



**JOHNS HOPKINS**  
BIOMEDICAL ENGINEERING



## **Engineering Immunotherapy through Biomaterials: From Stem Cells to Vaccines**

Monday January 28, 1 pm, Traylor 709



Photo by Patrick Cummings

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Recent advances in immunotherapy have opened up novel ways to manipulate the immune system and treat a variety of complex disorders including infectious diseases and cancer. Our laboratory focuses on developing engineering concepts and biomaterial-based strategies to manipulate the immune system both at the cellular as well as the system level. Specifically, our goals are two fold: (i) to understand the developmental pathways of immune cells from progenitor cells to eventually generate readily transplantable, disease specific immune-effector cells and (ii) to create effective carriers for antigens and adjuvants that can modulate and “train” the immune system to fight specific diseases. Our current projects include (a) manipulating embryonic and adult stem cells using polymer scaffolds and bioreactors to generate hematopoietic progenitors and dendritic cells (b) micro fabrication of spatio-temporally patterned polymer scaffolds for directing stem cells into multiple lineages (c) generating T cells from hematopoietic stem cells using biomaterial-directed notch signaling and (d) creating novel drug and vaccine delivery vehicles for dendritic cell-targeted or environmentally responsive release of antigens and adjuvants.

In this talk we would specifically focus on two aspects of our work:

(a) Engineering artificial niches to control stem cell fate. Specifically, we would present results from our effort to generate artificial thymic environments and influence notch signaling as well as T cell receptor development with the ultimate goal being generation of functional, antigen presenting T cells from stem cells. We would also present results from our work on generating new micro fabrication techniques to create complex stem cell niches.

(b) Generation of novel drug and vaccine carriers using both microencapsulation techniques and nanoimprint lithography concepts. In particular we would present results from our effort to generate vaccines against infectious diseases and cancer (lymphomas) using combinatorial delivery of plasmid DNA and siRNA. In addition our work on developing nanoimprinting methods to generate disease responsive polymer nanocarriers with precise size, shape and aspect ratios will be discussed.

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