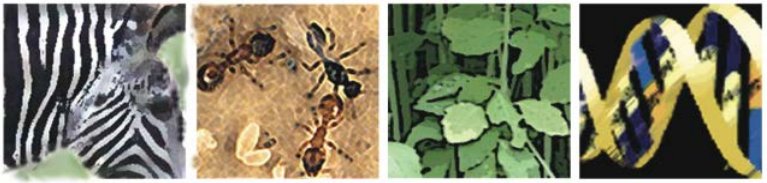
Independent Work in
Ecology and Evolutionary Biology



The EEB department emphasizes research and teaching from an evolutionary perspective, combining theory and empiricism and linking areas that are often treated as separate disciplines. Many of the research projects and courses are interdisciplinary.

The department's course of study culminates in the senior thesis, and students in EEB have a wide latitude in choosing a thesis topic — exploring research questions in the area of ecology, conservation, evolution, genetics, behavior, organismal biology, or disease. Theses can be lab- or field-based or can be theoretical or based on data mining.

The goal is for students to produce an original piece of scholarship that contributes to the field, and at the very least points to further development in the future.

Independent work begins in the junior year. EEB requires students to write two Junior Papers. The first JP arises out of the fall semester's Tuesday night Junior Tutorial, which meets from 7:30 until 9 p.m. Before fall break, most of these evening sessions involve short presentations from the faculty who advise senior theses, so students become acquainted with the research in different labs. Students also learn how to navigate electronic sources in the library and learn about compliance issues associated with independent research. These include rules and regulations applicable to research involving animals or humans, as well as biosafety.

After fall break, juniors are divided into three or four groups and are assigned to one faculty member to delve into a scientific question in depth over the course of three weeks. During this part of the tutorial, students focus on critical reading and discussion of the primary literature. For many juniors, this is the first time they are really introduced to reading the primary scientific literature that reports original research results.

The **fall JP**, due in early January, explores a focused topic that emerges from the three-week tutorial. This JP is usually 10-12 pages long and requires the student to think independently and critically about the primary scientific literature on their specific JP topic (reliance on textbooks or review articles is discouraged).

During the course of the fall semester, students should make appointments to meet with faculty members whose research most interests them. By the time winter break starts, students must have secured an adviser, who will advise them on the spring JP and senior thesis.

The **spring JP** usually relates to the background for a student's senior thesis research, but sometimes it can also involve original research, for example, in a campus laboratory or modeling or data mining on the computer. Most spring JP's comprise a careful and thorough review of the relevant primary literature underlying the thesis topic and a project proposal for senior independent research.

To help cover research expenses for the senior thesis, juniors have the opportunity in the spring to apply for senior thesis funds. This process gives students experience in writing what amounts to a mini grant proposal. Because funding requests are due before the actual spring JP deadline, it helps to discuss the senior thesis proposal and budget with a faculty adviser as early as possible during the spring semester. It is also important to review the guidelines from the various funding offices when planning the budget.

Any proposals involving human or animal research, as well as projects involving hazardous materials, must be approved well in advance by the Office of Research Integrity and Assurance.

Once a student has a faculty member serving as **thesis adviser**, it is important that the student meets often and regularly with the adviser beginning in the spring of the junior year. It is usually up to the student to arrange with his or her adviser the frequency of these meetings, and students must come to these meetings prepared to discuss progress and any problems the student has run into. For most students, especially those working in the field, most of the data is gathered in the summer and analyzed in the fall of the senior year.

The **senior thesis** is due in late April of the senior year with intermediate deadlines for the following sections: Methods (February) Introduction (early March), Results (late March), and Discussion (early April). If a student adheres to these interim deadlines, he or she will

generally have a stress-free spring heading into the completion of the thesis.

Evaluation of the thesis is usually broken down by section:

Introduction

A good thesis will have a clear and complete background on the subject, and a poor one will have overlooked many or all of the critical issues.

Issue/Question

A good thesis will clearly and explicitly present the research question while a poor one will not present the question at all or in such a way that it is difficult to identify the issue.

Description of Project or Sources of Data

A good thesis is one in which the data collection procedures are clearly described and the rationales are explained. A poor thesis is one in which the description is such that it would be impossible for a knowledgeable reader to reconstruct the work.

Results — Description

A good thesis has results presented accurately in a logical, , effective and creative manner. A poor thesis does not elaborate beyond the results themselves, where context or controls are missing, and the student failed to understand the data or failed to draw conclusions.

Results — Substantiation

For a good thesis, the student has collected a large data set to provide substantial evidence in support of his or her conclusions. In a poor thesis the student presents little or no data to support the conclusions.

Results — Analysis

In a good thesis the student will have analyzed the results with extraordinary creativity. In a poor thesis the student either did not use statistics or used incorrect statistical tests.

Discussion

A good thesis is one in which the student provides an in-depth analysis of the results and demonstrates exceptional insight into the broader implications. A poor thesis is one in which the student fails to provide a thorough critique of the experiments and results.

