ASM Conference for Undergraduate Educators

Save the Dates!

ASMCUE 2017
July 27-30
Denver, Colorado

ASMCUE 2018
July 26-29
Austin, Texas

www.asmcue.org

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## Program at a Glance

### THURSDAY, JULY 21

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<th>Session</th>
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<tbody>
<tr>
<td>9:00 AM – 3:00 PM</td>
<td>Authentic Research Experience in Microbiology (AREM): Integrating Student-Driven Microbiome Research into a Course-Based Research Program Pre-Conference Workshop (Registered Participants Only) – pg. 20</td>
</tr>
<tr>
<td>9:00 AM – 3:00 PM</td>
<td>Designing Lessons Based on National Recommendations for STEM Education Pre-Conference Workshop (Registered Participants Only) – pg. 20</td>
</tr>
<tr>
<td>9:00 AM – 3:00 PM</td>
<td>Genome Solver On-the-Go: Analyzing Microbial Genomes with Bioinformatics Tools Pre-Conference Workshop (Registered Participants Only) – pg. 20</td>
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<tr>
<td>2:00 PM – 8:00 PM</td>
<td>ASMCEU Registration – pg. 20</td>
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<tr>
<td>3:45 PM – 4:00 PM</td>
<td>Conference Welcome and Opening Remarks – pg. 20</td>
</tr>
<tr>
<td>4:00 PM – 5:00 PM</td>
<td>Opening Plenary Lecture – pg. 20</td>
</tr>
<tr>
<td>5:00 PM – 6:30 PM</td>
<td>Integrating Modern Genomic Science into Practical Microbiology: The Case of Food Safety</td>
</tr>
<tr>
<td>6:30 PM – 8:15 PM</td>
<td>Eric Brown, Director, Division of Microbiology in the Office of Regulatory Science, U.S. Food and Drug Administration Welcome from the ASM Chief Executive Officer – pg. 21</td>
</tr>
<tr>
<td>9:00 AM – 3:00 PM</td>
<td>Stefano Bertuzzi, ASM Dinner and Travel Award Recognition – pg. 21</td>
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</tbody>
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### FRIDAY, JULY 22

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>8:00 AM – 9:30 AM</td>
<td>Integrating Discovery-Based Research into the Undergraduate Curriculum: Discussion of a Report from the National Academies of Sciences, Engineering, and Medicine 8:30 AM – 9:00 AM</td>
</tr>
<tr>
<td>9:00 AM – 9:30 AM</td>
<td>Integrating Discovery-Based Research into the Undergraduate Curriculum: Discussion of a Report from the National Academies of Sciences, Engineering, and Medicine 9:00 AM – 9:30 AM</td>
</tr>
<tr>
<td>9:00 AM – 9:30 AM</td>
<td>9:45 AM – 10:15 AM Creating Active Learning and Research Based Laboratory Exercises 10:45 AM – 11:15 AM</td>
</tr>
<tr>
<td>9:45 AM – 10:15 AM</td>
<td>Concurrent Education Sessions – pg. 21</td>
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<tr>
<td>9:45 AM – 10:15 AM</td>
<td>Concurrent Education Sessions – pg. 31</td>
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### Tweeters and Instagrammers, your attention please!

The official hashtag of the Conference is #ASMCUE

Come and join the conversation!
### FRIDAY, JULY 22 (continued)

**Author Corner – pg. 36**
1:30 PM – 2:00 PM
ASM Press

**Concurrent Scientific Sessions – pg. 36**
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Host Biology in Light of the Microbiome: An Introduction to Holobionts and their Hologenomes

**Concurrent Education Sessions – pg. 37**
3:30 PM – 5:00 PM
Evolutionary Mechanisms of RNA Virus Host-Switching

**Concurrent Education Sessions – pg. 37**
3:30 PM – 4:00 PM
Marine Sponges and their Bacterial Symbionts: Key Players in Nutrient Cycling in Coral Reefs

### SATURDAY, JULY 23 (continued)

**Product Corner – pg. 47**
10:30 AM – 11:00 AM
Pearson

**Product Corner – pg. 48**
10:30 AM – 11:00 AM
McGraw-Hill Education

**Product Corner – pg. 48**
10:30 AM – 11:00 AM
eScience Labs, LLC

**Product Corner – pg. 48**
10:30 AM – 11:00 AM
Carolina Biological Supply Company

### SATURDAY, JULY 23

**ASMCE Registration – pg. 44**
7:00 AM – 4:45 PM
Networking Breakfast by Location – pg. 44
7:00 AM – 8:00 AM
Plenary Lecture – pg. 44
8:00 AM – 9:00 AM
Improving Education in and Increasing Access to Science: An Opportunity for Microbiology Educators
Shirley Malcom, American Association for the Advancement of Science
Exhibitor Showcase – pg. 44
9:00 AM – 3:30 PM
Poster Session A – pg. 44
9:15 AM – 10:15 AM
Author Corner – pg. 46
9:30 AM – 10:00 AM
W.W. Norton & Company, Inc.
Author Corner – pg. 47
10:00 AM – 10:30 AM
OpenStax
Product Corner – pg. 47
10:00 AM – 10:30 AM
John Wiley & Sons, Inc.
Product Corner – pg. 47
10:00 AM – 10:30 AM
McGraw-Hill Education

**Plenary Lecture – pg. 40**
5:15 PM – 6:15 PM
Pathogenesis of Fungal Infections
Arturo Casadevall, Johns Hopkins University, Editor in Chief, mBio

**Exhibit Opening & Reception – pg. 41**
6:30 PM – 8:30 PM

**Director’s Choice: HHMI Night at the Movies – pg. 90**
3:45 PM – 4:45 PM
SESSION G: 3:45 PM – pg. 79
SESSION H: 4:05 PM – pg. 83
SESSION I: 4:25 PM – pg. 86
Dinner on Your Own – pg. 90
7:00 PM

**SUNDAY, JULY 24**

**Breakfast on Your Own – pg. 91**
8:00 AM – 9:00 AM
The State of the Nation: What We Know About Learning Biology
Loretta Brancaccio-Taras, Kingsborough Community College, 2016 Carski Foundation Distinguished Undergraduate Teaching Awardee

**Closing Plenary – pg. 91**
8:00 AM – 9:00 AM

**Conference Wrap-up – pg. 91**
11:00 AM – 11:45 AM
End of Conference – pg. 91
12:00 PM
## Microbrews at a Glance

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<th>ROOM LOCATION</th>
<th>MICROBREW A: 11:30 AM – 11:45 AM – pg. 50</th>
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</thead>
<tbody>
<tr>
<td>Brookside A</td>
<td>Improving Student Understanding of Protein Structure and Denaturation Using Protein Modeling Kits Marsha Gaston, University of Cincinnati Blue Ash College Using the Improvisational &quot;Yes, and...&quot; Approach as a Review Technique in the Student Centered Biology Classroom Laura J. MacDonald, Hendrix College Scaffolded of Structured Assessments to Help Students Engage in the Central Dogma of Molecular Biology Jacob Adler, Brescia University Teaching Restlessness: How to Invigorate your Classroom (and Maybe Yourself in the Process) Ann Cleveland, Maine Maritime Academy Re-thinking Teaching and Learning Spaces: How Instruction in the Lab Impacts Student Engagement and Success Crystal Austin, Ferris State University Students Take Control of their Learning through a &quot;Pathogen Project&quot; Presentation and Research Paper Krista Clark, UC Clermont College Implementation of a Multi-week, Laboratory-Based DNA-barcoding Project in an Introductory Mycology Course Laura Robertson, Shepherd University Scaffold the Process of Thinking and Writing as Scientists Do Nickie Cauthen, LaGrange College</td>
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<td>White Flint Amphitheater</td>
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<tr>
<th>MICROBREW B: 11:50 AM – 12:05 PM – pg. 54</th>
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<tr>
<th>MICROBREW C: 12:10 PM – 12:25 PM – pg. 58</th>
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<td>White Flint Amphitheater</td>
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# Microbrews at a Glance

## MICROBREW SESSION II OF III
### SATURDAY, JULY 23

### ROOM LOCATION

<table>
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<tr>
<th>Brookside A</th>
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<th>Glen Echo</th>
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<th>White Oak A</th>
<th>White Oak B</th>
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### MICROBREW D: 2:30 PM – 2:45 PM - pg. 66

<table>
<thead>
<tr>
<th>Topic</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using a Simple Soil Assay to Demonstrate Regulation of Enzyme Production</td>
<td>Craig Phelps, Rutgers University</td>
</tr>
<tr>
<td>Jigsaw Group Discussions Enhance Active Learning and Formative Assessment in the Microbiology Laboratory</td>
<td>Padma Seshadri, Suffolk County Community College</td>
</tr>
<tr>
<td>Using a Personal Reflection Tool to Enhance Student Comprehension in Laboratory-Based Courses</td>
<td>Rebecca K. Hoffman, Rowan University</td>
</tr>
<tr>
<td>Why Do We Have to Do This? Helping Your Students Understand Why You Use Active Learning in the Classroom</td>
<td>Jennifer Brigati, Maryville College</td>
</tr>
<tr>
<td>Student Metacognitive Development as a Predictor of Success in an Introductory Biology Course</td>
<td>Jessica Santangelo, Hofstra University</td>
</tr>
<tr>
<td>Using Twitter to Access Current Events and Research in the Biofuel Industry Around the World</td>
<td>Sherry Ogg, Johns Hopkins University</td>
</tr>
<tr>
<td>The Search for Terrestrial Life: An Inquiry-Based Astrobiology Laboratory Module</td>
<td>Amy Treonis, University of Richmond</td>
</tr>
<tr>
<td>Designer Bacteria: A Fun Active Learning Activity to Apply Cell Structure and Growth Condition Concepts</td>
<td>Jennifer Koehl, Saint Vincent College</td>
</tr>
</tbody>
</table>

### MICROBREW E: 2:50 PM – 3:05 PM - pg. 70

<table>
<thead>
<tr>
<th>Topic</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning With Authentic Research: Implementing The PARE Project In A Freshman Laboratory</td>
<td>Ruth Plymale, Ouachita Baptist University</td>
</tr>
<tr>
<td>Teaching Students to “Talk the Talk”</td>
<td>Mary E. Shawgo, Graceland University</td>
</tr>
<tr>
<td>The Air That I Breathe: Increasing Understanding of Aerobic Respiration</td>
<td>Karen Huffman, Geneseo Community College</td>
</tr>
<tr>
<td>The Ebola Wars: Teaching About Emerging Infectious Diseases Using the Case Study Approach</td>
<td>Tracie Addy, Yale University School of Medicine</td>
</tr>
<tr>
<td>Collaborating with Undergraduates Across Disciplines to Create Peer-Led Distance Learning Modules for a Non-majors Microbiology Hybrid Lab</td>
<td>Stephanie M. Miller, Ohio University</td>
</tr>
<tr>
<td>Using Story telling and Anthropomorphic Formulations to Enhance Student Learning</td>
<td>Kari Brossard Stoos, Ithaca College</td>
</tr>
<tr>
<td>From Gene to Function, Use of PCR and Biological Assays to Connect Gene to Protein Function</td>
<td>Manuela Tripepi, Stockton University</td>
</tr>
<tr>
<td>Transformation of Online Videos into Active Learning Experiences</td>
<td>Thomas Koval, Johns Hopkins University</td>
</tr>
</tbody>
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### MICROBREW F: 3:10 PM – 3:25 PM - pg. 74

<table>
<thead>
<tr>
<th>Topic</th>
<th>Presenters</th>
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</thead>
<tbody>
<tr>
<td>Verification of Bioinformatically Identified Terminators in the Classroom</td>
<td>Nathan Reyna, Ouachita Baptist University</td>
</tr>
<tr>
<td>“Letters To Grandma”: An In-Class Writing Activity that Combines Informal Writing and Teaching as Tools to Increase Student Retention and Comprehension</td>
<td>J. Jordan Steel, Colorado State University-Pueblo</td>
</tr>
<tr>
<td>Helping Introductory Biology Students Forge Connections Between Concepts</td>
<td>Mike Keller, University of Maryland</td>
</tr>
<tr>
<td>Intentionality in Designing Laboratory Assignments For Student Success and Engagement</td>
<td>Huda Makhluf, National University</td>
</tr>
<tr>
<td>Using Google Draw as a Digital Drawing Kit to Manipulate Complex Concepts in Biology</td>
<td>Tracy Ruscetti, Santa Clara University</td>
</tr>
<tr>
<td>Blogging in a Laboratory Course as a Method to Increase Scientific Literacy and Practice Science Communication for a General Public Audience</td>
<td>Aimee Hollander, Nicholls State University</td>
</tr>
<tr>
<td>Using Oral Presentations to Cultivate Active Learning and Critical Thinking Skills in “Identification of Unknowns’’</td>
<td>Alioune Gueye, Mount Ida College</td>
</tr>
<tr>
<td>Using a 3-D Printer to Learn Cell Structure</td>
<td>Archana Lal, Independence Community College</td>
</tr>
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# Microbrews at a Glance

## MICROBREW SESSION III OF III
**SATURDAY, JULY 23**

### ROOM LOCATION

<table>
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<tr>
<th>Room</th>
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<td>Brookside B</td>
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</tbody>
</table>

### MICROBREW G: 3:45 PM – 4:00 PM – pg. 79

<table>
<thead>
<tr>
<th>Title</th>
<th>Presenter(s)</th>
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</thead>
<tbody>
<tr>
<td>Knowledge Sharing About Medical Viruses: Using Community Based Project to Motivate Learning Value and Build Up 21st Century Skills</td>
<td>Kanokwan Kittiniyom, Mahidol University</td>
</tr>
<tr>
<td>Teaching Partners</td>
<td>Necessary</td>
</tr>
<tr>
<td>Laboratory Exercise for the Isolation, Purification, and Characterization of Personal E. coli Cultures</td>
<td>Ned Barden, MCHPIS University</td>
</tr>
<tr>
<td>Use of Regular and Consistent Formative Feedback to Improve Problem-solving Skills in Weekly Online Assignments</td>
<td>Maureen Leonard, Mount Mary University</td>
</tr>
<tr>
<td>Achieving Course Improvement and Student Improvement through Student Evaluations</td>
<td>Sarah Sidipoulos, Oakland Community College</td>
</tr>
<tr>
<td>Embedding Quantitative Literacy into an Undergraduate Physiology Lab Curriculum</td>
<td>Jodie Krontiris-Litowitz, Youngstown State University</td>
</tr>
<tr>
<td>Campus Composters – Integrating Science, Sustainability, Service and Social Entrepreneurship</td>
<td>Tracey T. Meilander, Notre Dame College</td>
</tr>
<tr>
<td>Using Microbe Information Sheets to Connect Concepts and Increase Critical Thinking</td>
<td>Vicki Huffman, Potomac State College of WVU</td>
</tr>
</tbody>
</table>

### MICROBREW H: 4:05 PM – 4:20 PM – pg. 83

<table>
<thead>
<tr>
<th>Title</th>
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<tbody>
<tr>
<td>An In-Class Service Learning Activity to Advance Students' Research and Laboratory Competencies Using Bacterial Transformation with Green Fluorescent Protein</td>
<td>Margie Paz, University of Georgia</td>
</tr>
<tr>
<td>Incorporating Basic Statistics and Data Organization Into a Microbiology Teaching Lab</td>
<td>Joseph Battistelli, Virginia Commonwealth University</td>
</tr>
<tr>
<td>A Journey in Transforming Traditional Nursing Microbiology Curriculum through Gamification</td>
<td>Wendy A. Dustman, Georgia Gwinnett College</td>
</tr>
<tr>
<td>A Web Application for Automatically Generating Customized, Individual Assessment Feedback Reports</td>
<td>Monica Linden, Brown University</td>
</tr>
<tr>
<td>Design Your Animal! Blog as a Progressive Formative Assessment in an Online Animal Physiology Course and adaptation to a Microbiology/Pathology Laboratory Course</td>
<td>Donnasue Graesser, Quinnipiac University and University of Connecticut</td>
</tr>
<tr>
<td>There is an App for That! Educational App Use in the Biology Classroom</td>
<td>Mary Mawn, SUNY Empire State College</td>
</tr>
<tr>
<td>Modes of Inquiry-based Learning in a Laboratory Virus Biotechnology Course</td>
<td>Thomas Lentz, North Carolina State University</td>
</tr>
<tr>
<td>A Vision and Changed General Microbiology Curriculum Taught Directly From the Primary Literature</td>
<td>Melissa E. Marks, Williamette University</td>
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### MICROBREW I: 4:25 PM – 4:40 PM – pg. 86

<table>
<thead>
<tr>
<th>Title</th>
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<tbody>
<tr>
<td>The Addition of a Service-Learning Component to a General Microbiology Class Curriculum</td>
<td>Fernanda Santos, Adventist University of Health Sciences</td>
</tr>
<tr>
<td>Incorporating Modules of On-Campus Research Programs into a Freshmen Biology Lab</td>
<td>Jennifer McLean, Colorado State University</td>
</tr>
<tr>
<td>Rapid Response Lab Reports</td>
<td>Robert Maxwell, Georgia State University</td>
</tr>
<tr>
<td>Have Your Students Flipping for Microbial Metabolism: An Activity for Large Enrollment Classes</td>
<td>Jack Horne, University of New Orleans</td>
</tr>
<tr>
<td>Exposing Students to Primary Research Literature One Figure at a Time: Initial Assessment Data</td>
<td>M. Julia Massimelli, University of California</td>
</tr>
<tr>
<td>Positive Sense, Negative Sense, Non-sense? How to Help Students Make Sense of Virus Replication</td>
<td>Deb Scheiwe, Tarrant County College-Northeast Campus</td>
</tr>
<tr>
<td>Using Student Concept Surveys to Guide Reflection and Formative Assessment</td>
<td>Christopher Parker, Texas Wesleyan University</td>
</tr>
<tr>
<td>Have Your Students Flipping for Microbial Metabolism: An Activity for Large Enrollment Classes</td>
<td>Jack Horne, University of New Orleans</td>
</tr>
<tr>
<td>Exposing Students to Primary Research Literature One Figure at a Time: Initial Assessment Data</td>
<td>M. Julia Massimelli, University of California</td>
</tr>
<tr>
<td>Using Microbe Information Sheets to Connect Concepts and Increase Critical Thinking</td>
<td>Vicki Huffman, Potomac State College of WVU</td>
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</table>
Welcome

Welcome to North Bethesda, Maryland!

We look forward to engaging in meaningful ways during the 2016 American Society for Microbiology Conference for Undergraduate Educators (ASMCUE). This is our twenty-third conference! We welcome past and first-time attendees to enjoy the informal, inviting and academic camaraderie that this conference is known to generate each year. Please use this time to share ideas, make new friends and actively engage with leading microbiology and biology faculty and researchers. We hope you enjoy learning about the latest cutting-edge scientific updates and effective teaching strategies.

We look forward to a great line up of plenary speakers this year:

- **Eric Brown**, Integrating Modern Genomic Science into Practical Microbiology: The Case of Food Safety
- **Arturo Casadevall**, Pathogenesis of Fungal Infections
- **Shirley Malcom**, Improving Education in and Increasing Access to Science: An Opportunity for Microbiology Educators
- **Loretta Brancaccio-Taras**, The State of the Nation: What We Know About Learning Biology

Additionally, the American Society for Microbiology’s new CEO, **Stefano Bertuzzi, Ph.D., MPH**, will be on site to welcome ASMCUE attendees on Thursday, July 21st.

Finally, new and returning program highlights include:

- Concurrent pedagogy sessions, scientific sessions, microbrew symposia, poster presentations, and exhibits spread out over the four days.
- The return of last year’s inaugural and successful Dissemination Station Resource Fair to encourage networking and exploration of resources from nationally funded projects.
- The return of HHMI Night at the Movies!
- Multiple opportunities exist to meet and network with colleagues, including: receptions, poster presentations, breakfasts organized by themes, and “dressing for microbial success.” (Remember on Friday to wear your school colors, and on Saturday to wear “community” colors based on your institution type.)

As usual, the entire ASMCUE 2016 team has worked diligently to provide an outstanding conference program in a convenient and affordable venue. We express our utmost and sincere appreciation to the Local Organizing Chairs, **Gaurav Arora, Jennifer Biddle**, and **John Buchner**, who provided invaluable expertise in helping us locate inspiring, forward-thinking and local speakers for many of the sessions. And, as always, the ASM staff has been exceptional, going above and beyond to help us make the conference a success. Please take a moment to thank them!

We hope that you will take advantage of the many opportunities to engage and network during the conference; as always, while we provide the programming, it is truly you, the attendees, who make the conference by engaging with the content as well as your fellow attendees! We look forward to engaging with you all during ASMCUE 2016!

Sincerely,

Chair,
**Naomi Wernick**
University of Massachusetts, Lowell
Lowell, Massachusetts

Vice Chair,
**Amy Siegesmund**
Pacific Lutheran University
Tacoma, Washington

Abstract Review Chair,
**Jaclyn Madden**
Harford Community College
Bel Air, Maryland

Microbrew Review Chair,
**Ned Barden**
MCPHS University,
Boston, Massachusetts
Conference Planning Committee

Moving Beyond What Works: Design, Transform, and Assess
23rd Annual ASM Conference for Undergraduate Educators
Bethesda North Marriott Hotel & Conference Center
July 21–24, 2016

ASMCUE STEERING COMMITTEE

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University of Massachusetts, Lowell, MA

Amy Siegesmund, Vice Chair
Pacific Lutheran University, Tacoma, WA

Jaclyn Madden, Abstract Review Chair
Harford Community College, Bel Air, MD

Ned Barden, Microbrew Review Chair
MCPS University, Boston, MA

Gaurav Arora, Local Organizing Chair
Gallaudet University, Washington, DC

Jennifer Biddle, Local Organizing Chair
University of Delaware, Newark, DE

John Buchner, Local Organizing Chair
University of Maryland, College Park, MD

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Chair, Education Board
Washington State University, Pullman, WA

Susan Merkel
Chair, Committee on Undergraduate Education
Cornell University, Ithaca, NY

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Director, Education Department

Bethany Adamec
Science Education Specialist

Kelly Gull
Manager, Faculty Programs

Rachel Horak
Headquarters Fellow in Education

Claudia Ratti
Coordinator, Education Programs and Resources

Michelle Slone
Coordinator, Education Programs and Resources

Kari Wester
Coordinator, Education Programs and Resources

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Washington, DC 20036
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Email: asmcue@asmusa.org

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Drake University College of Pharmacy and Health Sciences, Des Moines, IA

Amy Morris
Hastings College, Hastings, NE

Jeffrey Olimpo
The University of Texas, El Paso, TX

Veronica Segarra
High Point University, High Point, NC

MICROBREW REVIEW COMMITTEE

Ned Barden, Chair
MCPS University, Boston, MA

Michael Hanophy
St. Joseph’s College, Brooklyn, NY

Jerry Kavouras
Lewis University, Romeoville, IL

Suzanne Long
Monroe Community College, Rochester, NY
Conference Steering Committee

**Naomi Wernick, Chair**, is a Senior Lecturer in the Biological Sciences Department at University of Massachusetts Lowell, where she teaches introductory biology as well as freshman seminar, and serves as academic advisor to all biology students in the UTeach program. She holds a Ph.D. in molecular and cellular biology from Brandeis University and a B.A. in biochemistry and molecular biology from Dartmouth College.

Her current research focuses on the high school to college transition for biology majors, including the development and assessment of a freshman seminar as well as the role of metacognition and motivation in academic success. She also explores the effectiveness of different active learning methods in the introductory biology classroom.

Naomi Wernick was also an ASM Biology Research Scholar in the 2011-2012 cohort.

**Amy Siegesmund, Vice Chair**, is an associate professor in Biology at Pacific Lutheran University in Tacoma, WA. She holds a Ph.D. in microbiology from Washington State University and a B.A. in biology from Alverno College. Her current research focuses on student metacognition and learning; the use of self-assessment to increase metacognition; and student theories of intelligence, learning, and failure. She is an alumni of the Biology Scholars Research Residency (2010) and was a member of the ASM Task Force on Curriculum Guidelines. Amy was awarded the PLU Faculty Award for Excellence in Teaching in 2015.

**Jacklyn Madden, Abstract Review Chair**, is an Assistant Professor of Biology and Academic Program Specialist at Harford Community College. She completed a Bachelor of Science in Biology at Saint Vincent College and a Master of Science in Biotechnology at Johns Hopkins University. She was a 2014–2015 ASM Assessment Residency Biology Scholar and a member of the 2015–2016 Quantitative Undergraduate Biology Education and Synthesis QB in Introductory Biology Faculty Mentoring Network. Her interests include embedding research activities in introductory biology and biotechnology courses, increasing the use of active learning techniques in introductory biology courses, and the effects of embedding first year experience concepts in first year science courses.

**Ned Barden, Microbrew Review Chair**, is an associate professor of microbiology at MCPHS University (formerly known as Massachusetts College of Pharmacy and Health Sciences) in Boston where he teaches Medical Microbiology, Advanced Microbiology with laboratory, the Environment and Public Health, and the Premedical and Health Studies Capstone Seminar courses and directs undergraduate research in microbial physiology and applied microbiology. Dr. Barden has also been a faculty member at the University of Mississippi and Eastern Michigan University, and has worked in and provided microbiology consulting services to private industry. He holds a Ph.D. and M.S. in Bacteriology from the University of Wisconsin-Madison and a B.S. in bacteriology from Iowa State University of Science and Technology.
Local Organizing Committee

Gaurav Arora, Local Organizing Chair, received his Ph.D. in Biology from Georgia Institute of Technology. His doctoral thesis focused on understanding the evolutionary differences between human and chimpanzee apoptotic function. He was also involved in looking at the effects of small insertion and deletion sequences between human and chimpanzee genomes. While at Georgia Tech, Dr. Arora entered a fellowship program for training undergraduate teaching assistants. It was during this time that he developed a strong interest in undergraduate biology education.

Dr. Arora conducted his post-doctoral fellowship in Dr. Anne Rosenwald’s lab at Georgetown University. He is involved with the Genome Solver project (http://genomesolver.org/), which aims to improve undergraduate bioinformatics education. Using bioinformatics tools, Dr. Arora’s current research looks at the effects of overlapping open reading frames in yeast genomes and the role of microbiome in ecological systems. Dr. Arora is involved with synergistic activities of the American Society of Microbiology and with the Genomics Education Partnership (http://gep.wustl.edu/) at Washington University in St. Louis.

Jennifer Biddle, Local Organizing Chair, is an assistant professor in the School of Marine Science and Policy at the University of Delaware in Lewes, DE. She researches the benthic environment including estuary and deep sea habitats. Her interests include microbial biogeography and life in extreme environments, particularly the deep biosphere.

John Buchner, Local Organizing Chair, Dr. John Buchner was awarded a B.S. in Bacteriology from the University of Wisconsin and a Ph.D. from the University of Georgia. He began teaching professionally at UCSD, training workers for the bioenergy sector.

As a lecture faculty at University of Maryland, he teaches general microbiology, and microbial genetics. His microbiology class is in “I Series” courses at UMD, courses giving the participants a genuine experience of the field.
General Information

Conference Statistics
There are 375 participants, compared to 398 in 2015. Of those registered, there are:

- 320 conference attendees and 55 exhibitors
- 269 ASM Members and 51 non-members (among the faculty participants)
- 47% first-time attendees
- 22 international attendees representing 19 countries

Registration
Registration times and locations are listed below. Program books and badges are available at registration.

<table>
<thead>
<tr>
<th>Thursday, July 21</th>
<th>Friday, July 22</th>
<th>Saturday, July 23</th>
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<tbody>
<tr>
<td>2:00 PM – 8:00 PM – Salon Foyer</td>
<td>7:00 AM – 8:00 PM – Salon Foyer</td>
<td>7:00 AM – 4:45 PM – Salon Foyer</td>
</tr>
</tbody>
</table>

Abstracts
Abstracts for the poster sessions are featured in Volume 16, Issue 1 of the Journal of Microbiology & Biology Education: [http://www.asmscience.org/content/journal/jmbe/10.1128/jmbe.v17i2.1148](http://www.asmscience.org/content/journal/jmbe/10.1128/jmbe.v17i2.1148). They may also be found in the hard copy of the JMBE Spotlight Issue given to attendees on-site. Late-breaking abstracts may be found in the Guidebook Mobile app.

Badges
Badges, available at registration, are required to enter all sessions and the Exhibit Hall.

Internet Connection
Complimentary wireless service is provided in the following designated areas of the hotel: lobby, meeting space, and attendee hotel rooms. Please select the network **ASMCUE16** and the password is **ASMCUE16**.

Microbrew Sessions
These grassroots sessions, arranged by topic, provide a forum for sharing the best practices and interesting activities used in laboratory and classroom teaching. Presentations are simple “chalk talks” (e.g., no PowerPoint) to facilitate informal discussion. Sessions will be facilitated by volunteer attendees in order to make certain each presentation stays within the 15-minute presentation (10-minute presentation and 5 minutes for discussion). Sessions must stay on time so attendees are able to move from room to room quickly to see their desired session (see pages xx for the Microbrew at a Glance schedule).

**Microbrew Session I: Saturday, July 23, 11:30 AM – 12:30 PM**
Session A: 11:30 AM
Session B: 11:50 AM
Session C: 12:10 PM

**Microbrew Session II: Saturday, July 23, 2:30 PM – 3:30 PM**
Session D: 2:30 PM
Session E: 2:50 PM
Session F: 3:10 PM

**Microbrew Session III: Saturday, July 23, 3:45 PM – 4:45 PM**
Session G: 3:45 PM
Session H: 4:05 PM
Session I: 4:25 PM
Poster Sessions
Posters will be available for viewing beginning Friday, July 22 at 6:30 PM through Saturday, July 23 at 2:30 PM in Salon E. Two time slots are set aside for authors to be at their posters. They are:

**Session A**: Author Presentations: Saturday, July 23, 9:15 AM – 10:15 AM
**Session B**: Author Presentations: Saturday, July 23, 1:30 PM – 2:30 PM

Presenters must set up and take-down/remove their posters according to the following schedule:

**Set up**: Friday, July 22, 3:00 PM – 6:00 PM  
**Take down**: Saturday, July 23, 3:30 PM – 4:00 PM

Any posters left after Saturday’s take-down period will be discarded. The poster must fit into a 3’ (height) x 4’ (width) area.

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**ASMCUE Transportation**

**ASMCUE Location**
All ASMCUE sessions are held at the Bethesda North Marriott & Conference Center located approx. 25 miles from Washington Dulles International Airport (IAD), 23 miles from Ronald Reagan Washington National Airport (DCA), and 36 miles from Baltimore/Washington International Thurgood Marshall Airport (BWI.)

**Getting to and from North Bethesda**
There are several options for getting to the conference from the airport. Attendees can take a taxi, drive a personal vehicle, or take a shuttle from the airport. More details about each option are below.

**Taxi Service**
Taxi service is available from the airport 24 hours a day, seven days a week. The fare from the airport to hotel is:

- **Washington Dulles International Airport**  
  ~$45 (one way), not including gratuity

- **Ronald Reagan Washington National Airport**  
  ~$55 (one way), not including gratuity

- **Baltimore/Washington International Thurgood Marshall Airport**  
  ~$70 (one way), not including gratuity

**Driving to and Parking at the Hotel**

- **Washington Dulles International Airport**

- **Ronald Reagan Washington National Airport**
  Take George Washington Parkway to I-495N. Merge onto I-270 and take Democracy Blvd East Exit. Turn Left on MD-187/Old Georgetown Rd. Turn Right on Executive Blvd. Turn Left on Marinelli Rd.

- **Baltimore/Washington International Thurgood Marshall Airport**
  Take I-195 W to I-95S. Merge onto I-495 to Exit 27 towards Silver Spring. Merge onto Rockville Pike at Exit 34. Turn Left on Marinelli Rd.

**Discounted self-parking rate of $8 per day is available for all overnight guests.**

**Other Transportation**

<table>
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<tr>
<th>Subway Station</th>
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<tr>
<td>White Flint Metro Station (Red Line)</td>
<td>Train Station</td>
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<tr>
<td>Union Station</td>
<td>20 miles S</td>
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</tbody>
</table>

12  
23rd Annual ASM Conference for Undergraduate Educators, North Bethesda, Maryland
Special Events and Networking

Thursday

Opening: Meet the American Society for Microbiology’s New CEO
ASM’s new CEO, Stefano Bertuzzi, Ph.D., MPH, will be on site to welcome ASMCUE attendees.

Evening: Opening Reception
Seek out those first-timers or experienced ASMCUE attendees and introduce yourself. Many lifelong friendships start at this conference! Thank you to sponsors at Pearson for making this gathering possible.

Friday

All Day: College and University Spirit Day
Represent your college or university! Break out your school jacket, t-shirts, ties & polos and show us your school spirit!

Breakfast: Roundtable Discussions—Topical Areas
Each year, attendees gather at this networking breakfast to meet with each other and discuss areas of interest, such as active learning techniques, issues surrounding teaching and to meet leaders and participants of ASM faculty development initiatives.

Lunchtime: Dissemination Station Resource Fair
Interested in our new Dissemination Station Resource Fair? Visit representatives listed below from grant-funded programs and non-profit organizations as they share information about their projects and ways you can incorporate their materials and/or contribute to their efforts.

| Genome Solver: Creating a Community Science Project in Bioinformatics |
| Gaurav Arora, Gallaudet University |
| National Academies of Sciences, Engineering, and Medicine |
| Jay Labov, National Academy of Sciences |
| American Association for the Advancement of Science |
| Sandra Blumenrath, AAAS |
| Authentic Research Experience in Microbiology (AREM): Course-Based Microbiome Research |
| Theodore Muth, City University of New York |
| Promoting Active Learning & Mentoring (PALM) |
| Thea Clarke, American Society for Cell Biology |
| Genetics Society of America: Resources for Educators |
| Beth Ruedi, Genetics Society of America |
| The STEM Ambassadors Program at UMass Amherst |
| Ally Hunter, UMass Amherst |
| The Build-a-Genome Network: A Research Intensive Course Experience in Synthetic Biology |
| Lisa Scheifele, Loyola University Maryland |
| QUBES and ASM: Adding up to Better Quantitative Skills |
| Kristen Jenkins, BioQUEST/QUBES |
| Promoting Concept-Driven Teaching Strategies in Biochemistry and Molecular Biology |
| Erica Siebrasse, American Society for Biochemistry and Molecular Biology |
| BioBuilder Educational Foundation, Q&A sessions |
| Natalie Kuldell, Massachusetts Institute of Technology |
Special Events and Networking (continued)

**Lunchtime: Job-Seeking Lounge**
Seeking a job or candidates for a position at your institution? Drop off your resume or a job announcement in the lounge Friday morning and use the lunch hour to visit and network.

**Evening: Exhibit Opening & Reception**
Welcome a variety of vendors who help make the conference possible through their participation and sponsorship. Learn about products and textbooks that you can incorporate into your teaching.

**Saturday**

**All Day: Identify Your Community Day**
Wear your “community” colors and represent your institution type so you can identify and network with your colleagues.

Community College = BLUE  
Primarily Undergraduate Institution = GREEN  
Comprehensive University = ORANGE  
Doctoral-Degree Granting University = RED  
International = PURPLE

**Breakfast: Roundtable Discussions–Network by Location**
ASM supports thirty-five Branches, organized by geographical territories, that are defined by one or more states and/or zip code areas. On site, attendees will be encouraged to meet others in the same vicinity and plan branch activities. International attendees will have an opportunity to meet as well.

**Daytime: Poster & Microbrew Sessions**
Visit your colleagues’ poster as they describe their innovative teaching approaches or the specific activities conducted by their students. Attend a Microbrew to hear your colleagues share best practices and interesting activities used in laboratory and classroom teaching.

**Evening: Director’s Choice: HHMI Night at the Movies**
Travel Awardees

Congratulations to all of the ASMCUE 2016 Travel Awardees!
Formal recognition of the recipients will take place during the Thursday dinner.

Announcing the 2016 ASMCUE Textbook Travel Award Winner!

Katherine Marsh, a professor at El Camino College Compton Center in Compton, CA is the 2016 ASMCUE Textbook Travel Awardee. The award is targeted at emerging leaders in biology education and research and offers the recipient an opportunity to learn research and pedagogy developments, practice new technologies and techniques, and connect with other educators and researchers by attending ASMCUE. Because Marsh’s ASMCUE Travel Award application was considered particularly exceptional, the reviewers agreed that she should receive this year’s Textbook Travel Award.

Funding for the Textbook Travel Award derives from a special endowment created in 2008 by several textbook authors committed to faculty development and ASMCUE. The authors sponsoring this endowment include Denise Anderson, University of Washington, Seattle; Robert Bauman at Amarillo College, Texas; Barry Chess at Pasadena City College, California; Marjorie Cowan at Miami University, Ohio; Jeffrey Pommerville at Glendale Community College, Arizona; Kathleen Talaro at Pasadena City College, California; and Christopher Woolverton at Kent State University, Ohio.

ASMCUE Travel Awardees

The ASMCUE Travel Award recognizes leaders in biology education and research and provides them with opportunities to learn research and pedagogy developments, practice new technologies and techniques, and connect with other educators and researchers by attending ASMCUE

- Frederick Baliraine, LeTourneau University, Longview, TX
- Jessica Bell, Century College, White Bear Lake, MN
- Marie Bissong, University of Bamenda, Bamenda, Northwest Region
- Jenifer Bourcier, Lansing Community College, Lansing, MI
- Maris Fonseca, Monroe County Community College, Monroe, MI
- Aimee Hollander, Nicholls State, Thibodaux, LA
- Caroline Kulesza, Fort Lewis College, Durango, CO
- Olivia Long, University of Pittsburgh at Greensburg, Greensburg, PA
- Shannon Seidel, Pacific Lutheran University, Tacoma, WA
- Jordan Steel, Colorado State University-Pueblo, Pueblo, CO
- Jennifer Walker, University of Georgia, Athens, GA
- Karena Waller, The University of Melbourne, Melbourne, VIC

ASMCUE Leadership Grant for International Educators

This program is sponsored by the ASM International Education Committee and has been developed to enable a select group of educators from resource-limited countries to attend the ASMCUE and a pre-conference workshop to provide international leaders in education with the resources to build innovative teaching modules that engage students and lead to enduring understandings in microbiology.

- Mehboob Ahmed, University of the Punjab, Lahore, Pakistan
- Patience Bazuaye-Alonge, Northern Caribbean University, Mandeville, Jamaica
- Melessa Brown-Ellis, University of Technology, Jamaica
- Jayasri Das Sarma, Indian Institute of Science Education and Research, Kolkata, Mohanpur, India
Travel Awardees (continued)

- **Eyasu Ejeta Duken**, Wollega University, Nekemte, Ethiopia
- **Remedios Flamiano**, Mindanao State University, General Santos, Philippines
- **Atia Iqbal**, The Women University Multan, Multan, Pakistan
- **Kanokwan Kittiniyom**, Mahidol University, Phutthamonthon, Thailand
- **Kiran Kondabagilu**, Indian Institute of Technology, Bombay, Mumbai, India
- **Shyam Kumar Mishra**, Institute of Medicine, Kathmandu, Nepal
- **Erina Petrera**, Universidad de Buenos Aires, Buenos Aires, Argentina

### ASM recognizes two dedicated educators

**Joseph P. Caruso**  
Florida Atlantic University  
Deceased: September 4, 2015

**David A. Dunbar**  
Cabrini College  
Deceased: May 21, 2016

ASM would like to recognize two dedicated educators and members of the ASMCUE community who were lost this year. Their enthusiasm and love of science teaching will be missed.
The American Society for Microbiology thanks the following sponsors and exhibitors for their generosity:

**Author Corner Sponsor**
www.asmscience.org

**NEW EXHIBITOR!**

**Author Corner Sponsor**
www.wwnorton.com

**WILEY**

**Refresher Break, Guidebook Mobile App, and Product Corner Sponsor**
www.wiley.com

**Conference Logo and Final Program Sponsor**
www.imagineeringart.com

**PEARSON**

**Thursday Reception and Product Corner Sponsor**
www.pearson.com

**NEW EXHIBITOR!**
www.edvotek.com

**www.edvotek.com**

**NEW EXHIBITOR!**
www.ibiology.org

**www.ibiology.org**

**www.morton-pub.com**

**NEW EXHIBITOR!**
www.asm.org

**www.asm.org**

**www.jblearning.com**

**www.biolog.com**

**NEW EXHIBITOR!**
www.mhhe.com

**www.mhhe.com**

**NEW EXHIBITOR!**
www.carolina.com/distancelearning

**www.carolina.com/distancelearning**

**NEW EXHIBITOR!**
OpenStax.org

**www.cellzone.org**

**NEW EXHIBITOR!**
www.bluedoorpublishing.com

**www.bluedoorpublishing.com**

**Product Corner Sponsor**
www.esciencelabs.com

**www.esciencelabs.com**

**www.licor.com/bio**

**www.minipcr.com**

**simbio.com**

**www.biointerative.org**

**NEW EXHIBITOR!**
www.genetics-gsa.org

**www.genetics-gsa.org**

**NEW EXHIBITOR!**
www.bio-rad.com

**www.bio-rad.com**

**NEW EXHIBITOR!**
www.embitec.com
Exhibitor Showcase

Friday, July 22, 6:30 PM – 8:30 PM and Saturday, July 23, 9:00 AM – 3:30 PM
Bethesda North Marriott Hotel & Conference Center – Salon E

Exhibitor set up is Friday 3:00 PM – 6:00 PM.
Exhibits must be dismantled by 4:00 PM on Saturday.
Read more about this year’s Exhibitors and Conference Sponsors in the Guidebook mobile app.

ASMCUE Scavenger Hunt and Raffle

The ASMCUE organizers invite you to participate in a scavenger hunt! In this game, the clues you will gather will be other attendees. Check your attendee packet for a yellow handout of instructions. This will also serve as your raffle entry. Read the instructions below carefully and you could win fabulous prizes donated by our generous sponsors!

Instructions: Find ASMCUE participant whose role is described on the handout. Place their name next to the appropriate description. Each participant’s name may appear ONLY ONCE on this sheet (yours included!). To be considered for the raffle, you must have at least 20 names.

Form submission and raffle drawing: Forms must be placed in the raffle box at ASMCUE registration table by Saturday by 12:15 PM. The raffle drawing will take place in the Exhibit Hall at 3:30 PM. Be certain to put your name and institution on the form so we can award your prize. You must be present to win!

Scavenger Raffle Prize Sponsors

The American Society for Microbiology thanks the following sponsors and exhibitors for their generosity in donating raffle prizes:

ASM Press        iBiology
Biolog           John Wiley & Sons, Inc.
bluedoor         McGraw-Hill Education
Carolina Biological Supply Company   miniPCR
CellZone, Inc.   Morton Publishing Company
Edvotek          Pearson
eScience Labs, LLC
## ASMCUE Program at a Glance — Thursday, July 21, 2016

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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| 9:00 AM – 3:00 PM | Pre-Conference Workshop  
*Authentic Research Experience in Microbiology (AREM): Integrating Student-Driven Microbiome Research into a Course-Based Research Program*  
(Registered Participants Only)  
*Brookside B* |
| 9:00 AM – 3:00 PM | Pre-Conference Workshop  
*Designing Lessons Based on National Recommendations for STEM Education*  
(Registered Participants Only)  
*White Flint Amphitheater* |
| 9:00 AM – 3:00 PM | Pre-Conference Workshop  
*Genome Solver On-the-Go: Analyzing Microbial Genomes with Bioinformatics Tools*  
(Registered Participants Only)  
*White Oak A* |
| 2:00 PM – 8:00 PM | ASMCUE Registration  
*Salon Foyer* |
| 3:45 PM – 4:00 PM | Conference Welcome and Opening Remarks  
*Salon A-C* |
| 4:00 PM – 5:00 PM | Opening Plenary Lecture  
*Integrating Modern Genomic Science into Practical Microbiology: The Case of Food Safety*  
*Eric Brown*, Director, Division of Microbiology in the Office of Regulatory Science, U.S. Food and Drug Administration  
*Salon A-C* |
| 5:00 PM – 5:30 PM | Welcome from the ASM Chief Executive Officer  
*Stefano Bertuzzi*, American Society for Microbiology  
*Salon A-C* |
| 5:30 PM – 6:30 PM | Dinner and Travel Award Recognition  
*Salon D* |

### Concurrent Education Sessions

<table>
<thead>
<tr>
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<td>6:45 PM – 7:15 PM</td>
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**How to Land a Faculty Position at a Non-Research Institution**  
*Lourdes Norman-McKay*, Florida State College Jacksonville  
*Roger Peffer*, Great Falls College MSU  
*Warner Bair III*, Lone Star Community College  
*Creating Frequent Online Quizzes that Enhance Lasting Learning*  
*Jennifer McLean and Erica Suchman*, Colorado State University  
*Re-emphasizing the 3 ‘Rs’ in a Microbiology Classroom using a Discussion on Antimicrobial Resistance*  
*Lalitha Ramamoorthy*, Marian University |
| 7:15 PM – 7:45 PM |  
*Teaching with the ASM Curriculum Guidelines for Undergraduate Microbiology: Using Backwards Design*  
*Sue Merkel*, Cornell University  
*Rachel Horak*, American Society for Microbiology  
*Moving Away from Dogmatic Teaching: Experiences and Perspectives*  
*Foong May Yeong*, National University of Singapore |
| 7:45 PM – 8:15 PM |  
*Assessment Made Easy: Writing Learning Outcomes*  
*Boots Quimby*, University of Maryland  
*Learning Science by Doing Science: An Inquiry-Based Introductory Microbiology Lab Course*  
*Sarah Ades*, Penn State University |
| 8:30 PM – 9:30 PM |  
*Welcome Reception*  
*Sponsored by Pearson*  
*Salon Foyer* |
ASMCUE Program — Thursday, July 21, 2016 (continued)

PRE-CONFERENCE WORKSHOP
9:00 AM – 3:00 PM
Brookside B

Authentic Research Experience in Microbiology (AREM): Integrating Student-Driven Microbiome Research into a Course-Based Research Program
Theodore Muth, Avrom Caplan, and Jessica Joyner, City University of New York

This workshop will introduce AREM, and facilitators will help participants develop a plan for experimental design, data management, analysis and assessment of student learning.

PRE-CONFERENCE WORKSHOP
9:00 AM – 3:00 PM
White Flint Amphitheater

Designing Lessons Based on National Recommendations for STEM Education Pre-Conference Workshop
Rachel Horak, American Society for Microbiology
Susan Merkel, Cornell University

This workshop will help participants with the process for re-configuring an existing lesson or designing a new lesson using backward design.

PRE-CONFERENCE WORKSHOP
9:00 AM – 3:00 PM
White Oak A

Genome Solver On-the-Go: Analyzing Microbial Genomes with Bioinformatics Tools Pre-Conference Workshop
Anne Rosenwald, Georgetown University
Gaurav Arora, Gallaudet University
Vinayak Mathur, Georgetown University

This workshop will train undergraduate faculty how to use web-based tools for database searches, sequence alignments, etc. to analyze existing microbial genomic data.

ASMCUE REGISTRATION
2:00 PM – 8:00 PM
Salon Foyer

WELCOME AND OPENING REMARKS
3:45 PM – 4:00 PM
Salon A-C

OPENING PLENARY LECTURE
4:00 PM – 5:00 PM
Salon A-C

Integrating Modern Genomic Science into Practical Microbiology: The Case of Food Safety
Eric Brown, Director, Division of Microbiology in the Office of Regulatory Science, U.S. Food and Drug Administration

Next generation sequencing of bacterial pathogens is revolutionizing the science behind clinical diagnostics, epidemiology and the field of microbiology in general. The first bacterial genome was sequenced in 1995 and took more than 13 months and cost tens of thousands of dollars to complete. Today, a microorganism’s entire genome can be sequenced in 48 hours for about $50. These technological advancements in the field of food microbiology have transformed our ability to use genomic sequence information to explore the origins, evolution, and drivers associated with dangerous disease outbreaks. The widespread availability of small, easy to use whole genome sequencers is resulting in a paradigm shift for scientists to approach the identification and traceability of pathogens in the environment and clinic.

In the US, WGS analysis of microbial pathogens is now supplanting traditional microbiological analytics with antimicrobial resistance profiling, detection of high risk virulence profiles, and general identification strategies that supersede serological, phenotypic, and classical cultural testing. WGS networks are envisioned to serve as future national rapid sentinel surveillance systems for foodborne pathogen outbreak traceback and antimicrobial drug resistance characterization, critical for an effective public health response to bacterial outbreaks. It is noteworthy that because such networks rely on DNA analytics solely, they could also be redeployed for applications beyond food safety, including other communicable and bioterror threats.
WELCOME FROM THE ASM CHIEF EXECUTIVE OFFICER
5:00 PM – 5:30 PM
Salon A-C
Stefano Bertuzzi, American Society for Microbiology

DINNER AND TRAVEL AWARD RECOGNITION
5:30 PM – 6:30 PM
Salon D

CONCURRENT EDUCATION SESSIONS

6:45 PM – 8:30 PM
Glen Echo
How to Land a Faculty Position at a Non-Research Institution
Lourdes Norman-McKay, Florida State College, Jacksonville
Roger Peffer, Great Falls College MSU
Warner Bair III, Lone Star Community College

Increasingly, people trained for research careers are seeking employment outside of the research ‘publish-or-perish’ atmosphere. Unfortunately, while these candidates are highly credentialed, they often don't land jobs at such institutions because they're taking the wrong approach in their applications. Join us in this interactive workshop to learn how to land a faculty position in a non-research based college. We'll cover application and interviewing tips, as well as how to craft an effective teaching demonstration and teaching philosophy statement. The workshop facilitators have extensive experience in teaching-centric higher-ed institutions and collectively have screened thousands of applicants for the very job you seek.

6:45 PM – 7:15 PM
White Oak A
Creating Frequent Online Quizzes that Enhance Lasting Learning
Jennifer McLean and Erica Suchman, Colorado State University

Frequent assessments are important to learning because they help students to avoid last-minute cramming before an exam, and they can help students gauge their own knowledge and understanding. Here, we conducted a 4-semester study to determine the efficacy of frequent online quizzing in a general microbiology lecture course. Our data show that when compared to students who did not take online quizzes, students performed better on exams during the semester, but not on the comprehensive final exam. These results suggest that when students get to practice the material before the exam, they may learn the concepts better in the short term, but they seem to forget what they learned by the end of the semester. We conclude, therefore, that perhaps integrating review questions into each of the online quizzes will better promote long-term retention on the final, comprehensive exam.

6:45 PM – 7:15 PM
White Flint Amphitheater
Re-emphasizing the 3 ‘Rs’ in a Microbiology Classroom using a Discussion on Antimicrobial Resistance
Lalitha Ramamoorthy, Marian University

In this session, I will present active learning strategies that enhance student learning through a discussion on bacterial pathogenesis and development of resistance to antimicrobial agents. These strategies address learning at multiple levels of pedagogy and build on students’ prior knowledge. The instructional resources emphasize reading comprehension, scientific writing and data analysis through the use of primary literature sources, case studies, and hands on activities. Student learning is assessed in a continuum throughout the course, through the use of formative and summative assessments.

7:15 PM – 7:45 PM
White Oak A
Teaching with the ASM Curriculum Guidelines for Undergraduate Microbiology: Using Backwards Design
Sue Merkel, Cornell University
Rachel Horak, American Society for Microbiology

Are your students thinking like scientists? Would you like them to become better problem solvers in biology? Appropriate curriculum design and student-centered classrooms are essential for developing critical thinking skills and for effective learning, but implementing them can be difficult. The
Understanding by Design (or “backward design”) framework for curriculum planning can help educators plan for and monitor student learning. This session will introduce educators to the process of backwards design (using the ASM Curriculum Guidelines for Undergraduate Microbiology). Through an interactive session, participants will learn how to write learning outcomes that address different levels of cognitive thinking, and how to align the learning outcomes to assessments and activities. We will also introduce participants to current ASM resources that support the ASM Curriculum Guidelines.

7:15 PM – 7:45 PM  
White Flint Amphitheater  
**Moving Away from Dogmatic Teaching: Experiences and Perspectives**  
Foong May Yeong, National University of Singapore  

Students should learn that we arrive at our knowledge about Cell Biology through experimentation and application of reasoning skills. However, presently most textbooks are written as a collection of conclusions that past scientists have made about their experimental data. During formal lectures, we tend to impart basic concepts by providing the information in didactic lectures, especially for large undergraduate classes. Consequently, students receive knowledge in a passive manner and have problems applying their knowledge to biological problems. One way to overcome such a dogmatic approach in disseminating knowledge could be to avoid always explicitly stating facts and concepts. Instead, during lectures, students could be asked to reason through key data to arrive at basic information or concepts. This approach can be reinforced in take-home assignments requiring students to read research articles and answer questions about the data. I would like to share my preliminary observations showing that students can extract simple knowledge and concepts through data analysis. Also, there are some indications of increased cognitive engagement when appropriate question prompts about research data are used in this manner. In summary, a less dogmatic way of teaching could therefore be used to complement the traditional didactic teaching.

7:45 PM – 8:15 PM  
White Oak A  
**Assessment Made Easy: Writing Learning Outcomes**  
Boots Quimby, University of Maryland  

All good assessment begins with well-written learning outcomes. In this, the first part of a two-part workshop on assessment, writing learning outcomes and a short discussion of the role of learning outcomes in developing an assessment plan will be discussed. Participants will classify learning outcomes using Bloom's taxonomy and write learning outcomes specific to their course or content. These activities will give participants hands-on practice in writing learning outcomes for their courses.

7:45 PM – 8:15 PM  
White Flint Amphitheater  
**Learning Science by Doing Science: An Inquiry-Based Introductory Microbiology Lab Course**  
Sarah Ades, Penn State University  

There is a fundamental disconnect between the traditional approach to science education and science as a discipline. Students are too often left with the impression that science is a string of techniques done in the lab and series of facts memorized in the classroom. They learn little about what science actually is. This session will present an inquiry-based introductory microbiology course that immerses students in the practice of science and prepares them to perform research throughout the rest of their education. The course is typically taken by students in their second semester, and is their first biological laboratory course. The emphasis is on understanding science as a discipline, while learning concepts of microbiology, laboratory safety, notebook skills, and experimental techniques. Modules are specifically designed to relate to the world outside of the laboratory to help students build connections between science and the world around them. Students are challenged to act as scientists from the start, thinking critically about all aspects of science from experimental design to quantitative data analysis.
A scientific community in the classroom is created through interactions and collaborations between students throughout the semester. Scaffolding and reinforcement of concepts and techniques are incorporated into the course design so that by the end of the semester students have progressed from acting as novices to designing and performing experiments similar to those conducted in active research laboratories.

WELCOME RECEPTION
8:30 PM – 9:30 PM
Salon Foyer
Sponsored by Pearson
<table>
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<th>Time</th>
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<tr>
<td>7:00 AM – 8:00 PM</td>
<td>ASMCUE Registration</td>
<td>Salon Foyer</td>
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<td>7:00 AM – 8:00 AM</td>
<td>Breakfast by Topical Areas</td>
<td>Salon D</td>
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**ASMCUE Program at a Glance — Friday, July 22, 2016**

### Concurrent Education Sessions

#### 8:00 AM – 8:30 AM

<table>
<thead>
<tr>
<th>Location</th>
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</table>
| Forest Glen      | **Integrating Discovery-Based Research into the Undergraduate Curriculum:** Discussion of a Report from the National Academies of Sciences, Engineering, and Medicine  
Jay Labov, National Academy of Sciences |
| White Oak A      | **It Takes A Village: Using Collaborations to Create Course Integrated Undergraduate Research Opportunities in Community Colleges Through Detection of Antibiotic Resistance Genes**  
Jessica Bell, Century College  
Jodi Goldberg, Hamline University |
| White Flint Amphitheater | **History and Development of the Microbiology for Health Sciences Concept Inventory, General Microbiology Concept Inventory, and Host Pathogen Interactions Concept Inventory**  
Heather Seitz, Johnson County Community College  
Rachel Horak, American Society for Microbiology  
Jeffrey Pommerville, Glendale Community College  
Lucy Kluckhohn-Jones, Santa Monica College  
Maureen Whitehurst, Trident Technical College  
Andrea Pratt-Rediske, University of Central Florida  
Megan Howard, Battelle Memorial Institute |
| Brookside        | **The Impact of Structured Professional Development Experiences on Biology Undergraduate Teaching Assistants’ Pedagogical Beliefs and Attitudes: A Multi-Institutional, Comparative Study**  
Jeffrey Olimpo, University of Texas at El Paso  
Thomas McCabe, University of Northern Colorado  
Patricia Shields, University of Maryland |

#### 8:30 AM – 9:00 AM

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Jay Labov, National Academy of Sciences |
| White Oak A      | **Design Principles for the Course-based Undergraduate Research Experience (CURE)**  
Paula Soneral, Bethel University |
| White Flint Amphitheater | **Development of Concept Inventory Questions through the Analysis of Student Misconceptions**  
Timothy Paustian, University of Wisconsin  
Amy Briggs, Beloit College  
Robert Brennan, University Central Oklahoma  
John Buchner, University of Maryland  
Rachel Horak, American Society Microbiology  
Lee Hughes, University of North Texas  
D. Sue Katz Amburn, Rogers State University  
Ann McDonald, Concordia University Wisconsin  
Todd Primm, Sam Houston State University  
Heather Seitz, Johnson County Community College  
Ann Smith, University of Maryland  
Ann Stevens, Virginia Tech  
Sunny Yung, Sam Houston State University |
| Brookside        | **Books-to-Lab: The Application of Book Knowledge to Industrial Laboratories**  
Mykeshia McNorton, American Society for Microbiology |
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<tr>
<th>Time</th>
<th>Concurrent Education Sessions</th>
<th>Concurrent Scientific Sessions</th>
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</table>
| 9:00 AM – 9:30 AM | Integrating Discovery-Based Research into the Undergraduate Curriculum: Discussion of a Report from the National Academies of Sciences, Engineering, and Medicine (repeated) | **Integrating Discovery-Based Research into the Undergraduate Curriculum: Discussion of a Report from the National Academies of Sciences, Engineering, and Medicine (repeated)**
Jay Labov, National Academy of Sciences
Scientific Literacy: Teaching Biology Majors to Read, Paraphrase and Cite Scientific Literature
Melissa Zwick and Karen York, Stockton University
Using Concept Inventories to Assess Student Learning of Microbiology Concepts
Safety First, Safety Last, but Safety Always—Understanding the Biological Safety Level Necessary for your Lab
Jeffrey Byrd, St. Mary’s College of Maryland |
| 9:45 AM – 10:15 AM | Assessment Made Easy: Aligning Assessment with Learning Outcomes
Boots Quimby, University of Maryland | **Beyond Plug and Chug: Finding Meaning in Quantitative Microbiology**
Kristin Jenkins, BioQUEST
Making the Case: What Matters for Case Study Development?
Ally Hunter, UMass Amherst
Data Diving: Using Primary Literature in an Introductory Biology Course
Amy Briggs, Beloit College
Course Redesign Initiatives
Scott Roberts, University of Maryland |
| 10:15 AM – 10:45 AM | Remodeling Bacterial Cell Walls: New Lego Building Blocks
Catherine Grimes, University of Delaware | **The Threat and Wonders of MRSA: Using Current Topics and Public Resources to Teach Fundamental Principles of Microbiology**
Michele Swanson, University of Michigan
Teaching Scientific Method and Data Analysis Through Primary Literature and HHMI’s The Biology of Skin Color
Mark Randa, Cumberland County College
CUREs For All: The Options and Opportunities of Course and Program-Based Research Opportunities for Undergraduates of All Backgrounds and Majors
Patrick Killion, University of Maryland |
| 10:45 AM – 11:15 AM | Creating Active Learning and Research Based Laboratory Exercises
Cynthia Keler, Delaware Valley University | **Creating Active Learning and Research Based Laboratory Exercises**
Cynthia Keler, Delaware Valley University
Using Primary Literature to Teach Data Analysis in Introductory Microbiology
Nancy Boury, Iowa State University
PULSE: Taking Transformation from the Classroom to the Departmental Level
Judy Awong Taylor, Georgia Gwinnett College
Samantha Elliott, St. Mary’s College of Maryland |
| 11:30 PM – 12:30 PM | Remodeling Bacterial Cell Walls: New Lego Building Blocks
Catherine Grimes, University of Delaware | **Mystery in the Female Infection of Neisseria Gonorrhoeae**
Wenxia Song, University of Maryland
Overwhelming Evolution. Patients, Microbes and the Darwinian Process
Andrew Read, Penn State |
| 12:30 PM – 2:00 PM | Lunch
Salon D | **Lunch**
Salon D |
| 12:30 PM – 2:00 PM | Dissemination Station Resource Fair
Salon Foyer | **Dissemination Station Resource Fair**
Salon Foyer |
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<th>Time</th>
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<tr>
<td>12:30 PM – 2:00 PM</td>
<td>Job-Seeking Lounge</td>
<td>Forest Glen</td>
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<tr>
<td>1:30 PM – 2:00 PM</td>
<td>Author Corner</td>
<td>ASM Press, Outside Veranda</td>
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### Concurrent Scientific Sessions

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<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>2:15 PM – 3:15 PM</td>
<td>Host Biology in Light of the Microbiome: An Introduction to Holobionts and their Hologenomes</td>
<td>White Oak A</td>
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<tr>
<td></td>
<td>Seth Bordenstein, Vanderbilt University</td>
<td>White Flint Amphitheater,</td>
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<tr>
<td></td>
<td>Evolutionary Mechanisms of RNA Virus Host-Switching</td>
<td>Brookside</td>
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<td></td>
<td>Colleen Jonsson, University of Tennessee, Knoxville and National Institute of Mathematical and Biological Synthesis</td>
<td>Marine Sponges and their Bacterial Symbionts: Key Players in Nutrient Cycling in Coral Reefs</td>
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<td>Russell Hill, University of Maryland Center for Environmental Sciences</td>
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### Concurrent Education Sessions

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<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>3:30 PM – 4:00 PM</td>
<td>Opportunities and Tension Points Associated with Integrating Teaching and Research in Undergraduate Biology Lab Courses</td>
<td>Forest Glen</td>
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<tr>
<td></td>
<td>Sara Brownell, Arizona State University</td>
<td>White Oak A</td>
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<td></td>
<td>Online Education: Engaging Your Students When You Can’t See Them</td>
<td>White Flint Amphitheater,</td>
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<td></td>
<td>Kris Obom and Karen Wells, Johns Hopkins University</td>
<td>Brookside</td>
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<tr>
<td>4:00 PM – 4:30 PM</td>
<td>How to Assess Your Course-Based Undergraduate Research Experience</td>
<td>Forest Glen</td>
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<td></td>
<td>Sara Brownell, Arizona State University</td>
<td>White Oak A</td>
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<tr>
<td></td>
<td>BioBuilder Classrooms: Engineering Ideas for Life</td>
<td>White Flint Amphitheater,</td>
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<td>Natalie Kuldell, Massachusetts Institute of Technology</td>
<td>Brookside</td>
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<tr>
<td>4:30 PM – 5:00 PM</td>
<td>So You Transformed Your Class to Active Learning – How Do You Assess the Impact of Active Learning on Students</td>
<td>Forest Glen</td>
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<td>Sara Brownell, Arizona State University</td>
<td>White Oak A</td>
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<td></td>
<td>What’s It Like to be a Scientist? Exposing Students to Different Fields of Biology and How to Think Like a Scientist</td>
<td>White Flint Amphitheater,</td>
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<td>Melissa Csikari, Howard Hughes Medical Institute</td>
<td>Brookside</td>
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<td></td>
<td>Jackie Washington, Nyack College</td>
<td>Wildcam Gorongosa (HHMI BioInteractive): A Citizen Science Project and Online Data Lab</td>
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<td>Bridget Conneely, Howard Hughes Medical Institute</td>
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<td>Dave Westenberg, Missouri University of Science and Technology</td>
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<td>5:15 PM – 6:15 PM</td>
<td>Plenary Lecture</td>
<td>Forest Glen</td>
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<td>Pathogenesis of Fungal Infections</td>
<td>White Oak A</td>
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<td>Arturo Casadevall, Johns Hopkins University</td>
<td>White Flint Amphitheater,</td>
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<td>Editor in Chief, mBio</td>
<td>Brookside</td>
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<td>Salon A-C</td>
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<td>6:30 PM – 8:30 PM</td>
<td>Exhibit Opening &amp; Reception</td>
<td>Forest Glen</td>
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<td>Salon E</td>
<td>White Oak A</td>
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</table>
COLLEGE AND UNIVERSITY SPIRIT DAY
Represent your college or university! Break out your school jacket, t-shirts, ties & polos and show us your school spirit!

