Twenty-first Annual American Society for Microbiology
CONFERENCE FOR UNDERGRADUATE EDUCATORS

MAY 15-18, 2014
DOUBLE TREE BY HILTON BOSTON NORTH SHORE
DANVERS, MASSACHUSETTS

FINAL PROGRAM

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<td>Opening Plenary Lecture</td>
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<td>8:30 AM – 9:00 AM</td>
<td>Picking for Progress: Mining Nostri Microbiota for New Insights into Pathobionts</td>
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<td>8:45 AM – 9:00 AM</td>
<td>K.P. Lemon, The Forsyth Institute, Boston Children's Hospital, and Harvard Medical School</td>
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<td>9:00 AM</td>
<td>Case Study and PBL in STEM Education Pre-Conference Workshop (By Invitation Only)</td>
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<td>9:00 AM – 10:00 AM</td>
<td>Microbrew Sessions (I of III)</td>
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<td>Classroom</td>
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<td>9:00 AM – 10:00 AM</td>
<td>Complex Microbiomes in the Hands-On Bioinformatics</td>
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<td>10:45 AM – 11:45 AM</td>
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<td>8:45 PM – 9:45 PM</td>
<td>Concurrent Sessions - pg. 0 – 1</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, MAY 16 (CONTINUED)**

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>5:15 PM – 6:15 PM</td>
<td>Plenary Lecture - pg. 43</td>
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<td></td>
<td>Bringing Role-Playing Exercises, Interactive Simulations, and Climate Change Science Together for Transformative STEM Education J.N. Rooney-Varga, University of Massachusetts Lowell</td>
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<tr>
<td>6:30 PM – 8:30 PM</td>
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<th>Time</th>
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<tbody>
<tr>
<td>11:30 AM – 12:30 PM</td>
<td>Microbrew Session (II of III) - pg. 46 - 55</td>
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<td>Session D: 11:30 AM - pg. 46</td>
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<td>Session F: 12:10 PM - pg. 52</td>
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<td>12:30 PM – 1:30 PM</td>
<td>Product Corner - pg. 46</td>
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<td>1:30 PM – 2:30 PM</td>
<td>Author Corner - pg. 57</td>
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<tr>
<td>1:30 PM – 2:00 PM</td>
<td>John Wiley &amp; Sons, Inc.</td>
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<tr>
<td>Refreshment Break - pg. 57</td>
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<tr>
<td>2:00 PM – 3:00 PM</td>
<td>Sponsored by John Wiley &amp; Sons, Inc.</td>
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<td>3:00 PM – 4:00 PM</td>
<td>Product Corner - pg. 57</td>
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<td>3:00 PM – 4:00 PM</td>
<td>John Wiley &amp; Sons, Inc.</td>
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<tr>
<td>3:00 PM – 4:00 PM</td>
<td>Microbrew Sessions (III of III) - pg. 57 - 65</td>
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<tr>
<td>3:00 PM – 4:00 PM</td>
<td>SESSION G: 2:30 PM - pg. 58</td>
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<td>3:00 PM – 4:00 PM</td>
<td>SESSION H: 2:50 PM - pg. 60</td>
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<tr>
<td>3:00 PM – 4:00 PM</td>
<td>SESSION I: 3:10 PM - pg. 63</td>
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<tr>
<td>Evening Free - pg. 65</td>
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<tr>
<td>3:30 PM</td>
<td>Buses loaded to asm2014 Field Trip (Registered Participants Only) - pg. 65</td>
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<tr>
<td>3:45 PM – 4:00 PM</td>
<td>Field Trip Buses Sponsored by John Wiley &amp; Sons, Inc.</td>
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<tr>
<td>5:00 PM – 8:30 PM</td>
<td>asm2014 Keynote Session &amp; Reception - pg. 65</td>
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<tr>
<td>5:00 PM – 8:30 PM</td>
<td>Keeping Signals Straight inside Bacteria</td>
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<tr>
<td>5:00 PM – 8:30 PM</td>
<td>Good Fences Make Good Neighbors: How We Maintain Symbiotic Relationships with Our Intestinal Bacteria L. Hooper, UT Southwestern Medical Center</td>
</tr>
<tr>
<td>5:00 PM – 8:30 PM</td>
<td>Climate Change and the Unravelling of Microbial Partnerships in the Ocean O. Hoegh-Guldberg, The University of Queensland</td>
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<tr>
<td>5:00 PM – 8:30 PM</td>
<td>ASM Lecturer</td>
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<td>5:00 PM – 8:30 PM</td>
<td>Buses loaded to the DoubleTree by Hilton Boston North Shore - pg. 65</td>
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**SUNDAY, MAY 18**

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<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>7:00 AM – 10:30 AM</td>
<td>Closing Plenary - pg. 66</td>
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<tr>
<td>7:00 AM – 10:30 AM</td>
<td>ASMCUE 2014 and asm2014 Joint NextGen Microbiologist Plenary Session</td>
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<tr>
<td>7:45 AM – 11:15 AM</td>
<td>Conference Wrap-up - pg. 66</td>
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<td>7:45 AM – 11:15 AM</td>
<td>End of Conference - pg. 66</td>
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**Rate ASMCUE 2014 Sessions using Guidebook!**

- Visit [http://guidebook.com/getit](http://guidebook.com/getit) from your phone's browser
- Scan the above image with your mobile phone (QR-Code reader required, e.g. ‘Red Laser’, ‘Barcode Scanner’)

Your Feedback is Important to Us!
Welcome to Danvers, Massachusetts!

It is our pleasure to have you join us for the 2014 American Society for Microbiology Conference for Undergraduate Educators (ASMCUE). This is our twenty-first conference, and this year’s theme, “NextGen MicroEdu: Engage, Construct, Connect” recognizes this moment in time as we explore scientific advances and pedagogical theory and practices for the 21st century. Over the coming days, we will meet with leading microbiology and biology faculty and researchers, who will share cutting-edge scientific updates and effective teaching strategies. We will also have numerous opportunities to engage with colleagues as we construct new understandings and make connections between theory and practice.

We have worked hard to put together an outstanding conference program in a wonderful venue. We would like to sincerely express our appreciation to the Local Organizing Chairs, Drs. Gail Begley and Naomi Wernick, who were invaluable in providing expertise to help us find talented local speakers for many of our sessions. Also, and as always, the staff of ASM have been exceptional and gone above and beyond to help us make the conference a success. Please take a moment to thank them!

Building on the conference theme, we look forward to a great line up of plenary sessions this year:

- Katherine P. Lemon, Picking for Progress: Mining Nostril Microbiota for New Insights into Pathobionts.
- Juliette N. Rooney-Varga, Bringing Role-Playing Exercises, Interactive Simulations, and Climate Change Science Together for Transformative STEM Education.
- Carl E. Wieman, Taking a Scientific Approach to Science Education.

In addition, several program highlights include:

- Concurrent pedagogy sessions, scientific sessions, microbrew symposia, and poster presentations spread over four days.
- Session themes include assessment tools and techniques, broadening participation, course-integrated undergraduate research, distance learning, facilitating active learning, professional development, and teaching resources.
- Two cutting-edge presentations given by the American Academy of Microbiology: “How Microbes Can Help Feed the World” and “The Human Microbiome.”
- Breakout focus groups to review and share learning objectives based on the ASM Curriculum Guidelines and draft multiple choice assessment questions that link back to these guidelines.
- Multiple opportunities to meet and network with colleagues during receptions, poster presentations, at breakfasts organized by themes, and while “dressing for microbial success.” (Remember on Friday to wear your school colors, and on Saturday to wear “community” colors based on your institution type.)

This year, ASMCUE is again meeting in conjunction with the ASM General Meeting (asm2014) and attendees will have an optional “field trip” to attend the asm2014 keynote sessions in Boston. Also, new this year is a joint interactive lecture where, on Sunday, the asm2014 “NextGen Microbiologist” plenary session will be streamed live to ASMCUE; we will be able to ask questions via social media.

This year’s conference promises to have something for everyone. We hope that you take advantage of all the opportunities to network with fellow like-minded colleagues, forge new friendships, and rekindle old ones. As you contribute, you can’t help but develop professionally while making a difference in our community, conference, and society. We know because we are not just conference organizers, but we’re attendees, too!

Sincerely,

Chair,
Mary Mawn
SUNY Empire State College,
Saratoga Springs, New York

Vice Chair,
Laura Regassa
Georgia Southern University,
Statesboro, Georgia

Abstract Review Chair,
Robyn Puffenbarger
Bridgewater College,
Bridgewater, Virginia

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

NextGen MicroEdu: Engage, Construct, Connect
21st Annual ASM Conference for Undergraduate Educators
DoubleTree by Hilton Boston North Shore
May 15-18, 2014

ASMCUE STEERING COMMITTEE

Mary Mawn, Chair
SUNY Empire State College, Saratoga Springs, NY

Laura Regassa, Vice Chair
Georgia Southern University, Statesboro, GA

Robyn Puffenbarger, Abstract Review Chair
Bridgewater College, Bridgewater, VA

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

Gail Begley, Local Organizing Chair
Northeastern University, Boston, MA

Naomi Wernick, Local Organizing Chair
University of Massachusetts, Lowell, Lowell, MA

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Neil Baker
Chair, Education Board
The Ohio State University, Columbus, OH

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

AMERICAN SOCIETY FOR MICROBIOLOGY EDUCATION DEPARTMENT REPRESENTATIVES

Amy Chang
Director, Education Department

Kelly Gull
Manager, Faculty Programs

Michelle Slone
Coordinator, Education Programs and Resources

Lyndsey Van Druff
Coordinator, Education Programs and Resources

Kari Wester
Coordinator, Education Programs and Resources

American Society for Microbiology

Education Department
1752 N Street, NW
Washington, DC 20036
ph: 202-942-9317
fx: 202-942-9329
Email: asmcue@asmusa.org
Mary Mawn, Chair, is an assistant professor and academic area coordinator in science, mathematics, and technology at the Center for Distance Learning, SUNY Empire State College, Saratoga Springs, NY, where she teaches courses in microbiology, genetics, molecular and cellular biology, and science education. Dr. Mawn earned a B.S. in biochemistry from the College of Mount Saint Vincent, Riverdale, NY, and an M.Ed. in educational technology and Ph.D. in molecular and cellular biology from the University of Massachusetts Amherst, where she studied ribosome structure and function in *Escherichia coli* and *Saccharomyces cerevisiae*. Her current research interests focus on identifying ways to teach scientific process skills in online undergraduate science courses, and promoting the professional development of science teachers through distance learning. She is a 2009-2010 ASM Biology Research Scholar.

Laura Regassa, Vice Chair, is the director of the Molecular Biology Initiative and a professor in the Department of Biology at Georgia Southern University. She has a Ph.D. in bacteriology from the University of Wisconsin-Madison, with research interests in bacterial biodiversity and systematics. Laura first started pursuing educational research after joining the inaugural Biology Scholars Program cohort. Her educational research has focused on the impact of inquiry-based learning in high school (students and in-service teachers) and university environments (undergraduate and graduate students), with much of her current work focused on the NSF-funded Molecular Biology Initiative. Laura is a Georgia Governor's Teaching Fellow and the recipient of the University System of Georgia Regents' SoTL Award, a Southeastern Branch ASM teaching award, and institutional teaching and SoTL awards.

Robyn Puffenbarger, Abstract Review Chair, is associate professor of biology at Bridgewater College, a private, liberal arts school with 1800 students. She has a bachelor’s of sciences in biology from Virginia Tech, and a Ph.D. in molecular immunology from the Medical College of Virginia. Her scientific research project range from the gene expression of the endocannabinoid system to determining the antigens involved in the immune response of turkeys infected with *Bordetella avium*. She was an ASM Biology Research Scholar in the 2012 cohort and is currently serving as Secretary of the Virginia Branch of ASM. Her research work in education is focused on increasing learning gains in introductory courses in genetics.

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 large enrollment medical microbiology and public health courses and is a Premed Mentor in the Premedical and Health Studies Program. He 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

Gail Begley, Local Organizing Chair, earned a Ph.D. in cell & molecular biology at Boston University where she was a Pre-doctoral fellow in molecular biophysics. She was subsequently awarded postdoctoral research fellowships at the Institute of Molecular Medicine at the University of Oxford and at Harvard Medical School. After working as a Staff Scientist at the Marine Biological Laboratory, Dr. Begley joined the faculty of the Biology Department of Northeastern University in 2001 where she teaches in the areas of molecular biology, microbiology, and research and directs the University PreHealth Program. Dr. Begley is an ASM/NSF Biology Scholar for the Assessment of Student Learning and has recently published articles in the Journal of Microbiology & Biology Education on reframing the first-year Biology experience based on AAAS core concepts and skills and on incorporating service-learning into a first-year biology course.

Naomi Wernick, Local Organizing Chair, is a lecturer in the Biological Sciences Department at University of Massachusetts Lowell, where she serves as freshman advisor and teaches introductory biology as well as freshman seminar. She also 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. 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.

ASMCUE 2014 has gone mobile using Guidebook!

Download our FREE mobile guide to enhance your experience at ASMCUE 2014:

• create a personalized schedule
• browse speaker abstracts and biographies
• browse poster session and microbrew abstracts
• browse exhibitors, maps and general show information
• rate each session and the overall conference

To get the guide, choose one of the methods below:

• Download ‘Guidebook’ from the Apple App Store or the Android Marketplace
• Visit http://guidebook.com/getit from your phone’s browser
• Scan the above image with your mobile phone (QR-Code reader required, e.g. ‘Red Laser’, ‘Barcode Scanner’)

The guide will be listed under the "Download Guides" section of the application.
General Information

Conference Statistics
There are 397 participants, compared to 395 in 2013. Of those registered, there are:

- 353 conference attendees and 44 exhibitors
- 281 ASM Members and 72 nonmembers (among the faculty participants)
- 43% first-time attendees
- 27 international attendees representing 15 countries
- 126 conference attendees registered for the asm2014 field trip on Saturday
- 44 conference attendees registered for the asm2014 one-day pass on Sunday

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

<table>
<thead>
<tr>
<th>Day</th>
<th>Times</th>
<th>Location</th>
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<tbody>
<tr>
<td>Thursday, May 15</td>
<td>2:00 PM – 8:00 PM</td>
<td>Banquet Foyer</td>
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<tr>
<td>Friday, May 16</td>
<td>7:00 AM – 8:00 PM</td>
<td>Banquet Foyer</td>
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<tr>
<td>Saturday, May 17</td>
<td>7:00 AM – 3:30 PM</td>
<td>Banquet Foyer</td>
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Abstracts

Badges
Badges, available at registration, are required to enter all sessions and the Exhibit Hall. Your badge will be specially marked if you have registered for the asm2014 Sunday pass and/or purchased asm2014 field trip pass. Please consider your badge your entry ticket.

Internet Connection
Complimentary wireless service is provided in the following designated areas of the hotel: lobby, meeting space, and attendee hotel room. Please select the network *attwifi* and the password is *ASM2014*.

Microbrew 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. 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.

**Microbrew Session I: Thursday, May 15, 8:30 PM – 9:30 PM**
- Session A: 8:30 PM
- Session B: 8:50 PM
- Session C: 9:10 PM

**Microbrew Session II: Saturday, May 17, 11:30 AM – 12:30 PM**
- Session D: 11:30 AM
- Session E: 11:50 AM
- Session F: 12:10 PM

**Microbrew Session III: Saturday, May 17, 2:30 PM – 3:30 PM**
- Session G: 2:30 PM
- Session H: 2:50 PM
- Session I: 3:10 PM

Poster Sessions
Posters will be available for viewing beginning Friday, May 16 at 6:30 PM thru Saturday, May 17 at 2:30 PM in North Shore Ballroom. Two time slots are set aside for authors to be at their posters. They are:

- **Session A**: Author Presentations: Saturday, May 17, 9:15 AM – 10:15 AM
- **Session B**: Author Presentations: Saturday, May 17, 1:30 PM – 2:30 PM
Presenters must set up and take-down/remove their posters according to the following schedule:

**Set up:** Friday, May 16, 3:00 PM – 6:00 PM  
**Take down:** Saturday, May 17, 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 & asm2014 TRANSPORTATION**

**ASMCUE & asm2014 Locations**  
All ASMCUE sessions are held approximately 19 miles north of the Boston Logan International Airport and downtown Boston.

**A – Boston Logan International Airport (BOS)**

**B - DoubleTree by Hilton Boston North Shore**  
50 Ferncroft Road  
Danvers, MA 01923

**C – Boston Convention Center (site of asm2014)**

**Getting to and from Danvers**  
There are several options for getting to the conference from Boston Logan International Airport (BOS). Attendees can take a taxi, drive a personal vehicle, or take a combination of a local express bus and hotel shuttle to get to and from downtown. More details about each option are below.

