Undergraduate Educator Webinar Series

Sponsored by

Undergraduate Education Subcommittee
SOT Education Committee

January 28, 2014
4:00 PM ET

(c) SOT2014
Welcome

Mindy Reynolds, PhD
Chair, Undergraduate Subcommittee
Washington College

Joshua Gray, PhD
Chair, Webinar Series
US Coast Guard Academy
Associate Professor
Education and Enrichment Activities for Educators

Sue Ford, PhD
Speaker
St. John's University
Associate Professor and Director, Toxicology Program
Panelists

Diane Hardej, PhD
St. John’s University, Associate Professor

Pamela Hanson, PhD
Birmingham-Southern College, Associate Professor
Education and Enrichment Activities for Educators

Webinar Objectives

• Describe resources and sources for undergraduate faculty to improve pedagogy

• Focus on developing faculty rather than curricula or courses

(c) SOT2014
Overview

• Transforming Undergraduate Biology Education (2003) and Vision and Change (2011)

• Scientific Societies Programs

  Comments and Questions Interlude

• Government Programs

• Communities

• Journals

  Comments and Questions Interlude

• Grants

  Comments and Questions Interlude

• SOT Resources
Vision and Change

NRC

**Vision and Change Report (2011):**

2009 AAAS Conference on Undergraduate Biology Education
Vision and Change Action Items

1. Integrate Core Concepts and Competencies throughout the Curriculum
2. Focus on Student-Centered Learning
3. Promote a Campus-Wide Commitment to Change
4. Engage the Biology Community in the Implementation of Change
Scientific Societies with Programs for Educators

- AAAS (Vision and Change)
- American Institute of Biological Sciences
- Society for the Advancement of Biology Education Research (SABER)
- American Society for Biochemistry & Molecular Biology (ASBMB)
- New York Academy of Sciences (NYAS)
- American Society for Microbiology
- Compilation at Center for Biology Education
American Institute of Biological Sciences

Education Programs

AIBS is dedicated to improving biological science literacy at all levels of formal and informal education so that the public is able to make decisions informed by the biological sciences, particularly through an understanding of the process and nature of science and how biology informs societal issues. AIBS works with organizations in biology and across the scientific community to advance knowledge about issues and best practices to improve public understanding of science.

As a result of our work:

• A team of 40 Vision and Change Leadership Fellows were selected through a peer-review process in part facilitated by AIBS to move institutional reform efforts forward at the departmental level through the Partnership for Undergraduate Life Science Education (PULSE) initiative.

• Over 450 biology and life sciences department leaders provided information about ways in which AIBS can support them as they improve teaching and learning within their departments. These survey results are being used to inform the work of the AIBS Education Committee through the AIBS Faculty Leadership Development Study, which is an extension of the fall 2012 Undergraduate Biology Department Leadership Survey.

• Our Eye on Education articles in BioScience describe successful programs, current issues, and new reports and recommendations in biology.

News

• 2nd Life Discovery-Doing Science Education Conference - Call for Proposals
• PULSE: Vision & Change Certification Program Pilot - Call for Applications
• Understanding Science for the iPad
• BSA Updates about PlantingScience
• Call for Genetics Education Resources from GSA
SABER

The Cutting Edge of Undergraduate Biology Education Research.

Generating the evidence for Evidence-Based Teaching.

Society for the Advancement of Biology Education Research (SABER)

The Society for the Advancement of Biology Education Research was founded in 2010 by a committee of 30 scholars from across the United States.

SABER Mission Statement

SABER is a scientific community whose members develop theory and generate evidence with the goal of improving biology education. SABER fosters Biology Education Research (BER) and for BER practice, supporting the BER community through training and faculty development programs, and fostering collaborations among BER investigators.

