

Teaching Biology for a Sustainable Future

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Teaching Biology for a Sustainable Future

SUSAN MUSANTE

Students at Calvin College in Grand Rapids, Michigan, can now take an innovative biology course in which an integrated, interdisciplinary, problem-based approach is used—one that the scientific community itself is promoting. The first course in a four-semester sequence, Biology 123—The Living World: Concepts and Connections—explores real-world problems and biology's role in addressing these major societal issues.

"We thought we could do a better job to help students retain conceptual knowledge from one course to the next and also to help students identify early on what you can do with a biology major," says Professor David Koetje, who coteaches the course with Associate Professor Amy Wilstermann.

In Bio123, students learn core biological concepts while developing their problem-solving and quantitative skills and applying their new knowledge to societal challenges related to food, the environment, energy, and health. The students work in teams and do not read a traditional textbook. Instead, they read trade books, such as Anthony Barnosky's *Heatstroke: Nature in an Age of Global Warming* and Michael Pollan's *In Defense of Food: An Eater's Manifesto*. "We spend time explaining to the students our rationale for doing the course this way and why we emphasize teamwork," Wilstermann says.

Courses such as this address critical needs identified by both the research and the education communities. The research community is increasingly interested in drawing connections between biological research and its application to societal issues, as is evidenced in the National Research Council's *A New Biology for the 21st Century*. The 2009 report highlights four of the major challenges facing our global society and argues that the biology community must "demonstrate that basic science research is not distinct from society but is a critical ingredient in developing

innovative solutions to societal problems." The report stresses that addressing the major challenges requires an interdisciplinary, collaborative approach.

For its part, the education community's 2011 *Vision and Change in Undergraduate Biology Education* report emphasizes that both faculty and students want to see courses connect biological concepts to real-world issues. The report outlines "core competencies" for students, including understanding the interdisciplinary nature of biology and developing communication skills. This report also states the need to prepare future biologists to work collaboratively "to address complex and increasingly interdisciplinary problems."

Many of these problems, such as those caused by climate change, the lack of a sustainable food supply, or reliance on nonrenewable energies, stem from years of shortsighted practices that will negatively affect future generations' quality of life. Sustainable solutions must take into account environmental, economic, and social implications, says David Hassenzahl, founding dean and professor at Chatham University's School of Sustainability and the Environment in Pittsburgh, Pennsylvania. He stresses the need for a holistic picture, saying, "Sustainability means treating as coequals environment, economics, and social justice and avoiding focus on any one of them." Students need to be inspired and prepared to join the scientific community's sustainability efforts.

Framing is critical when introducing global challenges and the impacts of unsustainable past practices to students. "One of the things we constantly wrestle with," says Koetje, "is providing a realistic picture of the situation while giving them hope." He and Wilstermann do not want to scare students into action. Instead, they provide students with information, tools, and experience so they can contribute to solving complicated problems.

"It turns students off when people are pessimistic," agrees Hassenzahl, adding that focusing solely on society's problems can lead to fatalism. "We should be innovative and optimistic," he says, and encourage students to think about how we can improve our quality of life as we put less demand on the planet.

Another new project is under way to support faculty who want to engage students in sustainability topics and connect course content to the "big questions" that students face as active citizens. Over the next couple of years, the project, called *Mobilizing Disciplinary Societies on Behalf of Our Students... and Our Planet*, will bring together societies representing a wide range of science, technology, engineering, and mathematics (STEM) disciplines to collectively assemble resources and provide professional-development opportunities for faculty. The project, funded by the US Department of Education's Fund for the Improvement of Post-secondary Education, is a collaboration among Project Kaleidoscope, Mobilizing STEM Education for a Sustainable Future, and the Disciplinary Associations Network for Sustainability.

Cathy Middlecamp, distinguished faculty associate at University of Wisconsin-Madison and one of the project's leaders, notes that, too often, faculty use teaching methods that do not support the ways in which people learn, the needs of the world, or the job market. By focusing on sustainability, students can experience firsthand the relevance of their STEM courses and can gain insight into how they can contribute to solving challenging global problems both throughout their lives and through their own career choices. Says Middlecamp, "We need to match our curriculum to the needs of our students and our planet."

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