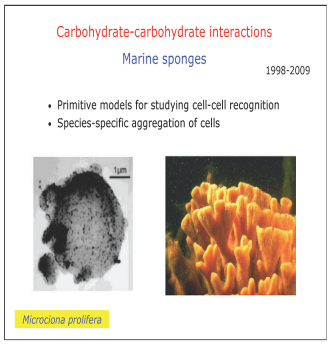


Carbohydrate-Carbohydrate Interactions

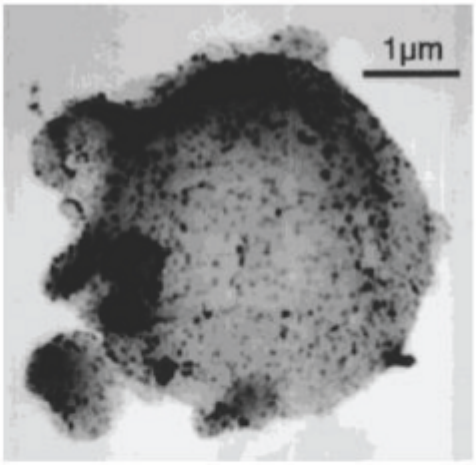
Description

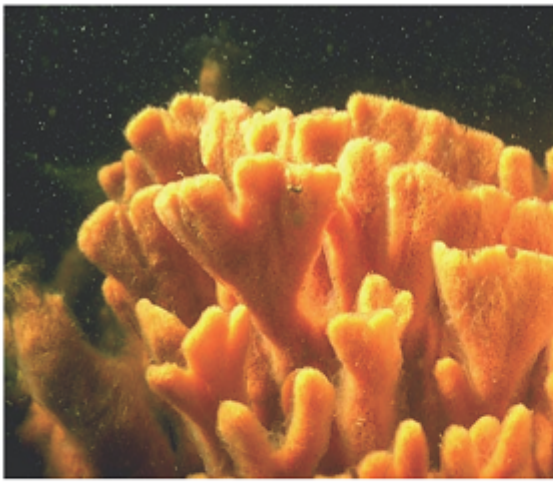
Carbohydrate-carbohydrate interactions

Marine sponges

199

- Primitive models for studying cell-cell recognition
- Species-specific aggregation of cells





Microciona prolifera

- When placed in artificial sea water free of Ca^{2+} ions, complete dissociation of the sponge tissue into a suspension of cells occurs.
- Formation of cell-aggregates by adding Ca^{2+} to the c suspension; completely functional sponges can be th result.
- Cell-surface proteoglycans underlie the Ca^{2+}-depend molecular mechanism of the self-recognition; coding aggregation factors (AF).
- Sponge-species specificity of the aggregation proces colour-specific sponge cell sorting. Can be mimicked different coloured beads, coated with species-specifi AFs.

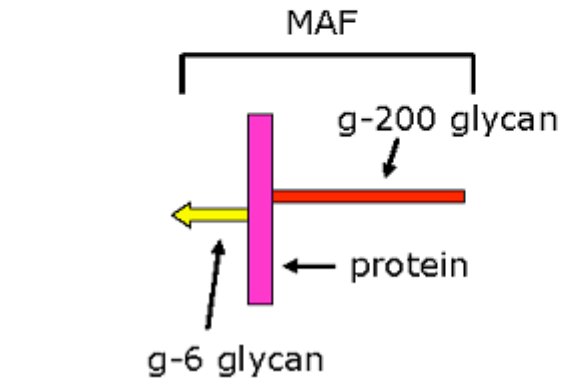
Proposed model for MAF-mediated sponge cell ad

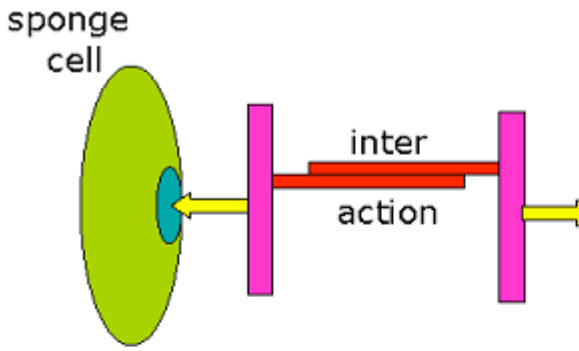
Microciona prolifera

Ca^{2+}-independent adherence of g-6 glycans to cell-surface receptors (carbohydrate-protein interaction).