ASMCUE REGISTRATION
7:00 AM – 8:00 PM
Salon Foyer

BREAKFAST BY TOPICAL AREAS
7:00 AM – 8:00 AM
Salon D

ASM facilitates the e-mail based discussion group, MICROEDU. Here, microbiology educators can learn from each other by exchanging ideas and communicating issues and challenges. Many informative and thoughtful conversations take place within this listserv community and we encourage attendees to revisit the issues face-to-face. Several topics have been identified by the Steering Committee and a complete list will be available on-site.

CONCURRENT EDUCATION SESSIONS

8:00 AM – 8:30 AM
Forest Glen

Integrating Discovery-Based Research into the Undergraduate Curriculum: Discussion of a Report from the National Academies of Sciences, Engineering, and Medicine

Jay Labov, National Academy of Sciences

The President’s Council of Advisors on Science and Technology report, “Engage to Excel” (2012), urges the STEM education community and funding agencies to “Advocate and provide support for replacing standard laboratory courses with discovery-based research courses.” This recommendation is based on emerging evidence that engaging undergraduates in discovery research as early as possible and under the guidance of an effective mentor can be an effective strategy for supporting and retaining STEM students and for improving scientific literacy. But providing all students with individualized mentored research experiences is not possible. Thus, many STEM educators are now experimenting with various strategies for replacing more traditional laboratory exercises with discovery-based research and related activities. To further explore opportunities and challenges of developing, implementing, and sustaining course-based undergraduate research experiences, a committee of the National Academies of Sciences, Engineering, and Medicine organized a convocation that was held in Washington, DC in May, 2015 and produced a report that summarized the proceeding. This session will summarize that report and catalyze discussions about the opportunities and challenges inherent in course-based research programs. Participants will receive a printed copy of the report.

8:00 AM – 8:30 AM
White Oak A

It Takes A Village: Using Collaborations to Create Course Integrated Undergraduate Research Opportunities in Community Colleges Through Detection of Antibiotic Resistance Genes

Jessica Bell, Century College
Jodi Goldberg, Hamline University

We have implemented a collaboration between Hamline University (a four-year university) and nearby Century College (a community college) located in Minnesota. Undergraduate students enrolled in courses at each institution have the opportunity to contribute to an ongoing faculty member’s research project. Our primary aim is to provide ongoing course integrated research experiences in varied and sequenced biology courses that include transferable and universal skill sets. Several collaborative projects exist and are at different stages of implementation. In the most evaluated research project, students use PCR and gel electrophoresis to detect three antibiotic resistance genes from environmental samples that they collect. Through a series of experiments students obtain an understanding of core biological principles including scientific process, cell structure, genetics, the role of the environment, and application of molecular biology techniques while contributing to ongoing primary research. The institutions involved in the collaboration serve varied undergraduate populations. In addition, faculty at each institution are subject to differing expectations regarding teaching, service and scholarship. This session focuses on the essential components, potential barriers and creative solutions to collaborating across institutions.
8:00 AM – 8:30 AM  
White Flint Amphitheater

History and Development of the Microbiology for Health Sciences Concept Inventory, General Microbiology Concept Inventory, and Host Pathogen Interactions Concept Inventory

Heather Seitz, Johnson County Community College  
Rachel Horak, American Society for Microbiology  
Jeffrey Pommerville, Glendale Community College  
Lucy Kluckhohn-Jones, Santa Monica College  
Maureen Whitehurst, Trident Technical College  
Andrea Pratt-Rediske, University of Central Florida  
Megan Howard, Battelle Memorial Institute

Upon completion of the ASM curriculum guidelines there was a need for assessment tools that are aligned with the guidelines. Therefore, faculty from across the country have worked to create several validated and reliable assessments for measuring student learning gains in microbiology. These are: The Microbiology for Health Sciences Concept Inventory, The general Microbiology Concept Inventory, and The Host Pathogen Interactions Concept Inventory.

This session will introduce the concept inventories that have been developed to date. Participants in this session will learn about the history and development process of the Microbiology for Health Sciences Concept Inventory (MHSCI), the general Microbiology Concept Inventory (MCI), and the Host Pathogen Interactions Concept Inventory (HPI-CI). Speakers will describe each concept inventory and discuss with the audience key concepts covered by each assessment. Authors of the current concept inventories under development (MHSCI and MCI) will include the progress made to date and expected timeline for public distribution. In addition, information about key differences between the MHSCI and MCI will be covered. Activities in this session will ask participants to think about the use of the concept inventories in their course and what they feel are the biggest misconceptions that students have in microbiology.

8:00 AM – 8:30 AM  
Brookside

The Impact of Structured Professional Development Experiences on Biology Undergraduate Teaching Assistants’ Pedagogical Beliefs and Attitudes: A Multi-Institutional, Comparative Study

Jeffrey Olimpo, University of Texas at El Paso  
Thomas McCabe, University of Northern Colorado  
Patricia Shields, University of Maryland

Within the last decade, the utilization of undergraduate teaching assistants (UTAs) in science, technology, engineering, and mathematics (STEM) learning environments has grown exponentially. Research suggests that this marked increase is resultant not only from substantive evidence regarding the benefits UTAs provide for student success, but also the challenges associated with burgeoning enrollment and limited institutional resources. Despite this being the case, the current literature on professional development (PD) experiences for UTAs remains relatively limited, with the majority of reported studies conducted in fields outside of biology or focused on training opportunities for graduate student and faculty instructors. During this interactive session, we will engage participants in a discussion regarding how to address these concerns, as well as present data from an ongoing, comparative study being conducted at our institutions that seeks to determine the objective impact of structured PD experiences on introductory biology UTAs’ pedagogical beliefs and attitudes, as well as their teaching self-efficacy.

8:30 AM – 9:00 AM  
Forest Glen

Integrating Discovery-Based Research into the Undergraduate Curriculum: Discussion of a Report from the National Academies of Sciences, Engineering, and Medicine (repeated)

Jay Labov, National Academy of Sciences

The President’s Council of Advisors on Science and Technology report, “Engage to Excel” (2012), urges the STEM education community and funding agencies to “Advocate and provide support for replacing standard laboratory courses with discovery-based research courses.” This recommendation is based on emerging
evidence that engaging undergraduates in discovery research as early as possible and under the guidance of an effective mentor can be an effective strategy for supporting and retaining STEM students and for improving scientific literacy. But providing all students with individualized mentored research experiences is not possible. Thus, many STEM educators are now experimenting with various strategies for replacing more traditional laboratory exercises with discovery-based research and related activities. To further explore opportunities and challenges of developing, implementing, and sustaining course-based undergraduate research experiences, a committee of the National Academies of Sciences, Engineering, and Medicine organized a convocation that was held in Washington, DC in May, 2015 and produced a report that summarized the proceeding. This session will summarize that report and catalyze discussions about the opportunities and challenges inherent in course-based research programs. Participants will receive a printed copy of the report.

8:30 AM – 9:00 AM
White Oak A

Design Principles for the Course-based Undergraduate Research Experience (CURE)
Paula Soneral, Bethel University

National reform efforts for undergraduate biology education emphasize the use of pedagogies and curricula that embrace authentic scientific discovery. The Course-based Undergraduate Research Experience (CURE) is an increasingly widespread model for involving students in collaborative research. Among several benefits of situating research within a course, students gain proficiency in science process skills, increase their self-efficacy as practitioners, and simultaneously contribute new knowledge to the scientific community. As educators and architects for a growing number of CUREs, how do we define essential CURE design elements and align them with our specific learning outcomes and scientific discovery milestones? In this session, we will apply research-based CURE design principles to define specific experimental and pedagogical outcomes for CUREs. Additionally, we will use an iterative backwards design process to create the experimental architecture, pedagogical scaffolding, and assessments for a CURE. Participants are encouraged to bring their CURE scientific discovery ideas and student learning outcomes to the session, and will leave with a preliminary course map.

8:30 AM – 9:00 AM
White Flint Amphitheater

Development of Concept Inventory Questions through the Analysis of Student Misconceptions
Timothy Paustian, University of Wisconsin
Amy Briggs, Beloit College
Robert Brennan, University Central Oklahoma
John Buchner, University of Maryland
Rachel Horak, American Society Microbiology
Lee Hughes, University of North Texas
D. Sue Katz Amburn, Rogers State University
Ann McDonald, Concordia University Wisconsin
Todd Primm, Sam Houston State University
Heather Seitz, Johnson County Community College
Ann Smith, University of Maryland
Ann Stevens, Virginia Tech
Sunny Yung, Sam Houston State University

The goal of this second session is to give participants a hands-on understanding of the methods used to create concept inventories. In this session participants will be brought into the process. The audience will be given student responses collected on a true/false assessment and use these to harvest and code common misconceptions. New multiple choice questions will then be written, using the student misconceptions to create the distractors. We will then as a group report out the multiple choice questions and compare the audience questions with to the actual question on the concept inventory.

8:30 AM – 9:00 AM
Brookside

Books-to-Lab: The Application of Book Knowledge to Industrial Laboratories
Mykeshia McNorton, American Society for Microbiology

Students face many challenges in college from learning complicated materials to managing their time, but what about preparing for their future careers? Many students leave college with a strong knowledge base, but little experience in application. In this session, industrial microbiology careers (including critical skill sets) in cosmetics, food, medical devices, and pharmaceuticals will be highlighted. The industrial field is consistently
The information presented stems from the Professional Practice Committee (PPC) ASM Industrial Microbiology Report. The data was compiled from thirty-seven telephone interviews from professionals in cosmetics, food, medical devices, or pharmaceutical microbiology. Telephone interviews covered topics such as job duties, professional development, and pressing workplace topics.

You will leave knowing:

- Key skills and concepts needed for a career in industry
- Job duties and titles of industrial microbiologists
- Regulatory bodies associated with the industrial sector
- Career opportunities for science graduates interested in non-academia fields
- Industrial-specific information to incorporate into your learning modules

9:00 AM – 9:30 AM
Forest Glen

Integrating Discovery-Based Research into the Undergraduate Curriculum: Discussion of a Report from the National Academies of Sciences, Engineering, and Medicine (repeated)

Jay Labov, National Academy of Sciences

The President’s Council of Advisors on Science and Technology report, “Engage to Excel” (2012), urges the STEM education community and funding agencies to “Advocate and provide support for replacing standard laboratory courses with discovery-based research courses.” This recommendation is based on emerging evidence that engaging undergraduates in discovery research as early as possible and under the guidance of an effective mentor can be an effective strategy for supporting and retaining STEM students and for improving scientific literacy. But providing all students with individualized mentored research experiences is not possible. Thus, many STEM educators are now experimenting with various strategies for replacing more traditional laboratory exercises with discovery-based research and related activities. To further explore opportunities and challenges of developing, implementing, and sustaining course-based undergraduate research experiences, a committee of the National Academies of Sciences, Engineering, and Medicine organized a convocation that was held in Washington, DC in May, 2015 and produced a report that summarized the proceeding. This session will summarize that report and catalyze discussions about the opportunities and challenges inherent in course-based research programs. Participants will receive a printed copy of the report.

9:00 AM – 9:30 AM
White Oak A

Scientific Literacy: Teaching Biology Majors to Read, Paraphrase and Cite Scientific Literature

Melissa Zwick and Karen York, Stockton University

The ability to properly paraphrase and cite scientific research is a vital and valuable skill all science students need to master. Students often struggle to understand complex and detailed scientific literature and communicate it in their own words. Proper paraphrasing demonstrates understanding and comprehension to both the learner and the instructor. Despite its importance, there is often a lack of formal instruction on proper paraphrasing technique and citation style and students are left to develop these skills on their own. As a result, unintentional plagiarism often occurs. This session will describe a one-credit course that was designed to teach biology majors and minors how to read, paraphrase and cite scientific literature. We will share our approach to the course along with some student-centered activities that were developed to provide instruction on proper paraphrasing techniques, correct in-text and end-reference citation usage. These activities can be adapted, by participants, for inclusion into new or existing courses. In addition, we will report our initial findings that show how students abilities and self-efficacy change as a result of taking the course.
Using Concept Inventories to Assess Student Learning of Microbiology Concepts

The goal of this third session is to give participants a hands-on understanding of how you might use a concept inventory. The audience will work in groups to consider how and why they might use one of the inventories. Audience members will consider their learning goals for courses and programs, and determine how a concept inventory may be used to address questions about student learning, retention of knowledge, impact of demographic variables, curriculum reform, and faculty professional development. Use of the Host Pathogen Interactions Concept Inventory delivered online as a pre and post course assessment tool for a series of microbiology courses will be provided as an example.

Safety First, Safety Last, but Safety Always–Understanding the Biological Safety Level Necessary for your Lab
Jeffrey Byrd, St. Mary's College of Maryland

As microbiologists, we love to show our students the microbial world around them. When doing so, it is incumbent upon us, as instructors, to make sure we safely introduce these microbes to our students. We must also consider the safety of those not in our laboratory but will interact with our students or the laboratory space. This session will use the ASM Biosafety Guidelines to help participants assess the level of safety required for the types of experiments performed in their particular labs.

Assessment Made Easy: Aligning Assessment with Learning Outcomes
Boots Quimby, University of Maryland

A good course design requires a comprehensive assessment plan that aligns with both the learning outcomes and the learning activities for the course. In this second part of the assessment workshop, development of a comprehensive assessment plan will be discussed. Participants will describe the different assessment types (formative, summative, formal, informal) and match learning outcomes to the appropriate assessment tool. These activities will give participants hands-on practice in aligning assessment to learning outcomes as a first step in developing a comprehensive assessment plan.

Making the Case: What Matters for Case Study Development?
Ally Hunter, UMass Amherst

Case studies have become widely used in the undergraduate science classroom and many instructors develop their own cases to custom fit their learning objectives. In addition, opportunities exist to publish case studies in peer reviewed repositories and journals making case study development part of some instructor's scholarly pursuits. So, what makes for a good case study? This session incorporates the results of a pilot study to inform on best practices for case study development. In a course that employed a variety of case studies, each case study was analyzed using a conceptual framework for case study development from the literature and aligned with student variables such as prior knowledge, self-efficacy, and learning outcomes. A framework for case study development will be provided and discussed so that attendees may begin to develop their own case studies.
9:45 AM – 10:15 AM  
White Flint Amphitheater  

Data Diving: Using Primary Literature in an Introductory Biology Course  
Amy Briggs, Beloit College

This interactive session will model a series of activities designed to help introductory students develop quantitative reasoning skills. When novice biology students “dive” straight into primary literature data that they know little about, they must search for connections between those data and their own content knowledge and data analysis skills. The goal of these activities is to make students comfortable with uncertainty and with the complexities of the scientific literature. Through these activities, students find that they can in fact pull pertinent information out of a much larger pool of information that is otherwise largely undecipherable to them. The data analysis activities modeled in this session may include: out-of-context data tables, primary literature and popular press comparisons, primary literature scavenger hunts, and sprint journal clubs. These activities are currently used in a prokaryote-centered introductory biology course in which most students have no prior biology or microbiology experience beyond high school biology. Participants will leave this session with ideas of how to introduce more data analysis and quantitative literacy tools into their own classrooms.

10:15 AM – 11:15 AM  
Forest Glen

Beyond Plug and Chug: Finding Meaning in Quantitative Microbiology  
Kristin Jenkins, BioQUEST  

Microbiology, like all biology, is becoming increasingly quantitative, but helping students understand the value of commonly used quantitative skills in microbiology courses can be a challenge. From dilutions to graphing to data analysis, students struggle to master the practical skills and reasoning necessary in microbiology. We’ll explore how to contextualize quantitative skills in interesting microbiology problems, and consider how to make quantitative reasoning more explicit while providing skills practice. Whether you teach a lab or lecture, come work with colleagues to design ways to integrate quantitative thinking throughout activities.

9:45 AM – 10:15 AM  
Brookside

Course Redesign Initiatives  
Scott Roberts, University of Maryland  

I will share some of our approaches to supporting course redesign, some of the major themes of our conversations on innovative teaching, and lead an interactive discussion on how we can all assess their impact on student learning outcomes.

10:15 AM – 10:45 AM  
White Oak A

The Threat and Wonders of MRSA: Using Current Topics and Public Resources to Teach Fundamental Principles of Microbiology  
Michele Swanson, University of Michigan  

Microbiology that makes headlines is a great hook to engage students at all levels. Using infections by Methicillin-Resistant Staphylococcus aureus as an example, I’ll demonstrate ways to incorporate vetted public resources into lectures and active learning exercises that teach key concepts endorsed by the ASM Curriculum Guidelines. Topics will include horizontal gene transfer, nutritional immunity, and interactions between microbes and host that drive evolution. Resources will include newspaper articles, CDC Fact Sheets, American Academy of Microbiology Reports and FAQs, Small Things Considered blog posts, and This Week in Microbiology and other ASM podcasts.
10:15 AM – 10:45 AM  
White Flint Amphitheater

Teaching Scientific Method and Data Analysis Through Primary Literature and HHMI’s The Biology of Skin Color

Mark Randa, Cumberland County College

In this hands-on workshop participants will see how to integrate primary literature and media to create an active learning environment. In HHMI’s The Biology of Skin Color, Dr. Nina Jablonski explains that the variation in skin color that evolved since our human ancestors migrated out of Africa can be explained by the tradeoff between protection from UV and the need for some UV absorption for the production of vitamin D. While working in small groups, participants will watch short clips from the film and then examine the data from several pieces of primary literature just like Dr. Jablonski did in her research. This activity will practice claim, evidence and reasoning, and help gain a better understanding of how researchers use the scientific method to answer questions from evidence and base their findings on basic science that spans different disciplines.

10:15 AM – 10:45 AM  
Brookside

CUREs For All: The Options and Opportunities of Course and Program-Based Research Opportunities for Undergraduates of All Backgrounds and Majors

Patrick Killion, University of Maryland

Many researchers report that their strongest motivating experiences for pursuing a career in science stem from early research experiences. The opportunity for young scientists to experience the ownership, mentorship, elations and even frustrations of the research process provide motivation and develop resilience in students that carry forward during their training and education. Unfortunately, at the undergraduate level many courses are designed and instructed in a manner where the research fundamentals of inquiry, hypothesis formation, and testing and analysis of results are rarely engaged. Course-based Undergraduate Research Experiences (CUREs), however, are becoming common in diverse academic settings in order to provide young professionals with more authentic, motivating and profound learning experiences while fulfilling core learning outcomes of the courses they are either supplementing or replacing. Broad research has demonstrated the benefits of CUREs to students, faculty and institutions of higher education while taking on a number of forms including courses for both majors and non-majors, as well as courses for early matriculation and senior-level students. This session is designed to provide a broad overview of the evidence for CURE efficacy while empowering the audience to consider a number of factors in the development of a novel CURE.

10:45 AM – 11:15 AM  
White Oak A

Creating Active Learning and Research Based Laboratory Exercises

Cynthia Keler, Delaware Valley University

Tired of the same old laboratory exercises? Want to get your students more engaged in the laboratory? Want to rekindle your excitement about lab? Why not move away from the traditional “cookbook” laboratory exercise(s) and try creating your own laboratory exercise(s). This session will explore how to start with an idea or concept and develop that idea into a working laboratory exercise that addresses some of the key skills and competencies recommended by ASM’s Curriculum Guidelines for Undergraduate Microbiology Education, and answers AAAS Vision and Change in Undergraduate Biology Education: Call to Action. These types of experiential learning laboratories help develop student’s scientific thinking and problem solving skills, as well as have students apply microbiology skills to a “research” problem. A recent study by Erin Shortlidge, Gita Bangera and Sara Brownnell report a number of benefits to faculty that teach these types of labs including a way to integrate teaching with research, faculty satisfaction with teaching this way, and improving faculty relationships with students.

10:45 AM – 11:15 AM  
White Flint Amphitheater

Using Primary Literature to Teach Data Analysis in Introductory Microbiology

Nancy Boury, Iowa State University

Universities offering majors in the biological sciences want students to graduate as scientifically literate
scholars. One of the hallmarks of scientific literacy is the ability to read and critique the science presented in primary literature. As class sizes increase and TA support decreases, the logistics of presenting journal clubs and engaging in deeper discussions become problematic. In this session, we will demonstrate how to find appropriate papers and encourage student buy-in. We will then walk through the process of how to complete an in-depth discussion of a paper in a class of over a hundred students. Finally, we will present research findings and discuss the advantages and pitfalls of this method. Participants will take on the role of students as we demonstrate the process and should leave the session with the skills and knowledge of the tools used to incorporate primary literature analysis in their large lecture classes.

**10:45 AM – 11:15 AM**

*Brookside*

**PULSE: Taking Transformation from the Classroom to the Departmental Level**

**Judy Awong Taylor**, Georgia Gwinnett College  
**Samantha Elliott**, St. Mary's College of Maryland

Dive into the PULSE Cycle of Transformation and learn how you can help catalyze department-level transformation as called for in Vision and Change in Undergraduate Biology Education: A Call to Action. In this working session, participants will explore the various PULSE products designed to stimulate life science educational reform: Regional Institutes, Recognition, Ambassadors, and Tools & Resources. PULSE Fellows will discuss how these efforts can help you and your colleagues assess your department’s alignment with the Vision and Change recommendations, identify your department’s strengths and areas for improvement, and show you how PULSE will provide support for using the products and services described in this session.

**CONCURRENT SCIENTIFIC SESSIONS**

**11:30 AM – 12:30 PM**

*White Oak A*

**Remodeling Bacterial Cell Walls: New Lego Building Blocks**

**Catherine Grimes**, University of Delaware

My lab is passionate about the polymer that surrounds all bacteria—peptidoglycan. My laboratory is interested in understanding how organisms sense and respond to this polymer at the molecular level, as misrecognition can lead to a variety of human diseases, including Crohn’s disease. Our lab uses techniques from synthetic organic chemistry, molecular biology, immunology, biochemistry, and microbiology to probe this important signaling pathway. In order for a cell to efficiently process and sense the peptidoglycan, we hypothesize that four events must take place: (1) degradation of the bacterial cell wall to form immune responsive fragments; (2) delivery of the fragments to the proper cellular compartment; (3) fragments engagement by a cellular receptor; and (4) relay of the bacterial molecular signal by the cell to generate a response. This talk demonstrates how to manipulate the bacteria’s peptidoglycan biosynthetic pathway to install bio-orthogonal probes (or unnatural building blocks) and then use these probes to determine how the human innate immune system breaks down this polymer to generate an immune response.

**11:30 AM – 12:30 PM**

*White Flint Amphitheater*

**Mystery in the Female Infection of Neisseria Gonorrhoeae**

**Wenxia Song**, University of Maryland

Gonorrhea, caused by Neisseria gonorrhoeae (GC), is a common sexually transmitted infection. It has re-emerged as a critical public health issue, as antibiotic resistance arises. While most female infections are asymptomatic, it can cause severe complications, including pelvic inflammation disease and ectopic pregnancy. How GC establish infection and cause complications in the female reproductive tract (FRT) remains elusive, consequently hindering the development of effective preventatives and alternative treatments. We have studied the cellular mechanisms
by which GC infect through the mucosal surface of the FRT using both 3D epithelial cell and human cervical tissue explant models. GC interaction induces signaling in epithelial cells, including EGFR and Ca2+ flux, which activates actin regulators, causing actin reorganization. The remodeling of the actin cytoskeleton supporting the epithelial morphology and cell-cell junctions drives microvilli elongation and epithelial barrier disruption, which leads to GC entry and penetration into the epithelium and sub epithelium. By phase varying its surface molecules, such as lipooligosaccharides and opacity proteins, GC can switch up and down this penetrating infection mode by enhancing or suppressing signaling and actin remodeling. Our studies have identified both GC and epithelial factors responsible for GC infection as potential targets of new preventatives and treatments for female gonorrhea.

11:30 AM – 12:30 PM
Brookside

Overwhelming Evolution. Patients, Microbes and the Darwinian Process

Andrew Read, Penn State

Antimicrobial resistance is one of the great challenges of 21st Century Medicine. Teaching evolutionary principles and demonstrating that they are needed in clinical practice is not easy, especially since there is a large disconnect between basic microbial evolutionary science and clinical decision making. We recently published a case report of a patient who died from overwhelming evolution (Evolution, Medicine and Public Health 2015: 281). From this tragedy emerges a powerful teaching tool. The case provides a focused illustration of the general problem of antimicrobial resistance and the evolutionary principles involved, as well as the complexities of clinical decision making. It also illustrates the rudimentary but fast moving science involved. The modern treatment of HIV shows that resistance evolution can be headed off. It should be possible to likewise predict, control and redirect life-threatening bacterial evolution. For the most part, that is not possible — yet. Evolutionary science promises to make a very real difference to medical outcomes. Teachers are major players in realizing that promise.

DISSEMINATION STATION RESOURCE FAIR
12:30 PM – 2:00 PM
Salon Foyer

Interested in our new Dissemination Station Resource Fair? Visit representatives from grant-funded programs and non-profit organizations as they share information about their projects and ways you can incorporate their materials and/or contribute to their efforts.

Genome Solver: Creating a Community Science Project in Bioinformatics
Gaurav Arora, Gallaudet University

American Association for the Advancement of Science
Sandra Blumenrath, AAAS

Promoting Active Learning & Mentoring (PALM)
Thea Clarke, American Society for Cell Biology

The STEM Ambassadors Program at UMass Amherst
Ally Hunter, UMass Amherst

QUBES and ASM: Adding up to Better Quantitative Skills
Kristen Jenkins, BioQUEST/QUBES

BioBuilder Educational Foundation, Q&A sessions
Natalie Kuldell, Massachusetts Institute of Technology

National Academies of Sciences, Engineering, and Medicine
Jay Labov, National Academy of Sciences

Authentic Research Experience in Microbiology (AREM): Course-Based Microbiome Research
Theodore Muth, City University of New York

Genetics Society of America: Resources for Educators
Beth Ruedi, Genetics Society of America

The Build-a-Genome Network: A Research Intensive Course Experience in Synthetic Biology
Lisa Scheifele, Loyola University Maryland

Promoting Concept-Driven Teaching Strategies in Biochemistry and Molecular Biology
Erica Siebrasse, American Society for Biochemistry and Molecular Biology
LUNCH
12:30 PM – 2:00 PM
Salon D

JOB SEEKING LOUNGE
12:30 PM – 2:00 PM
Forest Glen

Seeking a job or candidates for a position at your institution? Drop off your resume or a job announcement in the lounge Friday morning and use the lunch hour to visit and network.

AUTHOR CORNER
1:30 PM – 2:00 PM
Outside Veranda

Sponsored by ASM Press
Featured Author: Michele Swanson

Ice Cream with Dr. Michele Swanson, lead author of Microbe, Second Edition

Join Dr. Swanson for a short session on her experience updating Microbe, Second Edition, to incorporate the ASM Recommended Curriculum Guidelines for Undergraduate Microbiology Education. To put the Curriculum Guidelines to work, the authors collaborated with the ASM Education Board throughout the revision to integrate the key concepts and principles into each chapter of this general microbiology textbook. The result is a current, engaging textbook that brings the excitement, breadth, and power of the modern microbial sciences to the next generation of students and scientists and includes new active learning exercises appropriate for the flipped classroom.

Attendees will be provided with ice cream dessert and souvenir mug (supplies are limited).

CONCURRENT SCIENTIFIC SESSIONS

2:15 PM – 3:15 PM
White Oak A

Host Biology in Light of the Microbiome: An Introduction to Holobionts and their Hologenomes

Seth Bordenstein, Vanderbilt University

Unprecedented attention to our microbial world has turned the fields of zoology and botany inward—toward an increased awareness and appreciation of the universality of host-microbiota symbioses. In this context, scientists, philosophers and educators are now discussing questions at new biological levels of hierarchical organization above the individual—What is a holobiont and hologenome? When should this vocabulary be applied? Here, I introduce this developing conceptual framework and present our work on the origin of species in light of holobionts and hologenomes. Given the increasing centrality of microbiology in macroscopic life, microbial symbiosis is arguably the most neglected aspect of studies of animal and plant speciation, and studying it will yield a better understanding of Darwin’s mystery of mysteries.

2:15 PM – 3:15 PM
White Flint Amphitheater

Evolutionary Mechanisms of RNA Virus Host-Switching

Colleen Jonsson, University of Tennessee, Knoxville and National Institute of Mathematical and Biological Synthesis

Greater than half of all human infectious diseases are currently or originally zoonotic, implicating cross-species transmission of RNA viruses from wildlife to humans. Globalization and environmental changes promote emergence of RNA viruses from wildlife. Hantaviruses provide an exceptional model system for studying RNA virus emergence, as they are responsible for outbreaks of human disease that may be associated with changes in climate, landscape and/or anthropogenic activities. Experimental studies in a controlled wildlife setting that alter resource availability, and/or factors such as rodent community structure, are important to understand
the fundamental importance of these determinants in driving hantaviral prevalence in reservoir and non-reservoir rodents. Dr. Jonsson will share on-going research addressing this within a Forest Reserve in Paraguay and new primary cell culture models. These studies present new opportunities for greater insight into host ecology which is an undeniable factor in the emergence and epidemiology of zoonotic infectious agents in wildlife and human populations.

2:15 PM – 3:15 PM
Brookside

Marine Sponges and their Bacterial Symbionts: Key Players in Nutrient Cycling in Coral Reefs

Russell Hill, University of Maryland Center for Environmental Sciences

Coral reefs are biodiverse shallow-water marine ecosystems that cover two tenths of 1% of the ocean floor but have great importance for fisheries, tourism, conservation and as reservoirs of biodiversity. Charles Darwin was puzzled by the occurrence of such rich environments in areas where the surrounding seawater was very low in nutrients. This mystery has become known as “Darwin’s Paradox”. Sponges are sessile marine invertebrates that are key components of coral reefs. Sponges harbor diverse, dense microbial communities that can comprise as much as 30% of the weight of the sponge. The sponge, together with its associated microbes, is best considered as a holobiont, a single living entity that comprises separate parts. These are ancient symbioses that provide excellent model systems for studying symbiosis. We have studied the roles of these sponge microbial symbionts in cycling of nutrients, in particular nitrogen and phosphorus. We have found that nitrogen-fixing cyanobacteria contribute substantially to the fixed nitrogen in some sponge species and may be providing fixed nitrogen to the coral reef ecosystem. Cycling of phosphorus in the marine environment is much less understood than nitrogen cycling. To our surprise, we found major reservoirs of phosphorus in marine sponges, discovering that symbiotic bacteria within the sponges are forming polyphosphate which is a storage compound for phosphorus and energy. Sponge symbionts may help explain “Darwin’s Paradox”.

