
GUIDELINES FOR INDEPENDENT RESEARCH IN BIOLOGY AT DREW UNIVERSITY **Updated 3/13/06**

This document explains procedures, rules, and options for students who undertake research in biology at Drew University. Here you can learn how to arrange a research experience; in addition, you will find important guidelines which must be reviewed and followed by students involved with biological research at Drew, whether with a regular teaching faculty mentor or a RISE faculty member. If you are interested in Honors research you should also obtain a copy of the Honors information booklet, available from Dean Cucchi's office and on-line at the honors web page (under depts.drew.edu).

There are two types of research in biology: library research and hands-on research in the lab or field. For library research, take Biol 195/Independent Study in Biology: Literature Research. For research in lab or field, take Biol 196/Research in Biology. The latter option (Biol 196) is normally taken for 2 credits, but a 4-credit option is also available, usually for a second semester of research or for Honors projects. Neurosciences majors may choose to register for Neuro 195 (literature) or Neuro 197 (lab research). Biochemistry majors may register for Biochem 120/Research in Biochemistry. Each option is explained in detail below.

GETTING STARTED: FINDING A PROJECT: To connect with a research project and research mentor, speak with professors and RISE fellows whose interests parallel your own about the opportunities in their laboratories. Or speak to any faculty member for help finding a research mentor. A list of faculty (including RISE) research interests can be found posted in the biology lounge, HS 132. Normally all students who wish to do research are found a place, although not always with the first choice mentor if s/he already has a full load of research students.

The most successful and rewarding research projects are those done in conjunction with an ongoing research program with a research-active professor or RISE fellow. Unlike projects that you devise entirely on your own, projects with an expert mentor give you a research apprenticeship in a setting where most bugs have already been worked out. However, literature review projects can emphasize nearly any topic in biology that you would like to explore.

OFF-CAMPUS RESEARCH AND INTERNSHIPS: Off-campus internships and summer research experiences are invaluable. The biology department strongly urges all students to seek summer internships, and we publicize opportunities on the web site. An excellent source of information is the annual Biology Internship Information Session, where students report on their own summer internships and offer tips on finding such opportunities. You can get Drew credit (but not biology credit) for such experiences through the Academic Internship program in the UC where application materials are available. A Drew professor must agree to sponsor the internship and to grade a required term paper you write as part of the experience. Academic Internship credits are intermediate credits count toward graduation but not toward the biology major. Perhaps 75% of students who do summer internships in biology choose to receive Academic Internship credit for the experience.

Note that credit is not granted toward the Drew biology major for internships and summer research programs at other locations.

RESEARCH OPTIONS: REGISTRATION AND EXPECTATIONS: This section of the guidelines describes the three components of the Drew biological research program: the literature research option (Biol 195), the lab/field research option (Biol 196), and Honors research in biology (also undertaken through Biol 196). Students are also encouraged to consider summer research through Drew University's Summer Science Institute (DSSI), working with a Drew professor on campus for a stipend but not credit, or at other universities through summer internship programs. See the DSSI web site for more information.

1. LITERATURE RESEARCH:

Bio 195/Independent Study in Biology: Literature Research-2 credits. Available fall and spring semesters.

SIGNATURES: Registration requires the signature of the department chair or research coordinator (person listed as the instructor for Biology 196 for the given semester)

BEFORE REGISTERING: Identify a subject area you wish to investigate, and speak to a professor with whom you are interested in working. Depending on faculty workloads, you might be assigned to a different faculty member.

PREREQUISITES: minimum GPA of 2.00 in the major. Normally research is started in the junior or senior year after a background of coursework has been developed.

CATALOG DESCRIPTION: An in-depth study of selected topics in biological theories, processes, and applications.

LINKAGES TO LAB/FIELD RESEARCH AND HONORS: A thorough search and review of the literature is the recommended way to begin any scientific work. Literature research will help you learn more about your topic, identify interesting hypotheses to test, and discover methods and techniques you might use in field or lab research. Many students who do honors research in the senior year undertake literature research in the junior year.