Ca^{2+}-dependent self-association of g-200 glycans (carbohydrate-carbohydrate interaction).

Other alkaline earth cations, Mg^{2+}, Sr^{2+}, Ba^{2+} could not replace Ca^{2+} as an aggregation-mediating agent. The transition elements Mn^{2+} and Cd^{2+} could partially replace Ca^{2+}.



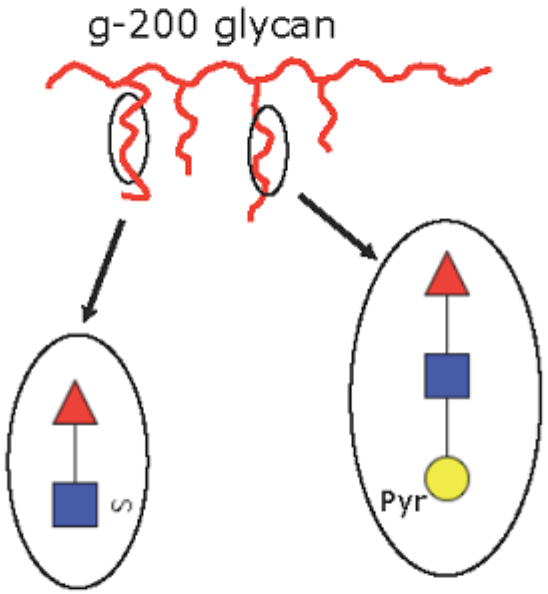


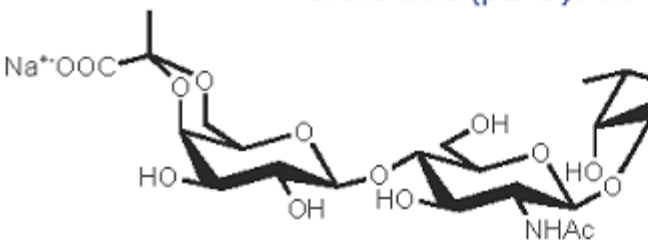
Multivalent interactio

Structural analysis of MAF fragments

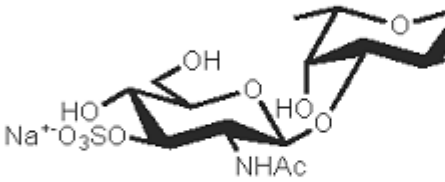
Two oligosaccharide fragments p
from *M. prolifera* MAF g-200 by r
hydrolysis were shown to be epit
the MAF self-recognition (Mab st

