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FEATURES

Editorial

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 Stefano Bertuzzi and Adam P. Fagen 318–319

Since its founding, *CBE—Life Sciences Education* has become the go-to place for biology education research and scholarship. Although the journal has always cultivated a broad range of authors, reviewers, and editors, we are pleased to announce that the Genetics Society of America will be joining ASCB as an editorial partner.

Editorial

Adding to the Biology Education Research Tool Kit: *Research Methods* Essays
 Erin L. Dolan and Elisa Stone 320–321

An increasing number of resources are becoming available to support the professional development of scientists transitioning to studying science education. *CBE—Life Sciences Education* is adding to the available professional development resources by launching a new type of essay, titled *Research Methods*.

Approaches to Biology Teaching and Learning

Structure Matters: Twenty-One Teaching Strategies to Promote Student Engagement and Cultivate Classroom Equity
 Kimberly D. Tanner 322–331

A host of simple teaching strategies—referred to as “equitable teaching strategies” and rooted in research on learning—can support biology instructors in striving for classroom equity and in teaching *all* their students, not just those who are already engaged, already participating, and perhaps already know the biology being taught.

Current Insights

Recent Research in Science Teaching and Learning
 Deborah Allen 332–335

This feature is designed to point *CBE—Life Sciences Education* readers to current articles of interest in life sciences education as well as more general and noteworthy publications in education research.

Book Review

A Pioneer of Hands-On Education
 Mary Lee S. Ledbetter 336–338

This biography of the physicist and science educator Frank Oppenheimer uses his crowning achievement, San Francisco’s Exploratorium, as the lens through which to explore his life and work.

Essay from the 2012 Bruce Alberts Award for Excellence in Science Education

International Institute for Collaborative Cell Biology and Biochemistry—History and Memoirs from an International Network for Biological Sciences
 L. C. Cameron 339–344

Memoirs by the 2012 recipient of the Bruce Alberts Award for Excellence in Science Education from the American Society for Cell Biology about the establishment of the International Institute for Collaborative Cell Biology and Biochemistry, which wants to inspire a new era of international scientific cooperation by exposing scientists to diverse learning experiences.

Research Methods

The Other Half of the Story: Effect Size Analysis in Quantitative Research

Jessica Middlemis Maher, Jonathan C. Markey, and Diane Ebert-May 345–351

Effect size measures are a key complement to statistical significance testing when reporting quantitative research findings. The authors provide a rationale for use of effect size and specific tools and guidelines for interpretation of results.

ESSAYS

Misconceptions Are “So Yesterday!”

April Cordero Maskiewicz and Jennifer Evarts Lineback 352–356

This essay provides an overview of the discussion within the learning sciences community surrounding the term “misconceptions.” Using examples of students’ incorrect ideas about evolution and ecology, the authors show that students’ naive ideas can provide the resources from which to build scientific understanding.

Underrepresentation by Race–Ethnicity across Stages of U.S. Science and Engineering Education

Howard Garrison 357–363

Differential graduation rates have the greatest impact on underrepresentation in science and engineering. Undergraduate and graduate school matriculation rates also contribute to the race-ethnicity gap. Race-ethnic differences among college freshmen’s plans for a science or engineering major are small and have less impact on later outcomes.

Problem- and Case-Based Learning in Science: An Introduction to Distinctions, Values, and Outcomes

Douglas Allchin 364–372

Problem-based learning and case-based learning embrace a wide range of overlapping but independent instructional strategies. Being aware of the variants, their values and learning outcomes allow informed and effective instructional design.

Post–*Vision and Change*: Do We Know How to Change?

Charlene D’Avanzo 373–382

Vision and Change in Undergraduate Biology Education: A Call to Action challenges biology educators to ask fundamental questions about widespread transformation of college biology teaching. This essay presents the argument that next steps will likely be limited because we lack evidence-based, reliable models for actually realizing the desired “change.”

