

Requirements of Students and Advisors in Bio 95, 96 and 97

Please carefully read the information in this document. Please be sure that you have met all the prerequisites, including the GPA requirements and that you have taken at least two biology courses above the foundation level (Biology 20 or higher).

Any Dartmouth faculty member, including Biology tenure-track faculty (those listed as professors, associate professors or assistant professors), adjuncts and research faculty, as well as those in the Geisel School of Medicine or Thayer Engineering School (whose primary appointment resides in a department other than Biology and who are not listed under the Biology Department Masthead in the ORC) can serve as a research supervisor. However, if the research supervisor is not a tenure-track Biology faculty member, a tenure-track **Biology faculty member** must agree to be the **Biology co-sponsor** and co-sign the application. The primary purpose of the Biology co-sponsor is to make clear to the research supervisor and the student the expectations of successful completion of independent study courses.



Important notes and deadlines:



- Bio 95 is open only to Dartmouth biological sciences minors and majors by application.
- Bio 96 and Bio 97 are open only to Dartmouth biological sciences majors by application.
- Applications and research proposals for Bio 95, 96 and 97 *are due at least one month prior to the beginning of the term in which course is to be elected.*
- Independent research conducted off campus during a leave/transfer term without the direct supervision of a Dartmouth faculty member cannot be used to earn credit for Bio 95/96/97. No exceptions.
- When the research supervisor is not a Biology faculty member, the Biology co-sponsor is responsible for the student meeting all requirements and will assign the final grade in consultation with the research supervisor.

You cannot be paid for working in the lab during the term(s) you are enrolled in Bio 95, 96, or 97.

Biology 95: Independent Research in Biology I

ORC Course Description

Original and independent investigation of a biological problem with associated study of primary literature sources under the supervision of a faculty member for one academic term. Open only to Dartmouth Biology majors and minors. Projects may include research in laboratory settings, field work, modeling, data mining, or development of new methodologies that will further understanding of a relevant basic or applied biological problem. May be taken as one course in the major by students not enrolled in the honors program. Students electing both BIOL 95 and BIOL 97 may count only one among the seven courses in the area of concentration. In no case may a student elect more than two courses among BIOL 95, 96, and 97.

Prerequisites: At least two Biology courses above the foundation level, a 2.67 average in all courses taken for the major, and permission of the Undergraduate Committee *and* the supervising instructor(s). The application and research proposal must be submitted *at least* one month prior to the beginning of the term in which the course is to be elected.

Requirements:

Students undertaking independent research in the laboratory of a Biology faculty member or other suitable research supervisor must fulfill the following requirements to receive a grade for Bio 95:

- a. Devote 15-20 hours per week on their independent research project during the term in which Bio 95 is taken for credit.
- b. Summarize the results of their work in a paper submitted to their research sponsor (and Biology faculty co-sponsor, if applicable) at the end of the term. The paper should be at least ten pages long, double-spaced, and in a standard font (see guidelines on page 3). Individual advisers may require more than this minimal departmental page requirement. The paper should at a minimum include an introduction describing the background and rationale for the study, a materials and methods section, and a combined results/discussion section describing the data obtained and their significance. The literature cited section need not be extensive, but it must be extensive enough to comply with the principle of academic honor. This format may be modified as required, but the research sponsor and Biology co-sponsor must agree to any modifications. Figures and tables will usually be necessary for clear presentation of the data, unless the nature of the data requires another presentation format.
- c. Upon successful completion of the independent project and preparation of the written report, the student's research supervisor or the Biology co-sponsor (if applicable) will submit to Sherry Finnemore, Department Administrator of the Biology Department, a grade for Bio 95 **and** a copy of the student's written report, which will be filed in the Biology Office. **No grade will be entered for Bio 95 in the absence of this written report.**

Biology 96: Independent Research in Biology II

ORC Course Description

A second term of original and independent investigation of a biological problem under the supervision of a member of the staff. Open only to Dartmouth Biology majors who have satisfied the requirements for Biology 95 and who wish to continue their independent research for a second term. Does not count for credit in the major.

Prerequisites: Satisfactory completion of Biology 95 (including research paper) and permission of both the Undergraduate Committee and the supervising instructor(s). The application and research proposal must be submitted *at least* one month prior to the beginning of the term in which the course is to be elected.