- Gal4,6(*R*)Pyr(β1-4)GlcNAc(β
- GlcNAc3*S*(β1-3)Fuc



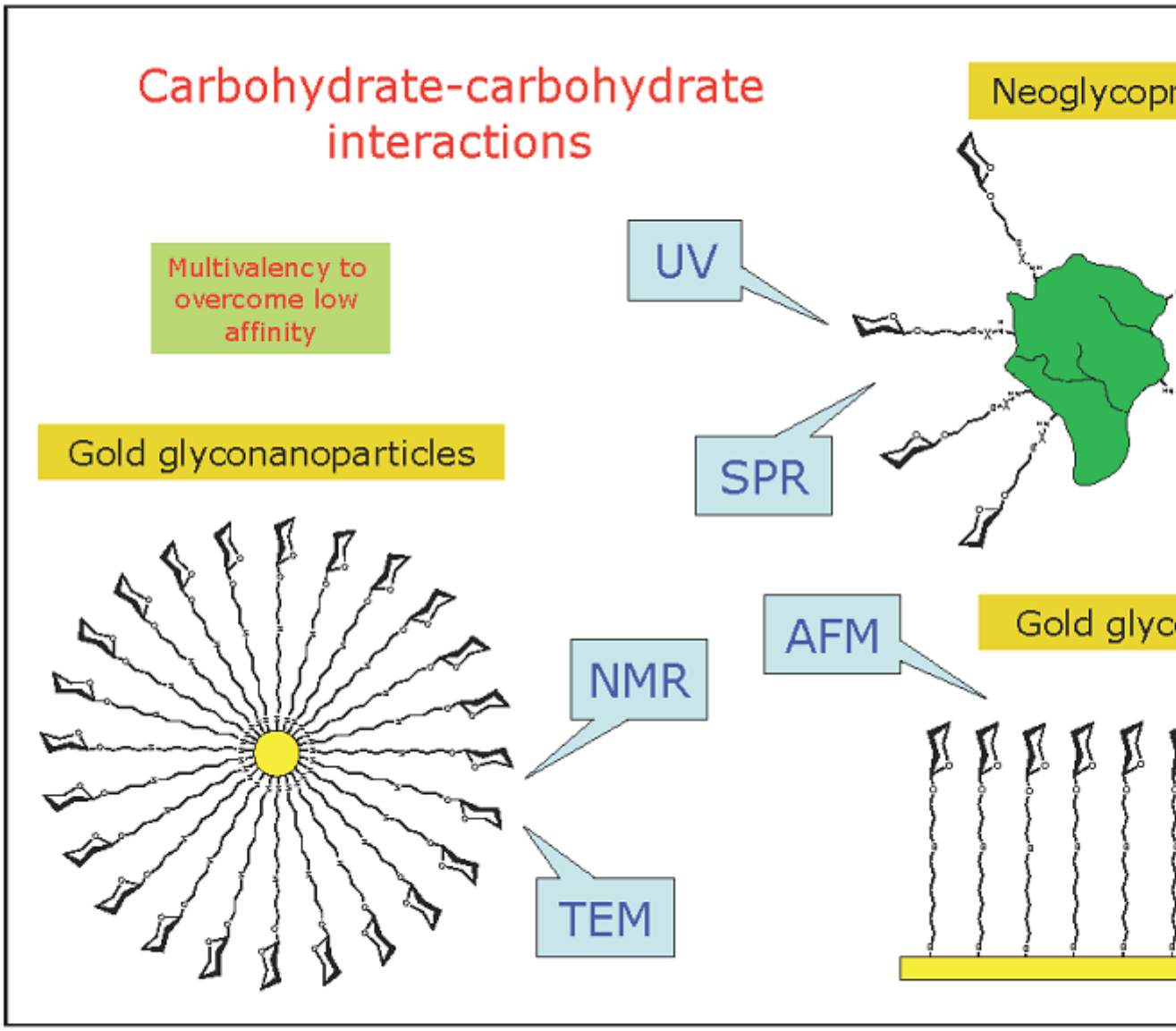


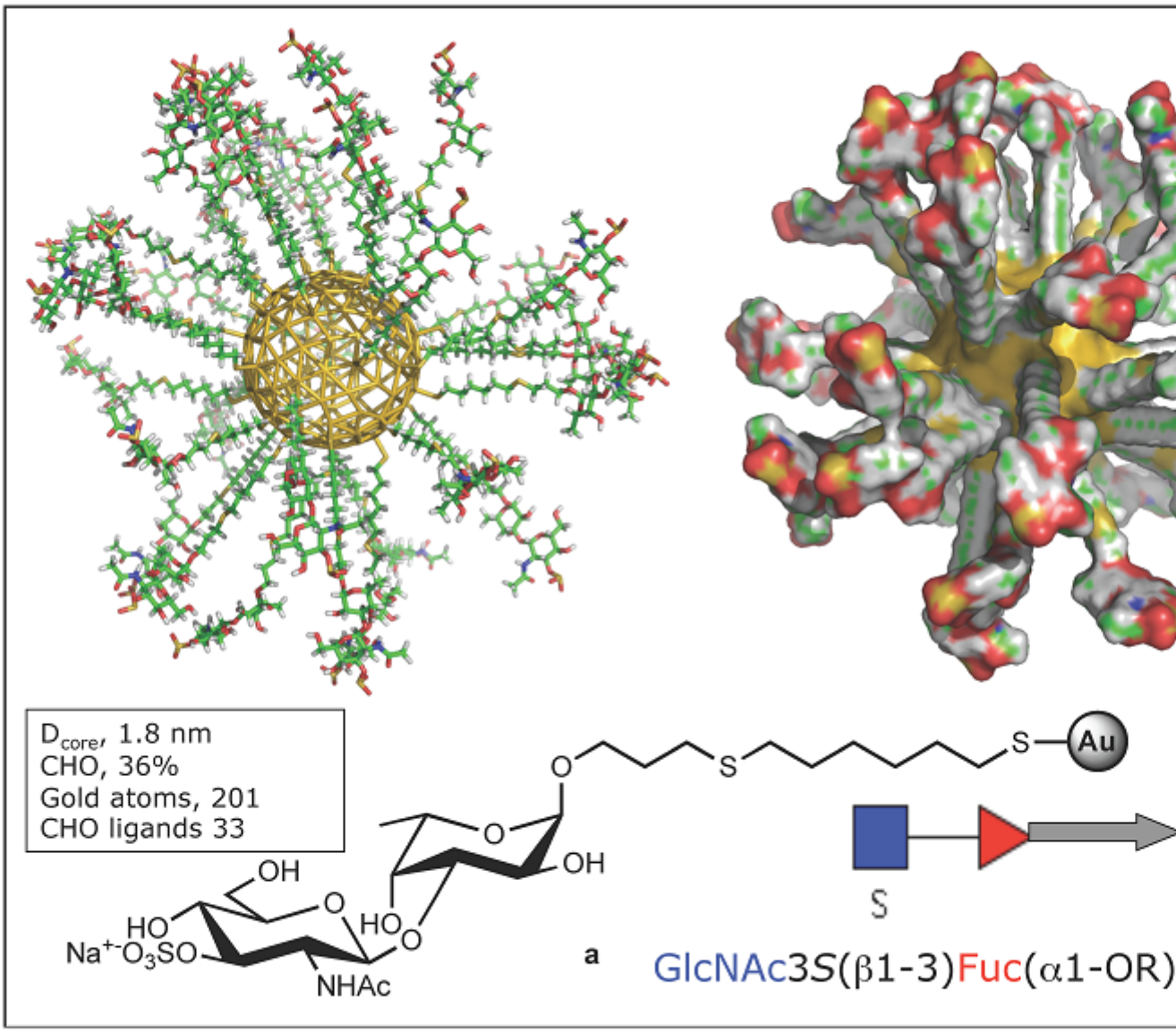
