

## **BIOLOGY DEPARTMENT**

### **BIO 497, 498 \*, 499**

#### **Requirements and Guidelines for Independent Study**

The purpose of the biology independent-study program is to encourage the pursuit of independent scholarship, scientific research, or related work experience with the guidance of a faculty supervisor.

Students may choose one of the following three modes for Independent Study:

#### **Bio 497 Independent Reading**

#### **Bio 498 Field Experience \***

\* Please note: Guidelines and eligibility requirements for Field Experience (BIO 498) will be presented at a later date following discussions within the department regarding the structure of this course.

#### **Bio 499 Independent Study (also called Independent Research)**

In no case shall an Independent Study project substantially duplicate the content of an existing course. Students may take Independent Study any number of times, but no more than nine credits of Independent Study will be counted toward graduation requirements except by special permission from the chair of the department and the Dean of the College of Science and Health. Independent Research (BIO 499), but not Independent Reading or Internship in Biology, will meet the biology major requirement of "Bioseminar or Independent Study". Only students with a minimum Biology GPA of 3.0 at the time the proposal is submitted shall be eligible for Independent Research (Biology GPA is the GPA for biology courses and biology-major co-requisites). This provision is consistent with University guidelines as mentioned in the Undergraduate Catalog.

Copies of these guidelines and application forms will be available in the Biology Department office and the Biology Department web page. All proposals are to be submitted electronically to the chairperson of the Independent Study Committee as attached Word or WordPerfect files **AND** as a hardcopy with the signatures of the student and the faculty supervisor. The faculty supervisor's signature attests that the supervisor has reviewed and approved the proposal. If the proposed work involves the use of animal or human subjects, approval from the WPUNJ Institutional Animal Care and Use Committee, or the Institutional Review Board (IRB) must be obtained in advance and indicated with the appropriate signature on the application form.

On receiving a proposal which meets the criteria mentioned above, the chairperson of the Independent Study Committee will contact other committee members and initiate a review of the submitted proposal. On conclusion of this review the chairperson will collate the referee reports and, in consultation with other committee members, write a comprehensive critique. This critique will be forwarded to the student with a copy to the faculty advisor. If extensive amplifications / alterations of the proposal are warranted then the student (in consultation with his advisor) has to submit an electronic copy of a revised proposal which meets or challenges the reviewer's concerns.

Students proposing to carry out Independent Research (BIO 499) will be asked to defend their proposal in a 10-15 minute talk at an open meeting which will be attended by members of the Independent Study Committee as well others who might be interested in the study. Students proposing to carry out Independent Reading (BIO 497) are exempted from this requirement. The time and date for the oral defense of all proposals for a particular semester is given below. Following this defense, the committee will meet briefly and their decision on the suitability of a proposal shall be final. When the committee has approved a proposal, they will send it to the department chairperson for approval and from there it will be forwarded to the Dean of the College of Science and Health.

ONLY WRITTEN APPROVAL FROM THE DEAN WILL CONSTITUTE PERMISSION TO REGISTER FOR INDEPENDENT STUDY.

**Deadlines for the first submission of proposals:**

First working day in April: For projects to be carried out in Summer or Fall

First working day in November: For projects to be carried out in Spring.

**Time and Dates for the oral defense of proposals submitted for Independent Research (BIO 499). Note: Proposals for BIO 497 are exempt from this requirement**

For projects to be carried out in Summer or Fall: Last Thursday in April; Common hour

For projects to be carried out in Spring: Third Thursday in November; Common hour

Students proposing to carry out Independent Research (BIO 499) are strongly encouraged to submit their initial proposal ahead of the deadline so as to allow time for review and revisions. Proposals that are late cannot fully benefit from the comments and criticisms of referees and will not be entertained.

Following completion of their Independent Study (BIO 497, 498 or 499), students will be expected to defend their research work as oral presentation to the Department and submit a written report to the Independent Study Committee. The assignment of a grade shall be the sole responsibility of the supervising faculty member. Although anyone may advise a student on an informal basis, only one faculty member can serve as the supervisor for a project and will be responsible for the student's work and his or her final grade for the course. However, faculty member should not submit the grade unless student has fulfilled the requirement of a) giving an oral presentation and b) submission of report/paper.

The following "student learning outcomes" can be assessed as part of independent study, in partial satisfaction of the biology department assessment requirements for graduation:

A1 Organize and synthesize biological information in logical sequence.

A2 Critically analyze biological information, including primary source material.

