, 75%); m.p. 111–113 °C. $[\alpha]_D^{20}$ = +63 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3433, 1132, 1058 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 8.16 (s, 2 H), 7.35 (br. t, *J* = 4.4 Hz, 2 H), 7.14 (br. t, *J* = 4.4 Hz, 2 H), 5.82 (s, 4 H), 4.73 (s, 2 H), 4.68 (d, *J* = 12.3 Hz, 2 H), 4.52 (d, *J* = 12.2 Hz, 2 H), 3.67 (d, *J* = 11.3 Hz, 2 H), 3.58 (s, 2 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 144.0, 134.2, 129.2, 129.0, 124.5, 99.1, 74.2, 71.0, 70.2, 67.1, 61.3, 59.1, 50.0 ppm. HRMS (FAB+): calcd. for $C_{26}H_{36}N_6O_{12}$ [M + Na]$^+$ 647.2289; found 647.2282.

1,2-Bis{4-(α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (7Bf): Obtained from **5Bb** (496 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:1 → 1:3) and lyophilization gave **7Bf** (234 mg, 100%) as a solid; m.p. 150–152 °C (dec). $[\alpha]_D^{20}$ = +133 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3421, 2929, 1071 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 7.85 (s, 2 H), 7.45–7.35 (m, 2 H), 7.35–7.20 (m, 2 H), 5.76 (s, 4 H), 3.85 (d, *J* = 14.4 Hz, 2 H), 3.76 (d, *J* = 14.4 Hz, 2 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 146.4, 135.0, 131.4, 130.7, 124.8, 85.3, 75.2, 73.2, 73.2, 68.9, 62.7, 52.0, 24.7 ppm. HRMS (FAB+): calcd. for $C_{26}H_{36}N_6O_{10}S_2$ [M + Na]$^+$ 679.1832; found 679.1835.

1,3-Bis{(-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (7Ce): Obtained from **5Ca** (480 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:1 → 1:2) and lyophilization gave **7Ce** (244 mg, 78%) as a deliquescent solid: $[\alpha]_D^{20}$ = +54 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3393, 2930, 1131, 1058 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 8.16 (s, 2 H), 7.38 (t, *J* = 7.5 Hz, 1 H), 7.34 (s, 1 H), 7.25 (d, *J* = 7.4 Hz, 2 H), 5.58 (s, 4 H), 4.71 (s, 2 H), 4.66 (d, *J* = 12.3 Hz, 2 H), 4.50 (d, *J* = 12.2 Hz, 2 H), 3.67 (d, *J* = 11.2 Hz, 2 H), 3.57 (s, 2 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 143.9, 136.6, 129.3, 127.8, 127.6, 124.3, 99.1, 74.2, 70.9, 70.2, 67.0, 61.3, 59.1, 52.6 ppm. HRMS (FAB+): calcd. for $C_{26}H_{36}N_6O_{12}$ [M + Na]$^+$ 647.2289; found 647.2284.

1,3-Bis{(-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (7Cf): Obtained from **5Cb** (496 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:1 → 1:2) and lyophilization gave **7Cf** (263 mg, 80%) as a deliquescent solid: $[\alpha]_D^{20}$ = +165 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3409, 2929, 1071 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 8.06 (s, 2 H), 7.37 (t, *J* = 7.6 Hz, 1 H), 7.29 (s, 1 H), 7.13 (d, *J* = 7.4 Hz, 2 H), 5.56 (s, 4 H), 3.84 (d, *J* = 14.4 Hz, 2 H), 3.75 (d, *J* = 14.4 Hz, 2 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 144.5, 136.7, 129.3, 127.6, 127.4, 123.4, 84.0, 74.8, 71.7, 71.5, 67.3, 61.1, 52.5, 23.5 ppm. HRMS (FAB+): calcd. for $C_{26}H_{36}N_6O_{10}S_2$ [M + Na]$^+$ 679.1832; found 679.1830.

