Graduate Program in Mathematical, Computational, and Systems Biology

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Overview

The graduate program in Mathematical, Computational, and Systems Biology (MCSB) is designed to meet the interdisciplinary training challenges of modern biology and function in concert with existing departmental programs (Departmental option) or as an individually tailored program (stand-alone option) leading to a M.S. or Ph.D. degree.

The degree program provides students with both opportunity for rigorous training toward research careers in areas related to systems biology and flexibility through individualized faculty counseling on curricular needs, and access to a diverse group of affiliated faculty and research projects from member departments. Current member departments include Biomedical Engineering, Biological Chemistry, Computer Science, Developmental and Cell Biology, Ecology and Evolutionary Biology, Mathematics, Microbiology and Molecular Genetics, Molecular Biology and Biochemistry, Chemistry, and Physics.

Admission

Students interested in the MCSB Program apply to the Office of Graduate Studies (OGS). Applicants must specify that they wish to pursue the M.S. or Ph.D. Upon completion of the M.S., students who may wish to pursue a Ph.D. may request to be evaluated together with the pool of prospective Ph.D. candidates for admission to the Ph.D. program.

Applicants are expected to hold a Bachelor’s degree in one of the Science, Technology, Engineering, and Mathematics (STEM) fields. Applicants are evaluated on the basis of their prior academic record and their potential for creative research and teaching, as demonstrated in submitted application materials (official university transcripts, letters of recommendation, GRE scores, and statement of purpose).

Required Core Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>DEV BIO 203A</td>
<td>Graduate Tutorial in Developmental and Cell Biology</td>
</tr>
<tr>
<td>PHYSICS 230A</td>
<td>Biophysics of Molecules and Molecular Machines</td>
</tr>
<tr>
<td>DEV BIO 232</td>
<td>Systems Cell and Developmental Biology</td>
</tr>
<tr>
<td>ECO EVO 251</td>
<td>Evolutionary and Ecological Principles in Medicine</td>
</tr>
<tr>
<td>or DEV BIO 203C</td>
<td>Graduate Tutorial in Developmental and Cell Biology</td>
</tr>
<tr>
<td>MATH 227A</td>
<td>Mathematical and Computational Biology</td>
</tr>
<tr>
<td>or BME 233</td>
<td>Dynamic Systems in Biology and Medicine</td>
</tr>
<tr>
<td>MATH 227B</td>
<td>Mathematical and Computational Biology</td>
</tr>
<tr>
<td>COMPSCI 284C</td>
<td>Computational Systems Biology</td>
</tr>
<tr>
<td>or MATH 227C</td>
<td>Mathematical and Computational Biology</td>
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</tbody>
</table>

1 BME 233 may be taken only if MATH 227A has been completed.

Students must complete the required core courses with at least a B+ average (3.3 GPA).

Required Labs

Students are expected to complete a minimum of two rotations during the first year. In some cases, students may arrive during the summer months (July and August) to start a rotation early, or finish a rotation prior to the start of the classes. In general, students are expected to complete rotations by the end of the spring quarter of their first academic year.

Students must perform one laboratory rotation in an experimental (wet) lab, and one in a computational (dry) lab.
Master of Science Program

Students pursuing the M.S. may choose either Plan I (Research Thesis Option) or Plan II (Literature Thesis Option). Students following Plan I must complete the seven required core courses (listed above), plus two electives. Students in Plan II must complete the seven required core courses, plus five elective courses selected from Breadth Categories I, II, and II. Students in Plan I and Plan II must attend first-year bootcamp.

In both plans, students must be supervised by a training faculty participating in the MCSB Ph.D. program and the student’s choice of Plan I or Plan II must be approved by the MCSB Executive Committee in consultation with the Program Director and their faculty supervisor. The normative time to degree is two years.

Doctor of Philosophy Program

Enrolled students participate in a common first-year “gateway” program and must complete the seven required core courses (listed above). Students are assigned an MCSB Advisory Committee consisting of two participating faculty members to oversee course and laboratory work. Subsequently, students select a thesis advisor and choose between the Departmental or Interdisciplinary (Stand-Alone) options for the remainder of their Ph.D. training.

Departmental Option

For students who select the Departmental option, a faculty member in a participating department must agree to serve as the student’s thesis advisor. Completion of the Ph.D. is subject to the degree requirements of the departmental Ph.D. program in which the student enrolls. Participating departments accept both the course work and research conducted during the “gateway” year in partial fulfillment of such requirements. Students are encouraged to consult with the department of choice for specific information on additional requirements. All department student advisory committees are established according to the rules of the participating department. In addition, the student’s MCSB Advisory Committee meets annually to follow progress and provide additional guidance. The normative time to degree for students in the Departmental option is five years.

To complete the coursework requirements for the Departmental option, students must:

- Attend first-year bootcamp
- Perform at least two laboratory rotations; one in an experimental (wet) lab and one in a computational (dry) lab
- Complete the seven required core courses, in addition to any departmental requirements.

Interdisciplinary (Stand-Alone) Option

For students who select the stand-alone option, the student’s thesis advisor assumes the role of the Committee Chair when a participating MCSB faculty member agrees to accept that role. Adjustments to the MCSB Advisory Committee may be made based on the area of the student’s research, or by request of the student, thesis advisor, or committee members. The student meets biannually with the Advisory Committee until an Advancement to Candidacy Committee has formed, which then assumes the duties until the M.S. or Ph.D. defense. The normative time to degree for students in the Stand-Alone option is five years.

To complete the coursework requirements for the Stand-Alone option, students must:

- Attend first-year bootcamp
- Perform at least two laboratory rotations; one in an experimental (wet) lab and one in a computational (dry) lab
- Complete the seven required core courses, plus five elective courses selected from Breadth Categories I and II.