F12

Facilities Reinvestment Funding Proposal
One-Time Non-Base Investment Proposal: Step 2

(Please limit the proposal narrative and attachments to 10 pages)

Proposal Name: Moving Teaching Laboratories into the 21st Century

1. Provide a description of the project being proposed. (5 points)

The current project is to replace/update marginally functional equipment in teaching laboratories for two large enrollment service courses (Biol 100 – Our Natural World, Biol 310/330- Human Physiology) and a core major's course (Biol 211-Genetics). Equipment includes microscopes ($52,500), dissecting microscopes ($13,500), and physiological computer interface equipment ($24,000). Microscopes in Biol 100 are well beyond their functional life, and decade-old interface equipment interacts poorly with modern computer operating systems. Biol 211 has no microscopes of its own.

Although it may be unusual to define "equipment" as "facilities", the role of equipment in science laboratories makes it an integral part of the laboratory structure. College and departmental equipment budgets have consistently been inadequate to meet the extensive needs of the equipment-intense disciplines in CSET. Another funding source, the Institutional Equipment Fund, funds equipment that is prioritized at the college level. All past CSET deans have limited the types of equipment that could be added to the Institutional Equipment list to single, high cost items (>$30,000), which eliminates the proposed purchase from this list.

Biology's non-salary budget (consumable supplies) has been stagnant for at least 10 years prior to last year, when the budget was *reduced*, despite increased enrollments. The departmental share of summer proceeds (from extensive summer course offerings) has traditionally been used as an equipment budget, to replace worn out teaching-laboratory equipment, and some research equipment. This "share" is subject to each dean's preferences, and thus may vary from year to year. Currently these funds also purchase upgraded faculty computers, supplement the inadequate consumable supplies budgets for teaching laboratories, and cover many supplies for undergraduate and graduate research projects, a significant expense only partially covered by URC grants. Given our increasing needs, inflation, and increased student numbers, costs currently surpass the available funds.

Proposed equipment purchases are as follows:

- Basic microscopes for Biology 100, *Our Natural World*, (approximately 1300 students/year) which has an average of 26 lab sections per week, with 24 students per section and two sections occurring simultaneously. 44 microscopes at $1100 each.

- Basic microscopes for Biology 211, Genetics, (approximately 220 students/year) which has 5 lab sections per week, with 22 students per section. 15 basic microscopes at $1100 each, plus 15 dissecting microscopes at $1000 each.

- Upgraded data collection systems for Biology 330/310 (approximately 600 students/year), which has 10-13 lab sections per week, with 24 students in each section. Students are set up 3 per station, so 8 data collection systems are needed, with a per station (total) cost of $3000.

2. Describe how the project will drive positive transformational change. (10 points)

Most of the Trafton South teaching laboratories underwent renovations two years ago to repair and modernize laboratory facilities. These changes have been highly effective in promoting a positive learning environment for students, with modern media technology now available to aid in creating an inspiring laboratory experience. Laboratory equipment, an integral part of any science lab, was not budgeted into the renovation, limiting the benefit of the newly remodeled laboratories.

Modern and functional equipment in the teaching laboratories transforms student learning, positively affecting the knowledge base and decision making capabilities of future teachers, medical personnel, scientists, and many Minnesota citizens. A good experience in a science course can promote an appreciation of scientific thought and knowledge, and improve student performance and retention. Conversely, a poor experience can turn-off enthusiasm, promote apathy, and make science learning an unpleasant chore, rather than the adventure into the "unknown" it should be. The biological sciences are difficult subjects for many students and with the extremely large number of students in the lectures, the laboratories are critical to facilitate student learning and promote enthusiasm. Two of the three courses affected by this grant are service courses, with the majority of the students majoring in disciplines outside Biology. Lack of student experience with the biological sciences, combined with marginally functional equipment creates insurmountable barriers to successful student learning. A well designed and implemented laboratory is easily *undone* by equipment failure.

3. **Describe the impact this project will have on students and/or others whom we serve. (10 points)**

Minnesota State University serves its students, the State of Minnesota, and the world. The three course affected by this funding are integral courses in science and medicine, both areas of current and future need in the State and world. Science holds the promise of providing local, state, national, and global solutions. Therefore, generating interest in science by giving the student a positive experience, particularly early in his/her education, is critical to our success.