**Taxi Service**  
Taxi service is available from Logan International Airport 24 hours a day, seven days a week. The fare from the airport to hotel is about $75 (one way), not including gratuity.

**Driving to and Parking at the Hotel**  
Complimentary self-parking is available for all overnight guests.

**Express Bus and Hotel Shuttle**  
Attendees may take the Logan Express bus from the airport to the Peabody Station. The DoubleTree by Hilton Hotel Shuttle will pick up attendees from the Peabody Station free of charge during operating hours. Attendees should call the hotel shuttle number once onboard the Logan Express to arrange pick-up. See below for pricing and hours.

**Logan Express**  

*Leave Logan to Peabody:*  
Weekdays: 6:15 PM - 12:15 AM every hour - and 1:15 AM  
Weekends: See online schedule.

*Leave Peabody to Logan:*  
Weekdays: 4:15 AM - 9:15 PM every hour - and 10:45 PM  
Weekends: See online schedule.

*Price:* Adult One-Way Fare: $12.00; Adult Round Trip Fare: $22.00

**DoubleTree by Hilton Hotel Shuttle**  
*Hours:* 7:00 AM – 11:00 PM Daily  
*Phone:* 978-777-2500
Price: Complimentary shuttle within a 5-mile radius of hotel.* Runs are on a first-come, first-served basis.

For a list of activities surrounding the hotel: Hotel Shuttle (pdf).

*Attendees staying at overflow hotels should call the hotel shuttle number to determine transportation availability.

Transportation for asm2014 Field Trip - Saturday, May 17
Attendees who registered in advance for the field trip Saturday evening to the asm2014 Opening Session and Reception will be provided with bus transportation to and from the DoubleTree Hotel and the Boston Convention Center.

Buses to the Boston Convention Center will load at 3:45 PM on Saturday and return to the DoubleTree Hotel around 9:30 PM. Badges will be marked with “asm2014 field trip” for registered attendees and serve as bus tickets.

Transportation to asm2014 - Sunday, May 18
Attendees who registered in advance for the discounted one-day registration pass to attend asm2014 sessions will be provided with a special badge to gain access. Participants need to arrange transportation to the Boston Convention Center on Sunday. To pick up your asm2014 registration bags please visit Registration Assistance at the Boston Convention Center.

Meet ASM leaders and participants of the following ASM Initiatives at the ASM Education Booth Exhibit Table!

Friday, May 16

6:30 PM – 7:30 PM
ASM Science Teaching Fellows Program

7:30 PM – 8:30 PM
Journal of Microbiology & Biology Education

Saturday, May 17

9:30 AM – 10:30 AM
International Educators Program

10:30 AM – 11:30 AM
MicrobeLibrary

1:30 PM – 2:30 PM
Biology Scholars Program

If you have participated in one of these opportunities, feel free to join us during your highlighted hour to share your experiences with attendees too!
Special Events and Networking

Contributing

ASM Curriculum Guidelines—Moving Forward
Friday, May 16 at 12:45 PM – 2:00 PM

Lunchtime provides opportunities for collaboration among attendees. This year at ASMCUE, the Curriculum Guidelines Task Force is joining forces with the ASM MicrobeLibrary Student Learning Assessments in Microbiology Database (SLAMD) to develop peer-reviewed multiple choice questions that will help microbiology educators to assess the learning objectives linked to the new Curriculum Guidelines. And we need your help!

We are asking ASMCUE participants to join us in focus breakout groups to review the example learning objectives and to share your own. We will then work in groups to develop new multiple choice assessment questions that directly link back to the Curriculum Guidelines. This will provide a valuable resource as microbiology educators across the world begin to adapt the new Curriculum Guidelines.

Networking

Sharing Issues, Finding Local Support, and More

One of the top reasons attendees give for attending ASMCUE is the opportunity to network with fellow educators. Meals at the Conference are intentionally served as a group to allow a time and place for this important networking to occur. This year, the three breakfast meals have been organized to maximize attendee interaction.

Friday - Breakfast by 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 issues.

Saturday - Breakfast by Location
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.

Sunday - Free for All!
You are on your own! Take a chance. Sit at a table where you recognize no one. Experienced faculty, introduce yourself to a first-timer. First-timers, hobnob with a speaker or ASM leader. Go outside your comfort zone! You never know, you may meet a collaborator or a friend for life. Many close friendships were born and nurtured at an ASMCUE meeting.

ASMCUE Spirit Week: Dress for Microbial Success!

Friday – 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!

Saturday – 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
Collaborations

ASM-NSF Leaders Inspiring Networks and Knowledge (LINK) Initiative

Join NSF research investigators in discussions about collaborations that simultaneously promote and sustain high quality undergraduate research, education and mentoring. Form an ASM LINK Mentoring Team and change how students prepare for scientific careers in the future. Learn more at multiple sessions planned throughout ASMCUE. The ASMCUE serves as a crossroad for linking research investigators with teaching scholars and undergraduate students.

ASMCUE LINK sponsored sessions included:

(1) Pre-Conference Workshop
Preparing Successful Proposals for the NSF Directorate of Biological Sciences
(Registered Participants Only)
Joanne M. Willey, Hofstra University
Gita Bangera, Bellevue College
Michael Ibba, The Ohio State University
Thursday, May 15 at 10:00 AM – 3:00 PM

(2) Implementing Vision and Change in the Classroom and in the Institution
Gita Bangera, Bellevue College
Thursday, May 15 at 7:15 PM – 7:45 PM

(3) Innovative Models for Staying Current in Research and Education
Beronda L. Montgomery, Michigan State University
Marcel Agüeros, Columbia University
Friday, May 16 at 3:30 PM – 4:00 PM

(4) Opportunities at the National Science Foundation
Susanne von Bodman, National Science Foundation
Friday, May 16 at 3:30 PM – 4:00 PM

ASMCUE/AAM Joint Program – Session to Delve into the Microbiology Behind News Events

The ASM Education Board and the American Academy of Microbiology will sponsor two sessions:

How Microbes Can Help Feed the World
Gwyn A. Beattie, Iowa State University
Linda L. Kinkel, University of Minnesota
Friday, May 16 at 2:15 PM – 3:15 PM

The Human Microbiome
Curtis Huttenhower, Harvard University
Friday, May 16 at 11:30 AM – 12:30 PM

In an effort to identify resources that deepen students' understanding about these topics, the AAM solicits innovative approaches from the ASM educator community. The FAQ Series is available at the Academy website.
ASMCUE/asm2014 Joint Program – Opening Keynote Session and Reception  
Saturday, May 17 at 5:00 PM – 8:30 PM

The Saturday evening “field trip” to the Opening asm2014 Keynote Session and Reception features:

- **Keeping Signals Straight inside Bacteria**  
  Michael T. Laub, Massachusetts Institute of Technology

- **Good Fences Make Good Neighbors: How We Maintain Symbiotic Relationships with Our Intestinal Bacteria**  
  Lora Hooper, UT Southwestern Medical Center

- **Climate Change and the Unravelling of Microbial Partnerships in the Ocean**  
  Ove Hoegh-Guldberg, ASM Lecturer, The University of Queensland

NEW! ASMCUE and asm2014 Joint NextGen Microbiologist Plenary Session  
Sunday, May 18 at 8:00 AM – 10:30 AM

Joint interactive lecture where the [asm2014 education plenary session](#) will be live-streamed to ASMCUE attendees:

**Convener:**  
Joanne M. Willey, Hofstra University

- **Facilitating and Disrupting Student Engagement: What Do We Know and How Do We Know That?**  
  Daniel D. Pratt, University of British Columbia and 2012 Imogene Okes Awardee for Outstanding Research in Adult Education

- **Teaching Your Students to Think Like a Microbiologist: Let Them Practice What You Preach**  
  Erica L. Suchman, Colorado State University and 2013 Carski Foundation Distinguished Undergraduate Teaching Award

- **Integrating Authentic Research into the Life Sciences Curriculum at Public Research Universities**  
  Erin R. Sanders, University of California, Los Angeles and Center for Educational Innovation in the Life Sciences

- **Crazy for CREs**  
  David J. Asai, Howard Hughes Medical Institute

- **Helping Diverse Students Transition from Undergraduate to Graduate Classes - an Intensive, Inquiry-Based Laboratory Course**  
  Alison E. Gammie, Princeton University and 2013 William A. Hinton Research Training Awardee

ASMCUE/asm2014 Joint Program - Discounted One-day Registration Pass to attend asm2014  
Sunday, May 18

Attend Sunday sessions planned at asm2014. Check the [asm2014 preliminary program](#) for schedule.  

(Attendees must have registered in advance for the asm2014 field trip and the Sunday registration pass to attend asm2014. On-site registration is not available. Transportation is provided on Saturday but NOT provided on Sunday. Please refer to pg. 9 for transportation information.)
Travel Awardees

Congratulations to all of the ASMCUE 2014 Travel Awardees!
Formal recognition of the recipients will take place during the Thursday dinner.

Announcing the 2014 ASMCUE Textbook Travel Award Winner!

Alice Mei Lee, Ph.D, a professor at North Carolina State University in Raleigh, NC is the 2014 ASMCUE Textbook Travel Awardee. The award is targeted toward new microbiology faculty members and provides an opportunity for educators to become familiar with undergraduate education research and to learn new instructional pedagogies. Because Lee’s Early-Career Faculty Travel Award application was considered particularly exceptional, the reviewers agreed that he 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 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.

Faculty Enhancement Program Awardees

The Faculty Enhancement Program is sponsored by the ASM Committee on Minority Education and supports the ASMCUE participation of non-ASM members who teach microbiology and biology at institutions serving minority and underserved populations.

- Daniel Harrigan, Blackhawk Technical College, Janesville, WI
- Nastassia Jones, Philander Smith College, Little Rock, AR
- Carol Stiles, Georgia Military College Valdosta Campus, Valdosta, GA

Early-Career Travel Awardees

The Early-Career Travel Award supports the ASMCUE participation of early-career undergraduate faculty, postdoctoral scientists, or senior-level graduate students interested in teaching careers.

- Sarah Council, NC Central University, Durham, NC
- Karla Lightfield, University of Kentucky, Lexington, KY
- Laura MacDonald, University of Arkansas for Medical Sciences, Little Rock, AR
- Holly Martin, Gillette College, Gillette, WY
- Maria Massimelli, Claremont Mckenna, Pitzer and Scripps colleges, Claremont, CA
- Lauren O'Donnell, Duquesne University, Pittsburgh, PA
- Kaustubha Qanungo, Trident Technical College, Charleston, SC
- Aarti Raja, Nova Southeastern University, Fort Lauderdale, FL
- Desislava Raytcheva, Tufts University School of Medicine, Boston, MA
- Stephanie Stockwell, James Madison University, Harrisonburg, VA

ASM-NSF LINK Travel Awardees

The ASM-LINK Travel Award supports the ASMCUE participation of active researchers with the commitment to connect with mid- or early-career and future faculty instrumental in student learning in undergraduate biology.

- Dawn Holmes, Western New England University, Springfield, MA
- Jesse Kwiek, The Ohio State University, Columbus, OH
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.

- Aaron Aboderin, Obafemi Awolowo University, Ile-Ife, Nigeria
- Battogtokh Chimeddorj, Health Sciences University of Mongolia, Ulaanbaatar, Mongolia
- Maricar Ching, Centro Escolar University, Manila, Philippines
- Maria del Pilar Crespo-Ortiz, Santiago de Cali University /University of Valle, Cali, Colombia
- Mojisola Edema, Federal University of Technology, Akure, Nigeria
- Howell Ho, St. Luke's College of Nursing, Trinity University of Asia, San Juan, Philippines
- Fawzi Mahomoodally, University of Mauritius, Reduit, Mauritius
- Lizzy Mwamburi, University of Eldoret, Rift Valley, Kenya
- María Alejandra Pereyra, Universidad Nacional de Mar del Plata, Buenos Aires Province, Argentina
- Kul Rai, School of Allied Science/Shi-Gan Health Foundation/Shi-Gan International College of Science and Technology, Narayangopal Chowk, Sankhamarga, Kathmandu, Nepal

ASMCUE Scavenger Hunt & 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 ASM 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.

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**Exhibitor Showcase**

*Friday, May 16, 6:30 PM – 8:30 PM and Saturday, May 17, 9:00 AM – 3:30 PM  
DoubleTree by Hilton Boston North Shore - North Shore Ballroom*

Exhibitor set up is Friday 3:00 PM – 6:00 PM. Exhibits must be dismantled by 4:00 PM on Saturday.
Exhibitors

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Sponsored Product Corner:

Featured Product: *BIO principles – Innovation and Value in Biology*

*Saturday, May 17, 1:30 PM, Manchester*

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Sponsored Product Corner:

Featured Product: *Microbiology, 1st edition*

*Saturday, May 17, 2:00 PM, Manchester*

This 1st edition offers an ideal balance between comprehensive, in-depth coverage of core concepts, while employing an engaging, narrative style that incorporates many relevant applications and a unique focus on current research and experimentation. Rather than presenting material as discrete pieces, Wessner, Dupont, Charles frames information around the three pillars of physiology, ecology and genetics; which highlights their interconnectedness and helps students see the big picture. Learn more here: [www.wiley.com/college/sc/wessner/](http://www.wiley.com/college/sc/wessner/)

Sponsored Author Corner:

Featured Author: Jeffrey Pommerville

*Saturday, May 17, 1:30 PM, Jones & Bartlett Learning Exhibit Booth – North Shore Ballroom*


Award-winning author, Jeffrey Pommerville provides his engaging and student-friendly writing style in the fully revised and updated fourth edition of the best-selling, Alcamo’s Microbes and Society. Comprehensive but accessible, this new edition features new information on viruses and microbial groups, new data on microbes in agriculture and the environment, current applications of genetic engineering and biotechnology, and fully updated coverage of microbes and the human microbiome.
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**Sponsored Product Corner:**

Featured Product: SmartBook

*Saturday, May 17, 9:30 AM, Essex Room*

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**Sponsored Author Corner:**

Featured Authors: Denise Anderson, Barry Chess, Kelly Cowan, and Kathy Talaro

*Saturday, May 17, 2:00 PM, McGraw-Hill Education Exhibit Booth – North Shore Ballroom*

*Prescott’s Microbiology, 9th edition*

Join Denise Anderson, University of Washington, and lead author of Nester’s Microbiology: A Human Perspective;

Barry Chess, Pasadena City College, and co-author of Talaro/Chess: Foundations in Microbiology;

Kelly Cowan, Miami University of Ohio and author of Microbiology: A Systems Approach and Microbiology Fundamentals: A Clinical Approach;

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Sponsored Product Corner:

Featured Products: MasteringMicrobiology and Learning CatalyticsTM

Saturday, May 17, 11:00 AM, Topsfield Room

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# ASMCUE Program

## THURSDAY, MAY 15

### PRE-CONFERENCE WORKSHOP

**9:00 AM - 3:00 PM**  
**Newburyport Room**

**Case Study and PBL in STEM Education**  
*(By Invitation Only)*

Participants in this workshop will engage in strategies for writing cases for their classes, as well as adopting and adapting existing cases available from a variety of sources. Science Case Network SOTL Scholars and New Case Scholars also will present results from their Spring 2014 projects.

### PRE-CONFERENCE WORKSHOP

**10:00 AM - 3:00 PM**  
**Ipswich Room**

**Analysis of Microbiomes at the rRNA and Whole-Genome Levels: How to Bring it in the Classroom**  
*(Registered Participants Only)*

The use of culture-independent genomic techniques (aka metagenomics) for the analysis of microbiomes in clinical or environmental settings has increased geometrically during the last five years. However, user-friendly tools to analyze metagenomic data are typically limited to the assembly and gene annotation of the metagenomic sequences. In this workshop, we will offer hands-on, bioinformatics exercises that we have successfully used in the classroom to allow efficient analysis of metagenomes and answer questions such as: who is in the sample; how much of the diversity was sampled; what genes and pathways are differentially abundant between metagenomes. Performing these exercises with available real data can easily engage students and spark their interest in research and discovery.

### PRE-CONFERENCE WORKSHOP

**10:00 AM - 3:00 PM**  
**Hamilton Room**

**Preparing Successful Proposals for the NSF Directorate of Biological Sciences**  
*(Registered Participants Only)*

This workshop will actively walk participants through the process of writing an NSF grant proposal to be submitted to the *Directorate of Biological Sciences*.  
Within the context of the two review criteria, intellectual merit and broader impacts, participants will practice the development of working hypotheses, crafting feasible specific aims, and integrating educational elements into the project design. The workshop will also help participants develop the ability to address review criteria used by panelists to critically assess proposals. By the completion of the workshop, participants should be able to craft a one-page Summary that describes their proposed program of research. Attendees will have direct access to successful grantees from a variety of institutions, and faculty from community colleges, principally undergraduate and research institutions are invited. While designed for those who have not yet submitted a successful NSF proposal, it is by no means limited to junior faculty.

