Funding Application
for Fall '08 Courses

Experiential Teaching and Learning Grants for Faculty
Extended Deadline: June 16, 2008

Purpose:
This grants program is a component of the *Learning by Doing* initiative to strengthen and grow experiential learning in the School of Arts and Sciences. It is an expression of the university's commitment to support effective, innovative teaching and to provide a full range of opportunities for students to deepen their learning through direct experience. The grants are primarily intended for courses that are either entirely new or newly experiential. Preference will be given to courses that embed the experiential methods throughout the course versus courses with an optional experiential component.

Amount:
Grants of amounts up to $1000 will offset expenses associated with embedding experiential methods into an existing or new course. Eligible expenses might include research supplies, materials needed for student projects, and food for celebratory events. We are unlikely to fund renting vehicles for one-time field trips. The average grant last year was approximately $400.

Eligibility:
Any faculty member on a multi-year contract teaching an undergraduate course with a significant experiential component is eligible to apply for funds. Those who are awarded a grant will be expected to meet with the Academic Administrator for Experiential Learning at the end of the course to discuss examples of student work and insights from teaching the course that could be helpful to share in the E-L Teaching Toolkit. Awardees will also be connected to a network of colleagues who exchange teaching strategies that have proven successful for experiential courses.

Selection Criteria:
The selection process will focus on the extent to which an application demonstrates that

a) the course design meets all of the criteria for an academically rigorous experiential learning course (see definition);
b) the expenses detailed in the budget are integral to fostering students' learning;
c) the reflection activities are appropriate and purposeful; and
d) there is the potential for the course to have an impact beyond the current group of students enrolled, for example the potential to provide a new model for experiential learning in the program or department.

To discuss ideas or to address any questions about the application before submission, please contact Jessica Paquin, Academic Internship Administrator (paquin@brandeis.edu) or Elaine Wong, Senior Associate Dean of Arts and Sciences (ewong@brandeis.edu).

For further information on experiential learning, including past grant awards, see the website www.brandeis.edu/experientiallearning.

Brandeis University

Proposal for Experiential Teaching and Learning Grant
Deadline: Email by JUNE 16, 2008

[Electronic version available at www.brandeis.edu/experientiallearning]

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Please provide the following information on the proposed course in 2-3 pages.

1. Title of Course: Biol101a, Molecular Biotechnology

2. Is this a brand new course or a redesign of an existing course? Redesign

3. Amount requested and budget: $1000 to cover the initial purchases of laboratory supplies and equipment. The following prices are approximate prices from Fisher Scientific.

P2 pipette: $250
P20 pipette: $250
Pipette Tips: $50
PCR primers: $50
Ready-to-go PCR beads: $187
Agarose: $150
pUC 19 plasmid: $50

4. Summarize the focus of the course and what you hope students will learn from the experiential methods.

5. Explain how this course will involve direct or "hands-on" experiences that engage students on multiple levels.

6. Explain how the design of the course allows students to make decisions and learn from natural consequences rather than predetermined outcomes.

7. Give examples of two assignments/activities you will use to encourage critical thinking about the direct experiences in relation to course content and theories. [You will find examples of such activities in the teaching toolkit "Making the Connection" on the website].

Biol101a, Molecular Biotechnology is a course designed for advanced undergraduate students and first year graduate students. In this course, students learn about both historical and new technologies in the field of molecular biology. Most students enrolled in this course intend on pursuing careers in the health sciences either through genetic counseling or continuing studies in medical programs. For this reason, all topics discussed in Biol101a are presented and then associated with a human health-related application component. Students in this class are exposed to the background and technical information governing such techniques as RT-PCR, gene therapy, siRNA, and cloning and are asked to read primary literature articles that apply these tools to such diseases as cancer, HIV, and congenital nystagmus. Throughout the course, students are presented with some of the most challenging obstacles faced in the life sciences over the last 50 years and asked to apply various strategies and techniques to help solve them. Students enrolled in this course are consistently expected to "think outside the box" and critically analyze published data. At the end of the semester, students are asked to apply all of the knowledge gained in the course and develop an independent research proposal that seeks to solve an unaddressed problem facing human health using the techniques they have learned. The students must identify and define a problem, set out a set of experiments to address the issue and then make predictions as to the possible experimental outcomes of their design.

I have taught Biol101a for three semesters and I am pleased with our current teaching model, but see one major gap in my students' understanding of the material. My students have never actually used the molecular technologies about which they are learning. In our current model, I have designed one class of interactive lecture, followed by one class session of application-based primary literature, and concluding with one class session of critical thinking and group problem solving exercises for each learning module. This has worked remarkably well thus far, but I find my students cannot effectively critically evaluate scientific data and make predictions about possible sources of experimental error, because they have never actually performed the experiments in question. I introduce topics such as PCR and gel electrophoresis and often show them examples of gels or samples that give misleading information. My students generally cannot understand how the experiment went astray simply because they have never poured a buffer or applied a voltage to a system. I propose to add hands-on laboratory modules to the Biol101a curriculum to give my students the chance to actually participate in the technology.

Because the addition of experimental modules is new to this course, I intend on organizing three new laboratory exercises as a starting model of how to effectively incorporate laboratory technology into this course. Our new laboratories will address the following topics: DNA extraction and RFLP analysis, mitochondrial inheritance, and restriction enzyme digestion and mapping. These experiments will allow the students to use such technologies as agarose gel electrophoresis, DNA sequencing, PCR, bioinformatics, and gene mapping. In two of the experiments, we will ask the students to purify and analyze their own DNA. Each student has different genetic material and therefore, we have no idea what the students will determine as to their own identity or the genetic diversity of our class. These experiments will not have known or even predictable outcomes and will thus provide students with "real" experimental data that they can analyze and interpret.

We will utilize the facilities and large equipment currently used by the Biol18 course series here at Brandeis, and so we do not have a large monetary start-up requirement for most of the required molecular biology tools such as thermocyclers and gel boxes. We do, however, have a few investment needs. In order to begin these labs, we will need to purchase two calibrated pipettemen that are clean and will be used only for sterile DNA work. In addition, consumable material to be used in the experiment including primers, agarose, and PCR material will be needed. Our start-up cost will be approximately $1,000.

I propose to redesign the learning modules of Biol101a into the following system: (1) background and interactive lecture, (2) primary literature application, (3) group problem solving, (4) hands-on laboratory activities. Although the current redesign only consists of adding three laboratory activities, if this system is effective, we can conceivably increase the number of laboratories to encompass additional topics such as RT-PCR, microarray analysis, and even siRNA transcriptional regulation. We will determine the effectiveness of these new activities in two distinct ways. First, I propose we use the preconception/misconception check and the one sentence summary. At the beginning of each module the students will be given 3-5 conceptual questions that they will be asked to complete and turn in at the beginning of the laboratory section. The students will not be graded as to how they respond to these questions, but rather whether or not they have completed the assignment in an all-or-nothing form as a pre-lab for the day's activity. I will use this information to evaluate the pace of the course and to determine what the students are having trouble understanding before entering the laboratory. In addition to this, the students will be asked to keep a lab notebook for each of the experiments that they will be performing. In this notebook they will be asked to keep scientific data, answer specific questions dealing with data analysis, and to record their personal reaction to the experience. I will collect these reactions and thought responses to determine how effective the labs were at increasing the ability of the students to problem solve.

We hope this redesign strategy will help our students interpret and assimilate the Biol101a course material in a more efficient and technologically advanced manner.