

“The Case of the Pilfered Plants”: Biotechnology (and More) Using an Interactive CD-ROM

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Abstract

The primary goal of this mini-workshop was to give participants an opportunity to test an instructional module in biotechnology. The module, which can stand alone or be accompanied by hands-on laboratory exercises, was developed for a college-level introductory biology course and takes the form of an interactive CD-ROM-based case study in forensics. Among the module features: an on-line laboratory notebook; detailed explanations and interactive animations illustrating laboratory techniques for chromatography, PCR, blood typing, and fiber analysis; and a “crime” that doesn’t involve murder or rape, but which serves as a springboard for discussions of rainforest destruction, genetic engineering, and animal rights issues.

The case study opens in a laboratory, which is pictured on the students’ computer screens. Students click on a newspaper (or a radio) in the lab to read (or hear) that the lab has been vandalized and that rare rainforest plants have been stolen from the university greenhouse:

“The UNC-Charlotte Department of Biology today reported thefts of materials which might have provided new hope to thousands of people suffering from a variety of tumor-related diseases. The materials, taken from the McMillan greenhouse and from researchers’ labs, were part of an ongoing project to develop an anti-tumor drug with promise for treating certain forms of cancer as well as a rare condition known as *Von Hippel-Lindau disease (VHL)*...”

As the scenario unfolds, students learn that the losses in the laboratory include bacteria that had been genetically engineered to express a tumor-repression factor originally discovered in the rainforest plants. Students are asked to examine the physical evidence of the crime and determine the strength of the case against each of three “suspects” (a disgruntled former graduate student, an entrepreneur with interests in a competing drug company’s tumor-repression factor, and an animal-rights activist unhappy about impending animal testing of the tumor-repression capabilities of the drug). The case continues with students “searching” the lab and discovering crime-related clues. The clues provide a backdrop for introductions to the theory and practice of DNA fingerprinting, chromatography, fiber analysis, and blood typing. In addition to their examination of the evidence, students are asked to consider the “weight” of evidentiary findings, to examine the difference between fact and theory, and to take into account how “probability” and “chance” factor into the certainty with which a conclusion can be made. In the culminating module activity, students prepare a report for the local district attorney in which they outline and analyze the strengths and weaknesses of the prosecution’s case against the potential suspects.

The module was initially designed for a course that serves 1200–1500 students each year, including an important sub-group of pre-service K–6 teachers. As with many such courses, the majority of students enroll to fulfill general education requirements and large numbers come to the course poorly prepared for college level work in the sciences. And, as often happens, the limited laboratory experience of these students, coupled with time, space, and funding constraints, relegates many of the wet-lab experiences to relatively unsophisticated cookbook exercises that can be completed within a 3-hour laboratory period. In our course, the module is paired with hands-on laboratory exercises and was conceived as a way of engaging student interest while introducing technically difficult and biologically complicated subject matter.

In testing the module, however, we’ve found applications beyond the introductory non-majors course. In addition to using the module with our general population of students, the module has also been examined by teachers of advanced-placement high-school biology and groups of their students,

by pre-service K–6 teachers, and by some of our biology majors and faculty. Minor modifications (*e.g.*, changing questions that accompany the module, spreading the topics covered by the module over several weeks, coupling the module with more complex laboratory exercises) make the module appropriate for use by high-school students as well as by upper-division undergraduates.

Response to the module has been overwhelmingly positive, with students commenting that the module increased their interest and understanding of biotechnology, genetic engineering, and forensic biology. Most of the difficulties we have encountered have been relatively minor and correctable: problems with navigating through the module, text and questions requiring clarification, images requiring revision. At times, we find students who are surprised by the content-heavy nature of a module that also contains a solve-the-mystery “game”; we take their surprise, however, as evidence that the “game” aspect of the module has not overshadowed the goal of teaching important biological concepts.

Additional information about the module and its distribution is now available through: <http://www.golgigroup.com/>