

### **Note concerning the 2020-2021 Academic Year**

Due to the pandemic, the application for BIOL 95-98 has been amended. For students in residence, applications for on-campus research must also include a description as to how the work will be amended should it need to be carried out remotely for any portion of the term. Proposals from students who are enrolled but not in residence must address how the research will be carried out remotely. In all cases, the sponsor (and co-sponsor if relevant) must be able to support any remote aspects of the project.

**Note: On August 19, 2020, the Provost announced that on-campus laboratory research by undergraduates would be allowed subject to a series of approvals and restrictions. Only undergraduates who are enrolled in “residential” terms can work in laboratories (those who are on “remote” or “off” terms but living in the area are not permitted access to laboratories). At present, undergraduates are approved to work in labs in Arts and Sciences and Thayer, but undergraduates are not approved to work in labs at Geisel or DHMC. Undergraduates must have the approval of the Professor who is supervising the research, and the undergraduate needs to be incorporated into a revised reopening plan from the Professor’s lab that is approved by Environmental Health and Safety (EHS).**

**If your project can be completed remotely without access to the laboratory, please include a description of this work in your research proposal. We anticipate that all projects that are 100% remote can move forward. If your project depends on access to the laboratory, approval will depend on the proposal, the supervising Professor and EHS.**

**Note that all proposals will also need to include a section addressing how the project will be carried out remotely should on-campus access be restricted at any point in the term.**

### **Requirements of Students and Sponsors in Bio 95, 96, 97 and 98**

Please carefully read the information in this document. Please be sure that you have met all the prerequisites, including the GPA and course requirements listed on the application.

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 sponsor if they do research in the biological sciences. However, if the research sponsor is not a tenure-track Biology faculty member, a tenure-track **Biology faculty member** must agree to be the **co-sponsor** and co-sign the application. The primary purpose of the co-sponsor is to make clear to the research sponsor and the student the expectations for successful completion of independent study courses.

#### **Important notes and deadlines:**

- Bio 95 is open only to Dartmouth biology majors and minors by application.
- Bio 96, Bio 97 and Bio 98 are open only to Dartmouth biology majors by application.
- Applications and research proposals for Bio 95, 96 and 97/98 *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 95/96/97/98. No exceptions.
- When the research sponsor 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 sponsor.
- You cannot be paid for working in the lab during the term(s) you are enrolled in Bio 95, 96, 97 or 98.

## Guidelines for Independent Research Projects (Bio 95 and 96)

### **Biology 95: Independent Research in Biology I – 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 Bio 95, 96, 97, and 98.

Prerequisites: At least three Biology courses number 11 or above, a 2.67 average in previous biology courses, and permission of the Undergraduate Committee and the supervising instructor. 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.

### **Additional requirements for Bio 95:**

When you undertake independent research for Biology credit, you must fulfill the following requirements to receive a grade for Bio 95:

- a. Devote 15-20 hours per week on your independent research project during the term in which you are taking Bio 95 for credit.
- b. Summarize the results of your work in a paper submitted to your research sponsor and co-sponsor (if applicable). The paper should be at least ten pages long, double-spaced, and in a standard font (see guidelines on page 3). Individual research sponsors and co-sponsors (if applicable) 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 Dartmouth's Academic Honor Principle. This format may be modified as required, but the research sponsor and co-sponsor (if applicable) 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. The final paper is due on the last day of classes to the research sponsor and co-sponsor (if applicable) as well as to the Biology Department Administrator Sherry Finnemore. **No grade will be recorded for Bio 95 in the absence of this written report.**

Your research sponsor and co-sponsor (if applicable) will submit a grade for Bio 95 to Sherry Finnemore by the deadline sent to research sponsors and co-sponsors during the term.

### **Biology 96: Independent Research in Biology II – Course Description**

A second term of original and independent investigation of a biological problem under the supervision of faculty member. Open only to Dartmouth Biology majors who have satisfied the requirements for BIOL 95 and who wish to continue their independent research for a second term. Does not count for credit in the major. In no case may a student elect more than two courses among Bio 95, 96, 97, and 98.

Prerequisite: Satisfactory completion of Bio 95 (including research paper) 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.

**Additional Requirements for Bio 96:**

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

- a. Devote 15-20 hours per week on your independent research project during the term in which Bio 96 is taken for credit.
- b. Summarize the results of your work in a paper submitted to your research sponsor and co-sponsor (if applicable). The paper should be 15-20 pages long, double-spaced, and in a standard font (see guidelines below). Individual research sponsors and co-sponsors (if applicable) 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 Dartmouth's Academic Honor Principle. This format may be modified as required, but the research sponsor and co-sponsor (if applicable) 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. The final paper is due on the last day of classes to the research sponsor and co-sponsor (if applicable) as well as to the Biology Department Administrator Sherry Finnemore. **No grade will be recorded for Bio 96 in the absence of this written report.**

Your research sponsor and co-sponsor (if applicable) will submit a grade for Bio 96 to Sherry Finnemore by the deadline sent to research sponsors and co-sponsors during the term.

**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 research sponsor and co-sponsor (if applicable), 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 Dartmouth's Academic Honor Principle. Text, exclusive of figures, tables and literature cited, will normally be 10-20 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 sponsor 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. The final paper must be submitted to the research sponsor, the co-sponsor (if applicable), and the Biology Department Administrator by the last day of classes for the term. Requests for exceptions to these guidelines should be submitted by the research sponsor to the co-sponsor (if applicable) and the Undergraduate Committee at least three weeks before the paper is due.

