

**College of Veterinary Medicine and Biomedical Sciences  
2007-08 Inquiry/Research-based Education Projects Report**

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## **Summary of Activities**

The purpose of the Biomedical Sciences Program at Texas A&M University is to prepare undergraduate students for careers in the biomedical sciences. While many of the students in the program are seeking entry into professional programs, a significant number use the BIMS degree to prepare for research careers in the biomedical sciences. One of the best ways to accomplish the task of preparing students for research careers in the biomedical sciences is by engaging them in undergraduate research experiences. In this proposal we will describe two programs designed to work together to encourage and prepare BIMS students for research careers in the biomedical sciences: The eBat Research Intensive Community (RIC) and the Three-week Biomedical Sciences Summer Academy.

The *eBat Research Intensive Community* provides undergraduates with the opportunity to study blood and blood vessels by noninvasive means. As a part of this effort, the Cardiovascular Systems Dynamics Lab (CSDL) has developed the sole, extant, chronic colony of Pallid bats used in the study of cardiovascular science. The thin, non-pigmented, nearly translucent wing membranes of the Pallid bats allows the microvasculature to be viewed *in vivo* through a microscope as researchers manipulate such variables as blood pressure, vascular occlusion, wing and body temperature and light stimulation during experimental procedures.

The CSDL has developed a number of unique resources to leverage the assets of the lab. Prominent among these resources, is an experiential learning/research management system to efficiently train and utilize undergraduate students as partners in the advancement of cardiovascular research. The effectiveness of this management system is such that it is not only beneficial to the productivity of the research scientist but also serves as a valuable learning opportunity for students. Another important CSDL resource is a web-based tool for asynchronous research collaboration and remote control of experiments called eBat. The eBat website is multifunctional; it allows remote experimentation, synchronous and asynchronous communication, and centralized access to manuscripts and ideas being developed by members of the research community. Collectively, the resources developed by the CSDL allow undergraduates to participate in an experiential learning opportunity known as the eBat Research Intensive Community.

Plans for this year include 2 assessment activities. First, we plan to collect additional assessment data from students in the eBat project. Second, we will be developing an assessment tool for an inquiry-based course, Mammalian Functional Neuroanatomy this year. Students will be assigned to complete a series of web-based clinical case simulations. We will measure development of students' problem-solving ability as they engage in these clinical problem-solving activities next year once this tool is completed.

## **Restatement of Outcomes**

The goal of the eBat Research Intensive Community is to help students accomplish the following learning outcomes: (1) understand and apply the scientific method; (2) develop a working knowledge of the anatomical and physiological concepts related to the study of blood and blood vessels of mammals; (3) proper and safe use of laboratory equipment; (4) proper experimental procedures in the laboratory; (5) proper use of the modeling software, STELLA, for communicating results of experimental procedures; (6) teamwork skills; (7) interdisciplinary skills in translating quantitative theory into experimental analysis and (8) skills in communicating experimental results for publication. To understand what students participating in RIC are learning, data will be gathered via a system of online submission and online grading. During 2007-2008, Dr. Farnsworth coordinated development and administration of rubrics designed to allow graders to uniformly apply standardized descriptions of various levels of student performance. While we originally planned to collect pre-test/post-test data related to students' written communication skills and other research-related performances, we chose, after careful analysis, to only collect data concerning students' research performance.

### **Restatement of the Assessment Methods for Each Outcome**

Last year we proposed to assess the following outcomes by the methods indicated:

1. Understand and apply the scientific method – students will be able to formulate hypotheses and carry out experimental procedures using the scientific method.

Assessment – weekly evaluations of students' laboratory work by graduate assistant group leaders.

2. Develop a working knowledge of the anatomical and physiological concepts related to the study of blood and blood vessels of mammals – students will be able to apply these concepts clearly and in their proper context as they communicate the results of their experiments.

Assessment – graduate assistant group leader use of a performance rubrics and comments to evaluate student manuscripts at their various stages of development and students' production of peer reviewed publications.

3. Proper use of laboratory equipment – students will be able to demonstrate proper and safe use of laboratory equipment.

Assessment – weekly evaluations of students' laboratory work by graduate assistant group leaders.

4. Proper experimental procedures in the laboratory – students will be able to demonstrate the proper laboratory procedures for testing hypotheses.

Assessment – weekly evaluations of students' laboratory work by graduate assistant group leaders.

5. Proper use of the modeling software, STELLA, for communicating results of experimental procedures – students will be able to use STELLA to develop graphic representations of mathematical models of theoretical concepts.

Assessment – (formative) use of a performance rubric and comments to evaluate students' use of STELLA to develop graphic representations of mathematical models of theoretical concepts in scientific manuscripts at their various stages of development and (summative) production of figures to communicate results in peer reviewed publications.