EXPECTATIONS: The literature review must be comprehensive. Computer literature searches and visits to other libraries are normal components of such research. Your critical evaluation of the literature is an important component as well. Work closely with your professor; meet frequently to discuss your ideas as well as your progress. Because you earn two academic credits, you are expected to spend at least 6 hours per week on the project. By the end of the sixth week of the semester, a bibliography must be submitted to your professor. Your professor may suggest that you withdraw from the course at this time if your progress is inadequate. A rough draft of your literature review is due two weeks before classes end. Two copies of your final paper are due by the last class day of the semester.

FORMAT FOR THE LITERATURE REVIEW: See the section below, Literature Review and Scientific Paper Format for requirements about format and documentation.

LITERATURE RESEARCH BUDGET: The biology department will reimburse you up to \$20 for expenses such as interlibrary loan fees and photocopying at other libraries. You must submit receipts to your professor.

2. LAB & FIELD RESEARCH

Bio 196/ Research in Biology 2 credits or 4 credits (for Honors projects). Available fall and spring semesters.

SIGNATURES: Registration requires the signature of the department chair or the current faculty coordinator of student research (whomever is teaching the Friday Biology 196 sessions) and requires prior arrangement with the research advisor. (See above re: finding a project).

PREREQUISITE: Two years of college biology and minimum GPA of 2.00 in the major. Normally research is started in the junior or senior year after a background of coursework has been developed.

CATALOG DESCRIPTION: An opportunity for upper-level students to design and execute an independent project in biology, including laboratory or field research, under the supervision of biology, psychobiology, or RISE faculty. A one-hour weekly research seminar meeting is required, where students present work in progress and receive logistical guidance. Interested students should meet with a faculty member to plan the project and establish the amount of credit before registration. Students normally enroll for 2 credits, especially when beginning a new project. Students conducting honors research in biology should register for this course rather than registering for HON 109 and 110. Two semesters of Biol 196 satisfy one laboratory course requirement toward the major. May be repeated, but a maximum of 8 credits of Biol 195 and 196 can be counted toward the 21-credit upper-level requirement for the biology major.

EXPECTATIONS: Requirements under this independent study option vary somewhat with the nature of the project you undertake. Written assignments will include an annotated bibliography and a final paper. An oral presentation to the research class is also expected. Keep in close contact with your faculty supervisor about his/her expectations. Before the end of the sixth week of the semester, you should formally meet with your professor to review your progress. You may be required to withdraw from the course at this time if your progress has been inadequate. You are expected to spend a minimum of 6 hours each week on a 2-credit research project.

WEEKLY RESEARCH MEETING: One-hour group meeting of all research students is a required component of this experience.

CONFERENCE PRESENTATION: All research students are urged to present their work at a Tri Beta Conference or other research conference, although only Honors students are required to do so. See the section below, Presenting Research Results.

FINANCIAL SUPPORT: For projects with biology faculty mentors, the biology department budget provides up to \$400 per semester for supplies. RISE mentors have separate lines of support, and some professors have grant monies with which to supplement this amount. All biology research

students are strongly urged to apply for research grants, the Brooks Awards, from Tri Beta, the Biology Honor Society. The annual deadline comes very early in the fall semester, so consider putting a proposal together the previous spring or summer.

3. HONORS RESEARCH:

Honors Research in Biology is a research option for the senior year, involving literature review, intensive lab or field research, a written honors thesis, and graduation with Specialized Honors in Biology.

IMPORTANT HONORS INFORMATION: See the Honors web page (www.depts.drew.edu/honors) for important information including entry qualifications, guidelines, and procedures that are applicable to Specialized Honors in all academic fields.

TO REGISTER FOR HONORS IN BIOLOGY: Register for Bio 196/Research in Biology at the 4 credit level in the fall and again in the spring. Note that this is different from procedures in most other departments whereby students register for Hon 109 and Hon 110.

