
THE COLLEGE OF

WOOSTER

Biology Junior
Independent Study
Handbook

Overview of Independent Study in Biology

Spring Junior Year	Biology 401 – JR IS / Biostatistics		<p>Biology Department Seminar Thursdays 11-12, G01 Mateer</p> <p><i>1st 2 weeks: OARDC researchers (potential co-advisors)</i></p>
	<p>Biostatistics</p> <ul style="list-style-type: none"> meet T/R 9:30-10:50 during 1st week (Thursdays only thereafter) learn about experimental design and data analysis 	<p>Research Proposal</p> <ul style="list-style-type: none"> work with a COW biology faculty member (IS & academic advisor) to plan a research project that will be completed during SR IS may also have a co-advisor at another institution (e.g. OARDC, clinic) submit research project & advisor preferences by end of 2nd week advisors assigned by early 3rd week schedule regular meetings with advisor (typically weekly, ~ 1 hour) culminates in a research proposal that includes an extensive literature review (guidelines specified by advisor) 	
	Grade: A-F (50% Biostatistics + 50% Research Proposal)		
Summer	Some students may choose to collect data during the summer.		
Fall Senior Year	Biology 451 – SR IS		<p>Biology Department Seminar Thursdays 11-12, G01 Mateer</p>
	<ul style="list-style-type: none"> conduct research (<i>once, twice... it'll take a few attempts!</i>) some students may compile & analyze data some students may begin writing their theses typically meet weekly with advisor 		
		<ul style="list-style-type: none"> Grade: S-N (assigned by advisor) 	
Spring Senior Year	Biology 452 – SR IS		<p>Biology Department Seminar Thursdays 11-12, G01 Mateer</p>
	<ul style="list-style-type: none"> some students may still be collecting data early in semester some students may still be analyzing data early in semester most students will be writing & revising their theses written thesis due Monday after spring break present 15-minute research seminar to Biology Department schedule oral exam with advisor and 2nd reader (assigned by faculty) typically meet weekly with advisor 		
	<ul style="list-style-type: none"> Grade: H / G / S / N (assigned by advisor with consultation from Biology faculty) 		

Junior Independent Study in Biology

Junior Independent Study is designed to help Biology majors develop a variety of skills that are fundamental in planning and carrying out an independent scientific research project, as well as in communicating research findings to one's intellectual community. At the end of your junior year you will have: (1) been assigned to an I.S. advisor, (2) learned about the proper use of statistics in biology, (3) developed and written a proposal for your senior I.S. research, and (4) regularly attended the departmental seminar series.

After completing the tasks required of you during this semester, you will have an excellent foundation from which to approach your IS research during your senior year.

Advisor Assignments

Late in the fall term, a document will be distributed to all juniors detailing the research interests as well as some current projects of each faculty member in the Biology Department. Over the holiday break, juniors should carefully read this document so they can begin to form an idea of which professors they might be most interested in working with for their I.S. Students are strongly encouraged to meet with any faculty members they are potentially interested in working with. In addition through a series of short seminars in the early weeks of Biology 401, you will learn about I.S. research opportunities at the OARDC and possibly other nearby institutions. Should you choose to work with an off-campus advisor, you will still be assigned a Biology department faculty member who will serve as your I.S. advisor, as well as your academic advisor. This person will work with you and your off-campus advisor in helping you to plan and carry out your IS project.

Early in the spring term, each student will be required to submit a ranked list of their top two choices for an I.S. advisor. The faculty will collectively consider these preferences and, if at all possible, give everyone their first choice. Often, however, some faculty may receive more requests than they are able to fill. For this reason, and to balance workload among faculty members, students may be assigned to the advisor who was their second choice. In rare cases, a student may be assigned to a faculty member that was not their first or their second choice. In any case, it is important to appreciate that you can approach any members of the department, where appropriate, to request specific help on your IS project. The actual process of the IS experience is, in the end, far more important than the actual topic on which you do your research. In addition to working with you in Biology 401, this faculty member will continue to advise your Senior I.S. thesis in the senior year, unless that faculty member is going on sabbatical leave or there are other extenuating circumstances that suggest a change in advisor is appropriate. Students who will be conducting I.S. research off-campus must still have a College of Wooster Biology professor to serve as your IS advisor. In Biology, the I.S. advisor is also the academic advisor, so students will go to their I.S. advisor for advice on classes as well as for I.S.

Biology 401 (Independent Study and Biostatistics)

Course Organization

Biology 401 is divided into two parts. In one part students prepare the Junior Independent Study Proposal in consultation with their IS advisor. Each student gains experience in reading and analyzing scientific papers, in writing clearly and concisely, and in framing testable experimental questions appropriate for a research project. Typically, the student will meet with their I.S. advisor once each week at a time to be arranged between the student and the advisor. Together, the student and the advisor will decide upon a specific project that will be the basis of the I.S. This portion of the course culminates in the writing of the Junior Independent Study Proposal.

In the other part of Biology 401, students learn about basic statistical analysis. Lectures and class exercises cover descriptive statistics, hypothesis testing, and parametric and non-parametric statistical procedures for data analysis, as well as principles of experimental design. Students complete weekly problem sets to practice statistical procedures. The biostatistics portion of the course concludes with a final examination to test comprehension.

