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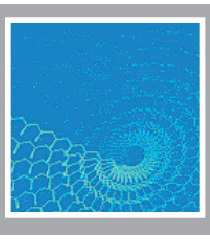

Polymer and Colloid Highlights

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Macrocyclic Molecules for the Design of Self-Assembling Amphiphiles

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Amphiphiles typically possess at least one polar hydrophilic group and one hydrophobic apolar moiety. This ambivalence of affinity for water provides this class of molecules with outstanding self-assembly properties at interfaces and in aqueous media. In addition to the natural lipids, a wide range of synthetic amphiphiles have been produced and used for applications ranging from material sciences to pharmaceutical formulations. Among them, an interesting class of complex amphiphiles is based on calixarenes where the macrocycle is used as organizing basis to orient the further grafted chemical functionalities in the three dimensions.[1]

Calixarenes are macrocyclic molecules produced by the base-catalyzed reaction of *p*-substituted phenols and formaldehyde. The resorcinarenes are commonly produced by the Brønsted acid-catalyzed reaction of resorcinol and an aromatic or aliphatic aldehyde. Because of their relative structural rigidity and the possibility to modify selectively both of their rims, these two classes of macrocycles may serve as bases to produce novel amphiphilic molecules.

We have recently produced a calixarene bearing aliphatic chains at the phenolic rim and aromatic amines at the *para*-positions (Fig. 1).[2] In addition to its ability to form stable Langmuir monolayers, it has been demonstrated that this amphiphile can form stable nanoparticles (NPs) in water. These NPs have been shown to have a positive surface charge and have been further coated with alternate layers of DNA and chitosan with the layer-by-layer (LbL) technique (Fig. 2).[3] It has been demonstrated that these systems possess the ability to carry safely DNA into mammalian cells. These results may open a new way for the use of calixarene-based nanoparticles for cell transfection.

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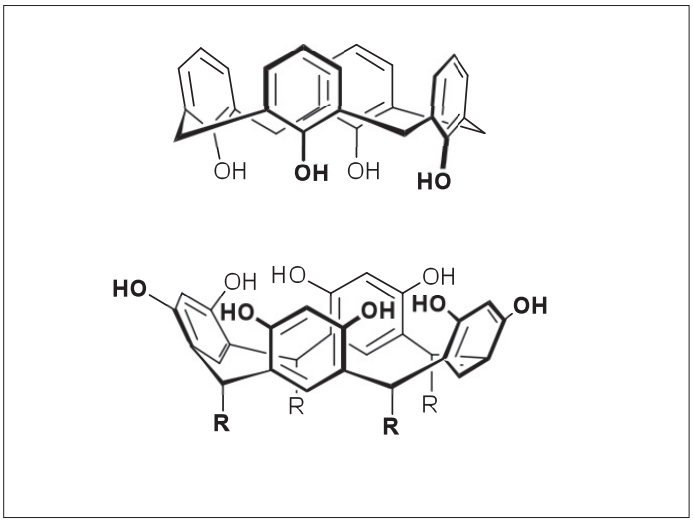

Fig. 1. Molecular formulas of calix[4]arene (top) and a resorcinarene (bottom).

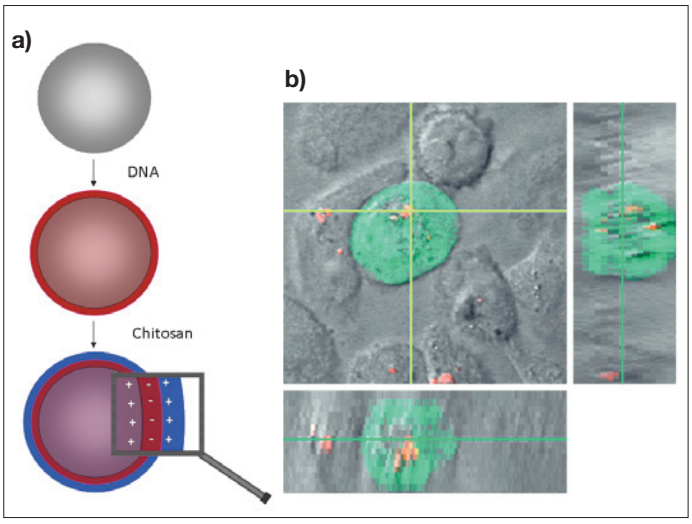

Fig. 2. Schematic representation of the LbL assembly process at the surface of calixarene NPs (*a*) and confocal micrograph of a cell transfected with these NPs (*b*).

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