MAST30032 Biological Modelling and Simulation

Credit Points:	12.5
Level:	3 (Undergraduate)
Dates & Locations:	This subject is not offered in 2016.
Time Commitment:	Contact Hours: 48 hours: 24 x one-hour lectures (2 per week), 12 x two-hour practice classes (1 per week) Total Time Commitment: 170 hours
Prerequisites:	

Subject	Study Period Commencement:	Credit Points:
COMP10002 Foundations of Algorithms	Semester 1, Semester 2	12.5
BIOL10005 Genetics & The Evolution of Life	Semester 2	12.5
BCMB20002 Biochemistry and Molecular Biology	Semester 1, Semester 2	12.5

and either:

Subject	Study Period Commencement:	Credit Points:
MAST20005 Statistics	Semester 2	12.5

or:

Subject	Study Period Commencement:	Credit Points:
MAST10006 Calculus 2	Semester 1, Semester 2	12.5
MAST10007 Linear Algebra	Summer Term, Semester 1, Semester 2	12.5
MAST10010 Data Analysis 1	Semester 2	12.5

Corequisites:	None
Recommended Background Knowledge:	None
Non Allowed Subjects:	None
Core Participation Requirements:	For the purposes of considering request for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005), and Student Support and Engagement Policy, academic requirements for this subject are articulated in the Subject Overview, Learning Outcomes, Assessment and Generic Skills sections of this entry. It is University policy to take all reasonable steps to minimise the impact of disability upon academic study, and reasonable adjustments will be made to enhance a student's participation in the University's programs. Students who feel their disability may impact on meeting the requirements of this subject are encouraged to discuss this matter with a Faculty Student Adviser and Student Equity and Disability Support: http://services.unimelb.edu.au/disability
Contact:	**jamesm@unimelb.edu.au (mailto:jamesm@unimelb.edu.au)**
Subject Overview:	This subject introduces the concepts of mathematical and computational modelling of biological systems, and how they are applied to data in order to study the underlying drivers of observed behaviour. The subject emphasises the role of abstraction and simplification of biological systems and requires an understanding of the underlying biological mechanisms. Combined with an introduction to sampling-based methods for statistical inference, students will learn

	how to identify common patterns in the rich and diverse nature of biological phenomena and appreciate how the modelling process leads to new insight into biological phenomena. # Modelling: Deterministic and stochastic population-level dynamic models; agent-based computational models; and geospatial statistical models will be introduced and studied. Indicative examples will be drawn from health (e.g. infectious diseases, cell tumour growth, developmental biology), ecology (e.g. predator-prey systems, sustainable harvesting, environmental decision making) and biotechnology (e.g. biochemical and metabolic models). # Simulation: Sampling based methods (e.g Monte Carlo simulation, Approximate Bayesian Computation) for parameter estimation and hypothesis testing will be introduced, and their importance in modern computational biology discussed.
Learning Outcomes:	On completion of this subject, students should: # Appreciate how abstraction and simplification of biological systems through modelling can provide new insight into biological phenomena # Be able to distinguish between different approaches to modelling (deterministic, stochastic, agent-based, statistical) and critically evaluate the suitability of these alternative approaches for particular biological problems # Be able to develop computer programs that implement and solve simple models of biological phenomena # Be familiar with the concept of statistical simulation and its role in testing hypotheses and understanding model behaviour # Use models and their application to data to formally evaluate biological hypotheses Understand how to interpret and critique the biological modelling literature
Assessment:	One x 1,000 word written assignment due in week 8 (20%). Four laboratory exercises completed during practice classes, held at regular intervals during semester due in weeks 4, 6, 10, 12 (10% for each exercise). A 2-hour written examination in the examination period (40%).
Prescribed Texts:	None
Breadth Options:	This subject is not available as a breadth subject.
Fees Information:	Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees
Generic Skills:	In addition to learning specific skills that will assist students in their future careers in science, they will have the opportunity to develop generic skills that will assist them in any future career path. In particular # modelling skills: the ability to abstract and generalise from observations of a complex system, providing an alternative perspective on the problem # numerical and computer simulation skills: the ability to design simple computer programs to solve models and test hypotheses # time-management skills: the ability to meet regular deadlines while balancing competing commitments.
Related Majors/Minors/ Specialisations:	Computational Biology Science-credited subjects - new generation B-SCI and B-ENG.