Development of Your Independent Study Research Project

Preparation of the Junior Independent Study Proposal

After you have been assigned to an IS advisor, you will begin to prepare for writing the Junior Independent Study Proposal. This proposal will accomplish two goals; it will place the project you have chosen to investigate in the context of the larger body of scientific literature, and it will provide an experimental framework for the way in which you will conduct your Independent Study research. The Biology 401 paper will be written in two parts: (i) a literature survey and (ii) a proposal for the independent study research to be conducted in the senior year.

Part I, Literature Review

In Part I of the junior independent study paper, the student is expected to thoroughly review the existing literature on the topic to be studied. To achieve this objective, the student must conduct an extensive electronic bibliographic search, the results of which should be submitted to your advisor by the assigned date. Based on the bibliographic search, the student should then use this information to (i) identify and summarize previous studies relevant to the topic, (ii) explore the theoretical background of the question, and (iii) identify directions for future research efforts.

Part II, Research Proposal

In Part II of the junior independent study paper, the student prepares a research proposal, which should include (i) a statement of the problem being investigated, (ii) a concise discussion of the questions being asked in the student's research plan, (iii) a detailed description of the methods and materials needed to carry out the project, and (iv) a budget of the expenses. The format of the research proposal generally should follow the guidelines described in Pechenik's *A Short Guide to Writing about Biology* (see the chapter on "Writing Research Proposals").

Your IS advisor will determine the schedule of due dates for completing drafts of your Junior IS proposal. In addition, your particular IS faculty advisor may ask for additional materials from you, or provide added guidelines for the format of your IS thesis.

Students who will be proposing research that involves the use of vertebrate animals or human subjects will need to prepare and submit a proposal to the Animal Care and Use Committee or the Human Subjects Committee before the data collection can begin. Your I.S. advisor will help you draft an appropriate proposal.

Evaluation of Biology 401

Your independent study advisor will assign you a letter grade based on your Junior I.S. proposal that will constitute 50% of your final grade in Biology 401. You will also receive a letter grade for the statistics portion of the course, which will constitute the other half of your final grade in Biology 401. However, the department feels that students must demonstrate proficiency in both biostatistics and the development of a research proposal by earning a C- or better in both of these components of Junior I.S. Thus, students who earn a D or F in either component must take remedial steps to master the material in some other format, even if failing one component does not result in a D or an F in Biology 401 overall (see table below).

write a passing research proposal (C- or better)		write a failing research proposal (D or F)	
pass biostatistics (C- or better)	fail biostatistics (D or F)	pass biostatistics (C- or better)	fail biostatistics (D or F)
Congratulations on a job well done – proceed directly to Biology 451: Senior I.S.	Take an approved statistics course off-campus during the summer or take Psychology 250 on campus during the fall semester concurrent with Biology 451: Senior I.S.	Work with your advisor during the summer by enrolling in summer school (if s/he agrees that your proposal is close enough to passable to be completed during the summer) or during the fall semester to improve your research proposal to a passable product. This must be accomplished BEFORE you begin Biology 451: Senior I.S. So delaying this until the fall semester will result in a delay in your graduation since Biology 401, 451 and 452 cannot be taken concurrently.	Work with your advisor during the summer by enrolling in summer school (if s/he agrees that your proposal is close enough to passable to be completed during the summer) or during the fall semester to improve your research proposal to a passable product. This must be accomplished BEFORE you begin Biology 451: Senior I.S. So delaying this until the fall semester will result in a delay in your graduation since Biology 401, 451 and 452 cannot be taken concurrently. Take an approved statistics course off-campus during the summer or take Psychology 250 on campus during the fall semester concurrent with Biology 451: Senior I.S.

Evaluation of the Junior Independent Study Proposal

Your advisor will evaluate the junior independent study proposal. The questions outlined below are meant to give you a sense of the components that are used in the evaluation process.

Literature Survey

1. Is the literature survey thorough?
2. Did the student consult the primary literature, in addition to using review papers and other secondary sources?
3. Was the survey done prior to and throughout the development of the research proposal?
4. Has the student effectively synthesized information from a variety of primary sources in summarizing the background relevant to their research project?

The Proposal

1. Did the student make original contributions to the development of the project?
2. Is the project novel? Is the work something that has not been done previously? Did the student modify or extend another, similar project in significant or novel ways?
3. Did the student actively engage the question, and show creativity and tenacity in fine-tuning the design as the situation required?
4. Is the experimental design statistically robust, and has the student identified appropriate statistical tests by which they can evaluate their hypotheses?

Summer Research

Some students will begin the process of collecting data for the IS research during the summer between their junior and senior year. Each student in the biology department will receive a budget of \$400.00 to be used for the purchase of supplies/travel reimbursement etc. related to IS research (for the entire three semesters of the project). In addition, students may choose to write a proposal for supplementary funding from the Copeland Fund. Students can apply for Copeland funds once during the course of the IS research. The deadline for applications is late March, for funding that students expect to use during the summer between their Junior and Senior years, and in early October, for funding that will be used during the Senior year..