

UNIVERSITY OF LOUISIANA AT LAFAYETTE

STEP Committee

Technology Fee Application

**Upgrading a Molecular Biology Teaching
Lab**

Title

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Name of Submitter
(Faculty or Staff Only)

Department of Biology

Organization

Title: Upgrading a Molecular Biology Teaching Lab Date: July 17, 2017
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ABSTRACT (250 words or less):

Molecular biology techniques such as molecular and cellular engineering are becoming extremely common in today's world. For example, about 95% of corn, soybean and cotton are genetically engineered in the US and genetically engineered fish (Atlantic salmon) has been approved by the FDA and is on its way to dinner tables across the country. It is an obligation to teach today's students such technology so that they are well prepared for the real world either as professionals or as informed citizens. However, the Molecular Biology Teaching Lab, the only one on campus, used for this purpose has not been updated in more than 30 years. Instructors have been using their research labs for teaching at least some of the courses such as BIOL 454, Molecular and Cellular Engineering, an upper division course for biology students. This proposal seeks to upgrade the teaching lab as one-time investment because later upgrading to keep the lab updated can be done using the laboratory fees. Therefore, for this one-time investment, hundreds of students will be positively impacted for at least next 10 years.

PROPOSAL DESCRIPTION:

Purpose of grant and impact to student body as a whole

The Molecular Biology Teaching Lab is used to teach upper division molecular laboratory biology courses such as BIOL 454, Molecular and Cellular Engineering. The lab is equipped with outdated equipment installed 30 years ago. To remedy this, the teaching using the lab has always been supplemented in the past with research labs since these courses has been taught by research faculty who had their own labs. The outdated equipment has caused problems and frustrations for the instructors and the students. Below are two student comments from Spring 2017 (partially redacted; original can be found in Student Evaluation BIOL454-001, Spring 2017):

Student comment 1:

Thinking about the **overall course [SURVEY]**, please complete the following questions.

Please provide any comments about the course in the space below, including ways to improve instruction.

- How [redacted] are people supposed to teach in these conditions? I'm [redacted] for the university, we had to use equipment and facilities that were outdated and unsafe for DECADES. The lab course was done to the best of their ability, but when you're 50 years behind in the field in terms of tools, how much can you really do? The [redacted] its students on this course.

Student comment 2:

Please rate the usefulness in this course of the following **activities and resources**.

Please list any other **activities and resources** used in this course. Indicate each as: Very Useful, Somewhat Useful, or Not Useful.

- Broken [redacted] lab equipment. Seriously, ULL, get your [redacted] together. You're falling behind and it's almost past the point where you can catch up. Get moving!

Frustration aside, the truth is majority of the equipment were over 30 years old (Table 1). Most of the listed equipment were used for monitoring and growing bacteria in liquid and on plates. Those water baths were at one time used for performing PCR (Polymerase Chain Reaction-DNA synthesis in a tube) 20 years ago by moving samples from one water bath to another (one can find published research that used water baths for PCR in Dijkhuizen et al. 1994, Theor. Appl. Genet. 89:42–48). PCR was later performed using thermocyclers in research labs. Currently, these water baths are used for bacterial sample incubations, but because it takes a few hours for them to settle on certain preset temperatures it has to be constantly monitored by the instructor to prevent the sample being cooked. The Thelco incubator is no longer adjustable but can maintain temperatures between 38-42 °C although we need 37 °C for optimum bacterial growth. The shaker/incubator is too loud even with lab door closed to run at RPM (revolution per minute) near 100 while we need at least 200 RPM. On several occasions, the noise triggered curious investigations from people downstairs in Wharton Hall. Most times we just used the shaker/incubator in my research lab in another building. Another needed lab equipment is laminar flow hood. Without a laminar flow hood, we had to prepare bacterial growth media, colony streaking, and colony picking on the bench, and could not perform tissue culture and plant genetic transformation. If the lab is upgraded as proposed, the students can learn in a professional lab setting additional and critical molecular biology techniques such as PCR (as mentioned above), photographing a gel, bacterial cell electroporation, proper bacterial cell plating/streaking and plant genetic transformation and tissue culture.

The purpose of the grant is to upgrade the teaching lab with more contemporary laboratory equipment (see Table 2) so that the upgrade can last at least next 10 years and students can learn cutting-edge molecular biology techniques in a professional setting because the upgraded teaching lab will resemble a laboratory in real life. This is important because student graduating from this lab will be familiar with modern laboratory equipment, not outdated/homemade ones. Most importantly, for this one-time investment, hundreds of students will be positively impacted for the foreseeable future.

