

Mathematical Biology Major

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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