Energy transfer and replication of amphiphilic β-sheet peptides

The self-assembly of amphiphilic biomolecules, such as peptides and proteins, is highly considered in the research fields of nanotechnology and supramolecular chemistry. The emergence of self-replicating molecules has been repeatedly advocated as a prerequisite in scenarios leading to the origins of first life on earth.

In previous researches in our group, amphiphilic peptides served as templates for replication when arranged into well-defined structures. The ligation of a nucleophile and an electrophile peptide forming the native amphiphilic peptide and increasing its own formation in its presence was shown. Another research in our group demonstrated that the introduction of the naphthalene diimide (NDI) moiety facilitates the efficient self-assembly into the fibril structures and provides efficient electron transport along the structure, resulting in a significant increase in the fibril conductivity. Our study investigates the replication ability of a 13 amino-acid peptide including one NDI moiety and a Tryptophan, and the conductivity of fibers built by these peptides using π-stacking interactions.

The replication study, based on the fluorescence properties and the energy transfer between two aromatic groups: tryptophan as a donor and NDI as an acceptor, relies on the native chemical ligation between a thioester on the extremity of the electrophile sequence and a cysteine in the nucleophile sequence. The product of this ligation is identical to the 13 amino-acid peptide (P13\textsubscript{NDI}). In order to present a template effect, the ligation of the nucleophile and the electrophile, in the presence of the template P13\textsubscript{NDI} is increasing and showing higher replication rate.
Bibliography: