

## **BIO 393 - Independent Research in Biology I**

### **Background**

Course Description: Biology 393 is a hands-on research experience conducted under the supervision of a research mentor. This experiential learning opportunity will give students the chance to become engaged in laboratory research within the context of a larger biological question. The major goal of BIO 393 is to provide students with the opportunity to become proficient in laboratory skills and techniques, protocols, design experiments with appropriate controls, interpret data, formulate conclusions, and present their findings in oral and written form. This experience culminates in the production of a final product, the specific details of which are at the discretion of the advisor. Examples of appropriate final documents include (but are not limited to) significant data analysis, a paper or a poster. All final documents must be archived by the Department of Biology.

How this course fits into the Biology Program: Independent Research in Biology I (BIO 393) is an engaging opportunity that allows students to explore hands-on, novel biology research by actively participating in experimentation, data acquisition, and data analysis. While most of the courses in the Biology Program offer laboratory components, and in fact, many provide students with the opportunity to engage in open-ended inquiry-based experimentation, Independent Research in Biology I gives the students unique exposure to the discipline. Students will be part of an on-going research program, designing novel experiments and collecting data important to the scientific community beyond TCNJ. The course is designed for students eager to begin independent research. A more advanced opportunity, Independent Research in Biology II (BIO 493/494), is also offered. The major difference between BIO 393 and BIO 493/4 is a qualitative and developmental distinction about the level of independent engagement of the student.

### **Learning Goals**

The ultimate goal of Independent Research in Biology I is to provide students with real-life exposure to original biological research under the direction of a research mentor. There is an understanding that Biology 393 experiences vary widely. For example, the student might collect extensive field samples, learn lab techniques, or perform in-depth data analysis. These experiences may not focus on a discrete scientific project, but rather give students an opportunity to engage in hands-on laboratory and/or fieldwork. Independent Research in Biology I is meant to enrich the students' understanding of the theories they are learning in the core courses, and allow them to become technically adept at a few techniques associated with one particular area of biological study.

### **Student Assessment**

In order to ensure that common standards for evaluating student performance are adopted by all faculty involved in Independent Research in Biology I, detailed guidelines outlining performance goals and expectations have been developed and are attached.

### **Learning Activities**

Specific learning activities will vary, depending on the nature of the research mentor and the laboratory in which the student is working. At a minimum, all Independent Research in Biology I

students will be responsible for maintaining a laboratory notebook, and working on a project under the supervision of the research mentor.

### **Performance Goals and Guidelines for Biology Undergraduate Research (BIO 393)**

#### Enrollment Requirements

1. Student must have a 2.5 GPA in sciences in order to enroll
2. Student should have achieved sophomore status, but exceptions may be made.
3. The first course unit (4 semester hours) of 393 may count toward the Biology Option requirements. But subsequent course units count as electives. A student cannot receive Biology Option credit for BOTH 393 and 493/4.
4. Student must obtain the agreement of a research mentor before registering for the class.
5. Student must file a signed copy of the “Independent Research Guidelines” as a formal acknowledgement of the course requirements.
6. Students must complete an Independent Study Enrollment Form and file with the department and Records and Registration.
7. Pre-requisites: BIO 201

#### Course requirements

1. Work load commensurate with credit hours; for a 0.5 course units (2 semester hours) course a student is expected to engage in an average of 7.5 hours of research activity per week and for a course unit 15 hours of work per week is expected
2. Maintenance of a laboratory notebook
3. Attendance at laboratory meetings
4. Attendance at Departmental Seminars and Poster Sessions Students who complete a half course unit of Bio 393 are expected to turn in their lab notebook for final evaluation.

Students who complete 1 or more course units in Bio 393 must submit an appropriate culminating project. The details of this culminating project are at the discretion of the research mentor. Examples might include a literature review, production of a final figure appropriate for presentation or publication, or a poster presentation.

A student that fails to meet the basic requirements and/or does not produce a research paper or poster will not pass. If the project involves more than one student working together, then each student is responsible for understanding the project completely.

## **Independent Research in Biology I:**

### **Performance Criteria**

#### **A Excellent Performance**

- engages in persistent, hard work
- exhibits ability to work independently and demonstrates technical independence
- shows strong interest in theoretical aspects of research
- maintains an excellent lab notebook with up-to-date recording, tabulating, and analysis of data
- gives competent presentations in lab meetings
- final culminating project is of excellent to outstanding quality

#### **B Good Performance**

- engages in persistent, hard work
- exhibits technical competence and follows instruction well
- demonstrates reliability and produces reproducible experimental work
- maintains a clear, organized lab notebook with evidence that the experiments are understood
- shows interest in lab meetings and participates in the research conversation
- final culminating project is of good to very good quality

#### **C Average performance**

- engages in persistent, hard work
- performance in experimental work is fair to poor
- demonstrates an ability to work with limited supervision
- lab notebook displays evidence of confusion and is inadequately maintained
- participation in lab and lab meetings is of low quality
- final culminating project is of fair quality

#### **D Poor Performance**

- performance is inadequate or sloppy
- displays inability to work without direct supervision
- has an inadequate grasp of the technical aspects of the work
- does not maintain an organized research notebook
- final culminating project is unclear and poorly organized or presented