SABER fosters Biology Education Research (BER) and its dissemination by supporting:

- faculty as they employ scientific methodology in their teaching;
- the generation of evidence-based knowledge to inform teaching practices;
- development of BER training and faculty development programs;
- national BER meetings;
- standards of BER practice and evidence;
- articulation and investigation of what constitutes a deep and meaningful understanding of biology;
- collaborations among BER investigators.
IMPLEMENTING VISION and CHANGE
Developing concept-driven teaching strategies in biochemistry and molecular biology

The Biochemistry and Molecular Biology (BMB) Concept Inventory project is built on the concept of bringing together a large network of undergraduate faculty and researchers to develop a central, web-based Concept Inventory (a rich resource of validated assessment tools and approaches) specifically designed for biochemistry and molecular biology educators at colleges and universities. This central resource, the BMB Concept Inventory, will be a convergence of assessment tools based on the foundational concepts, discipline specific knowledge and essential skills necessary to prepare students to take on the challenges of molecular life science research in the 21st century.

By developing the BMB Concept Inventory, our goal is to broadly impact biochemistry and molecular biology education across the U.S. at the program, departmental, course and faculty levels.

Additionally, this project aims to serve as a hub to connect biochemistry and molecular biology faculty from diverse communities, institutions and backgrounds.
Introduction to Scientific Teaching

Overview

Science education informs students about the biological, chemical, and physical world around them. Yet an effective instruction in science—its methods and approaches as well as its facts and theories—provides more. A strong science education establishes the framework for critical and analytical thinking that can be applied to all aspects of daily life, including the improvement of teaching. Unfortunately, scientific education in America lags significantly behind other developed nations. Numerous studies have found that “scientific illiteracy” is both prevalent and increasing. For this reason, on April 9, 2012, Matthew Marcello presented a seminar at the Academy titled Introduction to Scientific Teaching. Marcello advocated a new education paradigm that uses the basic principles of science to transform classroom education. Scientific inquiry is evidence-based, factual,
Welcome to the Biology Scholars Program

The mission of the Biology Scholars Program (BSP) is to empower biologists to be leaders in science education reform and catalyze professional societies to sustain undergraduate education reform. The Program, funded in part by the National Science Foundation and sponsored by the American Society for Microbiology (ASM), is one model for transforming undergraduate biology education as set forth in the AAAS publication, Vision and Change in Undergraduate Biology Education: A Call to Action.

In the last nine years, the Program has prepared over 200 Biology Scholars to engage in the scholarship of teaching and learning (SoTL) and lead the life science professional societies in new ways of practicing undergraduate teaching and mentoring in the discipline. This growing Biology Scholar Alumni community includes national and international biology educators from community colleges, undergraduate institutions, and doctoral-granting universities, who are typically involved in one or more disciplinary societies. Read more about these Scholars and learn how the Biology Scholars Program has helped educators answer the AAAS call to action!

We have three yearlong residencies available: Assessment, Research, and Transitions. Please visit the Residency Programs tab above for more information and to learn how to apply.
Links to Professional Societies in the Biological Sciences

Educational Activities

Annotation describes activities of life sciences professional societies towards improving undergraduate education. Because of the changing nature of websites, click on the name of the professional society to link to the homepage of the society and browse yourself. If you use or manage a website with activities that should be listed in the annotation, please let us know by contacting: tong@wisc.edu.

This page was originally developed by the Coalition for Education in the Life Sciences (CELS). CELS was a national coalition of professional societies in the biological sciences that have joined together in an effort to improve undergraduate education in the life sciences (1991-1998). See the CELS Monograph (1998) for more information. The Center for Biology Education was the home for CELS from 1994-1998 and maintains this page of links to professional societies.

Index to sections of this web page:

1. American Association for the Advancement of Science (AAAS)
2. American Association of Anatomists (AAA)
3. American Association of Immunologists (AAI)
4. American Association of Physical Anthropologists (AAPA)
5. American Bryological and Lichenological Society (ABLS)
6. American Institute of Biological Sciences (AIBS)
7. American Society of Plant Biologists (ASPB)
8. Association for Biodiversity Education and Research (ABER)
9. American Society of Cell Biology (ASCB)
10. American Society for Microbiology (ASM)
11. American Society of Plant Physiologists (ASPP)
12. American Society of Plant Biologists (ASPB)
13. Society for Integrative and Comparative Biology (SICB)
14. Society for the Study of Evolution (SSE)
Comments from Panelists and Participants
Government Supported Programs and Meetings
National Academies Summer Institute on Undergraduate Education
Come explore new models of instruction for the undergraduate classroom.