Reactive towards the cell
blocking antibody Block 1



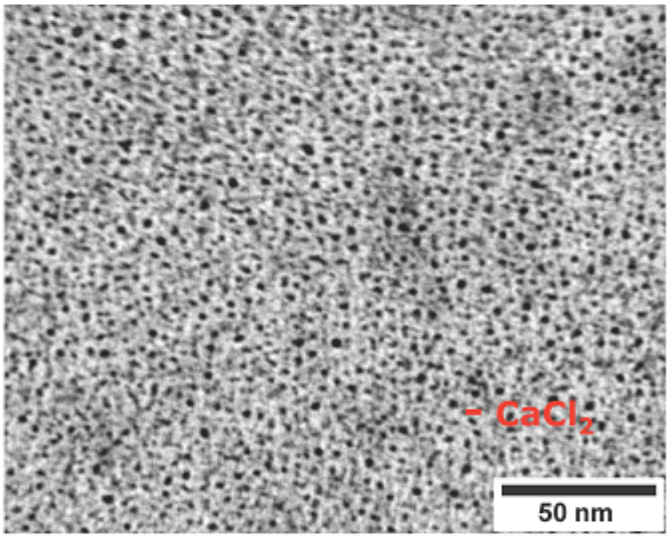
Reactive towards the cell
blocking antibody Block 2