### ASMCUE REGISTRATION

**2:00 PM - 8:00 PM**  
**Banquet Foyer**

### WELCOME AND OPENING REMARKS

**3:45 PM - 4:00 PM**  
**Grand Ballroom I & II**

**Conference Planning Committee**

- **Mary Mawn**, SUNY Empire State College  
- **Laura Regassa**, George Southern University  
- **Ned Barden**, MCPHS University  
- **Robyn Puffenbarger**, Bridgewater College

**Local Steering Committee Representatives**

- **Gail Begley**, Northeastern University  
- **Naomi Wernick**, University of Massachusetts, Lowell

### OPENING PLENARY LECTURE

**4:00 PM - 5:00 PM**  
**Grand Ballroom I & II**

**Picking for Progress: Mining Nostril Microbiota for New Insights into Pathobionts**

**Katherine P. Lemon**, The Forsyth Institute, Boston  
Children's Hospital, and Harvard Medical School

*Staphylococcus aureus* and *Streptococcus pneumoniae* are significant bacterial pathogens and also common constituents of healthy nasal microbiota, i.e., pathobionts. The emergence and spread of antibiotic-resistant clones accentuates the need for new therapies to prevent infection by these pathobionts. *S. aureus*, in particular, has eluded repeated efforts at vaccine development. Yet, it colonizes the nostrils of about a quarter of healthy adults and this colonization increases the risk of developing a *S. aureus* infection. It is commonly accepted that bacteria occupying the same habitat may profoundly influence each other’s physiology. A number of commensal/mutualistic bacteria colonize the same body sites as *S. aureus* and *S. pneumoniae*, but remarkably little is known about interactions that can occur between these benign...
bacteria and these pathobionts. We are focused on identifying and characterizing such interactions at a molecular level to better understand potential drivers of pathobiont colonization. We hypothesize that among the constituents of nasal microbiota, there are beneficial microbes that can interfere with pathobiont colonization and/or alter pathobiont physiology via diffusible substances. Such beneficial bacteria, and the molecules they produce, could be the basis for novel small molecule and probiotic therapies to both prevent and treat infections.

**ASM GLOSSARY, TOOLS AND WHAT'S NEW**

*5:00 PM - 5:30 PM*

Grand Ballroom I & II

**Amy Chang**, American Society for Microbiology

**DINNER AND TRAVEL AWARD RECOGNITION**

*5:30 PM - 6:30 PM*

North Shore Ballroom

**CONCURRENT SESSIONS – COURSE INTEGRATED RESEARCH**

*6:45 PM - 8:15 PM*

Grand Ballroom I & II

(3 sessions)

1. **Microbial Genome Sequencing and Analysis with GCAT-SEEK Crowdsourcing Science**

*6:45 PM - 7:15 PM*

**Jeffrey D. Newman**, Lycoming College

As DNA sequencing costs continue to decrease, sequencing a microbial genome is becoming a more feasible research project for undergraduates. The Genome Consortium for Active Teaching NextGen Sequencing Group (GCAT-SEEK) holds NSF and HHMI-funded faculty development summer workshops in which participant teams prepare and quantify their own DNA samples that are sent for NextGen sequencing. Participants then learn how to assemble and annotate a microbial genome using a sample dataset and develop curricular plans to incorporate their own data into their courses. In this ASMCUE session, segments of the GCAT-SEEK workshop Microbial Genomics breakout session will be presented. Participants will use their own laptops and the Rapid Annotation with Subsystem Technology (RAST) website to make predictions about a microorganism’s phenotypic characteristics based on the presence of specific genes and pathways. Comparison of several whole genomes will allow construction of an average amino acid identity (AAI) matrix to determine phylogenetic relatedness.

2. **Implementing Vision and Change in the Classroom and in the Institution**

*7:15 PM - 7:45 PM*

**Gita Bangera**, Bellevue College

Sponsored by ASM and NSF Leaders Inspiring Networks and Knowledge (LINK) Program.

NSF’s *Vision and Change: A Call to Action in Undergraduate Biology Education* (Brewer & Smith. 2011) recommends introducing students to research experiences early in their academic careers for helping them develop critical thinking skills and confidence in visualizing themselves as scientists. The Partnership for Undergraduate Life Science Education (PULSE) has identified departments as the key leverage points for change for implementing the recommendations of Vision and Change.

ComGen ARE expansion: Bringing Authentic Research Experiences to Community Colleges in the Pacific Northwest is an NSF funded project that is incorporating research experiences in to the standard curriculum of community colleges. Bellevue College is one of the examples of departmental and institutional level transformation in incorporating student centered learning in to the curriculum. The author who is a PULSE leadership fellow will share the lessons learned in both of these areas as well as provide an update on the PULSE Fellows activities.

3. **Hands-On Bioinformatics Exercises for the Analysis of Complex Microbiomes in the Classroom**

*7:45 PM - 8:15 PM*

**Kostas T. Konstantinidis**, Georgia Institute of Technology

Contemporary (micro-) biological research, a growing part of which is interdisciplinary, is becoming increasingly more high-throughput and requires substantial computational skills. A remaining shortcoming is that the curricula have not been adjusted to cover the interdisciplinary and computational aspects of modern biology, thus lessening the student's learning experience. In particular, the use of culture-independent genomic techniques (a.k.a. metagenomics) for the analysis of microbiomes in clinical or environmental settings has increased geometrically during the last five years. However, teaching this material to undergraduate and graduate students is challenging, mostly because user-friendly tools to analyze metagenomic data are limited to the assembly and gene annotation. In this presentation, I will provide examples of hands-on bioinformatics laboratory sessions that I have developed for freshman- and senior-level undergraduate courses. Specific problems given to students include how to identify which taxa are in a sample and determine what fraction of the microbial community was sampled by a metagenome. Problems are based on data taken directly from my research program, which helps to draw the attention
of the students. These laboratory sessions aim at transforming the cumbersome task of analyzing "tons of omic data" to an enjoyable experience for everybody in the classroom.

CONCURRENT SESSIONS – FACILITATING ACTIVE LEARNING
6:45 PM - 8:15 PM
Grand Ballroom III
(3 sessions)

1. Reading Beyond the Abstract: Students' Intensive Analysis of Primary Literature via the CREATE Strategy Leads to Deep Understanding of Research Process, Gains in Critical Thinking Ability and Insight into "Who does Science, and Why"
6:45 PM - 7:15 PM

Sally G. Hoskins, The City College of New York

We have developed and assessed a stepwise process that guides students in learning to decipher and understand primary literature. The CREATE (Consider, Read, Elucidate hypotheses, Analyze data, and Think of the next Experiment) strategy uses new and adapted pedagogical tools to help students penetrate scientific jargon, visualize studies described, and analyze a paper’s data as if it were their own. Experimental design and grant panel activities stimulate scientific creativity while building critical skills. Students’ email surveys of paper authors provide unique insight into the lives/motivations of working scientists. Reading a series of papers from a single lab or a set that follows a particular topic provides insight into the evolution of research projects over time; CREATE is also adaptable for stand-alone classes, with data analysis based on single papers or newspaper/Internet reports. In a NY area CREATE expansion with diverse student cohorts (private R1, liberal arts colleges, public universities) CREATE workshop-trained faculty in biology, chemistry and psychology courses taught effectively in their first attempts, with students making significant cognitive and attitude/belief gains. Overall, CREATE students gain transferable skills that can be applied to any situation requiring close reading and critical analysis, as well as deep insight into the research process.

2. The Science Case Network: Resources for Case-Based Learning in Microbiology
7:15 PM - 7:45 PM

Karen K.Klyczek, University of Wisconsin-River Falls
Drew Kohlhorst, Emory University

The NSF-funded (RCN-UBE) Science Case Network (SCN) brings together educators, developers and researchers to find, use and study case studies and problem-based learning in science education. This session will describe the features of the network, and provide examples of how the use of case studies and PBL in microbiology courses actively engages students in learning core concepts and competencies.

3. The Good, the Bad, and the Ugly: Recognizing, Leveraging and Addressing Students’ Prior Knowledge
7:45 PM - 8:15 PM

Cigdem Talgar, Northeastern University

Students do not arrive in our courses as blank slates, but rather they come with prior knowledge that impacts their learning in different ways. They connect what they are trying to learn with what they already know, in other words, they learn through their lens of existing knowledge, beliefs and assumptions. When that knowledge is accurate, activated, sufficient and appropriate, life is good! However, when any of the necessary prior knowledge is inaccurate and/or inactive and/or insufficient and/or inappropriate used, learning is impeded and all involved become frustrated! We will discuss concrete strategies instructors can use to better understand students’ prior knowledge so that we not only leverage their accurate knowledge, but also help students identify and fill gaps, apply what they know appropriately, and correct their misconceptions.

CONCURRENT SESSIONS – TEACHING RESOURCES
6:45 PM - 8:15 PM
Grand Ballroom IV
(3 sessions)

1. Adventures in Flipping My Freshman Biology Course
6:45 PM - 7:15 PM

Brian T. White, University of Massachusetts Boston

Flipping the class - moving content coverage on-line and replacing lectures with problem solving and application sessions - is a growing trend in science education. It's primary goal is to make the most effective use of students' and teachers' time and to take advantage of the benefits of active learning in the classroom. I will begin by discussing the context, motivations, and different practices of the flipped classroom. I will then describe my rationale and implementation of a flipped version of my large general biology course. Finally, I will describe some of our findings related to the students' learning processes and outcomes in this revised course.

2. Bringing Climate Change Science Alive Through Student-Produced Media
7:15 PM - 7:45 PM

Juliette N. Rooney-Varga, University of Massachusetts Lowell

The Climate Education in an Age of Media (CAM) Project (http://cleanet.org/cced_media/) offers freely available online materials for integrating student
media production into climate change education, in a way that is engaging, empowering, and can be readily adopted. Media production combines many key twenty-first century literacy skills, including research, writing, an understanding of the power of images and sounds, and the ability to manipulate, transform, and distribute digital media. Through collaboration, reflection, and visual expression of concepts, video production can facilitate deeper learning. CAM Project resources include PSA projects that communicate climate change science to a general audience; animation projects that convey dynamic processes in the climate system; video ‘mash-ups, in which students research a science topic, synthesize information in an original paper that becomes their ‘script,’ and use existing visuals and media to depict concepts; person-on-the-street interviews, which provide an effective means to make misconceptions explicit and then correct them; and visual story-telling, using images alone, to convey science concepts. These projects also empower students to reach beyond the classroom to educate others. Indeed, surveys of CAM Project audiences have indicated gains in concern, interest, and understanding of key climate change concepts.

3. Updated Tools for Genomics, Functional Genomics, & Metagenomics Analysis
7:45 PM - 8:15 PM

Brad W. Goodner, Hiram College

You have updated your lectures to include the key lessons learned from the explosion of genomic-level biology over the last two decades, but you know that students learn best when both their hands and minds are engaged with a subject. This session will focus on proven strategies for involving students directly in genomics, functional genomics, and metagenomics research as part of courses. We will go over the current state of genomic databases, improvements in on-line platforms for genome analysis, just-in-time approaches to metagenomics, and the range of functional genomic approaches that can be easily incorporated into labs. Examples will come from not only microbiology and genetics courses, but also from introductory and allied health courses. If you are willing to imagine the possibilities, then come and join in this collective brainstorming session.

MICROBREW SESSIONS I of III
8:30 PM – 9:30 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:**

**Grand Ballroom I & II**
Facilitator: Donald Breakwell, Brigham Young University

**Grand Ballroom III**
Facilitator: Shannon Hinsa-Leasure, Grinnell College

**Grand Ballroom IV**
Facilitator: Gary Kaiser, The Community College of Baltimore County, Catonsville Campus

**Gloucester Room**
Facilitator: Sue Katz Amburn, Rogers State University

**Newburyport Room**
Facilitator: Jerry Kavouras, Lewis University

**Marblehead Room**
Facilitator: Jovanka Koo, Wheaton College

**Ipswich Room**
Facilitator: Suzanne Long, Monroe Community College

**Hamilton Room**
Facilitator: Ann Williams, University of Tampa

**MICROBREW SESSION A: 8:30 PM – 8:45 PM**

1. Formulating a Template for Incorporating Best Teaching Practices into a Core Molecular Biology Course

Grand Ballroom I & II

L.A. Abrahamsen and S.A. Richards. Bates College, Lewiston, ME.

Having completed the Bioscholars Assessment Workshop, we are eager to include (and encourage our colleagues to include) some learning goals and best practices in our majors’ core cell and molecular biology course. Since different colleagues teach the course in different years, we are trying to create a template that would encourage different colleagues to design a topical unit, the focus of which could change depending on who teaches the course. This would allow each of us to “play to our strengths” while still including activities that facilitate student learning. We are proposing a template for learning goals, grading rubrics and a set of related in-class activities that include a hands-on, in class group activity, a related on-line small group activity that students can contribute to in a Google doc, and finally an integrative essay that each student does independently outside of class and that will be counted as one essay question on the subsequent exam. We have piloted one round of a protein structure/function unit using the template, with mixed
success. We are seeking feedback and help with ideas for meaningful assessment of each of the pieces that will 1) really tell us whether each piece enhances student learning 2) not add too much to an already large faculty work load and 3) be useful to colleagues in other science disciplines at Bates.

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

2. Visualization of Macrophage Differentiation and Function in an Undergraduate Immunology Laboratory using Image Cytometry

Hamilton Room

C.A. Berkes, Merrimack College, North Andover, MA.

The study of the mammalian immune system relies heavily on the ability to isolate and characterize various immune cell types from the body. This process – often referred to as immunophenotyping – is generally performed using a flow cytometer. At some primarily undergraduate institutions, lack of access to flow cytometry can present a barrier to the instructors’ goals of giving students an authentic hands-on experience to reinforce concepts learned in an immunology course. Here, I have developed a semester-long laboratory project that takes advantage of low-cost image cytometry to reinforce key principles of immunology while at the same time offering students an opportunity to design and execute their own experiments. In the first part of the semester, students are charged with differentiating macrophages from mouse bone marrow stem cells and performing immunophenotyping using myeloid markers that are either constitutively-expressed or expressed upon activation with microbial ligands. Here, immunophenotyping is performed using a low-cost image cytometer as an alternative to flow cytometry, allowing the students to simultaneously visualize and quantify cell populations. In the second part of the semester, students perform literature research on, design and execute a series of experiments aimed at investigating the effect of low anti-inflammatory compounds on TNFα production in their macrophages. Student surveys and performance on exam questions indicates that the highly visual aspect of image cytometry helps students grasp the principles of immunophenotyping and flow cytometry. The soup-to-nuts investigative approach in which students study both the differentiation and function of “their” macrophages over the course of the semester also fostered a sense of ownership and accomplishment.

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

3. Interactive Online Learning Modules for Difficult Concepts in General Microbiology

Grand Ballroom IV


In order to accommodate the growing demand for general microbiology courses, there is increased emphasis on distance education formats. Difficulties presented by distance education course material include fostering student engagement in an online environment and assessing whether students are grasping course material, particularly when presented with difficult concepts. To address these concerns, we are building interactive online learning modules that target difficult concepts in general microbiology. The online modules are self-contained and fully portable across different courses and learning management systems. Concept mapping is used to define the subject matter of a module. The pedagogical structure of each module is based on Gagné’s nine events of instruction, and the instructional design is developed using storyboards. Interactive student assessments are incorporated directly into the module. The module design is then implemented with web authoring software and published in HTML5 or SCORM formats. Completed modules may be incorporated into fully online courses as the primary teaching methodology, or used as an online supplement for in-person instruction. We will present details of the design process and illustrate them with examples taken from modules on regulation of gene expression, selective and differential media, and emergence of antibiotic resistance.

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

4. You Really are What You Eat: Using the Gut Microbiome to Teach Students about Syntrophy and Competition among Microbes

Grand Ballroom III

A.M. Buchmann. Chadron State College, Chadron, NE.

