



CLFS 608A

Bean Beetle Research

“One experiment is better than a thousand expert opinions.” Robert H. Mathies (co-inventor of sewing machine for attaching shoe soles)

Overview

The CLFS 608A Bean Beetle Research program is a hybrid research experience that combines local experiments with an online research community. Individual researchers in the program design, perform, and analyze their own experiments, with input and suggestions from other members of the program. In this sense, the program functions like an actual scientific community.

Expectations

The bean beetle (*Callosobruchus maculatus*) is an interesting model organism that can be used to experimentally evaluate an astonishingly diverse array of biologically-relevant questions. *Callosobruchus* is not the first insect model system widely available for research. Fruit flies (*Drosophila*) and flour beetles (*Tribolium*) have been used for many years, and have produced numerous insights into biological mechanisms. Bean beetles are similar to both of these in many respects, although they are more easily manipulated in experiments.

To succeed in this program, you'll need to become proficient at culturing bean beetles. You'll certainly need to understand their basic biology and life cycle, and how these relate to an experimental research program. Skills you'll need to acquire include:

- Identifying male and female beetles.
- Collecting virgin females.
- Identifying and counting eggs.
- Expanding and maintaining stock cultures.
- Manipulating beetles to set up experimental treatment conditions.

Bean beetles have a relatively long generation time of 3-7 weeks, depending on environmental conditions. Because of this constraint, much of the time in 608A will be spent expanding

cultures, and experiments will be limited to those that are short-term in nature. Longer, multiple generation experiments will simply not be possible, unless 608A is taken over successive academic terms.

The BeanBeetles.org website is an excellent resource and provides the information necessary to complete your experiment(s). The site also provides a number of possible experiments. Unfortunately, many of these experiments were designed to be as simple as possible, and ignore a number of extraneous and confounding factors. For example, experiments where female beetles are given a choice among two or more dried beans for oviposition are easily performed. But there are confounding factors (e.g., differences in bean size, exploration time or distance) that are almost universally ignored in these experiments. More sophisticated designs would address these confounding factors and minimize their impact on the results.

As already noted, time constraints imposed by the generation time of bean beetles precludes long-term experiments. To partially offset this difficulty, each researcher will need to design a long-term experiment of their choosing. The design should include research hypotheses, variables, data structure, data-collection protocols, and proposed statistical analysis.

Lab Notebooks

In lieu of a traditional lab notebook, each researcher will use the Discussion area for recording their work. Each of you should set up a new discussion (e.g., Wackadoodle's Lab Notebook), where all relevant information, including experimental designs, raw data, supporting photographs, should be posted to the notebook. Your notebooks are open to everyone in the program for providing feedback and constructive suggestions.

Grading

Grading in CLFS 608A consists of three components – (1) a lab notebook documenting your progress on your research, (2) two short-term experiments performed during the course, and (3) a design for a long-term experiment that could not be completed during a single term.

The lab notebooks are worth 50 points and are graded based on the following:

- **10 points** for the timely posting of activities
- **15 points** for clarity and accuracy
- **15 points** for the appropriate use of images, graphs and tables
- **10 points** for completeness

Each researcher must complete two experiments and report on the results. To assist you in designing these experiments, draft designs (worth 25 points) are due two weeks into the course. Recommendations based on these drafts will allow to maximize the quality of your

short-term experiments before the bean beetles are available to you. Each completed short-term experiment is then presented as a written report, which is graded on a total of 100 points:

- **15 points** for correctly identifying relevant variables.
- **15 points** for erecting testable hypotheses.
- **20 points** for the suitability for the data structure.
- **20 points** for the suitability for the data-collection protocol.
- **30 points** for appropriate analysis.

The design of the long-term experiment will be graded using the same point breakdown, although no data will be required. As with the short-term experiments a draft of your long-term design (worth 25 points) is required, and is due three weeks into the course.

Final grades will be assigned on percentages of the total of 400 points in the course, with a standard 10% breakdown for letter grades. Plus/minus grading will be used.

Assignments

Due Date	Assignment	Points
19 Mar.	Drafts of 2 Short Term Experimental Designs	25
26 Mar.	Draft of Long Term Experimental Design	25
9 May	Personal Lab Notebook	50
14 May	Reports on 2 Short Term Experiments	200
16 May	Final Long Term Experimental Design	100