

## Developing a Resource Library and Common Web Interface for Biochemistry

**Specific Objectives:** Enhance a basic course in biochemistry and standardize it across multiple large-enrollment sections taught by several instructors.

### I. PRIMARY DEVELOPMENT PHASE

#### 1. Programmatic Significance

a. Overview: The Biochemistry, Molecular Biology and Biophysics Department (BMBB) is responsible for instruction of biochemistry to undergraduate, graduate and professional students. In particular, the BioC 3021 course is required for most students in the College of Biological Sciences, as well as students from a number of other colleges at the University. BioC 3021 is a demanding course, covering a large volume of material on many topics. Students sometimes have difficulty knowing what to focus on and how to study the material effectively. Improving study options that enhance learning will benefit both students and faculty. We propose to develop a Biochemistry Resource Library (searchable online web site and database) and a common web site interface for all of the course sections. This resource will serve a number of purposes: enhancement of students' ability to learn biochemistry content, aid course instructors in developing their sections, and provide consistency among the multiple course sections. We propose to use several components of WebCT in building this resource including individual section web sites, quizzes and tutorials.

b. Courses affected: BioC 3021 is a large enrollment undergraduate biochemistry course, which provides the foundation for advanced studies in all areas of the biological sciences. Seven sections are taught on campus, and three sections are offered through IDL, serving nearly 1000 students per year. In addition to the BioC 3021 undergraduate course, there is a professional level version of the course offered as BioC 6021. BioC 6021 is based on the same lectures and exams as BioC 3021, but students must complete an additional project. In building the course web site and developing the enrichment activities, the professional students enrolled in BioC 6021 will be asked to devise appropriate tutorials and review materials to contribute to the web site. In this way, the professional students will fulfill their extra project requirement, will enhance their understanding of the course material and will have an invaluable experience in curriculum design. A long range plan is to expand the resource library to include content appropriate for several course levels (eg. 2011, 3021, 6021, 4331) and to potentially become a resource for many courses with biochemistry content.

c. Outcomes: The development of a common web site and searchable Resource Library for BioC 3021/6021 will have several positive outcomes. Most importantly, students will have access to new online resources to help them navigate a complex and challenging subject. Previous students were surveyed for their opinions about the use of technology in this course. The majority (73% of 155 respondents, including both in-class and distance students) asked for more technology enhancements in the form of quizzes, tutorials and online lectures for review, exam preparation and reinforcing concepts. The resource library will enhance student learning by helping them identify core course material, self-test their knowledge and provide easy connections between their questions and relevant course material. Current faculty will benefit from this resource as they design new lectures or enhance current lectures. New faculty rotating into this course will benefit since the web site/Resource Library would be an in-valuable guide for expectations for the course, and the information contributed from previous instructors will be available for use. Beyond the technological significance, another valuable outcome will be the generation of discussion among the instructors regarding appropriate learning

tools and approaches for enhancing student learning. In addition, this common resource will improve course continuity from year to year and section to section.

d. Specific Design: The overall plan is to develop a common web site that includes the course homepage and list of topics covered in the course. This information would be publicly available. The homepage will link to individual section homepages and to resources that would be accessible with various levels of password protection. A self-study resource will contain the entire set of course topics, divided into subtopics and linked to class presentation materials. Students may self-test via quizzes that consist of answers linked to the corresponding course materials. Some components of this resource will be patterned after technology enhancements that have been successfully implemented for General Biology. The resource can be viewed as having 4 parts:

- i. Homepage: A common BioC 3021/6021 homepage will introduce students to the goals of the course and course content. The homepage will link to individual section homepages, which contain the section syllabus, exam information, announcements, and access to the student's exam records. Self-study resources will be available to all students with X.500 access, serving a large population of students who require a foundation in biochemistry to advance in their chosen discipline.
- ii. Content: The major topics and subtopics covered in the course will be listed. For each topic a student could revisit topics covered in class via digital images with accompanying explanatory text, searchable QuickTime video clips currently available from the PI of this project, and future interactive exercises.
- iii. Self-testing: Students also will be able to approach each topic through self-testing. Quizzes will be developed that contain questions each linked to relevant course material. This resource will reinforce learning, detect misunderstanding and provide easy and immediate access to specific explanatory material.
- iv. Research Activities: This U of MN generated resource library also will be a vehicle to display U of MN research activities. Links between course topics and U of MN research will add relevance to the study of biochemistry and feature the U of MN faculty and laboratory contributions to the field of biochemistry.