SIGNATURES: Registration requires prior arrangement with and signature of the research advisor.

PREREQUISITES: A minimum overall GPA of 3.1 at the end of the junior year, a minimum GPA at graduation of 3.2 overall and 3.4 in biology. A Drew professor or RISE scientist must agree to mentor your honors project.

CATALOG DESCRIPTION: See above for Bio 196.

FINANCIAL SUPPORT: As for other Biol 196 students, projects with biology faculty mentors are supported by up to \$400 per semester for supplies. RISE mentors have separate lines of support, and some professors have grant monies with which to supplement this amount. Special needs beyond this allocation should be brought to the attention of your research advisor. All biology research students are strongly urged to apply for research grants, including the Brooks Awards from Tri Beta, the Biology Honor Society. Applications are due early in the fall semester. In addition, students doing honors research can be reimbursed for up to \$20 per semester for costs associated with literature review: photocopying, interlibrary loan fees, and the like. Submit receipts to your professor.

THE ADVANTAGE OF AN EARLY START: The nature of scientific research makes it difficult to complete an honors project during two semesters, especially since deadlines and thesis write-up leave little of the spring semester open for research. You should therefore do literature and/or field/lab independent study during your junior year to get a head start on your project. Extra work during the preceding summer will also help you. Consider applying for the Drew Summer Science Institute (DSSI) which provides a stipend and supply money for summer work on your research.

PROCESS VERSUS PRODUCT: Note that honors research need not be earth-shaking with new publishable outcomes, as some students seem to expect of themselves. The value is in the process rather than the product, and both student and research advisor must maintain realistic expectations given the brief time period available for an undergraduate thesis. A failed thesis is one in which the student did not invest the necessary time, thought, and energy.

EXAMINING COMMITTEE: An honors thesis is presented during a thesis defense at the end of the senior year, with a group of professors serving to evaluate but also to guide your project. You must designate your honors examining committee very early in the course of your project. The biology department requires these designations by October 1. Your 4-member examining board must include your advisor, a member of the biology department, one non-biology faculty member of your choice, and one member of the college Honors Committee (designated by the Honors Committee). Once you have chosen your honors examining board members, you must keep these people informed about your research. In particular, both biologists on your board must be involved from the outset in the design and planning of your research. Otherwise an examining board member who has had no opportunity for early input might require major revisions very late in the writing of your thesis. To avoid nasty surprises, and to take full advantage of their guidance, keep your examining board informed about and involved in your research.

HONORS TIME-TABLE: Work to keep on schedule with respect to college-wide honors program deadlines. These include a mid-October discussion of progress in a formal Honors Colloquium, with other honors students and faculty mentors; a finished first draft of the thesis by April 1; and an April 15 deadline for the final, polished thesis. In addition, your thesis advisor may impose other deadlines for thesis proposals, outlines, literature work, or drafts of the thesis. Note that the Tri Beta Convention (below) sometimes takes place as early as March or early April.

THESIS TIMETABLE: Several drafts of your thesis must be distributed to members of your examining board at various stages of your project. The biology department requires you to (1) distribute a polished thesis two weeks before your thesis defense; (2) collect feedback and make revisions; (3) distribute a revised thesis at least 3 days before your thesis defense; (4) anticipate and act upon further suggestions for revision as put forth by the examining committee during your thesis defense; and (5) present a final thesis to your research advisor for approval prior to making final copies for delivery to the library for binding.

THE WRITTEN THESIS: See section below on "Literature Review and Scientific Paper Format"

PRINTING AND COPIES OF THE THESIS: The final thesis should be printed or copied on bond paper, which the biology department will provide for you. Notify the department secretary at least two weeks in advance so that paper can be acquired. Typing and preparation of tables and figures are your responsibility. In addition to two thesis copies required by the library, three copies must be provided to the biology department: one to be bound and returned to you; one for your research advisor; and one for departmental archives.