Table 1. Laboratory equipment currently used in Molecular Biology Teaching Lab.

Equipment	Manufacturer	Purpose	Serial No.	Year of Acquisition*
Thelco Model 6 Incubator	Precision Scientific	Incubate bacterial culture plates	L-7	1985
IEC Centra-8R Centrifuge	International Equipment Co.	Sample centrifugation	24782008	1991
Controlled Environment Shaker/Incubator	New Brunswick Scientific	Bacterial liquid culture	M1024-0000	1982
Gyratory water bath shaker	New Brunswick Scientific	Low temperature bacterial liquid culture	671809	1978
Gyratory water bath shaker	New Brunswick Scientific	Low temperature bacterial liquid culture	872305	1978
Spectronic 20	Bausch & Lomb	Measure bacterial cell density	1113925	1984
Model 1300 water bath	Labline	Maintaining temperature	1275	1987
Model 1000 water bath	Labline	Maintaining temperature	1272	1985
Model 83 water bath	Precision Scientific	Maintaining temperature	13-AF-3	1982
Genie 2 Vortexer	VWR	Mixing sample	129273	1975
RR-800 Microwave	Amana	Making agarose gels	LJ55368704	1982

* Based on university and department records.

Projected lifetime of enhancement

The upgrade will provide needed laboratory teaching enhancement for at least next 10 years. After this upgrade, the lab will be maintained through lab fees so that its equipment setup is not behind the state-of-the-art.

Person(s) responsible for Implementation, Installation, Maintenance, Operation, Training

The proposers will be responsible for implementing, installing, maintaining, operating and training of the equipment. Both proposers have experience and skills to perform these tasks.

Table 2. Equipment requested for the Molecular Biology Teaching Lab.

Name	Price (\$)	Purpose	Justification
Fisher Scientific Incubator (Isotemp™ Micro-biological)	2,375.00 (Cat#: 15-103-0514)	Bacterial culture	The old incubator in the teaching lab does not maintain temperature at 37°C, the optimum temperature for bacterial growth. Some experiments had to be repeated several times.
Shaker/incubator (Southwest's In-cuShaker 10L)	5,616.00 (model SH1010)	Bacterial liquid culture	The old shaker/incubator in the teaching lab is extremely noisy even at very low RPM (revolution per minute); higher RPM is required for experiments.
MidSci OD600 Bacterial Growth Spectrophotometer	2,115.00 (Cat#: OD600-30; DC10)	Measure bacterial growth in liquid media	The current spectrophotometer, Spectronic 20 (see Table 1), is extremely inaccurate after 30 years of use.
Thermal Cycler (ABI™ 2720)	3,080.00 (Cat#: 4359659)	PCR amplification of DNA	Currently students perform PCR using the machine in my research lab in a different building; no thermal cycler in the teaching lab.
PHOTODOC-IT Gel Imaging System	4,586.19 (Cat#: 1219C68; Mfr. No. 97-0274-13)	Gel visualization of DNA	Currently no such system in the teaching lab; students used ones in various research labs in different floors and building.
CleaTech 6 ft benchtop Laminar flow hood	6,205.00 (Cat#: 1000-2-C, A10-WS-SR6, A10-UV-60)	Pour plates and perform tissue culture and other aseptic tasks	Currently no laminar flow hood in the teaching lab: students pouring plates on the bench-rarely done in real labs because of high risk of contamination, wasting students' time and university's resources.
Benchtop centrifuge (Hermle Z326 Universal Centrifuge)	5,415.00 (C-Z326-BND from Phenix Research)	For centrifugation of samples in 50/15 ml tubes	There is a similar centrifuge in the teaching lab (IEC Centra-8R in Table 1), but it does not keep time; students had to be assigned to time it during operation. This distracted them from performing their own experiments which had to be conducted within three hours.

Budget Proposal

1. **Equipment** **\$ 29,392.19**

See Table 2 for Equipment breakdown.

2. **Software** **\$**

N/A

3. **Supplies** **\$**

N/A

4. **Maintenance** **\$**

N/A

5. **Personnel** **\$**

N/A

6. **Other** **\$**

N/A

TOTAL: **\$ 29,392.19**