## Guidelines for Honors Research Projects (Bio 97 and 98)

### Biology 97 – Honors Research in Biology I – 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. Students electing both Bio 95 and Bio 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 Bio 95, 96, 97, and 98. Students who have completed or are enrolled in Bio 97 may enroll and receive college credit for Bio 99 during spring term of their senior year.

Students are awarded one course credit for successful completion of this course. Students who are choosing to do a second term of honors thesis research register for BIOL 98. A final grade will replace the “ON” for Bio 97 upon completion of the honors thesis.

Prerequisite: At least two Biology courses numbered 20 or above, a 3.0 average in previous Biology courses, and permission of the Undergraduate Committee and the supervising instructor, obtained at least one month prior to the beginning of the term in which the course is to be elected.

### Biology 98 – Honors Research in Biology II – 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. BIOL 98 does not count for credit in the major. In no case may a student elect more than two courses among BIOL 95, 96, 97, and 98. Students who have completed or are enrolled in BIOL 98 may enroll and receive college credit for BIOL 99 during spring term of their senior year.

Students are awarded one course credit for successful completion of this course. Students may receive credit for only two terms of honors research (BIOL 97 and BIOL 98). A final grade will replace the “ON” for both BIOL 97 and BIOL 98 upon completion of the honors thesis.

Prerequisite: BIOL 97

### Additional Requirements for BIOL 97 and 98:

Successful completion of Bio 97 and/or 98 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 you may enroll in up to two terms of Bio 95-98, but only one term may be used as part of your Biology Department major whereas the other term may be used as course count credit towards graduation. However, honors 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 honors thesis that is accepted by your **thesis committee** (composed of the research sponsor plus two other faculty members including the co-sponsor (if applicable)). See below for qualifications for participating on an Honors Thesis committee.
- c. An oral presentation of your research results to the Biology department (usually during May).
- d. Successful completion of an oral thesis examination before your thesis committee.

The completion of the above four requirements does not imply that you 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 you successfully complete 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 honors program, you 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 your thesis research.

**Preparation of the Thesis** – You will prepare a written Honors Thesis, in consultation with your research sponsor. 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 sponsor. When approved by the research sponsor, 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 Finemore, Department Administrator of the Biology Department, prior to the final June meeting of the Biology Department faculty at which the designation of Honors or High Honors is made. No grade(s) for Bio 97 or Bio 98 will be recorded until a final copy of the thesis has been submitted.

**Public Presentation** – You will present your 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. You 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, take part in the oral examination, and grade the student on these three aspects of the honors 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 recorded on the document entitled Evaluation of Senior Honors 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', you must achieve an average grade of 3.33 for the six grades received. In order to receive the degree 'With High Honors', you must achieve an average grade of 3.67 for the six grades received. In both cases, you 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. Note 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, typically in the spring term. A grade of ongoing (ON) will be assigned until all requirements of 97/98 have been met. If the student decides at any time not to complete the honors requirements, then enrollment in Bio 97/98 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 research sponsor and co-sponsor (if applicable) will alone assign the grade(s) for Biology 97/98 credit, and this/these grade(s) 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 95/96/97/98 (UNDERGRADUATE RESEARCH) APPLICATION FORM**

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

Name: \_\_\_\_\_ Class: \_\_\_\_\_ HB: \_\_\_\_\_

I am a Biology (circle one):            Major            Minor

This is an application for (circle one):            Bio 95            Bio 96            Bio 97/98 (Honors Program)

for \_\_\_\_\_ (enter term and year, i.e. 20F etc.)

What is your status for this term? \_\_\_\_\_ residential \_\_\_\_\_ remote

Note: If this is an Honors Program Proposal, and you plan to take both Bio 97 and 98 for credit, please indicate the term you plan to enroll in 98 here: \_\_\_\_\_.

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 Sponsors in Bio 95, 96, 97 and 98", 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 95/96/97/98 are fulfilled.

Name of biology faculty co-sponsor: \_\_\_\_\_

Signature of biology faculty co-sponsor: \_\_\_\_\_

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

- a. \_\_\_\_\_ research sponsor's grant(s)
- b. \_\_\_\_\_ biology department sponsor's grant(s) [if different than research sponsor]
- c. \_\_\_\_\_ funds I have been awarded (i.e. Richter, Waterhouse, etc.). Please list in space below.
- d. \_\_\_\_\_ 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.\*
- e. \_\_\_\_\_ 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 Biology major or minor requirements. **This listing should match your transcript and major plan and include the chemistry and quantitative prerequisites!**

Major/minor courses completed	Grade	Major/minor courses to be taken	Term
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
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_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Current GPA in courses required for your biology major/minor: \_\_\_\_\_ (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/minor 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 \_\_\_\_\_

Explanation of [b]:

Undergraduate Committee approval: \_\_\_\_\_ Date: \_\_\_\_\_

### PROJECT DESCRIPTION

For Bio 95 and 97/98 proposals, 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.

Note: If you are applying for Bio 96, your proposal should also include a summary of the work accomplished/results obtained in Bio 95.

**All proposals that include an on-campus research component must include a description as to how the work will be carried out remotely, if needed. This is not part of the two-page limit and can be added as a separate section at the end of the proposal.**