1,4-Bis{(-α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (7De): Obtained from **5Da** (480 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:1) gave **7De** as a foamy solid (312 mg, 100%): $[\alpha]_D^{20}$ = +44 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3372, 2926, 1566, 1411, 1130, 1052, 1024 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 8.15 (s, 2 H), 7.32 (s, 4 H), 5.57 (s, 4 H), 4.70 (s, 2 H), 4.65 (d, *J* = 12.2 Hz, 2 H), 4.49 (d, *J* = 12.2 Hz, 2 H), 3.67 (d, *J* = 11.0 Hz, 2 H), 3.56 (s, 2 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 143.9, 136.0, 128.5, 124.2, 99.1, 74.2, 70.9, 70.2, 67.0, 62.3, 59.1, 52.5 ppm. HRMS (FAB+): calcd. for $C_{26}H_{36}N_6O_{12}$ [M + Na]$^+$ 647.2289; found 647.2286.

1,4-Bis{(-α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (7Df): Obtained from **5Db** (496 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:1) and lyophilization gave **7Df** (233 mg, 71%) as a foamy

solid: $[\alpha]_D^{20}$ = +61 (*c* = 0.5 in H_2O); IR (KBr): $\tilde{\nu}$ = 3402, 1647, 1438 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz): δ = 8.03 (s, 2 H), 7.29 (s, 4 H), 5.53 (s, 4 H), 5.11 (s, 2 H), 9.96 (d, *J* = 4.3 Hz, 2 H), 4.73 (d, *J* = 4.5 Hz, 2 H), 4.66 (d, *J* = 4.5 Hz, 2 H), 4.52 (t, *J* = 5.8 Hz, 2 H), 3.85 (d, *J* = 14.3 Hz, 2 H), 3.73 (d, *J* = 14.5 Hz, 2 H), 3.65–3.60 (m, 6 H), 3.55–3.35 (m, 6 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 144.6, 136.0, 128.4, 83.9, 74.8, 71.6, 71.5, 67.3, 61.1, 52.4, 23.4 ppm. HRMS (FAB+): calcd. for $C_{26}H_{36}N_6O_{10}S_2$ [M + Na]$^+$ 679.1832; found 679.1833.

1,3,5-Tris{2-[4-(α-D-mannopyranosyloxymethyl)-1*H*-[1,2,3]triazol-1-yl]-ethoxy}benzene (7Ee): Obtained from **5Ea** (372 mg) following the general procedure (Method A). Column chromatography (CH_3CN/H_2O, 4:1) and lyophilization gave **7Ee** (210 mg, 85%) as a foamy solid: $[\alpha]_D^{20}$ = +52 (*c* = 0.5 in DMSO); IR (KBr): $\tilde{\nu}$ = 3400, 1171, 1129, 1064 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz): δ = 8.12 (s, 3 H, H-5 triazole), 6.11 (s, 6 H, ArH), 4.71 (s, 3 H, H-1), 4.69 (m, 18 H, 12 CH_2N, 6 OH), 4.65 (d, *J* = 12.3 Hz, 3 H, CH_2O-Man), 4.50 (d, *J* = 12.0 Hz, 3 H, CH_2O-Man), 4.50 (br. s, 3 H, OH), 4.45 (t, *J* = 5.8 Hz, 3 H, OH), 4.34 (t, *J* = 5.0 Hz, 2 H, CH_2O), 3.67 (dd, *J* = 11.3, 6.1 Hz, 3 H, H-6), 3.55 (br. s, 1 H, H-2), 3.50–3.32 (m, 12 H, H-3,4,5,6) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 159.5, 143.4, 124.4, 98.9, 94.5, 74.0, 70.8, 70.1, 66.9, 66.1, 61.2, 58.9, 48.8 ppm. HRMS (FAB+): calcd. for $C_{39}H_{57}N_9O_{11}$ [M + Na]$^+$ 1010.35; found 1010.40.

