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Engineered titanium surfaces for specific interactions with integrin receptors through poly (L-lysine)-g-poly (ethylene glycol) adlayers functionalized with collagen derived mimetic peptide

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Engineering surfaces for specific integrin-ligand interaction and signaling cascades provides a biomolecular strategy for optimizing cellular responses in biomaterials applications. The integrin α2β1 recognizes a specific amino acid binding sequence that is present on type I collagen. Integrin recognition is entirely dependent on the triple-helix conformation of the ligand similar to that of native collagen[1]. This study focuses on engineering α2β1-specific bioadhesive surfaces by immobilizing a triple-helical collagen-mimetic peptide, incorporating the specific binding sequence, onto model nonadhesive substrates. Metal oxide surfaces can be made protein-resistant through spontaneous assembly of poly-(L-lysine)-g-poly-(ethylene glycol) (PLL-g-PEG) grafted co-polymers. This copolymer is used as a basis for developing special surfaces with controlled specific biological properties[2], e.g. through grafting the binding sequence of type I collagen to part of the PEG-chains to induce a direct interaction of the peptide ligands at controlled surface density with cell receptors.

The polymer functionalized surfaces were characterized by Optical Waveguide Lightmode Spectroscopy (OWLS), Ellipsometry and X-ray photoelectron spectroscopy (XPS).

The peptide-modified polymers were adsorbed on TiO2 and preliminary tests with cells were performed. In particular Rat Calvarian Osteoblast and Human Fibroblast were used as substrate: the presence of the collagen-like functionalized polymer seems to induce a preferred cellular adhesion of Osteoblast with respect fibroblast, as compared to the control peptide-functionalized polymer, after 1 day of incubation; nevertheless more detailed experiment have to designed and performed to validate such results.

References

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