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### GENERAL ESSAYS AND ARTICLES

#### BOOK REVIEW

##### **A Compendium of Rationales and Techniques for Active Learning**

*C. Gary Reiness*

A review of *Active Learning in College Science*, a compendium of techniques for promoting active learning by students, reasons why faculty should adopt active-learning approaches, and suggestions for how to deal with resistance from faculty or students to these approaches.

#### MEETING REPORT

##### **A Call for Data-Driven Networks to Address Equity in the Context of Undergraduate Biology**

*Seth K. Thompson, Sadie Hebert, Sara Berk, Rebecca Brunelli, Catherine Creech, Abby Grace Drake, Sheritta Fagbodun, Marcos E. Garcia-Ojeda, Carrie Hall, Jordan Harshman, Todd Lamb, Rachel Robnett, Michele Shuster, Sehoya Cotner, and Cissy J. Ballen*

National efforts to improve equitable teaching practices have led to an increase in research on the barriers to student participation and performance, as well as solutions for overcoming these barriers. This report summarizes the conclusions of a meeting exploring our understanding of how these practices differ among institutions and geographic locations.

#### ESSAYS

##### **Is Active Learning Accessible? Exploring the Process of Providing Accommodations to Students with Disabilities**

*Logan E. Gin, Frank A. Guerrero, Katelyn M. Cooper, and Sara E. Brownell*

This essay documents the challenges that active-learning practices pose for students with disabilities and how these challenges are currently being addressed by disability resource centers, or DRCs. Recommendations are presented for instructors and DRC staff who aim to create more inclusive active-learning science classes for students with disabilities.

##### **Advancing Science While Training Undergraduates: Recommendations from a Collaborative Biology Research Network**

*Danielle Jensen-Ryan, Courtney J. Murren, Matthew T. Rutter, and Jennifer Jo Thompson*

This essay investigates the interplay of scientific and pedagogical objectives within an undergraduate-focused network research project. The multiple priorities faculty face in mentoring emerging scientists while producing high-quality data are discussed and pragmatic recommendations to support effective undergraduate-focused research networks are offered.

#### ARTICLES

##### **Biosensors Show Promise as a Measure of Student Engagement in a Large Introductory Biology Course**

*Karen S. McNeal, Ming Zhong, Nick A. Soltis, Lindsay Doukopoulos, Elijah T. Johnson, Stephanie Courtney, Akilah Alwan, and Mallory Porch*

Skin biosensors were used to measure student engagement in an introductory biology classroom. One section of the class was taught with active-learning approaches, the other with traditional lecture. Results from galvanic skin response devices indicated students in the active-learning classroom were more engaged than those in the traditional lecture.

### **A Pandemic Crash Course: Learning to Teach Equitably in Synchronous Online Classes**

*Daniel L. Reinholz, Amelia Stone-Johnstone, Isabel White, Lorenzo M. Sianez Jr., and Niral Shah*

A professional learning community in which faculty explored equitable teaching online is described. This article describes concrete practices other instructors can use.

### **BioSkills Guide: Development and National Validation of a Tool for Interpreting the Vision and Change Core Competencies**

*Alexa W. Clemmons, Jerry Timbrook, Jon C. Herron, and Alison J. Crowe*

This article presents the BioSkills Guide, a resource enumerating program- and course-level learning outcomes aligned with the six core competencies of *Vision and Change*. The learning outcomes were developed and then nationally validated using input from more than 600 college biology educators from a range of biology fields and institution types.

### **Does the Match Between Gender and Race of Graduate Teaching Assistants and Undergraduates Improve Student Performance in Introductory Biology?**

*Star W. Lee and Marsha Ing*

This study evaluated the academic performance of students who shared their graduate teaching assistant's demographic characteristics, including gender, race/ethnicity, and low-income or first-generation status. The study focused on underrepresented students in STEM, including female and Latinx students, at a Hispanic-serving institution.

### **The Moderating Effect of Faculty Mentorship on Undergraduate Students' Summer Research Outcomes**

*Angelica Monarrez, Danielle Morales, Lourdes E. Echegoyen, Diego Seira, and Amy E. Wagler*

This study focused on answering the research question: What are the independent and combined effects of student characteristics and faculty mentorship on the quality of summer undergraduate research experience (SURE) student poster presentations? The results of this study can improve SURE programs by informing directors on best practices for mentor and mentee matching.

