

## **Interdisciplinary starting points: Investigative case studies in introductory science and mathematics courses at Hope College**

Joanne L. Stewart, Department of Chemistry, Hope College

Contemporary science education must begin to reflect the rich interdisciplinary nature of modern scientific research. It should develop in students the intellectual capacity to deal with complex problems, the confidence and willingness to approach problems from multiple perspectives, and the flexibility to communicate with scientists from other disciplines. In order to introduce students to interdisciplinary thinking early in their college careers, the faculty at Hope College are developing interdisciplinary case studies for introductory science and mathematics courses with support from the Howard Hughes Medical Institute.

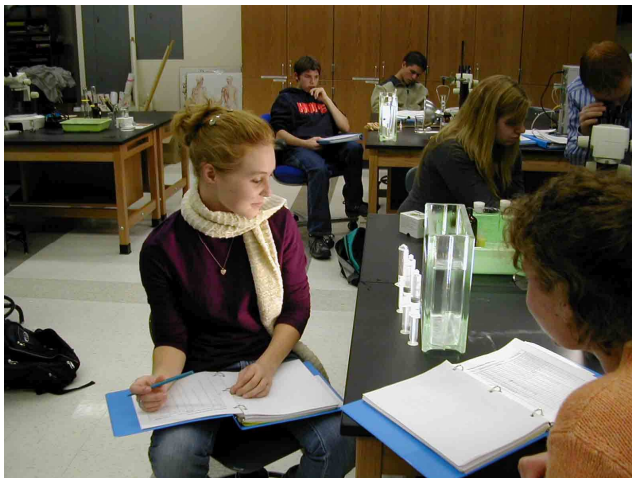
The case studies focus on compelling, real-world problems and incorporate activities grounded in research on learning. They employ data-rich approaches that develop students' ability to think about problems quantitatively and from different disciplinary perspectives. The structure of the case studies is modeled after BioQUEST's "investigative case studies." The problem is introduced through a story, and students design an investigation to address the problem. Students carry out the investigation and are expected to articulate and support their conclusions.

For example, students in Hope College's introductory chemistry and biology courses meet Claire and Ben, two imaginary Hope students with an unusual interest in carbon dioxide emissions, plant growth, and global climate change. In chemistry, Ben and Claire ponder which emits more CO<sub>2</sub>, driving or breathing, and students are challenged to design and carry out an experiment to answer the question. This laboratory was inspired and adapted from work by the NSF-sponsored ChemConnections consortium. In biology, Ben and Claire wonder if increasing atmospheric CO<sub>2</sub> levels will be ameliorated by increased plant growth. They soon realize this is a very complex question, and students are challenged to design and carry out experiments that explore the effect of different variables—CO<sub>2</sub> levels, temperature, wavelength of light, and plant type—on photosynthetic rates.

Finally, pairs of chemistry and biology students are brought together to share what they have learned about sources and sinks of atmospheric carbon dioxide. They compare their results to those presented in a well-known global carbon cycle model. They explore the similarities and differences in how biologists and chemists approach complex problems—how questions are framed, what counts as evidence, and what types of conclusions are acceptable.

Additional interdisciplinary case studies were developed this year on the biology and physics of vision, genetic and psychosocial influences on alcohol dependency, the chemical selectivity of biological catalysts, and dune ecology. These early introductions to interdisciplinary thinking develop in students the habits of mind needed for more advanced interdisciplinary studies and for participation in richly interdisciplinary research programs.

**Hope College students in introductory chemistry and biology courses participate in interdisciplinary case study on the global carbon cycle.**



Introductory biology students measure photosynthetic rates.



Introductory biology students design an experiment to measure the effect of light intensity on photosynthetic rates.



Introductory chemistry students devise an experiment to measure their personal contributions to atmospheric carbon dioxide.