Dr. Upal Roy's Research Interests

Our laboratory is focused on HIV-1 infection, HIV associated neurological disorders (HAND) and novel therapeutics for HIV. Our research interest is to address the following questions, 1) What is the basic mechanism of HIV-1 drug resistance? 2) What are the molecular factors that affect the central nervous system during HIV infection? 3) What are new therapeutic strategies to detect and improve treatment options for complete elimination of HIV-1 from its reservoir organs (the brain, lymphoid tissues)?

One major area of our research is concentrated on the central nervous system (CNS). The brain is separated from the peripheral system through the Blood Brain Barrier (BBB). The lack of therapeutic drug entry to the brain supports low-level HIV-1 replication and associated complications called HIV-associated neurological disorder (HAND). The main reason of inefficient drug entry to the brain is due to the presence of ABC transporters (e.g. P-glycoprotein or P-gp and Multidrug resistance-associated proteins or MRPs) in the BBB. We are interested in assessing the role of P-gp and MRPs in drug entry through the BBB. We study the molecular mechanisms of these transporters with respect to their drug resistance in patients and also investigate the therapeutic alternatives to reduce the effect of P-gp and MRPs.

A second major focus of our research is optimization of nanoformulated anti-HIV drug (nano drug) delivery to the HIV reservoir organs like the brain and gut-associated lymphoid tissues (GALT). This project has evolved to examine the potential of targeted, non-targeted, macrophages mediated nanodrug delivery to HIV-infected reservoir organs. In this study, we have characterized a series of nanodrug through a set of *in-vitro* and *in vivo* (mouse, macaques) study. We have also characterized two different humanized mouse models (hu-PBL, CD34 mice) to monitor the long-term effect of nanodrug on therapeutic efficacy and neurobehaviors.

Our work is very multidisciplinary and collaborative. We use different techniques including molecular characterization of host gene and protein in response to disease, physical and chemical characterization of the nanodrug molecule, the toxicological and neurobehavioral effect of the drug in vivo. Finally, optimize a humanized mouse model to study drug metabolism and disease pathology. Our ultimate goal is to develop our basic science studies to be translational and therapeutically relevant.