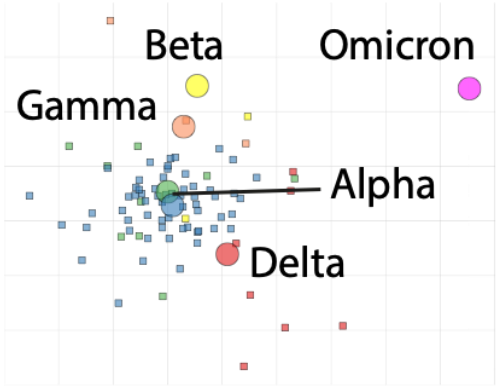
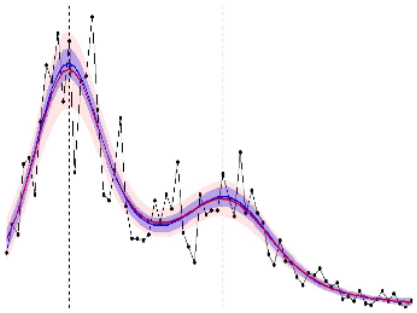
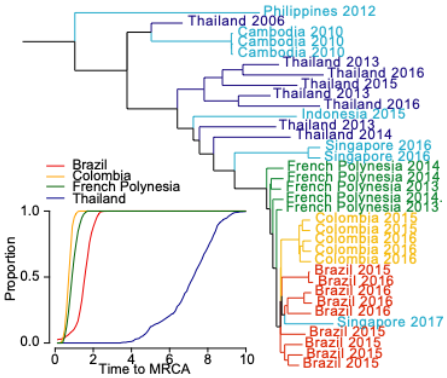
NST PART IB MATHEMATICAL & COMPUTATIONAL BIOLOGY







Course Leaflet

Natural Sciences Tripos Part IB:
Mathematical and Computational Biology

Course Information

The Mathematical and Computational Biology is a **brand-new course for 2022/23!** The course is delivered by lecturers based in Genetics, PDN, Pathology, Zoology, Plant Sciences, Veterinary Medicine, and Psychology.

Students will be provided with a training in **mathematical modelling, statistics, fitting models to data, simulation, bioinformatics, "big data"** and **computer programming**. Students will learn Python – which is taught from scratch – and should leave the course as fluent programmers, having worked on real datasets from across biology.

The MCB Course will equip students with a comprehensive suite of **quantitative and computational skills** that will be useful at Part II, Part III and beyond (in paid employment as well as in research). The course is particularly ideal preparation for Part III Systems Biology.

Each week there will be two **traditional lectures** and one **computer-based lecture**, complimented by **weekly practical classes**. Lectures will be Mondays, Wednesdays and Fridays at 9am, with the practical sessions available on Wednesday or Thursday afternoons 2pm-5pm. A significant proportion of the course is continuously assessed, with a pair of mini-projects focusing on computational analyses of biological data.

Course Content

<table>
<tr><th colspan="2">Michaelmas Term</th><th colspan="2">Lent Term</th><th colspan="2">Easter Term</th></tr>
<tr><td>1</td><td rowspan="4">Block A: Introduction
Introduction;
Data visualisation and dimensionality reduction;
Fitting simple models of random variables to data;
Statistical testing and resampling.</td><td>1</td><td rowspan="4">Block C: Foundations
Likelihood/Bayesian theory;
Statistical modelling; Linear algebra principles and methods;
Linearisation to analyse nonlinear systems.</td><td>1</td><td rowspan="2">Block E: Data Science
Clustering;
Classification/Discrimination.</td></tr>
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<tr><td>4</td><td>4</td></tr>
<tr><td>5</td><td rowspan="4">Block B: Bioinformatics
Alignment/homology;
Profiles, HMMs and Multiple Sequence alignment;
Large-Scale sequence analysis;
Principles of phylogeny.</td><td>5</td><td rowspan="4">Block D: Systems
Analysing models of biological systems; Modelling heterogeneous systems;
Stochasticity and fitting models to data; Analysis of time-resolved data.</td></tr>
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<tr><td>7</td><td>7</td></tr>
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Assessments and Examinations

- 50% of the final mark will be taken from a 3-hour theory/essay paper sat in June.
- 10% from a 3-hour computer examination, also sat in June, focusing on implementation/practical use of the computational methods and techniques.
- 30% from two mini-projects (each worth 15%) in Lent term.
- 10% from satisfactory learning at practical classes, based on confirmation of completion of Python notebooks and attendance records.

Entry requirements

Although there is no formal entry requirement, it is recommended that students should have obtained at least 55% in either IA Mathematics or IA Mathematical Biology. Students coming from the IA Mathematics course will also need to do some additional preparation prior to starting to ensure all students have the necessary base training at the start of the course. Several of the lecturers from IA Mathematical Biology will teach on this new course, including Dr Aylwyn Scally, Prof. Andrea Manica, Dr Nik Cunniffe and Dr Olivier Restif.

Further information about the course can be found:
https://www.gen.cam.ac.uk/maths-and-computational-biology