Instilling passion and interest in science is difficult when equipment is inadequate. Students graduate (bachelor's or master's) less prepared to utilize either basic or modern equipment. It is tough to train a student to use a microscope when that microscope fails to focus, moves out of focus, or is so scratched that images are nearly impossible to see. With a functional microscope, Biology 100 students can view unique microscopic organisms and organelles, compare plant, animal, and bacterial cells, observe blood disorders and plant structures, identify stages of mitosis and of development, and gain an appreciation for our natural world.

Students in Genetics can view the results of mating crosses, and see the pattern of inherited characteristics for themselves. Observation of mitosis and meiosis in cell can occur, along with characterizing finger print characteristics. Genetics instructors can design laboratories based on curriculum, and not on microscope availability.

Physiology students will be less frustrated if the equipment no longer stops working in the middle of data collection, and if data recording lines don't "disappear" suddenly. Students will spend less time restarting the computer and becoming stressed over interrupted experimental results, and more time experiencing physiology in their own bodies. Physiology students will gain valuable insight into body function and medicine when using updated interface equipment to measure electrocardiograms of the heart, electromyograms of the muscles, respiratory rate and depth, muscle contract strength, blood flow and heart rate, and nerve impulses. For all biological disciplines, student knowledge, understanding, and critical thought processes are strongly influenced by the hands-on experience that is an integral part of our teaching laboratories.

The aforementioned courses directly impact 2120 undergraduate students per year in majors that span the campus. Biology is a leader in undergraduate research, and has 40 graduate students who benefit the department as researchers and teaching assistants. Attraction and retention of undergraduate and graduate students in the sciences requires modern and functional equipment.

4. **Identify the "SMART" outcomes for the project (specific, measurable, achievable, relevant, and time-bound). (5 points)**

a) Students will be able to do the following with the new data collection equipment and microscopes (as compared to the old models):
   - use equipment 20% more easily
   - be 20% less frustrated with using equipment

- be 20% more satisfied with their lab experiences
- learn related science content 50% more easily
- Be more enthusiastic about science

b) Course instructors will be able to do the following because of the new data collection equipment and microscopes (as compared to the old models):
   - troubleshoot equipment 30% fewer times during each class period
   - spend 30% less time overall per class period troubleshooting equipment
   - be 50% less frustrated with equipment
   - spend 30% more time teaching and interacting with students
   - spend 90% less time outside of class time repairing equipment
   - perceive that students are learning the related science content more easily
   - Enjoy the student's enthusiasm

c) The Biology Department will spend less money on repairs and replacements for the new data collection equipment and microscopes when compared to that spent on the old models.

d) Assessment (measurement)
   - Student pre and post new-equipment survey asking about the student outcomes above
   - Instructor pre and post new-equipment survey asking about the instructor outcomes above
   - Budget analysis tracking total costs each semester of data collection equipment and microscope repairs and replacements

5. Discuss what this project will do for the university that warrants the investment. (5 points)

Equipment remains useful for 7-10 years. Besides markedly improving the student laboratory experience, "catching up" on teaching-equipment needs will allow some of the summer proceeds to be used for equipment purchases for research use, resulting in improved recruitment and retention of quality students, and improved experience and opportunities for undergraduate and graduate researchers, facilitating attainment of outside funding, and promoting publishable scholarly activity. If we are a "campus of the future", we must have not only modern facilities, but equipment that is from the current century.

6. If applicable, explain how the project addresses significant deferred maintenance. (5 points)

In the laboratory based sciences, "equipment" is as much a part of the laboratory structure as laboratory benches and projection equipment. Although the University has an equipment budget, the monetary value of the "share" assigned to the College of Science, Engineering, and Technology is inadequate, given the cost and amount of equipment in use in teaching and research laboratories within the college. Another funding source, the Institutional Equipment Fund, is an equipment list that is prioritized at the college level. The entire list for this funding generally totals about $800,000, with $270,000 funded last fall. Equipment spends an average of 4-5 years on the list before getting funded. All past CSET deans have prohibited adding small cost items (<$30,000/individual item) to list. This has eliminated the proposed equipment purchases of this grant from placement in the Institutional Fund equipment list.

As previously mentioned, the Department of Biological Sciences has tried to meet equipment needs by using summer proceeds for equipment purchases. Large microscope purchases have been split up, and funded over several years. We had been successful at meeting our needs until the past few years, when further reductions in supply budgets, and increasing enrollments and inflation, resulted in costs that exceed our funds.

