

## **Reform of Introductory Science Courses for Non-Majors Final Report**

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Institution: **Birmingham-Southern College**

Title of Project: **A Textbook Prototype for Non-Science Majors Cancer Biology Courses**

Date(s) of Project: **June 1, 2005-April 30, 2007**

Amount Awarded: **\$8,000**

### *1. Original goals and objectives*

The goal of this project was to construct a prototype non-majors cancer biology textbook (~200 pages in length) that uses an interdisciplinary, evidence-based approach to engage students in the process of science while also presenting substantial and rigorous content.

### *2. Any changes made in goals/objectives to date*

Although the goal to have an up-to-date, interdisciplinary, evidence-based resource for faculty teaching non-majors courses on cancer biology has not changed, the medium in which this goal will be achieved has been altered. Rather than producing a traditional, printed textbook, I have opted to develop an on-line text. This approach has several advantages, including:

- on-line texts can contain animations and other interactive material
- users are free to “jump” from chapter to chapter, helping them see connections between the diverse material presented
- web sites can freely link to a variety of other valuable resources
- web-based materials can be widely disseminated for free
- additions and revisions can be easily uploaded to the site, eliminating the need to wait for a publisher to decide to print a new edition

For users that prefer paper-based texts, pdf’s of non-interactive material (text and still images) will be available at the end of each chapter of this on-line text.

Due to the change in medium, the workload and writing demand of this project also increased substantially. Initially, the proposed textbook was a collection of readings that would be tied together by some supplementary text. Self-quiz questions and end of chapter exercises were also to be constructed. With the shift to a completely novel website, all material had to be written from scratch. Additional depth beyond the scope of this new on-line text is provided by links to other high quality educational materials on the web.

In addition to developing an initial draft of the on-line text, the goal of this project also shifted to include the adaptation and implementation of several in-class activities and lab exercises for use in cancer biology courses for non-science majors. Handouts describing these activities can be downloaded from the web.

3. *In what ways were the goals/objectives met. Please give examples.*

The goal of developing an on-line cancer biology textbook for non-science majors has been partially achieved, as a great deal of material has been posted on the web at <http://panther.bsc.edu/~phanson/cancer/>. Additional material is currently being reviewed by student editors and will be posted later this summer when the book is moved to its permanent home at <http://csunx2.bsc.edu/cancer/>.

Although not yet complete, the on-line textbook has begun achieving the goal of presenting fundamentally important scientific concepts in the context of cancer biology. For example, when discussing atoms, issues related to isotopes and radiation therapy are raised. Noncovalent bonds are discussed in the context of drug-protein interactions. Such applications of otherwise abstract concepts reinforce the importance of understanding fundamental scientific theories before one is prepared to tackle a “real world” problem such as cancer.

In addition to achieving the goals of this project through the development of the *Cancer – Biology and Beyond* hypertextbook, the proposal’s objectives have also been achieved through a \$34,540 “spin-off” grant funded by the Center for Educational Technology. In collaboration with Mike Roy and Anne Loyer at Wesleyan University’s Learning Objects Studio, we have developed the *Perspectives on Cancer* learning object, a dynamic teaching resource that can be found at <http://learningobjects.wesleyan.edu/cancer/>. This web-site continues the evidenced-based approach to teaching cancer biology as students can explore actual epidemiological data when searching for correlations between cancer mortality and lifestyle. This epidemiological approach to cancer is complemented by the portion of the site that focuses on the molecular basis of cancer. Users are invited to adopt a character profile and then monitor the accumulation of mutations in a single cell of their character. This narrative approach allows users to visualize the impact of behavior on mutation rate while actually observing that it takes many mutations for a cell to become cancerous.

In conclusion, although the *Cancer – Biology and Beyond* hypertextbook has not been fully completed, many of the goals of this project have been met through the progress made to date and through completion of the *Perspectives on Cancer* learning object that arose from the ACS-Keck Science Reform Mini-Grant.