An introductory undergraduate class may be the only exposure many students have to the sciences. It can be the best opportunity to interest students in scientific research and careers in the sciences.

The Howard Hughes Medical Institute and the National Academies invite college and university faculty and instructional staff to develop teaching skills at five-day workshops to transform the undergraduate classroom. The Summer Institutes on Undergraduate Education model the scientific teaching principles they teach. They draw on the expertise of participants and presenters. Current research, active learning, assessment, and diversity are woven into the week, creating a forum to share ideas and develop innovative instructional materials to be implemented upon returning home.

The institutes emerged from the 2003 National Research Council report, *Bio2010: Transforming Undergraduate Education for Future Research Biologists*. The report concludes that faculty development is a crucial component of improving undergraduate education. It recommends that universities provide faculty with
The institute embodies three core themes

- Active learning
- Assessment
- Diversity
The goal of scientific teaching is to make teaching more scientific.

It brings a philosophy and framework to teaching that makes the process more
• Rigorous
• Reflective
• Evaluative
Northeast Summer Institute (NESI) 2013

• Stony Brook University Campus
  – Stony Brook, NY
  – SUNY

• Topic: Interface of Biology and Math
  – 6 team members: 2 biologists, 2 toxicologists, 2 mathematicians, 2 facilitators
  – 3 universities represented in each topic
  – 36 participants + facilitators and speakers

• Other topics (cell and developmental biology, gene expression, neurobiology and physiology, evolution)
  – Topics vary with institute and year
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**ACTIVE LEARNING**
- Break (10:30-11:00)

**ASSESSMENT**
- Break (10:30-11:00)

**HOW PEOPLE LEARN**
- Break (10:30-11:00)

**PREPARE FOR PRESENTATIONS**
- Break (10:30-11:00)

**TRANSFORMATION**
- GROUP WORK TIME
  - Revise and upload final tidbit

**DIVERSITY**
- Work on Teachable Tidbits

**GROUP WORK TIME**
- Develop Teachable Unit Framework and Learning Goals

**SCIENTIFIC TEACHING IN PRACTICE**
- Work on Teachable Tidbits

**GROUP PRESENTATIONS**
- Streamed to Rm. 311

**GROUP PRESENTATIONS**
- Streamed to Rm. 311

**LUNCH (1-2:30)**

**LUNCH (1-2:30)**

**LUNCH (1-2:30)**

**GROUP PRESENTATIONS**
- Streamed to Rm. 311

**OPEN**
- Provost’s Lecture Series:

**Locations**
- SAC-Cafeteria: 6:00
- SAC-Ballroom B: 6:30
- SAC-Classrooms 3rd floor: 7:00
- SAC-Art Gallery: 7:30
- Simons Center: 8:00
- Sunwood: 8:30

**Communicating Science**
- Alan Alda; LH102: Upload group's Teachable Unit Framework (Mon) & Teachable Tidbit (Tues, Wed).
- Review assigned readings—relax and enjoy the company of the participants.
The visit by Alan Alda was unique to the Stony Brook University NESI

Stony Brook is the home of the Alan Alda Center for Communicating Science
Benefits of NESI

- Knowledge of the program
- Collaboration with professionals in different but related disciplines
- Teamwork
- Usable product (teachable tidbit)
- Fresh ideas for enhanced classroom learning, assessment, diversity and institutional change
The summer institutes provide venues for college and university faculty and instructional staff to meet for intensive discussions, demonstrations, and working sessions on research-based approaches to undergraduate education. The idea is to create the same atmosphere as a Cold Spring Harbor research course, but instead of a course topic on phage genetics, for example, the focus is on teaching biology. The institutes serve a growing variety of colleges and universities across the country.

In its call for new directions and transformation in teaching the biological sciences, the 2011 report produced by the American Association for the Advancement of Science and the National Science Foundation, *Vision and Change in Undergraduate Biology Education*, repeatedly cites the Summer Institutes and scientific teaching as models for improving undergraduate biology education.

