Abstract

"Fabrication of Nanobiomaterials though Molecular Self-assembling Peptides and Their Applications in Nanomedicine"

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Understanding of new materials at the molecular level becomes increasingly critical for a new generation of nanomaterials for nanobiotechnology, namely, the design, synthesis and fabrication of nano-devices at the molecular scale from bottom up. Basic engineering principles for microfabrication can be learned by understanding the molecular self-assembly and programmed assembly phenomena. Self- and programmed assembly phenomena are ubiquitous in nature. Numerous self-assembling systems have been developed ranging from models to study of protein folding and protein conformational diseases, to surfactant peptides, nano-surface engineering, and nanobiotechnology. Several distinctive types of self-assembling peptide systems have been developed. Two complementary strategies can be employed in the fabrication of molecular biomaterials. In the 'top-down' approach, biomaterials are generated by stripping down a complex entity into its component parts. This contrasts with the 'bottom-up' approach, in which materials are assembled molecule by molecule and in some cases even atom by atom to produce novel supramolecular architectures. The latter approach is likely to become an integral part of nanomaterials manufacture and requires a deep understanding of individual molecular building blocks, their structures, assembling properties and dynamic behaviors. Two key elements in molecular fabrication are chemical complementarity and structural compatibility, both of which confer the weak and noncovalent interactions that bind building blocks together during self-assembly. Significant advances have been achieved at the interface of biology and materials science, including the fabrication of nanofiber materials for 3-D cell cultures, tissue engineering and regenerative medicine, the peptide detergents for stabilizing, and crystallizing membrane proteins as well as nanocoating molecular for cell organizations. Molecular fabrications of nanobiomateirals have fostered diverse scientific discoveries and technological innovations.