University Studies Course Approval

Department or Program: **Biology**

Course Number: **BIOL 499**

Number of Credits: **3**

Course Title: **Student Research**

Catalog Description: **Student Research BIOL 499 - 3 S.H. An opportunity for an advanced student to work with a faculty member on an independent research project. Written report on results of research required. Prerequisites: BIOL 308, 310, 312 and instructor’s permission. Offered every semester.**

Material Submitted for Course Approval

**WRITING FLAG COURSE PROPOSAL**

**Overview of BIOL 499 Student Research.**

Biology is a research-based science. The purpose of this course is to provide all biology majors with an opportunity to learn “hands-on” the process of science. This involves applying methods of scientific inquiry to address a specific biological question. This is a capstone experience for students, where they apply their knowledge of their biology foundation to a specific situation or setting. To that end, students will consult with an instructor about a specific question, design and perform experiments, analyze data, statistically interpret results, and create a formal manuscript. The grade evaluation of the student work will be based on 1) student effort and thoroughness during their investigation, and 2) the final report submitted to the supervising instructor. Directions for the formatting of the paper will be according to the guidelines provided by the professor, and will be appropriate for the subject area. The report will include results in tabular or graphic formats and will emphasize appropriate analyses such that scientific conclusions can be drawn from their research efforts. This course emphasizes analyzing and interpreting the scientific information available in the literature and communicating in writing the scientific discoveries that enhance understanding of a particular biological topic.
### Outcomes Grid

<table>
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<th>Topics</th>
<th>Outcomes</th>
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<tr>
<td>Literature Review</td>
<td>Practice the processes and procedures for creating and completing successful writing in their fields</td>
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<tr>
<td>Research Report</td>
<td>X</td>
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1. Requirements and learning activities that promote students’ abilities to: practice the processes and procedures for creating and completing successful writing in their fields.

This requirement will be directly addressed as students write their literature reviews and research report. Scientific writing emphasizes clarity of expression, precise use of words, succinct communication and logical, linear development of ideas. Students learn to express themselves more clearly, to use words more precisely, to be succinct in their expression and to develop their ideas in a linear, logical argument through writing, editing and rewriting their manuscripts. The editing and rewriting is critically important because it draws repeated attention to details of English usage and logical development of ideas. It is through the repeated close scrutiny of their own manuscripts that students have a significant chance to practice better writing and better thinking. Good writing can be strong evidence of good thinking and poor writing is often a manifestation of fuzzy thinking.
2. Requirements and learning activities that promote students’ abilities to:
understand the main features and uses of writing in their fields.
This outcome is addressed in the literature review and research report associated
with this course. Students are required to write in appropriate scientific style as they
write their papers. Appropriate scientific style is manifest in the ancillary text for

3. Requirements and learning activities that promote students’ abilities to:
adapt their writing to the general expectations of readers in their fields.
This outcome is one of the features enumerated in the ancillary text, and in the
instructor’s and student peer’s feedback on various written drafts. Students write,
edit and rewrite their literature reviews and research reports with these
requirements in mind.

4. Requirements and learning activities that promote students’ abilities to:
make use of the technologies commonly used for research and writing in their fields.
This requirement is satisfied with the literature review and research report. These
are both research papers. Students must find and acquire appropriate higher-level
sources using available technology, and then use the resource materials to extend
their knowledge and understanding of their topic beyond that presented in most
course textbooks. Web sources are specifically excluded from being appropriate
higher-level sources. Ideally, students find recent monographs or journal articles
using appropriate search engines, and then use these materials for independent
learning. Students use their computers to write, edit, transfer, and print their
manuscripts.

5. Requirements and learning activities that promote students’ abilities to:
learn the conventions of evidence, format, usage, and documentation in their fields.
This requirement is met with the literature review and research report. Both
papers must be written in appropriate scientific style. The ancillary text, editorial
comments, and writing suggestions are designed to help students learn to write in a
scientific style.

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Sample Syllabus

Student Research
BIOL 499 (3 semester hours)
Spring 2006

This course is designed to meet the University Studies Writing Flag.

