



Project Proposal for Ph.D.

Project Details	
Project Title	Electro-mechanics of Biological Surfaces and Interfaces
Project Summary (Minimum 500 and maximum 2000 characters)	Cell membranes, composed of lipids arranged in bilayer with embedded proteins carries a net charge due to ion distributions across its surface. This charge distribution introduces electrodynamic forces which regulate morphology of the cell membrane, in turn affecting vital cellular process such as vesicle formation for cellular transport. At a larger scale, epithelial cells form tight junctions and act as first line of defense of organs against various pathogens. Cell-cell adhesion in these tissues is governed by electrostatic interactions. Further, vital process such as wound healing are governed by transport of metallic ions such as Calcium, Zinc and Magnesium. Of late, trans-epithelial potential has been shown to govern the morphology as well as integrity of epithelial cells. This study would aim to develop theoretical electro-mechanical models that will elucidate the importance of electrodynamics for interfaces in biology at multiple length scales. These models would couple multi-physics phenomenon at various length and time scales and would subsequently require computational approach to solve them. Models hence developed would pave the way for subsequent experimental studies on cells and tissues. Overall, this endeavor will be important for healthcare as well as synthesizing bio-mimetic systems.

Ph.D. Supervisors				
Role	Name of Faculty		Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1	Priti Sinha		Department of Biochemical Engg. and Biotechnology, IIT Delhi	sinhapriti@iitd.ac.in
Supervisor 2	Nikhil Walani		Applied mechanics, IIT Delhi	nwalani@iitd.ac.in

Project requirements (Student qualifications, experience required, etc) *The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)
- Students with background in Mechanical engineering/Chemical engineering/Applied mechanics/Physics - Computational skill: Knowledge of MATLAB, Python, FORTRAN (Not mandatory)

Source of fellowship/funding (CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

Role of Faculty Members involved:	
Supervisor-1	Electrodynamics of biological interfaces
Supervisor-2	Computational mechanics of biological interfaces