



Biomaterials for biomedical applications: bacterial cellulose, dextrin hydrogels and dextrin/mannan nanoparticles

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The polysaccharides mannan, pullulan, dextrin and bacterial cellulose (BC) were used for the production of BC hollow tubes, dextrin/mannan nanoparticles (NPs) and dextrin hydrogels. These biomaterials were comprehensively characterized. Applications currently studied include the controlled release of therapeutic proteins for immunotherapy and vaccination, artificial vascular prosthesis and injectable hydrogels for tissue engineering.

A strategy to functionalize these materials using Carbohydrate Binding Modules (CBM) fused to bioactive peptides such as RGD or LL37 was successfully developed (1). The use of CBMs allow the facile and affordable production of bioactive peptides, and simultaneously its binding to the biomaterials surface, through specific and stable adsorption mediated by the CBM. The interaction of the newly developed biomaterials with cells (*in vitro*), biocompatibility (*in vivo* – subcutaneous implants) and biodistribution of the NPs has been analysed (2).

Highlights of the ongoing and near future work include 1) the study of the NPs intracellular trafficking by confocal microscopy; 2) NPs as a vaccination adjuvant and antigen carrier – tests in a mice model; 3) *in vivo* studies – sheep - using BC for vascular replacements; 4) the development of new strategies for the production of BC and mammalian cell culture exploiting its piezoelectric properties; 5) use of injectable hydrogels for regenerative medicine – bone regeneration.

- (1) Andrade, F.K., Moreira, S.M.G., Domingues, L., Gama, F.M. “Improving the affinity of fibroblasts for bacterial cellulose using carbohydrate-binding modules fused to RGD” *Journal of Biomedical Materials Research: Part A* (in press)
- (2) Gonçalves, C., Gama, F.M. Characterization of the self-assembly process of hydrophobically modified dextrin. *European Polymer Journal* 44(11), 3529-3534, 2008