ARTICLES

Scientific Teaching Targeting Faculty from Diverse Institutions

Christopher S. Gregg, Jo Dale Ales, Steven M. Pomarico, E. William Wischusen, and Joseph F. Siebenaller 383–393

The authors report on four annual professional development STAR (Scientific Teaching, Assessment, and Resources) workshops offered to faculty from community colleges, 2-yr campuses, and public and private research universities. A survey of participants indicates that, in the opinion of faculty from both the 2- and 4-yr campuses, STAR had a positive impact on teaching, student learning, and engagement.

Partnered Research Experiences for Junior Faculty at Minority-Serving Institutions Enhance Professional Success

Andrew G. Campbell, Michael J. Leibowitz, Sandra A. Murray, David Burgess, Wilfred F. Denetclaw, Franklin A. Carrero-Martinez, and David J. Asai 394–402

This paper describes achievements of faculty in federal funding, publication, and other areas following their participation in the Visiting Professorship (VP) Program. Achievements of participants were compared with those of matched peers and showed marked improvement following their VP experiences.

Experiences of Mentors Training Underrepresented Undergraduates in the Research Laboratory Amy J. Prunuske, Janelle Wilson, Melissa Walls, and Benjamin Clarke	403–409
<p>The goal of this research was to better understand the experiences and perspectives of mentors in a program designed to increase the number of American Indian students garnering PhDs. Challenges and benefits associated with mentoring undergraduates were identified through semistructured interviews.</p>	
A Summer Academic Research Experience for Disadvantaged Youth Cathryn Kabacoff, Vasudha Srivastava, and Douglas N. Robinson	410–418
<p>We describe an outreach initiative to provide disadvantaged youth with an intensive academic research experience. To offer an effective internship for these underrepresented youth, one needs to develop a comprehensive program that addresses the students' academic, professional, and personal needs.</p>	
It's Money! Real-World Grant Experience through a Student-Run, Peer-Reviewed Program Sonya B. Dumanis, Lauren Ullrich, Patricia M. Washington, and Patrick A. Forcelli	419–428
<p>The authors describe a student-run, peer-reviewed grant program. The program aimed to give graduate students an opportunity to conduct small research projects, to encourage them to write grants, and to give them an opportunity to review grants. Participants showed improved grant-writing skills and an increased understanding of the grants process.</p>	
Correlation between MCAT Biology Content Specifications and Topic Scope and Sequence of General Education College Biology Textbooks Steven W. Rissing	429–440
<p>The topic scope and sequence of introductory majors and general education (GE) biology texts correlate with Medical College Admissions Test (MCAT) topic importance ratings. GE texts have higher MCAT term densities than introductory majors texts. Indirect impact of the MCAT on GE texts may detract from scientific literacy goals of GE courses.</p>	
Bioinformatics Education in High School: Implications for Promoting Science, Technology, Engineering, and Mathematics Careers Dina N. Kovarik, Davis G. Patterson, Carolyn Cohen, Elizabeth A. Sanders, Karen A. Peterson, Sandra G. Porter, and Jeanne Ting Chowning	441–459
<p>We report the effects of our Bio-ITEST teacher professional development model and bioinformatics curricula on cognitive traits (awareness, engagement, self-efficacy, and relevance) in high school teachers and students that are known to accompany a developing interest in STEM (science, technology, engineering, and mathematics) careers.</p>	
Mutation-Based Learning to Improve Student Autonomy and Scientific Inquiry Skills in a Large Genetics Laboratory Course Jinlu Wu	460–470
<p>The innovative mutation-based learning approach (MBL) was created to encourage students to propose redesigns of teacher designed experiments and to then conduct both teacher-designed and student-designed experiments for comparison. The MBL approach improves students' autonomy and scientific inquiry skills.</p>	
Student Learning about Biomolecular Self-Assembly Using Two Different External Representations Gunnar E. Höst, Caroline Larsson, Arthur Olson, and Lena A. E. Tibell	471–482
<p>This study found that external representations can support university students' learning in a group discussion about the counterintuitive concept of biomolecular self-assembly. In addition, qualitative differences indicated that the tangible model was particularly well-suited to support learning of dynamic aspects compared with the static image.</p>	
Six Classroom Exercises to Teach Natural Selection to Undergraduate Biology Students Steven T. Kalinowski, Mary J. Leonard, Tessa M. Andrews, and Andrea R. Litt	483–493
<p>Six classroom lessons are presented for teaching undergraduate students in introductory biology courses how natural selection works.</p>	

