

Protein-like Multifunctional Polymers and its Use as Stable Coatings for Bone Implants

A new set of protein-like recombinant biopolymers with biomineralization and enhancement of cell response functions have been successfully synthesized. A simple method to strongly-anchor the biopolymers on metallic biosurfaces has been also developed. Coated dental and orthopedic implants will have improved, more stable, and faster integration in bone tissue.

Partners to further develop the technology and/or to establish commercial agreements along with technical cooperation are sought.

The Challenge

During the last decade different methods of surface modification of biometals used to make dental and orthopedic implants have been investigated with the general purpose of fostering the regenerative capacity of the adjacent bone. Among them, topographical and physico-chemical modifications have been the most studied ones. However, more recent approaches focus on surface modifications inspired in nature that could provide biometals with osseostimulative capabilities.

Proteins that form part of the extracellular matrix of bone, such as collagen, play an important role in tissue regeneration by (1) providing anchorage points and signals that regulate cellular activities; and (2) controlling the bone biomineralization process. Their use to functionalize metallic surfaces for stimulating bone repair is a quite novel and very attractive strategy. Most of the technologies developed so far have important drawbacks, among them (a) the rather low stability of the protein fixation; (b) lack of selectivity in the targeted function; and (c) difficulties in combining different biomolecules and thus, multiple bioactivities in the same device.

The Technology

The present innovation unfolds in two main technologies. First, mono and multifunctional protein-like polymers have been obtained using recombinant biotechnologies. The biopolymers are easily activated by introducing specific peptides with intrinsic biological functions, such as cell recruitment, cell differentiation, or stimulation of biomineralization. Second, the polymers can be covalently-anchored by a simple method in three steps based in silane-chemistry. The coatings can contain one or more of the biopolymers providing multiple possibilities for activating the treated surfaces.

Innovative advantages

- Biopolymers can be easily modified to target properties
- Production of biopolymers can be easily scaled-up
- Coatings are mechanical and thermo-chemically stable
- Coatings retain specific targeted bioactivities of the isolated biopolymers
- Coatings are non-fouling and thus, cells can directly interact with the bioactive sites of the biopolymers.
- Coatings reproduce the topography of the substrate to the nanolevel.
- Proved enhanced cell response and controlled biomineralization.

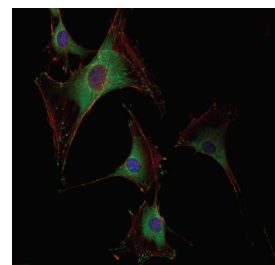
Current stage of development

The biopolymers and the coatings have been characterized in terms of chemical, physical, mechanical, and in vitro biological properties.

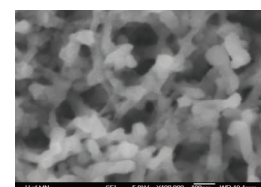
Applications and Target Market

This technology allows to obtain a new multifunctional coating to promote bone regeneration around metallic implants and thus, accelerate dental and orthopedic implants integration after surgery. It could also be used for incorporating antimicrobial agents and other specific drugs.

New stable coatings of biopolymers with biomineralization and cell recruitment tailored functionality



The coatings preserve substrate topography and do not detach after mechanical or biochemical stress



The multi-bioactive recombinant-biopolymer coatings can target different bone-regenerative responses and accelerate integration of medical implants

Business Opportunity

Technology available for licensing with technical cooperation

Patent Status

PCT application

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