CBE—Life Sciences Education: the story of a "great journal scientists might be caught reading"

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ABSTRACT **How did a moderately sized scientific society create what many consider to be the leading journal in biology education? As Editor-in-Chief of the education journal of the American Society for Cell Biology (ASCB), *CBE—Life Sciences Education* (*LSE*) and recipient of the 2018 Bruce Alberts Award for Excellence in Science Education, I tell the story of the establishment, growth, and impact of ASCB's "other journal."**

HOW IT ALL STARTED

Why would a group of cell biologists start an education journal? Back before the *CBE—Life Sciences Education* (*LSE*) launched under its original name of *Cell Biology Education*, I happened to be working with Samuel Ward, the first Editor-in-Chief of the journal. Sam had a habit of swinging by my office to bounce around ideas—he wanted nominations of education-interested biologists and education researchers with an interest in biology teaching and learning to serve as founding editorial board members of a new education journal. The journal would have three aims: 1) to provide an opportunity for scientists and others to publish high-quality, peer-reviewed, educational scholarship of interest to American Society for Cell Biology (ASCB) members; 2) to provide a forum for discussion of educational issues; and 3) to promote recognition for educational scholarship among scientists.

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I was intrigued but skeptical. Perhaps this new journal would be a source for scholarly information about teaching and learning that my fellow biologists would actually read. Or perhaps it would be disregarded as papers published in leading science education journals often were. "Who can understand all that education jargon!," I would hear my colleagues say, forgetting that they had also struggled to understand scientific jargon when they first started reading science research papers. They had a point, however. Many education journals are not written for people who teach and mentor undergraduate or graduate students in the life sciences or for readers who were not trained as education researchers or social scientists. *LSE* was designed to fill this gap—to publish education scholarship written by and for biologists. It was the right place at the right time—a visionary group of education-interested biologists joined forces with the staff and leadership of a professional society that was willing to think outside the box, and a journal was born.

The first issue of the journal was published by ASCB in 2002 with partial funding from the Howard Hughes Medical Institute. The journal experienced remarkable growth in readership and authorship under the leadership of Editors-in-Chief Malcolm Campbell and Sarah Elgin (2002–2007) and William Wood (2008–2010), and the editorial board of leaders in biology education (Dolan, 2014). When I became *LSE* Editor-in-Chief in 2011, I had some large shoes to fill. I am honored and delighted that the work I have done with *LSE* alongside a fantastic group of editorial board members and ASCB staff, including the research we have published in *LSE* on Course-based Undergraduate Research Experiences (CUREs) (Auchincloss *et al.*, 2014; Hanauer and Dolan, 2014; Corwin *et al.*, 2015a,b, 2018; Rodenbusch *et al.*, 2016) and mentoring of undergraduate

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researchers (Dolan and Johnson, 2010; Aikens *et al.*, 2016b, 2017), is being recognized with the 2018 Bruce Alberts Award for Excellence in Education. In this essay, I will share my perspective on why *LSE* has flourished and how it has influenced higher education in the life sciences and beyond. I will also highlight a few of *LSE*'s more innovative features in the hopes that everyone will find something that is useful to them in their work with students and colleagues.

DEVELOPMENT AND SUCCESS OF *LSE*

One of the keys to *LSE*'s success has been to take what we know makes for effective scholarship in the life sciences and apply it to publishing in education. For instance, *LSE* maintains a rapid review process. While many education journals take six or more months to reach an initial decision on a manuscript and years to publish it, *LSE* follows the much faster timeline common in the life sciences, aiming to provide initial decisions within one month of submission. The journal's continuous publication process, started in 2014, ensures that papers are live on the journal site as soon as the redaction process is complete. *LSE* is also open access. Although changes in the funding and publishing landscape over the past decade have made open access scholarship more commonplace, *LSE* was groundbreaking in making education scholarship freely available so that instructors working with students at all types of institutions—not just well-resourced colleges and universities—could learn from the work published in the journal and ultimately benefit their students (Dolan, 2017).

Unlike most journals in the life sciences, *LSE* recognizes that some of its authors may have limited if any experience publishing an education paper and little if any formal training in designing, conducting, and interpreting education studies. Thus, we emphasize the provision of developmental feedback to authors. This can include anything from pointing out the particularly novel elements of the work that would be of interest to the biology education community, to steering authors to key references they may have missed, to helping authors think more deeply about their study design, methods, and conclusions, including shortcomings in their work and whether or how they could be mitigated. This requires being able to speak two "languages"—translating the disciplinary norms, theories, and knowledge from education research into terms and ways of thinking that are familiar to biologists. It would be easier to focus either on publishing biology education research or on publishing evaluation studies of educational innovations. Yet, letting the pendulum swing too far in either direction will limit the influence of the journal—either missing the practical applications and implications of education studies or missing the underlying theories and mechanisms that lead to more general understanding of "what works" in education and for whom and in what contexts (Dolan, 2015).

