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Controlling Beta-peptide Assembly Formation

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Peptide-based supramolecular assemblies have gained increasing attention in different areas of nanotechnology, drug delivery, and molecular biology. Small manipulations in peptide sequences can lead to the formation of different morphological assemblies. Here, the non-natural peptidic scaffolds, such as those of beta-peptides, are particularly promising, as their diverse secondary structures, high stability, and self-association affnity could be readily exploited to create supramolecular assemblies with applicability in bio-nanotechnology. We have recently demonstrated that acyclic short beta-peptides with alternating amino acid chirality can achieve nanostructures that closely mimic both the oligomerization and the filament formation of natural peptide. However, a better understanding on the stages during assembly formation would be instrumental. We attempted to understand how systematic small variations on the sequence could affect assembly formation properties. Surprisingly, distinct levels of macromolecular assemblies could be identified, from oligomers to fibrillar bundles that were reached by applying single point mutations and N-terminal chemical modifications. These results propose that the self-assembly process of short beta-peptides could be highly controlled, allowing widespread applications where specific levels of assembly stages need to be maintained.