

RESEARCH IN BIOLOGY: BIOL 93, BIOL 99

BIOL 93: Independent Research in Biology

BIOL 93 is a *one-semester* supervised biological research experience in a Brandeis University laboratory. *Minimum work load in the lab is 10 hours per week.* In consultation with a Brandeis faculty member, the student will design and execute an individual research project, culminating in an oral and written presentation. BIOL 93 can be taken either semester; there is no GPA requirement to enroll in BIOL 93. Enrollment requires permission of the Biology department faculty sponsor and Biology department UAH. BIOL 93 petition completion, course requirements, time-table are given below.

Students are permitted to do research in Brandeis laboratories outside the Biology department (e. g., Biochemistry) but the *research involved must be of a biological nature, ask a biological question.* To do BIOL 93 research with a non-Biology department Brandeis faculty member, the student must obtain co-sponsorship of a Biology department faculty member as well as permission of the Biology department UAH. **BIOL 93 is not intended to and will not provide credit for off-campus internships.**

Students wishing to do a *summer* research internship in biology *at Brandeis* for academic credit can do so via BIOL 93. However, students must: (i) obtain permission from their Biology department sponsor and Biology UAH prior to starting the internship; (ii) complete the summer program (*minimum of 10 weeks full-time*) including research, written report, oral presentation; and (iii) enroll in BIOL 93 in the subsequent Fall semester.

BIOL 93 REQUIREMENTS

1. **Written report:** equivalent to a laboratory rotation report, ~5-8 pages.

Title Page, which includes your name, the title of your research, and date.

Abstract (not more than 250 words), which summarizes the nature of the research project, the results obtained, and the relevance of those results.

Introduction, which poses the research question asked in the context of current knowledge in the relevant field.

Materials and Methods, which describes how the experiments were conducted.

Results, which provides a written description along with some figures and tables, of the experimental data obtained.

Discussion, which evaluates the results obtained and their relevance and significance to current models and data in the field.

References, which includes complete citations (authors' names, paper titles, journal, volume, page, year). See the journal *Cell* for examples.

2. **Oral presentation:** specifics are left to the discretion of the faculty sponsor, e. g., this could be a data presentation during 'group' lab meeting, or a more formal presentation at the end of the semester to the lab, or a talk given at a meeting, etc.

BIOL 99: Senior Research and Senior Honors in Biology

The Senior Research Program is designed to provide an opportunity for undergraduate students concentrating in Biology to participate during their **senior year in a two-semester long**, independent research project, and to receive both course and elective credit for that research. **Any senior concentrating in Biology can participate in Senior Research.** Also, seniors conducting Senior Research may petition for *candidacy* for Senior Honors; eligibility is determined by the student's academic record and research performance (see below).

Students should think early (before they begin their junior year) about whether they want to do Senior Research: many students find it beneficial to spend their junior year, and the summer before their senior year, working in the lab. Students who contemplate doing senior research should first familiarize themselves with the research activities of the Biology and other life science faculty by visiting the web page <http://www.bio.brandeis.edu>.

BIOL 99 SENIOR RESEARCH

1. Selecting the Research Sponsor for Senior Research

Students may select any faculty member in the Department of Biology at Brandeis University as their research Sponsor. Alternatively, students may choose faculty members in the Departments of Biochemistry or Chemistry at Brandeis University, or faculty members in similar departments at other institutions in the Boston area, as their research Sponsor. However, in these latter cases, students *must receive permission* from the Senior Honors Coordinator; and the student's research *must be co-sponsored by a faculty member in the Department of Biology at Brandeis; and* the research *should have a biological foundation or pose a biological question*. The student should provide the Biology faculty co-sponsor a description of the proposed research, and meet with his/her co-sponsor on a regular basis to discuss how the research is progressing.

Some students begin working in the laboratory of their research Sponsor as early as their first or second year at Brandeis. It is strongly recommended that students select their research Sponsor no later than the beginning of Fall semester, junior year. Most research Sponsors expect students to work in the lab during the junior year, and Sponsors may also expect that students will work in their lab the summer before their senior year. Many research Sponsors will expect their students to work on their research projects during winter intercession and vacations. These and other issues such as rate of work per week should be discussed in advance with the prospective Sponsor, so that the expectations are clear to everyone involved.

