BIO ENGINEERING SEMINAR

at 4:00 PM on July 25th, 2014 (Friday)
Seminar Hall, Materials Research Center

Engineering "Pathogen Mimicking Particles" and "Immune Priming Microenvironment" for Cancer Immunotherapy

Pallab Pradhan

Research Scientist, Wallace H. Coulter Department of Biomedical Engineering
Georgia Institute of Technology and Emory University, Atlanta, USA

Existing approaches of cancer immunotherapy have been largely unsuccessful to generate sufficient antitumor immunity primarily due to the inherent weak immunogenicity of tumor self-antigens and poor T helper type 1 (Th1) and Cytotoxic T Lymphocyte (CTL) responses. Several key immunological events, as they happen in infection, need to be controlled to boost antitumor immunity. These are: a) recruitment of a large number of antigen presenting cells (APCs), especially dendritic cells (DCs), at the site of immunization, b) efficient delivery of antigen and danger signals to the migrated DCs, c) strong activation and maturation of the DCs with appropriate cytokine profile for antigen presentation and d) effective immunomodulation to generate a strong Th1 and CTL responses. We have developed biomaterial based "Pathogen Mimicking Particles (PMPs)" platform wherein multiple Toll Like Receptor (TLRs) agonists, immunomodulatory siRNA and tumor antigen (protein/DNA) can be loaded on micro/nanoparticles and delivered efficiently to dendritic cells. I will show our recent results on how these PMPs can be used to precisely control DC activation; maturation and cytokine profile, Th1/Th2 balance and ultimately modulate antitumor immunity. Also, we have developed a degradable in situ cross-linking hydrogel, which upon injection with a DC attracting chemokine along with PMPs creates an "Immune Priming Microenvironment" at the site of injection and thus resulting into a strong antitumor immune response. I will show our recent results on PMPs and "Immune Priming Microenvironment" mediated antitumor immune response in murine Melanoma and B cell Lymphoma models. Towards the end of my talk, I will discuss the role of immunosuppressive tumor microenvironment in dampening anti-tumor immune response and my future goals on targeting the tumor microenvironment using "Immunomodulatory Nanoparticles (IMN)" and a two-pronged approach of combined peripheral vaccination and tumor microenvironment immunomodulation to maximize antitumor immune response.

About the speaker:

Dr. Pallab Pradhan is currently working as a Research Scientist in the Wallace H. Coulter Department of Biomedical Engineering at Georgia Institute of Technology and Emory University, Atlanta, USA. Prior to this, he completed two postdoctoral fellowships in the Department of Biomedical Engineering at The University of Texas at Austin, USA and Technical University of Munich, Germany. He obtained his PhD in Bioscience and Bioengineering from Indian Institute of Technology Bombay (IIT Bombay), Mumbai in 2009. He was awarded DAAD sandwich fellowship in 2006 to do part of his PhD research in Technical University of Munich, Germany. He obtained his MVSc and BVSc&AH degree from West Bengal University of Animal and Fishery Sciences (WBUAFS), Kolkata. He has published in many international peer reviewed journals including Biomaterials, Journal of Controlled Release, Journal of Biomedical Materials Research Part B: Applied Biomaterials. His research interests are in Biomaterials, Engineering Immunotherapy, Nanomedicine, Drug/Gene Delivery Systems, Cancer Vaccine and Therapy.