

# INTERSCHOOL QUANTITATIVE BIOSCIENCES, GRADUATE CERTIFICATE

**Credential:** Graduate Certificate

**Field of Study:** Interschool Quantitative Biosciences

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## Program Overview

The vision for the Interschool Quantitative Biosciences Program (IQBP) is part of a broader effort to bring together quantitative bioscientists from across Case Western Reserve University to collaborate in research, education, and the building of a more diverse STEM academy.

The Interschool Quantitative Biosciences, Graduate Certificate requires 15 credit hours of required coursework and attendance at research seminars to be completed over the duration of three years. Each participant must prepare a plan on how the certificate will be completed and submit it for approval by the IQBP director and their PhD supervisor. The plan may be amended by mutual agreement.

## Learning Outcomes

- Demonstrate knowledge of quantitative approaches to scientific problems or data sufficient to collaborate with quantitatively focused scientists. (Quantitative courses)
- Demonstrate knowledge of one or more areas of biological sciences sufficient to collaborate with biologically focused scientists. (Biosciences courses)
- Demonstrate ability to acquire fundamental knowledge and skills in disciplines outside one's own primary discipline. (Interschool/interdepartmental courses)
- Demonstrate ability to communicate scientific research to scientists outside one's own primary discipline. (Student-led seminar)
- Demonstrate ability to acquire basic understanding of research in disciplines outside one's own primary discipline. (Research seminars)
- Demonstrate engagement with members of the local community to increase STEM literacy and broaden access to STEM education. (Outreach)

## Program Requirements

- Interschool/Interdepartmental Coursework (6 credit hours):** Students complete at least 6 credit hours of coursework taught by departments outside the student's PhD home department including at least 3 credit hours of course work outside their school/college and approved by the Interschool Quantitative Biosciences Program (IQBP) faculty director.
  - Breadth Coursework (12 credit hours):** Students complete at least 6 credit hours of coursework in the below two categories. Up to 3 credit hours of overlap are permitted with the Interschool coursework.
    - Quantitative: courses designated as Quantitative by the IQBP director; examples would include courses in Population and Quantitative Health Sciences, Computer & Data Sciences, Mathematics, Applied Mathematics & Statistics, and Physics that may or may not be directly targeted at biological applications.
    - Biosciences: courses designated as Biosciences by the IQBP director; examples might include courses in structural or cell biology.
  - Student-led Seminar Series (0 credit hours):** Students will participate for a minimum of three semesters in the IQBP student-led seminar series, which will meet weekly during each fall and spring semester for 90 minutes. Students must present at least once in those three semesters.
    - On alternate weeks, students will present their research or journal articles. Non presenting students will produce either summaries of material for a non-expert audience, or written evaluations of presentations.
    - On alternate weeks, faculty/staff/external guests will present on their field, research, techniques, or lead a session on professional development topics such as grants or communication skills.
    - Each semester the students will develop a schedule for the following semester in consultation to be approved by the IQBP director.
  - Research Seminar series (at least two instances, 0 credit hours):** Students regularly attend a standing research seminar or colloquium series sponsored by a department/center outside their home department. This shall include at least eight seminars over a maximum of 16 months. The IQBP director will facilitate that students meet with the speaker. Students provide a summary of the seminar suitable for a non-expert audience for sharing with the IQBP student cohort.
  - Outreach (at least three semesters, 0 credit hours):** Students engage in a thoughtful program of outreach to a underserved community.
    - Option 1: Students participate in an existing program that has been previously approved by the IQBP director as suitable for outreach.
    - Option 2: Students propose and execute an alternative plan for outreach to an underserved community, obtaining agreement of the community, of their PhD supervisor, and of the IQBP director.
  - Program of Study:** Students prepare a plan for how they will complete the Certificate and submit it for approval to the IQBP director and their PhD supervisor. Plan may be amended by mutual agreement.
  - Research Exploration outside the PhD department/school of the student (Optional, 0-6 credit hours):** Students may, with the permission of their PhD supervisor, complete a research experience in a laboratory outside their PhD department/school. This may be used to fulfill up to 3 credit hours of the Interschool Coursework requirement and up to 3 credit hours of the Breadth Coursework requirement with the approval of the IQBP director.
    - Credit: 1-6 credit hours of 501/601/701 at 1 credit hour per 42 hours of committed research effort, or equivalent as approved by the IQBP director.