Getting to Evo-Devo: Concepts and Challenges for Students Learning Evolutionary Developmental Biology
 Anna Hiatt, Gregory K. Davis, Caleb Trujillo, Mark Terry, Donald P. French, Rebecca M. Price,
 and Kathryn E. Perez 494–508

In this study we used surveys of evo-devo experts to identify the core concepts of evo-devo and outline an underlying conceptual framework. We also use interviews and surveys of conceptual difficulties with these concepts.

Increasing Student Success Using Online Quizzing in Introductory (Majors) Biology
 Rebecca Orr and Shellene Foster 509–514

Required pre-exam quizzes were given via an online homework platform. Students taking these quizzes had a significantly higher exam average than those who took none of the quizzes and had a significantly higher exam average than the class average. The benefit of quizzing is demonstrated to be significant for students of diverse academic abilities.

Verbal Final Exam in Introductory Biology Yields Gains in Student Content Knowledge and Longitudinal Performance
 Douglas B. Luckie, Aaron M. Rivkin, Jacob R. Aubry, Benjamin J. Marengo, Leah R. Creech,
 and Ryan D. Sweeder 515–529

The authors studied gains in student learning when curriculum was changed to include an optional verbal final (VF) exam. Students who passed the VF outscored peers on MCAT questions (66.4% [$n = 160$] and 62% [$n = 285$], respectively; $p < 0.001$), and passing the VF also correlated with higher performance in a range of upper-level science courses.

A Critical Analysis of Assessment Quality in Genomics and Bioinformatics Education Research
 Chad E. Campbell and Ross H. Nehm 530–541

An analysis of assessment quality in genomics and bioinformatics education literature found that a minority (<10%) of studies provided any validity or reliability evidence. This is concerning as it is at odds with the principles of scientific education research and the educational assessment standards.

Assessment of Student Learning Associated with Tree Thinking in an Undergraduate Introductory Organismal Biology Course
 James J. Smith, Kendra Spence Cheruvilil, and Stacie Auvenshine 542–552

We assessed student learning of tree-thinking concepts in an Introductory Organismal Biology course with labs that had been converted to inquiry-based instruction. Students made significant gains in their abilities to map characters onto cladograms and apply the principle of parsimony, but struggled with the concept of recency of common ancestry.

Assessing the Life Science Knowledge of Students and Teachers Represented by the K–8 National Science Standards
 Philip M. Sadler, Harold Coyle, Nancy Cook Smith, Jaimie Miller, Joel Mintzes, Kimberly Tanner,
 and John Murray 553–575

We present an analysis of the relationship between student and teacher mastery of National Research Council’s K8 life sciences content standards.

On the Cover

This diagram shows the formation of a tomato bushy stunt virus particle. Just like many other important biological structures, the virus capsid forms spontaneously through a process of self-assembly. Such processes are characterized by random encounters between subunits, upon which the subunits may “stick” to each other if their complementary surfaces come into contact. New additions lead to the formation of increasingly stable complexes, which increases the likelihood of further assembly. Through the seemingly simple scheme in the figure, a wide array of concepts are depicted, from the structure of a protein monomer, through the gradual buildup of a “shell” around the viral RNA, all the way to a completed virus particle. The complexity of the structure is further emphasized by using colors to indicate that identical monomer subunits end up in similar yet slightly different (quasi-equivalent) configurations. The article by Höst and coworkers (page 471) focuses on students’ learning about the self-assembly process. The main conclusion is that an interactive, tangible 3D model appears to support an understanding of the randomness of the process and other dynamic facets of biomolecular self-assembly. (Image credit: courtesy of Stephen Harrison)