1,3,5-Tris{2-[4-(α-D-mannopyranosyloxymethyl)-1*H*-[1,2,3]triazol-1-yl]-ethoxy}benzene (7Ef): Obtained from **5Eb** (360 mg) following the general procedure (Method A). Column chromatography (CH_3CN/H_2O, 4:1) and lyophilization gave **7Ef** (209 mg, 81%) as a solid; m.p. 117–119 °C. $[\alpha]_D^{20}$ = +177.4 (*c* = 0.5, DMSO); IR (KBr): $\tilde{\nu}$ = 3392, 1170, 1067 cm^{-1}. ^1H NMR ([D$_6$]DMSO + D_2O, 300 MHz): δ = 8.04 (s, 3 H, H-5 triazole), 6.11 (s, 3 H, ArH), 5.14 (s, 3 H, H-1), 4.70 (br. s, 6 H, CH_2N), 4.33 (t, *J* = 4.4 Hz, 6 H, CH_2O), 3.84 (d, *J* = 14.3 Hz, 3 H, CH_2S), 3.76 (d, *J* = 14.3 Hz, 3 H, CH_2S), 3.71–3.65 (m, 9 H, H-2,3,6), 3.50–3.41 (m, 9 H, H-4,5,6) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 159.5, 144.1, 123.4, 94.5, 83.8, 74.6, 71.5, 71.3, 67.2, 66.1, 61.0, 48.8, 23.3 ppm. HRMS (FAB+): calcd. for $C_{39}H_{57}N_9O_{18}S_3$ [M + Na]$^+$ 1058.29; found 1058.30.

1,3,5-Tris{4-(α-D-mannopyranosylmethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-2,4,6-trimethylbenzene (7Fe): Obtained from **5Fa** (360 mg) following the general procedure, (Method A). Column chromatography (EtOAc/MeOH, 1:3) and lyophilization gave **7Fe** (213 mg, 91%) as a foamy solid: $[\alpha]_D^{20}$ = +49 (*c* = 1, H_2O); IR (KBr): $\tilde{\nu}$ = 3410, 1643, 1227, 1131, 1058 cm^{-1}. ^1H NMR ([D$_6$]-DMSO, 300 MHz): δ = 7.96 (s, 3 H), 5.67 (s, 6 H), 4.77 (br. s, 12 H), 4.70 (s, 3 H), 4.62 (d, *J* = 12.2 Hz, 3 H), 4.47 (d, *J* = 12.2 Hz, 3 H), 3.72–3.30 (m, 18 H), 2.41 (s, 9 H) ppm. ^{13}C NMR ([D$_6$]-DMSO, 75 MHz): δ = 143.4, 139.3, 130.8, 123.8, 99.1, 74.1, 70.9, 70.1, 67.0, 61.3, 59.0, 48.4, 16.4 ppm. HRMS (MALDI-TOF): calcd. for $C_{39}H_{57}N_9O_{18}$ [M + Na]$^+$ 962.371; found 962.410.

1,3,5-Tris{4-(α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-2,4,6-trimethylbenzene (7Ff): Obtained from **5Fb** (372 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:2) and lyophilization gave **7Ff** (212 mg, 91%) as a deliquescent solid: $[\alpha]_D^{20}$ = +154 (*c* = 1, H_2O). ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 7.85 (s, 3 H), 5.64 (s, 6 H), 5.13 (s, 3 H), 3.82 (d, *J* = 14.3 Hz, 3 H), 3.72 (d, *J* = 14.4 Hz, 3 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 144.1, 139.3, 130.9, 122.8, 84.0, 74.8, 71.6, 71.5, 67.3, 61.1, 56.0, 23.5, 16.4 ppm. HRMS (MALDI-TOF): calcd. for $C_{39}H_{57}N_9O_{15}S_3$ [M + Na]$^+$ 1010.303; found 1010.296.