Writing

A good thesis is crisp, clear, concise, and a pleasure to read. A poor thesis is unclear, ungrammatical, and convoluted.

Other

In addition to the criteria above, students' theses will be judged on originality, completeness, quality, and scholarship. Feedback on prior term papers and the junior tutorial JP will help students excel in meeting these criteria.

Here is the grading rubric for the thesis:

Thesis evaluation (Please check one)

	4 A	**3.7**	**3.3**	**3 B**	**2.7**	**2.3**	**2 C**	**1.7**	**1 D**
Introduction									
Issue/Question									
Description of Project or Sources of Data									
Thesis Results - Description									
Thesis Results - Substantiation									
Thesis Results - Analysis									
Thesis Discussion									
Thesis Writing									
	4 A	**3.7**	**3.3**	**3 B**	**2.7**	**2.3**	**2 C**	**1.7**	**1 D**
Originality									
Completeness									
Quality									
Scholarship									

Comments

Here is the grading rubric for the oral exam:

Thesis Defense (Please check one)

	4 A	**3.7**	**3.3**	**3 B**	**2.7**	**2.3**	**2 C**	**1.7**	**1 D**
Discussion of Underlying Concepts									
Discussion of Methods									
Explanation of Inferences									
Exploration of next steps or what could have been done differently									
Factual knowledge									
Proposal of future directions and formulation of testable hypotheses									

Comments

General Knowledge (Please check one)

	4 A	**3.7**	**3.3**	**3 B**	**2.7**	**2.3**	**2 C**	**1.7**	**1 D**
Retention of EEB Coursework									

Comments

Self-Sufficiency (Please check one)

	4 A	**3.7**	**3.3**	**3 B**	**2.7**	**2.3**	**2 C**	**1.7**	**1 D**
Work ethic									
Independence									
Perseverance									

Comments

In addition to the senior thesis, EEB asks its seniors to present their work in an **annual poster show**, a requirement for honors, that takes place in early May. Departmental prizes are given to those posters that best explain the student's research and are independent from senior thesis grades.

Here is the rubric for the poster assessment:

ORIGINALITY This poster:

1. Demonstrated exceptional originality.
2. Creative and went beyond the literature in several areas.
3. Solid and contained one or more good ideas/tests that extended the current thinking.
4. Stayed within the bounds of current thinking.

SUBSTANCE This poster:

1. Tells a coherent and substantial story.
2. Needs just one or two additional experiments/controls or observations/analyses for completion.
3. Contains the elements of a nice result/idea that someone can follow up.
4. Contains few new results or ideas.

QUALITY OF RESEARCH The research:
1. Was beautiful, clear-cut, and well-controlled/thought-out/ structured/ designed — equivalent to top 5% of EEB seniors.
2. Was clearly above average.
3. Was pretty average, with evident problems.
4. Was often sloppy.

QUALITY OF POSTER The poster:
1. Text and graphics clear and understandable with right balance between text, graphics, and abstract /summary/conclusions.
2. Text or graphics unclear or insufficient in one or two ways, but does not seriously weaken the poster.
3. Significant problems with respect to clarity and/or meaning of text and graphics.
4. A careless and confusing presentation of material.

DISCUSSION The student:
1. Had excellent command of the material and was able to talk about the research in a coherent and well-informed manner. Answered questions knowledgeably and with some insight.
2. Had a good command of the material and articulated satisfactorily the nature of the project and research. Was able to answer questions satisfactorily.
3. Was able to describe project, but only in a superficial way. Did not give impressive answers to the questions.
4. Had a tenuous understanding of the research and had a hard time answering questions.

Students are required to sit for an **oral departmental exam** in mid May. This exam is one hour long, and the student must defend his or her thesis to two faculty examiners. Areas evaluated are listed in the grading rubric under Thesis Defense. In addition, faculty receive a list of all departmental courses taken by students for the section of the exam that covers scientific concepts and general knowledge the students learned in coursework during their EEB career.

Departmental Resources
Each year, the EEB department offers seniors an opportunity to work on their theses in a series of bootcamps and writing sessions. Led by EEB graduate students, these sessions are discrete blocks of time in which students commit to attending and completing different sections of the thesis. The graduate student leaders are helpful mentors in the process.

Online Resources:

- *How to Write a JP* — http://www.princeton.edu/writing/center/resources/JPHandbook.pdf
- *Writing Guide for EEB* — http://www.princeton.edu/eeb/undergraduate-studies/junior-senior/Science-Writing-in-EEB.pdf
- *Class of 2012 Thesis Titles and Abstracts* http://www.princeton.edu/eeb/undergraduate-studies/junior-senior/2012-Abstracts.pdf

EEB Website:
- http://www.princeton.edu/eeb/undergraduate-studies/junior-senior/

Blackboard Organization:
- EEB Concentrators

Funding Portal:
- Student Activities Funding Engine http://www.princeton.edu/studentfunding/

Creating a Poster:
- Sessions on designing a scientific poster are held in the spring