APPLICATION OUTLINE

Summary: The requested equipment will be used in the BIOL 395 Laboratory in Genetics and Cell Biology to allow students from multiple colleges to gain hands-on experience of important modern molecular biology techniques. The current equipment is very old and failing; replacement is essential to maintain the contemporary course content.

Description of the instrumentation

A central technique in modern molecular biology is the detection of specific proteins with antibodies of high sensitivity. This technique is called immunoblotting, commonly known as Western blotting (a play on the name of the Oxford scientist Ed Southern who came up with the original concept). The technique requires to first separate proteins by size in a gel using electric current, then transfer the proteins from the gel to a nylon membrane, and finally, identify specific protein using the antibody reagents. The requested instrumentation, two BioRad Trans-Blot Semi-Dry Electrophoretic Transfer Cells (#170-3940) and a power supply (#164-5052), is necessary to transfer the proteins from the gel to the nylon membrane.

A second critical technique is introducing engineered DNA into bacteria. The most effective way of doing this is to use a brief strong electric current. This technique is known as electroporation and we are requesting an Electroporator, an Eppendorf Eporator (4309000027) to carry this out. We are also requesting four quartz cuvettes (50-823-025), which are used to quantify DNA during manipulation procedures. We are updating half of the exercises for this class and the ability to electroporate is central to the new material.

The principal reason for this request is that the existing equipment used by the BIOL 395 class is very old and frequently fails to work, greatly extending the duration of the class (as late as 11pm in one recent instance). The requested equipment is fast, efficient and reliable greatly increasing the chances of student success in sophisticated laboratory exercises.

Research and instructional activities to be enabled, and impact

The requested equipment is used in exercises in BIOL 395 Laboratory in Genetics and Cell Biology to clone DNA and to demonstrate how bacteria respond to stress at the molecular level. Although students are engaged by the prospect of cloning DNA or choosing potentially stressful substances from outside the classroom (energy drinks, natural remedies), the principle goal of the exercises is to give students practical experience with current analysis techniques. The state of the existing equipment is threatening these student-learning objectives.

BIOL 395 a required course for the Biology major (COS), the Neuroscience major (COS/CLA) and the BSc/MSc in Biotechnology (CABNR), and as a result this class crosses college boundaries in its impact. BIOL 395 is rapidly growing with an enrollment of 107 undergraduates for the spring semester 2014. Maintaining the current content of the course will have a substantial and positive impact on a large number of undergraduates.

Impact on research, instruction and innovation infrastructure, and need

The requested equipment will prevent a substantial decline in the institution’s capabilities to provide a quality research experience to a large number of undergraduates. The UNR strategic goals include a planning goal to enrich undergraduate opportunities to engage in research projects. The rapidly increasing enrollment in the Biology and Neuroscience majors and the limited number of research laboratories means that for the majority of students, research experience is limited to the laboratory classes BIOL 192 and BIOL 395. This places an increasing responsibility of upper level BIOL 395 laboratory to maintain course content that is relevant to current laboratory practices and have the lab exercises provide a positive, learning experience.
Management Plan and Sustainability

The equipment will be used primarily for the BIOL 395 laboratory class; it will be willingly shared with other courses if the need arises. The Kidd laboratory in Fleischmann Agriculture has used this equipment weekly for several years with high reliability. The Trans-Blot is relatively unsophisticated consisting of little more than two large electrodes; failure will likely be trivial requiring simple soldering fixes or catastrophic (like the current equipment) when replacing the unit will be the more economical option. The Eporator is more sophisticated but should last at least a decade with careful usage. The Biology department has some funds that are used for the maintenance of shared equipment. The requested equipment has not been included in an existing proposal, either funded or soon to be funded.

Note
Although all this equipment is high priority for replacement, if the available funds were limited, the priority of each piece of instrumentation would be in the following order: (1) Biorad Trans-Blot SD Semi-Dry Blotters ($3232.50), (2) Eppendorf Eporator ($2430), (3) Quartz cuvettes ($492.06).