



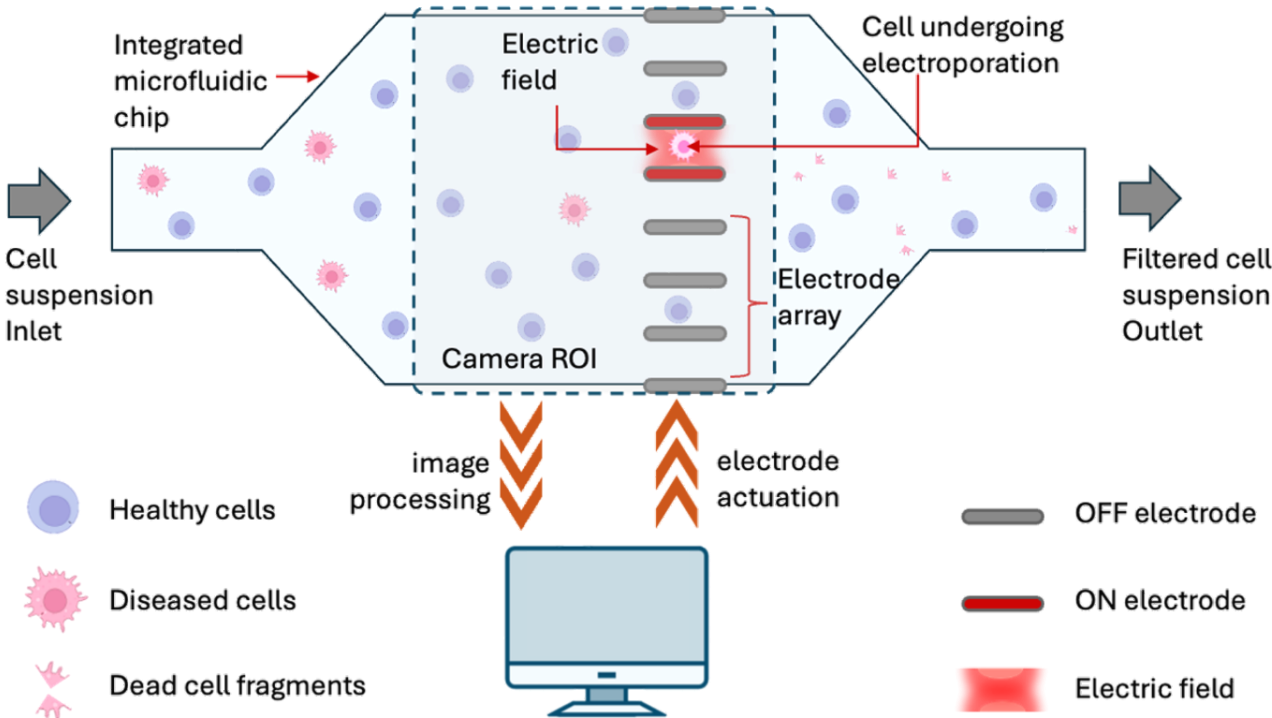
Project Proposal for Ph.D.

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)

Project Title
Developing a platform for selective single-cell electroporation

Single-cell electroporation (SEP) is a technique often employed in clinical applications to create temporary or permanent channels in the plasma membrane via application of an external electric field. The goals can range from delivering specific cargo into the cell through these pores to killing the cells by rupturing the membrane. In life science research, SEP is widely used in bacterial and yeast transformation protocols, CRISPR–Cas9 genome-editing experiments, mRNA transfection assays, RNA knockdown experiments, etc. Despite its popularity, SEP has faced many adaptability challenges due to limited throughput and high cost. The electric field parameters often need to be optimized for each cell or tissue type, to achieve a target distribution of pore sizes for specific applications. Thus, there is a need for an automated, high-throughput platform that can identify individual cells and precisely tailor electroporation conditions to achieve selective single-cell electroporation. **The student will develop such a platform by integrating real-time image processing and automated control of the electric field parameters to enable precise and selective electroporation of cells of interest.**

Project Summary



[1] SE, Khoo H, Hur SC. Recent Advances in Microscale Electroporation. Chem Rev. 2022;122(13):11247-11286.
[2] Thiriet PE, Pezoldt J, Gambardella G, Keim K, Deplancke B, Guiducci C. Selective Retrieval of Individual Cells from Microfluidic Arrays Combining Dielectrophoretic Force and Directed Hydrodynamic Flow. Micromachines. 2020;11(3):322
[3] Design and construction of a microfluidics workstation for high-throughput multi-wavelength fluorescence and transmittance activated droplet analysis and sorting; J Panwar, A Autour, CA Merten, Nature Protocols, 2023

Ph.D. Supervisors*
(Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)

Role	Name of Faculty	Date of Superannuation [§] (DD/MM/YYYY)	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1*	Jatin Panwar	30/06/2053	DBEB	jatinpanwar@iitd.ac.in
Supervisor 2	Mohan K. S. Verma	31/03/2047	Chemical Engineering	mksverma@chemical.iitd.ac.in

*Supervisor 1 must be from IIT, Delhi.
+All cells in this table are mandatory fields that need to be filled by faculty for consideration of proposal.
§The date of superannuation of supervisors should be at least three years from the date of registration of selected candidates.

Project requirements (Student qualifications, experience required, etc) *The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)
• BTech with 60% or above in Electrical, Electronics, Mechanical, Instrumentation, Chemical or related Fields • Experience or interest in developing devices and instrumentation

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

Role of Faculty Members involved:	
Supervisor-1	Responsible for primary supervision, research guidance, and providing necessary laboratory resources and infrastructure. Expertise in: Bioinstrumentation, Microfluidics and Chemical Engineering
Supervisor-2	Responsible for co-supervision, contributing interdisciplinary expertise, and supporting experimental design and data interpretation. Expertise in: Precision Microfabrication, Fluid dynamics.

- Note :-**
1. Approval from the respective DRC/CRC/ScRC of your Department/Centre/School will be required for using the "Full-time Institute Assistantship (Category-wise) (FIA)" for selecting the students in SIRe.
 2. Declaration:- Faculty members, please ensure that you have at least 3 years of service left before superannuation along with adequate sitting space & lab facilities for the SIRe student.
 3. PI/s are also encouraged to submit joint proposals with AIIMS, NII, JNU and institutes with which IITD has an existing MoU. If the Co-PI (Supervisor 2) is from outside IITD, kindly share his/her detailed CV.
 4. If a research scholar is to be considered for selection under the project fellowship, then the project should have a minimum of two-year duration remaining.
 5. A candidate applying with a valid JRF/INSPIRE/any national level fellowship should have at least two-year validity from the date of joining the Ph.D. program.
 6. The third supervisor's name (if required) can be added only after the formation of Student Research Committee (SRC) subject to a strong recommendation of SRC and subsequent approval from the competent authority.
 7. If Institute fellowship is being sought, then DRC approval of the parent department of Supervisor 1 is required at the time of selection.