A3 Discuss the necessity of integrity in science.

**Proposal preparation guidelines BIO 499 Independent Research**

BIO 499 Independent Research provides an opportunity for advanced undergraduate students to design and execute a research project involving collection and analysis of data under the supervision of a faculty mentor. BIO 499 Independent Research can be substituted for BIO 480 (Bioseminar). Students interested in conducting an independent research project should contact a faculty supervisor well in advance of the intended semester in which the project is to be

conducted. In consultation with the faculty supervisor, the student will define the project objectives, investigate the published research literature on the topic, and prepare a detailed plan of research. These shall be used in the preparation of a formal proposal for independent research, following the detailed guidelines below. Any proposal for independent study is to represent the scholarly work of an individual student and must strictly adhere to the University policy on academic integrity regarding plagiarism and appropriate acknowledgement of sources. Faculty guidance is not to include the writing of any part of the proposal, and supervisors should take special care that students do not paraphrase any source without attribution in the preparation of their proposals.

The purpose of the proposal is to convince the faculty supervisor, independent study committee, department chairperson, and dean:

... that the proposed project is scientifically and educationally worthwhile. Will the project, if successful, potentially make a contribution to general knowledge and provide the student with a valuable research experience?

... that the student investigator is well-prepared to conduct the proposed research. Is the student knowledgeable about the discipline, including the relevant scientific literature, the necessary methods, and the relation of the proposed project to issues of broad scientific interest?

... that the project is feasible. Are the necessary materials and equipment available? Do the student and supervisor have the necessary expertise? Can the proposed objectives be achieved in the proposed project period (typically one semester)? Are the proposed methods appropriate and sufficient to achieve the proposed objectives? Is there sufficient replication and an appropriate statistical design for meaningful data analysis? Is the description of procedures sufficiently detailed to demonstrate the student's knowledge and a likelihood of success?

The independent research proposal should accomplish these aims within the following components and format. DO use section titles (Introduction, Materials and Methods, etc.) as headings in your proposal.

### **Introduction**

Introduce the scientific context for the proposal, explain the motivation for your proposal, review the relevant scientific literature, provide a clear set of objectives and validate and justify the overall approach to be taken to achieve these objectives.

### **Research Plan**

Provide a clearly organized, detailed exposition of your plan for accomplishing the stated objectives. These details should allow a referee to judge that you have considered the approach thoroughly and are aware of its strengths and shortcomings. For experimental projects, this should generally include a detailed experimental design (treatments and controls, number of replicates, data to be collected, planned statistical analysis), detailed technical procedures (sample collection, tissue preparation, injection protocols, instrumental methods, etc.) and an exposition of limitations inherent in your approach and potential ways around it. For field studies, the research plan should generally include a description of study sites, a sampling design (number of samples and how selected, data to be collected, planned statistical analysis), and detailed technical procedures (behavioral observations, instrumental methods, handling of specimens, etc.). All proposals should include in this section a timetable or schedule indicating when various activities will take place and when you expect various goals to be achieved.

Subheadings (e.g., Experimental Design, Technical Procedures, Data Analysis, Timetable) might be helpful and are encouraged. NOTE: If the project involves animal or human subjects, approval from the WPUNJ Institutional Animal Care and Use Committee, or the Institutional Review Board (IRB) must be obtained in advance and indicated with the appropriate signature on the application form.

### **Equipment, Supplies, and Budget**

Provide a complete list of equipment and supplies needed for the project. For any items that need to be purchased, provide a cost estimate and suggested supplier. For sophisticated instrumentation that requires special training (electron microscopes, spectrophotometers, etc.), describe your experience with the instrument or a plan for becoming proficient under appropriate supervision.

### **Literature Cited**

List all of the information sources (and only those sources) that you cited in the body of your proposal. Citation by author's name and year is preferred over the "footnote" style citations found in Science and some other journals. For example: "Adult ticks have eight legs (Sonenshine 1991)" and not "Adult ticks have eight legs (1)" or "Adult ticks have eight legs 1." Listing in the Literature Cited section should begin with the author's surname and include the full title of the article and journal in which it was published. For example:

Andrews, R. H. and Bull, C. M. 1982. Mating behavior and reproductive isolation of three species of reptile ticks. *Animal Behaviour*. 30:514-524.

