CHAPTER 1

Utilisation of Nanotechnology to Functionalise Implants & Devices

M. Jokinen

Summary

Nanoscience and -technology is one the current fields of interest to adjust the properties of implants and tissue engineering scaffolds. It deals with systems and structures that result in new properties due their small size (1-100 nm). The two main approaches, 1) bottom up (from molecular level to organised molecular films, supramolecular structures or nanoparticles) and 2) top-down technologies (bits of bulk material are removed resulting in nanoscale features; e.g. surface patterning) are used. The main applications in the biomaterials science are controlled cell attachment on different implant surfaces and design of multifunctional drug delivery device. Because the cell attachment depends both on surface chemistry and on the surface nanoscale features, the modification of implants involves usually different surface treatments. The surface is either coated with a functional film or patterned on nanoscale. Cell or protein adhesive groups are commonly introduced as terminal groups in selfassembled (mono)layers of functional amphiphiles. The surface patterning can be done either by coating the implant with nanoparticle films with specific dimensions, by using lithography or by using imprints of biological molecules (e.g. proteins). In case of films, nanotechnology is utilised at two interfaces: functional coating-cells/tissue and functional coating-implant surface to optimise the interactions. In case of drug delivery device, attempts have been done to include several functionalities in the same structure, e.g., linkers for biological recognition, drug targeting and sustained release.

Current advances and future considerations of the utilisation of nanoscience and – technology to optimise the properties of multifunctional implants and devices are discussed.

Correspondence to: M. Jokinen, University of Turku, Turku, Finland. E-mail: mika.jokinen@utu.fi

Topics in Multifunctional Biomaterials and Devices, Ed. N Ashammakhi © 2008.