The human gut microbiome is a vast and complex ecosystem, involving 100s of species that both cooperate and compete with one another for scarce resources. The number and types of bacteria vary with diet and other environmental factors. There have been a number of current papers which have examined the metabolic relationships between normal flora bacteria, such as Bacteroides thetaiotaomicron, Methanobrevibacter smithii, and Eubacterium rectale in gnotobiotic mice and a few papers which have examined how pathogenic bacteria, such as Salmonella enterica Typhimurium manipulate conditions in the gut to gain a metabolic advantage. I used this research in my sophomore/junior level microbiology class to help students develop the ability to interpret primary literature and to understand the complexities of microbiological ecosystems. The project was scaffolded, so that students first learned how to analyze a primary literature paper, and then applied this skill to other research papers. Students learned to ask rational scientific questions, to find scientific information to answer these questions, and to synthesize information between groups. Students also gained an appreciation for the complexities of metabolism and gene regulation in the real world and
for the interaction between diet and microbial content of the gut.

**ASM Curriculum Guideline Concept(s):** Systems, Impact of microorganisms  
**American Academy of Microbiology Topic:** The Human Microbiome

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5. Microbiology in the News: Creative Ways to Encourage Enthusiasm for Microbiology  
*Marblehead Room*

**D.M. Foster-Hartnett.** Saint Catherine University, St. Paul, MN.

Students required to take Introductory Microbiology sometimes claim they do not like science or that science is too hard. For the past three years, I have structured class sessions around news articles from The New York Times, the ASM website, NPR or NPR’s RadioLab podcasts as a way of piquing interest in microbiology and demonstrating how often it impacts their daily lives. Students read or listen to stories before class and arrive prepared for discussions. Together we find vocabulary and concepts, outline the research process leading to the report, and identify the peer-reviewed paper covered by the article. For critical thinking, students propose what research they think should come next. How might the experiment be designed? Sometimes we conduct an informal debate on topics like spending limited funds on vaccination versus sanitation. We also discuss the research and peer-review process. Midway through the semester, students are invited to send me articles they have found, which I promise to use in class, if relevant. Students also post summaries of articles they have found on the class D2L discussion board. They are required to describe what concepts the article illustrates, to cite the original research article in CBE format and to read and make comments on articles chosen by three other students. Finally, outstanding students who will be teaching assistants for the next semester write their own news article-based case studies. Comments indicate that students’ interest in science and understanding were greatly enhanced by these exercises. As a way to encourage students to confidently speak about their topic, I award extra-credit to those who discuss their articles with family and friends and write to me about their experience. I’m interested in receiving feedback on assessment for these activities and will also provide a list of articles, podcasts, films and websites I use.

**ASM Curriculum Guideline Concept(s):** Impact of microorganisms, Advancing STEM education and research  
**American Academy of Microbiology Topic:** The Human Microbiome

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6. Oral Microbes in Students  
*Gloucester Room*

**C. Ho Pao,** S. Dorrough, M. Heller, C. Abelseth, and A. Rentas. Trinity International University, Deerfield, IL.

A new research module in the genetics lab was designed to investigate the microorganisms present in our oral cavities. The goal is to make genetics relevant because students research about themselves.

Voluntary students filled out consent forms and dental hygiene surveys. Students collected and extracted their own salivary microbial DNA. (An IRB was submitted and approved.) The extracted DNA samples were randomized and amplified with PCR for the 16S and/or 18S ribosomal RNA gene to differentiate taxonomic groups of microorganisms in archaea, bacteria, and fungi. The use of the ribosomal RNA gene primers led to the discussion of bioinformatics tools naturally.

Each student was responsible for amplifying the class DNA samples with a primer pair that represents a major group of microbes. Each student reported his/her findings (the distribution of one specific microbial group in the student population and its significance) in a poster session. One advantage of sampling saliva is that even though it is a relevant study to the students because it is a human study, it is not invasive or dangerous, and is easily amenable to different correlations statistically. For instance, students can study the effects of brushing with different kinds of toothpastes and mouth rinses, the frequency of brushing, and/or the presence of oral diseases.

Preliminary student research data have been collected. The results show interesting distribution of microbes before and after brushing. The most important finding is that the class experiments were manageable and overwhelmingly successful. Preliminary assessment data suggests that students found this series of research-based experiments engaging and effective.

The unit has also sparked the interest of two students (out of a class of 11 students) to further the research as independent, undergraduate projects. One extension of the unit is to clone the amplicons and sequence them to identify the species.

**ASM Curriculum Guideline Concept(s):** Systems, Laboratory competencies  
**American Academy of Microbiology Topic:** The Human Microbiome

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7. Expanding Vision and Change Initiative Beyond US: Training Young Educators in Turkey  
*Ipswich Room*


Sabanci University (SU) strives to provide interdisciplinary education to train individuals for the social and technological needs of the future. As an
innovative institution, SU has recently joined the global initiative to rethink the role of faculty and students in undergraduate education and prioritize scholarship of teaching and learning (SoTL) that values evidence-based student learning. A unique aspect of the undergraduate education at SU compared to other Turkish universities is the requirement for all its freshman students to enroll in foundations courses regardless of their prospective majors. The two-semester introductory science foundations course, “Science of Nature” (NS), serves ~700 students each semester. Starting in the Spring of 2014, the NS is offered in a new theme based and modular format, emphasizing an interdisciplinary and student-centered course structure and expectations. Lectures and weekly recitations are offered in active-learning environments, the latter in specially designed classrooms to facilitate collaborative learning. With such a large enrollment, well-trained graduate teaching assistants (TAs) are valuable, indispensable assets to the NS course.

In this session, we will share the design and outcomes of the two-semester Teaching Scholars Residency Program developed and initiated in Fall 2013, to inform aspiring graduate students on the current advances in SoTL and to give them the professional skills to become effective teachers. During the first semester, the 12 Scholars selected from Science and Engineering graduate programs were introduced to the “Vision and Change” Initiative and were trained on student-centered course design and collaborative learning. They applied their newly-acquired skills in mock recitations with volunteer students, as well as in developing NS course materials. Current semester is their intern period as Master TAs, actively leading the new format of recitations and training other TAs. Impact of such a TA training program on student learning and attitude will be discussed.

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

8. Translating Science to the Broader Public: Microbiology Student Outreach Activities

Newburyport Room

A.M. Lee. North Carolina State University, Raleigh, NC.

How do we engage the public in our science? We care deeply about our field, how can we share this passion with a broader audience? Lack of time, incentives, funding, support from peers, or your institution even, can make it difficult to engage in public outreach activities. Despite these obstacles, communicating our science has never been more important as we work to dispel misconceptions, stereotypes, increase scientific literacy and awareness. As scientists and educators, we must continue to communicate with the public and policy makers, that our science matters and is worth spending tax dollars on research and education. One way to achieve this broader impact is to give your students a chance to engage the public.

Each semester I assign a class project where teams of 3-4 microbiology students have an option of doing a science outreach project or researching a microbiological problem and presenting on it. About 70% of the students will choose the outreach project, despite the fact that it requires significantly more work in terms of time, planning, and execution. Variations of these projects range for creating a “flipped” microbiology lesson taught to a high school class, utilizing an informal education setting (North Carolina Museum of Natural Sciences - NCMNS) to present a poster presentation on a novel antibiotic discovery research project, developing a microbiology hands-on interactive exhibit or lesson at the NCMNS Micro World iLab, and creating YouTube videos on a microbiological topic.

Highly engaged college students communicate science to the public; develop interpersonal, presentation, and public speaking skills. Students have a unique opportunity to create an authentic piece of work and share their enthusiasm about microbiology to a range of audiences. This session will briefly describe these projects, their benefits, and explore how you can identify similar public outreach projects in your community.

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

MICROBREW SESSION B: 8:50 PM – 9:05 PM

1. iBiology’s Scientific Teaching Video Series On Active Learning

Grand Ballroom IV

L. Clement1, 2, S.S. Goodwin1, 2, A.M. Campbell3, K.D. Tanner4, W.B. Wood5, and R.D. Vale2. 1The American Society for Cell Biology, Bethesda, MD, 2University of California San Francisco, San Francisco, CA, 3Davidson College, Davidson, NC 4, San Francisco State University, San Francisco, CA, and 5University of Colorado Boulder, Boulder, CO.

The American Association for the Advancement of Science and the National Science Foundation (NSF) have been advocating for the adoption of evidence-based teaching across undergraduate biology programs, including through the “Vision and Change” report released in 2010. However, for instructors unfamiliar with active learning, the prospect of developing active learning modules might seem daunting.

The Scientific Teaching Series are free and open-access videos developed to support undergraduate biology instructors who are considering using active learning in their classroom. Our short videos, which will be posted in May 2014 on iBiology.org (a website funded by NSF and the National Institute of General Medical Sciences, and sponsored by the American Society for Cell Biology and the University of California, San Francisco), will use a constructivist learning cycle model and will encourage viewers to
reflect on their own pedagogical practices. The videos explain why active learning is beneficial, present different models of classrooms and feature interviews of instructors from a range of institutions with different levels of experience in active learning. The videos provide suggestions on how to get started with simple active learning methods that can easily be implemented in large-enrollment courses. Viewers will also learn about peer-reviewed research demonstrating the effectiveness of active learning. Our Scientific Teaching Series videos will be a useful resource for graduate students, postdocs and new instructors who have little or no teaching experience. We will “flip” our Microbrew session by recommending that attendees watch the videos on iBiology.org prior to our session, so we can use our time to discuss best practices in active learning.

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

Hamilton Room

N.N. Jones and J. Armstrong. Philander Smith College, Little Rock, AR.

Students enrolled in my microbiology course range from sophomores to seniors with equally varying skill sets. Some students have only taken one year of introductory biology whereas others have a diversified pedigree of several advanced biology courses. However, I have noticed that most of these students do not possess the critical thinking skills, foundational content knowledge, or written and oral communication skills needed to succeed in any scientific career field regardless of the number of classes they have taken. Additionally, these students often have to deal with trying to complete laboratory experiments with little to no equipment and supplies available to them. As such, we decided to use a few weeks of laboratory time to perform a guided inquiry-based research project focused on food fermentation using easily accessible, low-cost materials.

In this wine and cheese cook-off competition, student groups were given basic wine and cheese recipes to adapt at their will. After each group designed and tested specialty recipes, a panel of judges was assembled to determine who made the best product. As an incentive, products identified as first place earned extra credit points for the group responsible for its production. This small group activity was designed to not only build upon specific content knowledge such as morphology, taxonomy, microbial diversity and metabolism, and laboratory skills, but also workforce readiness and 21st century skills including written and oral communication, collaboration, creativity, and critical thinking skills.

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

3. Building on Experience: Microbial Genome Annotation as a Course Based-Undergraduate Research Experience
Grand Ballroom III


My students interpret the genome of the marine bacterium *Cellulophaga lytica* in a six-week research project imbedded in a genetics course required of all biology majors. Using a suite of online tools, students examine the computer generated annotation for assigned genes and make corrections as necessary. The project culminates with a poster session and paves the way for entry into an independent research project in future semesters. The Microbrew session will include a brief description of how I have framed the research project, with emphasis on aspects that work and lessons I have learned. The session will be appropriate for those exploring how to begin such a project in a course. I also invite all faculty who are already doing similar projects (I know you are out there!) to join the discussion to share your best-practices and connect with colleagues. Let’s build on each other’s experience!

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

4. Investigation of Excess Capsule Production in *Klebsiella pneumoniae* Cultures Maintained in a Student Laboratory
Gloucester Room

L. Leach and C. Bezotte. Elmira College, Elmira, NY.

Studies have shown that genetic mutations of laboratory *E. coli* strains occur and increase over time (Herring et al. 2006). Many college laboratories tend to reuse strains for multiple semesters. Phenotypic changes are often noted in purchased bacterial strains maintained long term in student laboratories. Over a semester, a *Klebsiella pneumoniae* strain [WARDS # 851011] appeared to produce copious amounts of capsule material becoming resistant to multiple antibiotics. Capsule production (CPS) is believed to be one of the most important virulence factors of this species (Ramos et al. 2012). An adapted Anthony’s capsule stain enabled visualization and measurement of the capsule of the maintained cultures. Extraction and quantification of the CPS was achieved using methods similar to that of Hsieh et al. 2012. The maintained cultures demonstrate more CPS than the control cultures.

Genomic and plasmid DNA isolations and initial PCR analysis for the presence of rmpA gene, encoding mucoid factor contributing to CPS biosynthesis, yields one band of approximately 500 bp which is consistent with the rmpA sequence (Cheng et al. 2010). Further analysis by qPCR will be utilized to investigate the mechanism of increased capsule production in the experimental strains.
Our research demonstrates increased production of capsular material may be due genetic alteration by extra-chromosomal elements of a teaching laboratory strain of *K. pneumonia*. Student safety in microbiological laboratories is always an issue. College laboratories serve students at various levels of mastering aseptic techniques. The possible finding of genetic alterations leading to increased virulence factors raises concerns of a serious safety issue. The discussion will center on best laboratory practices.

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

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**5. Foldables as Convenient Study Guides**  
*Ipswich Room*

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

Graphic organizers have been used for many years in the K-12 setting. They are a method for organizing information and come in many forms. Some are as simple as asking students to develop their own concept map about a topic, while others are a series of complex 3D folding entities (often called foldables) that are then grouped together in a cohesive whole, termed a lapbook. Foldables can also be used alone and are employed to engage students in a creative way and allow them to integrate information across a wide range of subjects. Foldables also have been shown to increase critical thinking and student learning (for example, Guastello, E.F., Beasley, T.M., & Sinatra, R.C. 2000. Concept mapping effects on science content comprehension of low-achieving inner-city seventh graders. Remedial and Special Education, 21, 356–365). Foldables are useful for many learning activities, over several levels of Bloom’s taxonomy, such as learning vocabulary, organizing information, sequencing pathways, showing correlations, effectively demonstrating cycles, integrating concepts, and demonstrating cause and effect. I found that many of my students take a very simple approach to learning, in that they try to memorize each individual pathway, molecule, idea, concept, or topic as a disparate “fact,” not connected to anything else. Therefore, I developed several foldables covering mitosis, meiosis, and regulation of gene expression in prokaryotes to try to give students a convenient portable study aid, which was developed to stimulate students to look at the whole, rather than trying to memorize the parts.

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

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**6. Student Monitoring of Study Habits In Microbiology**  
*Ipswich Room*

**A.H. McDonald.** Concordia University Wisconsin, Mequon, WI.

The most common question I receive from freshman and sophomore undergraduate students majoring in biomedical or health science has nothing to do with science. Inevitably, it is a plea on how to successfully study the material in microbiology. However, when I ask individual students how they study, very few seem capable of answering the question in any detail. In an effort to get students to objectively monitor what forms of studying are most effective for them, I recently developed a form they could use to daily track what they did and how much time they spent studying the course material every day of the week. In essence, I am trying to get the students to keep an experimental log on their study habits and to evaluate how effective their methods are. In addition, after every graded assignment, students are asked to fill out a form summarizing how they prepared for the test, what grade they expected to get and what they actually received. Individual student progress is monitored anonymously through the individual choice of a four-digit number. Finally, at the end of the semester, students will be expected to correlate their study habits with test scores. (Awarding extra credit points at the end of the semester for maintaining thorough logs should enhance student participation.) How effective this approach will be in helping students successfully pass science courses remains to be proven. However, getting students to see the value of using experimental design for personal gain may demonstrate the effectiveness of this technique in other aspects of their lives and careers.

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

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**7. Fine Focus: A New International Journal for Undergraduate Microbiology Research**  
*Newburyport Room*

**J.L. McKillip.** Ball State University, Muncie, IN.

Development of creative student-centered research into existing biology curricula is a major theme of the recent AAAS Call to Action, as is ‘community-based participatory research.’ Ball State University is well positioned to take advantage of many of these rapidly evolving objectives in undergraduate science education, largely due to an established track record of excellence through our Biotechnology Certificate Program, an active Chapter of Sigma Xi, and the only ASM chapter in Indiana. This proposed immersive learning course utilizes the skill sets of 12-15 undergraduates in five departments across three Colleges to develop a peer-reviewed journal that will publish findings of undergraduate microbiology research internationally. This journal, entitled *Fine Focus*, will be the first of its kind, and will be produced in print form and electronically. Participating students gain a multitude of experiences through collaborations with professionals from ASM and other professional coalitions. Such experiences will include acquisition of a working knowledge on scientific writing, editing, peer review, graphic design, and advertising, as they relate to dissemination of microbiological research data through an academic journal with international scope. Students will leave the course having also established permanent professional contacts in varied subdisciplines of microbiology worldwide. In order to be successfully implemented, contemporary undergraduate research in the biosciences must incorporate not only the bench skills, and...
experimental design principles, but the other vital aspects of doing original research, including peer review and manuscript management. It is this unique niche that Fine Focus will fill. Our proposed work here is the first undergraduate journal specifically in microbiology. In a time when limited research budgets prevent undergraduates from attending national conferences to present their data, a venue such as Fine Focus allows interested students the opportunity to see their research efforts to fruition and learn about the entire research process at the same time.