- Requirements: A plan of expected work signed by the student, their PhD supervisor, and the PI of the host laboratory including clear learning objectives.
- Minimum Deliverable: a technical summary of the work completed and progress toward learning objectives, or a poster or manuscript prepared for presentation at a professional conference or publication in a peer-reviewed journal.
- Evaluation: by the PI of host laboratory.

## Sample Plan of Study

The following are sample plans of study for three students, one each in a department of the School of Engineering, the School of Medicine and the College of Arts and Sciences.

### Code Title Hours

#### Student A: School of Engineering (e.g. Biomedical Engineering or Macromolecular Science)

##### Breadth:

Quantitative (choose two):

EBME 401D	Biomedical Instrumentation and Signal Processing	3
EBME 433	Advanced Topics for Physiological Systems Analysis	4
PHYS 420 or PHYS 430	Introduction to Biological Physics <sup>a</sup> Experimental Methods in Biophysics	3
EMAC 403	Polymer Foundation Course III: Physics	3
EMAC 453	Foundations of Scattering	3

Biosciences (choose two):

IBMS 453	Cell Biology I	3
IBMS 455	Molecular Biology I	3
EBME 406	Polymers in Medicine	3

##### Interschool:

NEUR 402	Principles of Neural Science <sup>b</sup>	3
PHYS 420 or PHYS 430	Introduction to Biological Physics <sup>a, c</sup> Experimental Methods in Biophysics	3

Seminars: Various seminars in the School of Medicine departments and the College of Arts and Sciences Biophysics department

Research: Possible research credits earned by working in the lab(s) of Principal Investigator collaborators

#### Student B: School of Medicine (e.g. Physiology and Biophysics)

##### Breadth:

Quantitative:

SYBB 402	Introduction to Scientific Computing	1
IBMS 450	Fundamental Biostatistics to Enhance Research Rigor & Reproducibility	1
STAT 426	Multivariate Analysis and Data Mining	3
PHYS 420 or PHYS 430	Introduction to Biological Physics <sup>a</sup> Experimental Methods in Biophysics	3

Biosciences (choose two):

IBMS 453	Cell Biology I	3
IBMS 455	Molecular Biology I	3
PHOL 475	Protein Biophysics	3

##### Interschool:

EMAE 414 or EMAE 415	Nanobiomechanics in Biology <sup>e</sup> Introduction to Musculo-skeletal Biomechanics	3
PHYS 420	Introduction to Biological Physics <sup>a, c</sup>	3

or PHYS 430 Experimental Methods in Biophysics

Seminars: Various seminars in the Biomedical Engineering department and the College of Arts and Sciences Biophysics department

Research: Already doing rotations if in Physiology & Biophysics

#### Student C: College of Arts and Sciences (e.g. Physics)

##### Breadth:

Quantitative:

PHYS 420 or PHYS 430	Introduction to Biological Physics Experimental Methods in Biophysics	3
MATH 419	Applied Probability and Stochastic Processes for Biology	3

Biosciences:

BIOC 407	Introduction to Biochemistry: From Molecules To Medical Science <sup>a</sup>	4
EBME 451	Molecular and Cellular Physiology	3

##### Interschool:

BIOC 407	Introduction to Biochemistry: From Molecules To Medical Science <sup>b, f</sup>	4
PHOL 401A	Physiology and Biophysics of Molecules and Cells	2
PHOL 401B	Physiology and Biophysics of Molecules and Cells	2
EBME 406	Polymers in Medicine	3

Seminars: Various seminars in the School of Medicine departments and the Biomedical Engineering department

Research: Possible research credits earned by working in the lab(s) of Principal Investigator collaborators

- a Meets Interschool requirement
- b School of Medicine course
- c College of Arts and Sciences course
- d Meets the Quantitative Breadth requirement
- e School of Engineering course
- f Meets the Biosciences Breadth requirement