

Georgios Hardo

Wolfson College, Cambridge • Barton Rd, CB3 9BB
gh464@cam.ac.uk

EDUCATION

- University of Cambridge, Wolfson College** *Oct 2019 - Present*
PhD in Biological Sciences (Systems & Synthetic Biology)
Department of Engineering
- University of Cambridge, Wolfson College** *Sept 2018 - Sep 2019*
MPhil in Biotechnology - Isaac Newton Scholar Special Commendation/1st Class Honours
Department of Chemical Engineering and Biotechnology
- University of Sheffield** *Sept 2015 - July 2018*
B.Eng in Chemical Engineering 1st Class Honours
Department of Chemical and Biological Engineering

SKILLS

- Software & Programming** Python, R, Julia, MATLAB, L^AT_EX, mage analysis, machine learning (CNNs)
- Lab experience** Standard molecular biology techniques, growth cultures & curves, cloning, plasmid design, time-lapse microscopy, microfluidics

EXPERIENCE

Department of Engineering - Cambridge University September 2019 - Present
PhD Student in Systems Biology

- I use various numerical simulation, mathematical modelling, synthetic biology and high throughput timelapse microscopy tools to probe the inner workings of ageing, and persistence in bacteria and their links to antibiotic resistance and persistence.
- I mainly use Python and Julia to create ODE and stochastic simulations of gene expression systems.
- I also develop high analysis tools for analysis of high throughput microscopy images. I use a combination of traditional image analysis tool and machine learning to perform image segmentation.
- I use synthetic biology to both reverse and forward engineer bacteria to try and re-create natural ageing phenomenon, as well as making genome level modifications in order to probe the molecular basis for ageing, and the links to antibiotic resistance.
- I also have a side project where I explore the thermodynamics and reaction mechanics of systems of interacting nucleic acids.
- I developed high fidelity DNA assembly techniques for synthetic biology. Modelled reaction mechanisms using kinetic and stochastic simulations of nucleic acid interactions.

AstraZeneca/MedImmune - Cambridge June 2019 - September 2019
MPhil Graduate Researcher

- Engineering 5' and 3' mRNA untranslated regions to improve *in vivo* stability and protein expression.
- Used deep learning to predict mRNA expression and stability based on 3' and 5' UTR sequence data.
- Extracted model weights and used bioinformatic/statistical techniques to do causal inference to elucidate important mRNA regulatory motif effects on expression.
- Used genetic algorithms to develop generative models to create high expression 5' UTRs which were successfully transfected into human cell lines to test model accuracy *in vivo*.

Dept. of Chemical Engineering and Biotechnology - Cambridge September 2018 - June 2019
MPhil Graduate Researcher

- Developed graph based tools for mapping the network of organic chemistry.
- Modelled the entirety of the organic chemistry literature as a searchable graph, along with algorithms to allow for efficient network searching.
- Developed all-in-one toolkit to allow for efficient organic chemical reaction synthesis pathway selection based on desired yield, reaction conditions, reaction feasibility, and other parameters.

Dept. of Chemical and Biological Engineering - Sheffield June 2016 - September 2018
Undergraduate Researcher

- EPSRC funded project investigating the growth and interactions of synthetic bacterial consortia in toxic landfill leachate for bioremediation purposes.
- Studied the effects of the composition of synthetic bacterial consortia, species richness (biodiversity) and bacterial interactions on the functioning of these synthetic ecosystems. Developed novel experimental and computational workflow analysing effects/interactions of large numbers of bacterial consortia using only growth rate and yield measurements - breaking open the black box by studying many black boxes.

PUBLICATIONS

Hardo, G., Noka, M., Bakshi, S. Accurate Segmentation of Bacterial Cells using Synthetic Training Data. *bioRxiv* 31 Jan 2022, doi: 10.1101/2021.07.21.453284

Hardo, G., Bakshi, S. Challenges of analysing stochastic gene expression in bacteria using single-cell time-lapse experiments. *Essays in Biochemistry* 16 April 2021; 65 (1): 67–79. doi: 10.1042/EBC20200015

TEACHING

Supervisor for Mathematical Biology - Natural Sciences Tripos 2020 - Present
Corpus Christi and Pembroke Colleges

Probability theory · Linear algebra · Statistics · Linear models · Calculus · Differential equations · Biological systems modelling · Game Theory

Supervisor for BioDesign - MPhil Systems Biology 2022
Department of Applied Mathematics and Theoretical Physics

Synthetic biology · Genetic circuit design · Modelling genetic circuits

Supervisor for Part III Systems Biology 2022
Cambridge Systems Biology Centre

Synthetic biology principles · Molecular cloning

STUDENT SUPERVISION

Sarah Murgraff 2022
MPhil Biotechnology

Machine Learning for phage protein structure classification

Dustin Baek 2021 - 2022
MEng Engineering Tripos

Superresolution microscopy using deep learning and synthetic image data

VOLUNTEERING AND EXTRACURRICULAR

Molecular Programming Society

Textbook Editor

2020 - 2022

International

- We are writing a free and open source textbook called *The Art of Molecular Programming*. I am one of the editors of the 3rd and final chapter: *Interfaces*, where I focus on biological interfaces with molecular programming.

Molecular Programming Interest Group (molpigs)

Co-founder, VP, treasurer

2019 - Present

International

- molpigs is an interest group for early career researchers in molecular programming. To date we have over 200 members across the world.
- We host a regular podcast with guests from across the entire field, where we discuss research, graduate student and early career life, and the challenges of academia.
- We also have an online forum where members of the molecular programming community can congregate to share ideas and have general academic discussions.

Cambridge University Synthetic Biology Society

President & iGEM coordinator

September 2018 - Present

University of Cambridge

- Part of team who are working on the Synthetic Biology Society's Long Term Project.
- Project involves developing a toolkit allowing for rational design of bacterial co-culture interactions (commensalism, parasitism, mutualism etc).
- Rebooted Cambridge's iGEM team for 2022.
- I lead the computational workshops which aim to teach anyone who is interested some principles for modelling biological systems.

Engineers Without Borders Sheffield

Project Leader and then Vice President

September 2015 - July 2018

Engineers Without Borders UK

- Leader of a project which aims to install irrigation solutions in Malawi. Goal is to transfer thousands of litres of water to farmland during the dry season, increasing food security.

ACADEMIC ACHIEVEMENTS

<i>MPhil</i> special commendation	<i>University of Cambridge, 2019</i>
Issac Newton Trust Master's Scholarship	<i>University of Cambridge, 2018</i>
Martin Pitt Prize for best Chemical Engineering Design Project	<i>University of Sheffield, 2018</i>
Sarjant Prize for best overall degree academic performance	<i>University of Sheffield, 2018</i>
EPSRC Vacation Bursary	<i>University of Sheffield & EPSRC, 2017</i>
Best Student Researcher	<i>Department of Chemical And Biological Engineering, 2016</i>
Summer Research Fellowship	<i>Department of Chemical And Biological Engineering, 2016</i>