2. How to enroll in Senior Research

- ❖ The student must get the agreement of a faculty member in the Department of Biology to act as research Sponsor (or co-sponsor).
- ❖ During the first week of Fall semester, the student must **complete a petition**, available in the Biology office, for enrollment in the Senior Research Program. The petition must be signed by the research Sponsor [and co-sponsor, if applicable] and **returned to the Biology office** by the specified deadline (see timetable below).

- ❖ The student must **enroll** in BIOL 99a in the Fall and BIOL 99b in the Spring using a course enrollment form obtained from the Registrar: <http://www.brandeis.edu/registrar/forms.html>
The enrollment form requires two signatures: the research Sponsor [Biology co-sponsor if applicable], and the Senior Research/Honors Coordinator for Biology. The student then submits the signed form directly to the Registrar.

3. Credit for Senior Research

BIOL 99 is a *year-long, two credit course*. If unusually intensive work by the student and his/her research Sponsor is anticipated, and if the student is taking a light course load enabling extra time to be spent in the lab doing research, the student may *request permission* from the Senior Honors Coordinator to enroll in BIOL 99e, to obtain a third credit. If permission is granted, the student would register for BIOL 99a in the Fall and for BIOL 99e in the Spring (or, BIOL 99e followed by BIOL 99a). A student may **not** receive more than three credits for Senior Research (including combining BIOL 93 and BIOL 99, see below).

4. Requirements for Senior Research, 1st (Fall) semester (BIOL 99a)

At the completion of the first (Fall) semester, *all students enrolled in BIOL 99* will write a paper which reviews the literature in the scientific field pertinent to their research and includes a bibliography of cited papers.

In a minimum of 5 pages of double-spaced text, your paper should **review** the scientific literature that is important for the problem you are investigating. If there are models or hypotheses, your paper should describe what they are. What evidence supports/negates the models. What is the specific question/problem you are working on, and how do you propose to solve it. You must include (a) references in your text description and (b) a bibliography containing those citations [the bibliography does not count toward the 5 pages of text]. This review paper should resemble a long version of the introduction to a scientific paper published in a journal in your field. You will be able to use all or some of this material when you write your senior research thesis. As part of the BIOL 99 course requirement, give a copy of this review paper to your faculty sponsor and a copy to the Senior Research/Honors Coordinator.

5. Requirements for Senior Research, 2nd (Spring) semester (BIOL 99b)

At the completion of the second (Spring) semester of BIOL 99, students who are **NOT** candidates for Senior Honors will write a Senior Research thesis. The timetable included with the BIOL 99 petition gives the **submission deadline**. Thesis copies are to be given to the research sponsor (and Co-sponsor) and to the Senior Research/Honors Coordinator.

The Senior Research thesis should contain the following sections:

Title Page, which includes your name, the title of your Senior Research, and date.

Abstract (not more than 250 words), which summarizes the nature of the research project, the results obtained, and the relevance of those results.

Introduction, which poses the research question that was asked in the context of current knowledge in the relevant field.

Materials and Methods, which provides in sufficient detail all aspects related to how the experiments were conducted.

Results, which provides a written description along with figures and tables, of the experimental data obtained.

Discussion, which evaluates the results obtained and their relevance and significance to current models and data in the field.

References, which includes complete citations (authors' names, paper titles, journal, volume, page, year). See the journal *Cell* for examples.

6. Evaluation of Senior Research, Spring semester

The research Sponsor will evaluate the student's laboratory performance and Senior Research thesis, then assign him/her a grade for BIOL 99. During the Biology, Biochemistry, and Neuroscience mini-commencement proceedings, it will be announced that the student participated in the Senior Research Program.

