Programming Biological Membranes and Protocells with Sequence-Defined Janus Glycodendrimers

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Our laboratory uses a materials genome approach to the discovery and prediction of programmed primary structures that are instructed to undergo intramolecular and intermolecular self-assembly, self-organization and the other sequences of events involved in the emergence of complex-homochiral biological functional systems. Materials genome uses *the first principles* employed in biology to design the tertiary structure responsible for a particular function. Since the mechanism of transfer of structural information in organic natural and synthetic compounds is not understood, theoretically the primary structures responsible for the creation of complex functional systems that are characterized by adaptation, self-control, self-organization, self-repair, etc. cannot be designed. This lecture will discuss the discovery of programmed primary structures that provide simple mimics of complex biological membranes and hybrid cells as well as their programmable glycan ligands. Sequence-defined building blocks were used to generate multivalent membrane topologies that program glycan-ligands binding to sugar-binding proteins such as lectins and galectins at unexpected low levels of carbohydrate concentration when arranged in a suitable sequence. Implications for biology and medicine will be discussed.