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Precision Nanostructured Presentation of Glycans at Interfaces for Multivalent Binding Specificity

A novel method generates highly controlled, nanoscale carbohydrate patterns on hydrogel surfaces for advanced drug screening, cell interaction studies, and medical diagnostics.

Researchers at Purdue University have developed a way to study glycan-lectin interactions at a nanoscale level. Generation of controlled glycan arrays can be used to design interfaces for the study of drug interactions in many fields such as immunotherapy and regenerative medicine. Cell surface glycans are present on the surface of all living cells and interact with glycan-binding proteins known as lectins. This glycan-lectin interaction regulates many critical cellular interactions like cell adhesion, cell differentiation, infection response, metastasis, etc., but is difficult to replicate in an in vitro setting due to relatively weak binding. Current approaches to depositing the glycans onto a surface rely on covalently binding functionalized glycans to a glass, silicon, or gold surface, but this renders limited control over inter-glycan distance and glycan orientation. Instead, Purdue researchers assembled diyne amphiphiles with carbohydrate headgroups on highly ordered pyrolytic graphite to generate nanometer-resolution carbohydrate patterns that are then photopolymerized and covalently transferred to the surfaces of hydrogels. These functionalized polymers can be used to evaluate interactions with a wide variety of biological molecules.

Technology Validation: A model lectin (wheat germ agglutinin) was found to bind selectively to the glycan array. The binding strength was modulated based on the carbon chain structure of the glycan interaction. The interaction between WGA and the amphiphilic GlcNAc monolayers was found to be multivalent by exposing the monolayer to increasing concentrations of fluorescent WGA.

Advantages:

-Nanoscale control of orientation, inter-glycan distance, density

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Category
Biotechnology & Life Sciences/Biomarker Discovery & Diagnostics
Pharmaceuticals/Drug Discovery & Development
Materials Science & Nanotechnology/Nanomaterials & Nanostructures

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-Compatibility with hydrogels

-Specific to selected lectin

Applications:

-Generating glycan arrays

-Designing cell interaction interfaces

-Drug screening and drug design

-Medical diagnostics

TRL: 3

Intellectual Property:

Provisional-Patent, 2022-05-31, United States | Provisional-Patent, 2022-08-08, United States

Keywords: glycan-lectin interactions, nanoscale level, glycan arrays, drug interactions, immunotherapy, regenerative medicine, cell surface glycans, lectins, diyne amphiphiles, carbohydrate patterns, Chemistry and Chemical Analysis, immunotherapy, Regenerative Medicine