



Mathematical Biology Major

www.Mathematics.Pitt.edu

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Mathematics has assumed a significant role in the study of biological systems, in the development of biotechnology, and in advances in medicine. The construction and analysis of mathematical models of biological systems allows for the precise formulation of theoretical ideas, the testing of assumptions that may not be easily accessible experimentally, and the generation of novel predictions that can guide future research. The University of Pittsburgh is known for its excellence in biomedical research, and the Department of Mathematics at Pitt includes prominent faculty with strong records of teaching and research in mathematical biology.

The major in Mathematical Biology will help students develop an expertise in thinking mathematically about biological systems. Students will acquire fundamental skills in mathematical analysis and simulation, specialized experience in mathematical modeling in biology and neuroscience, and knowledge of particular areas of biology. These tools will prepare students to participate in undergraduate research and to go on to use quantitative methods in biotechnology, medicine, and other fields.

Required courses for the Mathematical Biology major

The Mathematical Biology major will require the completion of 44 credits in mathematics, or as few as 37 with UHC (University Honors Course) options, plus 12 in Biology or Neuroscience and 3 in Mathematics or Statistics .

Three Calculus courses (12 credits)

MATH 0220 Analytic Geometry and Calculus 1

MATH 0230 Analytic Geometry and Calculus 2

*Note: Qualified students may substitute MATH 0235 Honors 1-Variable Calculus (UHC) for MATH 0220 and MATH 0230

MATH 0240 Analytic Geometry and Calculus 3

Two introductory theoretical courses (7 credits)

MATH 0413 Introduction to Theoretical Mathematics*

MATH 0420 Introduction to Theory 1 – Variable Calculus*

*Note: Qualified students may substitute MATH 0450 Honors Analysis for MATH 0413 and MATH 0420.

Professional Development

MATH 0500 Professional Development

Two upper-level required courses (6 credits)

MATH 1180 Linear Algebra 1 or MATH 1185 Honors Linear Algebra

MATH 1270 Ordinary Differential Equations 1 or MATH 1275 Honors Ordinary Differential Equations

Two mathematical biology courses (6 credits)

MATH 1370 Introduction to Computational Neuroscience

MATH 1380 Mathematical Biology

Two numerical mathematics courses (6 credits)

MATH 1070 Numerical Mathematical Analysis

MATH 1080 Numerical Linear Algebra

Two applied analysis courses from the following list (6 credits)

MATH 1280 Ordinary Differential Equations 2

MATH 1470 Partial Differential Equations 1

MATH 1530 Advanced Calculus 1

MATH 1550 Vector Analysis and Applications

MATH 1560 Complex Variables and Applications

Additional Requirements (15 credits)

Two introductory Biology courses

BIOSC 0150 Foundations of Biology 1

BIOSC 0160 Foundations of Biology 2

Two of the following; at least one must be at the 1000 level

BIOSC 0350 Genetics

BIOSC 0370 Ecology

BIOSC 1000 Introductory Biochemistry

BIOSC 1070 Human Physiology or BIOSC 1250 Human Physiology

BIOSC 1130 Evolution

BIOSC 1320 Population Biology

BIOSC 1470 Biophysical Chemistry

BIOSC 1500 Cell Biology

BIOSC 1520 Developmental Biology

BIOSC 1540 Computational Biology

BIOSC 1760 Immunology

NROSCI 1000 or NROSCI 1003 Introduction to Neuroscience

NROSCI 1011 Functional Neuroanatomy

NROSCI 1012 Neurophysiology

NROSCI 1017 Synaptic Transmission

NROSCI 1034 Neural Basis of Cognition

One of the following probability or statistics courses

MATH 1119 Applied Probability for Actuarial Mathematics

MATH 1510 Mathematical Theory of Probability

STAT 1000 Applied Statistical Methods

STAT 1100 Statistics and Probability for Business Mgmt.

