

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>)

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.

| Code | Title | Credits |
|--|--|---------|
| 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 | |

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|-------------------------|---|
| MATH 242 | Modern Computational Mathematics |
| MATH 330 | Differential Equations II |
| STAT 212 or STAT 272 | Statistics for the Sciences Statistical Modeling |
| STAT 302 | Biostatistics: Design and Analysis |

Biology Electives

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|------------------------------|---|------|
| 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.