Macromolecular Assembly of π-Embedded Synthetic Polypeptides

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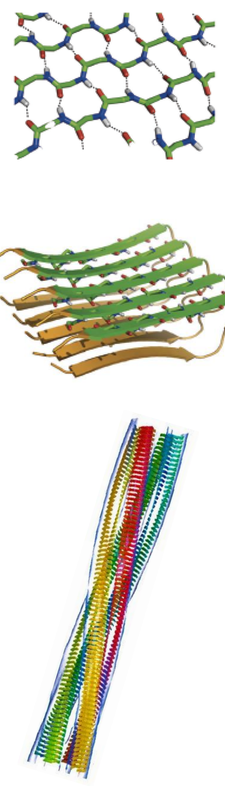
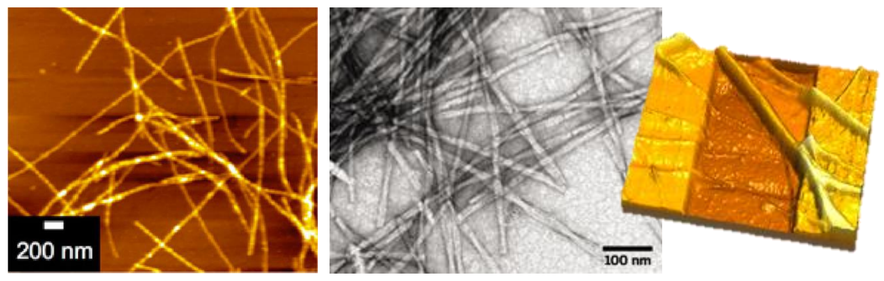
Artificial Amyloids as Functional Materials

Hierarchical Assembly of Amyloid Fibres



Natural amyloids fibres, e.g., collagen and silk, exhibit high levels of mechanical toughness and aspect ratios as a result of ***hierarchical macromolecular assembly*** via extensive cross-β-sheet and hydrogen-bonding network formation



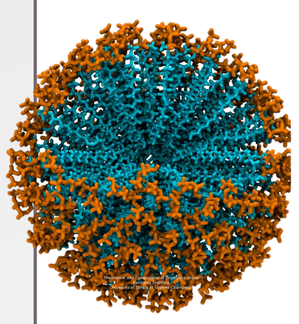
Artificial amyloid-mimetic polypeptides form the structural basis for accessing functional one-dimensional nanomaterials

Installation of photo- and redox-active cores within these synthetic macromolecules tune and enhance the potential for observing emergent optical and electronic properties.[1-3]

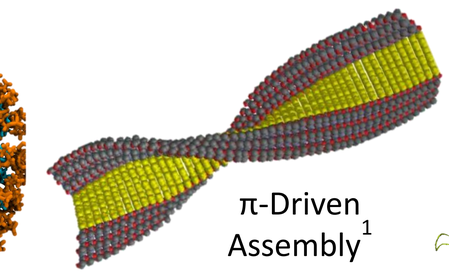
Supramolecular vs. Macromolecular Assembly

Complementary bottom-up strategies towards realising functional soft matter and novel organic–hybrid nanomaterials with directed interactions

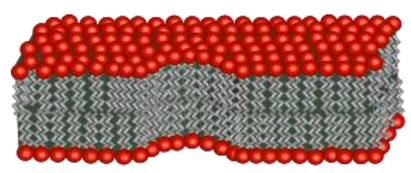
Supramolecular	Macromolecular
Multiple Low MW Components	High MW / Polymeric Building Blocks
Simpler Syntheses	Multistep Synthesis
Energetically Limited Assemblies	Access to Hierarchical Structures
Dynamic / Reversible Structures	Kinetic Wells / Robust Products

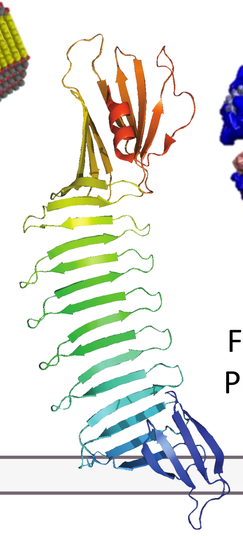


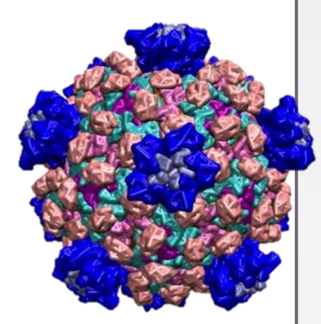
Amphiphilic Assembly[2]