This is an independent study course designed to fulfill the Biology Department’s Capstone Research requirement. As such, this course is designed to provide the student with an opportunity to:

* Complete a literature search on a research topic and write a thorough literature review in proper scientific format.
* Expand upon ideas that were generated during the literature review, and, with the assistance of the instructor, generate a research question.
* Design and develop a research protocol to address the question.
* Conduct experiments to address research question and collect data.
* Interpret results using appropriate analytical techniques.
* Write a manuscript, in proper scientific format, addressing findings relating to the research question.


The student will meet with the instructor at least on a weekly basis to discuss the literature review, project, and/or final report. This time is flexible and designed to accommodate both the student’s and instructor’s schedules.

**Prerequisites: BIOL 308, BIOL 310, BIOL 312, and instructor’s permission.**

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**Catalogue Description:**

Catalog Description: An opportunity for an advanced student to work with a faculty member on an independent research project. Written report on results of
research required. Prerequisites: BIOL 308, BIOL 310, BIOL 312 and instructor’s permission. Offered every semester. This course is designed to fulfill the University Studies Writing Flag according to the criteria established by the University.

**Grades:** A letter grade will be assigned upon completion of the semester. The grade will reflect effort and thoroughness. It will not necessarily reflect simple completion of the project or acquisition of expected results. Student and instructor will work together on a weekly basis to determine project progress, assess possible pitfalls and problems, and set goals/objectives for the next week.

The final report is the capstone of the project and will be the showpiece of the student’s actual work. A polished manuscript is the ultimate goal at end of the semester, and will include a complete literature review and all experimental procedures used to address a given biological question.

**Generalized Schedule:**

**Preparation:**

1. Complete a literature search and formal written scientific review on the research topic. For the search, students are expected to utilize the scientific databases which the library has available. Internet sources will not be acceptable unless supported with additional findings. The professor will demonstrate how to conduct a rudimentary search with the student. Student drafts of the written review will be evaluated and edited by the instructor to improve its scientific style and content.

2. Formulate a research question. What research problem will be addressed?
   a. Develop a rudimentary research protocol.
   b. Assess the feasibility of the research and consider alternatives.
   c. Consider potential pitfalls that might occur.

3. Review how research notes should be written in a lab notebook. Learning how to keep meticulous notes is invaluable.

**Experimentation:**

4. Conduct experiments. Work with instructor to develop experimental expertise. Collect data for research question by filling in data sheets, tables, or
charts in the lab notebook. Create summary tables or graphs as procedures or experiments are completed. Enter data into computer (if appropriate) and statistically analyze data (whenever appropriate).

**Write Final Report:**

5. Write a report based on the research question. The literature review may be included in the report in part or in its entirety. The instructor will review the drafts and provide critical comments. The student also is required to seek at least one peer review of a draft from a fellow student. The drafts will be modified to address the comments of the reviewers. All researchers have their work reviewed prior to publication. This is an introduction to this peer-review process.

   a. *Abstract* – Summary of report in 500 words or less.

   b. *Introduction* – Summary of background information that should lead reader to the research question. Part or all of the literature review may be used here. State question in succinct form; do not make reader guess what is being examined.

   c. *Materials and Methods* – Written description of the techniques used to address the research question.

   d. *Results* – Written, descriptive summary of the project results, supplemented with graphs, tables, and/or illustrations to enhance a reader’s understanding of the data.

   e. *Discussion* – Comparison of project results to those of past research efforts. What is the relevance of the project findings? Portions of the literature review may be included here.

   f. *Literature Cited* - Complete listing of literature examined in the literature review and cited in the report. Format used will be based on that used in scientific journals in the field of the research project.

**Time Commitment:** The student should be willing and able to devote approximately nine hours per week to this project. Ordinarily 2/3 of the time is spent in the laboratory or meeting with the instructor. The other 1/3 represents an external time commitment spent writing results, preparing for experiments, doing library research, and so on (i.e., "homework").