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

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8. The Great Diseases Project: Bringing Real-world Science into the High School Classroom

_Grand Ballroom I & II_

**D.A. Raytcheva** and B. Jacque. Tufts University School of Medicine, Boston, MA.

Students will become deeply engaged with life sciences only when they see the science behind their real world experiences modeled in the classroom. Through the support of a Science Education Partnership Award from the National Institutes of Health (SEPA) Boston teachers and Tufts University scientists have collaborated and built a novel inquiry-based, differentiated curriculum for high school students focused on the ‘Great Diseases’ that impact global health. Starting with Infectious Disease and moving onto Neurological Disorders, Metabolic Disease, and Cancer, the curriculum challenges students to think critically about scientific literature and to participate in problem solving. The curriculum is targeted for biology II levels classes and each diseases module fills approximately six weeks of in class learning, and assessment shows strong student gains in both scientific knowledge and attitudes towards the study health sciences. Student gains in knowledge are also intended to increase their health literacy; people must be able to find and evaluate health information to accurately assess risks and make health choices. We have incorporated numerous activities throughout the curriculum that will guide the students in learning how to find and evaluate health claims using their scientific knowledge. As a specific example, we will present activities that are used to weigh out the evidence for pro- and anti-vaccine arguments, by exploring and discussing risk and benefits for individuals and society.

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

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**MICROBREW SESSION C: 9:10 PM – 9:25 PM**

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1. Incorporating Evolutionary Theory About Spices and Investigation of their Antimicrobial Properties into Traditional Microbial Growth Activities

_Hamilton Room_

**M.E. Allen.** Hartwick College, Oneonta, NY.

Quantifying microbial growth by measuring absorbance of a liquid culture and using the resultant growth curve to extrapolate doubling time is a traditional microbiology laboratory exercise. I use this activity to emphasize the impact of varying parameters on growth rates and final population sizes. To increase the critical thinking component of the exercise I have begun including _Escherichia coli_ in growth medium infused with spices, including ginger, garlic, chili, and allspice. Students collect data on _E. coli_ growth in untreated and spice infused growth medium, construct microbial growth curves for both bacterial populations and compare doubling times. I incorporate elements of experimental design by assembling doubling times calculated by student pairs into a class data set, which can be analyzed for statistical significance. This approach has been successful in both introductory and upper-level microbiology courses. Additionally, students in an introductory course on scientific method used the approach in experiments of their own design comparing, for example, the effects of dried and fresh spices on doubling time. For all course levels I accompany this activity with reading and discussion of a scientific article proposing the antimicrobial properties of spices as an ultimate hypothesis to explain the origins of human spice use in food preparation. Combining the presentation of this evolutionary theory with experimental tests of the proximal hypothesis that spices inhibit microbial growth appears to effectively engage students in a topic of general interest, food, with an emphasis on development of scientific hypotheses and experimental investigation.

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

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2. iEngage: Using iPads in Microbiology to Address Engagement and Biosafety Challenges

_Grand Ballroom IV_

**D.M. Jones** and E.F. Mitchell. Central Piedmont Community College, Charlotte, NC.

For microbiology instructors, student preparation and student engagement are two factors that can directly influence student success in microbiology courses. As participants in an iPad Pilot program, we will share how we have explored the use iPads to address these factors in lecture and lab and, potentially, improve student learning outcomes. In this discussion, we will also discuss how the iPads have been tested as a way to overcome the challenges that come with meeting biosafety guidelines in high volume microbiology labs. Participants will have a chance to view examples from students, and they will have an opportunity to consider how they might incorporate
similar mobile technology in microbiology courses while evaluating potential challenges with colleagues.

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

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3. Linking prior Knowledge Assessment with the Development of Advanced Learning Strategies

**Marblehead Room**

**S.D. Molloy.** University of Maine, Orono, ME.

The overarching goal of any science course is to teach scientific content while simultaneously teaching critical thinking skills essential to conducting good scientific research. In order for instructors to design classroom experiences that are most effective at facilitating student learning, it is important for teachers to understand students’ current knowledge base. Daily formative assessment quizzes may be used to introduce one complex problem that challenges students’ ability to apply knowledge from a reading assignment. A second question requires students to reflect on how they might approach a challenging or novel learning situation such as how to answer a question/problem that initially appears impossible, how to use visual tools to organize old and new knowledge, how to read complex journal articles, or how to work effectively in teams. Reviewing the quiz answers, instructors gain insight into students’ knowledge base and their approach to learning. In a following interactive lecture, the instructor and the students collectively develop a strategy for the challenging learning situation. Collaborating with the students, the instructor demonstrates the learning strategy to solve the complex problem from the quiz, while simultaneously addressing student misconceptions about the scientific content. Students then actively practice working with the scientific concepts and the newly developed learning skills in classroom activities. Weekly reflective assignments encourage heightened awareness of conceptual understanding, gaps in knowledge and the value of specific learning strategies.

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

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4. Enhancing Science Education through Service Learning

**Newburyport Room**

**A. Raja**, R. Navarra, and J.A. Azua. 1Nova Southeastern University, Fort Lauderdale, FL and 2West Broward High School, Pembroke Pines, FL.

It is increasingly recognized that there exists a crisis in STEM education, especially the K-12 level. In the state of Florida, due to recent budget cut backs, several Broward county public schools lost access to science education specialists causing children to become increasingly less familiar with basic scientific concepts in the classroom. To alleviate the decline in STEM literacy, similar to many universities across the country, Nova Southeastern University (NSU) partnered with local community schools to incorporate “service learning” to better enrich science education. In this service learning project we worked with two local High Schools to provide a microbiology outreach program wherein a team of undergraduates from NSU introduced a microbial project to the high school science class. R. Navarra created microbiology learning modules, on the topics of “Microbes and the immune system” and “Introduction to bacteria”. NSU college students came to the high schools and using hands-on-experimental modules, taught the children how the immune system reacts to foreign pathogens, importance of vaccination, proper use of antibiotics, sterile techniques, importance of microorganisms and identifying bacterial strains; all topics that they were studying in their microbiology course. The focus was to present content while at the same time providing undergraduate students with a practical application for sharing their knowledge as part of their course. The school students had the opportunity to be involved in scientific experiments (building models, swabbing for microorganisms, looking at bacteria under the microscope etc.), thereby keeping their interest piqued for STEM-related fields. By bringing a team of NSU faculty and students to community schools, local teachers were supported. The modules once created can be used every year in local schools with technical support from a student scientist and instructional support from a local teacher. Development of these projects fosters community outreach between NSU and the local area schools.

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

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5. Plasmid Loss in the Absence of Antibiotic Selection – An Open-Ended Laboratory Exercise

**Gloucester Room**

**P. Rock.** Virginia Wesleyan College, Norfolk, VA.

This laboratory exercise demonstrates the persistence of antibiotic resistance plasmids in *E. coli*, in the absence of antibiotic selection. It is standard laboratory procedure when culturing *E. coli* (or other) transformants containing antibiotic resistance plasmids, to maintain them on media containing the antibiotic – that is, to maintain selection for the plasmid. A culture of *E. coli* expressing green fluorescent protein from a commonly available ampicillin-resistance plasmid (or your favorite plasmid), grown in selective media, is used to inoculate identical media with and without ampicillin. The cultures are sub cultured periodically and screened for the plasmid by plating on media with and without ampicillin. The often surprising result is that in the absence of selection, even after hundreds of generations, the plasmid can still be recovered. This exercise lends itself to individual research projects as well as longer-term laboratory exercises for a microbiology class. Variations include: the strain of *E. coli* used, the type and size of the plasmid, the type of media (complex vs. simple) and the duration of sub-culturing in the absence of selection. This exercise emphasizes sterile technique, serial dilution and
quantification of broth cultures. It also highlights the problem of antibiotic resistant microorganisms persisting in the environment.

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

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### 6. Systems Thinking In Microbe-Mediated Animal Behavior

*Ipswich Room*

**M.H.H. Stevens.** Miami University, Oxford, OH.

Most undergraduates in ecology courses and even their professors do not fully appreciate the power of microbes in governing ecosystems and individuals. In this chalk talk, I will walk through an in-class activity designed to enhance undergraduates’ appreciation of the importance of microbes in their lives, and reinforce fundamentals of system thinking. This activity relies on students’ fascination with (i) animal behavior and (ii) disgusting or scary stuff. The first step, pre-lecture, is to have students reading a short scientific review article on animal behavior and the microbiome (Ezenwa et al. 2012, Science v. 338, p. 198-200), and to administer an on-line pre-class quiz to reward good study habits. For the next step, in class, students and instructor review the principles of system models for information flow (i.e., cause-and-effect systems) and for material and energy flow. Students are then asked to work in small groups (2-3) to create two conceptual system models of a microbe-animal interaction based on one examples in the review article; one information model and one material flow model. After models are constructed (drawn on paper), each group “submits” their models to peers for in-class peer review. Peer review can take one of two forms, depending upon the classroom dynamics and assessment preferences. Groups can either present to the class, or submit models to the editor in chief (the instructor) who redistributes them among peer reviewers (students).

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

**American Academy of Microbiology Topic:** The Human Microbiome

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### 7. Flipped Classroom Strategies for Reflective Learning

*Grand Ballroom I & II*

**D. Vardar-Ulu.** Wellesley College, Wellesley, MA.

In the last ten years there has been an increasing emphasis on incorporating results of educational and cognitive psychology research into classroom teaching, especially in the STEM fields. The biggest challenge in this move is how to restructure the use of classroom time to best facilitate student learning and skill development, without significantly compromising from content coverage. In this Microbrew session, I would like to share some specific strategies including online shared platforms, such as google docs, blogs, forums, etc. as well as out-of-class public venues, I have incorporated into two of my courses: Fundamentals of Biochemistry course designed for science majors with specific interest in biochemistry, and an introductory level chemistry seminar course for non-majors titled Art of Science: Think like a Scientist, Act like an Artist. The unifying goal of these practices is to help students practice transferring their learning to new contexts through individual reflection followed by group communication. For the biochemistry course, the focus is helping students build a molecular level understanding of the four biomolecules, proteins, nucleic acids, carbohydrates, lipids, and water, as the medium of life. At the completion of the course the students are expected to be able to describe and predict structural and functional relationships among these five groups of molecules using their molecular understanding. For the Art of Science course, the goal is to provide the students with a framework that would enable them to compare and contrast the scientific process and its products with the creative process and its products, and to develop the skills to recognize and communicate the creative elements underlying scientific products, as well as scientific elements underlying artistic products. The scientific focus of the current seminar course is the use of the following four elements, H, C, O, and N in selected vital molecules of life.

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**WELCOME RECEPTION**

9:30 PM - 10:30 PM

*Living Room*

Sponsored by Pearson

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**MIKEY THE MICROBE!**

Thank you to Imagineering for creating our Paul Revere mascot for ASMCUE!
FRIDAY, MAY 16

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 BY TOPICAL AREAS
7:00 AM - 7:45 AM
Grand Ballroom I & II
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.

ASMCUE REGISTRATION
7:00 AM - 8:00 PM
Banquet Foyer

CONCURRENT SESSIONS – COURSE INTEGRATED RESEARCH
8:00 AM - 9:30 AM
(3 sessions)

1. The Small World Initiative: The Challenges and Successes of Integrating an Authentic Research Course into Introductory Curriculum
8:00 AM - 8:30 AM
Tiffany M. Tsang, Yale University
We propose an interactive panel discussion with pioneering Pilot Partners who are collaborating on an innovative course-based undergraduate research collective called the Small World Initiative. Using authentic scientific research as inspiration, this initiative focuses on addressing a worldwide health threat: the diminishing supply of effective antibiotics. Undergraduates will contribute to crowdsourcing the discovery of new antibiotics from soil bacteria in their local environment. In spring 2014 Pilot Partners at 26 institutions nationwide will implement a research-based course that integrates the core antibiotic discovery research project with foundational biology concepts in one of four introductory courses (cell/molecular biology, microbiology, and majors and non-majors lab). Each Pilot Partner is developing teaching materials aligned with the research project and preparing to teach the new course at their respective institutions in spring 2014. At this session, Pilot Partner panelists will highlight challenges and successful strategies based on their experiences developing and teaching their course during this pilot year.

2. Don't Tell Me! I'll Do It Myself!! (Inquiry-Based Learning and Undergraduate Research in the Community College Classroom)
8:30 AM - 9:00 AM
Ashley A. Hagler, Gaston College
To meet the needs of an evolving STEM workforce, Gaston College, a North Carolina Community College, developed the SPARC3 initiative in order to increase STEM student persistence and retention. As part of this, STEM faculty at Gaston College realized that traditional teaching methods no longer work, so they embedded inquiry-based learning and undergraduate research experiences into introductory courses in the Science and Math curricula. This presentation will focus on the implementation of this initiative, successes, challenges, and lessons learned at Gaston College. Participants will actively experience the new community college science classroom and leave with a toolbox of ideas and resources to enable them to begin to implement inquiry-based learning and undergraduate research experiences in their own classrooms.

3. Embedding Undergraduate Research throughout Microbiology Majors
9:00 AM - 9:30 AM
Jack T.H. Wang, The University of Queensland
Hands-on exposure to research and discovery can greatly enhance Microbiology education through improving student scientific skills and their engagement in the discipline. However isolated laboratory internships are the most frequent mode of delivery for undergraduate research, greatly limiting the number of available opportunities. Large-scale Undergraduate Research Experiences (URE) can overcome this hurdle by integrating authentic research projects into the undergraduate laboratory coursework, simultaneously exposing large numbers of students to inquiry-driven research. At the University of Queensland, Australia, a number of UREs have been strategically embedded across multiple courses within the Microbiology major. These UREs span across clinical and molecular microbiology, in topics ranging from sequencing the human microbiome to the cloning and characterisation of potential vaccine antigens. These scaffolded research experiences demonstrated incremental student learning gains in research skills across each URE, and can serve as a template for enhancing horizontal and vertical integration across Microbiology majors.

CONCURRENT SESSIONS – FACILITATING ACTIVE LEARNING
8:00 AM - 9:30 AM
Grand Ballroom III
(3 sessions)
FRIDAY, MAY 16

1. The Miniflip: A Minor Change with a Big Impact  
8:00 AM - 8:30 AM

Denise G. Anderson, University of Washington

Are you interested in creating a more engaging classroom environment, but not convinced that a flipped classroom is your style? Come learn about a moderate form of that approach — Let’s call it a “mini-flip”.

A mini-flip moves straightforward concepts out of the traditional lecture format, requiring students to learn that information independently instead. An obvious benefit is it avoids using valuable class time to cover simple topics such as vocabulary, allowing for increased lecture coverage of complex topics and/or the incorporation of active learning activities during class. Additionally, when students come to class armed with the basics of a particular topic, they grasp the difficult concepts more readily.

The format has been successfully used in large classes up to 300 students, but can also be used in smaller classes. Students praise the format, reporting that it encourages them to stay current with the assigned readings and keeps them engaged in the lecture. In essence, the mini-flip encourages independent methods of inquiry that can lead to lifelong learning habits.

2. Attracting Student Attention with Magnets and Flipping  
8:30 AM - 9:00 AM

Jennifer L. McLean, Colorado State University

Many science students are “hands-on” learners, but designing such activities for large lecture classes is extremely difficult. We have developed a teaching tool that allows students to carry out gene expression and protein translation by manipulating magnets representing mRNA, tRNA, ribosomes and amino acids. In addition, I will discuss how we use classroom flipping to help prepare the students for this activity and clicker quizzing to assess whether learning takes place. Student feedback and performance data will be presented.

3. BioBuilder: Ready-to-use Classroom and Lab Curricula that Integrates Engineering into Biology  
9:00 AM - 9:30 AM

Natalie H. Kuldell, Massachusetts Institute of Technology, BioBuilder Educational Foundation

Our students cannot afford to be left behind in science. We have the ability and obligation to better prepare them for the societal questions they’ll face, for their higher education careers and for the tech jobs of today and tomorrow. The BioBuilder curriculum introduces teachers and students to modern microbiology and molecular biology methods through the growing field of synthetic biology, the engineering of living systems. This session will introduce the concepts of synthetic biology and describe the hands-on exploration of BioBuilder experiments that can be done in middle school, high school or college settings. For example, BioBuilder's Eau That Smell lab transforms foul-smelling but harmless bacteria into banana-scented microorganisms. BioBuilder's Color My World experiment provides an engineering twist on the traditional bacterial transformation lab performed in many teaching settings. BioBuilder's Picture This! lab introduces participants to computer aided-design tools for studying and modeling biology. Finally, the Golden Bread experiment investigates the suitability and bioethical implications of a yeast engineered to bake VitaminA-enriched bread. These investigations, which require minimal standard molecular genetics equipment provide middle school, high school and college students with inquiry-based labs and lessons that connect state-of-the-art research to engineering and biology.

