Bachelor / Master Thesis Proposal

NOVARTIS

Mathematical approaches and reproducible workflows to create virtual populations for systems pharmacology models

The thesis aims to design and implement a reproducible workflow to generate virtual patient populations for quantitative systems pharmacology (QSP) models. Commonly used approaches such as optimization-based calibration, prevalence weighting and Bayesian methodologies to generate populations of models will be evaluated and incorporated in the workflow, with a goal to capture the observed target physiological and clinical distributions.

A key deliverable is to design a reproducible end-to-end workflow that integrates data preprocessing, efficient parameter sampling and model simulation, diagnostics, and reporting. The workflow will follow version control, modular code structure, and aim for computational efficiency so that analyses can be repeated and extended across QSP case studies. There is an opportunity to contribute to an in-house QSP model development using literature data and applying the workflow to it.

The project is suitable for MSc students with a background in computational biology, computational mathematics, or computer science. Experience with non-linear regression or ODE-based models and proficiency in MATLAB or Python are essential; prior exposure to systems biology/pharmacology/PK-PD modeling is advantageous. Applicants are encouraged to share code repositories as part of their application.

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Desired project start: Summer 2026 (flexible)