7. Combining BIOL 93 and BIOL 99

Typically, students who elect to take BIOL 93 (research internship) intend to do only one semester of research (and they receive credit for one course but not elective credit). After taking BIOL 93, some students may decide they really liked the research experience. These students can then take one semester of BIOL 99 (with the *same* research sponsor). The combination of both these courses will count as one biology elective (and also as senior research), *as long as* (i) the student **fulfills the BIOL 93** requirements *and* (ii) the **student at the conclusion of BIOL 99 writes a senior research dissertation**, following the guidelines listed above for BIOL 99. The senior dissertation may incorporate some of the BIOL 93 lab report but it must be longer and provide a brief review, much more data, and a lengthier discussion. *It is unlikely that only two semesters of research will be sufficient for senior honors.*

Students may also do the following: take BIOL 93 in spring of their junior year or over the summer before their senior year (see BIOL 93 petition), and then take both BIOL 99a and BIOL 99b in their senior year. This combination will yield one elective as well as 3 courses. Students could petition for senior honors candidacy.

BIOL 99: SENIOR RESEARCH WITH HONORS

1. Senior Honors Eligibility and Requirements

Senior Honors is the Departmental award for Distinction in Biology. It is earned by students who have a good academic record and who have excelled in laboratory research. The levels of Distinction in Biology are Honors, High Honors, and Highest Honors.

In order to become a candidate for Senior Honors, students must **enroll in BIOL 99 and complete the petition for the Senior Research Program, including the section about candidacy for Senior Honors**. All the Fall and Spring semester requirements given above for Senior Research (BIOL 99) apply to candidates for Senior Honors

Eligibility for Senior Honors is decided at the conclusion of the senior year:

- ❖ Senior Biology majors enrolled in BIOL 99 who have a FOC grade point average of **3.30 or better** in **all courses required for the Biology concentration** are automatically eligible for Honors. *FOC: all courses needed to fulfill the Biology major requirements.*
- ❖ Senior Biology majors enrolled in BIOL 99 who have a FOC grade point average between 3.0 and 3.3 **and** who have achieved an **average of B+ or better in THREE electives** taken to fulfill the Biology concentration requirement for either the B. A. or the B. S. degree in Biology, are also eligible. For this calculation, BIOL 99 does not count as one of the 3 required electives.

2. Honors Thesis and Defense

The Honors candidate writes a Senior Honors thesis using the format of the Senior Research thesis (see above). A copy of the Honors thesis is submitted to each member of the student's Faculty Research Committee by the designated deadline.

The Honors candidate gives a public oral presentation and defense of his/her research before his/her Faculty Research Committee. The Faculty Research Committee consists of the faculty research Sponsor [and co-sponsor, if applicable] and two faculty members of the Department of Biology.

The oral defense is 60 minutes long. Students typically plan a talk of ~30 min that introduces the topic; indicates why the work was undertaken and what the goals were; provides a summary of the experiments done and results obtained; and gives a succinct discussion of the significance of the findings. The Faculty Research committee members will have read the thesis in advance and will interrupt throughout the presentation to ask the Honors candidate questions. Presentations may include the use of the blackboard, handouts, slides, overhead transparencies and/or Power Point presentation. The student should make arrangements in advance with the Biology office for the appropriate equipment.

3. How is Senior Honors determined

The Faculty Research Committee members read and evaluate the Senior Honors Research thesis, and they attend and evaluate the oral presentation. Each member of the committee makes one of the following recommendations to the Department of Biology: no honors, Honors, High Honors, or Highest Honors. The candidate's final FOC GPA and laboratory performance, and the Faculty Research Committee recommendations, are all considered by the Department of Biology faculty, who make the final determination of the candidate's status.

If the Biology faculty determine that the candidate is deserving of Honors (or High or Highest Honors) in Biology, this is announced during the joint Biology, Biochemistry, and Neuroscience commencement proceedings. If the faculty determine that the candidate is not deserving of Honors in Biology, then it will be stated during the commencement proceedings only that the student conducted Senior Research in Biology.

The research Sponsor will assign a grade for BIOL 99 based upon the student's laboratory performance and Senior Honors Research thesis.

**SENIOR RESEARCH PROGRAM AND SENIOR HONORS COORDINATOR:
for AY 2009-2010:**

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