CONCURRENT SESSIONS – ASSESSMENT TOOLS AND TECHNIQUES  
8:00 AM - 9:30 AM

1. Building Understanding with the Backwards Design Approach to Course Planning  
8:00 AM - 8:30 AM

Michelle Scribner-MacLean, University of Massachusetts Lowell

Devised by Grant Wiggins and Jay McTighe in the 1990s as part of their Understanding by Design approach to curriculum design, Backwards Design provides a roadmap for instructors to provide effective teaching and learning experiences for students by considering outcomes of instruction. We will discuss the rationale for this approach, as well as how it can be used for effective course, unit, and lesson design.

2. Quantitative Data – The What  
8:30 AM - 9:00 AM

Christine M. Pribbenow, Wisconsin Center for Education Research

This session is designed for researchers who are new to studying “human subjects” and are interested in gathering data through quantitative techniques. This session of this two-part series will focus on typical forms of data and how to analyze them based on how they are collected (nominal, ordinal, interval). Both parametric and non-parametric tests will be discussed, along with the use of a decision tree to determine the appropriate statistical test. Session #2 entitled, Quantitative Data – The How, will take place at 10:15 AM.
3. Qualitative Data – Data Sources, Collection, and Analysis  
9:00 AM - 9:30 AM

Stanley M. Lo, Northwestern University

This interactive session will engage audience in hands-on analysis of qualitative data. From these activities, participants will learn about sources of data that can be used to assess student learning and how to collect them, analyze and code data, and discuss the importance of reliability and validity. We will use sample data collected from free-response survey items that probe how students understand the purpose of undergraduate laboratory courses. This session is designed for novices (i.e. someone who has considered using qualitative data but may be unsure of how to begin), but others who have had some experience with qualitative analysis are also welcome. After this session, participants are expected to get a sense on how to approach the collection and analysis of qualitative data.

CONCURRENT SESSIONS – PROFESSIONAL DEVELOPMENT  
9:45 AM - 11:15 AM
Grand Ballroom I & II  
(3 sessions)

1. Career Opportunities in Health Care for Microbiologists and Immunologists  
9:45 AM - 10:15 AM

John L. Schmitz, University of North Carolina Chapel Hill

The fields of clinical microbiology and immunology impact many aspect of the practice of medicine. As such, these fields offer unsurpassed diversity in career opportunities for individuals with bachelors or advanced degrees. Infectious and autoimmune disease, immunodeficiency, cancer, allergy, and transplantation are examples of areas for which immunologists and microbiologists can contribute via development of new tests in commercial or academic research settings, performance of tests in the clinical or public health laboratory and providing interpretation and consultation to clinicians managing these patients. However, career opportunities in the clinical arena for individuals interested in these specialties are often not well appreciated. The goal of this session is to highlight these opportunities with specific examples and to identify resources for students to obtain more detailed information on the role of clinical microbiologists and immunologists and rewarding career opportunities using newly developed resources available via the ASM website that include access to practicing microbiologists and immunologists.

2. Bridging the Boundary Between Science and Industry  
10:15 AM - 10:45 AM

Fred D. Ledley, Bentley University

The translational science that creates new products, jobs, economic value, and public benefits from the fruits of biomedical discovery commonly takes place in a commercial enterprise such as a biopharmaceutical company or healthcare institution. The success of this enterprise requires a critical synergy between the potential of the technology and the business model of this enterprise. There is a critical need for scientific and business leaders who are able to more effectively integrate a critical understanding of both science and business into the business models for translational science. This requires training that bridges the traditional boundaries between science and business.

3. Preparing Undergraduates for Research Careers in Industry  
10:45 AM - 11:15 AM

Kimberly L. Carey, Excelimmune

For each research associate job posted, hundreds of applications are submitted. How can students improve their chances of landing a job in this competitive market? How can students best prepare for the transition into the biotechnology industry and meet the expectations of the company? The goal of this session is to provide a glimpse from the perspective of supervisors and bachelors-level scientists working for biotechnology and pharmaceutical companies on how instructors and advisors can help students prepare for successful research careers in industry.

CONCURRENT SESSIONS – BROADENING PARTICIPATION  
9:45 AM - 11:15 AM
Grand Ballroom III  
(3 sessions)

1. Should I Stay, or Should I Go: An Examination of Factors Influencing Student Persistence in the Biology Major  
9:45 AM - 10:15 AM

Jeffrey T. Olimpo, University of Northern Colorado  
Sue Ellen DeChenne, University of Northern Colorado  
Biscah Munyaka, University of Northern Colorado

Large numbers of students enter college with an interest in pursuing undergraduate work in the biological sciences. However, empirical and anecdotal evidence has shown that many of these same students do not persist past the first year and, instead, elect to switch to other programs of study. Are you and your colleagues experiencing this same trend? Are you interested in learning more about how to address this issue? If you answered yes to either of
these questions, then this session is for you. We will present our current findings from an ongoing mixed-methods study examining student persistence in introductory biology (IB), which focuses specifically on factors pertaining both to students and faculty engaged in IB coursework. During the session, participants will also have ample time to discuss with colleagues issues pertinent to student persistence in biology. Participants will leave the session with clear ideas and examples for addressing student attrition at their own institution.

2. How to Create Community Outreach Programs in Biology and Microbiology Education
10:15 AM - 10:45 AM

Barbara D. Davis, Bergen Community College
Mary Flannery, Bergen Community College
Marty Lowe, Bergen Community College
Jeannie Payne, Bergen Community College

Outreach to global, local and professional communities is an important aspect of undergraduate education and allows students to integrate classroom information with real world experiences. Multiple programs have been created, which have provided stimulating and integrative learning experiences.

The outreach awareness programs were created as campus wide events with expert speakers on public health topics and service learning student activities. Events included topics such as Clean Water; Infectious Diseases; Diabetes and Organ Donation. High school students were invited to participate in events to encourage interest in science programs.

“Meet the Expert” provided outreach to clinical microbiologists and authors of scientific papers. A Science Literacy interdisciplinary program studied food safety and connected biology and English students with the parent of a food poisoning victim.

Attendance at this seminar will be interactive with an overview of the outreach programs. The audience will participate in the development of ideas for outreach programs.

3. That’s Edu-tainment
10:45 AM - 11:15 AM

Dave Westenberg, Missouri University of Science and Technology
Ruth Gyure, Western Connecticut State University
Mark Martin, University of Puget Sound
Phil Mixter, Washington State University

Are educators entertainers? Educators as entertainers is a controversial concept that some of us embrace and others look at with disdain. What is Edu-tainment and how can we assess the effectiveness of edu-tainment activities? The ways we can entertain and educate is incredibly diverse and ranges from acting out biological processes, recreating scientific discoveries to hands-on activities and student developed projects. This session will present a panel of educators who use a variety of strategies to entertain and educate. Attendees will come away with ideas to use in their own classroom or modify for their own purposes. More importantly, we will discuss the learning objectives of projects and activities and assessment strategies to measure learning gains.

CONCURRENT SESSIONS – ASSESSMENT TOOLS AND TECHNIQUES
9:45 AM - 11:15 AM
Grand Ballroom IV
(3 sessions)

1. Measurement Theory to Classroom Practice
9:45 AM - 10:15 AM

Jennifer E. LeBeau, Washington State University

This session will engage participants in bridging the gap between theory and practice related to assessment and evaluation. The session will include information on measurement theory, instrument development, reliability and validity, and ways to incorporate assessment into evaluation of educational projects. Instruments will be identified, both by the presenter and through participant sharing, for measuring performance in a number of areas (e.g., content knowledge, skills, attitudes). The primary focus of the session will be an interactive component in which participants consider and share their own measurement and evaluation challenges and develop an evaluation plan that incorporates an assessment component. Participants will come away from the session with resources, activities, outputs (measures), outcomes, and impacts related to their current or proposed work as well as resources for locating assessment instruments that can be used to improve classroom practice. The session facilitator serves as an external evaluator for several STEM projects and has an educational background in biology and educational psychology.

2. Quantitative Data – The How
10:15 AM - 10:45 AM

Christine M. Pribbenow, Wisconsin Center for Education Research

This session relies on information shared in the previous session, Quantitative Data – The What, and uses an actual dataset to determine the type of data collected and how it should be analyzed. Participants will play an active role in determining the type of test to be used. A resource list will be provided for future reference.
3. Qualitative Data – Deductive vs. Grounded Approaches in Data Analysis
10:45 AM - 11:15 AM

Stanley M. Lo, Northwestern University

This interactive session will engage audience in hands-on analysis of qualitative data. From these activities, participants will analyze and code data using two different approaches (deductive vs. grounded) and discuss the importance of reliability and validity. We will use sample data collected from free-response survey items that probe how students understand the purpose of undergraduate laboratory courses. This session is designed for participants who have had some experience with qualitative analysis, but others who may be unsure of how to begin are also welcome. After this session, participants are expected to develop deeper understanding of qualitative analysis that is grounded in theoretical frameworks.

CONCURRENT SCIENTIFIC SESSIONS
I of II
11:30 AM - 12:30 PM
(3 sessions)

1. The Human Microbiome
Grand Ballroom III

Curtis Huttenhower, Harvard University

Sponsored by the American Academy for Microbiology

Among many surprising insights, the genomic revolution has helped us to realize that we’re never alone and, in fact, barely human. For most of our lives, we share our bodies with some ten times as many microbes as human cells. They are resident in our gut and on nearly every body surface, and they are a normal part of human health. Within the past decade, new "computational microscopes" have changed our understanding of the microbiome’s importance in maintaining health and mitigating disease. This has generated a detailed landscape of microbial variation across the human body, since each microbial habitat within different body sites is distinctly colonized. It has also helped to begin understanding personalization of the microbiome, since unlike our highly-similar genomes, the composition of our microbial residents is typically quite different from person to person. Finally, the field is beginning to use this "parts list" of microbial residents and their genes to understand molecular function, metabolism, and interactions among microbes and with our own immune systems. Many open questions remain, however, regarding the ecological assembly driving colonization in the microbiome, its biomolecular functions, the causality of microbial community activity in various diseases, and how the microbiome can be intentionally modified to improve human health.

2. Modeling and Forecast of Network-Driven Contagion Processes –
Grand Ballroom IV

Alessandro Vespignani, Northeastern University

In recent years the increasing availability of computer power and informatics tools has enabled the gathering of reliable data quantifying the complexity of socio-technical systems. Data-driven computational models have emerged as appropriate tools to tackle the numerical study of epidemics and have gained importance in the public-health domain, especially in infectious disease epidemiology, by providing quantitative analysis in support of the policy-making processes. In this lecture I will focus on discussing the recent successes as well as the methodological challenges in the modeling and forecast of network-driven contagion processes.

Grand Ballroom I & II

Paula I. Watnick, Boston Children’s Hospital and Harvard Medical School

Biofilm formation is the process by which microbes attach to environmental or host surfaces. Attachment often depends on secretion of an adhesive matrix comprised of exopolysaccharides, protein, and DNA. Synthesis of this matrix is tightly regulated to insure that attachment does not commit the microbe to an inauspicious environment.

*Vibrio cholerae*, the bacterium responsible for the severe epidemic diarrheal disease cholera, is excellently adapted for environmental persistence, and biofilm formation is one key to its success. Here we will discuss the natural environments in which *V. cholerae* forms a biofilm, the signals that activate this process, and the complex interactions of matrix components that lead to formation of a stable biofilm structure. Within these studies, one finds themes that are a common to biofilm formation by diverse bacterial species.

PLENARY SESSION
12:45 PM - 1:15 PM
Grand Ballroom I & II

ASM Curriculum Guidelines—Moving Forward

Susan Merkel, Cornell University
Gary Kaiser, Community College of Baltimore County, Catonsville
Ann Stevens, Virginia Tech

Two years ago, the ASM Task Force on Curriculum Guidelines published new concept-based guidelines for introductory microbiology courses (https://www.asm.org/index.php/guidelines/curriculum-guidelines). The guidelines are based on the “Backward Design” model which emphasizes a deep
understanding of fundamental concepts.

Last year at ASMCUE, we asked the community to help us write learning objectives for the fundamental statements in the Guidelines. These were vetted and edited by a new Curriculum Guidelines Task Force (Ann Stevens, Chair, Billy Hung, Min-Ken Liao, Susan Merkel). The learning objectives were shared with the community on the ASMCUE website as examples of both lower- and higher-order thinking goals for students.

Moving forward, we are now at the point of developing assessments for these (and other) learning objectives. This year at ASMCUE, the Curriculum Guidelines Task Force is joining forces with the ASM MicrobeLibrary Student Learning Assessments in Microbiology Database (SLAMD) to develop peer-reviewed multiple choice questions that will help microbiology educators to assess the learning objectives linked to the new Curriculum Guidelines. And we need your help!

We are asking ASMCUE participants to join us in focus breakout groups to review the example learning objectives and to share your own. We will then work in groups to develop new multiple choice assessment questions that directly link back to the Curriculum Guidelines. This will provide a valuable resource as microbiology educators across the world begin to adapt the new Curriculum Guidelines.

LUNCH AND BREAKOUT SESSIONS
1:15 PM - 2:00 PM
Grand Ballroom I & II

Breakout Session Rooms and Curriculum Concept:

Evolution
Hamilton Room

Impact of microorganisms
Gloucester Room

Impact of microorganisms
Newburyport Room

Information flow
Marblehead Room

Pathways
Essex Room

Structure and function
Ipswich Room

Systems
Topsfield Room

CONCURRENT SCIENTIFIC SESSIONS II of II
2:15 PM - 3:15 PM
(3 sessions)

1. How Microbes Can Help Feed the World
Grand Ballroom III

Gwyn A. Beattie, Iowa State University
Linda L. Kinkel, University of Minnesota

Sponsored by the American Academy for Microbiology

Global population size is projected to reach 9 billion by 2050, requiring estimated increases of 70-100% in agricultural production. Limited availability of water, fertilizer, and arable land, coupled with the anticipated impacts of global climate change on production, pose significant challenges to achieving this goal. Yet microbes present a dramatic bright spot in this picture and are recognized as perhaps the single greatest untapped resource for significant and sustainable enhancement of crop yields. Plants have developed diverse bacterial, fungal, and viral partnerships that capitalize on the metabolic and biochemical capacities of microorganisms to enhance plant fitness. Microbes acquire carbon, physical protection, dispersal capabilities, and presumably further as-yet unknown benefits from associating with plants. Microbial symbionts benefit plants by enhancing nutrient acquisition, providing protection from pathogens, promoting growth and tolerance to drought, flooding, high-salinity soils, high and low temperatures, and environmental pollutants, and even enhance plant flavor. Though the vast majority of plant symbionts remain uncharacterized, our understanding of plant-microbial symbioses has exploded over the past decade, offering significant hope for sustainable and dramatic increases in food production.

2. This Week in Virology
Grand Ballroom IV

Vincent Racaniello, Columbia University

Each week I record an episode of the science show ‘This Week in Virology’, on which we review the latest stories in the field. Our listeners include sixth graders, high schoolers, college students, graduate and medical students, their teachers, and many others in a diverse array of fields and professions. In this session I’ll touch on some of the amazing aspects of virology, and will describe in detail two incredible stories about viruses: how they can be beneficial, and the unusual giant viruses that have been recently discovered, and what they mean.
3. The Challenge of Antibiotic Resistance: A Microbial Perspective
Grand Ballroom I & II
Margaret A. Riley, University of Massachusetts Amherst

Antibiotic resistance is becoming a global health crisis, and there is no magic bullet on the horizon. The traditional paradigm for antibiotic discovery, development and therapy is not capable of responding to the rapid evolution and shifting ecology of our most virulent pathogens. We must act now to search for alternative solutions to this fundamental challenge to human health. Our research program, based on sound ecological principles, begins with lead compounds honed by three billion years of evolution. The focus of our research is an exploration of the potential of naturally occurring bacteriocin toxins as the entry point for the development of novel narrow-spectrum antimicrobials. Using urinary tract infections (UTI) as the model test case, we systematically investigate the therapeutic potential of bacteriocins: highly specific antimicrobials, non-toxic to human cells and demonstrably effective against all known UTI-causing bacteria. With the growing incidence of resistant UTI-related bacteria as a backdrop, we propose to exploit the potential of these targeted, narrow-spectrum antibiotics for the treatment of UTI’s. Our approach provides a bold challenge to the existing broad-spectrum drug discovery and development paradigm. If we are to outsmart germs at the game they play so well, we must attempt something radically different.

