Mathematical Biology

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Overview of the Concentration

Advances in the mathematical sciences — mathematics, statistics, and computer science — have brought new perspectives to biological research. By answering questions that cannot be addressed using other means, the mathematical sciences can provide indispensable tools for biological research. The result is the interdisciplinary field of mathematical biology, which involves developing analytical and computational predictive models of biological systems.

The concentration at St. Olaf is intended to train students in mathematical biology, allowing them to understand the development and applications of these models. With the large number of subfields in mathematical biology today, the concentration allows students to pursue a path that best suits their interest (e.g., mathematical modeling or bioinformatics).

Students completing the concentration will be equipped with the skills necessary to enter the fast-growing field of mathematical biology or pursue graduate work in the field.

Intended Learning Outcomes for the Concentration (http://wp.stolaf.edu/curriculum-committee/mathematical-biology-concentration-ilos)

Distinction

See Academic Honors (http://catalog.stolaf.edu/academic-regulations-procedures/academic-honors/#distinction)

Requirements

The mathematical biology concentration consists of five courses, an integrative project, and participation in a Math Biology Symposium. A student may petition to count a course other than the pre-approved electives towards his or her concentration if the student can show and the director concurs that the course includes an integrative component related to mathematical and/or computational biology.

Mathematical Biology Core Course		
This course presents the essential modeling techniques of formulation, implementation, validation, and analysis and applies these tools to a wide variety of biological systems and disciplines.		
MATH 236	Mathematics of Biology	1.00
Mathematics/Computer Science/Statistics Electives		
Two electives are required in MSCS that focus on modeling, computational, or statistical techniques.		
Select two of the following:		2.00
CSCI 125	Computer Science for Scientists and Mathematicians	
or CSCI 251	Software Design and Implementation	
CSCI 315	Bioinformatics	
MATH 230	Differential Equations I	
MATH 242	Modern Computational Mathematics	
MATH 330	Differential Equations II	
STAT 212	Statistics for the Sciences	
or STAT 214	Honors Statistics for the Sciences	
or STAT 272	Statistical Modeling	
STAT 302	Biostatistics: Design and Analysis	
Biology Electives		
Select two of the following:		2.00
BIO 233	Intermediate Genetics	
BIO 247	Animal Physiology	
BIO 261	Ecological Principles	
BIO 315	Principles of Bioinformatics	
BIO 371	Field Ecology	
BIO 383	Evolutionary Biology	
BI/ES 350	Biogeochemistry: Theory and Application	
NEURO 239	Cellular and Molecular Neuroscience	
Integrative Project		
Students are required to work on an independent project that integrates mathematics, computer science, and/or statistics with biology.		
Senior Math Biology Symposium		
Seniors present their independent project in the form of a poster in a Mathematical Biology Symposium held at St. Olaf in the spring.		
Total Credits		5

Integrative Project

The project must be approved by the director in order for the student to finish the concentration. There are many ways in which the project can be completed. For example, the level III biology electives in the concentration all include final projects that allow a student to work on an integrative project for the concentration. Other experiences that could fulfill this requirement include a research project such as a summer Research Experience for Undergraduates (REU); a project in the expanded Center for Interdisciplinary Research (eCIR); working with faculty to develop a module for a course; an independent research or independent study with a faculty member; or working with a faculty member to develop a computational lab that could be incorporated into an existing course.

Senior Math Biology Symposium

The symposium is open to the public and provides students the opportunity to explain mathematical and biological concepts to a broad audience. In addition, the symposium is an event that brings together all the students in the concentration, thus strengthening the mathematical biology community here at St. Olaf.