Deadlines vary e.g., Northeast application deadline is March 31, 2014

Follow links below to apply for the institute in your region:

- Midwest, June 9-14, 2014, University of Minnesota-Twin Cities
- Northeast, June 15-June 20, 2014, Harvard University
- Mountain West, July 21-July 25, 2014, University of Colorado-Boulder
- Gulf Coast, July 21-25, 2014, Louisiana State University
- West Coast, 2014 Dates and Location TBD
- Southeast, 2014 Dates TBD, University of Georgia, Athens

Read [journal articles and background publications](#) about the summer institutes or *Bio2010*.
Implementing Vision and Change: ASBMB
(RCN UBE Grant: Research Co-ordination Network Undergraduate Biology Education)
IMPLEMENTING VISION and CHANGE

Developing concept-driven teaching strategies in biochemistry and molecular biology

PROJECT OVERVIEW

ABOUT ASBMB

Promoting the Understanding of the Molecular Nature of Life Processes

The American Society for Biochemistry and Molecular Biology (ASBMB) is a nonprofit scientific and educational organization with over 12,000 members.

Founded in 1906, the Society is based in Bethesda, Maryland, on the campus of the Federation of American Societies for Experimental Biology. The Society's purpose is to advance the science of biochemistry and molecular biology through publication of scientific and educational journals, the Journal of Biological Chemistry, Molecular & Cellular Proteomics, and the Journal of Biological Research, organization of scientific meetings, advocacy for funding of basic research and education, support of science education at all levels, and promoting the diversity of individuals entering the scientific workforce.

ABOUT THE BMB CONCEPT INVENTORY PROJECT

Project at a Glance

The ASBMB has a well-developed interest in education research and practice as well as a history of promoting biochemistry and molecular biology education as evidenced by the publication of the recommended Undergraduate Biochemistry and Molecular Biology Curriculum in 1992 and a 2003 report to The Teagle Foundation titled Biochemistry and Molecular Biology and Liberal Education. In 2009, the society was awarded a 5-year PC5 UBE National Science Foundation grant to begin developing a concept inventory.
Who Can Participate?

Faculty and researchers from community colleges, primarily undergraduate institutions (PUI) and research institutions that serve diverse student populations are invited to participate in this project and form teams of common interest. Recognizing that Biochemistry and Molecular Biology depend heavily on foundational concepts and skills from related disciplines such as Physics, Mathematics, Chemistry and Biology, the involvement, from the very earliest stages, of faculty and educators from a broad scientific base is emphasized in the network of faculty that will be created as a central part of this project. Three types of groups will be formed for the purpose of this project: Conceptual Assessment in Biochemistry and Molecular Biology (CABMB) Group, Core Working Group and the Undergraduate Affiliated Network (UAN). It is critical that individuals making up these three groups represent faculty from across the country with diverse interests and expertise including educational research, assessment, scientific research and teaching. Please contact concept@asbmb.org if you are interested in contributing to the project.
2013 Workshops

Implementing Vision and Change, Seattle, WA
August 5-6, 2013
Seattle University

This 2-day workshop was held as part of the ASBMB Student-Centered Education in the Molecular Life Sciences special symposia.

Presenters: Cheryl Sensibaugh (University of New Mexico), Sam Elliott (St. Mary’s College of Maryland), Karen Sirum (Bowling Green State University), Ben Caldwell (Missouri Western State University), Cheryl Bailey (HHMI), Ellis Bell (University of Richmond), Ann Wright (Canisius College)

Meeting Program

Assessment of Students’ Reasoning with Core Concepts and Visualizations in Biochemistry and Molecular Biology
January 12, 2013
Marymount Manhattan College

Led by Hal White, Professor of Chemistry and Biochemistry, Section Editor of Biochemistry and Molecular Biology Education, University of Delaware. Workshop co-leaders were Brian White, Member of the BioQuest Consortium, Professor of Biology, College of Arts and Sciences, University of Massachusetts-Boston and Ann Aguanno, Associate Professor of Biology, ASBMB UAN Committee NE Regional Director, Marymount Manhattan College.

