

MARIE SKŁODOWSKA-CURIE POSTDOCTORAL FELLOWSHIPS 2024

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

NOVA Institute for Medical Systems Biology (NIMSB)

RESEARCH GROUP AND URL

<https://nimsb.unl.pt/>

E-MAIL

Expressions of interest should be submitted to: nimsb@unl.pt

SHORT DESCRIPTION

Systems Biology for Medical Innovation and Precision Medicine

NIMSB aims to pioneer interdisciplinary research for the early detection and diagnosis of chronic diseases through an advanced understanding of cellular-level disease mechanisms. The research plan proposed should outline a comprehensive strategy to leverage cutting-edge technologies in single-cell and spatial multi-omics, artificial intelligence, and patient-derived disease models to develop precise diagnostic tools and therapies tailored to individual patients. The ultimate goal is to enhance early disease detection, enabling proactive therapeutic interventions that prevent irreversible damage to tissues and organs. Proposals should be focused in one of the following objectives:

- i. Identify Earliest Cellular Changes: Detect the initial cellular alterations that precede the onset of chronic diseases.
- ii. Develop Advanced Diagnostic Tools: Create novel diagnostics with high accuracy for early disease detection.
- iii. Personalize Therapeutic Interventions: Design personalized treatment strategies based on genetic and environmental factors.

Candidates will have training and access to the following methodologies:

1. Single-Cell and Spatial Multi-Omics

Objective: Utilize single-cell RNA sequencing (scRNA-seq) and spatial transcriptomics to map cellular heterogeneity and spatial organization within tissues.

Activities:

- a) Collect and process tissue samples from diverse patient cohorts.
- b) Perform scRNA-seq to identify gene expression profiles at the single-cell level.
- c) Integrate spatial transcriptomics to visualize the spatial distribution of gene expression within tissues.
- d) Analyze data to pinpoint early cellular deviations associated with disease onset.

Expected Outcomes:

Comprehensive maps of cellular states and interactions in diseased versus healthy tissues, identifying biomarkers for early disease detection.

2. Artificial Intelligence and Machine Learning

Objective: Develop AI algorithms to analyze complex multi-omics data and predict disease states.

Activities:

- a) Train machine learning models on large datasets integrating genetic, transcriptomic, proteomic, and environmental data.
- b) Use AI to identify patterns and predictive markers of disease.
- c) Validate AI-driven predictions through experimental and clinical studies.

Expected Outcomes:

Robust AI models capable of predicting early disease onset and progression, leading to new diagnostic criteria and early intervention strategies.

3. Patient-Derived Disease Models

Objective: Use organoids and organ-on-a-chip models to study disease mechanisms and test therapeutic interventions.

Activities:

- a) Develop organoids and organ-on-a-chip systems from patient-derived cells.
- b) Mimic disease conditions in these models to observe cellular changes and disease progression.
- c) Screen potential therapeutics for efficacy and safety in these models.

Expected Outcomes:

In-depth understanding of disease mechanisms and identification of effective therapies, facilitating the translation of findings into clinical practice.

NIMSB is a partnership between NOVA University Lisbon (NOVA) and Max Delbrück Center for Molecular Medicine (MDC, Berlin) supported by the European Union (Teaming for Excellence – Horizon Europe), the Portuguese Government and the Municipality of Oeiras. Candidates will have access to mentoring and training programs from both Institutions.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST*

Life Sciences (LIF)

***Scientific Area where the project fits best** – Please select/indicate the scientific area according to the panel evaluation areas: Chemistry (CHE) • Social Sciences and Humanities (SOC) • Economic Sciences (ECO) • Information Science and Engineering (ENG) • Environment and Geosciences (ENV) • Life Sciences (LIF) • Mathematics (MAT) • Physics (PHY)