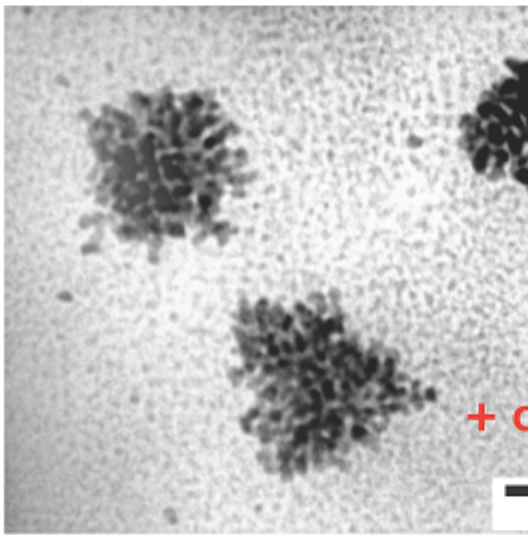
■ = D-GlcNAc ▲ = L-Fuc ● = D-Gal

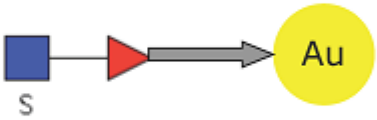

Carbohydrate-carbohydrate interactions
Neoglycopr
Multivalency to overcome low affinity
UV
SPR
Gold glyconanoparticles
AFM
Gold glyc
NMR
TEM

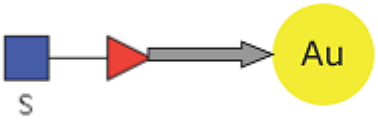

D_{core}, 1.8 nm
CHO, 36%
Gold atoms, 201
CHO ligands 33
OH
HO
$Na^{+-}O_3SO$
O
HO
O
NHAc
O
OH
O
S
S
Au
S
a
GlcNAc3S(β1-3)Fuc(α1-OR)

