Genetically engineered Silk-Elastin-Like Proteins as a versatile platform for the development of new biomaterials

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Throughout evolution nature created and refined proteins for a wide range of functions, working as structural components or as molecular motors. In this sense, the natural fibrous proteins represent the utmost case of function specialization and high performance materials. The remarkable mechanical properties of proteins like elastin or silk are founded on conservative blocks of amino acid sequences that propagate through the natural protein. These repetitive amino acid sequences are arranged in a way that creates flexible, rigid or tough domains, which are responsible for the physical and mechanical properties of the natural protein. Indeed, the recognition of the mechanics linking the nano- and micro-scale structure with the macromolecular assembly and organization, enabled molecular biologists to understand nature's refined ways of creating high performance structural materials. Advances in synthetic protein biotechnology, emerging from the increase of knowledge in structural and molecular biology, combined with the use of recombinant DNA technology and biotechnology processes, made possible the advent of a new class of artificial biomacromolecules, the recombinant Protein-Based Polymers (rPBPs). This new class of protein-based materials, inspired in nature and with precisely controlled amino acid sequences, mimic the properties of their natural counterparts but can also combine in the same polypeptide chain the properties of two or more different proteins, creating copolymers with distinct properties from their native equivalents. Indeed, by recombinant DNA technology, it is possible to design and produce tailored synthetic genes, allowing for the creation of multifunctional complex PBPs with absolute control of its composition, structure and molecular weight.

Silk-elastin-like proteins (SELPs) are a class of bioinspired, genetically engineered block copolymers, composed of silk and elastin repeating units [1]. As base materials for biomedical purposes, SELP nanofibre mats demonstrate potential to be applied as wound dressing materials for skin regeneration applications [2] whereas SELP films have interesting properties for a wide variety of applications [3]. Due to its high versatility of processing, SELP copolymers can be used for the development of several different types of materials such as (nano)fibres, free standing films, hydrogels and composite materials. For instance, antimicrobial SELP materials can be produced by using silver (Ag) as filler for the development of SELP/Ag materials. Similarly, the use of essential oils for the formulation of SELP composites provides the basis for the development of bioactive materials.

This work intends to provide an overview of the research developed by our group in the development of SELP-based materials and composites as new materials.

[1] Machado R. et al, (2013), *AMB Express*, 3:11
[2] Machado R. et al, (2013), *Biomed Mater*, 8:065009
[3] Machado R. et al, (2015), *Macromol Biosci*, 15(12):1698-1709

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Abstract submission form

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Presentation title	Genetically engineered Silk-Elastin-Like Proteins as a versatile platform for the development of new biomaterials
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