Requirements:

Students who perform exceptionally well in Biology 95 may be invited to undertake a second term of independent research within the same laboratory. Such students must fulfill the following requirements to receive a grade for Bio 96:

- a. Devote 15-20 hours per week on their independent research project during the term in which Bio 96 is taken for credit.
- b. Summarize the results of their work in a paper submitted to their research sponsor and Biology faculty co-sponsor at the end of the term. The paper should be 15-20 pages long, double-spaced, and in a standard font (see guidelines below). Individual advisers may require more than this minimal departmental page requirement. The paper should include a thorough introduction describing the background and rationale for the study, a materials and methods section, and a combined results/discussion section describing the data obtained, their significance, and your conclusions. The literature cited section should be extensive enough to comply with the principle of academic honor. This format may be modified as required, but the research sponsor and Biology co-sponsor must agree to any modifications. Figures and tables will usually be necessary for clear presentation of the data, unless the nature of the data requires another presentation format.
- c. Upon successful completion of the independent project and preparation of the written report, the student's research supervisor or the Biology co-sponsor (if applicable) will submit to Sherry Finnemore, Department Administrator of the Biology Department, a grade for Bio 96 **and** a copy of the student's written report, which will be filed in the Biology Office. **No grade will be entered for Bio 96 in the absence of this written report.**

Guidelines for Biology 95 and Biology 96 reports:

Your report is the permanent record of your research; other researchers may use it and cite it. The quality of the report will influence your grade. In consultation with your advisors, analyze your data rigorously. Make specific inferences logically and carefully. Construct figures and tables to present your results with maximum clarity. Pay special attention to figure legends and table captions. Ideally, they should be clear without reference to the text; use leading journals in your field as models. Your Introduction should frame the scientific question/hypothesis that you addressed, indicating why it is important, and the approach you took to testing it. In some cases, the hypothesis actually addressed may differ from that in your original proposal. Your Methods section should parallel your statement of results and be sufficiently detailed to allow another scientist to repeat your work. Standard methods, or those used in another published study, can be cited, rather than described in detail. Before writing the text of your Results/Discussion section, first decide on any qualifications arising from inadequacies in data and methods. Second, reflect on the implications of your findings, synthesizing what they mean in a larger context. Make sure your logic is 100% sound at the outline stage, and that the precise meaning of every sentence in your text is clear. Eliminate unnecessary verbiage. The Literature Cited section need not be extensive, but it must be sufficient to support statements that are not based on your data and to satisfy the academic honor principle. Text, exclusive of figures, tables and literature cited, will normally be 7-15 pages long (double-spaced, standard font). Use the minimum number of figures and tables required for your results; there is no maximum. Biology 96 papers should be submitted to the research supervisor and biology co-sponsor (if applicable) along with a copy of the Biology 95 paper submitted previously, and the relation to the Biology 95 research should be made clear in the text. Papers must be submitted to the research advisor, the Biology departmental co-sponsor, and the Biology office by the last day of classes for the term. Requests for exceptions to these guidelines should be submitted by the research advisor to the departmental co-sponsor (if different from the research supervisor) and the Undergraduate Committee at least three weeks before the paper is due.

Biology 97: Honor's Research

ORC Course Description

Original and independent investigation of a biological problem with associated study of primary literature sources under the supervision of a faculty member. Open only to Dartmouth Biology majors. Projects may include research in laboratory settings, field work, modeling, data mining, or development of new methodologies that will further understanding of a relevant basic or applied biological problem. Required of honors students as part of the major. Students taking both BIOL 95 and BIOL 97 may count only one term toward the elective courses for their major. In no case may a student elect more than two from courses among BIOL 95 and 97. Students who have completed or are taking BIOL 97 may enroll and receive college credit for BIOL 99 during spring term of their senior year.

Prerequisites: At least two Biology courses above the foundation level, a 3.0 average in all courses taken for the major, and permission of the Undergraduate Committee and the supervising instructor(s). Work on an Honors thesis normally extends through three terms (which may include one term of Bio 95 enrollment). Candidates for Honors must meet the minimum College requirements. Permission from the Undergraduate Committee and the supervising instructor must be obtained *at least* one month prior to the beginning of the term in which the course is to be elected. Plans for research should be made in the term before the project begins.