4. *Describe the evaluation/assessment process used.*

The materials developed through this grant have been evaluated through a variety of means including the use of student editors, focus groups, and anonymous surveys given to Cancer Biology students. To assess the *Cancer - Biology and Beyond* web-site for overall readability, student editors read and provided feedback on the content. Interactive materials and lab exercises were tested by student volunteers. Their feedback was solicited through an informal focus group. Furthermore, anonymous feedback was solicited from students enrolled in the *Cancer- Biology and Beyond* course during Spring 2007. Data from these assessment efforts can be found in the report submitted on March 15, 2007.

5. *If you were to redesign your project, what would you do differently and why?*

If I were to redesign my project, I would have paid student web-designers to be involved from the beginning. Such a strategy would have allowed me to focus on the web-site's content without getting bogged down in the construction of graphics, animations, links, etc.

6. *Have you shared the results of your project with ACS colleagues and beyond?*

The results of this project have been widely disseminated. This work was first presented at the ACS Science Reform Workshop at Furman University in Fall 2005. Progress on this project was also presented at the Education Section of the American Society for Cell Biology Meeting in December 2005. Assessment of lab exercises and the associated CET-sponsored Learning Object were presented at the Computers in Teaching and Research Poster Session at the Experimental Biology Meeting in April 2007. Furthermore, instructors from several institutions have contacted me by e-mail to discuss how they might best use the resources I have developed through this grant.

7. *What are the next steps (follow-up) on your project?*

The next major step is to complete development of the web-site. Although a substantial amount of material has already been posted, additional writing, revision and site construction are required. In addition to basic content, several novel features will be added, including "Breaking News" pop-ups, which will bring relevant news items to the attention of readers. When appropriate, these news elements will be used to highlight the ethical, legal, and social implications of advances in cancer research. For example, one breaking news pop-up will feature the Texas governor's efforts to make HPV vaccination mandatory in his state. Such controversial news items will help students see how cancer biology is relevant to their daily lives and can even impact their civil liberties.

I also plan to continue assessment and dissemination of this project. When the *Cancer – Biology and Beyond* course is taught next (Spring 2009), student users will be repeatedly surveyed for their opinion of the site. Results of this evaluation and assessment of the associated *Perspectives on Cancer* learning object will be written up for possible publication in a relevant science education journal such as *CBE-Life Sciences Education*.

## 8. Financial Statement

### Proposed Budget:

<b>Item</b>	<b>Cost</b>
Stipend for Pamela Hanson	\$5000
Travel to Meetings	
American Society for Cell Biology, December 10-14, 2005	\$1500
Cost of Printing and Distributing Textbook Prototype	\$1500
Estimated cost of \$75 per book includes copyright fees, printing fees, and shipping and handling	
<b>Total</b>	<b>\$8000</b>

### Actual Expenditures:

<b>Item</b>	<b>Cost</b>
Stipend for Pamela Hanson	\$5000.00
Travel to Meetings	
American Society for Cell Biology, December 10-14, 2005	\$985.00
Experimental Biology Meeting, April 28-May 1, 2007	\$989.41
Supplies for Web-Site and Lab Development	
BioDraw Ultra	\$185.00
Adobe Illustrator	\$204.95
Lab Supplies	\$90.99
Assessment	
Stipends for Student Editors	\$500.00
Food for Focus Group	\$44.65
<b>Total</b>	<b>\$8000</b>

\*Please note: Any discrepancies with previous reports are due to errors by Birmingham-Southern's Accounting Department. During several administrative shifts that occurred during the last two years, I was unable to access account records. Upon further investigation this spring I discovered that several items that were supposed to be charged to the grant were not. Furthermore, some costs that were supposed to be shared by the College were not handled appropriately. Our accountants informed me that these errors (predominantly from 2005-2006) could not be corrected.

9. *I give the Associated Colleges of the South permission to post my original proposal and the results of my project on the ACS Science Reform Web-Site.*

Send your report to  
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