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### LETTER TO THE EDITOR

#### **Structuring and Supporting Excellence in Undergraduate Biochemistry and Molecular Biology Education: The ASBMB Degree Accreditation Program**

*Victoria Del Gaizo Moore, Jennifer Loertscher, Diane M. Dean, Cheryl P. Bailey, Peter J. Kennelly, and Adele J. Wolfson*

### CURRENT INSIGHTS

#### **Culture and Equity in Science Classrooms**

*Julia Svoboda Gouvea*

This installment of *Current Insights* features recent examples of scholarship examining the intersections between culture and equity in science education.

### MEETING REPORT

#### **Recognizing and Reducing Barriers to Science and Math Education and STEM Careers for Native Hawaiians and Pacific Islanders**

*JoNita Q. Kerr, Donald J. Hess, Celia M. Smith, and Michael G. Hadfield*

A workshop with 25 participants, mostly college or high school teachers, many from Pacific Island ethnic groups, explored the causes underlying the underrepresentation of Native Hawaiians and Pacific Islanders in college majors and careers that focus on math and science, especially the biological sciences. Solutions were advanced.

### ESSAY

#### **Can I Have Your Recipe? Using a Fidelity of Implementation (FOI) Framework to Identify the Key Ingredients of Formative Assessment for Learning**

*Erika G. Offerdahl, Melody McConnell, and Jeffrey Boyer*

A fidelity of implementation (FOI) framework is used to examine the critical components of formative assessment as a high-impact instructional practice. This essay is intended to be the first step in an iterative process through which the community will determine when, how, and under what conditions formative assessment supports student learning.

### ARTICLES

#### **“Is This Class Hard?” Defining and Analyzing Academic Rigor from a Learner's Perspective**

*Sara A. Wyse and Paula A. G. Soneral*

Despite its value in higher education, academic rigor is a challenging construct to define for instructor and students alike. How do students perceive academic rigor in their active-learning biology course work? Active-learning courses were “easy” and “hard” for the very reasons that they are effective: they challenge and support student learning.

#### **The Graph Rubric: Development of a Teaching, Learning, and Research Tool**

*Aakanksha Angra and Stephanie M. Gardner*

The development of a graph rubric informed by literature from the learning sciences, statistics, representations literature, and feedback and use of the rubric by many users is described. The result is an evidence-based, analytic rubric that consists of categories essential for graph choice and construction.

### **Representation of Industry in Introductory Biology Textbooks: A Missed Opportunity to Advance STEM Learning**

*Sharotka M. Simon, Helen Meldrum, Eric Ndung'u, and Fred D. Ledley*

This work characterizes representations of industry in undergraduate biology textbooks and explores how these representations could impact STEM learning for students. A significant number of passages embodied negative connotations regarding business. How the representation of industry in these textbooks may affect student engagement is discussed.

### **Probing the Relevance of Chemical Identity Thinking in Biochemical Contexts**

*Courtney Ngai and Hannah Sevian*

A survey of practicing biochemists and analysis of student responses to biochemical creative exercises provide evidence that chemical identity is relevant for biochemical contexts.

### **The Learning Loss Effect in Genetics: What Ideas Do Students Retain or Lose after Instruction?**

*Amber Todd and William Romine*

How students' knowledge of modern genetics changes after instruction (i.e., the learning loss effect) was investigated. Students retained significant gains in five of the 12 constructs 18 months after instruction ended. Students were better able to retain mechanistic explanations in genetics than memorized details.

### **A Low-Intensity, Hybrid Design between a "Traditional" and a "Course-Based" Research Experience Yields Positive Outcomes for Science Undergraduate Freshmen and Shows Potential for Large-Scale Application**

*Thushani Rodrigo-Peirís, Lin Xiang, and Vincent M. Cassone*

This study reports the design, implementation, and evaluation of a novel, effective, and efficient research experience for a large cohort of predominantly biology and chemistry freshmen. Institutional data analyses and student perceptions revealed that the participants made gains in retention in a STEM major, competency development, and academic performance.