EXHIBITOR AND POSTER SETUP
3:00 PM – 6:00 PM
Salon E

CONCURRENT EDUCATION SESSIONS

3:30 PM – 4:00 PM
Forest Glen

Opportunities and Tension Points Associated with Integrating Teaching and Research in Undergraduate Biology Lab Courses

Sara Brownell, Arizona State University

National calls for more broadly integrating research into the undergraduate curriculum have sparked the development of course-based undergraduate research experiences (CUREs). In a CURE, students explore a question with an unknown answer that is of relevance to the broader scientific community. The dual functions of a CURE—as a learning opportunity for students and a research generating opportunity for faculty—create unique opportunities and tension points that have yet to be fully explored. In this talk, I will present findings from an interview study of 61 faculty members who either have developed and taught their own CURE or implemented a CURE developed by someone else. I will also present a conceptual framework of CUREs that considers how student and faculty benefits may be in conflict, how the intersection of research goals and learning goals may create tension in a course that students take for credit, and how the authenticity of research may be dampened by the structural elements of the course. As we move into the next phase of CURE implementation, we may need to carefully consider the ethical implications of conducting research in the context of a credit-bearing course before rushing to CURE lab courses.

3:30 PM – 4:00 PM
White Oak A

Online Education: Engaging Your Students When You Can’t See Them

Kris Obom and Karen Wells, Johns Hopkins University

For most instructors who teach onsite, facial and other cues (i.e. sleeping in class) are essential to recognizing engagement with the material and
whether or not your students are grasping the content. Adapting to the online environment requires the instructor to think about engagement in new ways and employ new tools for interactivity between instructor and students, and among students. In this presentation we will demonstrate several tools as well as discuss the advantages and disadvantages of each and student feedback on these tools. Methods that we will discuss include:

- Threaded discussion and wikis using our CMS Blackboard, for asynchronous discussions
- Online presentations using adobe connect or other web conferencing software for student and faculty presentations
- Voice thread (asynchronous conversations) for student and faculty presentations and interactivity

3:30 PM – 4:00 PM
White Flint Amphitheater

Outreach Opportunities through Community Laboratories

Lisa Scheifele, Loyola University Maryland

For most Americans, their last exposure to scientific experimentation will be in high school labs, which often follow highly prescribed protocols to arrive at predetermined results. Baltimore Underground Science Space (BUGSS), is a community laboratory, which welcomes members of the public back in to the scientific enterprise by providing a space to learn about the latest in biological technology and research advances, gain laboratory skills, and design and execute experiments of an individual’s own design. Because they bring together diverse citizens, community laboratories inherently foster projects that are communal, creative, and interdisciplinary. For professional scientists, community laboratories offer the chance to engage in more risky projects, to interact with professionals from fields such as art and engineering, and to teach a self-selected group of highly engaged adults. In addition, they provide scientists with a conduit to disseminate their research to the public and engage in discussion about the ethics of research and its practical applications. This session will discuss our experience establishing and growing the BUGSS community laboratory. We will engage the audience in dialogue about the impact that the community lab and DIY-Bio movement is having on the sciences, the types of courses and activities that work best in this setting, various options for interacting with local community laboratories, and assessment mechanisms.

3:30 PM – 4:00 PM
Brookside

The Whole Classroom: A Pedagogy for Diverse Students

Bryan Dewsbury, The University of Rhode Island

Good pedagogy considers all stakeholders in the social interaction of the classroom. In the self-critical process of finding ways to increase success, especially in introductory classes, we must consider the increasing diversity of students entering our classrooms. In this presentation, we discuss a model that promotes a critical approach to the classroom as a whole, not simply to consider diversity. Through this lens we discuss ways in which we can transform our own understandings of diverse backgrounds, and pragmatic ways to promote community in the classroom.

4:00 PM – 4:30 PM
Forest Glen

How to Assess Your Course-Based Undergraduate Research Experience

Sara Brownell, Arizona State University

Integrating research experiences into the undergraduate life sciences curricula in the form of course-based undergraduate research experiences (CUREs) can meet national calls for education reform by giving students the chance to “do science.” In this talk, I will provide a step-by-step practical guide to help instructors assess their CUREs using best practices in assessment.

4:00 PM – 4:30 PM
White Oak A

BioBuilder Classrooms: Engineering Ideas for Life

Natalie Kuldell, Massachusetts Institute of Technology

Synthetic biologists program living cells to tackle today’s challenges. Biofuels, safer foods, anti-malarial drugs, less toxic cancer treatment, biodegradable adhesives — all fuel for young students’ imaginations. BioBuilder labs empower students to tackle these big
questions. Developed by an award-winning team from MIT, BioBuilder puts cutting-edge synthetic biology research and biological engineering practices into the hands of high school students and teachers. BioBuilder’s curricula and teacher training capitalize on students’ need to know, to explore and to be part of solving real world problems.

In this session, BioBuilder founder and MIT instructor Dr. Natalie Kuldell will explore the science and engineering that underlies synthetic biology. She will also introduce the many resources BioBuilder provides to teachers and students, including hands-on activities, teacher workshops, online animations, and community forums.

4:00 PM – 4:30 PM
White Flint Amphitheater

Leveraging the Web to Improve Science Communication Skills

Katherine Lontok and Julie Wolf, American Society for Microbiology

The ability to communicate complex scientific information to a general audience is increasingly recognized as an essential skill for a successful career in science and science-related fields, such as science policy. In this session, we will discuss several strategies for getting undergraduate students involved in the communication of science by leveraging their web and social media savvy. Experience first-hand the challenge of distilling cutting-edge research into digestible Tweets. Learn about the Wiki Education Foundation’s “Wikipedia Year of Science 2016” and how you can help improve web content while honing your students’ comprehension and science communication skills. Plus, discover other web-based opportunities, such as ASM’s own Agar Art competition, that offer students the opportunity to practice communicating science.

4:00 PM – 4:30 PM
Brookside

Science Posse: The Importance of the Cohort in Normalizing Academic Challenge

Kim Godsoe, Brandeis University

In 2008, Brandeis University began a new program in conjunction with the Posse Foundation for underrepresented students interested in studying science at the college-level. The Science Posse Scholars Program is based on the premise that students who are recruited together to major in science and who continue as a cohort in their initial years at Brandeis would be more likely to stay in the sciences.

This chapter explores why Science Posse has been an effective tool for Scholars graduating with a major in a STEM discipline. The first key finding is that Science Posse Scholars experienced strong feelings of doubt about their academic abilities; based on previous research, this should have resulted in their not majoring in STEM disciplines.

The second key finding was the importance of the cohort model for Science Posse Scholars’ success. Cohort models are often cited as an effective tool in retaining first-generation, low-income students in college. However, this research found it was not only the social support that was important for Scholars, but the normalizing of academic challenge. Rather than internalizing times of struggle as a personal shortcoming, the Posse Scholars program teaches student to externalize struggle as a feature of studying a STEM discipline.

4:30 PM – 5:00 PM
Forest Glen

So You Transformed Your Class to Active Learning – How Do You Assess the Impact of Active Learning on Students?

Sara Brownell, Arizona State University

Studies have shown that active learning courses in contrast to traditional lecturing can lead to more conceptual learning and lower failure rates. However, there is much that we don’t know about how different types of active learning implemented in different ways can affect different populations of students. In this talk, I will discuss multiple ways of assessing an active learning classroom using examples from my own research and draw attention to aspects of active learning courses that we need to further examine.
4:30 PM – 5:00 PM  
**White Oak A**

**What’s It Like to be a Scientist? Exposing Students to Different Fields of Biology and How to Think Like a Scientist**

Melissa Csikari, Howard Hughes Medical Institute  
Jackie Washington, Nyack College

Connecting students to current research and scientific practices is an important aspect of every science course. HHMI BioInteractive’s “Scientist at Work” videos expose students to a variety of world-renowned scientists and their current research. The “Data Point”, activities are designed to build students’ ability to think critically and interpret data. The figures are taken from primary literature. The activity gives students a small amount of background information, then asks them to interpret and discuss the figure or graph presented to them.

These two resources are an excellent way to start or finish a unit with an exposure to careers in life science and a connection to current research and practices.

Participants will view a short segment of a “Scientist at Work” clip and then actively work through a “Data Point” activity.

4:30 PM – 5:00 PM  
**White Flint Amphitheater**

**Wildcam Gorongosa (HHMI BioInteractive): A Citizen Science Project and Online Data Lab**

Bridget Conneely, Howard Hughes Medical Institute  
Dave Westenberg, Missouri University of Science and Technology

HHMI BioInteractive has developed free educational resources using Gorongosa National Park as a case study. Researchers in Gorongosa National Park in Mozambique have set up remote trail cameras throughout the park that have captured hundreds of thousands of animal photos. Students can help scientists by identifying animals in the photos. This citizen science contributes to a dataset that helps scientists better understand which animals exist in Gorongosa, where they are, how they behave, and how the ecosystem is responding to restoration efforts. In addition, educators and students will have access to an online platform that allows them to work with the data collected. Students can develop a scientific question about the park and then filter and analyze the data to answer their question. These interactive resources can be used to teach concepts in ecology, conservation, social science, and inquiry-based science practices.

4:30 PM – 5:00 PM  
**Brookside**

**Engaging Deaf and Hard of Hearing Students in STEM**

Caroline Solomon, Gallaudet University

Deaf and hard-of-hearing scientists are currently under-represented in STEM. This talk will discuss the current challenges that deaf and hard-of-hearing people face in STEM and offer solutions. Current research is providing data on how different challenges can be overcome. A variety of pedagogical approaches on how to make classroom and labs inclusive will also be discussed.

PLENARY LECTURE  
5:15 PM – 6:15 PM  
**Salon A-C**

**Pathogenesis of Fungal Infections**

Arturo Casadevall, Johns Hopkins University, Editor in Chief, mBio

The germ theory of disease was a landmark moment in human progress because it provided actionable information that was used to reduce mortality from infectious diseases, as societies focused on increased sanitation, vaccine development and the discovery of antimicrobial drugs. However, the germ theory left unanswered two major questions: 1) why are some microbes pathogenic while others are not? 2) Why are some hosts susceptible while others not? To these question can be added a deeper question: how does the capacity for virulence emerge in some microbes? The emergence of fungi as major human pathogens at the end of the 20th century provides a new window to looks at these questions for they highlighted the critical role of the host and environment in microbial pathogenesis. Furthermore, consideration of particular properties of pathogenic fungi as a group of pathogenic microbes provided important new insights into how virulence emerges and is maintained. For microbes acquired from other
hosts the capacity for virulence, which includes many common pathogenic microbes, disease often results from host-microbe interactions that perturb host homeostasis. However, for pathogenic microbes that are acquired directly from the environment, the origin of virulence is less clear, because those microbes have no need for animal virulence in their survival and/or life cycle. Studies with the fungus Cryptococcus neoformans have provided insight in how virulence can emerge by environmental pressures that have no relation to the final host. C. neoformans is often found in the same environmental niches as amoeba and a comparison of the interaction between amoeba and mammalian phagocytic cells revealed remarkable similarities in the fungal intracellular survival strategy despite the enormous phylogenetic distances for these two cellular hosts. This similarity led to the insight that fungal-amoeba interactions could select for traits that also allowed C. neoformans and other soil microbes to survive in mammalian hosts, a process that has been called accidental virulence. Consistent with this thesis, many of the virulence factors that confer to C. neoformans the capacity for virulence in mammals also provide defenses against amoeba predation. Subsequent studies with other fungi suggest that the same theme contributes to their virulence. This concept, the ‘environmental predatory selection hypothesis’ suggests mechanisms for how virulence emerges and is maintained. Furthermore, this line of thought provides a fertile ground for re-thinking evolutionary processes including great mammalian radiation and the end of the age of reptiles after the events at the Cretaceous-Tertiary boundary and could give us insights into what is ahead.
### ASMCUE Program at a Glance — Saturday, July 23, 2016

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<tr>
<th>Time</th>
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<tr>
<td>7:00 AM – 4:45 PM</td>
<td>ASMCUE Registration</td>
<td>Salon Foyer</td>
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<td>7:00 AM – 8:00 AM</td>
<td>Breakfast by Location</td>
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| 8:00 AM – 9:00 AM  | Plenary Lecture                                                                                               
<p>|                   | Improving Education in and Increasing Access to Science: An Opportunity for Microbiology Educators          | Salon A-C      |
|                   | Shirley Malcom, American Association for the Advancement of Science                                               |
| 9:00 AM – 3:30 PM  | Exhibitor Showcase                                                   | Salon E        |
| 9:15 AM – 10:15 AM | Poster Session A                                                      | Salon E        |
| 9:30 AM – 10:00 AM | Author Corner                                                         | Salon E        |
|                   | W.W. Norton &amp; Company, Inc.                                          | W.W. Norton Booth – Salon E |
| 10:00 AM – 10:30 AM| Product Corner                                                        | Salon E        |
|                   | John Wiley &amp; Sons, Inc.                                              | Linden Oak     |
| 10:00 AM – 10:30 AM| Product Corner                                                        | Salon E        |
|                   | McGraw-Hill Education                                                | White Oak B    |
| 10:30 AM – 11:00 AM| Product Corner                                                        | Salon E        |
|                   | Pearson                                                              | Timberlawn     |
| 10:30 AM – 11:00 AM| Product Corner                                                        | Salon E        |
|                   | McGraw-Hill Education                                                | White Oak B    |
| 10:30 AM – 11:00 AM| Product Corner                                                        | Salon E        |
|                   | eScience Labs, LLC                                                   | White Oak A    |
| 11:00 AM – 12:30 PM| Product Corner                                                        | Salon E        |
|                   | Carolina Biological Supply Company                                    | Forest Glen    |
| 11:00 AM – 12:30 PM| Product Corner                                                        | Salon E        |
|                   | Pearson                                                              | Timberlawn     |
| 11:30 AM – 12:30 PM| Microbrew Session (I of III) – See pg. 49 for Microbrew at a Glance Schedule | Salon E        |
|                   | Session A: 11:30 AM                                                  |                |
|                   | Session B: 11:50 AM                                                  |                |
|                   | Session C: 12:10 PM                                                  |                |
| 12:30 PM – 1:30 PM | Lunch                                                                | Salon D        |
| 1:30 PM – 2:30 PM  | Ice Cream Break                                                      | Salon E        |
|                   | Sponsored by John Wiley &amp; Sons, Inc.                                 |                |
| 1:30 PM – 2:30 PM  | Poster Session B                                                     | Salon E        |</p>
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<td>2:30 PM – 3:30 PM</td>
<td><strong>Microbrew Sessions (II of III)</strong> – See pg. 65 for Microbrew at a Glance Schedule</td>
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<td>SESSION D: 2:30 PM</td>
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<td>SESSION F: 3:10 PM</td>
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<td>3:45 PM – 4:45 PM</td>
<td><strong>Microbrew Sessions (III of III)</strong> – See pg. 78 for Microbrew at a Glance Schedule</td>
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<td>SESSION G: 3:45 PM</td>
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<td>SESSION H: 4:05 PM</td>
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<td>SESSION I: 4:25 PM</td>
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<td>5:00 PM – 7:00 PM</td>
<td><strong>Director’s Choice: HHMI Night at the Movies</strong></td>
<td>Salon A-C</td>
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<tr>
<td>7:00 PM</td>
<td><strong>Dinner on Your Own</strong></td>
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**Now Available at ASMscience!**

**Laboratory Protocols Collection**
Access information briefs about standard laboratory tests including the procedural steps as well as the purpose, theory, history, safety considerations, tips and comments, and references.

**Curriculum Archive**
Features 85 peer-reviewed activities promoting active learning in undergraduate microbiology. Developed by faculty at diverse institutions, activities include inquiry-based field-tested materials, student-driven activities, case-based problems, and ideas for independent and/or research projects.

Visit the Reports/Guidelines section of [www.ASMscience.org](http://www.ASMscience.org)
IDENTIFY YOUR COMMUNITY DAY

Wear your “community” colors and represent your institution type so you can identify and network with your colleagues.

Community College = BLUE
Primarily Undergraduate Institution = GREEN
Comprehensive University = ORANGE
Doctoral-Degree Granting University = RED
International = PURPLE

ASMCUE REGISTRATION
7:00 AM – 4:45 PM
Salon Foyer

BREAKFAST BY LOCATION
7:00 AM – 8:00 AM
Salon A-C

ASM’s supports thirty-five Branches organized by geographical territories that are defined by one or more states and/or zip code areas. On site, attendees will receive information about their branch and region, be encouraged to meet others in the same vicinity, and plan branch activities. International attendees will have an opportunity to meet as well.

PLENARY LECTURE
8:00 AM – 9:00 AM
Salon A-C

Improving Education in and Increasing Access to Science: An Opportunity for Microbiology Educators

Shirley Malcom, American Association for the Advancement of Science

How do we provide quality undergraduate education in science to all students, majors and non-majors alike? Who are the students we are serving; what do they bring to our programs; what are their aspirations and career goals? The presentation will explore these issues from the perspectives of the field (Vision and Change) and the programs, policies, and practices of institutions (Barriers and Opportunities for 2-Year and 4-Year STEM Degrees: Systemic Change to Support Students’ Diverse Pathways).

EXHIBITOR SHOWCASE
9:00 AM – 3:30 PM
Salon E

POSTER SESSION A
9:15 AM – 10:15 AM
Salon E

The 2016 abstracts are organized by both content and pedagogy to help participants navigate more easily through the poster session. The content themes are based upon the ASM Recommended Curriculum Guidelines for Undergraduate Microbiology Education (www.asm.org/educators). The guidelines identify six overarching concepts, which provide a framework for 27 key microbiological topics, scientific thinking skills, and laboratory competencies and are based on concepts put forth in the 2011 AAAS report, Vision and Change in Undergraduate Biology: A Call to Action. The ASM concepts and topics were selected to promote deep understanding of core concepts that are deemed to be of lasting importance beyond the classroom. Likewise, students’ development of competency in the selected skills will have enduring and lasting value beyond both the classroom and laboratories.

In May 2012, a Perspectives article published in the Journal of Microbiology & Biology Education (JMBE) entitled, “The Development of Curricular Guidelines for Introductory Microbiology that Focus on Understanding,” described the consensus-building process around the new, concept-based curriculum for Introductory Microbiology courses. For the purposes of ASMCUE, a seventh concept, advancing STEM education and research has been added to the abstract in order to identify authors working in this broader-scoped area.

The pedagogy themes are organized into five categories: course design, hands-on projects, student learning, teaching approaches, and teaching tools.

Each abstract is assigned to both content and pedagogy themes. These assignments, designated by the submitting author, are placed below the full abstract. Abstracts are found in the Journal of Microbiology & Biology Education, Volume 17, Issue 2 available online at www.asmscience.org/content/journal/jmbe. They may also be found in the hard copy of the JMBE Spotlight Issue given to attendees on-site. Late-breaking abstracts are found in the Guidebook Mobile App.
1-A
Students ‘Tackle’ Biology Problem Solving Skills with Real-World Football Activity
Jacob Adler, Brescia University, Owensboro, KY.

ASM Curriculum Guideline Concept(s): Pathways, Advancing STEM education and research
Pedagogical Category(ies): Teaching tools

3-A
Student Attitudes toward Active Learning in Introductory Biology
Jennifer Brigati, Maryville College, Maryville, TN.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Teaching approaches

5-A
Use of a Concept Triangle to Align Assessment of Student Learning with Goals of Vision and Change Criteria
Aaron Coby, Saint Martin’s University, Lacey, WA.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Student learning

7-A
Retaining ‘At Risk’ Freshman Through Metacognitive Training and Delayed Entrance to High-Stakes Gateway STEM Course
David Gondek and Maya Patel, Ithaca College, Ithaca, NY.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Student learning

9-A
A Focused Primary Literature Review Assignment Increases Student Confidence in Developing an Original Research Question and Sound Scientific Hypothesis
Marisa Isaacson, Pace University-NYC, New York, NY.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Student learning

11-A
Unique Down to Our Microbes—Assessment of an Inquiry-Based Metagenomics Activity
Thomas B. Lentz (1), Laura Ott (2), Sabrina Robertson (1), Sarah Council (3), Joshua Kelley (4), Rob Dunn (1), and Carlos Goller (1), (1) North Carolina State University, Raleigh, NC, (2) University of Maryland, Baltimore County, Baltimore, MD, (3) North Carolina Central University, Durham, NC, and (4) Washington and Lee University, Lexington, VA.

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Advancing STEM education and research
Pedagogical Category(ies): Hands-on projects

13-A
In Silico Phage-Hunting in Sinorhizobium Genomes: Integrating Bioinformatics and Basic Virology in Undergraduate Microbiology Courses
Betsy Martinez-Vaz, Autumn Jensen, Mandy Vang, and Jessica Johnson, Hamline University, Saint Paul, MN.

ASM Curriculum Guideline Concept(s): Structure and function
Pedagogical Category(ies): Hands-on projects, Teaching tools

15-A
Alignment of Lecture and Lab in Introductory Microbiology and Biology Courses: Analysis of Current Practices
Andrea Rediske, Malcolm Butler, Stephen Sivo, Morgan McAfee, and Heidi Eisenreich, University of Central Florida, Orlando, FL.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Course design

17-A
Community College Accelerated Research Experience (CCARE): A Pilot Study to Integrate Student-Driven Research into a Course-Based Research Program

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Course design, Hands-on projects, Student learning, Teaching approaches
19-A
Breast Cancer and Precision Medicine: A Proof-of-Concept CURE for Biology Majors
Paula A.G. Soneral, Bethel University, St. Paul, MN.

ASM Curriculum Guideline Concept(s):
Information flow, Advancing STEM education and research

Pedagogical Category(ies):
Course design, Hands-on projects, Student learning

21-A
Learning and Research Gains in a Semester-Long Undergraduate Laboratory Class Focusing on Characterization of Predicted LysR-Type Regulators (LTTRs) of Acinetobacter baylyi ADP1
Julie Stoudenmire, Eileen Neidle, and Anna Karls, The University of Georgia, Athens, GA.

ASM Curriculum Guideline Concept(s):
Pathways, Advancing STEM education and research

Pedagogical Category(ies):
Hands-on projects

23-A
Scientific Process Flowchart Assessment (SPFA): An Interdisciplinary Method for Evaluating Changes in Understanding and Visualization of the Scientific Process
Kristy J. Wilson, Bessie Rigakos, Marian University, Indianapolis, IN.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Pedagogical Category(ies):
Hands-on projects

25-A
Investigation of Potential Correlation between Mindset and Attitude towards Active Learning, in an Internationalized Non-majors Biology Class
Pratima C. Darr, Marty Thomas, and Wendy A. Dustman, Georgia Gwinnett College, Lawrenceville, GA.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Pedagogical Category(ies):
Teaching tools

27-A
CREATE-ing Scientific Narratives to Improve Critical Thinking and Communication Skills
Jordan Moberg Parker, Emma Goodwin, Casey Shapiro, Lucia Tabarez, Erin R. Sanders, and Marc Levis-Fitzgerald, University of California, Los Angeles, Los Angeles, CA.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Pedagogical Category(ies):
Teaching tools

29-A
Does the Structure and Length of Scientific Writing Assignments Impact Student Learning in a Microbiology Laboratory Course?
Emily Nowicki, The University of Texas at Austin, Austin, TX.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Pedagogical Category(ies):
Student learning

31-A
Embedding Research Ethics and Integrity into Undergraduate Practical Classes
Karena L Waller, Daniel P Barr, Paul M Taylor, and Odilia L Wijburg, The University of Melbourne, Melbourne, Australia.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Pedagogical Category(ies):
Student learning

AUTHOR CORNER
9:30 AM – 10:00 AM
W.W. Norton Booth – Salon E

Sponsored by W.W. Norton & Company, Inc.

Featured Author: Joan Slonczewski

Teaching with Case Histories in a Flipped Classroom

Microbiology: The Human Experience author Joan Slonczewski will discuss a model for teaching foundational concepts in microbiology through case studies. Dr. Slonczewski will discuss specific text-based and digital resources for teaching with case studies and present an example assignment/teaching sequence involving before class reading/assessment and in-class small group discussion.
AUTHOR CORNER
10:00 AM – 10:30 AM
OpenStax Booth – Salon E
Sponsored by OpenStax
Featured Authors: Nina Parker and Mark Schneegurt
In this session, senior contributing authors Nina Parker (Associate Professor of Biology, Shenandoah University) and Mark Schneegurt (Professor of Biological Sciences, Wichita State University) give a sneak preview of the forthcoming OpenStax Microbiology text. Microbiology is being developed as a free, peer-reviewed, openly licensed introductory textbook produced through a collaborative publishing agreement between OpenStax and the American Society for Microbiology Press. The book presents the core concepts of microbiology, with a focus on applications for careers in allied health. The pedagogical features of Microbiology make the material interesting and accessible to students while maintaining the career-application focus and scientific rigor inherent in the subject matter.

PRODUCT CORNER
10:00 AM – 10:30 AM
Linden Oak
Sponsored by John Wiley & Sons, Inc.
Featuring: Rod Anderson and Linda Young
Uniquely innovative and student oriented, Anderson/Young, Visualizing Microbiology, 1e offers a striking visual focal point for each major concept which is highlighted with succinct narrative. Numerous other visually-centered formatting techniques maintain student interest, encourage critical thinking, and enhance overall knowledge retention by delivering manageable amounts of application-based information. Visualizing Microbiology, 1e will offer your students an opportunity to master Microbiology as it applies to their pathway of study or future careers. Come to this product corner and learn how you can class test this difference maker for students.

PRODUCT CORNER
10:00 AM – 10:30 AM
White Oak B
Sponsored by McGraw-Hill Education
Featuring: Kelly Cowan
Closing the Learning Gap Between Under-Resourced and Fully-Resourced Students: Part II
Under-resourced and underprepared students make up an increasing proportion of colleges and universities. Nationwide, 55% of 2- and 4-year college students are on federal Pell grants. However, students lack other resources than simply money. They may lack time, family support, preparation skills, social, motivational, and emotional characteristics. We can't fix all of these issues; but we can adopt some simple strategies around that have been shown to assist all students, but especially the under-resourced. (Installment I of this talk was given at 2015 ASMCUE.)

PRODUCT CORNER
10:30 AM – 11:00 AM
Timberlawn
Sponsored by Pearson
Featuring: Lourdes Norman McKay
Teaching with Case Studies from Day ONE of Class
How can allied health microbiology students think clinically and critically about cases from the first day of class? Lourdes Norman-McKay will share her practical teaching tips for easily integrating real-world applications and cases into introductory courses. Come learn new ways to empower your students to tackle higher order cases and questions with confidence while keeping learners motivated and interested in learning microbiology concepts from day one of class. Participants will each receive a sample clinical case study and accompanying chapter material to test out with students in their own classes.
PRODUCT CORNER  
10:30 AM – 11:00 AM  
White Oak B  
Sponsored by McGraw-Hill Education  
Featuring: Heidi Smith  

The Top Microbiology Active Learning Exercises Today  
Learn what the top face-to-face and online Microbiology active learning exercises are today and how you can structure your class to get to them. Participants vote for the winner, who will receive an Apple iWatch.

PRODUCT CORNER  
10:30 AM – 11:00 AM  
White Oak A  
Sponsored by eScience Labs, LLC  
Featuring: Jan Benedict and Jacqueline Spencer  

An Authentic Science Lab Experience for the Online Learner  
eScience Labs partners with hundreds of schools to provide online students an opportunity to engage in real science exploration outside of the traditional laboratory environment. We work with instructors to customize lab kits and curricula that deepen science comprehension for all learners. At this seminar, attendees will hear from experienced online science educators and developers, and have the opportunity to experience how authentic science labs work in world of online education.

PRODUCT CORNER  
11:00 AM – 11:30 AM  
Forest Glen  
Sponsored by Carolina Biological Supply Company  
Featuring: Eddy VanHunnik  

Teaching Lab Science Courses Online: It CAN Be Done!  
Science education has been challenged by the demands and rapid growth of online education. Many schools and professors are reluctant to teach science courses in the online modality, because they fear that the loss of time spent in the science laboratory will impact the learning outcomes. The incorporation of well-designed labs using kits for the hands-on, inquiry component to online science courses will accomplish the essential learning outcomes. This session will conclude with participants actively taking part in hands-on lab investigations developed for online science courses.

PRODUCT CORNER  
11:00 AM – 11:30 AM  
Timberlawn  
Sponsored by Pearson  
Featuring: Derek Weber  

Flipping the Microbiology Classroom Using Learning Catalytics  
While we aspire for our students to think like scientists, we often neglect to apply the same approach to our own pedagogy. Bring your smartphone, tablet, or other web-enabled device to participate in a hands-on demonstration of how to use Learning Catalytics to engage students and make data-informed decisions in the classroom. In this session, Derek Weber will share details about the framework of his Flipped Classroom, its pedagogical underpinnings, and practical tips for increasing student participation and success.
### MICROBREW SESSION I OF III
#### SATURDAY, JULY 23

<table>
<thead>
<tr>
<th>Room Location</th>
<th>Presentation</th>
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<tbody>
<tr>
<td>Brookside A</td>
<td>Using the Improbabilal &quot;Yes, and...&quot; Approach as a Review Technique in the Student Centered Biology Classroom&lt;br&gt;Marsha Gaston, University of Cincinnati Blue Ash College&lt;br&gt;Laura J. MacDonald, Hendrix College&lt;br&gt;Jacob Adler, Brescia University&lt;br&gt;Teaching Restlessness: How to Invigorate your Classroom (and Maybe Yourself in the Process)&lt;br&gt;Ann Cleveland, Maine Maritime Academy&lt;br&gt;Re-thinking Teaching and Learning Spaces: How Instruction in the Learn Lab Impacts Student Engagement and Success&lt;br&gt;Crystal Austin, Ferris State University&lt;br&gt;Students Take Control of their Learning through a &quot;Pathogen Project&quot; Presentation and Research Paper&lt;br&gt;Krista Clark, UC Clermont College&lt;br&gt;Laura Robertson, Shepherd University</td>
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<tr>
<td>Forest Glen</td>
<td>Improving Student Understanding of Protein Structure and Denaturation Using Protein Modeling Kits&lt;br&gt;Marsha Gaston, University of Cincinnati Blue Ash College&lt;br&gt;Lab Courses&lt;br&gt;Introductory Biology&lt;br&gt;a Metagenomics in the Pilot Year of&lt;br&gt;Lessons Learned&lt;br&gt;Time Around: Perfectly the First&lt;br&gt;It Never Works</td>
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<td>Glen Echo</td>
<td>Microbrew B: 11:50 AM – 12:05 PM – pg. 54&lt;br&gt;Using Pectobacterium carotovorum in Lab Exercises Dealing with Infectious Dose, Antibiotic Treatment of Disease, and Epidemics&lt;br&gt;David Glick, King's College&lt;br&gt;A Hands-On Activity to Demonstrate the Central Dogma of Molecular Biology Via a Simulated VDJ Recombination Activity&lt;br&gt;Pamela A. Marshall, Arizona State University&lt;br&gt;Scratch-Off Ticket Quizzes Promote Teamwork and Metacognition&lt;br&gt;Lorayn Cozy, Illinois Wesleyan University&lt;br&gt;Calculating Calculus Education to Retain and Engage Students in STEM: Making Everyday Connections&lt;br&gt;Jerry Kavouras, Lewis University&lt;br&gt;Redesigning Different Active Learning Activities Upon Student Gains in Knowledge and Application in Upper Level Biology Courses: Comparing the Use of Case Studies and Analysis of Primary Research Articles in Microbiology Courses&lt;br&gt;Samantha T. Parks, Georgia State University&lt;br&gt;Science Seminar: A Freshmen Seminar Course Designed for Biology Majors to Increase Retention of Undergraduates in Biology&lt;br&gt;Michael J. Hanophy, St. Joseph's College&lt;br&gt;Olivia Long, University of Pittsburgh at Greensburg&lt;br&gt;If at First You Don't Succeed: Evaluating Student Learning Gains After Repeated Attempts at Online Quizzes&lt;br&gt;Amanda Simons, Framingham State University&lt;br&gt;Fine Focus: a New International Journal for Undergraduate Microbiology Research&lt;br&gt;Ashleigh South, Ball State University&lt;br&gt;A Case Study for Students to Create a Dichotomous Key With Biochemical Experiments to Identify an Unknown Enteric Bacterial Species Causing an Outbreak of Gastrointestinal Illnesses&lt;br&gt;Cynthia DeBoy, Trinity Washington University&lt;br&gt;Opportunities and Pitfalls of Team-Taught Bioethics in a Diverse Biology Department&lt;br&gt;Drew Rholl, North Park University</td>
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<td>White Oak A</td>
<td>Microbrew A: 11:30 AM – 11:45 AM – pg. 50&lt;br&gt;Using Pectobacterium carotovorum in Lab Exercises Dealing with Infectious Dose, Antibiotic Treatment of Disease, and Epidemics&lt;br&gt;David Glick, King's College&lt;br&gt;A Hands-On Activity to Demonstrate the Central Dogma of Molecular Biology Via a Simulated VDJ Recombination Activity&lt;br&gt;Pamela A. Marshall, Arizona State University&lt;br&gt;Scratch-Off Ticket Quizzes Promote Teamwork and Metacognition&lt;br&gt;Lorayn Cozy, Illinois Wesleyan University&lt;br&gt;Calculating Calculus Education to Retain and Engage Students in STEM: Making Everyday Connections&lt;br&gt;Jerry Kavouras, Lewis University&lt;br&gt;Redesigning Different Active Learning Activities Upon Student Gains in Knowledge and Application in Upper Level Biology Courses: Comparing the Use of Case Studies and Analysis of Primary Research Articles in Microbiology Courses&lt;br&gt;Samantha T. Parks, Georgia State University&lt;br&gt;Science Seminar: A Freshmen Seminar Course Designed for Biology Majors to Increase Retention of Undergraduates in Biology&lt;br&gt;Michael J. Hanophy, St. Joseph's College&lt;br&gt;Olivia Long, University of Pittsburgh at Greensburg&lt;br&gt;If at First You Don't Succeed: Evaluating Student Learning Gains After Repeated Attempts at Online Quizzes&lt;br&gt;Amanda Simons, Framingham State University&lt;br&gt;Fine Focus: a New International Journal for Undergraduate Microbiology Research&lt;br&gt;Ashleigh South, Ball State University&lt;br&gt;A Case Study for Students to Create a Dichotomous Key With Biochemical Experiments to Identify an Unknown Enteric Bacterial Species Causing an Outbreak of Gastrointestinal Illnesses&lt;br&gt;Cynthia DeBoy, Trinity Washington University&lt;br&gt;Opportunities and Pitfalls of Team-Taught Bioethics in a Diverse Biology Department&lt;br&gt;Drew Rholl, North Park University</td>
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**23rd Annual ASM Conference for Undergraduate Educators, North Bethesda, Maryland**
MICROBREW SESSIONS I OF III

11:30 AM – 12:30 PM
(8 sessions)

These grassroots sessions, arranged by topics, provide a forum for sharing best practices and interesting activities used in laboratory and classroom teaching. Presentations are simple “chalk talks” (e.g., no PowerPoint) to facilitate informal discussion. Unlike the poster sessions, Microbrews do not require assessments. Sessions will be facilitated by volunteer attendees in order to make certain each presentation stays within the 15-minute presentation (10-minute presentation and 5 minutes for discussion). Sessions must stay on time so attendees are able to move from room to room quickly to see their desired session.

