

Objectives:

- Understand and apply key concepts in designing and performing authentic experimental research
- Learn and practice good science communication, ethics and responsible conduct in research
- Develop research practices and critical thinking skills needed for a career in research
- Compile evidence of rigorous training in research for applicants to jobs and graduate programs

Overview

- Four terms of inquiry-based research in lab or field settings under faculty mentorship, overseen by Research Certificate Oversight Committee
- Two courses about research methods
- Three courses focusing on quantitative skills
- One course in history and philosophy of science
- Written and oral presentations of research

Application Requirements:

Eligibility: Degree-seeking undergraduate

BEFORE applying to the program:

1. Introductory Biology. Completed **two** terms of introductory biology, with a grade of **C** [not C-] or above. Transfers or students with AP/IB credit may be exempt from part of this requirement.

Bio 1: Choose one (each totals 4 cr.)

- BIOSC 0150 Foundations of Biology 1 **and** (BIOSC 0050 Foundations of Biology Lab 1 **or** BIOSC 0057)
- BIOSC 0715 Foundations of Biology 1 [UHC] **and** (BIOSC 0050 Foundations of Biology Lab 1 **or** BIOSC 0057)
- BIOSC 0190 Discovering Life: An Introduction to the Biological World 1 (includes a lab component)

Bio 2: Choose one (each totals 4 cr.)

- BIOSC 0160 Foundations of Biology 1 **and** (BIOSC 0060 Foundations of Biology Lab 1 **or** BIOSC 0067)
- BIOSC 0716 Foundations of Biology 1 [UHC] **and** (BIOSC 0060 Foundations of Biology Lab 1 **or** BIOSC 0067)
- BIOSC 0191 Discovering Life: An Introduction to the Biological World 1 (includes a lab component)

2. Completed 2 credits of mentored research in a Certificate-approved faculty laboratory (one term; min. 140 hr; BIOSC 1903/1904 or NROSCI 1901/1961 or equivalent) **and** have a letter of support from the faculty sponsor.

3. GPA. If students have a cum GPA ≤ 2.75 after completing the initial term of research, the faculty sponsor must comment in their letter of support on whether the student is likely to meet the rigorous demands of the Certificate.

Requirements to Complete the Certificate:

1. Mentored Research in Life Sciences

A. Components of mentored research projects: Formulation of hypotheses, experimental design, data collection, data interpretation, drawing conclusions supported by the data. Presentation of research findings, understanding the pertinent scientific literature, developing new knowledge, and development of a path towards research independence.

B. Research credit requirements: Three additional terms (each term; min. 140 hr; BIOSC 1903/1904 or NEURO 1901/1961 or equivalent.) of research for a total of at least 8 credits or credit equivalents. **BIOSC1903/1904 and NROSCI 1901/1961 must be approved and credits awarded according to departmental procedures.** The final 2 terms of research *must be* with the same faculty mentor. Research equivalents must be approved by the RCOC.

C. Pre-planning and Reporting for each Term
Pre-planning and Reporting: In the last week of classes before the next term of research (see *B* above), students must submit a 1-2 page report and prospectus summarizing accomplishments and aims for the next term. RCOC determines whether the research can count towards the Certificate before the end of the add/drop period.
Oversight: Reporting documents must be co-signed by the faculty sponsor (and co-sponsor if any).

D. Choice of Research Faculty

Research-active faculty in the Departments of Biological Sciences or Neuroscience may sponsor students for research in their labs. Faculty sponsors in other A&S departments or other University of Pittsburgh schools **must be approved by RCOC.**

E. Optional Off-campus Research Term

One term of off-campus research may be approved (e.g. summer fellowship or study abroad). **Submit in advance** a 1-page description to RCOC of the project and the research environment plus a letter from the research advisor confirming commitment to the ≥ 140 hours of research activity.

2. Quantitative Skills Courses - Statistics/Math:

Complete three courses from this list (9 credits):

BIOSC 1545: Mathematics of Biology

MATH 0220: Calculus I

MATH 0230: Calculus II

MATH 0280: Intro to Matrices & Linear Algebra

MATH 0290: Applied Differential Equations

MATH 1380: Math Biology

STAT 1000: Applied Statistical Methods

STAT 1221: Applied Regression

STAT 1211: Applied Categorical Data Analysis

STAT 1231: Applied Experimental Design

STAT 1241: Applied Sampling

STAT 1311: Applied Multivariate Analysis

STAT 1321: Applied Time Series

Graduate level options for the certificate:

BIOST 2041: Introduction to Statistical Reasoning

BIOST 2011: Principles of Statistical Reasoning

BIOST 2012: New advanced course

3. History and Philosophy of Science Courses:

Complete one course from this list (3 credits)

HPS 0427: Myth and Science

HPS 0437: Darwinism and its Critics

HPS 0430: Galileo & Creation of Modern Science

HPS 0515/HIST 0089: Magic, Med. & Science

HPS 0611: Principles of Scientific Reasoning

HPS 1620: Philosophy of Biology

HPS 1625: Philosophy of Medicine

HPS 1508: Classics in the History of Science

HPS 1653: Introduction to Philosophy of Science

HPS 1670: Philosophy of Neuroscience

HPS 1800: Special Topics in HPS

4. Research Methods Courses.

Complete two Research Methods courses, one in research communication and one in research mechanics; it is recommended that the research courses be in the student's major department.

BIOSC 1906 Research Methods: Communication in Life Sciences Research

BIOSC 1907 Research Methods: Under the Hood of Life Sciences Research

NROSCI 2014 - Speaking of Science

NROSCI 2410 - Translating Neuroscience

Be enrolled in the Certificate and performing research in a Certificate-approved lab during the same term as enrolled in these courses. Courses may be taken in any order. *Substitution of other Research Methods courses* must be pre-approved by RCOC.

5. Presenting Research: The student must present their research at two scientific meetings or symposia, at least one venue must be outside of major and research Departments. Ex.: Honors College Research Fair, Science20xx, Duquesne Summer Undergraduate Research Symposium, regional or national scientific meeting. Presentation

and abstract must be designed and delivered by the student and approved by the research faculty advisor and RCOC. The research abstract and a copy of poster or talk must be submitted to RCOC.

6. Research paper: The student will submit a manuscript describing the research completed in the final research experience spanning at least two consecutive terms. This will be in the form of a research manuscript. The paper must be submitted to the faculty sponsor and the RCOC by the last week of classes before finals week. The paper must be approved by the faculty sponsor and RCOC. The same final research paper may be considered for satisfying both Departmental Honors and the Research Certificate, provided it fulfills other requirements of the Department.

7. Portfolio Documentation. Upon registration for the Certificate, students must start (and regularly update) their electronic Portfolio, documenting their progress towards Certificate completion. Each proposal, presentation, research report, and other Certificate-related materials must be collated in the Portfolio. The Portfolio allows students, faculty, and advisors to review progress towards the Certificate, and provides coherent documentation of research proficiency when applying for employment or graduate school admission.

8. GPA requirements. The student must remain in good academic standing (minimum cum GPA 2.00); if students have a cum GPA ≤ 2.75 after completing the initial term of research, the faculty sponsor for that research must comment in writing their letter of support on whether the student is likely to meet the rigorous demands of the Certificate.

9. Advising. Majors in the Departments of Biological Sciences or Neuroscience will be advised through their departments. Students outside of these majors will be assigned an advisor within one of these majors.