Requirements:

Successful completion of Bio 97 requires:

- a. Independent research of at least two term's duration (usually three, although course credit may only be obtained for two terms of research). Note that students may enroll in up to two terms of BIO 95/97, but only one term may be used as part of a Biology Department major. The other term of BIO 95/97 may be used as course count credit towards graduation. However, honor's projects often require more than two terms to complete. See the ORC for the rules pertaining to major credit for these courses.
- b. The production of a written honor's thesis that is accepted by the student's **thesis committee**.
- c. An oral presentation of the student's research results to the Biology department (usually during May).
- d. Successful completion of an oral thesis examination before a committee composed of the research supervisor plus two other faculty members including the Biology co-sponsor (if applicable). (See below for qualifications for participating on a BIO 97 thesis committee).

The completion of the above four requirements does not imply that the student will graduate with 'Honors' or 'High Honors.' These designations are decided by the full faculty of the Biology Department upon the recommendation of the thesis committee. A recommendation by the thesis committee will only be made after the student successfully completes the four requirements listed above. The details of these requirements and the manner in which a recommendation of Honors or High Honors is determined are described below:

Effort - For the honor's program, the student must be enrolled for at least one term of Bio 97, and devote on the order of 15-20 hours per week per term to their thesis research.

Preparation of the Thesis - A written honor's thesis will be prepared by the student, in consultation with the research supervisor. The thesis will contain sections corresponding to a normal research paper, written in a style that would be found in a typical journal from the student's chosen field of research. This usually means that the thesis will have sections entitled Abstract, Introduction, Methods, Results, Discussion, and Literature Cited. The thesis will be typed, double spaced, and contain figures, charts, graphs, tables, etc., as necessary, documenting the data gathered as part of the independent research project. The thesis will typically be at least 30 pages long. Examples of previous theses are available for examination in the Croasdale Lounge (LSC 330).

The thesis should be read and commented on at least once by the research supervisor. When approved by the research supervisor, the thesis should then be distributed to the examining committee **no later than four days prior** to the scheduled day of the thesis presentation and examination. After the examination, a final bound copy of the thesis (including any changes required by the examining committee) must be submitted to Sherry Finnemore, Department Administrator of the Biology Department, prior to the final June meeting of the Department Faculty at which the designation of Honors or High Honors is made. No grade(s) for Bio 97 will be entered into the record until a final copy of the thesis has been submitted.

Public Presentation - Honor's students will present their thesis research to the department in a formal, publicly announced seminar. This will normally occur during the last two complete weeks of the spring term immediately prior to graduation. In general, honors thesis seminar presentations should last thirty minutes, including introductory and concluding remarks, as well as data presentation. The student should also be prepared to entertain questions from the audience.

Oral Examination - The oral thesis examination will normally take place immediately following the thesis seminar. The examination committee will be composed of the thesis committee. The oral examination will cover specifics about the methods used in the study, interpretation of results and potential alternative interpretations, the general background of the research area, and the significance and potential implications of the findings of the work.

Thesis Committee: The thesis committee will be composed of three faculty members, one of whom will be the research sponsor and one of whom will be the biology co-sponsor if applicable. Specifically, at least two of the three members of the examination committee must be members of the Biology Department faculty (tenure-track, adjunct or research faculty) and at least one of these two must be a member of the Biology Department tenure-track faculty (those listed as professors, associate professors or assistant professors).

Grading - The thesis committee members must read the thesis, attend the seminar, and take part in the oral examination, as it is their responsibility each to grade the student on these three aspects of the honor's thesis. At the completion of the oral exam, each member of the committee will assign a grade (either A, A-, B+, B, B-, C+, C, C-, D, E) for the written thesis and oral examination; a grade of Pass/No Pass will be assigned for the oral presentation. These grades will be entered on the document entitled Evaluation of Senior Honor's Research. The grades are assigned in private on individual sheets, one per faculty member. In computing the mean grade for the six letter grades assigned (two per committee member), A = 4.0, A- = 3.67, B+ = 3.33, B = 3.0, etc.

In order to receive the degree 'With Honors,' the student must achieve an average grade of 3.33 for the six grades received. In order to receive the degree 'With High Honors', the student must achieve an average grade of 3.67 for the six grades received. In both cases, of course, the student must also have received a P for the oral presentation. These grades constitute the recommendation of the thesis committee to the Biology Department faculty. **The final designation of Honors or High Honors will be determined by the Biology Department faculty**, a decision that is made at a faculty meeting held in early June. Thus, the results computed by the thesis committee are to be regarded solely as advisory to the Biology Department faculty. Students completing these Bio 97 requirements with less than a 3.33 average (i.e. on the thesis and examination, as determined as described above) will simply receive credit for Bio 97, if the grade assigned for Bio 97 by the research sponsor is D or better (see below). Note also that the Honors Program as defined in the ORC imposes certain other GPA requirements (such as a minimum overall GPA requirement) that may supersede the departmental requirements outlined in this paragraph.