1,3,5-Tris{4-(α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-2,4,6-trimethoxybenzene (7Ge): Obtained from **5Ga** (372 mg) following the general procedure (Method A). Column chromatography (CH_3CN/H_2O, 5:1 → 3:1) and lyophilization gave **7Ge** (187 mg, 76%) as a foamy solid: $[\alpha]_D^{20}$ = +57.9 (*c* = 0.19, DMSO); IR (KBr): $\tilde{\nu}$ = 3394, 2920, 2866, 1616, 1587, 1454, 1414, 1344, 1101, 1069 cm^{-1}. ^1H NMR ([D$_6$]DMSO + D_2O, 300 MHz): δ = 8.04 (s, 3 H), 5.53 (s, 6 H, CH_2N), 4.68 (s, 3 H, H-1), 4.62 (d, *J* = 12.1 Hz, 3 H, CH_2O), 4.49 (d, *J* = 12.1 Hz, 3 H, CH_2O), 3.66 (s, 3 H, OMe), 3.64 (m, 3 H, H-6), 3.54 (br. s, 3 H, H-2), 3.50–3.20 (m, 12 H, H-3,4,5,6) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 159.9, 143.4, 124.6, 119.6, 99.0, 74.1, 70.9, 70.2, 67.0, 62.3, 61.3, 59.0, 43.3 ppm. HRMS (MALDI-TOF): calcd. for $C_{39}H_{57}N_9O_{21}$ [M + Na]$^+$ 1010.35; found 1010.29.

1,3,5-Tris{4-(α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-2,4,6-trimethoxybenzene (7Gf): Obtained from **5Gb** (384 mg) following the general procedure (Method A). Column chromatography (CH_3CN/H_2O, 5:1 → 3:1) and lyophilization gave **7Ge** (214 mg, 83%) as a foamy solid: $[\alpha]_D^{20}$ = +210 (*c* = 0.5, in DMSO); IR (KBr): $\tilde{\nu}$ = 3384, 1200, 1101, 1070 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz): δ = 7.95 (s, 3 H, H-5 triazole), 5.51 (s, 6 H, CH_2N), 5.12 (s, 3 H), 5.00 (d, *J* = 3.9 Hz, 3 H), 4.82 (s, 3 H), 4.70 (s, 3 H), 4.55 (m, 3 H), 3.82 (d, *J* = 14.3 Hz, 3 H, CH_2S), 3.74 (d, *J* = 14.3 Hz, 3 H, CH_2S), 3.65 (s, 9 H, OMe), 3.65 (m, 9 H), 3.51–3.40 (m, 9 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 159.7, 144.0, 123.4, 119.5, 83.8, 74.6, 71.5, 71.3, 67.2, 62.2, 61.0, 43.2, 23.3 ppm. HRMS (MALDI-TOF): calcd. for $C_{39}H_{57}N_9O_{18}S_3$ [M + Na]$^+$ 1058.29; found 1058.30.

1,2,4,5-Tetrakis{4-(α-D-mannopyranosyloxymethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (7He): Obtained from **5Ha** (460 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:3) and lyophilization **7He** (258 mg, 95%) as a foamy solid: $[\alpha]_D^{20}$ = +58 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3365, 1645, 1230, 1134, 1059 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz): δ = 8.08 (s, 4 H, H-5 triazole), 6.98 (s, 2 H), 5.73 (s, 8 H), 4.71 (s, 4 H), 4.64 (d, *J* = 12.3 Hz, 4 H), 4.50 (d, *J* = 12.2 Hz, 4 H), 4.65–4.50 (m, 16 H), 3.70-3.33 (several m, 24 H) ppm. ^{13}C NMR ([D$_6$]-DMSO, 75 MHz): δ = 143.9, 134.8, 124.4, 99.0, 74.1, 70.9, 70.2, 67.0, 61.3, 59.0, 49.0 ppm. HRMS (MALDI-TOF): calcd. for $C_{46}H_{66}N_{12}O_{24}$ [M + Na]$^+$ 1193.4210; found 1193.316.

