THE DESIGN OF FUNCTIONAL SUPRAMOLECULAR GELS AND COATINGS USING HYDROPHOBICALLY MODIFIED BIOPOLYMERS AND POLYPEPTOIDS

Vijay John, Tulane University, USA
vj@tulane.edu

Our recent work is based on the hydrophobic modification of biopolymers to provide building blocks for supramolecular architectures. The attachment of long chain alkyl groups to the polymer backbone allows the polymer to stick to hydrophobic surfaces and to “hook” onto lipid bilayers. The hydrophobic effect exhibited by such systems can be used to design new functional nanostructures. For example, the use of such polymers to capture and tether liposomes leads to surfaces with densely packed liposomal layers that exhibit very low coefficients of friction in sliding lubrication, representative of articular joints.

We also extend this concept to a system of hydrophobically modified polypeptoids (HMPs) which are amphiphilic pseudo-peptidic macromolecules with hydrophobic groups attached randomly along the polypeptoid backbone. We show that these biocompatible polymers connect across lipid bilayers and thus form layered structures on liposomes. The transition from a single bilayer to multiple bilayer structures is characterized by small angle neutron scattering (SANS) and cryo-transmission electron microscopy (cryo-TEM). Of specific interest is the observation that small bilayer rafts reattach to fresh unilamellar liposomes and self-assemble to form new two-bilayered liposomes reminiscent of two-bilayered organelles such as the nucleus in eukaryotic cells. These observations have significance to designing new nanoscale drug delivery carriers. Results on the *in-vitro* delivery of a highly hydrophobic chemotherapeutic agent, sorafenib, to hepatocellular carcinoma cells shows the feasibility of the concept.