Session Room Facilitators:

Brookside A
Facilitator: Mette Ibba, The Ohio State University

Brookside B
Facilitator: Amanda Simons, Framingham State University

Forest Glen
Facilitator: Brian Gentry, Drake University

Glen Echo
Facilitator: Michael Hanophy, St. Joseph’s College

Linden Oak
Facilitator: Jerry Kavouras, Lewis University

White Flint Amphitheater
Facilitator: Krista Clark, UC Clermont College

White Oak A
Facilitator: Robert Maxwell, Georgia State University

White Oak B
Facilitator: Drew Rholl, North Park University

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MICROBREW A: 11:30 AM – 11:45 AM

Improving Student Understanding of Protein Structure and Denaturation Using Protein Modeling Kits

Marsha Gaston, University of Cincinnati Blue Ash College, Blue Ash, OH.

Brookside A

Disrupting protein structure is the mechanism of action for many physical and chemical methods of microbial control. Having microbiology students understand the varying levels of protein structure and how denaturation impacts the protein is key to their understanding of how these control methods impact the cell. However, students frequently struggle with interpreting information about protein structure as three-dimensional structures from two-dimensional illustrations or crystal structure ribbon models. Using the Tangle® Protein Building Set, a protein modeling kit, students can observe and denature three-dimensional models of proteins possessing all levels of structure.

I have implemented the use of this protein modeling kit as a lab activity in a microbiology course for health professionals. During the activity students manipulate a three-dimensional protein model in groups, denaturing the protein themselves. Afterwards, students attempt to properly reconstruct secondary and tertiary structure. A worksheet leads them through the activity, making points about the ease with which each level of protein structure can be disrupted and the broader implications that this would have on a cell.

Initial survey data suggests that microbiology students perceive increased understanding of the levels of protein structure, increased understanding of the types of chemical bonds involved in each level of structure, and increased understanding of the process of protein denaturation after this activity. Student performance on assessments of knowledge of protein structure and denaturation is being collected from both before and after the implementation of the modeling kit and will be shared as a part of this Microbrew session.

ASM Curriculum Guideline Concept(s): Structure and function
Using the Improvisational “Yes, and...” Approach as a Review Technique in the Student Centered Biology Classroom

Laura J. MacDonald(1), Amanda Solem(2), and Verónica A. Segarra(3), (1) Hendrix College, Conway, AR, (2) Hastings College, Hastings, NE, and (3) High Point University, High Point, NC.

Forest Glen

In the biological sciences, students frequently equate understanding to compiling and memorizing information as a series of isolated facts. For this reason, they struggle to connect major concepts across course curriculums. In other disciplines, improvisation techniques have been introduced as a way to engage with millennials, who learn best through inductive and experiential learning. Here we present an improvisational classroom activity called “Yes, and...” as a review technique that can be used throughout the semester to help students assimilate and integrate information. Using this technique, students are divided into small groups and given a major topic of review (for example, DNA structure or DNA properties). After being given some time to review the topic of interest as a group, one student in the group begins the “Yes, and...” exercise by contributing one sentence that starts a narrative about the topic being reviewed as learned in class. Additional members of the group would then take turns, one at a time, to add additional layers of details to the narrative. The group dynamic continues until all of the students in the group have contributed a sentence to the narrative. Students are encouraged to listen carefully to their classmates’ contributions so that inaccurate ideas can be identified and tweaked through conversation at the end of one round of the exercise. The instructor moves between groups to continue to foster the learning experience. We find that the “Yes, and...” approach promotes deep student engagement with course material, collaboration among students of different backgrounds, and fosters development of oral communication skills.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Scaffolding of Structured Assessments to Help Students Engage in the Central Dogma of Molecular Biology

Jacob Adler, Brescia University, Owensboro, KY.

Glen Echo

Students in introductory biology courses consistently score low on essay problems involving the Central Dogma of Molecular Biology. Even when presented in multiple formats, students are unable to tackle these problems. Thus, new hands-on activities were developed to help students tackle the learning outcome of being able to analyze changes to a specific protein production in response to modification of a step in the Central Dogma. First, students watched several animation videos and video lectures on transcription and translation. Then, students worked in small groups to create a concept sketch of the locations and major components of the Central Dogma using strip sequences of individual steps. Students were provided active instructor feedback. Next, students worked both in small groups and individually on a series of problems where they applied their understanding of the process they just sketched. Problems were designed to modify a part of the Central Dogma, and students were asked to analyze the impact on the production of a specific protein. These problems were graded with a rubric to provide students with formative feedback. Finally, students had two summative assessment problems where students analyzed how the steps of the process feed into one another and are connected. A report will be presented during this session on the effectiveness of these scaffolded structured assessments. Resources will be provided to session attendees for immediate classroom use.

ASM Curriculum Guideline Concept(s): Information flow

Teaching Restlessness: How to Invigorate your Classroom (and Maybe Yourself in the Process)

Ann Cleveland, Maine Maritime Academy, Castine, ME.

Linden Oak

“Teaching restlessness” – a purposeful play on words. When I first encountered the term; it was a noun, a thing, a great idea referring to the way a good faculty
member always seems somewhat dissatisfied with their current level of teaching skill and pedagogy and is looking for ways to shake things up, to improve. It is this feeling of restlessness that lead me to my current research in student learning, with a major goal of improving not only student learning, but faculty teaching. Thus, I am looking for ways to “teach” restlessness to my peers and to encourage them to develop new and creative ways of delivering course content. I constructed a faculty workshop with follow-up working lunches to introduce and develop new ways of teaching. The workshop consisted of a short (20 minute) presentation of 20 different techniques (one-minute papers, exam wrappers, strip sequences, Twitter, etc.). Faculty were then divided into eight groups anchored by facilitators well-known on campus for their teaching effectiveness. Prior to the workshop, faculty were asked to identify a concept in a course that students struggle with, and once in the groups, faculty brainstormed how to use one or more of the teaching techniques to perhaps make the concept more accessible. While the workshop was well-received and many faculty were excited by all of the new teaching options, it has been difficult to gain full participation on campus. My interest in presenting this Microbrew is to discuss with my “restless” ASMCUE peers more ways of engaging faculty to assess and invigorate their classroom teaching practices.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Re-thinking Teaching and Learning Spaces: How Instruction in the Learn Lab Impacts Student Engagement and Success

Crystal Austin, Ferris State University, Big Rapids, MI.

Brookside B

The Learn Lab is a unique instructional space designed to support an interactive, learner-centered environment. It is equipped with an array of technological features and allows for multiple learning styles. In an effort to decrease drop, fail, withdraw (DFW) rates, I taught Medical Microbiology to Allied Health majors in the Learn Lab for 50% of the semester last fall. The other 50% of the semester was taught in a traditional, row-style classroom. As a result of teaching in the Learn Lab, my traditional 50-min lectures were transformed into lively activities and discussions among students and resulted in a decreased DFW rate. The Learn Lab is designed such that students sit at tables in groups of 6, with each table having its own large-screen monitor and capability of supporting up to 6 other electronic devices like smartphones, tablets, and laptops. In an effort to initially engage students, each class began with a set of clicker questions combined with peer instruction. I saw an increase in peer interaction merely with students sitting in groups rather than in rows. I then “lectured” for a short period of time but with increased mobility around the room, which facilitated my interactions with students and allowed for gauging student understanding in real-time. Students then worked on a short case study or activity in their groups. Some class periods allowed for the groups to present their answers using movable white boards or the Eno Board. During this Microbrew, I will present how these instructional spaces are designed and their potential for increasing student engagement and success based on my experience. I plan to teach in the Learn Lab again and would value feedback from attendees on use of this instructional space.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Students Take Control of their Learning through a “Pathogen Project” Presentation and Research Paper

Krista Clark, UC Clermont College, Batavia, OH.

White Flint Amphitheater

UC Clermont College is an open-access regional campus that serves students from diverse educational, cultural and social backgrounds. With this diversity comes the complexity of providing an active learning environment that can challenge the more prepared students, while not leaving under prepared students behind. Microbiology for Health Professionals is a course designed for allied health students and has a large pathogen and disease element. I found the process of teaching these diseases, pathogens, symptoms and treatments in lecture format was not effective. Therefore I tried a flipped format providing students with a PowerPoint presentation and a blank graphic organizer to fill in with the information
outside of class. Neither of these methods seemed to engage students, nor did they help students retain the information for exams. Two and a half years ago I began assigning the course material on diseases to the students. Each student is assigned a different microbe; they research and develop an in-class presentation call “Project Pathogen.” The presentations are 5-8 minutes long and are delivered at the beginning of each class period. This allows us to cover 20-24 diseases each semester. Students are given a short list of information that is required in the presentation, but are given freedom to present what they find interesting about “their” microbe. The presentations have been exceptional. Students take notes on the presentations and the information is included on each of the four exams. Student responses have been so positive that I have expanded the assignment to include a short research paper with a peer review process. Next fall students will also begin writing test questions about their pathogens to be included on the exams. Assignment handouts, presentation and research paper rubrics, as well as assignment schedules, will be provided in this workshop.

**ASM Curriculum Guideline Concept(s):** Impact of microorganisms, Advancing STEM education and research

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**Implementation of a Multi-week, Laboratory-Based DNA-barcoding Project in an Introductory Mycology Course**

*Laura Robertson*, Shepherd University, Shepherdstown, WV.

*White Oak A*

Historically, classification of fungi was based on morphological characters of the sexual reproductive structures (which include mushrooms). Recently, fungal classification underwent a major revision based on molecular phylogeny. This study reports on a multi-week, laboratory-based DNA-barcoding project implemented in a new introductory mycology course. Following a protocol developed by the Cold Spring Harbor Laboratory, students collected mushrooms, identified collected specimens using visual morphological characteristics, extracted DNA from field-collected specimens, PCR-amplified the fungal DNA barcode (the nuclear internal transcribed spacer region surrounding the 5.8S ribosomal RNA gene), and then compared the DNA barcode sequence to fungal sequences in Genbank to identify the fungal species. Understanding of the laboratory techniques was assessed by graded quizzes and students submitted a final written report. Discussion of the different results achieved by the student groups was enlightening to the class. One group correctly identified their mushroom visually and obtained confirmatory DNA barcode sequence; one group correctly identified their mushroom visually, but obtained obviously incorrect DNA barcode sequence, suggesting contamination during the laboratory process; and one group was unable to identify their fungus visually due to generic gross morphological characteristics, but obtained identification by DNA barcode sequence consistent with morphology. This multi-week laboratory project introduced students to a variety of important concepts and techniques, required critical thinking from the students, and involved writing of a multi-page final report. This project also linked an outdoor field experience involving large biological specimens to molecular, laboratory techniques. The enthusiasm generated by an outdoor field experience enhanced the laboratory experience. The varied results obtained by the different student groups illustrated both the utility and the difficulties inherent in these research techniques.

**ASM Curriculum Guideline Concept(s):** Evolution, Laboratory competencies

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**Scaffolding the Process of Thinking and Writing as Scientists Do**

*Nickie Cauthen* and *Melinda Pomeroy-Black*, LaGrange College, LaGrange, GA.

*White Oak B*

Designing and carrying out scientific experiments and communicating research results are important skills for scientists. In major’s introductory biology lab, which is largely populated by freshman, students focus on the scientific process, experimental design, and scientific writing. The process is broken down into digestible parts that culminate in a high quality research report, a midpoint, and end of the semester assessment. The students begin this journey in their first semester with active learning exercises to identify the components necessary to scientifically investigate
a question. In hands-on experiences, students make observations, which are then discussed as a class. This discussion creates the foundation for groups of students to design experiments. Each group presents an experimental design to the class which is discussed and reworked, as needed. Students then carry out the experiment with replicates and use this data as the basis for a research report. To introduce students to scientific writing, they use a published writing guide and checklist to identify important components of scientific communication in a journal article. At this point, students begin their drafts of the lab. To begin the drafting process, difficult sections are written separately (methods, and figure with legend) and evaluated with feedback. Finally, the entire research report is written by the student and each section is evaluated independently of the others, beginning with methods, followed by results, discussion, abstract and introduction. The instructors use a rubric to determine if the student meets the requirements of the section. If that section meets the requirements, then the next section is evaluated; if not, the evaluation stops and the student must revise that section. Through 3–4 drafts, most students achieve the goal of a high quality research report. This method continues into the second semester of major’s introductory biology, using a more complex experimental design and analysis.

ASM Curriculum Guideline Concept(s):
Laboratory competencies

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**MICROBREW B: 11:50 AM – 12:05 PM**

**Using Pectobacterium carotovorum in Lab Exercises Dealing with Infectious Dose, Antibiotic Treatment of Disease, and Epidemics**

**David Glick**, King’s College, Wilkes-Barre, PA.

**Brookside A**

*Pectobacterium carotovorum* can be used in laboratory exercises dealing with infectious dose, antibiotic treatment of disease, and epidemics. *Pectobacterium carotovorum* numbers can be easily determined by plating serial dilutions on nutrient agar. These same dilutions can be applied to the surfaces of carrot slices to determine the infectious dose. Antibiotic sensitivities of *P. carotovorum* can be determined by plating the bacteria on nutrient agar and then adding antibiotic disks to the agar surface. Once the antibiotic sensitivities are known, students can place antibiotic disks directly on the carrot surface to prevent disease. Finally, epidemics can be studied with *P. carotovorum*. Carrot slices can be placed randomly over a dish lined with moist paper towels. One carrot slice is infected with *P. carotovorum*. Over the next few days, students can watch the epidemic unfold as the bacteria infect more and more of the carrot slices. Students can investigate ways to control the epidemic.

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Laboratory competencies

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**A Hands-On Activity to Demonstrate the Central Dogma of Molecular Biology Via a Simulated VDJ Recombination Activity**

**Pamela A. Marshall**, Arizona State University, Phoenix, AZ.

**Forest Glen**

Essential or enduring understandings are often defined as the underlying core concepts or “big ideas” we’d like our students to remember when much of the content of the course has been forgotten. The central dogma of molecular biology and how cellular information is stored, used, and conveyed is one of the essential understandings students should retain after a course or unit in molecular biology or genetics. An additional enduring understanding is the relationships between DNA sequence, RNA sequence, mRNA production & processing, and the resulting polypeptide/protein product. A final big idea in molecular biology is the relationship between DNA mutation and polypeptide change. To engage students in these essential understandings in a Genetics course, I have developed a hands-on activity to simulate VDJ recombination. Students use a foldable type activity (inspired by the MAD magazine back cover “fold-in”) to splice out regions of a mock kappa light chain gene to generate a DNA sequence for transcription and translation. Students fold the activity several different times in multiple ways to “recombine” and generate several different DNA sequences. They then are asked to construct the corresponding mRNA and polypeptide sequence of each “recombined” DNA sequence.
The learning objectives of this activity are

1. modeling how recombination leads to enhanced genetic variability in the formation of the B cell kappa light chain;
2. demonstrating how an mRNA molecule relates to a DNA molecule;
3. applying the central dogma of molecular biology to kappa light chain recombination and subsequent gene product by translating the mRNA generated;
4. describing and predicting how changes in DNA lead to changes in gene products.

In this session, attendees will carry out the foldable activity and the participants will discuss implementation in class as well as improvements and extensions that can be made.

**ASM Curriculum Guideline Concept(s):**
Information flow

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**Scratch-Off Ticket Quizzes Promote Teamwork and Metacognition**

*Loralyn Cozy*, Illinois Wesleyan University, Bloomington, IL.

*Glen Echo*

Two critical elements in constructing new knowledge are (1) receiving immediate feedback on understanding and (2) metacognition, or reflection, on that feedback. Traditional assessment techniques, such as exams and quizzes, frequently fall short in both of these areas. Feedback can be significantly delayed and students are rarely required to reflect on the feedback they receive. To address these issues, I recently introduced IF-AT (Immediate Feedback Assessment Technique) forms to both my freshman-level nursing microbiology course (Bio 114) and my upper-level microbiology course for majors (Bio 314). IF-AT forms are multiple-choice response sheets on which the answer squares have been covered with silver “scratch off” material. Under the correct answer is a star, while under incorrect answers students find a blank. In my courses, students first take a short multiple-choice quiz individually without the IF-AT form and then immediately retake the same quiz in teams with the IF-AT form. Students are directed to discuss the questions and come to consensus before answering since everyone will receive the same grade. In Bio 114, I use these forms as a check of pre-reading, while in Bio 314, I use them to extend student knowledge to answer applied questions. For both groups of students, the IF-AT form requires peer teaching, practice speaking about the topic, and group decision-making. Because student response has been very positive, and the cost per answer sheet is minimal, I would recommend others give them a try as well. Attendees at this Microbrew will have an opportunity to use the IF-AT form, reflect on this experience as compared to a traditional multiple-choice quiz, and discuss ways this technique could be applied in their classrooms.

**ASM Curriculum Guideline Concept(s):**
Advancing STEM education and research

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**Redesigning Calculus Education to Retain and Engage Students in STEM: Making Everyday Connections**

*Jerry Kavouras*, Cindy Howard, Sarah Powers, Raymond Klump, and Lauren Rentfro, Lewis University, Romeoville, IL.

*Linden Oak*

The presentation will discuss a project funded by the National Science Foundation in the category of Improving Undergraduate STEM Education. Introductory calculus is a routine requirement for life science majors. Many students view calculus as a course mandated by the program that presents concepts that are not directly relevant to their careers – some may even think that higher level math is not relevant to their biology coursework. This perspective may discourage students to complete a STEM degree. One of the project’s goals is to invigorate the course Calculus for the Life Sciences, for life science majors, by integrating modules that highlight the relevant applications of mathematical concepts. Two modules will be highlighted in this presentation that reinforce quantitative biology concepts – rate of change and interactions. The modules include reading assignments, discussion groups, and simulations. The modules also integrate best practices associated with inclusive pedagogy, which should improve retention among underrepresented students in STEM and create a more productive classroom environment. This presentation will review the modules currently in use and preliminary data on the effectiveness of this project.
The Impact of Different Active Learning Activities Upon Student Gains in Knowledge and Application in Upper Level Biology Courses: Comparing the Use of Case Studies and Analysis of Primary Research Articles in Microbiology Courses
Samantha T. Parks, Georgia State University, Atlanta, GA.

The use of active learning in undergraduate biology courses is generally encouraged; however, there is a lack of quantitative research comparing the effectiveness of specific types of active learning with student achievement. Active learning can be used to describe many different educational modalities, including interactive activities, discussions and assessments, but generally refers to the participation of students during the classroom education process. To compare the efficacy of case studies and analysis and discussion of primary scientific literature with learning gains, two microbiology courses were taught via alternating between case studies and literature analysis with discussion per unit. Classes were taught using identical lecture content and online learning activities. For four separate content units, the classes had supplementary learning activities. Two supplementary activities were conducted using analysis and class discussion of a current primary research article. The other two supplementary activities consisted of the use of interrupted case studies which were analyzed via class discussion and problem solving. Activities were alternated such that each class was taught via two case studies and two primary research articles throughout the semester. Pre and post unit analyses were conducted, prior to the start of the units, to determine baseline knowledge and compare for analysis of post-unit learning gains. The two classes were similar in size and distribution of students, but alternated in their use of case studies and primary literature. Although this study is ongoing, preliminary comparisons of learning gains achieved by students via case study or literature analysis will be presented and the potential ramifications of the use of specific active learning modalities will be discussed.

Genome Solver: Creating a Community Science Project in Bioinformatics
Vinayak Mathur(1), Gaurav Arora(2), and Anne Rosenwald(1), (1)Georgetown University, Washington, DC and (2)Gallaudet University, Washington, DC

The Genome Solver Project aims to create and populate an online community environment to allow faculty and students, even at different schools, to share ideas and work on common projects related to bioinformatics. For our new Community Science Project initiative, we have developed a research project to explore horizontal gene transfer (HGT) between bacteria and the phages that infect them. We invite faculty and their students to join in the search for additional evidence of this type of HGT by collaboratively investigating the vast wealth of phage and bacterial sequences currently in databases. We propose that individual faculty and their students can either investigate evidence of HGT between phages and bacteria of interest to them or we can guide them in picking a bacterial study organism that has incorporated phage genes. Our own work has demonstrated that undergraduates can produce publishable data using this approach. By pooling all of the information from a variety of small projects under the umbrella of the Genome Solver Community Science Project, we will be able to make broad and fundamental hypotheses about the role that HGT from bacteriophages plays in bacterial evolution. Genome Solver is supported by a grant from the National Science Foundation (DUE 1505102).

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Advancing STEM education and research

ASM Curriculum Guideline Concept(s): Evolution, Advancing STEM education and research
Student-Driven Inquiry-Based Research Project to Foster Independent Thinking and Engagement in an Honors Undergraduate Microbiology Lab

Patricia L. Rossi and Kathleen Feldman, University of Connecticut, Storrs, CT.

White Oak A

Our introductory microbiology class is large (250 to 450 students per semester), with students attending 3 hours of lecture and 3 hours of laboratory weekly. The laboratory is fairly standard with exercises set up for students to learn aseptic technique, bacterial identification, etc. We wanted to incorporate a student-driven inquiry-based research project into our course; however, the large number of students made this difficult. We therefore decided to start small and see if we could implement an independent research project into an “honors” lab section.

Honors students were therefore involved in a semester-long research project of their own design. In addition to their regular weekly microbiology laboratory period, they attended a 50-75 minute discussion session. The purpose of this session was to discuss their projects and get feedback from other students in the course, the graduate student teaching assistants, and the course instructor. Students were asked to choose a project that involved a “time-course” study with samples that could be taken on a weekly basis for 5 weeks. Examples of projects chosen included changes in microbial load of makeup, dental retainers, computer keyboards, bathroom floors, water bottles, and student ID cards, etc. Students were given a list of standard media and supplies that were available from the lab prep staff. Students were asked to put together a proposal and a weekly supply list which consisted of required growth media, sampling equipment, dilution bottles, etc.

Students took samples weekly, reviewed their data at the weekly discussion session, and tweaked dilutions, etc., as necessary. At the end of the semester, students produced a written laboratory report presenting their data and involving primary literature searches to back up findings. They then presented a 20 minute power-point talk to the class.

Following completion of the course, students were asked to evaluate their experience by completion of a questionnaire. Review of student comments will be presented to Microbrew attendees.

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Laboratory competencies

Opportunities and Pitfalls of Team-Taught Bioethics in a Diverse Biology Department

Drew Rholl, North Park University, Chicago, IL.

White Oak B

Small, liberal arts schools with flexible program requirements allow students to explore a diversity of courses that should be connected with each other and examined with an ethical lens. Without a dedicated bioethicist on our campus, a collaboration rooted in three departments on our small campus was created to reinforce these principles. The goals of this upper-level, seminar-style course were to: 1) Introduce common ethical frameworks and methods for analysis that could be used in any situation (scientific or otherwise); 2) Revisit a wide range of biological content while discussing current ethical dilemmas therein; 3) Provide students with formal writing instruction focusing on argumentation and literature review; and [to the delight of the faculty] 4) Reconnect with students during their final year of study and encourage their growth as positively-contributing members of society. Workload per faculty member is marginal; 2-15 hours prep and grading the first time (2-8 hours the second time), and a single two-hour evening lecture per semester. The primary instructor load was much greater with 8 of 15 meetings and a majority of the writing instruction. With two iterations under our belts, strengths and weaknesses have been addressed:

Strengths: Students have evaluated this course very highly, and appreciated the re-exposure to past topics and professors. Both self-perceived and faculty-observed student growth in ethical thought and writing skills were positive. Guest lecturer workload is negligible, and faculty value one last face-to-face contact session with graduating students.

Weaknesses: Pre-recorded ethics videos/modules from the Philosophy Department were vague and disconnected from applications in biology. Instructors’ expectations of student work varied greatly during the first iteration (e.g. pre-lecture
preparation, homework, etc.), but strides were made for consistency during the second round. Participants will learn how the course was designed, and the steps our college took to address perceived weaknesses.

**ASM Curriculum Guideline Concept(s):**
Advancing STEM education and research

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**MICROBREW C: 12:10 PM – 12:25 PM**

*It Never Works Perfectly the First Time Around: Lessons Learned in the Pilot Year of a Metagenomics Module in Large Introductory Biology Lab Courses*

Karen Hogan, Linda Robinson, and Amanda Cottone, University of Pennsylvania, Philadelphia, PA.

Brookside A

Student-centered learning practices, such as inquiry-based instruction, are effective in improving student performance in the sciences. Lab courses are an optimal place to utilize these teaching approaches and to introduce students to cutting edge research tools. Here we describe the pilot year of a multi-week inquiry-based metagenomics lab module that employed Next Generation Sequencing technology in our large introductory biology courses (combined enrollment >500 students/semester). Our goals for this unit were to generate interest in scientific majors and careers, increase student understanding of the scientific process, and impart an understanding of the field of metagenomics and the use of Next Generation Sequencing technologies in contemporary research. We evaluated our effectiveness in meeting these goals by administering pre- and post-module surveys and end of the semester course evaluations to students, and conducting instructor surveys. We will share our findings from these assessments on student interest and learning and how this information will guide our future modifications to the lab module. For example, based on analysis to date, we plan to choose a singular theme to unify the research question across all sections and solicit greater feedback from departmental faculty on experimental design in order to better leverage the sampling power of the large number of students participating in the unit. Additionally, we will move the unit to the second semester of the introductory series to reinforce ecological concepts taught in the accompanying lecture and to reinforce connections between molecular/cellular biology and organismal biology/ecology. Finally, implementing inquiry-based labs at this scale requires serious consideration of the logistical constraints of multi-section lab courses including training multiple teaching assistants (TA), budgetary concerns for equipment and materials, and reducing bacterial contamination of reagents and samples. We will provide examples of how we addressed these considerations including lab chapters, TA notes, and lab prep documents.

**ASM Curriculum Guideline Concept(s):**
Advancing STEM education and research; Laboratory Competencies

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**Video Shorts: Using Storytelling About Infectious Diseases To Improve Student Retention And Increased Coverage Of Material**

Rodney P. Anderson and Linda M. Young, Ohio Northern University, Ada, OH.

Forest Glen

The purpose of this session is to introduce the participants to how they can use short video presentations about infectious diseases produced by students in their introductory microbiology course to improve student retention of content and coverage of course material. The project requires cooperative learning groups of four students to present basic content information about infectious diseases by developing a 7 minute video and a 2 page summary paper. The video short projects provide students with an opportunity to develop oral and written communication skills and they develop team-building skills through the collaborative topic research and organization into a creative video presentation. The result is a creative video which is interesting to peers that tells a memorable story that helps students retain content.

The benefits of using video shorts to begin lectures and present disease topics included (1) Students considered their presentations significantly more creative and interesting than the traditional lecture format; (2) In large classrooms, there was significantly higher attendance observed on days in which student team disease presentations were given; and (3) The incorporation of student disease presentations
allowed significant additional coverage of content material during the course.

Initial assessment indicated that student performance on retention of content presented by their peers using video shorts was higher than that of material presented in traditional lecture format as measured by performance on term and final exams.

ASM Curriculum Guideline Concept(s): Impact of microorganisms

Activating Prior Knowledge in the Biology and Microbiology Classroom

Michael J. Hanophy, St. Joseph’s College, Brooklyn, NY.

Glen Echo

All students come to biology classes with some background in the life sciences, whether from classes in high school or from lower level undergraduate courses. That background information, the ability to access it effectively, and the skill to apply it to new learning can be vitally important for success in biology courses. In an attempt to improve student outcomes in several of our courses for biology majors, deliberate efforts were made to introduce activities and teaching techniques that would help students to activate prior knowledge.

In a General Biology I class, lessons on cellular structure and function were supplemented with images and questions from New York State high school level examinations and pre-tests were administered as formative assessments. These activities helped students to develop a cognitive framework on which to organize and interpret new and more advanced concepts. In an upper level microbiology course, attempts were made to frame lessons on microbial biochemistry and metabolism in a way that tied new material directly to the basic biochemistry taught in our general biology course. This included modifying familiar images from the freshman biology text to introduce new concepts in microbiology. Additional tools, like muddiest point assessments and brief instructor-produced video reviews, helped to identify and review critical prior knowledge.

Preliminary data indicates improvements in student outcomes on topics where strategies to activate prior learning were utilized.

ASM Curriculum Guideline Concept(s): Structure and function, Systems

Science Seminar: A Freshmen Seminar Course Designed for Biology Majors to Increase Retention of Undergraduates in Biology

Olivia Long, University of Pittsburgh at Greensburg, Greensburg, PA.