1,2,4,5-Tetrakis{4-(α-D-mannopyranosylthiomethyl)-1*H*-1,2,3-triazol-1-ylmethyl}benzene (7Hf): Obtained from **5Hb** (476 mg) following the general procedure (Method A). Column chromatography (EtOAc/MeOH, 1:3) and lyophilization gave **7Hf** (86%) as a deliquescent solid: $[\alpha]_D^{20}$ = +249 (*c* = 0.5 in DMSO); IR (KBr): $\tilde{\nu}$ = 3401, 2926, 1638, 1228, 1073 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 7.78 (s, 4 H), 7.17 (s, 2 H), 5.74 (s, 8 H), 5.20 (s, 4 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 143.6, 131.8, 129.5, 121.6, 81.7, 70.6, 68.8, 68.6, 64.3, 58.0, 47.9, 21.3 ppm. HRMS (MALDI-TOF): calcd. for $C_{46}H_{66}N_{12}O_{20}S_4$ [M + Na]$^+$ 1257.330; found 1257.335.

1,2,3,4,5,6-Hexakis{4-(α-D-mannopyranosyloxymethyl)-1*H*-[1,2,3]-1-methyl}benzene (7Ie): Obtained from **5Ia** (688 mg) following the general procedure (Method A). The white solid (**7Ie**) that appears is filtered, washed with cold MeOH and dried (395 mg, 92%); m.p. 178–180 °C. $[\alpha]_D^{20}$ = +49 (*c* = 1 in H_2O). ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 7.78 (s, 6 H), 4.76 (s, 12 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 100 MHz): δ = 143.3, 137.4, 124.1, 99.0, 74.0, 70.9, 70.1, 67.0, 61.3, 58.9, 47.7 ppm. HRMS (MALDI-TOF): calcd. for $C_{66}H_{96}N_{18}O_{36}$ [M + Na]$^+$ 1739.613; found 1739.52.

1,2,3,4,5,6-Hexakis{4-(α-D-mannopyranosyltjiomethyl)-1*H*-[1,2,3]-1-methyl}benzene (7If): Obtained from **5Ib** (705 mg) following the general procedure (Method A). The white solid (**7If**) that appears is filtered, washed with cold MeOH and dried (372 mg, 82%); m.p. > 230 °C (dec). $[\alpha]_D^{20}$ = +250 (*c* = 0.5 in DMSO); IR (KBr): $\tilde{\nu}$ = 3392, 2929, 1073 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 7.67 (s, 6 H), 5.89 (s, 12 H), 5.11 (s, 6 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 143.9, 137.3, 123.1, 83.9, 74.6, 71.6, 71.4, 67.2, 61.1, 47.6, 23.4 ppm. HRMS (MALDI-TOF): calcd. for $C_{66}H_{96}N_{18}O_{30}S_6$ $[M + Na]^+$ 1835.476; found 1835.476.

Tetrakis-*O*-{4-(α-D-mannopyranosyl)-1*H*-1,2,3-triazol-1-ylmethyl}pentaerythritol (8Jg): Obtained from **6Jc** (445 mg) following the general procedure (Method B). Column chromatography (EtOAc/MeOH, 1:5) and lyophilization gave **8Jg** as a foamy solid (236 mg, 85%): $[\alpha]_D^{20}$ = +34 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3410, 1658, 1384, 1085 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz): δ = 8.18 (s, 4 H), 5.88 (d, *J* = 4.1 Hz, 4 H, H-1), 5.31 (br. s, 4 H), 5.12 (br. s, 4 H), 5.04 (br. s, 4 H), 4.64 (br. s, 4 H), 4.46 (s, 8 H), 4.38 (br. s, 4 H), 3.85 (dd, *J* = 7.0, 3.2 Hz, 4 H), 3.60 (m, 12 H), 3.41 (m, 4 H), 3.36 (s, 8 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 144.56, 124.1, 86.2, 78.8, 71.7, 69.5, 68.7, 68.2, 64.7, 61.2, 45.6 ppm. HRMS (MALDI-TOF): calcd. for $C_{41}H_{64}N_{12}O_{24}$ $[M + Na]^+$ 1131.40; found 1131.50.

