

Job Title:

Postdoctoral Fellow — Simulating Microbial Systems

Workplace:

The Agmon Lab (<https://eagmon.github.io>), part of the Center for Cell Analysis and Modeling at UConn Health, develops and maintains Vivarium, an open-source modular simulation framework for multiscale biological modeling. We apply Vivarium to a range of biological use cases, including whole-cell modeling, microbial community modeling, and other multicellular systems. We collaborate broadly across computational biology, synthetic biology and bioinformatics, working with research teams to both apply and enhance our infrastructure and capabilities for modeling complex biological systems.

Project Description:

This postdoctoral position is part of a project focused on advancing the state of the art in predictive models of microbial systems, by integrating whole-cell modeling, multiscale simulation, computational statistics, and large-scale experimental measurements under diverse physiological conditions. The project will develop high-performance inference methods for refining biochemical simulations of *E. coli* cells, including functional annotations of genes, regulatory networks and metabolic pathways, and the parameters of associated dynamical system models. The position involves close collaboration with Markus Covert's lab (Stanford University), Suckjoon Jun's lab (UCSD), Minsu Kim's lab (Emory University), the Bioinformatics Research Group at the Stanford Research Institute (SRI), and Ginkgo Bioworks.

Job Description:

We seek a highly motivated Postdoctoral Researcher to lead the simulation-based inference effort within this ambitious collaboration. The ideal candidate will have a strong background related to computational biology and a passion for solving complex biological questions, with a methodological focus on mathematical modeling, computational statistics and high-performance computing.

Requirements:

- PhD and MSc degrees, or equivalent, which together cover both of the following:
 - Computational Biology, Bioinformatics, Systems Biology, Biochemical Engineering, Complex Systems Science, Scientific Computing, Applied Mathematics, or a related specialization.
 - Computational Statistics, Applied Probability, Optimization Theory, Control Theory, Operations Research, Machine Learning, or a related specialization.
- High-quality peer-reviewed publications in scientific modeling and simulation, and in Bayesian inference or probabilistic machine learning or inverse problems.
- Experience with systems biology or biochemical engineering, or alternatively, with ODEs, continuous-time stochastic processes and optimal control.
- Experience with high-performance computing and large-scale data analysis.
- Strong programming skills, particularly with Python/Cython/C++. Familiarity with declarative/functional/strongly typed and with JIT-compiled programming languages is a plus.
- Familiarity with bioinformatics databases, knowledge representation systems, or deductive/relational databases is a plus.
- Excellent interdisciplinary communication and collaboration skills, including the ability to work effectively with external collaborators under tight schedules, and to proactively manage scientific and software engineering risks.

Responsibilities:

- Develop and implement numerical methods combining multi-scale stochastic dynamics, global optimization, Bayesian inference and causal discovery.
- Co-design application-specific extensions to process and measurement models, as well as validation and performance metrics, in close collaboration with project partners.
- Conduct simulation and inference workloads, analyze and validate results, and help integrate findings to enhance scientific knowledge.
- Contribute to relevant software engineering aspects of the simulation framework Vivarium.
- Publish findings in high-impact journals and present at international conferences.

Benefits:

- Competitive salary with comprehensive medical and dental insurance.
- Access to state-of-the-art computational resources and collaboration with leading researchers in the field.
- Opportunity to contribute to groundbreaking research with expected long-term multidisciplinary impact.
- Flexible work schedule and a supportive, inclusive lab environment.

Availability:

- This position is available with a starting date in Summer 2025. For further details or to apply, please contact Dr. Eran Agmon at agmon@uchc.edu.