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DocMASE Project Proposal 2012-01

Project Title	***CoCr alloy surface modification for cardiovascular applications***
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Project Description	Surface quality (physical, chemical, and topographical) of biomaterials is a key influencing factor to elucidate specific signals for the regeneration of each specific biological tissue. Among others, modification of the surface topography and, more recently, physisorption and biofunctionalization of the material with target biomolecules are gaining special attention in the scientific community. The main novelty of this project arises in the combination of the use of those biomolecules with functional activity with different topographic pattern substrates made of biomaterials with a relevant interest in biomedicine, which is a step forward to gain fundamental knowledge and to develop new biomedical product. The proposed project is focused on developing bioactive CrCo surfaces with a series of selected functional biomolecules (peptides, biopolymers) to be used in cardiovascular applications. The project will include the synthesis of biofunctional cues, the controlled modification of the micro- and nano-topography of the surfaces, and the covalent attachment of the functional biomolecules by appropriate chemical paths to obtain stable and biologically active functionalized surfaces. Metallic alloys such as Co-Cr have been lately used in the cardiovascular field for stents manufacture. The surfaces of these metals consist of a passivating oxide film with hydroxyl groups that can be further exposed and used for silane chemistry coupling [1, 2]. Organo silanes have been extensively used as substrates for anchoring specific biomolecules for bone regeneration [2]. With this in mind, silanization will be the strategy adopted in our group to achieve biofunctionalization of the selected metal-surfaces. To improve implant success, biomaterials surfaces are designated to modulate endothelial cells (EC) adhesion and response. To address selectivity towards endothelial cells two main approaches will be studied: (1) the attachment of different peptides to the CoCr surfaces [3]; and; (2) the formation of a specific surface pattern by laser interference experiments [5, 6]. Special attention will be paid to the characterization of the quality of the obtained surfaces. Adhesion, proliferation and differentiation of progenitor cells on the modified surfaces and influence of mechanical stimulus applied by a bioreactor will be studied with specific cell lines of the target tissue, i.e., endothelial progenitor cells.
References	[1] Puleo DA. *Biomaterials* 17:217-212, 1996 [2] Textor M, Tosatti S, Wieland M, Brunette DM. 'Bio-Implant Interface: Improving Biomaterials and Tissue Reaction', eds: Ellingsen & Lyngstadaas, cap 19:341-366, 2003 [3] Veiseh M, Veiseh O, Martin MC, Asphahani F, Zhang M. Langmuir 27: 4472-4479, 2007
Previous Publications	[4] M. Pegueroles, C. Aparicio, M. Bosio, E. Engel, F.J. Gil, J.A. Planell, G. Altankov. *Acta Biomaterialia* 6: 291–301 [5] Lasagni A., Holzapfel C., Mücklich F. *Applied Surface Science* 253 (3): 1555-1560 [6] F. Mücklich, A. Lasagni, C. Daniel. *Int. J. Mat Res*. 97 (2006) 10 [7] F. Yu, F: Mücklich et al. *Biomacromolecules* 6: 1160-1167 (2005)