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Nano-scaffold development for targeting mast cells in human tissue

Mature mast cells reside in connective tissues that largely interface with the external environment, making them crucial sentinel cells that help to direct and control the innate immune response. The rapid degranulation and long-term expression of various proteins that occurs upon mast cell activation provides both a quick and long-term response mechanism. These released mediators are central to protective actions such as wound healing, angiogenesis, and host defense against pathogens and animal venoms. Thus, mast cells are ideal targets for novel immunotherapies. Engineering biomaterials to manipulate the immune response to elicit specific therapeutic outcomes is a burgeoning field of research. In particular, the development of self-assembled peptide systems for directing the action of mast cells within a local tissue environment will be presented, with a special focus upon skin tissue applications. The effect of Nano scaffolds composed of self-assembled peptides was explored using several mast cell types. Initial work focused upon understanding the influence of Nano scaffold structure and chemistry on bone marrow-derived murine mast cell (BMMC) activity: adhesion, degranulation and cytokine release. Results show that BMMCs adhere to the matrix without previous sensitization and can be found within the matrix itself, without exhibiting any signs of activation. This work is considered the first step in quantifying mast cell activity in artificial matrices composed of self-assembling peptides and led to further work looking at IgE independent activation of human mast cells through Mas-related G-protein coupled receptor member X2 (MRGPRX2) receptor. Herein, it was observed that the engineered Nano scaffold matrix could be designed to locally activate tissue-resident mast cells within human tissue samples. This Nano scaffold may provide a new platform to modulate localized mast cell functions thereby facilitating their protective role in the skin.

Speaker Biography

Larry D Unsworth, is a professor in chemical engineering at the University of Alberta. In 2005, he was awarded the international research associate award by NRC-Canada and joined the Massachusetts Institute for Technology USA to work in the area of self-assembled peptides and diffusion in complex media. His PhD was based on the area of engineered surfaces for bio-fouling applications. He has 2 patents and 60+ papers, with a total citation record of 2300: three papers cited 250+ times and another six cited 100+ times, with an h index of 18. His research focus is on development of bio responsive and bioactive, self-assembled peptide constructs.

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