KP 2 - The concept of Chemical and Physical Decoy of Biological Media: Applications for Tissue Engineering

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In the concept of scaffold used in tissue engineering, the idea is to present to a biological media a material that is structurally and/or chemically similar to the living material, with even the presence of cells trapped within the biomaterial. This methodology is limited by the complexity of the natural living materials that are impossible to mimic completely at every scale.

We recently proposed a different approach based on the concept of 'decoy', which means that an efficient tissue regeneration can be obtained in-vivo and in-vitro with materials that are not identical to the living media but must be designed to have some parts in common with living tissues and others that must remain different. The introduced differences or similarities can concern both the chemical and physical structure of such materials.

On a chemical point of view, a decoy polymer is fully absent in mammal tissues since the structural units constituting its primary structure should be, at least for one part, absent in the corresponding extra-cellular matrixes (ECM). A decoy effect is easy to conceive in copolymers of unknown entities (absent, but similar and/or of a natural origin) and known (present) entities that lead to a necessarily erroneous biological responses, which can be favorable for cell proliferation. Thus, we are involved in the use of naturally occurring decoys such as chitosan, but we also work to elaborate other decoys based on the controlled chemical modification of glycoaminoglycans or other polysaccharides.

On a physical point of view, a similarity of structure between living tissues and decoy materials can be obtained through the elaboration of hydrogels. Actually, these synthetic or natural structures exhibit a pore size sufficiently low to preclude any physical transfer of living cells, in clear opposition with the methodology derived from the concept of scaffold. Nevertheless, these gels can be used for the elaboration of complex structures such as multi-membrane objects in which cells can be introduced for the regeneration of multi-layer tissues. We are thus involved in the evaluation of our decoy materials in different biological situations corresponding to either in-vivo or in-vitro experiments with epithelial cells or chondrocytes.