Citation and listing of a publication indicates that you have read the publication yourself. Second-hand citation should be avoided, and clearly acknowledged when necessary (as when the original is unavailable or in a language you don't read, for example:

Aeschlimann, A. 1958. Development embryonnaire d'*Ornithodoros moubata* et transmission transovarriene de *Borrelia duttoni*. *Acta Tropica* 15: 15-64, cited in Sonenshine, D., 1991. *Biology of Ticks*. Oxford University Press.).

Heavy reliance on web sources (other than peer-reviewed publications available online) is discouraged. Where necessary, citation of web sources should be as complete as possible, should indicate the authority for the information on the site, and should include the date when the site was last updated (if available) and the date when it was accessed by the student.

### **Proposal preparation guidelines BIO 497 Independent Reading**

BIO 497 Independent Reading provides an opportunity for advanced undergraduate students to design and execute an in-depth literature-research project under the supervision of a faculty mentor. BIO 497 Independent Reading cannot be substituted for BIO 480 Bioseminar. Students interested in conducting an independent reading project should contact a faculty supervisor well in advance of the intended semester in which the project is to be conducted. In consultation with the faculty supervisor, the student will define the project objectives, do a preliminary literature search to identify sources, develop an outline of topics and subtopics, and prepare a project proposal according to the detailed guidelines below. Any proposal for independent study is to represent the scholarly work of an individual student and must strictly adhere to the University policy on academic integrity regarding plagiarism and appropriate acknowledgement of sources. Faculty guidance is not to include the writing of any part of the proposal, and supervisors should

take special care that students do not paraphrase any source without attribution in the preparation of their proposals.

The purpose of the proposal is to convince the faculty supervisor, independent study committee, department chairperson, and dean:

... that the proposed project is worthwhile. Is the topic scientifically worthy of in-depth investigation? Will the project provide a worthwhile experience in independent scholarship for the student?

... that the student is well-prepared to conduct the proposed project. Is the student sufficiently knowledgeable about the discipline, especially the relevant journals and other sources of scientific literature? Does the student demonstrate sufficient preliminary knowledge and intellectual maturity to successfully conduct independent scholarship?

... that the project is feasible. Is there sufficient accessible literature to support an in-depth investigation of this topic? Are the time available and the scope of the project compatible?

The independent reading proposal should accomplish these aims within the following components and format. DO use section titles (Introduction, Outline of Topics, Sources & Availability, Literature Cited) as headings in your proposal.

### **Introduction**

Introduce the scientific context for the proposal, explain the motivation for your proposal, and provide a clear statement of objectives. Your purpose is to demonstrate an understanding of the conceptual framework for the questions you propose to investigate, indicate some familiarity with the relevant literature, and make the case that your proposed investigation is scientifically worthwhile.

### **Outline of Topics**

Provide a reasonably detailed list of topics and subtopics (or, alternatively, questions and sub-questions) that will provide the starting point for your investigation and the framework for your final paper and oral presentation. It is to be expected that this list may be modified to some degree in the course of your investigation, but a carefully-prepared outline will indicate your preparedness and facilitate your scholarly work.

### **Sources and Availability**

Provide a list of professional journals and other sources that you expect to consult in the course of your scholarship. For each such source, indicate the means by which you intend to access it (WPUNJ library, online, interlibrary loan, personal loan from professor, etc.).

### **Literature Cited**

List all of the information sources (and only those sources) that you cited in the body of your proposal. Citation by author's name and year is preferred over the "footnote" style citations found in Science and some other journals. For example: "Adult ticks have eight legs (Sonenshine 1991)," not "Adult ticks have eight legs (1)" or "Adult ticks have eight legs 1." Listing in the Literature Cited section should begin with the author's surname and include the full title of the article and journal in which it was published. For example:

Andrews, R. H. and Bull, C. M. 1982. Mating behavior and reproductive isolation of three species of reptile ticks. *Animal Behaviour*. 30:514-524.

Citation and listing of a publication indicates that you have read the publication yourself. Second-hand citation should be avoided, and clearly acknowledged when necessary (as when the original is unavailable or in a language you don't read, for example:

Aeschlimann, A. 1958. Development embryonnaire d'*Ornithodoros moubata* et transmission transovarriene de *Borrelia duttoni*. Acta Tropica 15: 15-64, cited in Sonenshine, D., 1991. Biology of Ticks. Oxford University Press.).

Heavy reliance on web sources (other than peer-reviewed publications available online) is discouraged. Where necessary, citation of web sources should be as complete as possible, should indicate the authority for the information on the site, and should include the date when the site was last updated (if available) and the date when it was accessed by the student.