Developing Novel Platforms for Engineering Human Tissues

by

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ABSTRACT

Cell surface interactions are ubiquitous and play a very important role in biological systems. It is necessary to investigate such interactions and apply them in the fields ranging from tissue engineering and biomaterials design. We are more interested in the cell-ecm interactions and how they can be better understood to design human tissues. We have specifically focused on the development human skin tissue model and tumor spheroids as well as cell-ligand interactions.

A novel tissue engineering approach called 3D Free Form Fabrication (3DFFF) is being used to design human skin tissue model. The new 3DFFF approach is believed to be best suited for the generation of a complex organ such as skin as it is a powerful and flexible technology that allows printing of multi-cellular, multi-layered and physiologically relevant tissue structures in a high-throughput manner. This novel cell-printing platform allows on-demand control of cell-to-cell and cell-to-environment interactions. *In vitro* models of human skin will be of great advantage in designing disease models for autoimmune diseases of the skin such as psoriasis, atopic dermatitis, allergic contact dermatitis and vitiligo; models of skin malignancies such as melanoma; and models for skin wound healing. Such disease models can provide a useful platform to study disease pathophysiology, as well as, design effective therapeutics. Additionally, we have developed a quick and reproducible way of generating uniform sized tumor spheroids using patterned PDMS molds. The long-term goal is to develop a high-throughput platform for the screening of anti-cancer drugs. Simultaneously, we are employing high-throughput cell-based assays for exploring the interactions between peptide-ligands and cell-surface receptors. These ligands can then be used to design a variety of novel biomaterials in the field of tissue engineering and also have their applications in drug discovery.