ImmunoTools *special* Award 2018

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Bio-fabrication of Artificial Tissues for Tissue Engineering

Tissue engineering is a very attractive branch of modern medicine. In fact, it represent not only a promising vehicle to face the “regenerative medicine” requests, but it is also a very sophisticate tool for the in vitro studies of complex biological systems such as tissues development and regeneration. A great step forward in tissue engineering advancement is represented by the improvement of biomimetic materials that are able to active interact with cells in order to provide microenvironments suitable for the clinical application and the basic theory progress.

My current PhD project is to develop some innovative materials suitable for tissue engineering applications; in particular, I focused on the stimulation of periodontal tissue (cementum, alveolar bone, periodontal ligament and gingiva) regeneration using a chitosan-based 3D model scaffold, designed as multiple layers to accommodate and support specific different types of the regenerated tissues. The surface modifications have been developed in order to improve the adhesion and to promote the proliferation of the tissue-specific cells (osteoblasts for bone, cementoblasts for cementum and fibroblasts for gingiva and periodontal ligaments) with the purpose to improve the repair and the regeneration of the damaged tissue where the materials could be implanted.

As the surface modifications are innovative, from a biological point of view, in vitro cytocompatibility is the first evaluation necessary to validate the materials. In order to do that, cells are to be seeded directly onto the materials surface and some biological parameters are to be evaluated. First of all, materials surface modifications must not inhibit cells adhesion; therefore, the use of specific markers related to adhesion protein such as collagen, integrins and hyaluronic acid could be an important proof to demonstrate that cells are attached and are successfully promoted to produce their natural extracellular matrix (ECM). So, cells positive response to specific antibody such as CD54, 47, 41, 36, 29 and 18 represent an excellent tool to answer to this first question. Then, once cells are attached, they must also be able to proliferate and

reproduce a complex structure suitable to develop a biochemical microenvironment for the cell-to-cell cross talk.

Annexin V and CD95 are specific markers related with apoptosis; in fact, Annexin V is representative for the phosphatidylserine nuclear translocation while CD95 is related with the caspase 8 cascade activation. Thus, by using these specific markers it is possible to understand if cells seeded onto materials surface are undergoing into apoptosis or not.