Meeting Program

Effectively Assessing Laboratory and Research Skills
Saturday, February 23, 2013
University of Alabama, Tuscaloosa, AL

Hosted and facilitated by Margaret Johnson, Associate Professor of Biological Sciences, University of Alabama.

Presenters: Ellis Bell, Professor of Chemistry, University of Richmond, Marcy Osgood, Associate Professor & Vice Chair of Education, University of New Mexico, and Ben Caldwell, Professor of Chemistry and Dean of Graduate School, Missouri Western State University.

Meeting Program

Effectively Assessing Core Concepts in the Molecular Life Sciences
Saturday, March 2, 2013
St. Mary’s College of Maryland, St. Mary’s City, MD
2014 Meetings

Designing Scientific Teaching Tools for BMB Education
Saturday, November 2, 2013
University of San Diego, San Diego, CA

Host and Facilitator: Joe Provost (USD)
Presenters: Ben Caldwell (Missouri Western State University), Ellis Bell (University of Richmond), Cheryl Sensibaugh (University of New Mexico)

Meeting Program

Developing Assessment Tools to Improve Student Learning
Saturday, November 9, 2013
Viterbo University, La Crosse, WI

Presenters: Scott Gabriel, Assistant Professor of Biochemistry, Viterbo University, Cheryl Bailey, HHMI, and Debra Martin, Professor of Biology, Saint Mary’s University of Minnesota
IMPLEMENTING VISION and CHANGE
Developing concept-driven teaching strategies in biochemistry and molecular biology

OVERVIEW NEWS MEETINGS FOUNDATIONAL CONCEPTS FOUNDATIONAL SKILLS ASSESSMENT PEOPLE CONTACT

Designing Scientific Teaching Tools for BMB Education, Simmons College, January 11, 2014

This workshop is designed to increase participant knowledge and use of student assessment techniques around the pre-identified biochemistry and molecular biology foundational concepts and skills and to actively engage participants in creating assessment tools and best practices. This workshop is open to all undergraduate faculty, postdoctoral fellows, and graduate students interested in undergraduate science education.

Simmons College, Boston, MA
School of Management/Academic Building M501/502- 5th Floor
Saturday, January 11, 2014
Cost: Free

Presenters: Jennifer Roecklein-Canfield (Simmons College), Kristin Fox (Union College), and Samantha Elliott (St. Mary’s College of Maryland)
Comments from Panelists and Participants
Communities of Science Educators

- **ToXchange**
- **Partnership for Undergraduate Life Sciences Education (PULSE)**
- **ASBMB Undergraduate Affiliate Network (UAN)**
- **Sigma Xi links**
- **BiosciEdNet (BEN)**
Journals for Science Educators

- Journal of Toxicology Education (new!)
- American Biology Teacher
- Advances in Physiology Education
- American Journal of Pharmaceutical Education
- Biochemistry and Molecular Biology Education (BAMBED)
- Bioscene: Journal of College Biology Teaching
- Journal of Microbiology & Biology Education
- CBE- Life Sciences Education
- Education
- Journal of Chemical Education
- Journal of College Science Teaching
- Journal of Research in Science Teaching
- Pharmacy Education Journals
- The Physics Teacher
- Science Education
- Free Book downloads at National Academies Press
Comments from Panelists and Participants
Grants to Support Undergraduate Science Education
Charge: discuss your experience with NSF and how you successfully applied for funding to enhance your teaching

- Brief History of NSF Funding for STEM Education
- Broad, Recurring Themes in NSF STEM Education RFPs
- BSC’s History of Success with NSF STEM Education Funding
  - CCLI
  - TUES
  - WIDER

Disclaimer: This portion of the webinar reflects my personal viewpoint and experience. I do not work for the NSF. For official NSF-sanctioned information on this topic, you should visit nsf.gov and talk to an NSF Program Officer.
A Brief History of NSF Funding for Undergraduate STEM Education

Course and Curriculum Development (CCD)
Instrumentation and Laboratory Improvement (ILI)

