

PhD Opportunities

Supervisor: Dr Gizem Buldum

I am excited to offer PhD supervision in the following cutting-edge research areas: Synthetic Biology and Biocomputing. The successful applicants will join The Interdisciplinary Computing and Complex BioSystems (ICOS) research group within Newcastle University's School of Computing. Our mission is to carry out ground-breaking research at the interface of computing science and complex biological systems. The multidisciplinary nature of the projects will give students the opportunity to acquire knowledge and skills in other relevant disciplines. Below are the details of potential PhD projects:

- **Novel strategies for designing synthetic pathways in microbial systems capable of producing cellulose-based materials**

Overview: Bacterial cellulose is a high-value biomaterial with excellent purity, strength, and biocompatibility, making it attractive for biomedical applications, packaging, textiles, and cosmetics. However, real-world applications are still limited due to its mechanical performance. Synthetic biology offers promising avenues for engineering cells to produce high-value products with tailored functionalities. We are interested in exploring novel strategies for designing synthetic pathways in microbial systems capable of producing cellulose-based materials with improved properties. Ideal candidates combine biodesign with hands-on molecular biology to engineer microbial pathways. A Master's degree in a relevant subject area (Synthetic Biology, Bioengineering, Biosciences) will be highly advantageous. Enthusiasm for research, the ability to think and work independently are essential requirements.

- **Reservoir Computing with Coupled Genetic Oscillators**

Overview: Just like electronic computers can take input signals and employ algorithms to get an output, living cells can also react to some input molecules and produce another in response. Reservoir computing is emerging as a unique approach as a low-cost, training-light route to machine learning for biological signals. A biological system, such as a microbial culture or synthetic gene circuit, can be treated as a reservoir, where controllable inputs (e.g., chemical inducers or environmental parameters) perturb internal dynamics, and measurable outputs (e.g., metabolite levels or gene expression) reflect system behaviour. This research aims to explore a physical reservoir computing implementation of engineered genetic circuits. The project requires modelling and wet-lab experience. Ideal candidates combine strong modeling (ODEs/time-series analysis, Python/MATLAB) with hands-on molecular biology for genetic circuit design and measurement. A Master's degree in a relevant field will be highly advantageous.

How to Apply

Interested candidates should submit a cover letter outlining their research interests and alignment with the projects above, along with a CV. For more information or to discuss your application, please contact me directly at gizem.buldum@newcastle.ac.uk