### **Students Who Fail to Achieve Predefined Research Goals May Still Experience Many Positive Outcomes as a Result of CURE Participation**

*Logan E. Gin, Ashley A. Rowland, Blaire Steinwand, John Bruno, and Lisa A. Corwin*

This research examines the roles of scientific challenges and course-based undergraduate research experience (CURE) course design features in student outcome achievement. In a unique CURE with a high incidence of scientific challenges, students engaged in iteration and achieved multiple positive outcomes as a result of CURE participation.

### **Short-Term Research Experience (SRE) in the Traditional Lab: Qualitative and Quantitative Data on Outcomes**

*David I. Hanauer, Justin Nicholes, Fang-Yu Liao, Aaron Beasley, and Heather Henter*

This paper develops and assesses a short-term research experience (SRE) as an addition to the traditional lab. Results show that the SRE increased project ownership, excitement, engagement, and a sense of participation in authentic science. The SRE was found to add value to the science education of students.

### **Authentic Inquiry through Modeling in Biology (AIM-Bio): An Introductory Laboratory Curriculum that Increases Undergraduates' Scientific Agency and Skills**

*Susan D. Hester, Michele Nadler, Jennifer Katcher, Lisa K. Elfring, Emily Dykstra, Lisa F. Rezende, and Molly S. Bolger*

The Authentic Inquiry through Modeling in Biology (AIM-Bio) curriculum engages introductory-level students in the scientific practices of modeling, explanation construction, experimental design, and data analysis. Course outcomes include increased agency and identity as scientists, understanding of the nature of science, and scientific skills.

### **Becoming a “Science Person”: Faculty Recognition and the Development of Cultural Capital in the Context of Undergraduate Biology Research**

*Jennifer Jo Thompson and Danielle Jensen-Ryan*

Patterns in science-related cultural capital that help render undergraduate researchers recognizable to faculty mentors are identified, and it is posited that faculty recognition reflects a (mis)alignment between students' cultural capital and faculty expectations. Faculty can support students with fewer cultural resources by expanding their scopes of recognition.

### **Life Science Undergraduate Mentors in NE STEM 4U Significantly Outperform Their Peers in Critical Thinking Skills**

*Kari L. Nelson, Claudia M. Rauter, and Christine E. Cutucache*

Undergraduate life science majors who participated in the NE STEM 4U pre-professional training program scored significantly higher than their peers not in the intervention as measured using the California Critical Thinking Skills Test. The participants reported stronger math skills and retention in STEM majors. Moreover, of the students who have graduated from the program thus far ( $n = 117$ ), 95.9% of them have both completed an academic degree in STEM and entered into the STEM workforce or graduate school upon graduation.

### **Student Learning Outcomes and Attitudes Using Three Methods of Group Formation in a Nonmajors Biology Class**

*Deborah A. Donovan, Georgianne L. Connell, and Daniel Z. Grunspan*

Three methods of forming groups in a large-enrollment, nonmajors biology class were tested. Heterogeneous competence groups yielded better learning outcomes for low-performing students and better attitudes for all students. Assigning groups using demographic factors and allowing students to self-select their group mates resulted in heterogeneous groups.

### **Department-Level Instructional Change: Comparing Prescribed versus Emergent Strategies**

*Kathleen Quardokus Fisher and Charles Henderson*

We performed case study analysis of department-level instructional change via two theoretical frameworks. One framework embodies prescribed change, emphasizing leader actions. The other framework embodies emergent change, emphasizing participants' responsibilities. Results provide guidance for planning or implementing instructional change initiatives.

#### *On the Cover*

Brain showing hallmarks of Alzheimer's disease (plaques in blue). Image by Alvin Gogineni, Genentech. From “Life Magnified” Online: <https://www.nigms.nih.gov/education/life-magnified/Pages/default.aspx>.