STAT 1151 Introduction to Probability

Students pursuing the Mathematical Biology major are encouraged to take CHEM 0110 General Chemistry 1 and CHEM 0120 General Chemistry 2, as these courses will satisfy the Dietrich School of Arts and Sciences breadth requirement in natural science and will expand their biology and neuroscience course options. Several of the BIOSC courses that fulfill requirements for this major have prerequisites, but some do not have prerequisites. PHYS 0174 Basic Physics for Science and Engineering 1 and PHYS 0175 Basic Physics for Science and Engineering 2 also carry a high degree of relevance for Mathematical Biology majors.

Mathematical Biology students who plan to continue in graduate studies are advised to take MATH 1530 Advanced Calculus 1 and MATH 1540 Advanced Calculus 2.

MATH 1370 Introduction to Computational Neuroscience and MATH 1380 Mathematical Biology introduce students to techniques for independent research; students completing these courses are encouraged to pursue research opportunities in Mathematical Biology that are available locally and nationally.

Grade requirements

A grade of C or better is required in each course that is to count toward the major. A minimum GPA of 2.0 in departmental courses is required for graduation.

Satisfactory/No Credit option

Only MATH 0500 may be taken on an S/NC basis. All other courses must be taken on a letter grade basis.

Writing (W) requirement

Students must complete at least one W-course in the major. Either MATH 0413 or MATH 0450 satisfies this requirement.

Honors major requirements

To earn departmental honors in Mathematical Biology, the student must:

- Fulfill all requirements for a degree in Mathematical Biology.
- Complete the following courses with a grade of A- or higher.
- MATH 1370 Introduction to Computational Neuroscience
- MATH 1380 Mathematical Biology
- Complete the following courses with a grade of B or higher.
- MATH 1530 Advanced Calculus 1;
- One 2000-level mathematics course (in lieu of an upper level elective);
- Complete one of the following requirements.
 - An honors thesis under the direction of Mathematics faculty member; for students seeking a BPhil from the University Honors College, this requirement could be satisfied by the Honors College thesis;
 - A 2000-level mathematics course with a grade of B or higher, in addition to the course used for requirement 3, above.

Although not required, the department strongly recommends that honors degree candidates take the intermediate honors courses MATH 1185 and 0450 during their freshman or sophomore year.

Advising

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Checklist for the Mathematical Biology major

Three Calculus courses (12 credits)

_____ MATH 0220

_____ MATH 0230

_____ MATH 0240

Two introductory theoretical courses (7 credits)

_____ MATH 0413 *

_____ MATH 0420 *

Professional Development

_____ MATH 0500

Two upper-level required courses (6 credits)

_____ MATH 1180 or MATH 1185

_____ MATH 1270 or MATH 1275

Two mathematical biology courses (6 credits)

_____ MATH 1370

_____ MATH 1380

Two numerical mathematics courses (6 credits)

_____ MATH 1070

_____ MATH 1080

Two applied analysis courses from the following list (6 credits)

_____ MATH 1280

_____ MATH 1550

_____ MATH 1470

_____ MATH 1560

_____ MATH 1530

Additional Requirements (15 credits)

Two introductory Biology courses

_____ BIOSC 0150

_____ BIOSC 0160

Two of the following; at least one must be at the 1000 level

_____ BIOSC 0350 or

_____ BIOSC 1500

_____ BIOSC 0355

_____ BIOSC 1520

_____ BIOSC 0370

_____ BIOSC 1540

_____ BIOSC 1000

_____ BIOSC 1760

_____ BIOSC 1070 or

_____ NROSCI 1000 or

_____ BIOSC 1250 or

_____ NROSCI 1003

_____ BIOSC 1870

_____ NROSCI 1011

_____ BIOSC 1130

_____ NROSCI 1012

_____ BIOSC 1320

_____ NROSCI 1017

_____ BIOSC 1470

_____ NROSCI 1034

One of the following statistics courses

_____ MATH 1119

_____ STAT 1100

_____ MATH 1510

_____ STAT 1000

_____ STAT 1151