

Project Year

2013-2014

Project Title

Publication of Biochemistry Lecture Notes in E-Book Format with Interactive Content

Project Team

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Audience

The project will serve the course *Biochemistry I* (250.307), offered annually and required for Biophysics majors. Currently the course is limited to 15 students and this limitation will be lifted next year with the opening of the new computer classroom in the Undergraduate Teaching Laboratories addition in Mudd Hall. The four credit course is approximately half lecture sessions and half computer laboratory sessions. Future expansion to serve *Biochemistry II* (250.308), the second semester continuation of *Biochemistry I*, is anticipated.

Pedagogical Challenge

The lecture portion of the course is held in a standard lecture hall and includes many clicker questions. This works well only if the students have prepared by reading lecture note handouts made available to them ahead of time. Many students bring these hard copy handouts to class for reference during the clicker question discussions. These instructor-prepared handouts include numerous chemical diagrams and molecular graphics images. For many of these visual aids online, interactive versions exist but must be accessed using a standard computer and previously installed software. Therefore the interactive aids are largely ignored.

Solution

In order to allow students continuous access to lecture notes before class in a portable form that can also be brought to class and in a format that includes interactive diagrams and molecular graphics displays, we propose to create interactive e-book versions of the Biochemistry lecture notes. The novel and potentially important pedagogical aspect of this project is the embedding of interactive visual aids into ubiquitous lecture notes.

Faculty Statement

The use of clicker questions during lectures has been adopted by many faculty as a means to engage students and provide feedback to the instructor. I have used clickers in class for two years. They can work well, but for a very factual body of knowledge such as Biochemistry, the clicker questions only generate useful discussion if a majority of the students have previously spent time reviewing the material. Getting students to read ahead of time is not an easy task and anything that would facilitate this process would be welcome.

Currently, the instructor generates conceptual lecture notes that supplement the textbook. These notes are posted online and hardcopies are handed out to the class at least a day ahead of the lecture. Although hardcopies seem old fashion, the students have asked for these to facilitate reading and so that they can bring the hardcopies to class. These documents are used during the spirited discussions that ensue for each clicker question.

An e-book version of the lecture notes would address both problems of handy access and portability. However, these two advantages are perhaps of less importance to the project than the inclusion of interactive visual aids in the e-book version of the lecture notes.

Many of the concepts in biochemistry are illustrated either by chemical reaction pathways or through the use of molecular graphics programs that allow interactive viewing of molecules. Animated chemical reaction pathways are very useful and we currently use Javascript to generate these for viewing by students. To be viewed while reading the lecture notes requires a separate browser on a device running Javascript. Molecular graphics programs are used extensively to view both small and large biomolecules and these programs allow the viewer to appreciate the 3D structure of these molecules. A standalone graphics application (PyMOL, VMD, etc.) must be installed on a device and launched separately in order for the student to view the molecular graphics object while reading the notes. Both Javascript and interactive molecular graphics objects can be embedded into iBooks documents. These interactive objects are within the text layout and are easy to access while reading the text. This juxtaposition is quite impressive.

We believe that the combination of continuous remote availability, portability, and embedded interactive visual aids will stimulate students to view the subject material before class when the relevant clicker question discussions will occur.

We are entering the era of “Bring Your Own Device” to the classroom. The iBooks files can only be viewed on iOS devices. Other e-book formats do not currently allow the combination of interactivity suitable for the biochemistry examples. More interactive ebook authoring apps and formats are appearing, e.g. Inkling, iBooks Author, Adobe DPS, HTML5, Wolfram CDF. Which one of these will eventually become the standard is unknown. Rather than waiting the competition of formats to get sorted out, we hope to be able to start with iBooks to test the concept.