### **Relationships between the Religious Backgrounds and Evolution Acceptance of Black and Hispanic Biology Students**

*M. Elizabeth Barnes, K Supriya, Hayley M. Dunlop, Taija M. Hendrix, Gale M. Sinatra, and Sara E. Brownell*

An evolution education study spanning 77 courses and 17 states found that Black and Hispanic students' stronger than average religiosity explains their lower evolution acceptance. This indicates a need to take into account students' religious culture and background to teach evolution in an inclusive way.

### **An Investigation of How Environmental Science Textbooks Link Human Impact to Ecology and Daily Life**

*Yael Wyner and Rob DeSalle*

Pre-college and college-level environmental science textbook case studies were analyzed for how they portray the human-environment connection. It was found that daily life connections were frequently absent from human impact discussions and that almost all case studies described human impacts without linking them to their ecological underpinnings.

### **Demystifying the Meaning of Active Learning in Post-Secondary Biology Education**

*Emily P. Driessen, Jennifer K. Knight, Michelle K. Smith, and Cissy J. Ballen*

Active learning is not well-defined in the context of undergraduate biology education. To clarify this term, this study explored how active learning is defined and what active learning strategies are used. This work highlights the importance of elaboration and specificity when using the term "active learning" to characterize teaching.

### **The National Center for Advancing Translational Sciences' Intramural Training Program and Fellow Career Outcomes**

*Brittany Haynes, Kyle Brimacombe, Christy Hare, and Jessica Faupel-Badger*

The translational scientist skill sets are consistent with those currently being emphasized in biomedical research to prepare trainees for various career options. The framework of the National Center for Advancing Translational Sciences intramural research program and the career outcomes of its alumni will be of interest to those involved in the career preparedness of early-career scientists.

### **Assessing High Performers in the Life Sciences: Characteristics of Exams used at the International Biology Olympiad (IBO) and Their Implications for Life Science Education**

*Sebastian Opitz and Ute Harms*

Six assessment cohorts ( $N = 703$  items) from the International Biology Olympiad, a top-tier student competition in the life sciences, were analyzed to derive assessment characteristics for high-ability tests in the life sciences. The findings address the items' formal features, cognitive aspects, scientific content/practices, and representations.

### **Student Behaviors and Interactions Influence Group Discussions in an Introductory Biology Lab Setting**

*Alex R. Paine and Jennifer K. Knight*

Students naturally take on different behaviors when engaged in group discussion of data, which sorts them into preferred roles. In discussions in which all students collaborate, groups generate more complete arguments to support conclusions. Without guidance, groups generally focus on analyzing data rather than building reasoned explanations.

## **SPECIAL SECTION ON CROSS-DISCIPLINARY RESEARCH IN BIOLOGY EDUCATION**

### **ARTICLE**

#### **Teaching and Learning Science through Multiple Representations: Intuitions and Executive Functions**

*Janice Hansen and Lindsey Engle Richland*

The results presented here provide new recommendations for helping students make connections across visual representations of science concepts. It was found that comparing diagrams of processes such as mitosis and meiosis leads to better learning than when they are presented separately. At same time, instructors tend to believe others learn better from visual representations presented separately.

### **CORRECTIONS**

#### **Mixed Student Ideas about Mechanisms of Human Weight Loss**

*Kamali N. Sripathi, Rosa A. Moscarella, Rachel Yoho, Hye Sun You, Mark Urban-Lurain, John Merrill, and Kevin Haudek*

#### **Language Matters: Considering Microaggressions in Science**

*Colin Harrison and Kimberly D. Tanner*

### *On the Cover*

Zebrafish F-actin by Andrew Moore, Howard Hughes Medical Institute. Co-submitted by Dvir Gur. This image shows Lifeact-EGFP in epithelial and muscles cells of a zebrafish. It is a color-coded maximum-intensity projection. This image received an honorable mention in the 2019 American Society for Cell Biology GFP Image and Video Contest.