Tetrakis-*O*-{4-(α-D-mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-ylmethyl}pentaerythritol (8Jh): Obtained from **6Jd** (489 mg) following the general procedure (Method B). Column chromatography (EtOAc/MeOH, 1:5) and lyophilization gave **8Jh** (280 mg) as a syrup (87%): $[\alpha]_D^{20}$ = +31 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3397, 1644, 1458, 1227, 1134, 1090, 1056 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz): δ = 8.00 (s, 4 H), 4.61 (br. s, 4 H), 4.57 (s, 4 H), 4.57–4.50 (m, 16 H), 4.43 (s, 8 H), 4.15 (br. s, 4 H), 3.91 (m, 4 H), 3.77 (m, 4 H), 3.62–3.33 (m, 24 H), 3.32 (s, 8 H) ppm. ^{13}C NMR ([D$_6$]-DMSO, 75 MHz): δ = 144.0, 124.0, 99.8, 74.1, 70.8, 70.1, 68.7, 66.7, 64.9, 64.1, 61.1, 49.2, 44.9 ppm. HRMS (MALDI-TOF): calcd. for $C_{49}H_{80}N_{12}O_{28}$ $[M + Na]^+$ 1307.52; found 1307.54.

Methyl 2,3,4,6-Tetrakis-*O*-{4-(α-D-mannopyranosyl)-1*H*-1,2,3-triazol-1-yl}-α-D-glucopyranoside (8Kg): Obtained from **6Kc** (460 mg) following the general procedure (Method B). Column chromatography (MeOH) and lyophilization gave **8Kg** as a foamy solid (502 mg, 92%); m.p. 220 °C (dec). $[\alpha]_D^{20}$ = +73 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3366, 1644, 1435, 1114, 1044 cm^{-1}. ^1H NMR ([D$_6$]-DMSO, 300 MHz, selected signals): δ = 8.28 (s, 1 H), 8.26 (s, 2 H), 8.21 (s, 1 H) 5.92 (br. s, 4 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 144.2, 143.9, 143.8, 123.8, 123.7, 123.6, 97.1, 85.8, 85.7, 81.2, 79.2, 78.1, 77.1, 69.6, 68.8, 68.1, 67.6, 65.4, 64.9, 63.8, 63.4, 60.7, 54.4 ppm. HRMS (FAB+): calcd. for $C_{43}H_{66}N_{12}O_{26}$ [M + Na]$^+$ 1189.411; found 1189.468.

Methyl 2,3,4,6-Tetrakis-*O*-{4-(α-D-mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-yl}-α-D-glucopyranoside (8Kh): Obtained from **6Kd** (504 mg) following the general procedure (Method B). Column chromatography (MeOH) and lyophilization gave **8Kh** as a foamy solid (505 mg, 90%): $[\alpha]_D^{20}$ = +61 (*c* = 1, H_2O); IR (KBr): $\tilde{\nu}$ = 3404, 1645, 1134, 1092, 1054 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 8.11 (s, 2 H), 8.08 (s, 2 H), 4.84–4.46 (m, 29 H), 4.62 (s, 8 H), 3.94 (m, 4 H), 3.79 (m, 4 H), 3.68–3.17 (m, 30 H), 3.23 (s, 3 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 144.3, 144.1, 143.9, 143.7, 124.2, 124.1, 99.8, 97.0, 80.9, 79.1, 77.0, 74.1, 70.8, 70.0, 69.6, 68.5, 66.8, 65.5, 65.1, 64.8, 63.8, 63.3, 61.1, 54.4, 49.2 ppm. HRMS (FAB+): calcd. for $C_{51}H_{82}N_{12}O_{30}$ $[M + Na]^+$ 1365.516; found 1365.575.