REQUIRED CONFERENCE PRESENTATION: The biology department requires students who receive honors to present their work at a conference. See below on "Presenting Research Results."

CREDIT TOWARD MAJOR REQUIREMENTS: A maximum of 8 credits of Independent Study (Bio 195, 196) may be counted toward the required 21 upper-level credits for the biology major. Two semesters of Biol 196 can be counted as one laboratory course toward the biology major; only one laboratory course equivalent can be earned through Biol 196. Independent study/honors work does not count toward fulfillment of the biology minor requirement for one upper level lab course.

LITERATURE REVIEW AND SCIENTIFIC PAPER FORMAT:

All literature reviews (for Biol 195) and scientific papers prepared for honors projects (Biol 196) must follow the approved scientific format. The Biology Department has adopted the guidelines of the Council of Biology Editors for literature reviews, scientific paper formats, and literature citation procedures. Handouts including an article by retired Drew Professor Nagle summarize conventions of documentation. More detail is available in the Council of Biological Editors Style Manual, a copy of which may be found in the secretary's office adjacent to the Biology Lounge. Direct any questions to your research advisor or the Biol 196 course leader.

Papers must also be well written and clearly organized. You should strive to deliver polished written work but anticipate that the supervising professor will usually recommend revisions and editorial changes. Plan to submit your paper well before the end of the semester to allow time for such revisions.

PRESENTING RESEARCH RESULTS AT A SCIENTIFIC MEETING

Scientific research is not complete until your findings are shared with others. Thus Drew biology honors candidates are expected, and independent study students are encouraged, to present their results at a scientific meeting, normally Tri Beta. Failure to participate may adversely affect your Honors grade. Note that you must present work at a Tri Beta Convention if you receive a Brooks Award for Student Research from Tri Beta.

Each spring the Biology Department participates in a nearby TriBeta convention or other undergraduate research conference for this purpose. Students may also present at other scientific conferences; recent venues include national meetings of the American Society for Microbiology, the Neurosciences Society, and the Ecological Society of America. The Biology Department pays the expenses of student presenters and pays for costs of posters and other presentation costs. Shortly before your presentation, the biology faculty will host a practice session to help you polish your speech or share your poster. Your participation in this practice session is expected. While planning your presentation, work closely with your research advisor.

If appropriate, you may be encouraged to publish the results of your research in the primary scientific literature. Consult with your research advisor for more information.

WORKSPACE AND SAFETY: As appropriate, students conducting laboratory or field research will be assigned to a work space, often in the shared laboratory. Students can request lockers or lockable drawers for personal items when workspaces are within one of the main laboratories. Space provision is a departmental privilege. Students should use these spaces for legitimate research work. Students are also responsible for the maintenance, safety, and aesthetics of their assigned areas. Abuse of this arrangement may entail loss of use of the assigned space.

Special handling of waste materials is necessary if classified as medical or hazardous wastes. Drew University follows special procedures for waste disposal in order to comply with laws and protect the

environment. Students must check with their research advisors about proper disposal procedures for all waste generated by their research.

Student researchers must familiarize themselves with the nearest locations of all safety equipment – phones, fire extinguishers, first aid kits, eye-wash stations, exits, etc. Students involved in field or lab research are encouraged to complete a "Right to Know" program, offered by the University early in each semester. As privileged members of the department, you should assume responsibility for helping us maintain safety and security.

Students must not work alone – even in assigned workspaces – outside of normal weekday hours, 8:30-5:00. Arrangements to work after hours must include provision for there to be at least two people present. This is especially important for safety reasons when conducting experimental work. Furthermore, the attractiveness to thieves of computer hardware, balances, chemicals, and syringes make it unsafe to be alone in the building for any reason. Even when working with others, you must be prepared to stop work and leave the building by 10 p.m. Students should speak to their research advisors about any after-hours needs for access to research space. Note that the building is locked on most weekends. Doors must not be propped open for evening and weekend work under any circumstances. The Drew emergency phone number is 4444.