



SIRe Project Number

2026-02-22

(will be assigned by SIRe)

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)	
Project Title	Defining Mutagenic Processes, Therapeutic Vulnerabilities and Novel Oncogenic Fusions in Young Onset Lung Adenocarcinoma
Project Summary (Minimum 500 and maximum 2000 characters)	Young-onset lung adenocarcinoma (YOLA), defined as lung cancer diagnosed at or before 40 years of age, is uncommon globally, constituting up to 6% of all lung cancers in published series. In contrast, at AIIMS, New Delhi, 142 of 1,300 lung cancer patients (approximately 11%) were aged ≤ 40 years over a three-year period, suggesting a substantially higher burden of young-onset disease in the Indian population. These patients are frequently never-smokers and may have a distinct molecular profile, including an increased prevalence of targetable driver alterations and oncogenic gene fusions. However, the biological mechanisms underlying the development of lung cancer at an unusually young age remain poorly understood, particularly in South Asian populations. It is also unclear whether environmental exposures, inherited susceptibility, or distinct mutational processes contribute to this phenotype. This study aims to comprehensively characterize the genomic and transcriptomic landscape of young-onset lung adenocarcinoma and compare it with late-onset disease. Hypothesis: Young-onset lung adenocarcinoma carries a distinct genomic signature and is enriched for oncogene fusions arising from complex rearrangements (chromoplexy/chromothripsis) acquired in the early decades of life. Objectives: · To define the genomic landscape of young-onset disease, including somatic alterations, copy-number changes, structural alterations, and potentially actionable molecular abnormalities. · To characterize mutational signatures and mutagenic processes associated with young-onset lung adenocarcinoma and evaluate their relationship with potential environmental exposures. · To identify novel oncogenic gene fusions and determine their biological and therapeutic relevance through functional validation of selected candidates. · To determine the transcriptomic and regulatory consequences of genomic alterations in young-onset lung adenocarcinoma, including changes in gene expression, alternative splicing, transcriptional regulatory programs, and tumor microenvironmental states. Design: The study will be conducted as a prospective observational case-control study involving 100 patients with adenocarcinoma aged ≤ 40 years and 100 late-onset controls aged ≥ 60 years, matched for sex and smoking status. Tumor tissue and matched peripheral blood will be used for comprehensive genomic and transcriptomic profiling. Clinical, demographic, smoking, occupational, environmental exposure, and family-history data will be integrated with molecular findings. Selected candidate gene fusions will undergo in vitro and, where appropriate, in vivo functional validation. Status: Ethics approval has been obtained, and recruitment of young-onset lung cancer patients is currently ongoing, with sample processing and sequencing initiated as part of an ongoing project.

Ph.D. Supervisors ⁺ (Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)				
Role	Name of Faculty	Date of Superannuation ^s (DD/MM/YYYY)	Academic Unit in IITD/Institute/University	Email ID (Official) & Contact Number
Supervisor 1	Dr.Ishaan Gupta	31-07-2052	Assistant Professor, Dept. of Biochemical Engineering & Biotechnology, IIT Delhi	ishaan@iitd.ac.in
Supervisor 2	Dr. Prabhat Singh Malik	30-11-2044	Professor, Dept. of Medical Oncology, DR BRA IRCH, AIIMS, New Delhi	drprabhatsm@aiims.edu

Project requirements (Student qualifications, experience required, etc) *The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)
Qualification: M.Sc./M.Tech. in Biotechnology, Bioinformatics, Computational Biology, Life Sciences or an equivalent degree meeting IIT Delhi Ph.D. eligibility norms.
Essential skills: working proficiency in Linux/command-line, R and Python; prior hands-on exposure to next-generation sequencing analysis.
Desirable skills: Wet-lab exposure to nucleic acid extraction, library preparation, molecular cloning and cell-based assays is an advantage as the candidate will prioritise fusion candidates for functional validation and interpret the validation outcomes.
Other requirements: Willingness to work in a clinical-collaborative setting at AIIMS New Delhi, and to observe institutional ethical and data-sharing protocols.

Source of fellowship/funding and project number (CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)
Through JRF from Project RP05065G_SN titled “Comprehensive genomic characterization of young onset lung adenocarcinoma in India” alongside

Role of Faculty Members involved:	
Supervisor-1	Will supervise the computational, analytical core of the thesis and for academic supervision, doctoral committee reporting and manuscript preparation at IIT Delhi.
Supervisor-2	Principal Investigator of the parent study. Will provide access to the recruiting cohort clinical and exposure metadata, samples and pathology review; will oversee the functional validation carried out in the collaborating laboratory at AIIMS; and will facilitate ethics endorsement and the data transfer and data sharing agreement between the two institutions.