No final letter grades will be determined until after the completion of the thesis in the spring term. A grade of ongoing (ON) will be assigned until all requirements of 97 have been met. If the student decides at any time not to complete the honors requirements, then enrollment in Bio 97 will cease, and the student will not receive a grade or credit. If the student, research sponsor, and Undergraduate Committee mutually agree, however, the research project can revert to a Bio 95 or Bio 95/96 (non-honors) project, in which case the rules listed above for Bio 95 and Bio 96 would apply.

Finally, it should be made clear that the responsible member of the biology department alone assigns grade(s) for Biology 97 credit, and this/these grades are different from the grades assigned by thesis committee members at the oral examination, which deal solely with the thesis, oral presentation, and oral exam.

BIOLOGY 95/96/97 (UNDERGRADUATE RESEARCH) APPLICATION FORM

Return the completed **and signed** form to
Amy Layne, Department of Biological Sciences, HB 6044

NOTE: This form must be received by the deadlines stated on p. 1 of this information packet.

Name: _____ Class: _____ HB: _____

This is an application for: _____ Bio 95, _____ Bio 96, _____ Bio 97

for _____ (enter term and year, i.e. 16F etc.)

Application date: _____,

My area of concentration is: _____

The title of my research project is:

Prof. _____ (please print or type) will supervise the research project. The signature below indicates this professor has read the "Requirements of Students and Advisors in Bio 95, 96 and 97", agrees to these requirements, and is willing to supervise the project.

Signature: _____

Note: If your research sponsor is not a regular member of the biology department faculty, this application must be supported by a tenure-track faculty member in the Biology Department who, by signing below, also agrees to see that all the requirements of Bio 95/96/97 are fulfilled.

Name of biology faculty co-sponsor: _____

Signature of biology faculty co-sponsor (if required):

My research will be supported by at least one of the following (check all of a-e that apply):

- _____ research sponsor's grant(s)
- _____ biology department sponsor's grant(s) [if different than research sponsor]
- _____ funds I have been awarded (i.e. Richter, Waterhouse, etc.). Please list in space below.
- _____ departmental funds (limited to \$200 total per Bio 95 project and \$400 total per Bio 97 project; if this line is checked, a detailed itemized budget must accompany this application). Please see Sherry Finnemore in the Biology Department about accessing these funds.*
- _____ other (explain):

*Students will be given a chart string for purchasing supplies from Remsen/Borwell Stockrooms or given a departmental credit card to purchase supplies via internet vendors.

Use this page to tell the committee about the courses you have taken as well as those that you intend to take to fulfill your major requirements. **This listing should match your transcript and major plan!**

Biology courses taken: Grade:	Biology courses to be taken: Term:
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Other courses in your major (including Chemistry and Quantitative pre-requisites):	
Courses taken: Grade:	Other courses needed: Term:
_____	_____
_____	_____
_____	_____
_____	_____

Current GPA in courses required for your biology major: _____(including prerequisites)
 Overall GPA in all College courses: _____

Students should note that College regulations require a minimum overall GPA of 3.0 and a minimum major GPA of 3.0 for admission to the Honors Program (i.e. Bio 97). A minimum major GPA of 2.67 is required for admission to Bio 95. The minimum major GPA calculation includes all courses taken for the major and is made at the beginning of the senior year OR at the time application is made if other than the beginning of the senior year.

- Notes on committee action:
- a. _____ approved; date _____
 - b. _____ not approved; date _____
 - c. _____ deferred pending more information; date _____

Explanation of [b] or [c]:
 Undergraduate Committee approval: _____
 date: _____

PROJECT DESCRIPTION

Write a complete description of your planned research project [up to two pages (single-spaced), not including references and budget] and append it to this application. References must come from the primary literature. This description should clearly state the biological questions to be addressed, the hypotheses to be tested, and the methodologies to be used. In addition, you should explain how your project relates to your area of concentration and include an estimate of the time required for project completion (one term, two terms, etc.). If departmental funds are requested, please include an itemized budget.