EXHIBITOR AND POSTER SETUP
3:00 PM - 6:00 PM
North Shore Ballroom

CONCURRENT SESSIONS – PROFESSIONAL DEVELOPMENT
3:30 PM - 5:00 PM
Grand Ballroom I & II
(3 sessions)

1. Opportunities at the National Science Foundation
3:30 PM - 4:00 PM

Susanne von Bodman, National Science Foundation

Sponsored by ASM and NSF Leaders Inspiring Networks and Knowledge (LINK) Program.

This forum provides participants an opportunity to learn about the grant program from the NSF program officer representing:

• The Division of Molecular and Cellular Biosciences (MCB) in the Directorate of Biological Sciences supports research and related activities that contribute to a fundamental understanding of living systems at the molecular, subcellular, and cellular levels. The mission of the Directorate for Biological Sciences (BIO) is to enable discoveries for understanding life. BIO-supported research advances the frontiers of biological knowledge, increases our understanding of complex systems, and provides a theoretical basis for original research in many other scientific disciplines.

2. Implementing Vision and Change Recommendations at the Departmental Level: An Introduction to the Partnership for Life Science Undergraduate Education (PULSE) Framework and Resources
4:00 PM - 4:30 PM

Sharon B. Gusky, Northwestern Connecticut Community College
Loretta Brancaccio-Taras, Kingsborough Community College
Nitya Jacobs, Oxford College of Emory University
Karen K. Klyczek, University of Wisconsin-River Falls

In 2012, the National Science Foundation (NSF), the Howard Hughes Medical Institute (HHMI), appointed 40 Life Science educators from research universities, regional comprehensive universities, liberal arts colleges, and two-year colleges as Vision and Change Leadership Fellows in the Partnership for Life Science Undergraduate Education (PULSE) initiative. The goal of this collaborative effort is to develop strategies to support the national implementation of recommendations in the Vision and Change in Undergraduate Biology Education: A Call to Action report. During this session participants will be provided with an overview of the recommendations and be introduced to the PULSE Framework and resources which include an online workshop, a virtual toolbox, ambassadors to visit departments and assist with strategic planning, and credentialing rubrics. Participants can use these resources as they answer the “Call to Action” at their own institutions. Participants are encouraged to join the PULSE Community, www.pulsecommunity.org.

3. Laboratory Safety
4:30 PM - 5:00 PM

Diane M. Hartman, Baylor University
Jeffrey J. Byrd, St. Mary’s College of Maryland

This session will review and discuss the laboratory biosafety guidelines published in the Journal of Microbiology & Biology Education. Objectives are to raise awareness of biosafety hazards in microbiology teaching laboratories, distinguish between BSL-1 and BSL-2 criteria and requirements, present possible less virulent alternative microbes for introductory microbiology courses, and include examples of implementation of the guidelines in a teaching lab. Audience questions and concerns will be addressed to the best of our ability within the allotted time frame.
FRIDAY, MAY 16

CONCURRENT SESSIONS – BROADENING PARTICIPATION
3:30 PM - 5:00 PM
Grand Ballroom III
(3 sessions)

1. Innovative Models for Staying Current in Research and Education
3:30 PM - 4:00 PM

Beronda L. Montgomery, Michigan State University
Marcel Agüeros, Columbia University

Sponsored by ASM and NSF Leaders Inspiring Networks and Knowledge (LINK) Program.

There has been a recent recognition that the current rates of training in science, technology, engineering, and mathematics (STEM) disciplines will result in a shortage of nearly 1 million workers unless significant changes in education and training are made. Such large-scale changes in increasing access and success in STEM for individuals from a range of diverse backgrounds will require innovations and collaborative efforts from scientists and educators from a diversity of backgrounds, disciplinary knowledge, and experimental approaches. This session highlights mentors and models exemplifying successful strategies for supporting interdisciplinary and racially and ethnically diverse teams. The session is a part of a multiyear collaboration called the ASM-NSF Leaders Inspiring Networks and Knowledge (LINK) initiative. LINK seeks to stimulate and support meaningful interactions between established investigators and undergraduate educators, faculty and future faculty. By responding to a national need for structured mentoring, the ASM-NSF LINK program aspires to cultivate diversity and competency in STEM fields.

2. BioSOLVE Brings Undergraduate Research to a Non-research Program through Courses, Collaboration, and Application-Based Service Learning
4:00 PM - 4:30 PM

Gail E. Rowe, La Roche College

How to create an undergraduate research program when you don’t have time, money or space: Real research experience is essential for today's biology majors. But providing a positive, authentic biology research experience for undergraduates can be prohibitively difficult in small colleges where faculty have no laboratory space, equipment or budget dedicated to research. At such institutions, faculty members typically carry heavy teaching loads and give substantial time and effort to advising and service. Research is valued less than teaching for purposes of promotion and tenure and may not even be required where “scholarship” is broadly defined.

Faculty peers and administrators may be skeptical or reluctant to implement change. This session demonstrates how I created an on-going cohort of student researchers and a sustainable research program in spite of such limitations at a small, liberal arts college. I will describe the BioSOLVE series of research courses, the Application-Based Service Learning (ABSL) pedagogy on which they are based, the use of essential collaborations with academic and community partners, and how I overcame institutional obstacles to create a manageable research program that greatly improved the quantity and quality of biology student research and has become a showcase, signature program at our college.

3. Advancing Undergraduate Research at a Primarily Undergraduate Institution
4:30 PM - 5:00 PM

Jennifer A. Bennett, Otterbein College

Research is a powerful hands-on approach for student learning as well as an opportunity for scholarship and professional development that transfers to better teaching in the classroom. Primarily undergraduate institutions (PUIs) are becoming increasingly interested in teacher-scholars who are capable mentors for undergraduate research students. This session highlights best practices in undergraduate research and is geared primarily towards individuals who desire to work at PUIs and those beginning positions at PUIs as well as those with established careers who want to infuse more energy into their research programs. Strategies for developing a successful research program, recruiting and managing students, and increasing research productivity, while creating a rich learning environment, will be presented. Examples of how student research can be successfully combined with faculty scholarship, teaching and service will be discussed.

CONCURRENT SESSIONS – DISTANCE LEARNING
3:30 PM - 5:00 PM
Grand Ballroom IV
(3 sessions)

1. Engaging Online Learners With Web 2.0 Assessment Tools
3:30 PM - 4:00 PM

Michelle Scribner-MacLean, University of Massachusetts Lowell

With the increase in distance education courses being offered, it is vital that instructors create an engaging online learning space. Learn how to use effective curriculum design, a variety of assessment tools, and Web 2.0 technology to ensure that meaningful learning is happening in your online courses.
2. Authentic AND Online: Designing Scientific Laboratory Experiences for Distance Learning Students
4:00 PM - 4:30 PM

Mary V. Mawn, SUNY Empire State College

Laboratory experiences are considered a key component of science coursework. A significant challenge is presenting meaningful laboratory experiences in the online environment. This session explores how hands-on and virtual experiments can support the development of scientific process skills in students working at a distance. Recommendations related to the design of laboratories for online learning will be discussed.

3. Incorporating Digital Resources into your Student-Centered Classroom
4:30 PM - 5:00 PM

Sarah Goodwin, American Society for Cell Biology

The past several years has seen a dramatic increase in the availability of free digital resources, from the Massive Open Online Courses offered by Ed Tech companies, to peer-reviewed digital libraries like ASM’s MicrobeLibrary. The availability of digital resources and technology in most classrooms has opened up possibilities not only for online courses, but also for the brick-and-mortar classrooms, allowing instructors to shift toward a more student-centered curriculum.

In this session, we will give a brief overview of the landscape of available digital resources for biology classrooms with a focus on science videos. We will discuss how the use of these resources can help enhance equity and diversity, offer opportunities for more active learning time in class, and optimize the use of formative assessments in an in-person course. We will also share our users’ experience with our iBiology videos as well as examples of classroom models that leverage science videos to improve students’ core competencies and skills. At the end of this session, the audience should walk away with a better understanding of the resources that are available to them, and also with some new ideas of how to use these resources.

PLENARY LECTURE
5:15 PM - 6:15 PM
Grand Ballroom I & II

Bringing Role-Playing Exercises, Interactive Simulations, and Climate Change Science Together for Transformative STEM Education

Juliette N. Rooney-Varga, University of Massachusetts Lowell

Climate change science and the complex systems integral to its causes and impacts are among the most pressing and difficult STEM educational challenges. In addition to their inherent complexity, the prevalence of misconceptions and tendency to portray climate change as a politically and emotionally charged topic present barriers to learning. Simulation role-playing exercises offer an educational approach that is both powerful and, in STEM areas, underutilized. These exercises engage learners in immersive experiences that enable them to find out, for themselves, how complex systems respond to perturbations. Like the scientific process, learners pose a hypothesis, test it in simulated time and space, and adjust their understanding based on observations. Here, we present a powerful learning tool, “World Climate,” in which learners take on the roles of delegates to the UN climate negotiations. The exercise is framed by current scientific understanding of how the climate system responds to the decisions about future greenhouse gas emissions, through the C-ROADS computer model. Evaluation of the tool indicates that it has the potential to transform students’ understanding of the urgency, scale, and complexity of mitigation policies needed to address climate change. Ongoing work aims to improve accessibility, dissemination, and understanding of how role-playing simulation exercises can overcome barriers in climate change education.

EXHIBITOR SHOWCASE AND RECEPTION
6:30 PM - 8:30 PM
North Shore Ballroom

81% of 2014 conference presentations were submitted by attendees!

We continue to need your help in building the conference and determining content.

Submit your ASMCUE 2015 session ideas by September 15 and your abstracts for posters and microbrews in February 2015.

ASMCUE...the conference...by educators. ...for educators.
SATURDAY, MAY 17

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 BY LOCATION
7:00 AM - 7:45 AM
Grand Ballroom I & II

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.

ASMCUE REGISTRATION
7:00 AM - 3:30 PM
Banquet Foyer

PLENARY LECTURE
8:00 AM - 9:00 AM
Grand Ballroom I & II

Taking a Scientific Approach to Science Education

Carl E. Wieman, Carl Wieman Science Education Initiative and Stanford University

Guided by experimental tests of theory and practice, science has advanced rapidly in the past 500 years. Guided primarily by tradition and dogma, science education meanwhile has remained largely medieval. Research on how people learn is now revealing much more effective ways to teach and evaluate learning than what is in use in the traditional science class. The combination of this research with information technology is setting the stage for a new approach to teaching and learning that can provide the relevant and effective science education for all students that is needed for the 21st century.

EXHIBITOR SHOWCASE
9:00 AM - 3:30 PM
North Shore Ballroom

The 2014 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 22 key microbiological topics, and two key skills and are based on concepts put forth in the 2011 national 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. See page 68 for Poster Abstract Content and Pedagogy Grid. Abstracts are found in the Journal of Microbiology & Biology Education, Volume 15, Issue 1.

1-A
Can a Flipped-Classroom Approach in Combination with Inquiry-Based Learning Foster Content Acquisition and Hypothesis Testing in Introductory Biochemistry?
I.H. Barrette-Ng. University of Calgary, Calgary, Alberta, Canada.

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

3-A
STEMM: Sequencing Technology Education using Microbial Metagenomes
E.A. Dinsdale and R.A. Edwards. San Diego State University, San Diego, CA.

ASM Curriculum Guideline Concept(s): Impact of microorganisms, Advancing STEM education and research
Pedagogical Category(ies): Hands-on projects, Student learning
American Academy of Microbiology Topic: The Human Microbiome

5-A Cheese Microbiology and Biochemistry: A Laboratory Activity
M.A. Furlong and R.E. McFarlane. Clayton State University, Morrow, GA.

ASM Curriculum Guideline Concept(s): Impact of microorganisms
Pedagogical Category(ies): Hands-on projects

7-A Variation in Student Response to an Authentic Research Experience
H.J. Henter, M.M. Butler, and S.F. Mel. University of California San Diego, La Jolla, CA.

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

9-A A Large Course Redesign of a General Microbiology Lecture Course Incorporating a Student-Centered Active Learning Environment with Upside-Down Pedagogies (SCALE-UP)
A.M. Lee, M.G. Keen, T.I. Petty, M. Miller-Kittrell, and J.M. Bradshaw. North Carolina State University, Raleigh, NC.

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

11-A Effects of a Classroom-Based Authentic Research Experience on Learning Genetics Concepts

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

13-A The Emerging Microbe Project: Synthesis of Pathogen Identification and a Clinical Case Study in a Doctor of Pharmacy Infectious Disease Course
L.A. O'Donnell, M.W. Perry, and D. Doup. Duquesne University, Pittsburgh, PA.

ASM Curriculum Guideline Concept(s): Impact of microorganisms
Pedagogical Category(ies): Hands-on projects, Student learning

15-A Using Community Partners to Effectively Engage Students in Microbiology Research
K.A. Page. Southern Oregon University, Ashland, OR.

ASM Curriculum Guideline Concept(s): Impact of microorganisms
Pedagogical Category(ies): Hands-on projects

17-A Teaching Scientific Writing and Reasoning using Peer Assessment

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

19-A This Flippin’ Class: Attitudes About Learning in a Flipped Microbiology Classroom
H.M. Seitz. Johnson County Community College, Overland Park, KS.

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

21-A Selective Flipping: A Problem Solving-Based Approach to Teaching DNA Replication

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

23-A Effects of In-Class Group Problem Sessions on Group Studying
K.E. Tifft, M. Reese, and E.J. Fisher. John Hopkins University, Baltimore, MD

ASM Curriculum Guideline Concept(s): Information flow, Advancing STEM education and research
Pedagogical Category(ies): Course design, Student learning

25-A Promoting Metacognition to Improve Studying and Learning Skills and Mastery of Microbiology

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Student learning
PRODUCT CORNER
9:30 AM – 10:00 AM
Essex Room

Sponsored by McGraw-Hill Education

Featured Product: SmartBook

No two students are the same, so why should their learning experience be?

Adaptive technology uses continual assessment and artificial intelligence to personalize the learning experience for each individual student.

By identifying a student’s strengths and weaknesses, you can ensure that every minute a student spends studying has the highest possible impact. With users experiencing an average of a letter grade improvement, adaptive learning is a proven way to increase student success and confidence.

As the global leader in adaptive and personalized learning technologies, McGraw-Hill Education is pioneering ways to improve results and retention across all disciplines.

You’re invited to a demonstration of SmartBook, the first and ONLY adaptive reading experience available for higher education. Powered by an intelligent diagnostic and adaptive engine, SmartBook facilitates the reading process by identifying what content a student knows and doesn’t know through adaptive assessments. As the student reads, the reading material constantly adapts to ensure the student is focused on the content he or she needs the most to close any knowledge gaps.

MICROBREW SESSIONS II 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:

Grand Ballroom III
Facilitator: Mary Allen, Hartwick College

Grand Ballroom IV
Facilitator: Laurie Caslake, Lafayette College

Gloucester Room
Facilitator: Michael Hanophy, St. Joseph's College

Newburyport Room
Facilitator: Janet Hart, MCPHS University

Marblehead Room
Facilitator: Shannon Hinsa-Leasure, Grinnell College

Ipswich Room
Facilitator: Renee McFarlane, Clayton State University

Hamilton Room
Facilitator: Lorraine Olendzenski, St. Lawrence University

Essex Room
Facilitator: Ann Williams, University of Tampa

MICROBREW SESSION D: 11:30 AM – 11:45 AM

1. Writing a Research Proposal in Biology Capstone: Scaffolding the Process
Grand Ballroom IV

G.S. Begley, Northeastern University, Boston, MA.

Biology Capstone represents an opportunity for students to synthesize concepts from across the curriculum, develop key disciplinary skills, and prepare for diverse careers. The major product of our capstone experience is a student-initiated research proposal. Most of our students have experience working in research labs, but few have had an opportunity to design their own project. This is quite challenging, so a multistep process in which component skills are scaffolded is coupled with
frequent feedback from peers, the instructor, and expert consultants. Students are guided as a class through a 5-part analysis of primary research papers and then individually apply this process to a paper of their choosing. These same five steps are used to frame the proposal, and topics are developed through several iterations. Each component of the proposal is written following relevant skills development. For example, students give an elevator speech (60-90 second summary) on one method they would use in the proposed research and present a one-slide analysis of preliminary data before they write the specific aims section of the proposal. This allows opportunities for feedback on how well the student builds on preliminary data and the appropriateness of the proposed methodology. Students also obtain feedback from a consultant in the field, either a faculty member or external researcher, during the development of the specific aims and research design. By the time the full proposal is submitted, students have had many opportunities to practice the component skills of reviewing and synthesizing the scientific literature, formulating a novel research question, designing appropriate experimental approaches, and communicating the significance of a research project.