π-Driven Assembly[1]



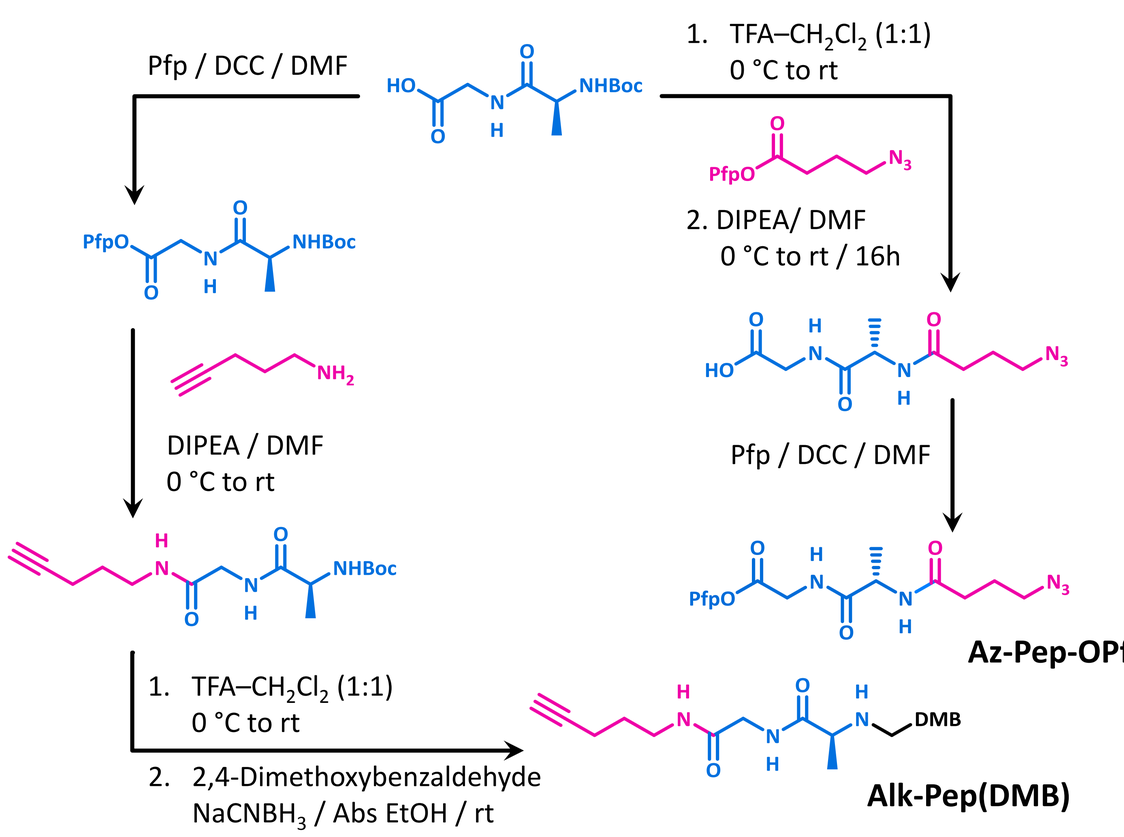




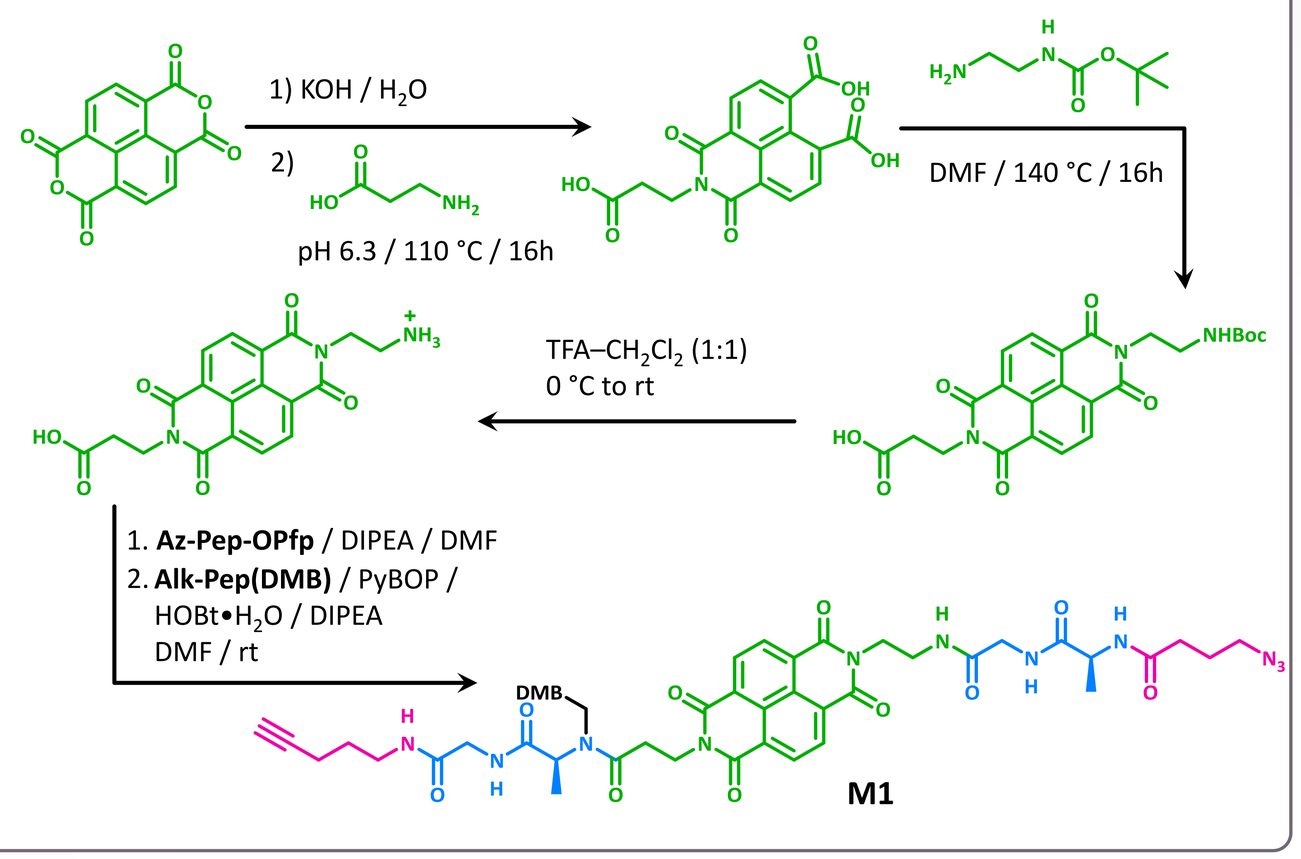
Foldamers[3,4] and Protein Assembly

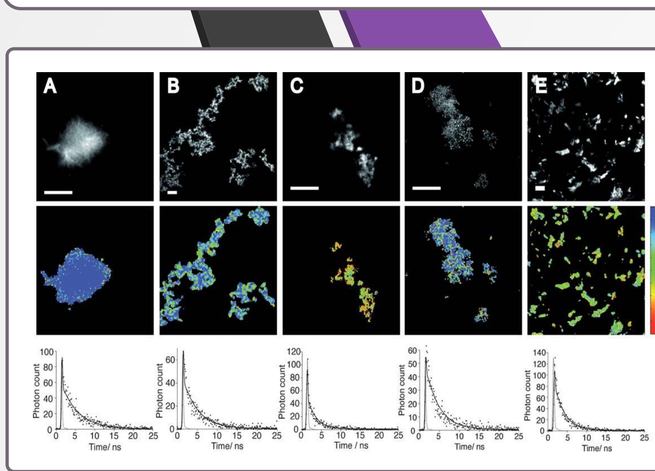
Convergent Synthesis of a π-Embedded Macromonomer

Peptide Fragments By Solution-Phase Chemistry



Naphthalene Diimide: A Model Redox-Active Aromatic Core





Time-resolved Intrinsic Amyloid Emission

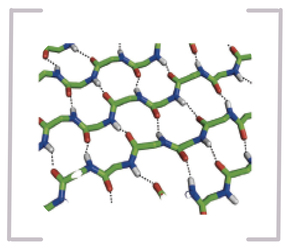
Macromolecular Folding and Assembly 'On Demand'

'Click' Polymerisation[4]

X-ray Structure

1,4-Triazoles as Hairpin Mimicks[5]

Hierarchical Assembly



Acid-cleavable DMB provides polymer solubility and enables **stimuli-responsive** β-sheet and fibre formation

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