Transmission Electron Microscopy of gold glyconanoparticles









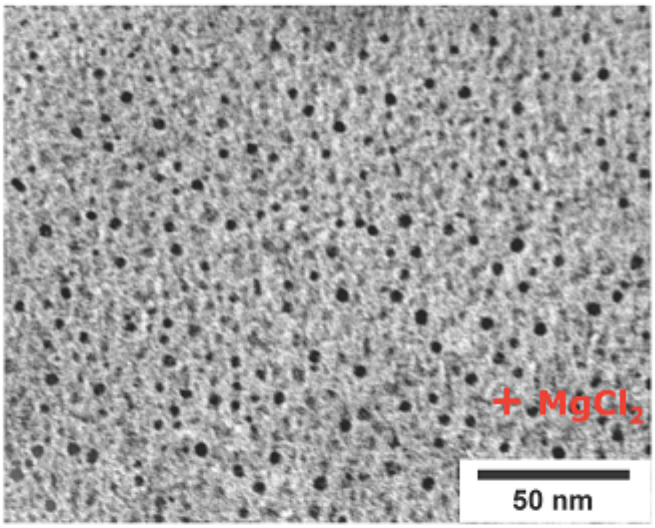
0.1 mg/ml; without calcium ions

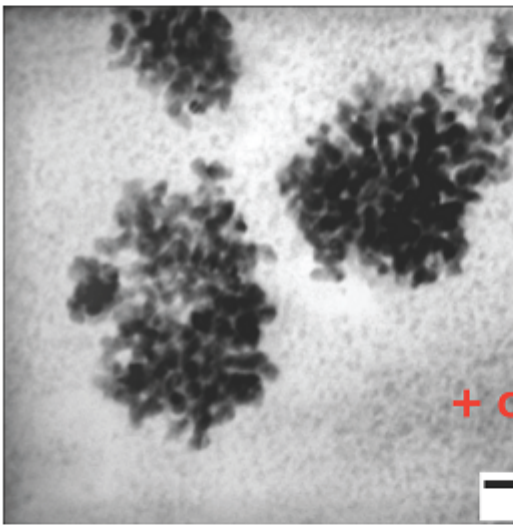
0.1 mg/ml; with calcium ions (10 m

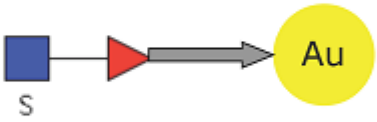
TEM analysis of gold glyconanoparticles

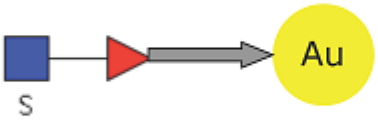
No self-recognition in the presence of $MgCl_2$ and $MnCl_2$.

Weak self-recognition in the presence of $CdCl_2$.









0.1 mg/ml; with magnesium ions (10 mM)

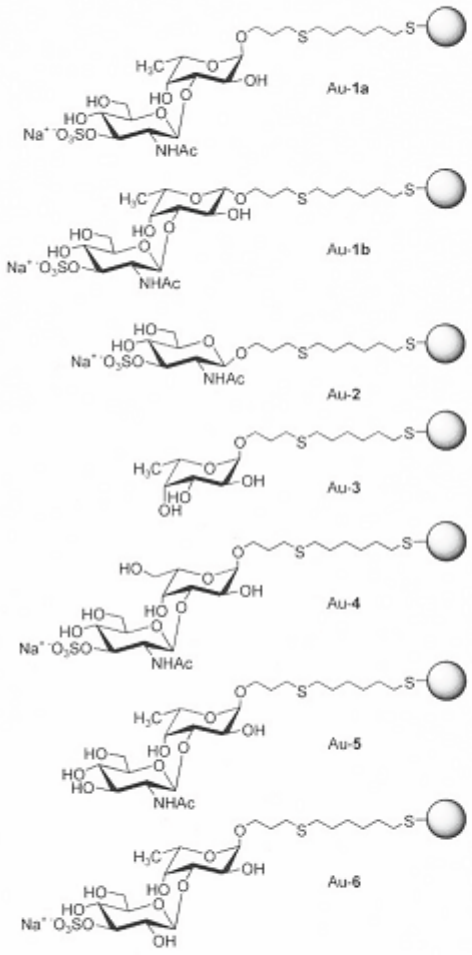
0.1 mg/ml; with calcium ions (10 m

Gold Glyconanoparticles as Probes to Explore the Carbohydrate-Mediated Self-Recognition of Marine Sponge Cells

Adriana Carvalho de Souza,[a] Koen M. Halkes,[a] Johannes D. Meeldijk,[b] Arie J. Verkleij,[b] Johannes F. G. Vliegenthart,[a] and Johannis P. Kamerling*[a]

