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Injectable Sponge-like Scaffolds for Cancer Immunotherapy

Monday, April 27
340 Curry
11:15am – 12:30pm

Refreshments will be served

ABSTRACT Cancer immunotherapy is rapidly emerging as a self-standing therapeutic domain in oncology, set to revolutionize the treatment of cancer. Cancer vaccines with defined antigens are now commonly used. However, using whole tumor cells, as tumor-associated immunogens, is a more promising and versatile approach that could lead to personalized vaccines. Currently, whole cell tumor vaccination is carried out as simple cell infusions that lead to large-scale cell death, little control over cell fate and immunomodulation, and a typically poor clinical outcome. To address these limitations of whole cell tumor vaccination, a polymeric biomaterial-based vaccination system was engineered to mimic key aspects of bacterial infection and directly control immune-cell trafficking and activation in the body, to evoke protective immunity, to break tumor tolerance and to elicit durable, tumor-specific immunity with minimal extracorporeal manipulation. To this end, macroporous sponge-like cryogel scaffolds have been designed to first serve as cell carriers or attractors of host cell populations, and then serve to program cells of the immune system in vivo and ultimately disperse the cells to participate in immunotherapy. These sponge-like cryogel vaccines are injectable and, therefore, can be administered in a minimally invasive manner, and they can serve as delivery vehicles for both immunomodulators and transplanted antigenic whole tumor cells. The use of these biomaterials, through their in vivo modulation of dendritic cells, has shown great potential in promoting antigen-specific T cell responses of magnitudes relevant to combating cancer. The technology was initially designed to target cancerous cells in skin, but might have application to an array of cancers, where patients own cancer cells could be used for cancer treatment and inhibition.

BIOGRAPHY Dr. Bencherif received two First Class Honors Masters degrees in Physics and Chemistry (2000) and then in Materials and Technology Engineering (2002) from Montpellier II University in France. He moved to the United States in 2002 and worked for NIST as a guest researcher in the Polymer Division. In 2005, he joined the Department of Chemistry at Carnegie Mellon University. His work focused primarily on developing complex degradable synthetic and semi-synthetic polymeric scaffolds for biomedical applications. In 2009, he received a Ph.D. degree in Chemistry under the supervision of Profs. Matyjaszewski and Washburn. Following his PhD, he was initially appointed from 2009 to 2012 as a postdoctoral researcher and later from 2012 as a researcher associate in the laboratory of Prof. David Mooney at Harvard University and the Wyss Institute for Biologically Inspired Engineering. His research interests include developing naturally derived biomaterials that can be used for tissue engineering, drug delivery, immunotherapy, and studies into fundamental cell biomaterial interactions. Specific targets of his research include: developing novel hydrogels with enhanced nano- and microstructure for tissue engineering, scaffolding for cell and biomolecules/drug delivery; controlling stem cell differentiation; and the design of minimally invasive systems for biomaterials implantation and immunotherapy. Dr. Bencherif has authored and co-authored over 50 journal articles in top journals (Science, PNAS, Nature Materials, etc), international conference proceedings, reviews and patent applications, and is the recipient of several fellowships, honors and awards.