4-(α-D-Mannopyranosyl)-1*H*-1,2,3-triazol-1-ylmethyl 2,3,4,6-Tetrakis-*O*-{4-(α-D-mannopyranosyl)-1*H*-1,2,3-triazol-1-yl}-β-D-glucopyranoside (8Lg): Obtained from **6Lc** (558 mg) following the general procedure (Method B). Column chromatography (EtOAc/MeOH, 1:5) and lyophilization gave **8Lg** as a foamy solid (325 mg, 94%): $[\alpha]_D^{20}$ = +31 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3394, 1117, 1072 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 500 MHz): δ = 8.27, 8.24, 8.23, 8.21, 8.20 (5 s, 5 H), 5.89 (m, 5 H), 5.40–4.50 (several m, 29 H), 4.39 (m, 5 H), 3.84 (m, 5 H), 3.60–3.10 (several m, 28 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 125 MHz): δ = 144.1, 143.9, 143.2, 123.8, 101.4, 85.7, 83.5, 81.2, 78.2, 78.1, 76.9, 73.8, 71.1, 68.2, 67.5, 64.8, 63.9, 61.7, 60.6, 57.5 ppm. HRMS (MALDI-TOF): calcd. for $C_{51}H_{77}N_{15}O_{31}$ $[M + Na]^+$ 1418.40; found 1418.50.

4-(α-D-Mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-ylmethyl 2,3,4,6-Tetrakis-*O*-{4-(α-D-mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-yl}-β-D-glucopyranoside (8Lh): Obtained from **6Ld** (613 mg) following the general procedure (Method B). Column chromatography (MeOH) and lyophilization gave **8Lh** as a foamy solid (350 mg, 87%): $[\alpha]_D^{20}$ = +31 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3392, 1131, 1089, 1055 cm^{-1}. ^1H NMR ([D$_6$]DMSO, 300 MHz, selected signals): δ = 8.19 (s, 1 H), 8.16 (s, 1 H), 8.08 (s, 1 H), 8.05 (s, 2 H) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 144.2, 144.0, 125.9, 125.7, 125.5, 101.7, 99.7, 83.0, 80.8, 76.9, 73.5, 72.9, 70.6, 70.0, 67.9, 66.6, 65.6, 60.8, 50.2 ppm. HRMS (MALDI-TOF): calcd. for $C_{61}H_{97}N_{15}O_{36}$ $[M + Na]^+$ 1638.60; found 1638.50.

1,2,3,4,5,6-Hexakis-*O*-{4-(α-D-mannopyranosyl)-1*H*-1,2,3-triazol-1-ylmethyl}-D-mannitol (8Mg): Obtained from **6Mc** (662 mg) following the general procedure (Method A). Column chromatography (CH_3CN/H_2O, 2:1) gave **8Mg** as a solid (370 mg, 90%); m.p. 203 °C (dec). $[\alpha]_D^{20}$ = +16 (*c* = 1 in H_2O), $[\alpha]_{436}^{20}$ = +84 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3411, 2924, 1640, 1437, 1114 cm^{-1}. ^1H NMR ([D$_6$]-DMSO, 300 MHz, selected signals): δ = 8.28, 8.22, 8.21 (3 s, 6 H, H-5 triazole), 5.93, 5.90, 5.89 (3 d, *J* = 3.7 Hz, 6 H, H-1 Man), 4.80–4.50 (several m, CH_2O), 4.46–4.38 (m, 6 H, H-2 Man), 4.00–3.50 (several m, 28 H, H-3,4,6,6 Man, CHO) ppm. ^{13}C NMR ([D$_6$]-DMSO, 100 MHz): δ = 144.6, 144.5, 144.4 (C-4 triazole), 124.5, 124.3 (C-5 triazole), 86.3, 86.2 (C-1 Man), 78.7 (C-5 Man), 77.9, 71.7, 68.7, 68.1, 68.0 (C-2,3,4 Man), 64.2 (CH_2O), 61.2 (C-6 Man), 49.1 ppm. HRMS (FAB+): calcd. for $C_{60}H_{92}N_{18}O_{36}$ $[M + Na]^+$ 1663.582; found 1663.621.