Cell aggregation in the red-beard marine sponge *Microciona prolifera* is mediated by a 2×10^4 kDa proteoglycan-like macromolecular aggregation factor (MAF), and is based on two highly polyvalent functional properties; a Ca^{2+}-dependent proteoglycan self-interaction and a Ca^{2+}-independent cell-binding activity.[1–3] MAF, the first circular proteoglycan described, is composed of two *N*-glycosylated proteins, MAFp3 and MAFp4, with twenty units of each glycoprotein forming the central ring and the radiating arms, respectively. Each MAFp3 carries one or two copies of a 200 kDa acidic glycan, g-200, whereas each MAFp4 carries about 50 copies of a 6 kDa glycan, g-6.[3] The MAFp4 arms of the sunburst-like proteoglycan are linked to cell-surface binding receptors, while the MAFp3 ring exposes the g-200 glycans so that they can engage in the Ca^{2+}-dependent self-association (for a detailed review, see ref. [4]). By making use of MAF-specific monoclonal antibodies, it could be demonstrated that the self-association of MAF occurs through highly repetitive epitopes on the g-200 glycan.[5,6] One of these epitopes was shown to be the sulfated disaccharide GlcpNAc3*S*(β1–3)Fuc*p*.[7] To gain insight into the role of carbohydrate interactions in MAF self-aggregation, we designed a challenging system for mimicking the g-200 self-association.[8] By using the synthetic sulfated disaccharide, multivalently presented as a bovine serum albumin conjugate, and surface plasmon resonance spectroscopy, it was shown that Ca^{2+}-dependent carbohydrate self-recognition is a major force in the g-200 association phenomenon.

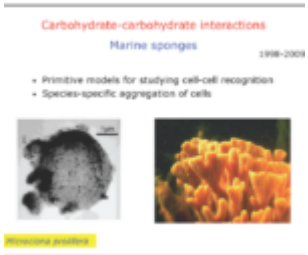
Gold glyconanoparticles have been successfully used as inert multivalent systems to explore either carbohydrate self-interac-



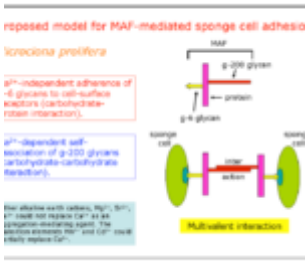
Scheme 1. *Gold glyconanoparticles Au-1a/b to Au-6, related to the MAF sulfated disaccharide epitope.*

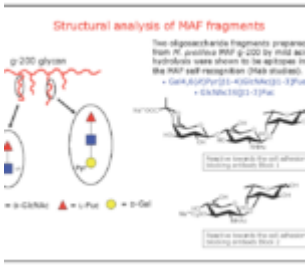
Adria
de So

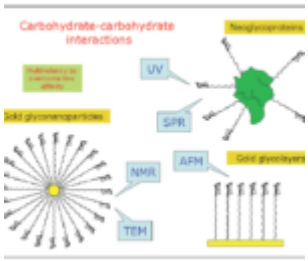
ChemB
6 (200




When placed in artificial sea water free of Ca^{2+} ions, a complete dissociation of the sponge tissue into a suspension of cells occurs.
Formation of cell-aggregates by adding Ca^{2+} to the cell suspension; completely functional sponges can be the result.
Cell-surface proteoglycans underlie the Ca^{2+}-dependent molecular mechanism of the self-recognition; coding: aggregation factors (AF).
Sponge-species specificity of the aggregation process; colour-specific sponge cell sorting. Can be mimicked by different coloured beads, coated with species-specific AFs.


reposed model for MAF-mediated sponge cell adhesio
Icreciona prolifera
MAF
g-200 glycan
protein
g-4 glycan
Multivalent interaction


Structural analysis of MAF fragments
g-200 glycan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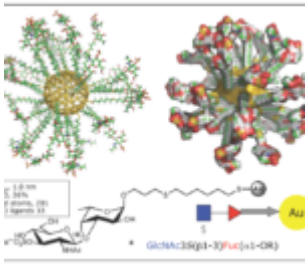

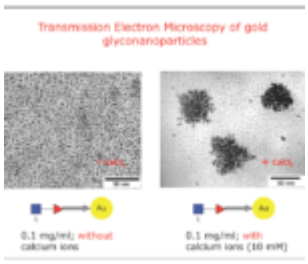

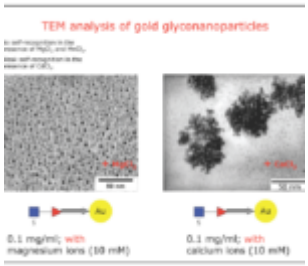

Category

1. News