The aforementioned microscopes (Biol 100) should have been replaced 4-5 years ago. The Genetics laboratory has no microscopes of its own, thus the instructors have been borrowing microscopes from other courses. It is destructive to delicate microscopes to have them hauled back and forth between laboratories, and finding microscopes that are free on any given week is a limiting factor in the design of laboratory exercises for the Genetics course. Furthermore, lining up and "borrowing" microscopes from other courses is time consuming for the instructors, who, with faculty cuts and increased enrollments, have precious little to spare. Finally, increased student numbers have fueled the need for additional microscopes.

The computer interface equipment in the physiology laboratories is more than 10 years old, and poorly compatible with current computer operating systems. It should have been replaced 2 years ago.

7. Describe how the activities generated by this project would be sustained after one-time funding has ended, or if applicable, explain why the project does not need to be sustained. (5 points)

The project does not need to be sustained beyond the department level. The microscopes and computer interface units will be maintained by the Department of Biological Sciences. Annual cleaning and maintenance of microscopes already takes place and is part of faculty responsibility. Microscopes, if well cared for, can last 8-10 years. Repairs and maintenance of the physiology interface units are funded by the physiology budget, and coordinated by physiology faculty. These units should be usable for up to 10 years.

8. Budget (5 points):

Outline the funding requested using the categories listed below. Please identify any additional or matching funds that may available to support the project. Please note, budget revisions beyond 10% total change from the initial proposal require approval. Budget revisions of more than 20%, constitutes a major change in the project scope and will not be approved.

	FY12	FY 12 Matching Funds	FY13	FY 13 Matching Funds	FY14	FY13 Matching Funds
Personnel						
Unclassified Salary (in-load, overload)						
Classified Salary						
Fringe[a] (Classified and Unclassified)						
Graduate Assistant Salary						
Graduate Assistant Tuition Reduction/Waiver[b]						
Non-Salary						
Student Help						
Purchased Services/Travel Expenses						
Supplies and Materials						
Building Improvement/Construction Costs						
Equipment	$103,900					
Total Budget Requested	$103,900					

[a] Note: All current employees must be paid fringe benefits. Fringe should be estimated based on salary and position classification: Unclassified 30%, Classified 37%, Adjunct 7.65%.
[b] Estimated Tuition Reduction/Waiver for full-year enrollment: Masters $5,858, Doctoral $10,000.

Equipment details:

Microscopes for Biol 100: 44 x $1100 each = $48,400.
Microscopes for Biol 211: 15 x $1100 each = $16,500.
Dissecting microscopes for Biol 211: 15 x $1000 = $15,000.

Physiology Computer Interface Units (with software and transducers): 8 x $3000 each = 24,000.

- Regular binocular microscopes allow magnification of microscopic organisms up to 1000x. These are used in Biology 100 to observe microscopic animals and plants, and cells and tissues from larger organisms. In genetics, the microscopes are used to observe mitosis and meiosis in cells, count *Sordaria* spores for mapping genes, and determine fingerprint characteristics.

- Dissecting scopes have lower magnification capabilities, (40x), and are used to look directly at small organisms such as fruit flies used in genetic crosses, to determine the presence/absence of inheritable characteristics such as eye color or wing shape.

- Physiology computer interface devices hook into a computer (already in the lab), and have connecting ports for different transducers, each of which allows for collection of a specific type of physiological data, such as electrical activity (ECG, EMG) force (muscle), respiration and lung volumes, blood flow and heart rate, etc. Electric stimulators (which plug in to the interface device) are also included in this equipment, and these are used to artificially stimulate animal (amphibian) nerves or muscles.

9. Identify any special considerations or needs required for this project (e.g. physical space, contractual obligations, IT support, or collaborations with/implications for other units). (5 points)

The laboratories are already set up for microscope use. The physiology laboratories (Biol 330) have computers already present that are currently maintained by IT. The software comes along with the new units, and can be installed by faculty or by IT. The units simply plug in to the computers.

10. Provide a project timeline outlining key tasks, milestones and dates for completion. (5 points)

Spring 2012

February: Administer instructor and student pre- new-equipment surveys.

March: Purchase of microscopes and data collection units as soon as funding is available.

April: Begin use of microscopes in Biol 100 and 211, as soon as they arrive.

May: Administer post-surveys to instructors and students in Biol 100 and 211.
Install software on the Biol 330 computers and hook up new interface units. Rewrite the laboratory manual to correlate with the upgraded software. Begin using the new units for summer session 1.

2012-13

End of Fall Semester: Administer post-surveys to instructors and students in Biol 230/330.

January 18: Submit midyear report.

June 15: Analyze budget savings in equipment maintenance and repair costs.

June 30: Submit annual report.