Linden Oak

Retention of science, and specifically Biology, undergraduates is a challenge at most undergraduate institutions. Attrition of these students has been estimated as high as 50% at my institution. Therefore I have helped to develop a freshmen seminar course to help retain these students. Science Seminar is a year-long, credit-earning, letter-grade college course designed exclusively for first-year students enrolled in Biology at my four-year undergraduate institution. The course is designed to assist students in making a successful transition (academically and socially) from high school to college. To facilitate these goals, the course includes a variety of important topics for science students such as: reading primary research articles, study habits of successful students, establishment of study groups, class discussions, learning to develop an argument, ethical discussions on research, job shadowing and working on scientific case studies. Additionally, this course is used to mature the students as adults, and therefore also included such topics as community service, attending campus events (graduate fair), advising/career planning, and time management. I will be talking about a few of the best practices we have learned from running this course. Based on course evaluations, this course has been essential in increasing the students understanding and ability to communicate in the scientific community, increasing their satisfaction with the Biology Program, and based on preliminary numbers, to an increase in the retention of our undergraduates within the Biology Major.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
If at First You Don’t Succeed: Evaluating Student Learning Gains After Repeated Attempts at Online Quizzes

Amanda Simons, Framingham State University, Framingham, MA.

Brookside B

Part of learning is learning from mistakes, but there often is no attempt/failure/reattempt cycle built into course design, where a small number of exams may determine the final grade in a class. More frequent tests or quizzes can help boost student mastery of learning objectives due to the well-documented testing effect; however, if every assessment counts toward a final grade a student may still be unable to overcome early failures and receive a good grade in the course. Thus, some students get frustrated or discouraged when faced with early failures, and this can subsequently impact their motivation and study practices later in the semester.

Students in a mid-sized intermediate-level Cell Biology course were assigned four online quizzes throughout the semester. If they completed each quiz by the due date, they could take up to three more “re-quiz” attempts for each unit. Re-quiz could be taken at any time up until the end of the semester, and the highest grade counted. At the end of the semester, student learning gains were evaluated by performance on individual questions on the final exam, comparing learning objectives that were not quizzed, objectives that were quizzed once (only assessed on the first version of one quiz), and objectives that were quizzed multiple times (assessed on all versions of a quiz). Students were also given a short survey to assess their perceptions of the quiz structure and how it impacted their learning.

In this Microbrew session, we will discuss preliminary findings from this study, including whether repeated attempts on the quizzes correlated with improved learning gains, student perceptions of their learning gains, and student opinions of the quiz structure.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

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Fine Focus: a New International Journal for Undergraduate Microbiology Research

Ashleigh South and John McKillip, Ball State University, Muncie, IN.

White Flint Amphitheater

Since 2013, Fine Focus has been developed and implemented as a product-based course comprised of 12-24 undergraduates from a variety of disciplines. This course manages the first (and only) international digital and print journal for undergraduate microbiology research, with ASM as a community partner. The student review team in this course is responsible for making important decisions that direct the future of the journal, including learning the process of manuscript management through our double-blind peer review system using experts from the external Editorial Board. The marketing/design team is responsible for determining how to best target Fine Focus to our global audience, soliciting manuscripts, promoting Fine Focus through our website and social media, and creating an Executive Committee. Current objectives also include design of an assessment rubric to quantify the long-term impact of Fine Focus on undergraduate research, as well as a consumer survey to maximize the quality of our print journal. Throughout the process, participating students gain a comprehensive understanding of how to work with others across disciplines in a professional atmosphere to create a respected, tangible product with a distinct contribution to the undergraduate microbiology research community. Fine Focus also provides undergraduate students internationally the valuable opportunity to publish their own microbiology research when they otherwise may not be able to. This faculty-led, student-driven “immersive learning” model allows the students to be the authors of, and authorities on, their own education.

ASM Curriculum Guideline Concept(s):
Information flow, Advancing STEM education and research
A Case Study for Students to Create a Dichotomous Key With Biochemical Experiments to Identify an Unknown Enteric Bacterial Species Causing an Outbreak of Gastrointestinal Illnesses

Cynthia DeBoy, Trinity Washington University, Washington, DC.

White Oak A

A classroom case study will be presented which involves students working in groups to identify the causative microorganism for an outbreak of a gastrointestinal illness that occurred in employees working in a medical microbiology laboratory. The goal of the case study is for students to understand differences between microorganisms within the Enterobacteriaceae family, and how such differences can be detected with biochemical tests. Students will also increase awareness of laboratory safety precautions. Students will create a dichotomous key as they design a series of biochemical laboratory experiments to identify the species of the enteric microorganism causing the ailment. The instructor supplies student groups with the data that would result from the students’ laboratory experiments, with which students interpret and draw conclusions about the causative microorganisms. This activity is based on a published journal article describing the process of identifying the causative microorganism of a true outbreak, the source of the outbreak, and the safety precautions that were implemented afterwards.

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Laboratory competencies

Guiding their Reading: Piece By Piece in Anatomy and Physiology

Marirose Ethington, Genesee Community College, Batavia, NY.

White Oak B

A common homework practice is to assign a chapter to be read in the textbook and study. However, in Anatomy and Physiology courses (and many other content rich courses) reading and understanding the introductory textbooks can be overwhelming to many students with the amount of new vocabulary and detailed explanations of processes. Highlighting bold words and passively reading often do not provide students with the basic understanding they need to be able to apply their knowledge in critical thinking exercises, nor does it often give students the practice required for retention of the details. Students often need help to navigate the textbook and explicit instructions using additional study strategies to help them comprehend their reading and retain the information. Students need support in how to pay attention to important details and remember them, organize their study material, and meta-cognitive skills to help them apply their knowledge. In this presentation I will give examples of support material and instructional strategies I use in an Anatomy and Physiology course to help the students navigate their reading and lecture notes, along with material to help students take notes from the reading. This work has been funded in part by the NSF grant TUES 1245896.

ASM Curriculum Guideline Concept(s): Laboratory competencies

LUNCH
12:30 PM – 1:30 PM
Salon D

ICE CREAM BREAK
1:30 PM
Salon E

Sponsored by John Wiley & Sons, Inc.

POSTER SESSION B
1:30 PM – 2:30 PM
Salon E

The 2016 abstracts are organized by both content and pedagogy to help participants navigate more easily through the poster session. The content themes are based upon the ASM Recommended Curriculum Guidelines for Undergraduate Microbiology Education (www.asm.org/educators). The guidelines identify six overarching concepts, which provide a framework for 27 key microbiological topics, scientific thinking skills, and laboratory competencies and are based on concepts put forth in the 2011 AAAS report, Vision and Change in Undergraduate Biology: A Call to Action. The ASM concepts and topics were selected to promote deep understanding of core concepts that are deemed
to be of lasting importance beyond the classroom. Likewise, students’ development of competency in the selected skills will have enduring and lasting value beyond both the classroom and laboratories.

In May 2012, a Perspectives article published in the *Journal of Microbiology & Biology Education (JMBE)* entitled, “The Development of Curricular Guidelines for Introductory Microbiology that Focus on Understanding,” described the consensus-building process around the new, concept-based curriculum for Introductory Microbiology courses. For the purposes of ASMCUE, a seventh concept, advancing STEM education and research has been added to the abstract in order to identify authors working in this broader-scoped area.

The pedagogy themes are organized into five categories: course design, hands-on projects, student learning, teaching approaches, and teaching tools.

Each abstract is assigned to both content and pedagogy themes. These assignments, designated by the submitting author, are placed below the full abstract. Abstracts are found in the *Journal of Microbiology & Biology Education, Volume 17, Issue 2* available online at www.asmscience.org/content/journal/jmbe. They may also be found in the hard copy of the JMBE Spotlight Issue given to attendees on-site. Late-breaking abstracts are found in the Guidebook Mobile App.

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**2-B**
The Flipside of Active Learning and the Inverted Classroom
Ana Maria Barral, Veronica Ardi, and Rachel E. Simmons, National University, CA.

**ASM Curriculum Guideline Concept(s):** Advancing STEM education and research
**Pedagogical Category(ies):** Teaching approaches

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**4-B**
Effect of Web-Enabled Student Response Systems on Student Engagement in Large Introductory Biology Classes
Benjamin Clegg and Melissa Chipman, University of Illinois at Urbana-Champaign, Champaign, IL.

**ASM Curriculum Guideline Concept(s):** Advancing STEM education and research
**Pedagogical Category(ies):** Teaching approaches, Teaching tools

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**6-B**
A Bridge to Active Learning: A Summer Bridge Program Equips Students with Strategies for Maximizing Active Learning that Leads to Academic Gains
Katelyn Cooper, Michael Ashley, and Sara Brownell, Arizona State University, Tempe, AZ.

**ASM Curriculum Guideline Concept(s):** Advancing STEM education and research
**Pedagogical Category(ies):** Student learning

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**8-B**
Effectiveness and Adoption of a Drawing-to-Learn Study Tool for Recall and Problem Solving: Minute Sketches with Folded Lists
Paul Heideman, Adryan Flores, Lu Sevier, and Kelsey Trouton, College of William and Mary, Williamsburg, VA.

**ASM Curriculum Guideline Concept(s):** Advancing STEM education and research
**Pedagogical Category(ies):** Student learning

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**10-B**
Using Macroevolutionary Primary Literature to Increase Student Engagement in a Sophomore-Level Cellular Biology Course
Adam Kleinschmit, Adams State University, Alamosa, CO.

**ASM Curriculum Guideline Concept(s):** Evolution, Structure and function
**Pedagogical Category(ies):** Student learning
12-B
The Impact of an Interactive Statistics Module on Novices’ Development of Scientific Process Skills and Attitudes in a First-Semester Research Foundations Course
Lynnsay A. Marsan, Christina E. D’Arcy, and Jeffrey T. Olimpo, University of Texas at El Paso, El Paso, TX.
ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Course design, Student learning, Teaching approaches

14-B
The Examination of a Metacognition Exercise to Facilitate Intellectual Development
Jennifer O’Connor, Rose-Hulman Institute of Technology, Terre Haute, IN.
ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Student learning

16-B
Developing Quantitative Writing Skills in Lower-Division Laboratory Biology Students
Tracy Ruscetti and Christelle Sabatier, Santa Clara University, Santa Clara, CA.
ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Student learning, Teaching approaches

18-B
Can a Short Mentored Teaching Residency Result in a Successful Classroom Teaching Experience?
Michèle Shuster (1) and Karen Peterson (2), (1) New Mexico State University, Las Cruces, NM, and (2) Fred Hutchinson Cancer Research Center, Seattle, WA.
ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Teaching approaches

20-B
Microbial Murders: A “Crime Scene Investigation” Project that Enhances Student Enthusiasm and Comprehension of Clinical Microbial Pathogens
J. Jordan Steel, Colorado State University-Pueblo, Pueblo, CO.
ASM Curriculum Guideline Concept(s): Impact of microorganisms, Advancing STEM education and research
Pedagogical Category(ies): Hands-on projects

22-B
Do Compressed Classes Motivate a Learning State?
Ram Veerapaneni, Michelle Brodke, Cynthia Bailey, Seth Gardner, Christine Genovese, Tamara May, Jaclyn McLean, and Subha Nagarajan, BGSU Firelands, Huron, OH.
ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Student learning

24-B
A Classroom Research Module to Assess the Prevalence of Antibiotic-Resistant Microbes in the Environment
Carol Bascom-Slack, Tufts University, Medford, MA.
ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Hands-on projects

26-B
Integration of Graphing Activities in Non-Science Major Environmental Science and Nursing Microbiology Lab Courses
Brian Michael Forster, Catalina Arango Pinedo, Jonathan Fingerut, Caitlin Fritz, Joanna Huxster, and Christy Violin, Saint Joseph’s University, Philadelphia, PA.
ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Student learning
28-B
Integrating Sediment Microbial Fuel Cells (sMFCs) in the Teaching of Microbial Ecology
John M. Pisciotta and Paige Minka, West Chester University, West Chester, PA.

ASM Curriculum Guideline Concept(s):
Systems, Advancing STEM education and research
Pedagogical Category(ies): Hands-on projects, Teaching tools

30-B
Students Gain Confidence In Experimental Design Skills And Exhibit Different Attitudes About Scientific Research After A Guided CURE In Immunology
Claire Trottier and Sylvie Fournier, McGill University, Montreal, Canada.

ASM Curriculum Guideline Concept(s):
Pathways, Advancing STEM education and research
Pedagogical Category(ies): Student learning

32-B
Freshman Biology: Tracking Changes in Academic Motivation, Metacognition and Grades
Naomi L.B. Wernick, Erika M. Nadile, and Courtney P. Bradley, University of Massachusetts Lowell, Lowell, MA.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research
Pedagogical Category(ies): Student learning

PRODUCT CORNER
1:30 PM – 2:00 PM
White Oak B
Sponsored by McGraw-Hill Education

PRODUCT CORNER
1:30 PM – 2:00 PM
W.W. Norton Booth – Salon E
Sponsored by W.W. Norton & Company, Inc.
Featured Author: Joan Slonczewski

Antarctic Microbiology

Microbiology: An Evolving Science author Joan Slonczewski will recount her thrilling experience doing microbiology research in Antarctica in the winter of 2014 with vibrant photos, videos, and colorful stories about life—microbiological and otherwise—near the South Pole. Examples of Antarctic microbiology throughout the upcoming new edition of Microbiology: An Evolving Science make up one of the two new themes in the fourth edition; the other theme is the gut microbiome.
### MICROBREW SESSION II OF III
#### SATURDAY, JULY 23

#### ROOM LOCATION

<table>
<thead>
<tr>
<th>Location</th>
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<tbody>
<tr>
<td>Brookside A</td>
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#### MICROBREW D: 2:30 PM – 2:45 PM – pg. 66

- **Using a Simple Soil Assay to Demonstrate Regulation of Enzyme Production**
  - Craig Phelps, Rutgers University

- **Jigsaw Group Discussions Enhance Active Learning and Formative Assessment in the Microbiology Laboratory**
  - Padma Seshadri, Suffolk County Community College

- **Using a Personal Reflection Tool to Enhance Student Comprehension in Laboratory-Based Courses**
  - Rebecca K. Hoffman, Rowan University

- **Why Do We Have to Do This? Helping Your Students Understand Why You Use Active Learning In the Classroom**
  - Jennifer Brigati, Maryville College

- **Student Metacognitive Development as a Predictor of Success in an Introductory Biology Course**
  - Jessica Santangelo, Hofstra University

- **Using Twitter to Access Current Events and Research in the Biofuel Industry Around the World**
  - Sherry Ogg, Johns Hopkins University

- **The Search for Terrestrial Life: An Inquiry-Based Astrobiology Laboratory Module**
  - Amy Treonis, University of Richmond

- **Designer Bacteria: A Fun Active Learning Activity to Apply Cell Structure and Growth Condition Concepts**
  - Jennifer Koehl, Saint Vincent College

#### MICROBREW E: 2:50 PM – 3:05 PM – pg. 70

- **Beginning With Authentic Research: Implementing The PARE Project In A Freshman Laboratory**
  - Ruth Plymale, Ouachita Baptist University

- **Teaching Students to “Talk the Talk”**
  - Mary E. Shawgo, Graceland University

- **The Air That I Breathe: Increasing Understanding of Aerobic Respiration**
  - Karen Huffman, Geneseo Community College

- **The Ebola Wars: Teaching About Emerging Infectious Diseases Using the Case Study Approach**
  - Tracie Addy, Yale University School of Medicine

- **Collaborating with Undergraduates Across Disciplines to Create Peer-Led Distance Learning Modules for a Non-majors Microbiology Hybrid Lab**
  - Stephanie M. Miller, Ohio University

- **Using Story telling and Anthropomorphic Formulations to Enhance Student Learning**
  - Kari Brossard Stoos, Ithaca College

- **From Gene to Function. Use of PCR and Biological Assays to Connect Gene to Protein Function**
  - Manuela Tripepi, Stockton University

- **Transformation of Online Videos into Active Learning Experiences**
  - Thomas Koval, Johns Hopkins University

#### MICROBREW F: 3:10 PM – 3:25 PM – pg. 74

- **Verification of Bioinformatically Identified Terminators in the Classroom**
  - Nathan Reyna, Ouachita Baptist University

- **“Letters To Grandma”: An In-Class Writing Activity that Combines Informal Writing and Teaching as Tools to Increase Student Retention and Comprehension**
  - J. Jordan Steel, Colorado State University-Pueblo

- **Helping Introductory Biology Students Forge Connections Between Concepts**
  - Mike Keller, University of Maryland

- **Intentionality in Designing Laboratory Assignments For Student Success and Engagement**
  - Huda Makhluf, National University

- **Using Google Draw as a Digital Drawing Kit to Manipulate Complex Concepts in Biology**
  - Tracy Ruscetti, Santa Clara University

- **Blogging in a Laboratory Course as a Method to Increase Scientific Literacy and Practice Science Communication for a General Public Audience**
  - Aimee Hollander, Nichols State University

- **Using Oral Presentations to Cultivate Active Learning and Critical Thinking Skills in “Identification of Unknowns”**
  - Alioune Gueye, Mount Ida College

- **Using a 3-D Printer to Learn Cell Structure**
  - Archana Lal, Independence Community College
MICROBREW SESSIONS II OF III
2:30 PM – 3:30 PM
(8 sessions)

These grassroots sessions, arranged by topics, provide a forum for sharing best practices and interesting activities used in laboratory and classroom teaching. Presentations are simple “chalk talks” (e.g., no PowerPoint) to facilitate informal discussion. Unlike the poster sessions, Microbrews do not require assessments. Sessions will be facilitated by volunteer attendees in order to make certain each presentation stays within the 15-minute presentation (10-minute presentation and 5 minutes for discussion). Sessions must stay on time so attendees are able to move from room to room quickly to see their desired session.

Session Room Facilitators:

Brookside A
Facilitator: Dawn Foster-Hartnett, University of Minnesota

Brookside B
Facilitator: Jean Huang, Olin College

Forest Glen
Facilitator: Amy Briggs, Beloit College

Glen Echo
Facilitator: Tim Paustian, UW-Madison

Linden Oak
Facilitator: Jennifer Brigati, Maryville College

White Flint Amphitheater
Facilitator: Renu Kumar, Minnesota State University

White Oak A
Facilitator: Emily Nowicki, The University of Texas at Austin

White Oak B
Facilitator: Archana Lal, Independence Community College

MICROBREW D: 2:30 PM – 2:45 PM

Using a Simple Soil Assay to Demonstrate Regulation of Enzyme Production
Craig Phelps, Rutgers University, New Brunswick, NJ.

Brookside A

Understanding that microbes regulate the production and activity of catabolic enzymes in response to their environments is an important concept for students studying microbial ecology. That concept is demonstrated effectively in this lab exercise using easy-to-construct soil microcosms and a simple colorimetric assay.

The soil microcosms are constructed using soil amended with different combinations of organic (yeast extract) and inorganic fertilizers (15:30:15) in small plastic flowerpots. They are incubated for two to three weeks before being assayed for alkaline phosphatase activity. The assay involves an hour-long incubation with a commercially-available p-nitrophenol phosphate solution in buffer. The product (p-nitrophenol) is measured by absorbance at 440nm on a spectrophotometer. Absorbance measurements are then used to calculate the amount of enzyme activity present in each soil sample.

Students use the results from the enzyme assay to compare the amount of enzyme expression in each sample as it correlates to the soil treatments. Soils amended with an organic source of phosphorus show an increase in enzyme expression compared to the native soil. Those amended with inorganic phosphorus exhibit enzyme repression. Combinations of organic and inorganic fertilizers will show intermediate levels of enzyme activity depending on the amount of inorganic phosphorus provided.

The activities in this lab exercise help students to understand one of the important ways that microbes respond to their environments. The quantitative nature of the assay helps them to directly link enzyme expression to nutrient availability in an ecological context.

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Laboratory competencies
Jigsaw Group Discussions Enhance Active Learning and Formative Assessment in the Microbiology Laboratory

Padma Seshadri, Suffolk County Community College, Grant Campus, Brentwood, NY.

Forest Glen

Vision and Change in Undergraduate Biology Education report, published by the AAAS, emphasizes that the students actively participate in the learning process rather than being the passive recipients of information. Jigsaw group discussions were used to facilitate student-centered learning and formative assessment in a microbiology lab that is designed for biology majors. Horizontal gene transfer (HGT) in bacteria was the focus of the discussions. A week before the lab session, reading assignments, procedures for the experiments, and a study guide were given to the students for homework. At the beginning of the lab session, instructions to set up the experiments were explained to all the students in the class. The class was then divided into three groups. Each of the three groups conducted one of the three HGT experiments, namely, transformation, transduction and conjugation. During the subsequent lab session, each of the students in the groups examined and discussed the interpretation of the results of the experiments within his/her group. Jigsaw groups were then formed and each jigsaw group had a few members from transformation, transduction and conjugation groups. The members of the jigsaw group showed the plates from their experiments to each other and explained the interpretation of the results. The students were actively exchanging their thoughts about the topics such as controls, donor strains and recipient strains. Instead of passively listening to the instructor’s explanations, the students were actively analyzing their observations. The students’ discussions provided an opportunity for the instructor to assess the students’ strengths and weaknesses on their understanding of the HGT. Dividing the students in groups for the three HGT experiments and then creating the jigsaw groups, for the discussion of the results, provided a highly fertile environment for active learning in the lab and for formative assessment of the students’ knowledge of the concept.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research, Laboratory competencies

Using a Personal Reflection Tool to Enhance Student Comprehension in Laboratory-Based Courses

Rebecca K. Hoffman, Rowan University, Glassboro, NJ.

Glen Echo

Laboratory-based courses usually require students to record their activities in either a paper or an electronic-format notebook, a process that may not invest the student with understanding the importance of translating that skill to the research lab or workplace setting. I developed a personal reflection tool that requires students to use information they have recorded in their laboratory notebooks to answer a series of evidence-based questions as a means of assessing the quality of their laboratory observation and interpretation skills. As students become experienced with using the technique they learn how to apply their understanding through critical thinking to answer more complex questions based on experimental extensions of the core concepts of each unit. Students are provided with explicit directions for the content of their notebooks at the beginning of the course and are required to complete their first reflection after the initial lab exercise in order to reinforce their understanding of the scope and quality of the information they record in their notebooks. All reflections are scored using a rubric specific for each lab exercise, and the students are provided with a copy of their rubric. Each reflection requires students to self-evaluate the effectiveness of their records in providing the information necessary to answer the questions, a process that enables them to learn how to improve the content and quality of their records. Using the reflective assessment to evaluate lab notebooks encourages students to progress beyond simple mechanical catalog-keeping and to develop an understanding of how information derived from experiments can be used to make decisions. The reflection has the added benefit of providing the instructor with a more revealing summary of students’ progress rather than simply using a checklist rubric. After students have completed a series of lab reflection assessments throughout their semester-long course, they come to understand the significance of their own investment in their laboratory learning. Although I originally developed the reflection tool and its questions for
use in a biology majors’ microbiology course, it can easily be adapted for use in other laboratory-based courses such as cell biology, molecular biology, and immunology.

**ASM Curriculum Guideline Concept(s):** Advancing STEM education and research, Laboratory competencies

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**Why Do We Have to Do This? Helping Your Students Understand Why You Use Active Learning In the Classroom**

Jennifer Brigati(1), Benjamin England(2), and Elisabeth Schussler(2), (1) Maryville College, Maryville, TN and (2) University of Tennessee at Knoxville, Knoxville, TN.

**Linden Oak**

In response to STEM education reform efforts, many instructors have incorporated active learning into their courses, but few instructors offer their students a thorough explanation of why they are using these techniques. In this session we will present data about student misconceptions regarding why active learning is used, and you will strategize effective ways to share your justifications for using active learning with your students. To determine what instructors in the Introductory Biology series at a large public university were telling their students about their use of active learning, we completed observations and a document analysis. We also surveyed the instructors regarding their motivations for using various types of active learning. Students were interviewed and surveyed to determine what they remembered their instructors saying about why active learning techniques were being used, and what they thought their instructor’s motivations were for using active learning. We found that while instructors often offered students some explanation for why they were using active learning, the clarity and amount of explanation varied. Students were more likely to remember instructor explanations of active learning use if the instructor justified its use in general, rather than justifying the use of individual methods. Regardless of how much explanation was provided, many students (23% – 50% depending on the class) did not remember that any explanation occurred. Students most often remembered their instructors saying that active learning is used to keep students engaged (14.6% – 36.9%) and to help students learn (23.1% – 39.1%). However, many students had misconceptions that instructors used active learning mainly to encourage or monitor attendance and/or to give “easy” points. Explaining your motivations for using active learning is helpful, but students also infer your motivations based on how active learning techniques are used in your classroom.

**ASM Curriculum Guideline Concept(s):** Advancing STEM education and research

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**Student Metacognitive Development as a Predictor of Success in an Introductory Biology Course**

Jessica Santangelo, Hofstra University, Hempstead, NY.

**Brookside B**

‘Metacognition’ is the combination of awareness of one’s learning (self-monitoring) and the use of that awareness to enhance learning (self-regulation). Students enter introductory biology courses with a range of metacognitive abilities (Stanton et al 2015). Those with less developed skills may struggle in fast-paced courses that require conceptual understanding rather than rote memorization. I asked whether we can predict student success based on their metacognitive development as determined by the Metacognitive Awareness Inventory (MAI) and student responses to open ended prompts. Students (N=292) enrolled in eight sections of an introductory biology course took the MAI and responded to prompts at the beginning and end of the semester. Metacognitive knowledge and regulation scores were calculated and written responses are being coded to categorize each student’s metacognitive development (Stanton et al. 2015). Preliminary analyses reveal a weak positive correlation between student pre-course MAI knowledge score and course grade (Pearson’s correlation: r=0.17, N=292, p=0.002). In addition, a subset of students (N=39) were in a section that received metacognition instruction while a second subset (N=25) were in a section for honors students. These subsets should allow me to ask whether the MAI and prompts detect changes in metacognitive development when students are given metacognitive instruction and whether historically high-performing students have more developed metacognitive skills, respectively. If we can identify easy-to-use instruments to assess student metacognitive
development, we could intervene early for those with less-developed skills to help more students succeed in STEM courses.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Using Twitter to Access Current Events and Research in the Biofuel Industry Around the World
Sherry Ogg, Johns Hopkins University, Baltimore, MD.

White Flint Amphitheater

Our Biofuels class is an elective in the Biotechnology program and it is taught online. Biofuels is currently a hot topic with many opportunities in research and development. The objective for using Twitter in the classroom was to expose students to biofuel research and commercial applications on a global scale. Each student was required to open a Twitter account, if they did not already have one. After opening their account, they were required to follow at least ten individuals or companies related to the biofuel industry. The Twitter exercise was carried out for seven weeks during a 14 week semester. During this time, the students were required to tweet at least three times per week. The tweets could report on something they read, saw, or heard about biofuels during the current week. The tweets could be links to news articles, biofuel industry posts, or personal comments or reflections about the current topics in class. This comparable to current events log for biofuels. Retweets were discouraged, in order to enhance originality. The students were also required to engage in at least three conversations about biofuel technology with people outside of our class. This allowed the students to gain knowledge about the biofuel industry and research from those directly in the field. At the end of the assignment, students were required to write a reflection or "Storify" their experience with Twitter. Storify is a web based vehicle to compile Twitter posts and create a story of current events. Our Twitter feed resulted in a collective newsfeed and narrative of current topics in the realm of biofuels and biotechnology, and provided a platform to showcase how biofuel industry is using Twitter.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

The Search for Terrestrial Life: An Inquiry-Based Astrobiology Laboratory Module
Amy Treonis, University of Richmond, Richmond, VA.

White Oak A

I developed a laboratory module for “Astrobiology”, an Introduction to Biological Thinking course that serves as the entry point for undergraduate students (usually first-years) into the Biology major at my university. The module requires students to study desert soils for signs of life. Students, working in teams, are randomly assigned soil samples collected from the Mojave Desert. Each soil sample is named after an actual extrasolar planet (e.g., Gliese 581g, a.k.a. Zarmina), and students are asked to research their planet and generate hypothesis regarding potential habitability. Over the course of ten weeks, students aseptically sample their soils and perform various analyses, including measurement of CO2 evolution, counts of culturable microbes, extraction of DNA and amplification of 16S rDNA fragments, observation of the soil via scanning electron microscopy, and geological analysis of a mineral sample. In complementary lecture activities, we study the Viking Lander experiments, more recent Martian missions, and analog studies performed on Earth. We also study the characteristics of star systems (and their planets) that are associated with habitability. Student learning is assessed via frequent low-stakes worksheet assignments and by the preparation of a comprehensive lab report. The learning objectives of this comprehensive module are for students: (1) to practice and perform several biology laboratory skills, including aseptic technique, manipulation of microbial cultures, microscopy, PCR, and electrophoresis, (2) to apply the scientific method to analyze and evaluate several lines of evidence for support of a hypothesis, and (3) to write a laboratory report that communicates their experiment in scientific writing. The module is noteworthy due to its emphasis on a wide array of biological skills presented within an open-ended experimental framework that ignites students’ imagination. In this presentation, I am seeking ideas for new analyses and improved assessment.

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Laboratory competencies
Designer Bacteria: A Fun Active Learning Activity to Apply Cell Structure and Growth Condition Concepts
Jennifer Koehl, Saint Vincent College, Latrobe, PA.

White Oak B

For my flipped section of Microbiology, I developed an activity to help the sophomore through senior science students apply and integrate concepts taught during different units including microbial structure and growth conditions (pH, temperature, and water activity). Prior to this class, students have been introduced to these topics; cell structure during the third to fifth week of the semester and growth conditions during the seventh week of the semester (exam 1 covers cell structure but not growth conditions). To help the students integrate topics and have a fun activity before spring break, I created the "Designer Bacteria" activity. Students, in small groups (three to four students), randomly selected five prepared notecards, one for each of the following characteristics: cell wall, flagella arrangement, pH group, temperature group, and salt group. Growth conditions include “normal” and extremophile conditions; for example, for pH, a student could select a card that says “neutrophile” or “acidophile” or alkaliphile. The students then drew their bacterium in detail. Students had to determine the specific ways that their bacterium would deal with multiple environmental conditions (high pH and low temperature). It also gave students a chance to review terminology. At the end of the activity, groups uploaded their pictures which were viewed as a class. Students had to justify their choices (more saturated fatty acids versus less saturated fatty acids) for their bacterium. While no assessment has been created for this assignment, I believe it met the goals of allowing students to apply and integrate cell structure and growth condition concepts in a fun and active way.

ASM Curriculum Guideline Concept(s): Structure and function, Systems

MICROBREW E: 2:50 PM – 3:05 PM

Beginning With Authentic Research: Implementing The PARE Project In A Freshman Laboratory
Ruth Plymale(1) and Carol Bascom-Slack(2), (1) Ouachita Baptist University, Arkadelphia, AR and (2) Tufts University, Boston, MA.

Brookside A

There is consensus that course-based research improves student engagement and enhances student learning. Yet, moving from traditional to research-based labs can seem overwhelming. The Prevalence of Antibiotic Resistance in the Environment (PARE) project is a short research module that can be run on its own or provide a good transition to a larger course-based research project. In the PARE project, college students pair with local high school students to screen soil samples for antibiotic resistant bacteria. Both the high school and college students collect soil samples, then the college students plate serial dilutions on nutrient agar or tetracycline plates. After incubation, each group counts their respective plates and records site information, number of colony-forming units, and percent resistance in a national database. I have implemented the PARE project as a module in freshman General Biology laboratory sections of 24 students each; the laboratory otherwise consists of traditional lab experiment and dissection modules. I scheduled the PARE project to coincide with the Central Dogma and Inheritance topics in the General Biology lecture, and spread the project out over 4 laboratory periods. For the first two laboratory periods, the students learned to do dilutions and plating using the high school samples. For the second two laboratory periods, the students diluted and plated their soil samples, then determined colony-forming units and percentage resistance. They also completed a POGIL-style activity on transcription and translation and a photo-based skills test on dilutions and colony-forming unit calculation. In this Microbrew session, I will describe my experiences with implementing the PARE project as a course-based research module in a General Biology laboratory, including sharing the assignments that I have used.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research, Laboratory competencies
Teaching Students to "Talk the Talk"
Mary E. Shawgo, Graceland University, Lamoni, IA.

