Biomedical applications and challenges.

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Description

Over the last 20 years, self-assembled nanostructures based on peptides have been investigated and presented as biomaterials with an impressive potential to be used in different bionanotechnological applications such as sensors, drug delivery systems, bioelectronics, tissue reparation, among others. Several advantages mild synthesis conditions, relatively simple functionalization, low-cost and fast synthesis confirm the promise of those biological nanostructures as excellent candidates for such uses. Through self-assembly, peptides can produce to a variety of well-defined nanostructures like nanotubes, nanofibers, nanoparticles, nanotapes, gels and nanorods. However, there are several challenges that have yet to be extensively approached and solved. Issues like controlling the dimensions during synthesis, the steadiness in liquid environments and manipulation need to be confronted when trying to integrate these nanostructures within the development of sensing devices or drug-delivery systems. The fact that these issues present difficulties is reflected within the low number of devices or systems using this material in real applications.

The present chapter discusses these challenges and presents possible solutions. A review of the state-of-the-art work concerning the utilization of peptide self-assembled structures in biomedical applications is given. Additionally, our findings regarding the on-chip synthesis of peptide self-assembled nanotubes and nanoparticles, their controlled manipulation, also as electrical and structural characterizations is introduced. Our latest results showing the interaction of peptide self-assembled structures with cells for the event of a combined sensing/cell culture platform and thus the utilization of these material in clean-room processes along the steadiness of the biological structures in liquid also are presented.

The field of biological self-assembly is extremely diverse and thus the structures formed can vary tremendously in both shape and size. For this reason, a full description of all possible assembled structures and the monomers forming them is beyond the scope. Rather, the main targets are going to be on the applications and challenges that one must remember of when working with such structures. For this, it's important to possess a particular understanding of the method behind the formation and this section therefore provides a quick introduction to the concepts behind self-assembly along with a brief description of the foremost important structures which will be formed though self-assembly. Reviews are written about each of the various structures and that we therefore by no means claim to supply an exhaustive account of those configurations.

The structures formed by hydrophobic dipeptides and people formed by phenylalanine are going to be given special attention since they're ready to produce to nanotubes, nanofibers and nanoparticles depending on the formation conditions. Furthermore, these structures will function model materials throughout the chapter as an example the challenges faced when working with the self-assembly of structures. Biers have long been a focus for researches all round the world and permanently reason. These structures have received much attention as potential building blocks for subsequent generation of biosensors.

They have been considered both as a fabrication material and as important components within the final device as electrode modification or because the central a part of a biological field effect transistor. Many different structures are shown to self-assembly into nanofibers-like conformations. The most well-known of those are undoubtedly the amyloid fibrils. These beta sheets of amino acids stack together in aggregates to form long insoluble fibrils. The insolubility of the structures is often harmful within the body and, for instance, Alzheimer's disease is caused by such an aggregation of the amyloid beta protein fragments. However, in biosensor applications the insolubility of the self-assembled nanofibers is very desirable since it'll insure the long-term stability of the sensor.

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