An example of the self-study resource site design: For the topic of protein structure, the resource library will contain drawings to illustrate primary, secondary, tertiary and quaternary protein structures. An interactive module may show a three-dimensional protein structure that contains a variety of secondary structures and bonding interactions; students can point to different areas of the diagram to identify particular types of secondary structures ( $\alpha$ -helix,  $\beta$ -sheets) or particular types of interactions (covalent, ionic, hydrophobic, etc.). Video clips or QuickTime movies will be used to illustrate conformational changes in protein structure. A number of quiz questions will be developed to test the student's knowledge of this material. Answers and explanations of questions will be provided, some of which will be in an interactive format. Research links to faculty working on protein structure and function will give students information about current research interests on campus and identify faculty as potential research mentors for undergraduate projects.

## 2. Evaluation Plan

a. Student surveys. Student feedback will provide important information concerning the value of this web site and suggestions for improvement. A link on the web site will be available for student comments throughout the semester. Students will be able to provide open-ended responses, and will be asked to respond to specific questions at selected intervals throughout the course. Specific questions concerning the web site will be incorporated into the course evaluation. Survey responses will be used to guide modifications to the web site.

b. Faculty surveys. Faculty teaching the course will be urged to provide comments and concerns about the web site content and design throughout the course, and will be formally surveyed at the conclusion of each semester.

c. Survey evaluation: a TA from Science Education will be hired to help with design and analysis of surveys.

### 3. Timetable and Budget

a. Timetable: During the first six months of this grant, the shell for the web site will be established, which will incorporate digital images and other resources currently available from the PI of the grant. The second six months of the grant will focus on enhancing a library of resources for the course topics. Two or three of approximately 12 total topics will be developed in depth to use as a model for developing the remaining topics. In the second year, 3-6 additional topics will be added, and instructors who are rotating into the course will be shown how to use the tools and participate in the development of the resources. In future years, additional material will be added to the web site by the course instructors. An advisory committee composed of a subset of the instructors will be formed to monitor additions to the web site.

<u>b. Budget Items: Year 1</u>	<u>Amount</u>	<u>Total</u>
Paul Kluge - IT Professional in BMBB (~5 hr/wk @ \$22.72/hr, salary + fringe)	\$6000	
Develop homepage; organize resource library; provide web support		
Science Education TA - advise on the development of quizzes, tutorials, surveys for the resource library, and also on evaluation design (50 hr @ \$20/hr)	\$1000	
WebCT and other software training for faculty, TAs and staff	\$ 600	
Hardware/Software: PowerMac G4 and 19" CRT Display; external HD	\$2400	
		\$10,000
<u>c. Budget Items: Year 2</u>		
Paul Kluge - continued work on resource library and additional topic areas	\$1500	
Science Education TA - Evaluation of surveys	\$1000	
		\$2500

### 4. Collegiate and Departmental Support

Faculty release time for the principal investigator and faculty participants will be granted by the department to oversee development of the web site.

<u>a. Matching funds: Year 1:</u>		
Organization and digital contributions		
PI: Professor John Anderson (5%)	\$6095	
Co-PI Instructor Mark Arneson, (5%)	\$1967	
Organization and content advisory committee (teaching faculty - 1% each)		
Janet Schottel, Ken Adolph, Alan Hooper, Robert Roon	\$3344	
		\$11406

b. Matching funds: Year 2:

Mentorship and training for mentees in the use of the technology (1% each)

John Anderson, Mark Arneson, Janet Schottel, Ken Adolph, Alan Hooper,  
and Robert Roon

\$5052

**II. MENTORSHIP PHASE**

Faculty who have experience with digital media and development of the web site and Resource Library (PI John Anderson and Co-PI Mark Arneson) will mentor faculty who have various levels of experience with technology (Janet Schottel, Ken Adolph, Robert Roon, and Alan Hooper). Procedures for using and enhancing the web site will be developed by the advisory committee to encourage instructor participation and contribution. In addition, assistance with survey evaluations by a Science Education TA will facilitate the refinement and improvement of the learning resources. The BMBB Department will provide continued support for the training of the teaching faculty and updating of the Resource Library.