

Optimizing your undergraduate teaching as you would an experiment: developing the next generation of cell biologists

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ABSTRACT The American Society for Cell Biology (ASCB) is a community dedicated to helping prepare the next generation of scientists to advance our understanding of the cell to an unprecedented level of sophistication and detail. Its Education Committee fosters this process by creating educational and professional development opportunities around best practices in science pedagogy, while its Minorities Affairs Committee aims to strengthen the scientific workforce by broadening participation of and support for underrepresented minorities in cell biology. To act upon these complementary priorities, the ASCB has developed a Declaration on Effective and Inclusive Biology Education. Its purpose is to outline practical actions for stakeholders in undergraduate education at the levels of faculty, departments, institutions, professional organizations, and funding agencies. Its recommendations are rooted in evidence-based best practices to support the success of diverse and heterogeneous undergraduate demographics and are designed to be highly adaptable to the existing strengths and needs of individual practitioners, student populations, and institutions. We acknowledge the ever-evolving nature of best practices in undergraduate education and hope that the dissemination of this declaration will play a role in this iterative process.

To the Editor:

Before engaging in an experiment at the bench, we maximize chances for success by optimizing each step of the protocol. Rather than improvising or building a procedure from scratch each time, we incorporate evidence-based elements from the primary literature that have documented success and a reasonable chance of working in the desired application. This bears some similarities to the process by which we should implement and differentiate instruction for

our undergraduate students—the future of cell biology. Each time we teach a course to a group of undergraduates, even when the content is familiar, it brings an entirely new set of challenges and opportunities. The challenge is to create an inclusive learning environment that simultaneously catalyzes learning for students from diverse backgrounds, interests, and prior knowledge of the subject matter. The opportunity is to optimize our teaching to build on students' unique strengths to prepare the next generation of cell biologists, guided by evidence-based methods of teaching that have been demonstrated to work and documented in science pedagogy primary literature. The stakes are higher than for the typical process of optimization, as the experimental readout in this case is essentially for the field of cell biology and its workforce to be as innovative and diverse as it can be.

This responsibility of being strategic and inclusive in teaching the next generation of cell biologists has been one of the foremost priorities of the American Society for Cell Biology (ASCB). ASCB established *CBE—Life Sciences Education*, currently one of the premier education journals, in which we can find many pioneering

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and breakthrough primary literature articles related to best practices in science pedagogy (Dolan, 2018). Moreover, through the work of its Education and Minorities Affairs Committees, the ASCB has a long history of implementing programs and initiatives to raise awareness and provide opportunities to our members to engage in evidence-based teaching and mentoring of the next generation of cell biologists (Wilson and Haynes, 2002; Segarra *et al.*, 2017). ASCB has also been part of efforts to rally life sciences professional societies to expand undergraduate education efforts (Matyas *et al.*, 2017).

To continue this tradition, the ASCB has developed and adopted the *Declaration on Effective and Inclusive Undergraduate Biology Education* (www.ascb.org/society-news/ascb-declaration-on-effective-and-inclusive-undergraduate-biology-education/). Our declaration outlines actionable steps that can be followed by all stakeholders in undergraduate education, including faculty, departments, institutions, professional organizations, and funding agencies. Below is an example of two guiding principles for a faculty member:

Approach teaching and mentoring as an opportunity to learn and improve, including participating in teaching and mentoring professional development, reading and reflecting on how to use an education resource, and making a habit of noting what improvements to make in teaching and mentoring along with supporting data and reasoning.

Advocate holistic and formative (low-stakes assessments used before or during instruction to drive learning) evaluation of teaching, including moving beyond student end-of-course evaluations as a sole metric of teaching quality.

Most importantly, these recommended actions are in synergy with best practices in science pedagogy.

We encourage you to find ways to incorporate the recommendations in a way that is appropriate for the role you play in undergraduate education at your institution. We also encourage you to share these with others and support your colleagues in the adoption of these recommendations. By taking part in the evolution of best practices in undergraduate teaching and mentoring, each of us can play a role in optimizing the development of a powerful next generation of cell biologists.

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