Do your students struggle explaining scientific processes or presenting data? The use of oral exams and journal club in the classroom could provide opportunities for students to improve upon their skills presenting scientific data. Currently, foreign language studies use oral exams to evaluate students, and science should do the same. This presentation will discuss the use of the high impact teaching techniques of oral exams and a journal club. These techniques were developed in classrooms and laboratories to provide students with more practice in using science vocabulary and in presenting data. Students from sophomore to senior level were given at least one oral exam each semester, with the type of oral exam ranging from individual to group, depending on classroom size and student ability. Students not only practiced “talking the talk,” but they learned to be better listeners. “Talking the talk” also includes learning to present data. A journal club was implemented in an upper level science class to teach students how to analyze journal articles and to present data. Various versions of a journal club were used. Through the use of oral exams and journal clubs, dramatic improvements have been seen in the students' abilities and confidence when explaining scientific information and presenting data. Examples of activities, assessments and the case study used will be shared and discussed.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

The Ebola Wars: Teaching About Emerging Infectious Diseases Using the Case Study Approach
Tracie Addy(1), Derek Dube(2), and Linda Iadarola(3), (1)Yale University School of Medicine, New Haven, CT, (2)University of Saint Joseph, West Hartford, CT, and (3)Quinnipiac University, Hamden, CT.

After a recent outbreak, the Ebola virus came to the forefront of the media as an emerging infectious disease. Similar waves of attention occurred during past viral outbreaks including SARS coronavirus and H1N1. When such outbreaks occur, the media often plays a large role in conveying how different viruses are transmitted, infect cells, and propagate, as well as the prognosis of infected individuals and their treatment regimens. This portrayal may not include all of the facts, and some may be misconstrued, leading to the formation of misconceptions. As basic virology is a topic discussed in most introductory biology and microbiology courses, and student-centered activities are supported in fostering student learning, we developed and published two cases on the Ebola virus for both introductory and advanced students, namely, “The Ebola Wars: General Edition” and “The Ebola Wars: Advanced Edition.” The general case scaffolds students through introductory concepts in virology into the in making energy, but what happens between oxygen entering the lungs and carbon dioxide leaving the lungs is often a black box. A series of activities and assessments (both formative and summative) were developed during the 2015 ASM Biology Scholars Assessment Residency Program that address this black box. Through a variety of activities that include drawing processes, taking short online quizzes, and discussing a case study on aerobic respiration, students learn the process of aerobic respiration, and compare aerobic respiration to fermentation and to anaerobic respiration. These activities increase overall student understanding of the process as well as the real purpose of oxygen in aerobic respiration. Examples of activities, assessments and the case study used will be shared and discussed.

ASM Curriculum Guideline Concept(s):
Pathways, Advancing STEM education and research

The Air That I Breathe: Increasing Understanding of Aerobic Respiration
Karen Huffman, Genesee Community College, Batavia, NY.

Students often struggle with the process of aerobic respiration and fermentation, even at the basic level. Students usually understand that we breathe oxygen and exhale carbon dioxide and that oxygen is used
basic science of the Ebola virus using the scenario of a college student infected with Ebola during an international medical outreach experience. At the end of the case, learners make decisions regarding how to treat the infected student. The “Ebola Wars: Advanced Edition” case is appropriate for upper-level virology courses and allows students to step beyond basic virology to explore the detailed structural and mechanistic information on the Ebola virus. The latter case requires higher level critical thinking, and supports hypothesis-driven problem-solving.

We implemented the general edition case in introductory microbiology courses for allied health majors, as well as general biology courses for majors. Preliminary data supports student satisfaction with learning using this case. At ASMCUE we will introduce participants to the cases, provide tips on implementation, and discuss any preliminary outcomes of a current research project underway at two of our institutions on teaching and learning using the general case.

ASM Curriculum Guideline Concept(s): Structure and function, Impact of microorganisms

Collaborating with Undergraduates Across Disciplines to Create Peer-Led Distance Learning Modules for a Non-majors Microbiology Hybrid Lab

Stephanie M. Miller and Michael Roy, Ohio University, Athens OH.

Brookside B

There are challenges when designing and developing an online non-majors microbiology laboratory course that is (1) rigorous enough to meet department curriculum standards and is true to the skill-learning objectives of a lab course, but (2) provides flexibility in the academic schedules needed by health science professional students. The objective of this collaboration was to design and develop online learning modules for a hybrid microbiology lab that were peer-led and of high quality. The modules included peer-produced videos and were designed specifically to allow experienced undergraduate health science students to teach microbiology concepts and protocols. Using these volunteer students to produce and act in the videos included a peer-learning component, but also there were media art students involved that edited and produced videos to ensure professional quality.

With these video modules we were able to design a course with 50% reduced traditional lab meeting time, but that was still designed to allow for rigorous learning objectives and assessment of practical skills.

The interdisciplinary team involved in the course design and video development was composed of one faculty member in the Department of Biological Sciences and a team of three health science undergraduate students and one instructional technologist at the university’s Instructional Innovation Center and 3 student interns in media arts and studies. Idea-sharing, course design, organization and production of modules have all had some hurdles and successes, and the focus of this talk will be on what was learned by the collaborators.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research, Laboratory competencies

Using Storytelling and Anthropomorphic Formulations to Enhance Student Learning

Kari Brossard Stoos, Ithaca College, Ithaca, NY.

White Flint Amphitheater

Teaching in depth courses in microbiology and human disease to public health students or other non-science majors that lack knowledge of not only human anatomy, but also cell biology, can be challenging. By incorporating the use of storytelling, via creating anthropomorphic and teleologic formulations to represent components involved in disease processes, students take ownership of content and partake in the metacognitive process. For each disease, students read the content in the text prior to entering class. Once in class, students are asked to assist in the development of a fictional story that explains the steps in the mechanism of the disease or the mechanisms of the host immune system in response to the disease. Pathways are drawn on the board as students build the stories based on the previously read content. Students are encouraged to use alliteration when developing characters, such as “Max the Macrophage,” to increase retention. By designating human characteristics and reasoning to components at the molecular level, students
find the content more relatable, accessible, and have better recall. This method deviates from the typical “sage on the stage” approach and demands student engagement with the material. After the first applications of the method in class, students not only visibly show increased enjoyment in the learning process, they also are observed to come to class having read the material with greater attention to detail so that they are maximizing their roles in story development. In this Microbrew, we will demonstrate this pedagogical approach and discuss how initial qualitative assessments have shown an increase in both student interest and competence with subject matter as compared to traditional lecture style alone.

**ASM Curriculum Guideline Concept(s):**
Pathways, Advancing STEM education and research

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**From Gene to Function. Use of PCR and Biological Assays to Connect Gene to Protein Function**

*Manuela Tripepi*, Stockton University, Galloway, NJ.

*White Oak A*

During this laboratory activity, students will understand the correlation between genes and protein function. By using PCR analysis targeting the flagellin gene flgA1, students will investigate the genotype of an unknown strain of Haloferax volcanii, and at the same time, using a motility assay, they will compare the presence or absence of motility to the PCR results.

Haloferax volcanii is a halophilic archaea that was isolated from the Dead Sea.

This haloarchaea model organism is particularly suitable to use in activities with undergraduates as it is non pathogenic, easy and cheap to grow (we developed a “grocery store ingredients” media to grow these organisms), and a variety of genetic tools are available to work with this organism.

Haloferax swim by means of flagella, and the motility of the strain can be tested using modified agar plates (motility plates). Motile colonies will form swimming halos, meanwhile, motility mutants will show only a dot on the motility plate, at the point of inoculation.

The first step of this exercise is to extract DNA for PCR amplification. Students will not be told whether the strain they are assigned is motile or not.

They will learn how to design primers for the target gene and set up the PCR reaction. Subsequently, they will set up a motility assay of the provided strain (along with a control). In the next laboratory period, students will perform gel electrophoresis on their PCR reactions and will analyze their results. These will be compared to the results of the motility assay to confirm the motility of the strain.

**ASM Curriculum Guideline Concept(s):** Structure and function, Laboratory competencies

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**Transformation of Online Videos into Active Learning Experiences**

*Thomas Koval*, Johns Hopkins University, Baltimore, MD.

*White Oak B*

The Internet is teeming with an abundance of videos concerning nearly all aspects of cell and molecular biology, as well as most other STEM topics. Many instructors utilize such online videos as supplemental material to accompany lectures, textbook readings, or laboratory exercises. Students can learn a great deal from well-done animations as well as microscope videos demonstrating selected cell and molecular functions. However, it can be difficult to ensure that all students obtain the desired information from such videos. Zaption is an online tool that allows selection of videos from many internet sites, including YouTube, Vimeo, PBS, National Geographic, TED Talks, Discovery, NASA, Edutopia, and several other sites, as well as your own original videos, and then customize these videos into interactive student learning tools that align with the learning objectives of your class. Zaption allows you to truncate and edit the selected videos, and then insert text, images, drawings, multiple-choice or essay questions, or simply boxes for reflection, at any points you choose during the video. Such newly created videos can then be shared with students by providing them with the URL or embedding the video in text within a learning management system. Students can then view the videos in an asynchronous manner as is typical for many online courses, or the instructor may choose to provide the video in a synchronous online session.
for the entire class. In either case, an abundance of the analytical data can be collected from student participation and responses. The basic version of Zaption that contains the features mentioned in this abstract is free, has no expiration, and does not contain ads.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

MICROBREW F: 3:10 PM – 3:25 PM

Verification of Bioinformatically Identified Terminators in the Classroom

Nathan Reyna, Ouachita Baptist University, Arkadelphia, AR.

Brookside A

Recent initiatives such as the Genome Solver Project and HHMI SEA-PHAGES program have made bioinformatic analysis of microbe genomes common in the classroom. However, as increasing amounts of bioinformatic software are developed, each with a unique prediction algorithm, more discrepancy occurs between putative results. Consequently, our students began to ask the question “How do we know these predictions are correct?”. Our goals in addressing this question was twofold: first, to examine characteristics of bioinformatically identified regulatory elements; second, to create an analysis platform that can be used in the classroom. We developed a novel plasmid (pGR-Blue) and streamlined protocols for the physical verification of transcription terminator sequences. The result is a rapid and cost-efficient method to validate transcription terminator predictions that can be used as a modular wet-lab component in a bioinformatics class or a standalone semester course-based research experience (CURE). At Ouachita Baptist University (OBU), this project allows for scaffolding of research into multiple classes and into independent research projects. Student-collected results have begun to provide insights into the effective utilization of bioinformatic methods and comparative genomics. In an attempt to encourage faculty at other institutions to participate in similar projects, we have made both pGR-Blue and our protocols freely and openly available. Additionally, we have begun to develop grading rubrics and semester outlines that will help other faculty manage similar projects in their classes. We will present how we used this lab at OBU, the key components needed to complete the project, and how to access our material for use at other universities.

ASM Curriculum Guideline Concept(s):
Information flow, Advancing STEM education and research

“Letters To Grandma”: An In-Class Writing Activity that Combines Informal Writing and Teaching as Tools to Increase Student Retention and Comprehension

J. Jordan Steel, Colorado State University- Pueblo, Pueblo, CO.

Forest Glen

It is well documented that in-class informal writing activities enhance student comprehension by providing students with the opportunity to internalize the material and then synthesize a written version of their comprehension. It is also well established that having students teach about a given concept will help students more fully understand the material. In an effort to combine these two pedagogies, I have incorporated a writing activity called “Letters to Grandma.” This short and informal activity allows the students to pause during lecture and write a brief “letter” to “grandma” (some real or imaginary person that is respected and loved, but may be ignorant to the world of microbiology). Students have the responsibility to teach, through their letter, a microbiology concept to their grandma. This activity is short (5-10 minutes), and has been very effective at helping students understand concepts such as specific microbe properties, metabolism, ecological impact, antibiotic resistance, immune response, evolution, and genetic engineering/GMO’s. Students indicate through end-of-the-semester surveys that this activity is helpful and that they remember concepts from “Letters to Grandma” better than other topics, but I am seeking ideas on how to perform an accurate assessment on the effectiveness of this activity on student comprehension, application, and retention. A list of writing prompts will be provided at the Microbrew session and details/logistics will be explained.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research
Helping Introductory Biology Students Forge Connections Between Concepts

Mike Keller and Patty Shields, University of Maryland, College Park, MD.

Glen Echo

In introductory courses, we all want our students to see the connections between the different topics we cover, whether obvious or subtle. More importantly, we believe it is important for students to make connections in the classroom that are conceptual and show some depth of understanding of the topic at hand. Unfortunately, forging these connections can be difficult for the students, and they need active guidance in finding new ways to think about material and put what they know together in a novel context. Moreover, students make connections that we as teachers don’t often see or understand, and our understanding of those can be an important part this process. As part of our flipped-classroom active learning arsenal, we have introduced our “Warm-up Monday” exercise, a Think-Pair-Share worksheet designed around recognizing and making connections. All of the worksheets have a similar structure: the first question asks the students to brainstorm with each other to make connections between two recent topics. Sometimes it is a list, sometimes examples, etc. After 5 minutes working with a group of those around them, we share all the answers as a class. This allows us as the instructors to see what connections the students see as important and relevant to the topic. The second question is more detailed and asks the student to make a connection that we as instructors have decided is a critical one to be made. In this Microbrew, we will share some of our strategies for making this work in large classrooms (up to 250–300 people), how to write meaningful questions, feedback from students and some of our favorite worksheets.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Intentionality in Designing Laboratory Assignments For Student Success and Engagement

Huda Makhluf, National University, La Jolla, CA.

Linden Oak

Undergraduate research experiences are considered high impact educational practices. In a microbiology laboratory course, students collected household toothbrushes from which they cultured bacterial isolates while learning microbial aseptic techniques on selective and differential media. Research methodology, data collection and analysis were emphasized throughout the course. We tested the hypothesis that adopting an authentic research approach to our curriculum could lead to increased student satisfaction and enhanced learning. To that end, we performed an assessment of the Classroom Undergraduate Research Experience (CURE) by using surveys and collecting student artifacts for assessment. Students were shocked that there would be fecal traces on their toothbrushes albeit while living in a microbial world. The results triggered lively discussions on oral flora, microbiomes, hygiene and proper storage of toothbrushes to avoid fecal contamination. Student engagement—by doing relevant and current research activities—and subsequently student satisfaction were increased compared to a control class. Additionally, this Microbrew session will address the use of the Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics in scoring students artifacts.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research, Laboratory competencies

Using Google Draw as a Digital Drawing Kit to Manipulate Complex Concepts in Biology

Tracy Ruscetti and Christelle Sabatier, Santa Clara University, Santa Clara, CA.

Brookside B

Modeling and Simulation is one of the core competencies highlighted in Vision and Change. Part of the modeling process is visualizing and drawing complex concepts. We have encouraged drawing in many ways, including group work with colored markers and big paper, drawings as an assessment,
practicing drawings, etc. While students participate in these class exercises and assignments, we find that students are reticent to draw out a concept, an experiment or a problem. To help students move beyond their initial resistance, we started using Google Draw. In 2015, we built a Google Doc with an embedded schematic drawing of the lac operon to help students model transcriptional regulation. The drawing included the lac operon, associated transcription factors, and sugars relevant to its regulation. In lecture, students copied the Google Doc so they could manipulate the model using their own laptops. Then they modified the drawing to simulate the state of the lac operon in specific culture conditions. Once students finished manipulating the drawing, it could be saved and submitted for assessment. This assignment was linked to a laboratory experiment probing lac operon function. The students then used similar models of the lac operon to communicate their interpretation of the experimental data. In 2014, prior to implementing the Google Draw, the mean on the final exam related to the lac operon was 59%. After implementing the lac operon drawing kit in 2015, the mean on that section increased 30% to 76% (p < 0.001). Our preliminary data suggest that giving students the opportunity to manipulate a visual representation of a complex concept increases their understanding of that concept. In this Microbrew, we will work through our online google draw worksheet on the lac operon as well as discuss other applications of the digital drawing kit in Google Draw.

ASM Curriculum Guideline Concept(s): Structure and function, Information flow

Blogging in a Laboratory Course as a Method to Increase Scientific Literacy and Practice Science Communication for a General Public Audience

Aimee Hollander, Nicholls State University, Thibodaux, LA.

White Flint Amphitheater

AAAS Vision and Change and ASM curriculum guidelines recommend undergraduate STEM majors participate in science communication including science writing. Developing skills to communicate science at a level that a general audience can understand requires deliberate practice and careful attention to language. In most laboratory curriculum students are taught to perform experiments, make observations, quantify results, draw up models, and formulate theories. They then communicate their findings and insights to their immediate research groups. In our cell and molecular biology laboratory course, students write for a blog available to the public. Students are required to review an assigned peer-reviewed publication throughout the semester involving the topics taught during the course. They then write a blog post that is written specifically for the general public based on their assigned paper. Students also blog about the specific laboratory exercises performed during the course. Through this student centered activity, students learn how to explain difficult science jargon, use analogies to describe various biological systems, structures and functions, as well as develop a portfolio of their own science communication. Students also master creating a collaborative blog and capitalize on their on-line communication capabilities. This project increases scientific literacy, as students must be able to deduce peer-reviewed publications before writing their blog posts. Students are also encouraged to comment on one and another’s blog posts throughout the semester. This type of activity can be utilized for laboratory and lecture courses and encourages students to practice communicating microbiology to the general public.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research

Using Oral Presentations to Cultivate Active Learning and Critical Thinking Skills in “Identification of Unknowns”

Alioune Gueye, Mount Ida College, Newton Center, MA.

White Oak A

Integrating active learning and critical thinking skills into a microbiology laboratory curriculum can be highly effective in improving students’ understanding of bacterial growth characteristics and identification, and their applications to understanding the mechanisms of animal infections. In this introductory microbiology course, students in the veterinary technology programs use traditional methods of identification of unknown bacteria, and prepare a PowerPoint presentation of their findings. During the course of the semester, each student
will give two PowerPoint presentations detailing all steps that enable them to characterize their unknown selections based on colony morphology, Gram stain results, and biochemical test results. As an end-of-term project, students create and conduct an experiment in which they collect clinical specimens from domestic animals or the environment, and perform the biochemical tests to identify the microbial species that is potentially responsible for the signs of infections observed in the animal or the significance of the presence of the bacteria in the environment. Students develop experiments including hypothesis, methodology and identification, and they discuss the infection of disease process caused by the presence of the pathogen in the animal or in the environment. Then they present an abstract and their experiment in the form of a PowerPoint presentation to the laboratory class. The oral presentation format gives students experience in developing oral communication skills, and they use these skills to communicate critical thinking and active learning skills in microbiology. In addition, these projects help students Integrate the knowledge they acquire from lab and make judgments about microbiology when discussing certain types of infections found in animals.

**ASM Curriculum Guideline Concept(s): Impact of microorganisms, Laboratory competencies**

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**Using a 3-D Printer to Learn Cell Structure**

Archana Lal, Independence Community College, Independence, KS.

*White Oak B*

Cell structure is a topic that is covered in all introductory Biology and Microbiology classes. Most of the time it is hard for the students to understand and retain the information presented in the class. Our campus recently opened a Fab Lab with 3-D printers. I toured the Fab Lab with the students enrolled in my Biology I: Cellular and Molecular Biology class. When the cell structure topic was discussed in the class, students were asked to use the 3-D printer to print a model of a typical eukaryotic cell. Each group of two student was assigned one structure or organelle. They were given four weeks’ time during which they went to the Fab Lab, familiarized themselves with the software to draw the structure and learnt to use the 3-D printer. All the groups were asked to collaborate with each other regarding the size of different structures so that they fit inside the “cell”. After the entire cell was printed, the students were asked to give a class presentation and discuss the structure of the organelle and its function. They also discussed the organelles that are present in all the eukaryotic cells and if they have to represent a typical animal cell or plant cell, what organelles will have to be added and removed from the printed cell. Students seemed to understand the cellular structure better and their retention improved. Throughout the semester whenever any reference was made to the cell structure, they tended to answer it accurately. Next fall semester, I plan to ask students to print a typical prokaryotic cell and then they would be required to compare the two printed cells to understand the differences between prokaryotic and eukaryotic cells. During this Microbrew session, I plan to show the cell that students planned and printed using a 3-D printer.

**ASM Curriculum Guideline Concept(s): Structure and function**
<table>
<thead>
<tr>
<th>MICROBREW SESSION III OF III</th>
<th>Saturday, July 23</th>
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<tr>
<td>ROOM LOCATION</td>
<td></td>
</tr>
<tr>
<td>Brookside A</td>
<td>Forest Glen</td>
</tr>
</tbody>
</table>

| MICROBREW G: 3:45 PM – 4:00 PM – pg. 79 | |
| Knowledge Sharing About Medical Viruses: Using Community Based Project to Motivate Learning Value and Build Up 21st Century Skills | |
| Kanokwan Kittiniyom, Mahidol University | |
| Laboratory Exercise for the Isolation, Purification, and Characterization of Personal E. coli Cultures | Teaching Partners | Use of Regular and Consistent Formative Feedback to Improve Problem-solving Skills in Weekly Online Assignments | Achieving Course Improvement and Student Improvement through Student Evaluations | Embedding Quantitative Literacy into an Undergraduate Physiology Lab Curriculum | Campus Composters – Integrating Science, Sustainability, Service and Social Entrepreneurship | Using Microbe Information Sheets to Connect Concepts and Increase Critical Thinking |
| | Dave Westenberg, Missouri S&T | Maureen Leonard, Mount Mary University | Sarah Sidiropoulos, Oakland Community College | Tracey T. Meilander, Notre Dame College | Vicki Huffman, Potomac State College of WVU |

| MICROBREW H: 4:05 PM – 4:20 PM – pg. 83 | |
| An In-Class Service Learning Activity to Advance Students’ Research and Laboratory Competencies Using Bacterial Transformation with Green Fluorescent Protein | |
| Margie Paz, University of Georgia | Incorporating Basic Statistics and Data Organization Into A Microbiology Teaching Lab | A Journey in Transforming Traditional Nursing Microbiology Curriculum through Gamification | A Web Application for Automatically Generating Customized, Individual Assessment Feedback Reports | "Design Your Animal!" Blog as a Progressive Formative Assessment in an Online Animal Physiology Course and adaptation to a Microbiology/Pathology Laboratory Course | There is an App for That! Educational App Use in the Biology Classroom | Modes of Inquiry-based Learning in a Laboratory Virus Biotechnology Course |
| | Joseph Battistelli, Virginia Commonwealth University | Wendy A. Dustman, Georgia Gwinnett College | Monica Linden, Brown University | Donnasue Graesser, Quinnipiac University and University of Connecticut | Mary Mawn, SUNY Empire State College | Thomas Lentz, North Carolina State University | Melissa E. Marks, Willamette University |

| MICROBREW I: 4:25 PM – 4:40 PM – pg. 86 | |
| The Addition of a Service-Learning Component to a General Microbiology Class Curriculum | |
| Fernanda Santos, Adventist University of Health Sciences | Microbes Rule! Using Microbial Communities to Foster Creative, Collaborative Undergraduate Research Experiences and Promote STEM Competencies | Positive Sense, Negative Sense, Non-sense? How to Help Students Make Sense of Virus Replication | Using Student Concept Surveys to Guide Reflection and Formative Assessment | Rapid Response Lab Reports | Have Your Students Flipping for Microbial Metabolism: An Activity for Large Enrollment Classes | Incorporating Modules of On-Campus Research Programs into a Freshmen Biology Lab |
| | | Pratima Darr, Georgia Gwinnett College | Deb Scheiwe, Tarrant County College-Northeast Campus | Christopher Parker, Texas Wesleyan University | Jennifer McLean, Colorado State University | Jack Horne, University of New Orleans | M. Julia Massimelli, University of California | Exposing Students to Primary Research Literature One Figure at a Time: Initial Assessment Data |
MICROBREW SESSIONS III OF III
3:45 PM–4:45 PM
(8 sessions)

These grassroots sessions, arranged by topics, provide a forum for sharing best practices and interesting activities used in laboratory and classroom teaching. Presentations are simple “chalk talks” (e.g., no PowerPoint) to facilitate informal discussion. Unlike the poster sessions, Microbrews do not require assessments. Sessions will be facilitated by volunteer attendees in order to make certain each presentation stays within the 15-minute presentation (10-minute presentation and 5 minutes for discussion). Sessions must stay on time so attendees are able to move from room to room quickly to see their desired session.

Session Room Facilitators:

Brookside A
Facilitator: Miriam Martin, University of California, Davis

Brookside B
Facilitator: Ally Hunter, UMass Amherst

Forest Glen
Facilitator: Ned Barden, MCPHS University

Glen Echo
Facilitator: John Buchner, University of Maryland

Linden Oak
Facilitator: Tracie Addy, Yale University

White Flint Amphitheater
Facilitator: Mary Mawn, SUNY Empire State College

White Oak A
Facilitator: Kristi Miranda, Tarrant County College

White Oak B
Facilitator: Melissa Marks, Willamette University

MICROBREW G: 3:45 PM – 4:00 PM

Knowledge Sharing About Medical Viruses: Using Community Based Project to Motivate Learning Value and Build Up 21st Century Skills

Kanokwan Kittiniyom, Wijit Wonglumsom, Chongrak Pemmongkol, Tanawut Tantimongcolwat, Sujin Assawawitoontip and Kuntida Kittidee, Mahidol University, Nakhon Pathom, Thailand.

Brookside A

Many students were complaining about knowledge from lectures that would be with them just for the exam periods. They could not link to other subjects or apply to use. What were the causes of these?

Did students know their goals of learning or realize the values of what they learned? Did the learning processes that teachers prepared lead them to integrate knowledge into students’ lives? These questions lead us to develop the community-project based learning called “Knowledge sharing about medical viruses to community” by aiming for knowledge integration and application to community and also empowerment the 21st century skills especially team working. There were 3 steps of learning; (1) Preparedness, with a half day activity to explore their own goals of life, to understand themselves and others as human by identifying personal characters classified into 4 groups and to practice deep listening and dialogue; (2) Community, with a three-week project, working as a group of 9–10 students with mixed characters and gender under supervision of teacher. Each group searched and chose their own topic that was a problem, question or controversy to Thai beliefs about virus causing diseases and developed communication tools that matched to the target group and worked in the community. And (3) Lesson learned, with half day in-class activity for every group to share the design and outcome of their projects and reflection. There were 4 levels of assessment by individual, groups, teachers and participants in community. This activity has also motivated students to love Microbiology and profession of Medical Technologist. At the end, students realized that they could apply their knowledge to benefit society, following the philosophy of Mahidol University stated by Prince of Songkla “True success is not in the learning, but in its application to the benefit of mankind.”

ASM Curriculum Guideline Concept(s): Systems, Impact of microorganisms
Laboratory Exercise for the Isolation, Purification, and Characterization of Personal E. coli Cultures

Ned Barden, MCPHS University, Boston, MA.

Forest Glen

In the study of the microbiota of the human intestine it is often necessary to use fecal samples as the source of microbial cultures. The simplest and safest way to obtain material for genomic analysis or selected pure culture samples for further laboratory analyses is the “toilet tissue touch” technique, developed for the Human Microbiome Project study of the intestinal microbiome. Touching a swab to used toilet tissue and inoculating a plate of EMB Agar readily yields isolates of the ubiquitous intestinal inhabitant, Escherichia coli. In this exercise developed for an upper-division microbiology course, “personal” cultures of presumptive E. coli are isolated from the fecal swab samples and are further characterized using biochemical tests, including the E. coli confirming IMViC series. An antibiogram pattern and the presence of plasmids are also used to show differences among the various E. coli strains isolated by the class. In this Microbrew session the successfully implemented laboratory protocol will be presented. Ensuing discussion will allow the session participants to address additional aspects of this exercise, including but not limited to: laboratory safety concerns of working with unknown cultures isolated from the students themselves, possible additional laboratory studies of the isolates, the extraction and comparison of plasmid DNA using a commercial mini-prep kit plus electrophoresis, and the use of the individual antibiogram results to establish a March Madness-like bracket to determine the most resistance and the most sensitive E. coli champions.

ASM Curriculum Guideline Concept(s):
Pathways, Laboratory competencies

Teaching Partners

Dave Westenberg, Missouri S&T, Rolla, MO.

Glen Echo

This session will present the Teaching Partners Program being implemented at Missouri S&T for peer evaluation of teaching. The program pairs educators along with an education technology professional. This session will walk participants through the evaluation process and how it is being implemented.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Use of Regular and Consistent Formative Feedback to Improve Problem-solving Skills in Weekly Online Assignments

Maureen Leonard, Mount Mary University, Milwaukee, WI.

Linden Oak

Problem solving is a key skill in effectively performing the process of science. Problems can range from simple where the problem is easily identified and has a single underlying cause, to complex where phenomena observed may have multiple causes and can confuse identification of the problem and/or the solution(s) possible. A learning goal in an upper level microbiology course was to improve complex problem solving skills. Student evaluations indicated students did not have the skills or the confidence to successfully solve complex problems. To improve student skills, I implemented a new assessment approach involving individualized formative feedback using a standardized rubric. Students were presented with a complex problem related to the material being covered in class as a homework assignment. Their responses were then assessed using the rubric and specific feedback was provided to highlight where the responses did and did not align with it. The students were then allowed to review the feedback and revise their responses before the response was graded. In-class interventions using both “good” and “bad” examples also allowed whole-class review and discussion, as well as practice with the rubric as an assessment tool. This improved student scores and allowed patterns of individual areas of strength or concern to be identified and targeted for support. Student performance showed trends toward improved first attempt scores and increased consistency in responses.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research
Achieving Course Improvement and Student Improvement through Student Evaluations

Sarah Sidiropoulos, Oakland Community College, Auburn Hills, MI.

Brookside B

Overwhelmed new faculty members are often given the advice to focus on just surviving their first semester teaching, and to build their classes up from there. But after the first semester is over, how can a new faculty member make the switch from surviving to excelling as an educator? As a new faculty member interested in creating the most student-centered classroom possible, my first instinct was to use student evaluation data to improve my courses. But, as I found out shortly after my first semester ended, relying on student evaluation forms to generate course improvements can be disappointing. Comments are often non-constructive, whether positive (“she’s nice!”) or negative (“class is too hard!”). Based on that experience, I made major changes to how I collect student feedback in my courses. My current model (in my second year as a faculty member) involves three stages of gathering additional student feedback outside of my institution’s official feedback form: I assign students a pre-class survey, a mid-semester survey, and a post-semester essay. I have discovered that if presented correctly, these feedback opportunities not only allow me to make course changes, but also allows students to reflect on their own role in our student-teacher interactions. In fact, student feedback opportunities can be used to clarify to both my students and I how we can maximize the impact of our interactions together to improve student learning. The creation of my student feedback materials came largely from informal, online interactions with other educators, including utilizing discussion forums and blog posts. Here, I will lead an in-person, interactive discussion on effective ways to glean useful information, and generate genuine course improvements, from student-centered feedback.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Embedding Quantitative Literacy into an Undergraduate Physiology Lab Curriculum

Jodie Krontiris-Litowitz and Alicia Prieto-Langarica, Youngstown State University, Youngstown, OH.

White Flint Amphitheather

The practice of biology frequently involves the collection and interpretation of data sets that require mathematical analysis or statistical tests. Therefore, it is important for students to build the skill set that enables them to analyze data, communicate data, develop predicative numeric relationships and create mathematical models that mimic physiological events. The scientific community has identified a gap in quantitative literacy (QL) or mathematical and computational preparation of future scientists and has encouraged institutions of higher education to address this problem by developing STEM curricula that embed QL. In this project we identify a set of Quantitative Literacy Learning Objectives (QLLO) that are relevant to life sciences careers and aligned with the objectives of a biology major’s lab course in physiology. We then develop new, and revise existing, Human Physiology Lab protocols so that they embed these skills. The QLLO identified thus far address: (1) the concepts of gain, scale, units, approximation, and rates (2) the physiological applications of differentiation and derivative calculations (3) simple quantitative and inferential statistics (4) the use of quantitative evidence to support complex conclusions and (5) effective communication of data in tables, graphs, and mathematical equations. We present here the first phase of the project where we identify the QLLO in the current curriculum and evaluate student learning of these objectives using course exams. In this analysis we ask the questions “Do the existing lab protocols teach these concepts effectively?” and “Do the existing assessment tools evaluate student learning effectively?”. Using this data we will proceed to the next phase of the project where we revise the existing curriculum and create new lab protocols that will address QLLO missing in the original curriculum.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research, Laboratory competencies
Campus Composters – Integrating Science, Sustainability, Service and Social Entrepreneurship

Tracey T. Meilander, Bill Leamon, Vince Palombo, and Eric Matthews, Notre Dame College, South Euclid, OH.

