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Title:

Supramolecular Self-Assemblies for Functional Nanomaterials in Chem-Bio Sensing

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Abstract:

Supramolecular self-assembly is at the top of technologies of interest to agencies such as DTRA. Generating functional nanomaterials through self-assembly at the meso-, micro- and macro-scopic scales is ill-defined with regard to functionality, molecular recognition, chirality and asymmetry. Fundamental investigations of self-assembly are essential to unravel such systems from molecules to nanomaterials that transform into optoelectronic microdevices. We propose supramolecular self-assemblies of cyanines and porphyrins as models for functional nanomaterials. Cyanines cooperatively self-assemble on helices and achiral polymers forcing conformational changes that transform the polymers into supramolecular helices. Cyanines have helicophilic and helicogenic properties resulting in red shifted absorption and fluorescence spectra due to molecular J-aggregation. We reported the dynamic supramolecular self-assembly of cyanine on biopolymer scaffolds yielding bathochromic J-aggregates or hypsochromic H-aggregates that were used for chem-biosensing. Controlling and tuning supramolecular self-assembly facilitate improved functional nanomaterials for highly sensitive chem.-bio detection in a broad range of applications.