1,2,3,4,5,6-Hexakis-*O*-{4-(α-D-mannopyranosyloxyethyl)-1*H*-1,2,3-triazol-1-ylmethyl}-D-mannitol (8Mh): Obtained from **6Md** (485 mg) following the general procedure (Method A). Column chromatography (CH_3CN/H_2O, 2:1) gave **8Mh** as a solid (283 mg, 90%); m.p. > 260 °C (dec). $[\alpha]_D^{20}$ = +12 (*c* = 1 in H_2O), $[\alpha]_{436}^{20}$ = +49 (*c* = 1 in H_2O); IR (KBr): $\tilde{\nu}$ = 3417, 1652, 1139, 1102 cm^{-1}. ^1H NMR ([D$_6$]DMSO + D_2O, 400 MHz): δ = 8.04, 7.98, 7.93 (3 s, 6 H, H-5 triazole), 4.70–4.40 (m, 18 H, CH_2O-triazole, CH_2N, H-1 Man), 3.93, 3.80 (2 br. s, 16 H, CH_2O, OCHO, CH_2O-Man), 3.62 (m, 4 H, CH_2O), 3.53 (br. s, 6 H, H-2 Man), 3.60 (m, 6 H, H-6 Man), 3.40 (m, 6 H, H-6 Man), 3.50 (m, 12 H, H-3,4 Man), 3.17 (m, H-5 Man) ppm. ^{13}C NMR ([D$_6$]DMSO, 75 MHz): δ = 143.9, 143.7 (C-4 triazole), 124.2, 124.0 (C-5 triazole), 99.7 (C-1 Man), 77.2 (OCH), 74.0, 70.7, 69.9 (C-2,3–5 Man), 66.7 (C-4 Man), 65.0, 64.7, 63.6 (CH_2O), 61.0 (C-6 Man), 49.1 (CH_2N) ppm. HRMS (FAB+): calcd. for $C_{72}H_{116}N_{18}O_{42}$ $[M + Na]^+$ 1927.739; found 1927.788.

Enzyme-Linked Lectin Assay (ELLA): ELLA assays were carried out as described previously.[33] Experiments were carried out using a Metertech Σ960 instrument. Microtitration plates were coated with *S. cerevisiae* mannan with 100 μL/well of a solution of 10 μg/mL in 10 mM phosphate buffer (PBS, pH 7.4) for 2 h at 37 °C. The wells were then washed twice with 10 mM phosphate buffer containing 1% (v/v) Tween 20 (PBST) and once with PBS. This

washing procedure was repeated after each incubation period. Wells were then blocked with 300 μL/well of BSA/PBS (1% w/v) for 2 h at 37 °C. Each inhibitor (the glycoconjugates or methyl α-Man) was added in serial dilution (60 μL/well) in PBS (pH 6.8, containing 0.1 mM $Ca^{2+}$and 0.1 mM Mn^{2+}), and the peroxidase-labeled Con A (60 μL/well of a solution of 50 μg/mL in PBS, pH 6.8, containing 0.1 mM $Ca^{2+}$and 0.1 mM Mn^{2+}) was added. The mixtures of glycoclusters or methyl α-Man and the peroxidase-labeled lectin (100 μL/well) were added, and the plates were incubated for 2 h at 37 °C. After that, 50 μL/well of a solution of *o*-phenylenediamine dihydrochloride (20 mg/50 mL) in citrate-phosphate buffer (pH 5.0 with 0.4% H_2O_2) was added. The plates were incubated for 30 min at 37 °C. The reactions were stopped by the addition of aqueous H_2SO_4 (50 μL/well, 1.25 M), and the absorbance was measured at 492 nm.

Acknowledgments

We thank the Dirección General de Investigación Científica y Técnica (DGICYT) for financial support (CTQ2005-02219).

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Received: November 25, 2008
Published Online: April 2, 2009