Course, Curriculum, and Laboratory Improvement (CCLI)

Transforming Undergraduate Education in STEM (TUES)

STEM Talent Expansion Program (STEP)

Widening Implementation and Demonstration of Evidence-Based Reforms (WIDER)

Improving Undergraduate STEM Education (IUSE)
Broad, Recurring Themes in NSF STEM Education RFPs

- Development, adaptation, implementation, and/or propagation of strategies for improved student learning.
  - Increase active-learning
    - case studies, clickers, flipping the classroom, etc.
  - Increase inquiry
    - transition away from “cook book”, verification-based labs
- Integrating research and teaching
  - Students conduct scientific research in courses
  - Faculty conduct educational research on pedagogical innovation
- Assessment
- Dissemination/Propagation
BSC CCLI: Enhancing Multidisciplinarity through Molecular Modeling

Goals:

• Improve student visualization of molecular events
• Use modeling to drive experimental design
• Make connections between biology and chemistry courses via a “molecular thread” – acetylcholinesterase inhibitors
BSC TUES: Multi-Level Implementation of Interdisciplinary Inquiry- and Research-Based Labs

Goals:
• Address *Vision and Change* Action Items:
  • Integrate research into the curriculum
  • Relate abstract concepts to real-world examples
  • Develop students’ ability to tap into the interdisciplinary nature of science
• Gain new knowledge about the anticancer ruthenium complex KP1019
BSC TUES: Multi-Level Implementation of Interdisciplinary Inquiry- and Research-Based Labs

• Chemical Principles (CH 149) students
  • synthesize KP1019 and characterize its hydrolysis
• Honors Cell and Molecular Biology (HON 126) students
  • use yeast as a model to study bioactivity
  • examine correlations between hydrolysis and bioactivity
• Linkage and cross-talk between courses

![Images showing 0mM and 5mM caffeine effects on KP1019]
BSC TUES: **Multi-Level Implementation of Interdisciplinary Inquiry- and Research-Based Labs**

Evidence of success:
- Increased student confidence
- Increased interest in research outside of class
- Improved articulation of interdisciplinary concepts

![Graphs showing reading primary literature and working on a problem that requires integrating ideas from two or more sciences.](chart.png)
BSC WIDER: Workshop on Integrating Research and Teaching via Interdisciplinary, Inter-institutional Partnerships

Goals:
• Disseminate early findings from TUES project
• Expand and establish interdisciplinary, inter-institutional partnerships
• Discuss approaches for implementing and assessing course-associated research experiences
Summary and Acknowledgments

• Successful proposals are:
  • Research-based
  • Research-generating
  • Sustainable
  • Transferable

• NSF funding can:
  • catalyze improved instruction
  • fuel synergy between research and teaching
  • foster collaboration
  • thank you, Laura Stultz!... an amazing Co-PI!

• Disclaimer reminder: This portion of the webinar reflects my personal viewpoint and experience. I do not work for the NSF. For official NSF-sanctioned information on this topic, you should visit nsf.gov and talk to an NSF Program Officer.
Comments from Panelists and Participants
SOT Undergraduate Faculty Resources

Join the Undergraduate Educator Network
SOT ToXchange community for faculty networking
ToXchange community
UEN e-Newsletter
UEN Meeting at SOT

Wednesday, March 26, 2:15-3:30 PM

Undergraduate Curriculum Resources
http://www.toxicology.org/ai/eo/UndergradCR.asp
• Contribute and share
• Use the materials and provide feedback
Workshop Session: The Role of Toxicology in Undergraduate STEM Education Reform

Tuesday, March 25  1:30 PM to 4:15 PM

• Overview of STEM Landscape
• 4 STEM Case Studies
• Breakouts
General Questions and Concluding Comments
Thank you for participating today!

Undergraduate Educator Network Webinar Series

April 2014

Innovative Uses of Technology for Teaching Toxicology

• Use of Twitter® to Engage Freshman in Learning Current Toxicology Concepts and Topics, Angie Slitt, University of Rhode Island
• Other speakers TBD

Thank you for participating today!