6. Teamwork skills – students will be able to demonstrate the ability to work productively and cooperatively in small groups and as a member of the entire research community.

Assessment – ethnographic analysis of electronic communications conducted between group members and other members of the research community and weekly evaluations of students' laboratory work by graduate student group leaders.

7. Interdisciplinary skills in translating quantitative theory into experimental analysis – students will be able to develop sound experimental hypotheses after careful reading of relevant, peer reviewed, scientific literature.

Assessment – weekly evaluations of students' work by graduate assistant group leaders, graduate assistant group leader use of a performance rubrics and comments to evaluate student manuscripts at their various stages of development and students' production of peer reviewed publications.

8. Skills in communicating experimental results for publication – students will be able to produce scientific manuscripts communicating the results of their experiments that are worthy of publication.

Assessment – graduate assistant group leader use of a performance rubrics and comments to evaluate student manuscripts at their various stages of development and students' production of peer reviewed publications.

During the year supported by this grant (FY 2007-2008) a post-doctoral researcher, Dr. Thomas Stiles, from the Texas A&M University College of Education & Human Development was consulted to refine the assessment tools for this study. Dr. Stiles conducted a series of interviews with Dr. Christopher Quick and other research leaders to develop a list of performance criteria for successful scientific researchers and four-point rubric for assessing the level of student performance within each criterion. This performance rubric was developed into an on-line survey with the assistance of Dr. Charles C. Farnsworth and his student worker. This improved instrument was used to replace the previously-planned assessment methods for the study.

The criteria, with subcategories for each criterion, used in the performance rubric were as follows:

1. Individual Curiosity
  - i. Self-Knowledge of Discovery
  - ii. Fascination with Phenomena
2. Being Inquisitive (in Team Context)
  - i. Self-Confidence in the Interactions with Team
3. Project Background Knowledge
  - i. Field of Research
  - ii. Lab Technique
  - iii. Problem-Situation
4. Subject Area Knowledge
  - i. Research Process
  - ii. Interdisciplinary Approach
5. Being Critical
  - i. Judging Information Quality
  - ii. Perspective-Taking
  - iii. Question Colleagues
6. Creativity
  - i. Realizing Connections
  - ii. Insights into Situation
  - iii. Seeking Alternative Solutions
7. Project-Orientation
  - i. Does the Work of Research
  - ii. Pursues Productive Goals of Project
8. Interest in Doing Research
  - i. Personal Interest
  - ii. Shared Interest with Community
9. Independent Inquiry
  - i. Individual Initiative
  - ii. Problem Solving
10. Collaboration with Others
  - i. Coordination with Team
  - ii. Communication with Others

Nineteen undergraduates involved in the eBat Research Intensive Community participated in an end-of-the-semester, on-line survey. In the survey, each student was asked to perform a self-evaluation of their performance using the four-point rubric developed for the survey by Dr. Stiles.

### **Summary of Results**

The average self-evaluation score for the group was 3.1990, with individual averages ranging from a low of 2.6875 to a high of 3.7813. The nineteen students were put into groups according to where their average score fell in relationship to the overall mean.

Group 1: Average score is  $\leq 1$  std. dev. below the mean – five students were in this group.

Group 2: Average score is < the mean but less than 1 std. dev. below the mean – three students were in this group.

Group 3: Average self-evaluation score is => the mean but less than 1 std. dev. above the mean – nine students were in this group.

Group 4: Average self-evaluation score is at least 1 std. dev. above the mean self-evaluation score – two students were in this group.

We plan to have research leaders evaluate each of the nineteen students and compare their ratings to the self-evaluation scores. Also, we plan to track the students over the next year to correlation self-evaluation scores with program outcomes for each student.

### **Closing the Loop**

Assessment data will be analyzed each semester to gauge the effectiveness of the eBat Research Intensive Community in reaching its goals. These data will also be used to discover new ways to improve the program. If the data indicate that the program is successful in achieving its goals then we will seek to publish the data as a means for improving other undergraduate research programs.

### **FY 2008/2009 College of Veterinary Medicine & Biomedical Sciences Institutional Assessment Budget**

Assessment activity 1 – Collection and analysis of eBat participant data.

\$5000.00 Funds for Dr. Christopher M. Quick to provide either a faculty stipend or graduate student salary to obtain research assistance during the spring 2009 semester for the eBat student research program.

Assessment activity 2 – Development of assessment tools for an inquiry-based course, Mammalian Functional Neuroanatomy.

\$5000.00 Funds for Dr. Gladys Ko to provide either a faculty stipend or graduate student salary to develop online assessment tools for her inquiry-based course, Mammalian Functional Neuroanatomy.