Advancing Undergraduate Biology Education: a Critical Role for Disciplinary Societies

Scientific societies have an important role to play in keeping undergraduate education effective and relevant

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If you stepped into an undergraduate biology classroom today, what would you want to see? Individual answers will vary, but among the individual voices, a collective voice is rising to define what a 21st-century biology education should look like. Reflected in the National Academy of Science (NAS) reports “BIO 2010” and “A New Biology for the 21st Century,” and the American Association for the Advancement of Science (AAAS) and National Science Foundation (NSF) initiative “Vision and Change in Undergraduate Biology,” this collective vision is rooted in an awareness of the modern landscape: we now face unprecedented challenges that grow increasingly more urgent and complex as the world changes rapidly around us. Within this landscape, biology plays a vital role; it holds great promise for helping to solve many of the “grand challenges” we face, such as providing food, health care, and energy while preserving healthy environments and ecosystems, particularly in light of the rapid transformations that have occurred in the discipline in recent history. As the NAS and Vision and Change reports make clear, this modern landscape calls for a more problem-focused, process-oriented, interdisciplinary approach to biology, and today’s biology education should reflect this.

But while the landscape of modern biology has changed dramatically, undergraduate biology education has not. In many biology classrooms today, traditional, lecture-based approaches are still the norm despite mounting evidence showing that they are relatively ineffective; students are not learning concepts in a way that is retained over the long term, nor are they sufficiently learning critical, transferable skills, such as problem-solving, critical thinking, and teamwork. As a consequence, a new generation of scientists and citizens may not be getting the preparation they need to face the substantial challenges of the 21st century. The need for excellent STEM education to prepare students to rise to these great challenges, as professionals and as engaged citizens, has never been greater.

While the Vision and Change initiative sounds a call to action, much more work is needed for this message to be heard and for the needed changes to be implemented in our classrooms. This is a formidable challenge. We now have a rich body of knowledge about what works in a biology classroom. Yet despite the existence of this knowledge and associated materials, many faculty are not making the needed changes in their classrooms. The reasons for this lack of progress cannot be oversimplified as a divide between those who care and those who don’t, as the majority of scientists personally value education as much as they value research. Rather, the issue is complex and multidimensional; among other reasons, faculty may be unaware of these pedagogies, unwilling or unable to spend the time to adopt them, skeptical of their value, or weary of student resistance. There are, however, a growing number of faculty who have been able to make positive changes in their teaching practices and are inspiring others to follow their lead. A fundamental challenge in advancing biology education, then, is figuring out how to motivate and empower more faculty to improve their teaching.
practices and to create an environment that allows for such individuals to be rewarded for their efforts.

This is a challenge that disciplinary societies, as one of the most powerful forces in shaping the culture and priorities in a discipline, are well suited to tackle. A few biological disciplinary societies, including ASM, are leading the way. One of the barriers that these leading societies are tackling is the institutional and cultural attitude in many colleges and universities that teaching is secondary to research.

Recognizing that changes in the classroom will never happen unless there is a shift in what we value and a corresponding change in institutional policies, several societies are making efforts to promote the scholarship of teaching and learning. Given the heavy emphasis on publishing in academia, perhaps the single most effective way to accomplish this is by sponsoring venues for publishing high-quality education-related research. The creation of such venues is a statement of commitment to excellence in biology education, and ASM has made such a commitment by creating the *Journal of Microbiology and Biology Education* 11 years ago. The journal has now expanded its reach by broadening its scope beyond microbiology and becoming open access. Other societies have carved space for teaching and learning articles within their journals; for example, the American Institute of Biological Sciences (AIBS) publishes articles on advances in biology education and includes an “Eye on Education” column alongside their biology research articles in the publication, *BioScience*.

While the existence of these venues for publication of education scholarship is vital, disciplinary societies do much more to motivate and help faculty to make changes in their classrooms. They also play an important role in supporting both current and future faculty. This is accomplished in several ways, including the facilitation of professional development opportunities and support in building communities of biology educators. ASM has led several successful efforts in this arena. For example, ASM organizes an annual Conference on Undergraduate Education, which brings together a community of educators from across biology. The rapid growth of this annual conference, with 40–50% of registrants being newcomers at the last conference, is testament to the need for such a venue. Similarly successful are ASM’s popular Faculty Programs Institutes, which provide training to society members in new areas and topics such as functional genomics, bioinformatics, and learning interventions. ASM also runs a faculty training program that helps individuals gain experience with scientific teaching and the scholarship of teaching and learning. This Biology Scholars Program aims to help faculty make the needed changes in their classroom and to empower them to be agents of change within their own professional societies. The program, which reaches beyond the microbiology community, continues to build an interactive community of committed Biology Scholars. Efforts like these not only provide inspiration and support for individual faculty, but they also make a powerful statement about how a society, and the disciplinary community it represents, values and invests in education. It is a statement that answers the call for Vision and Change.