Co-Assembly of Peptide Amphiphiles (PAs) and Lipids into Supramolecular Nanostructures

Co-assembly of binary systems driven by specific non-covalent interactions can greatly expand the structural and functional space of supramolecular nanostructures. Examples include coassembly of bioactive and nonbioactive molecules to tune the intensity of smart drugs, or functional biomimetic structures. In our work, the self-assembly of peptide amphiphiles (PA) and fatty acids (lipids) driven primarily by anion−π interactions are focused. With a low content of the lipid, the cylindrical nanofiber morphology is preserved. However, as the aromatic units are placed along the peptide backbone away from the hydrophobic residues, the interactions with the lipids transform the cylindrical supramolecular morphology into ribbon-like structures. Increasing the stoichometric ratio of the lipid to PA leads to either the formation of large vesicles in the binary systems or a heterogeneous mixture of assemblies. Our findings reveal how co-assembly involving designed specific interactions can drastically change supramolecular morphology and cross from nano to micro scales.

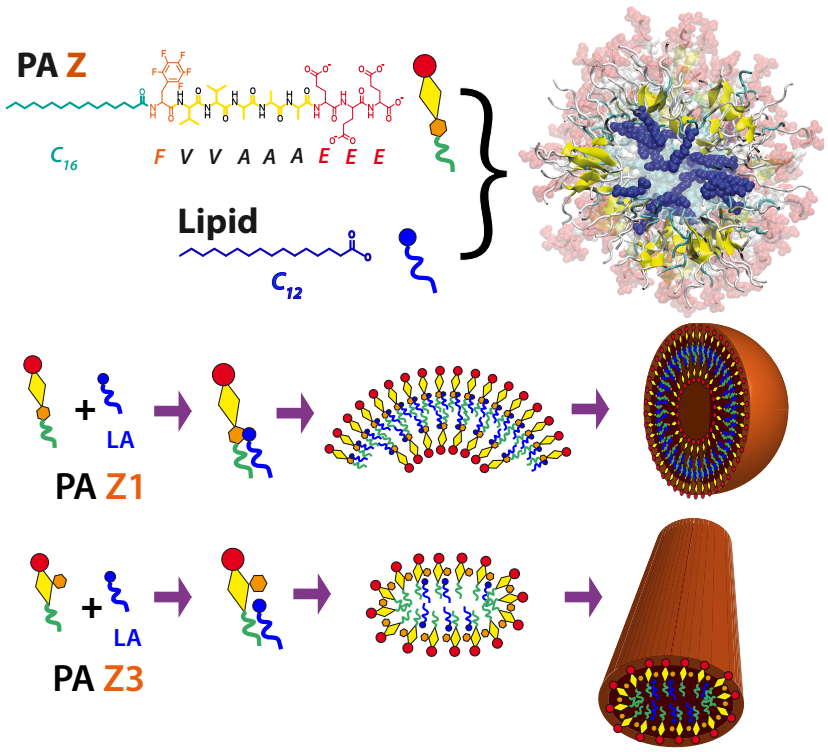

Figure 1: Top: The molecular structures of PA and lipids (left), and the cross-section of a nanofiber (right). Center and bottom: Association of PAs and the lipids lead to various morphologies depending on the the position of the aromatic groups (rendered by orange).

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