



Project Proposal for Ph.D.

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| Project Details (The research problem must clearly indicate the need for an interdisciplinary approach) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Project Title                                                                                           | Predicting traumatic brain injury (TBI) Cerebral Edema: A Proteomics and Metabolomics Approach                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Project Summary<br><br>(Minimum 500 and maximum 2000 characters)                                        | <p>Traumatic Brain Injury (TBI) is a major source of preventable morbidity and mortality globally, and cerebral edema significantly worsens outcomes by increasing intracranial pressure and complicating management. Secondary brain injury mechanisms, especially blood-brain barrier disruption (BBBD), neuroinflammation, and excitotoxicity, play crucial roles in the development of cerebral edema, often manifesting as delayed deterioration in TBI patients. Despite its severity, treatment options for cerebral edema are limited, and there are knowledge gaps about its pathophysiology.</p> <p>Current evidence suggests that BBBD and inflammatory responses are principal drivers of cerebral edema. Traditional serum biomarkers like GFAP, UCHL-1, HMGB-1, and IL-6 indicate BBBD and inflammation, but their correlation with edema, as revealed in preliminary studies, remains inconclusive due to small sample sizes. Thus, integrating proteomics and metabolomics profiling may provide better predictive biomarkers and uncover novel therapeutic targets.</p> <p>This project is the first in India to examine plasma and plasma-derived exosomal proteomics and metabolomics in TBI patients compared to healthy controls.</p> <p>Objectives of the project:</p> <ul style="list-style-type: none"><li>Correlate clinical and radiological progression of cerebral edema with blood biomarkers</li><li>Isolate and characterize exosomes from patient plasma</li><li>Quantitatively analyze protein expression in plasma and exosomes via label-free proteomics</li><li>Validate findings using Western blotting and ELISA</li><li>Profile blood metabolites using high-resolution mass spectrometry</li></ul> <p>Clinical and radiological data, molecular profiling, and bioinformatics analysis will be combined for a comprehensive understanding. If the selected biomarkers reliably indicate the onset of cerebral edema, early intervention with anti-inflammatory agents may be developed. Proteomics and metabolomics integration will deepen insights into cerebral edema's molecular mechanisms and inform screening, prognostic, and therapeutic strategies for TBI patients in India.</p> |

| Ph.D. Supervisors*<br>(Supervisor 1 and Supervisor 2 cannot be from the same department of IITD) |                            |                                                                                                    |                                                                                  |
|--------------------------------------------------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Role                                                                                             | Name of Faculty            | Academic Unit in IITD/Institute/University                                                         | Email ID (Official)                                                              |
| Supervisor 1*                                                                                    | Dr. Shivajirao L. Gholap   | Department of Chemistry, Indian Institute of Technology Delhi, New Delhi                           | <a href="mailto:slgholap@chemistry.iitd.ac.in">slgholap@chemistry.iitd.ac.in</a> |
| Supervisor 2                                                                                     | Dr. Surya Gour Sri Krishna | Department of Neurosurgery All India Institute of Medical Sciences (AIIMS) Ansari Nagar, New Delhi | <a href="mailto:suryaskgour@aiims.edu">suryaskgour@aiims.edu</a>                 |

\*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.

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| Project requirements (Student qualifications, experience required, etc)<br>*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe) |
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- M.Sc. in Chemistry, Biological Science, Biochemistry, Biotechnology or any discipline of biology.
- Preference will be given to the candidates with experience in multi-omics.

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

ICMR Fellowship/  
Project ID: IIRP-2023/4232/F1 (Project approved from 2024-2027)

**Role of Faculty Members involved:**

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|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Supervisor-1</b> | Dr. Shivaji, with extensive experience in chemistry, will guide on the methods of mass spectrometry and chemistry behind the metabolites. |
| <b>Supervisor-2</b> | Dr. Surya is an experienced neurosurgeon who will guide in the traumatic brain injury and its clinical medicine.                          |

**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 SRe.
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 SRe 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.