White Oak A

Campus Composters, a student developed sustainability initiative and social entrepreneurship enterprise at Notre Dame College, aims to engage students in the reduction of food waste on campus and in the community. In this mission-focused, service-learning research collaboration between the biology department, business division and Office of Community-Based Learning, students will initially collect pre-consumer food waste from the campus cafeteria and coffee grounds from the college café with the goal of expanding to a fee-based service offered to local residents and businesses. Campus facilities will provide grass clippings and wood chips for compost in an effort to reduce campus yard waste. Students plan to donate the compost, created in an O2 Compost aerated composting system, to local community gardens. Biology and environmental science students will monitor compost production and collect data on temperature, pH, organic matter, salinity, time to production, and yield. The data gathered will be used to make recommendations on how to maximize compost production. We will assess content knowledge (Core Concepts of Biological Literacy–Pathways and Transformations of Energy and Matter and Systems) of biology students participating in the program. Science process skills will be assessed by rating students on an original Core Competencies and Disciplinary Practices Rubric and evaluation of student notebooks. Students’ ideas on service, servant leadership and vocational discernment will be assessed through self-reflection and interviews. Students will communicate their findings to the community at the annual celebration of scholarship on campus. The challenges and successes of this interdisciplinary initiative will be addressed. We welcome suggestions that will help students to investigate the microbial communities within the compost, ideas for strengthening interdisciplinary collaborations, and recommendations for scientific content assessment tools.

ASM Curriculum Guideline Concept(s):
Pathways, Systems

Using Microbe Information Sheets to Connect Concepts and Increase Critical Thinking

Vicki Huffman, Potomac State College of WVU, Keyser, WV.

White Oak B

Instead of teaching individual concepts to help students understand microbes, I created information sheets in which students learn about microbes so they can learn the important concepts in microbiology. Most texts, and thus courses, teach individual concepts, like structure, metabolism, genetics, etc…, and then use diseases or microbes to put those concepts together. Most of my students, however, have been unable to put all the concepts they learn throughout the semester together or apply them. To try to help improve this, I created and utilized information sheets that students complete prior to class. The information sheets require students to look up the general characteristics, specific structures and functions of structures, metabolism, pathogenesis/virulence factors and treatment/control of a pathogenic microbe. I chose multiple Gram negative bacteria, Gram positive bacteria, viruses and eukaryotic microbes that range in the previously mentioned categories to help demonstrate the diversity of microbe.

Students bring their completed information sheets to class and work in groups to compare and contrast microbes in each category and between categories throughout the semester. Concepts are then explained and expanded upon. By continuously comparing and contrasting microbes, students seem better able to understand how structures, metabolism and virulence factors determine function, pathogenesis and control. With the information sheets, students are repeatedly required to describe the various concepts (metabolism, structure/function, pathogenesis, etc…), which seems to help them retain and better understand them. In addition, students seem more prepared for class, better able to see the whole picture, make connections, determine credible sources, relate concepts to the “real” world and think critically.

During my presentation, I will provide copies of the information sheets and the microbes used. I will also discuss what worked well, what didn’t, and some student feedback.

ASM Curriculum Guideline Concept(s): Structure and function, Impact of microorganisms
MICROBREW H: 4:05 PM – 4:20 PM

An In-Class Service Learning Activity to Advance Students’ Research and Laboratory Competencies Using Bacterial Transformation with Green Fluorescent Protein

Margie Paz, University of Georgia, Griffin, GA.

Brookside A

I have implemented a service learning component for the students in BIOL 3110L (Basic Skills in the Laboratory) at the University of Georgia, Griffin campus. Students work with 9th graders from Spalding County to conduct a guided inquiry-based laboratory investigation on the transformation of E. coli with Green Fluorescent Protein (GFP).

First, the students perform the transformation of E. coli with GFP as a required laboratory exercise in the course. Proper laboratory techniques and analysis of data are emphasized so students have a clear understanding of the foundational concepts and skills. The regulation of gene expression as influenced by molecular cues/signals and the utilization of microorganisms as models to gain fundamental knowledge about life processes are highlighted.

The 9th graders conduct a similar transformation experiment of E. coli with GFP at a later date (i.e., after the BIOL 3110L students have completed their transformation experiment/data analysis). At each step of the methodology, students provide the 9th graders with guidance and instructions on how to perform a given protocol and, more importantly, why it works. The procedures take 60 minutes to complete, followed by my 10-minute PowerPoint presentation on the expected results and applications of GFP in bioluminescence technology. The 9th graders are then provided with culture plates generated from E. coli transformation experiments previously done by my students. They write down their observations on a results form (handout) and discuss their observations.

Each BIOL 3110L student is required to write an essay on how this project affects their understanding of the scientific methods, their ability to communicate scientific principles, and how the project is likely to impact the needs of students from Spalding County. Feedback from the BIOL 3110L students was generally positive, and students viewed favorably the opportunity to apply their classroom learning within the context of community service.

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Advancing STEM education and research

Incorporating Basic Statistics and Data Organization Into A Microbiology Teaching Lab

Joseph Battistelli and Rima Franklin, Virginia Commonwealth University, Richmond, VA.

Forest Glen

As an environmental microbiologist, statistics are essential for analyzing microbial communities and their relationships to the environment. Students seldom see applications of statistics in microbiology. As instructors of a 2-credit, 400-level lab, we have the opportunity to provide direct interaction with a small group of senior-level students. We set out to design a lab activity that included working with simulated data to highlight the importance of integrating statistics in the field of microbiology. Specifically, we guided students through performing a t-test to compare denitrification rates of microbes isolated from two unique environments. This approach is unique in an undergraduate lab setting because it focuses on the analysis and interpretation of data rather than the process of generating data, and for its application of statistics in microbiology. Statistical analysis is something students struggle with because there are multiple steps along the way that require interpretation. By working directly with the instructors and other classmates in this group setting, the students garner instantaneous feedback that helps them better understand the conceptual foundation for what statistics “mean” and what they can tell us about the data. Evaluation of the teaching approach was based on anonymous surveys, including categorical ranking of effectiveness and free response comments. Student responses ranked the approach as very good, and stated the approach resulted in significant learning gains. Student comments in the survey and in real-time were consistent with survey results stating that one-on-one interaction with a faculty member provided significant learning gains and was tremendously helpful in understanding what the statistics truly mean and how they can be
applied in a microbiological setting. This information suggests we need to integrate more statistical analysis in lower-level labs and create better training for our graduate teaching assistants so they can provide more constructive feedback to their students.

**ASM Curriculum Guideline Concept(s):**
Advancing STEM education and research, Laboratory competencies

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**A Journey in Transforming Traditional Nursing Microbiology Curriculum through Gamification**

**Wendy A. Dustman**, Georgia Gwinnett College, Lawrenceville, GA.

**Glen Echo**

Gamification of curriculum isn’t just about using games in the classroom to engage students and promote learning. Instead, gamification is based on integration of game elements and game-thinking in course design to engage students, promote learning, motivate their action, and develop problem-solving skills.

By using elements of game play (experience points, badges, leaderboards, etc.), students are guided along their educational journey which has been transformed to make the learning experience more compelling while encouraging development of problem-solving skills, focus, and a drive to go beyond minimum goals. In a gamified course, rewards and incentives, rather than fear of poor grades, motivate student-players to continually improve, or “level-up”, and add to the sense of enjoyment of participating.

This session describes and follows the transformation of a traditional Nursing Microbiology course into a richer learning experience based on tenets of gamification. The gamified course design was modeled after a multiplayer role-playing game (like World of Warcraft) and was set in a present-day health-care facility.

Game terminology (e.g., quests, raids, etc.) was substituted for standard terms (e.g. assignments, exams, etc.) in the course syllabus. Challenges (individual and/or cooperative), were related to course goals which reflected real-world applications of the content as often as possible. An overall team competition was implemented to enhance cooperative learning and teamwork skills. While the actual content coverage, as well as most of the activities and assessments, remained unchanged from previous traditional course design, the manner in which the course was delivered and the ways in which the students reacted was noticeably different. Course designs, grading schemes, instructor’s observations, and student reactions collected from pilot offerings of the gamified course will be presented.

**ASM Curriculum Guideline Concept(s):** Impact of microorganisms, Advancing STEM education and research

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**A Web Application for Automatically Generating Customized, Individual Assessment Feedback Reports**

**Monica Linden**, Brown University, Providence, RI.

**Linden Oak**

Detailed exam feedback may serve as a mechanism to improve student study methods. For example, individualized exam feedback showing student performance on levels of Bloom’s taxonomy, coupled with study suggestions for each level, could improve student critical thinking skills. However, the creation of individual exam feedback forms to provide this type of feedback can be tedious. To address this issue, I am working with a team of computer science students to develop a free web application (app) that uses exam scores (either entered by the instructor or by the students themselves) to automatically generate customized reports. Instructors can use the web app to organize how their exam questions are categorized (including adding their own categories), to enter scores, to generate aggregate reports on class performance, and to view individual performance reports. Students can use the app to enter their own scores, view their customized reports, and review study suggestions. In this Microbrew, I will discuss the app itself and how it might be used to enhance student performance. I will also describe the web app creation process and plans for additional features. I would like to receive feedback on the app as we continue to develop it and hope to make it available for use in a variety of classroom settings.

**ASM Curriculum Guideline Concept(s):** Advancing STEM education and research
“Design Your Animal” Blog as a Progressive Formative Assessment in an Online Animal Physiology Course and adaptation to a Microbiology/Pathology Laboratory Course

Donnasue Graesser(1,2), Kristen Kimball(2), and Lylah Deady(2), (1)Quinnipiac University, Hamden, CT and (2)University of Connecticut, Storrs, CT.

Brookside B

We were tasked with converting a face-to-face Animal Physiology course to an online version of the course, developing active-learning activities that met the same learning objectives as the face-to-face course. To this end, we developed a “Design Your Animal” (DYA) blog activity. Students are given a scenario in which they are a scientific explorer who has discovered a unique animal that has never been described before. Students choose characteristics for their fictitious animal and its environment including taxonomic class, size, habitat, and climate. Throughout the semester, students apply the information they learn about each physiologic system to the animal they created, using guiding questions aligned with learning objectives for each unit. The criteria for blog posts include:

- All physiology must be feasible.
- All blog posts must build on previous posts and not conflict with previous information. (eg., after students describe respiratory adaptations of their animal, the animal must retain those adaptations when describing acid-base balance or thermoregulation).
- Students integrate new concepts learned in each unit to their existing physiologic framework for their animal.

Instructors provide timely feedback on each blog post, so that any misconceptions can be corrected as students continue to design their animal. Thus, the blog serves as a true formative assessment. In addition to direct assessment by the instructors, the activity has been assessed via modified SALG instrument.

The DYA blogging activity will be adapted for a Microbiology/Pathology course. In the laboratory, students will experimentally determine physical, biochemical, and susceptibility profiles for an unknown microbe, and relate these traits to microbial physiology/pathogenicity, as well as treatment of infection by this microbe. The goal of this activity in both courses is to develop an understanding of an organism as a whole, rather than isolated systems (in the physiology course) or isolated characteristics of the microbe (in the microbiology course).

ASM Curriculum Guideline Concept(s): Structure and function, Systems

There is an App for That! Educational App Use in the Biology Classroom

Mary Mawn(1) and Laura Regassa(2), (1) SUNY Empire State College, Saratoga Springs, NY and (2) Georgia Southern University, Statesboro, GA.

White Flint Amphitheater

Given the increased use of mobile devices in the classroom and the number of free and low-cost educational apps, this is an ideal time to identify what is available and share best practices for incorporating such resources in the biology curriculum. During this Microbrew session, we will provide an overview of educational app use and share examples of apps used in biology education. We will then discuss an initiative to develop an interactive collection of curated, pedagogically-aligned apps that will draw on the collective experiences of the biology education community. We will then invite participants to share examples of “go-to” apps and discuss how these can be used to support biology teaching and learning.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research; Laboratory competencies

Modes of Inquiry-based Learning in a Laboratory Virus Biotechnology Course

Thomas Lentz, North Carolina State University, Raleigh, NC.

White Oak A

Viruses are playing an increasingly important role in the field of biotechnology and biomedicine. However, courses in virology often focus on molecular replication and pathogenesis, but neglect applications in biotechnology. I have designed and implemented the course, Virus Biotechnology: Pathogens to Therapeutics, in the Biotechnology Program of North Carolina State University in order to fill this
gap in the curriculum of our program. This course was designed for upper-level undergraduate and graduate students and is comprised of both lecture and laboratory components. Inquiry-based learning was an emphasis in the design of this course and is achieved using several modes throughout the course. In particular, three principle modes will be discussed. The first is something of a capstone project. Termed the Gene Function Project, students use sequence homology and primary literature searches to predict the function of a gene in the life cycle of a virus. The virus is the same used as in the model system in the laboratory of the course, so students are observing the biology of this virus as they investigate its mechanisms. The second mode of inquiry is through the quantitative analysis performed completing laboratory experiments (assessed with lab reports and worksheets). Students learn qPCR and flow cytometry techniques to quantitatively evaluate virus replication and efficiency of cell transduction. The third mode of inquiry, is participation in primary research. Students analyze samples contributed by collaborating labs. Employing the quantitative methods learned in the lab to parse the implications of their results for a larger research question. Students are faced with the consequences of calling ‘false positives’ and epidemiological concepts, such as calculating prevalence. Each of these modes of learning was structured around achieving specific learning objectives. Assessment of student gains in these objectives will be available from a small cohort to inform discussion.

**ASM Curriculum Guideline Concept(s):** Structure and function, Impact of microorganisms

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**A Vision and Changed General Microbiology Curriculum Taught Directly From the Primary Literature**

**Melissa E. Marks**, Willamette University, Salem, OR.  
**White Oak B**

In this session, I will share my approach to, and experience in, developing a syllabus and teaching an undergraduate-level general microbiology course directly and entirely from the primary literature. At many small institutions, biology majors’ only exposure to the field of microbiology occurs in a single elective course. As a result, this course “serves many masters” as an introduction to the field, preparation for advanced coursework, and a prerequisite for graduate or professional programs. In addition, teaching this type of general microbiology from a textbook can feel content heavy, but concept and competency-poor. Including primary literature enhances a traditional curriculum, but is frequently tacked-on, crammed in, or in all ways “extra.” I experimented with a “less is more” approach designed to help students become proficient in learning how to learn microbiology through analysis of the primary literature. Using a thoughtfully selected series of contemporary papers analyzed as homework and in class with a modified version of the C.R.E.A.T.E. method (Hoskins et al. 2007), I offered a one-semester general microbiology course incorporating content meeting the majority of the ASM Recommended Curriculum Guidelines for Undergraduate Microbiology. Overall, the approach appeared to be successful; it was fun and resulted in student learning and retention of important content. I also noticed clear and immediate changes in student attitudes toward hard work, ambiguity, and ownership of their own learning. This approach appeared to benefit all students, but disproportionately improved the work of students who had underperformed in previously courses. In addition, students who completed this version of microbiology are notably more independent, engaged, and prepared to complete a mentored research project. I will share my experiences, talk about what worked and what could work better, and seek suggestions regarding methods of assessment.

**ASM Curriculum Guideline Concept(s):** Impact of microorganisms and Advancing STEM education and research

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**MICROBREW I: 4:25 PM – 4:40 PM**

**The Addition of a Service-Learning Component to a General Microbiology Class Curriculum**

**Fernanda Santos**, Kendra Presley-Van Houten, Ann Vinning, and Anaël Santos, Adventist University of Health Sciences, Orlando, FL.  
**Brookside A**

Service-learning (SL) combines academic subject matter in a given discipline with service within the community. Guided reflection is a key component
of SL; students integrate their service experience(s) with classroom knowledge to enhance the learning process. A SL component was added to an existing assignment within the General Microbiology class curriculum. Previously, this class lacked the SL activity, which is gradually becoming a required component of our undergraduate courses. Therefore, it is our goal to provide ideas of how SL can be applied to the subject of Microbiology.

The concept is to ask undergraduate college students to develop a lesson based on a topic of microbiology found within their curriculum and design a lesson that would be used with a community-based audience. The student would then follow a process to align the lesson with a SL project. First, the students are given their topic of instruction. The students would follow with taking a pre-service survey to gauge their understanding of SL. Next, the students would register through an online system for their SL project. The students proceed to design their own curriculum for the lesson that should be structured to present in a lecture style to an at-risk middle school audience. Once students have completed these processes, they will present their lecture in class as part of their assignment for both instructor review and peer review. The instructor assesses the quality, relevance, and applicability of the lesson for the target audience, and those meeting the aforementioned criteria would be selected to present the lesson during the Institution’s first annual Science Camp, designed for at-risk middle school students within the community.

The first Service Camp is scheduled for June 2016. At the time this abstract is being submitted, the students are working on their projects and preparing their presentations. Presentation to the Microbiology class instructor will take place in the end of March 2016.

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Advancing STEM education and research

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**Microbes Rule! Using Microbial Communities to Foster Creative, Collaborative Undergraduate Research Experiences and Promote STEM Competencies**

**Pratima Darr**, Rebekah J. Ward, and Wendy A. Dustman, Georgia Gwinnett College, Lawrenceville, GA.

**Forest Glen**

Authentic research experiences embedded into curricula are a powerful means of increasing research accessibility for STEM majors in a variety of academic settings. Several models have involved students investigating microbes in defined contexts and using primarily regimented methodologies. Here we describe a course design which provides students greater flexibility in selecting their research focus by framing it within the broad realm of microbial ecology. This design allows instructor-designated groups of 3–4 students to select a microbial community from soil, water or other specific context like phyllospheres (plant surfaces) and frame a research question that they subsequently pursue. To promote a measure of uniformity and ensure that community structure is investigated in both culture-dependent and culture-independent contexts, widely utilized microbial ecology procedures like FISH (Fluorescent in situ Hybridization) and phylogenetic analysis, are utilized in addition to project-specific analyses selected by student groups. First-hand appreciation of the concept of the “unseen majority” is a major focus of this course design. Specifically, this course is a special theme within a regular course offering that aims to provide upper level undergraduates an experience which will prepare them for pursuing STEM careers. Students immerse in the collaborative nature of real world research by selecting, designing and executing projects as teams. Further, they practice communicating effectively, both orally and in writing, with extensive use of peer review to mimic what takes place in authentic research. This will help to boost confidence and hone skills, in various forms of communication. We will share and discuss our schedule of implementation, as well as preliminary successes, shortcomings and, student feedback. We seek pinpointed critique about our venture so that we may institute improvements to it while also providing a model for developing similar courses, especially in settings where independent research opportunities are limited.
ASM Curriculum Guideline Concept(s):
Advancing STEM education and research,
Laboratory competencies

Positive Sense, Negative Sense, Non-sense?
How to Help Students Make Sense of Virus Replication
Deb Scheiwe and Jennifer Smith, Tarrant County College-Northeast Campus, Hurst TX.

Glen Echo

One of the core concepts which students find particularly difficult to comprehend is microbial genetics. Understanding the variety of replication strategies of viruses is particularly confusing. We have developed a series of quick, in class demonstrations to help students make sense of the different replication strategies of viruses. We will demonstrate how positive sense RNA viruses (Poliovirus), negative sense RNA viruses (Influenza), Retroviruses (HIV) and carcinogenic viruses (HPV) replicate using these models. We will show the important features of each replication method as well as how each contribute to pathogenicity and the emergence of new infectious diseases. Instructor handouts will be provided with easy to follow instructions for the models, and student handouts will contain a series of questions to be used in class for a guided discussion.

ASM Curriculum Guideline Concept(s):
Information flow, Impact of microorganisms

Using Student Concept Surveys to Guide Reflection and Formative Assessment
Christopher Parker, Texas Wesleyan University, Fort Worth, TX.

Linden Oak

Educators who embrace active learning environments often ask students to reflect on recently covered material by composing short essays recounting what they have learned or asking questions that test the students’ recall of material. Reflection helps students organize new information into coherent, conceptual frameworks, and provides them with an opportunity to identify gaps in their understanding. To encourage students to identify gaps in knowledge, educators often include a “muddiest point” mechanic in which students are asked to identify concepts that they do not fully understand. One drawback to this practice is that it relies on students to recognize what they do not know, a self-awareness that is often lacking in students.

I have supplemented the typical muddiest point assignment by providing students with a concept survey that contains a list of course learning objectives. As part of each reflection assignment, students use a Likert scale with a range of one to ten to rate their understanding of each objective for that chapter. Providing students with the objectives requires them to assess their understanding of the material at a more granular level. The concept surveys aim to help students recognize knowledge gaps by reminding the students of the current learning objectives, allowing them to better evaluate their understanding. In addition, students must explain what part of the current objectives confuses them the most.

The benefits of these surveys are two-fold. First, students can use the results of their surveys to focus their studies on areas where they ranked their understanding lowest. Second, the collective data from the class’s surveys provide the instructor with a snapshot of the class’s understanding of course content. The instructor can then immediately address any content associated with the learning objectives that the class has not mastered.

ASM Curriculum Guideline Concept(s):
Advancing STEM education and research

Rapid Response Lab Reports
Robert Maxwell, Georgia State University, Atlanta, GA.

Brookside B

Rapid documentation has become a cornerstone of our society, and individuals in both professional and academic environments are often required to submit reports with rapid deadlines. In an effort to increase student comfort and skill at writing, and to encourage them to consider material while it is still fresh, students have to submit a written introduction and procedure to their digital lab notebook (LabArchives), and have a rapid turnaround time to submit their lab reports after the completion of a lab exercise, typically four days. This rapid response lab report occurs between four and five times during a semester.
The system allows for the instructor to identify students with writing difficulties prior to a lab report, as well as students who may have misunderstandings regarding the lab. It further challenges the students to maintain lab notebook documentation on a regular basis, and enhances their skills at writing under pressure. There has been an observed increase in student preparedness for lab, and the retention of information.

**ASM Curriculum Guideline Concept(s): Laboratory competencies**

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**Have Your Students Flipping for Microbial Metabolism: An Activity for Large Enrollment Classes**

Jennifer McLean and Erica Suchman, Colorado State University, Fort Collins, CO.

*White Flint Amphitheater*

If your students notoriously struggle with metabolism like mine do, you may find the intervention proposed here helpful, particularly if you also teach large enrollment microbiology courses. I have chosen a flipped classroom activity for this intervention because it is well established that active learning in STEM courses is more effective than traditional lecturing, and classroom flipping has been shown to increase student learning and engagement. To prepare for this 50-minute, in-class activity, students watch three mini-lecture videos at home on chemolithotrophy, photolithotrophy and fermentation. They will have also previously received a traditional lecture covering respiration. To ensure they watch the video lectures, students are required to take a 5-point online pre-quiz covering material from the mini-lectures before they come to class on the day of the activity. In class, the students form groups of three to collaboratively complete a series of worksheets about metabolism. These worksheets are laminated so students can easily make changes as they work through the activity. Formative assessment includes clicker questions asked during the exercise as well as in subsequent class periods. Summative assessment includes questions on the next exam as well as on the final exam approximately three and six weeks later, respectively. Participants at this session will get to try the activity and receive sample materials.

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**Incorporating Modules of On-Campus Research Programs into a Freshmen Biology Lab**

Jack Horne, University of New Orleans, New Orleans, LA.

*White Oak A*

One of the challenges in developing the laboratory section of an introductory biology course for majors is finding the right balance between breadth and depth. As an introductory course, it is important to expose students to multiple areas of experimental investigation. However, simply introducing a variety of techniques, even if the techniques are current, does not provide students with genuine insight into the iterative and multi-approach process of biological research. At the University of New Orleans (UNO), we are piloting a completely redesigned introductory biology lab for majors that utilizes small pieces of several different research programs from UNO faculty research labs. The research methods chosen are fundamental techniques in cell and molecular biology (enzyme assay, PCR genotyping, yeast complementation), but are used to focus on a specific aspect of an active research program on campus. This approach gives students first hand experience in several different areas of research but also provides a genuine research context for each method. The laboratory exercises involve an assay or measurement that is fundamental to the research program, and students gain insights into the necessary analysis and controls important for obtaining meaningful results. Indeed, for one of the methods incorporated – PCR genotyping in Anolis lizards – the results obtained by students may be used for the actual research program. The research context is further enforced through a series of short research talks by faculty members after students have carried out the appropriate experiment. The eventual goal is to have all faculty research programs represented with individual exercises in one of the four core courses for the major.

**ASM Curriculum Guideline Concept(s): Laboratory competencies**
Exposing Students to Primary Research Literature One Figure at a Time: Initial Assessment Data

M. Julia Massimelli, University of California at Irvine, Irvine, CA.

White Oak B

Primary literature is essential for scientific communication. We designed a classroom intervention exercise to improve students’ ability to read, understand, and explain data, as well as increase confidence about their abilities to understand scientific articles. This intervention was used in a small elective Microbial Genetics course. Since students often report getting overwhelmed with the information contained in a journal article, which can affect their confidence, the exercise introduced students to data analysis one step at a time. We first practiced analyzing isolated figures from papers for each topic covered in lecture for a total of 6 weeks. The concepts, background, methods and jargon (e.g. protein, gene names) needed to understand the experiment were explained during the lecture. This allowed the students to focus completely on data analysis, which included quantitative reasoning, outlining experiments, identifying controls and writing results and conclusions. After practicing this figure comprehension exercise for 6 weeks, the students were assigned two full papers to read related to the class topics. Two full classes were dedicated to dissect the assigned papers using the same data analysis approach they learnt for isolated figures. The final exercise involved reading one scientific article containing background information not familiar to the students (not covered in class). During my presentation at the ASMCUE I will discuss preliminary data assessing student performance pre- and post- this class intervention. This data includes performance in an analysis/quantitative reasoning test and self-reported data about students’ attitudes about the nature of science, beliefs about learning, and confidence in their ability to read, analyze, and explain research articles.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research

DIRECTOR’S CHOICE:
HHMI NIGHT AT THE MOVIES
5:00 PM TO 7:00 PM
Salon A-C

DINNER ON YOUR OWN
7:00 PM
CLOSING PLENARY LECTURE  
8:00 AM – 9:00 AM  
Salon A-C  

The State of the Nation: What We Know About Learning Biology  
Loretta Brancaccio-Taras, Kingsborough Community College  
2016 Carski Foundation Distinguished Undergraduate Teaching Awardee  

Over the past several years, the federal government has made a substantial investment in science, technology, engineering, and mathematics (STEM) education and training. In addition, national reports, such as Vision and Change: A Call to Action and Engage to Excel, have made recommendations about what needs to be accomplished to improve student outcomes in the sciences. Educators have been encouraged to review their classroom techniques and use the results of education research studies to guide their practices. So, where are we? This session will describe the current initiatives underway, their impact on biology education and project what will need to be done so that biology education proceeds on a positive trajectory towards changing the way we think about STEM education.

ANCHOR PLENARY SESSION  
9:15 AM – 11:00 AM  
Salon A-C  

The anchor session will challenge you to reflect upon the lessons learned at the conference, to put your understanding into a larger context, and to align your goals with future actions. Educational thought leaders will address overarching questions during this interactive session, and participants will discuss how these trends and ideas relate to their own campuses and experiences. In addition, participants will develop a clearer vision for the future of higher education and how that will translate to their own work.  

Moderator:  
Naomi Wernick, University of Massachusetts, Lowell  
Amy Siegesmund, Pacific Lutheran University  

Panelists:  
David Asai, Howard Hughes Medical Institute  
Loretta Brancaccio-Taras, Kingsborough Community College  

Additional panelists TBA

CONFERENCE WRAP-UP  
11:00 AM – 11:45 AM  
Salon A-C  

Here is your chance to contribute and give us feedback about the conference.

END OF CONFERENCE  
12:00 PM
ABRCMS advances undergraduates and postbaccalaureates from underrepresented populations, including those with disabilities, in science, technology, engineering and mathematics (STEM) along the path toward graduate-level training. The conference features about 1,800 poster and oral presentations, along with scientific, professional development, and networking sessions. Approximately 700 exhibitors showcase their summer research and graduate school opportunities.

**Important Deadlines:**

- Judges’ Travel Subsidy Application: .......... July 12, 2016
- Travel Award Application: ...................... August 26, 2016
- Discount Registration: ........................... October 12, 2016

For more information, please visit: www.abrcms.org.

ABRCMS is sponsored by National Institute of General Medical Sciences (award number: T36GM073777) and the American Society for Microbiology.

“**It was a great opportunity to see the extraordinary research being conducted in the country and also to encourage and offer thoughtful advice to the future scientists.**”

FACULTY/JUDGE

“I love ABRCMS because of the vast amount of opportunities it has to offer. I meet so many new people who broaden my perspective of different areas of research. It’s great to see people from all walks of life who possess the desire to be involved in science.”

STUDENT ATTENDEE
Turning Your Science into a Company

October 6-8, 2016 | Washington, DC
Application deadline: August 20

This two and half day course explores the process of becoming an entrepreneur using examples from companies involved in biotechnology.

Goals are to:
(i) understand differences between academia and starting a company,
(ii) learn the importance of networking and relationship building, and
(iii) expand one’s business vocabulary and understanding

bit.ly/asmtsc16

Scientific Writing and Publishing Online Course

This online course will provide participants with:
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(ii) strategies for writing the first paragraph of the discussion and common mistakes to avoid, and
(iii) tips for selecting a journal, suggesting a reviewer and understanding the review process

2017 course information will be available in Fall 2016

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**Faculty Development Online Course**

This fall, ASM and QUBES have prepared a new four-part webinar series **focused on increasing quantitative biology in undergraduate education**. Each of the four 60-minute sessions will address common issues around teaching quantitative skills and reasoning, ranging from dilutions to graphing to data analysis. The program will run from September to December, 2016 and will be coupled with a virtual learning community.

To apply for these opportunities, visit [www.facultyprograms.org](http://www.facultyprograms.org)
Need Guidance in Preparing Your Courses?

ASM’s recommended Curriculum Guidelines for Undergraduate Microbiology can help!

• Get content ideas for your microbiology courses
• Learn the most important concepts for undergraduate General Microbiology courses
• Find new ways to connect microbiology concepts

Are Your Students Practicing Good Lab Safety?

Developed by ASM educators & the CDC, the ASM Guidelines for Biosafety in Teaching Laboratories provide a clear and consistent way to safely work with microorganisms.

Visit the Science Skills section of www.asm.org
Free Resources in JMBE’s Themed Issues

> Scientific Citizenship

- Published as a standalone issue in March 2016 (Vol 16, Iss 1)
- Curated by Guest Editor Jack Gilbert of Argonne National Laboratory
- 41 article-issue contains fun activities including:
  > turning microbial data in to music
  > recording shark encounters
  > tracking Lyme disease
  > smelling armpit microbiota
  > modeling zombie epidemics
  > observing flowers for the effects of climate change
  > using community labs for “DIY Biology”

> Scientific Ethics

- Published as part of the December 2014 issue (Vol 15, Iss 2)
- Curated by Guest Editors Beth A. Fischer, Ph.D., and Michael J. Zimmond, Ph.D., from the University of Pittsburgh and Frederick Grinnell, Ph.D., from UT Southwestern Medical Center
- 45 article-issue discusses:
  > teaching ethics at all academic levels
  > promoting academic honesty
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