This is the tightrope *LSE* has successfully walked for almost two decades. Even with an influx of new authors and reviewers and elevating standards in the field, *LSE* editors and staff continue to receive positive feedback about the constructive nature of reviews, even from authors of manuscripts that are not selected for publication. One such author recently wrote, "I'm encouraged to see that *LSE* still provides so much thoughtful guidance. Your detailed insights and suggestions for references to review will be extremely helpful as we continue our work. This level of collegial support for authors has become increasingly rare, but still is greatly appreciated."

LSE editors and staff also continue to receive positive feedback from biologists indicating that the journal publishes work that is approachable to them. This is a particularly noteworthy accomplishment given the rapid growth and development of the field of biology education research (BER). *LSE* has emphasized the importance of authors presenting their work in ways that are comprehensible to the diverse readership of the journal, including biology education researchers and education-interested biologists. As the journal has matured, our strategies for building capacity among life scientists to read, evaluate, and conduct biology education studies have also matured. For example, the journal launched the Current Insights feature in 2007, in order to draw attention to papers published in other journals that are likely to be of interest to *LSE* readers (Dolan, 2007). The journal also launched Research Methods essays in 2013 (Dolan and Stone, 2013), which aim to introduce readers to established social science methods and techniques, including where to learn more. *LSE* has continued to publish Approaches to Biology Teaching and Learning (Allen and Tanner, 2002). This wildly popular essay series authored by Kimberly Tanner and colleagues synthesizes scholarly work from diverse disciplines and discusses its applications and implications for teaching and learning. *LSE*'s new capacity building resources include

- Evidence-based Teaching Guides (Wilson and Brame, 2018), which distill education research into practical guides on topics such as group work (Wilson *et al.*, 2018) and peer instruction (Knight and Brame, 2018);
- Anatomy of an Education Study, versions of *LSE* papers that have been annotated to make transparent various aspects of study design, methods, interpretation, and presentation using a Learning Lens pioneered by the American Association for the Advancement of Science in the Classroom; and
- Online with *LSE*, a virtual journal club with authors of *LSE* papers, offering "behind the scenes" insights into how particular studies were done, including any implications for research and practice.

THE IMPACT OF *LSE*

Because of its unique position at the intersection of biology and education, *LSE* has published leading papers on diverse topics in undergraduate education, such as how course structure improves student learning and closes achievement gaps (e.g., Eddy and Hogan, 2014; Freeman *et al.*, 2011), the development and validation of tools for measuring teaching and learning (Smith *et al.*, 2008, 2013a,b; Eddy *et al.*, 2015), and strategies for helping students learn to read and evaluate primary literature (Hoskins *et al.*, 2011; Round and Campbell, 2013; Sato *et al.*, 2014). The journal has also published some of the first studies to explore the education and career trajectories of graduate students and postdoctoral associates in the life sciences (Gibbs and Griffin, 2013; Rybarczyk *et al.*, 2016; Price *et al.*, 2018). *LSE* was the first journal to publish collections of articles on the integration of mathematics and biology education and the integration of physics and biology education. Even though the journal had been published for only a decade, a 2012 National Research Council (NRC) report cited *LSE* as one of four journals in which the majority of papers presenting evidence on biology student learning and development had been published (Singer *et al.*, 2012). Papers published in *LSE* have also been cited in program announcements from the National Science Foundation and in other high-profile venues such as the *New York Times*, *USA Today*, and "Editors' Choice" in *Science*.

By providing a venue for life scientists and others to publish high-quality, peer-reviewed biology education scholarship, *LSE* has been a cornerstone in the development of the field of biology education research (BER). BER is a field of discipline-based education research (DBER), which is defined by the NRC as combining

"expert knowledge of a science or engineering discipline, of the challenges of learning and teaching in that discipline, and of the science of learning and teaching generally" (Singer *et al.*, 2012, p. 2) to address "discipline-specific problems and challenges" (p. 202) In recent years, graduate and postdoctoral training in BER has grown rapidly and there have been upward of 25 active searches for tenure-track positions in BER in a single year (Aikens *et al.*, 2016a; Dolan *et al.*, 2018). Many individuals in these programs and positions have chosen to publish their work in *LSE* because it is one of the "great journals scientists might be caught reading" (Slater *et al.*, 2010, p. 67).

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