Research Experiences for Undergraduates
STEPHENS EXPERIMENTAL BEHAVIORAL ECOLOGY LAB

Program Overview

The long-range goal is to develop a program that helps undergraduates participate in our laboratory at a higher level. Our idea is to implement a “Practicum in Experimental Behavioral Ecology” that will be offered as a seminar course, but will also involve specific expectations for research in the lab. The practicum will serve a handful of students (4) recruited from a range of majors across our campus. The rationale for this approach is two-fold. First, the seminar mechanism gives us a tool to introduce scientific and technical issues. Second, while it is difficult for a single undergraduate to complete a project in a lab like ours, a well-prepared team of undergraduates can accomplish a great deal. Moreover, this team-oriented approach reflects the reality of many highly technical scientific projects. Our research group has much to offer for the motivated undergraduate. We are proud of our efforts to combine mathematical modeling with rigorous experimentation. In addition, our laboratory is equipped with up-to-date equipment to control food delivery and record choice behavior, and well-developed tools for analysis, monitoring and data reduction.

This REU program has two aims:
1. Practicum in Experimental Behavioral Ecology. Implement a seminar course that will provide background and technical skills in the questions addressed and techniques used in our laboratory.
2. A Publishable Project. Participants in the Practicum will work as a research team to design, implement and analyze a publishable research project over the course of one year.

Background

Synopsis of the larger project. Animals often prefer small-immediate options, even when they could gain more in the long-term by choosing a larger-delayed option. This project explores a new hypothesis to explain this impulsiveness. Our premise, the ecological rationality hypothesis, focuses on how a single choice is framed within the stream of gains that an animal obtains during a foraging bout. So our experiments involve offering similar choices that are “framed” in different ways. The experimental subjects are captive blue jays (Cyanocitta cristata). Our experiments offer precisely controlled choices to the jays using computer controlled equipment (i.e. in Skinner or operant boxes).

Aim 1: Practicum in Experimental Behavioral Ecology

The objective of this aim is to develop a mechanism that will provide the context and skills necessary to do meaningful hands-on science in our laboratory. As explained above, a conventional one student-one project model does not work well for our lab. Our alternative approach is to recruit a small team of undergraduates with diverse backgrounds, and the tools and guidance necessary to do science in our lab. The rationale is that a small team working together (i) can accomplish more, (ii) is a more realistic model of how complex scientific projects works, and (iii) allows each student to develop their own strengths.

Design

Recruitment and selection criteria. A group of 4 students with diverse interests will be recruited via advertisements in other departments (Biology, Engineering, Computer Science,
Neuroscience, Psychology etc). Applicants will be interviewed and assessed for their interests, academic accomplishments, educational goals, and their level of maturity and commitment.

Students will participate in practicum course for two consecutive semesters. This seminar will address: 1) the background necessary to understand our project; 2) the rationale and design of our project; 3) basic procedures in our laboratory; 4) readings from related primary literature; 5) basic research skills as needed (e.g. experimental design & hypothesis testing, statistics, computer use, data management, animal welfare, ethics and so on). In addition, the students will commit to working 10 hours per week in the laboratory. Initially, this will be lower level work (not supported by REU), but it will give students a practical context for the topics discussed in the seminar. Roughly, halfway through the first semester, the seminar participants will begin to develop hypotheses of their own consistent with our project’s aims.

**Expected Outcomes.** I expect this practicum to develop a team of motivated undergraduates with complementary skills and interests; collectively, they will be well prepared to do meaningful hands-on science.

**Problems and Alternatives strategies.** It may be difficult to recruit students from a large number of majors. We will not be rigid about this, but will try to select people with complementary skills even if this does not correspond to their chosen major. Some students will be more committed to this scheme than others, and it is likely that one or two will drop out without completing two semesters. We will try to assess levels of commitment when we interview students, and may select one or two extra students, if this seems to be a concern.

**Aim 2: A Publishable Project**
The objective of this aim is to move from preparation to accomplishment. Students will solidify the skills and concepts they have learned by applying them. Our approach capitalizes on the ongoing practicum, by encouraging the team to develop its own hypothesis and an experiment designed to test it. The rationale is that students will learn best by striving to accomplish and publish real science; helping them build a CV, and giving them a deeper understanding of the scientific process.

**Design.**
*Role of student participants.* As the practicum course continues we will shift our focus from skill building to hypothesis development, then to project planning, and then to project implementation and management. We will evaluate candidate hypotheses for their significance and testability. Ultimately, we will select one that is appropriate to the aims of our larger project and appropriate to the skills of the team. Students will, as much as possible, conduct their experiment on their own. They will assign tasks to members of the team, monitor the progress of the study, analyze data and write drafts of manuscript sections. As part of a team all members will participate fully in conducting this experiment. Seminar meetings will continue to read primary literature and develop skills, even after the main experimental project has begun.

**Expected Outcomes.** We expect two significant outcomes. First, the students will develop a deeper appreciation for how science works both conceptually and practically. Second, students will produce a publishable work of science that addresses the aims of our larger project. In addition, we expect that some students will be motivated to pursue further education in science.