ENS – IISER Network / BIOSANTEXC Project

Internship Proposal Form
France to India

(Discipline/Field name)

Virology: Vaccine Development

Internship title: Development of a Self-Replicating RNA as Vaccine Candidate Against Kyasanur Forest Disease Virus (KFDV)

Keywords related with the subject (minimum 3): Self-Replicating RNA, Vaccine, KFDV

Name of the laboratory(ies): IISER Bhopal, Laboratory of Virology and Viral Immunology

Name of the internship supervisor(s): Dr. Debasis Nayak

Email(s) of the supervisor(s): debasis@iiserb.ac.in

Prerequisites for the internship: --

Requested level: (For IISER Bhopal, it could be French Student M1/M2 level): M1/M2

Foreseen internship dates: May 2025

Internship type (refer to page 1):
■ 3–6-month internship ☐ ~~Research stays~~ ☐ ~~6+6 months internship~~

For 3 to 6 months internships, please indicate the desired duration: 3 months

For 6+6 months internships, please also fill in:

- **Name of the internship co-supervisor:**
- **Name of the co-supervisor's laboratory/entity:**
- **Email of the co-supervisor:**

Internship proposal (description and expected training outcomes / half page min, 1 page max) (mandatory):

Title: "Development of a Self-Replicating RNA Vaccine Against Kyasanur Forest Disease Virus (KFDV)"
This project is a critical initiative to address the public health threat posed by KFDV in endemic regions spreading across Sourthern Indian continent. KFDV is a zoonotic virus transmitted by ticks, causing severe hemorrhage and encephalitis in humans. Discovered in 1957 in Karnataka's Kyasanur Forest, India, it has since spread to various regions, highlighting the need for effective measures. Due to its BSL-3 pathogen classification, stringent containment is crucial due to its heightened virulence. Unfortunately, approved treatments are lacking, resulting in fatality rates of 10% to 50% among the infected. KFDV is among the top 10 deadly pathogens with pandemic potential, and no approved vaccines exist.This innovative approach holds the potential to provide an effective, scalable, and long-lasting solution to combat Kyasanur Forest Disease.

The non-structural proteins and non-coding parts found in various flaviviruses play a crucial role in creating the RNA needed for replication. This process enables the production of desired proteins without causing the disease or significant harm.

Specifically, it can trigger cellular responses like stress, autophagy, and activate the innate immune system through pattern recognition receptors (PRR) and sensors. This also involves activities such as protein sorting, secretion, proteolytic processing, and presenting peptides on major histocompatibility molecules, all of which can induce protective adaptive immune reactions in the form of neutralizing antibody responses when dealing with KFDV.

In our project, we plan to use a synthetic approach to design and produce sr-RNA, which acts as a mimic of KFDV. This approach is intended to stimulate a robust neutralizing response to combat the virus effectively.

Training Objectives for Internship Students:

During this internship, students will gain practical laboratory skills in molecular virology and immunology while focusing on Kyasanur Forest Disease Virus (KFDV) as a zoonotic pathogen. . Hands-on experience will be provided in designing and producing self-replicating RNA (sr-RNA) for potential vaccine development against KFDV. Students will understand immune response mechanisms and data analysis techniques relevant to molecular biology research. This internship will foster collaborative research and communication skills while contributing to a critical public health initiative. Additionally, we welcome students from France for this exchange program.

Internship conditions:

- monthly stipend of INR 15,000
- Accommodation will be provided on the IISER Bhopal campus
- cultural tour of nearby locations for ENS students during the stay.