

DATE: Fall 2007

COURSE NAME: Research Methods In Biology
PREFIX AND NUMBER BIO 291
CREDIT AND CONTACT HOURS 3 credit hours – 6 contact hours

CATALOG DESCRIPTION:

Under supervision of biology faculty mentors, students will select a research project, write a literature review and research proposal, conduct preliminary experiments, and write a research report. Research methods and experimental design will be emphasized, including the location and study of articles from the professional literature. The undergraduate research projects will help students develop valuable research skills, and it will provide students with an opportunity to apply scientific knowledge in the context of “real world” problems. Participation will also open up opportunities for students to take part in analyzing data and conducting field research. One 2-hour lecture period, and 4 hours of laboratory work per week. Students must also schedule time for consultation with the supervising faculty member. Prerequisites: BIO 121 and 122, AND permission from the instructor

II. Course Outcomes and Objectives

Learning Outcomes: Students will develop an understanding of modern biological research methods. A major objective of the course is to develop skills relating to the process of conducting science and the scientific method. Students will develop an understanding of the basics of experimental design, data collection, data analysis, and hypothesis testing. In addition, students will develop the skills to critically analyze current research published in the primary scientific literature. Students will learn to convey ideas, scientific knowledge, and experimental outcomes through both written and oral communication.

College Competencies Addressed by the Course:

Writing, ethics/values, oral communication, citizenship, reading, global concerns, mathematics, information resources, problem-solving, professional competency, computer literacy

III. Methods of Instruction

Types of Course materials: Textbook, laboratory notebook

Methods of instruction: Two hours of lecture and four hours of laboratory per week.

Assessment measures: Longitudinal assessment of student performance on tests, homework, labs, research work, laboratory notebooks; Classroom Assessment Techniques. Peer review of laboratory presentations and discussions.

Methods of Evaluation: Quizzes, examinations and laboratory reports and presentations.

IV. General Outline of Topics Covered

- I. Sources of Scientific Information
- II. Searching for Scientific information
 - A. Library Technology
 - B. Electronic Searches
 - C. Primary Literature Searches
- III. Primary Literature
 - A. Reading scientific papers
 - B. Critical analysis of research results
- IV. Doing Science: Where do questions come from?
 - A. Science as asking questions
 - B. Basic considerations
 - C. The skill of asking questions
 - D. Where do questions come from?
- V. Asking Questions: The art of framing hypotheses and predictions
 - A. Observation
 - B. Exploratory analysis
 - C. Forming hypotheses
- VI. Answering Questions: What do the results say?
 - A. Confirmatory analysis
 - B. What is statistical significance
 - C. Significance tests
 - D. Testing hypotheses
 - E. Testing predictions
 - F. Refining hypotheses
- VII. Presenting Information: How to communicate outcomes and conclusions
 - A. Presenting figures and tables
 - B. Presenting results
 - C. Writing reports

The remaining topics covered in this course will be project-specific. Faculty mentors will work with undergraduate researchers to provide them with up-to-date information on the current state of understanding as it relates to the specific research question being explored by each student.