

## Mathematical Biology Major

[www.mathematics.pitt.edu](http://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 43 credits in mathematics.

#### Three Calculus courses (12 credits)

MATH 0220 Analytic Geometry and Calculus 1  
MATH 0230 Analytic Geometry and Calculus 2 or  
MATH 0235 Honors Variable Calculus 1  
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.

#### 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 or BIOSC 0355 Genetics  
BIOSC 0370 Ecology  
BIOSC 1000 Introductory Biochemistry  
BIOSC 1070 Human Physiology **or** BIOSC 1250 Human Physiology **or** BIOSC 1870 Animal 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 statistics courses

MATH 1510 Mathematical Theory of Probability  
STAT 1000 Applied Statistical Methods  
STAT 1100 Statistics and Probability for Business Mgmt.

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:** No course that counts toward the major can be taken on an S/NC 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:

1. Fulfill all requirements for a degree in Mathematical Biology.
2. Complete the following courses with a grade of A- or higher.
  - MATH 1370 Introduction to Computational Neuroscience
  - MATH 1380 Mathematical Biology
3. 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);
4. Complete one of the following.
  - 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.

**Related area:** A minimum of 12 credits is required in any one Arts and Sciences department chosen in consultation with the major advisor. The completion of an official Arts and Sciences minor or an Arts and Sciences or UCIS certificate also satisfies this requirement.

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## **Checklist for the Mathematical Biology major**

### **Three Calculus courses (12 credits)**

\_\_\_\_\_ MATH 0220  
\_\_\_\_\_ MATH 0230 or MATH 0235  
\_\_\_\_\_ MATH 0240

### **Two introductory theoretical courses (7 credits)**

\_\_\_\_\_ MATH 0413 \*  
\_\_\_\_\_ MATH 0420 \*

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

### **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 1470  
\_\_\_\_\_ MATH 1530  
\_\_\_\_\_ MATH 1550  
\_\_\_\_\_ MATH 1560

### **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 0355  
\_\_\_\_\_ BIOSC 0370  
\_\_\_\_\_ BIOSC 1000  
\_\_\_\_\_ BIOSC 1070 **or** BIOSC 1250 **or** BIOSC 1870  
\_\_\_\_\_ BIOSC 1130  
\_\_\_\_\_ BIOSC 1320  
\_\_\_\_\_ BIOSC 1470  
\_\_\_\_\_ BIOSC 1500  
\_\_\_\_\_ BIOSC 1520  
\_\_\_\_\_ BIOSC 1540  
\_\_\_\_\_ BIOSC 1760  
\_\_\_\_\_ NROSCI 1000 or NROSCI 1003  
\_\_\_\_\_ NROSCI 1011  
\_\_\_\_\_ NROSCI 1012  
\_\_\_\_\_ NROSCI 1017  
\_\_\_\_\_ NROSCI 1034

#### **One of the following statistics courses**

\_\_\_\_\_ MATH 1510  
\_\_\_\_\_ STAT 1000  
\_\_\_\_\_ STAT 1100