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

2. A Simple, Engaging, and Effective Activity for Teaching Students About Cell Parts

Hamilton Room


All ASM scientists and instructors have either attended or taught a class that has covered the basic parts of the cell. With a veritable myriad of cell parts to cover it is easy for educators to become locked into marathon presentations that become taxing for both the instructor and the students. While we hope and expect that students master this material, the lack of engagement and disconnect between this material and its practical value often encourages students to tune out. How can we cover this topic with the depth and breadth it deserves while simultaneously engaging the students? How can students learn the subtleties of the cell when each part is a world unto itself? During this Microbrew I will explain how educators can use the “Cells: A World A Part” activity to do exactly that. It quickly determines what students know about each cell part and then uses a constructivist approach which allows students to build on their former knowledge. Students develop teamwork and time-management skills as they collectively answer their own questions using a variety of resources. Students also learn the practical value of this knowledge when they uncover how these cell parts relate to human disease. Furthermore this activity encourages students to explore recent cell biology and microbiology literature, ask thought provoking questions, and propose experiments to address some of the enduring mysteries about these cell parts. All of these benefits do not come at a cost; this approach is arguably much easier on the instructor than a traditional lecture and it can easily be adapted to different topics. Participants will come away from this Microbrew with the tools and resources they need to successfully implement this activity in their own classrooms.

ASM Curriculum Guideline Concept(s): Structure and function

3. Flipping the Classroom with Online Science Videos

Grand Ballroom III

S.S. Goodwin1, 2, L. Clement1, 2, R.D. Vale2, and J.M. Scholey2, 1American Society for Cell Biology, Bethesda, MD, 2University of California - San Francisco, San Francisco, CA, and 3University of California - Davis, Davis, CA.

The National Science Foundation’s “Vision and Change” report serves as a call to action for biology educators to bring active learning into the classroom and to teach students the scientific process. Much focus has been spent around alternative ways to deliver content outside of class, often called “flipping” the classroom, which allows educators time during class for active learning activities. One method of flipping the classroom involves assigning students to watch video lectures, which deliver most of the didactic content as homework.

In Spring 2013, iBiology piloted a senior-level cell biology flipped course. Students were assigned one or two 30-40 minute iBioSeminar videos, research talks by the leading scientists in their field, as homework before class. Students were also asked to complete assignment questions on the video, including a question to prepare for the class discussion. The assignment questions were designed to include lower order and higher order thinking questions. Throughout this course, we collected video analytics data using simple YouTube tools to find out how many times students viewed the videos. In addition, we surveyed students on their perceptions of the material at the end of the course. This course is being held again in Spring 2014, where we will collect similar analytics about the students’ experience.

In this Microbrew, I will talk about the lessons we learned from this flipped course, as well as provide an overview of some of the methods we used to promote scientific thinking in the class.

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

4. Three Laboratory Activities for Appreciation of Microbial Diversity

Marblehead Room

J.J. Huang. Olin College, Needham, MA.

The breadth of microbial diversity and range of microbial metabolic capabilities is astounding and...
This activity engages students in authentic research while they gain practice following detailed protocols meticulously. Students also hone their skills in graphing, data analysis, evidence-based argumentation and oral presentations.

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

6. **TWIM, TWIP, and TWIV: How I use Podcasts to Excite Students about Current Microbiological Research**  
*Newburyport Room*

**S.E. Lettini.** Gwynedd Mercy University, Gwynedd Valley, PA.

The use of technology in and out of the classroom is often used as a mechanism to engage students and can be used to increase critical thinking skills. Podcasts are an excellent way to introduce students to current topics and research in microbiology. The ASM produces three podcasts that are microbiologically focused: This Week in Microbiology (TWIM), This Week in Parasitology (TWIP), and This Week in Virology (TWIV). These podcasts are often presented in a similar manner to a journal club, as the presenters regularly invite guests to discuss current research papers. Since students often find reading scientific literature difficult and get bogged down in the details rather than seeing the overarching purpose of a paper, these podcasts have been used in a General Microbiology course to introduce recent research articles. The students were first assigned an original research article to read and review and they were also asked to generate questions pertaining to things they did not understand. Next, students listened to the corresponding TWIM, TWIP, or TWIV that discussed the article and used it to answer their questions. This was followed up with a classroom discussion of the article and subsequent podcast. The ASM podcast helped to demystify original research by providing details of the experimental design and presentation of the results in a language that is more casual and relatable. Students demonstrated greater critical thinking and comprehension of microbiology literature after listening to the podcast. This activity can be used in a variety courses including but not limited to: microbiology, biology, virology, and parasitology.

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

7. **Learning with iGEM**  
*Gloucester Room*

**B. Marintcheva.** Bridgewater State University, Bridgewater, MA.

Training students to acquire higher-order thinking skills such as analysis, synthesis, and critical evaluation is a must in the contemporary undergraduate education. The iGEM (International Genetically Engineered Machine) competition in...
I have designed a semester-long assignment for upper level molecular biology course that challenges students to analyze, evaluate and present an iGEM project using all available team resources and independent literature research. Two in-class round tables were used as a tool to monitor assignment progression and provide opportunities for brainstorming in small groups and questions. At the end of the semester each student presented their work using a media of their choice and received instructor and peer feedback on biological content and presentation technique. Students selected a topic based on their own aspirations, however the diversity of the iGEM projects allows for assignment content themes, if desired. The available iGEM resources facilitate productive discussion of various modes of scientific communication and offer insights about biological research as a process. Students perceive the task of analyzing material written by undergraduates as less challenging than reading primary literature, and get excited about the cool ideas behind most of the projects. The designed assignment could be viewed as a unique approach to peer teaching where students learn from the iGEM experience of other undergraduates and share their newly acquired knowledge in the classroom.

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

8. Student Exam Preparation Self-Assessment
Ipswich Room

J.A. Oliver. Cosumnes River College, Sacramento, CA.

Students spend time preparing for exams and other assessments, but what exactly are they doing to prepare? What does their study time entail? Prior to the first exam many tips are provided to students on how to study, on what to content to know, and the amount of time that should be spent studying, but without being with them every step of the way it is impossible to know exactly how they study. Immediately after taking the first exam, students are asked to complete an “Exam Preparation Evaluation”. This evaluation will provide the students and the instructor with insight into how to better prepare for the next exam. The form asks many questions including how many hours they studied, if they studied with others, if they were late or absent for any class sessions, how many hours they work at a job, what other classes they are taking, and many other questions. At the end of the evaluation they predict their grade on the exam. Upon receiving their graded exam, the students complete the last section of the evaluation and reflect on what they need to do differently to prepare for the next exam. Depending on the size of the class and the available time, instructors may also collect the evaluations and provide their own feedback to students based on the students self-evaluation. Again after the second exam, the students are provided with a few questions to reflect on their preparation and predicted performance on the second exam. Often students fail to use an exam as a learning experience, and these exam preparation evaluations offer students the opportunity to reflect and make adjustments to their study habits in hope of improving their success on exams and other assessments.

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

MICROBREW SESSION E: 11:50 AM – 12:05 PM

1. Writing to Learn in the Microbiology Classroom
Grand Ballroom IV

C.K. Bieszczad. Colby-Sawyer College, New London, NH.

Students often have difficulty retaining the abundance of information in content-rich science classes, like microbiology. Various disciplines in higher education, such social science and humanities, often utilize low stakes writing to help students stay engaged and to improve their higher stakes writing. Low stakes writing (also known as writing to learn) involves short, informal writing assignments that are not graded on organization, spelling or grammar; rather, they focus on content and learning.

There is a lack of information regarding the use and efficacy of low stakes writing in biology courses. I have instituted its use in my microbiology course in an attempt to promote learning, enhanced retention of information and to develop critical thinking. Upon completion of a set of material in the course, a low stakes writing homework is assigned. Hand written answers are encouraged. Typically, an appropriate response is a paragraph or picture. Students are graded on specific concepts that are key to understanding the course information rather than writing mechanics. These require students to review their notes for answers and put ideas together to complete the assignment. Students are graded on a +/- scale and these assignments have a very low point value in a course. This greatly reduces the amount of time it would take to grade a formal assignment. Student responses to short answer exam questions that focus on informal writing concepts were compared to short answer exam questions that were not reinforced with low stakes writing assignments. Students’ grades were much better on the questions that low stakes writing focused on, suggesting greater learning. This Microbrew session will focus on how to incorporate low stakes writing into microbiology class to enhance learning. Examples of
2. A Role for an Interdisciplinary Course in Teaching Fundamentals of Biology

Grand Ballroom III

L.A. Gregg-Jolly, Grinnell College, Grinnell, IA.

In an interdisciplinary course “Racing through Genetics”, students explore the role that science has played in the construction of race. Such an interdisciplinary course can be a way to advance three of the six core competencies for biology students outlined in “Vision and Change”, including developing student abilities to tap into the interdisciplinary nature of science, communicate and collaborate with other disciplines, and understand the relationship between science and society. Data using the pre-course/post-course Research on the Integrated Science Curriculum (RISC) survey support this. On a five-point scale, students reported at least a one unit level of increased experience with course elements such as “Use instruments/materials from other field of study”, "Integrate ideas from both science and non-science disciplines”, “Translate specialized language of a discipline into the language of other disciplines”, “New insights emerge from considering multiple disciplines”, “Judge relative contribution of disciplines to problem solution”, and “Study problems with simultaneous, interactive multiple causes”.

Although not an explicit objective, students also made gains in the ability to apply the process of science. Comparing gains in student learning queried in both the RISC survey (n=10) and the Summer Undergraduate Research Experience (SURE) survey (n=660), students in the course reported a significantly higher gain (4.6 on a 5 point scale with 5 as the largest gain) in “Understanding how knowledge is constructed”, compared to research students (3.2 with a standard deviation of 1.15). Course students also reported relatively high gains for “Understanding that scientific assertions require supporting evidence”, and an increase in their attitude that they “can do well in science courses”. These gains are especially surprising considering that the structure and format for this course was quite different than most biology courses. These data suggest a role for interdisciplinary courses that are often relegated to “non-major” status in biology curricula.

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

3. Student-Centered Teaching of Core Concepts in Microbiology as a Method of Active Learning

Hamilton Room

D.V. Harbour. College of Southern Nevada, Las Vegas, NV.

Student-centered teaching of core concepts provides active learning in microbiology and may facilitate a deeper learning experience for the entire class. Groups of five or six students choose a microbiology topic, such as, the healthy human microbiome and effects of dysbiosis in infection, allergy, and obesity, misuse of antibiotics and increases in superbugs, mechanisms of novel microbial emerging infections, and organic farming with soil bacteria compared to farming using chemical fertilizers. Student groups are given a list of questions to research to gain background knowledge about the topic. The student groups discuss their research findings of the topic within the group, and with the instructor, as well as, provide documentation of their research. Groups also provide the instructor with quiz or exam questions on their topic for the class, which are accepted or rejected based on level of blooms taxonomy. The groups assign background reading for the entire class prior to their presentation. The reading can be a peer reviewed journal article on their topic or a review from an expert journal source. The presentations are timed to coincide with the brief introduction of the core concept topic in the class. Groups manage their own informal presentations which includes discussing the questions provided by the instructor. The presentation may include videos, chalk talks, brief audiovisuals, or detailed discussion of original research. The group members must field questions by the instructor and class to test their understanding of the topic, and clarify the importance of the topic’s relevance to microbiology core concepts. Each group asks questions of the class about their topic in the form of a written quiz or oral discussion. Group exam questions may be modified by the instructor and placed on formal exams. Groups receive grades for the formal presentation and their role in the class discussion.

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

American Academy of Microbiology Topic: The Human Microbiome and How Microbes Can Help Feed the World

4. Using Case Studies to Prepare Students for Research Projects

Essex Room

K. Klyczek and M. Bergland. University of Wisconsin-River Falls, River Falls, WI.

In order to prepare students for conducting experiments and analyzing data, we have uses case studies that include experiments and data similar to what the students might generate. Putting students in the role of scientists interpreting and explaining the data engages them in thinking about issues such as experiment design and sample size, that will lead them to construct better experiments and be aware of potential problems and complicating factors. As an
example, we will demonstrate a case used in a first-year General Biology course where the lab consists of a research project focused on honey bee biology and investigating potential causes of colony decline. The case study is about a researcher testing the effects of pesticide exposure on virus levels in the bees. Using molecular biology simulation software (Case It, www.caseitproject.org), students run PCR gels, testing for viruses known to impact honey bee health. Participants in this session will work collaboratively to analyze the data and suggest modifications to the experiment design.

**ASM Curriculum Guideline Concept(s):** Information Flow, Laboratory Competencies

5. Strengthening Information Literacy in the Microbiology Course Using Padlet

*Newburyport Room*

K.A. Metera. Wake Technical Community College, Raleigh, NC.

Padlet is a virtual pin board that allows students to share information (documents, videos, images) on a given topic. This online application allows you to customize your board and privacy settings, as well as allow students to post by name or anonymously. This board is a fantastic tool to get students interested in the content of our upcoming lectures or gain a richer understanding of lecture content and laboratory activities. This semester, I have started using Padlet as a posting board for students to share peer reviewed scientific journal articles on various course topics. By creating posts in Padlet, students learn valuable information literacy skills such as how to use our library databases and how to differentiate between peer reviewed and common scientific articles. Various assignments, including lab reports and article summaries, can then be created using the information posted by students in these topic boards. Padlet has been a great tool for my courses, allowing students to collaboratively research topics, share their findings and enrich their learning.

6. Big City, Big Data - Urban Microbial Metagenomics

*Gloucester Room*

T.R. Muth1 and A.J. Caplan2. 1City University of New York - Brooklyn College, Brooklyn, NY and 2City University of New York, Manhattan, NY.

Advances in next generation sequencing (NGS) have revolutionized biomedical and environmental research to the extent that questions can now be addressed that seemed well out of reach only a few years ago. The urban microbial metagenomics authentic research project lets students take advantage of NGS and metagenomics to address engaging and meaningful questions centered on urban microbial communities. This focus on the city is significant: while a great deal of research has investigated microbial diversity from a wide variety of environments around the globe, the urban environments, where many students live and study, have largely been overlooked - despite the fact that a majority of the world’s population now resides in cities. The project addresses a number of concepts in the ASM recommended curriculum guidelines, including, human influences on the structure and dynamics of microbial communities, the relationship between the environment and metabolic characteristics required for survival and growth, and the changes that result from the interaction and exchange between the human microbiome and urban microbial communities. The urban microbial metagenomics project encourages students to use quantitative reasoning and graphing skills in assessing the data they collect and provides an opportunity to develop hypotheses and design experiments that can be used to address questions raised by their microbial community data. In our Microbrew talk we will describe how we have incorporated the urban microbial metagenomics into a large undergraduate lab and discuss the benefits, including the ability to provide large numbers of students with a research experience and the reduction of the number of students dropping or failing the microbiology lab. The urban microbial metagenomics project is novel, affordable, scalable, flexible and exciting, and we hope that we can work with others to help them adopt this project for use in their courses.

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

**American Academy of Microbiology Topic:** The Human Microbiome and How Microbes Can Help Feed the World

7. A Vertical Collaborative Laboratory Activity in Biology

*Marblehead Room*

J. Neely and S. Gall. Ashford University, Clinton, IA.

The modern biology curriculum focuses more on competency-building, while the academy-wide call for high-impact classroom practices continues to surge. One such practice involves heterogeneous collaboration between different student groups, such as those enrolled in different yet tangentially-related courses, on a common cause. A variation of this format pairs students of different experience levels for collaboration in a common field. The vertical approach to collaboration allows senior students to step into positions of leadership and authority, while junior participants are provided contact with peer mentors. Both student groups must rely on the other to actively participate and contribute to the design and implementation of an original experiment based on a foundational scholarly article.

We developed a collaborative independent laboratory investigation between a microbiology class (composed of sophomores, juniors, and seniors) and an introductory majors biology course (mostly freshmen). The students were divided into groups of three to four, mixing students between the microbiology and general biology courses. All students were assigned to read a previously selected paper on yeast cell growth, which served as the basis
for the collaborative project. Students first met to discuss the article together. A few weeks later, the groups discussed hypotheses relating to yeast growth and adaptation and developed an experimental design. The students then collaboratively collected data and wrote up their results as a formal research paper.

Over the course of the project, the microbiology students served as mentors to the general biology students. The comments were generally positive, although students at all levels were caught off guard by the amount of planning required for designing even a small research project. We are continuing this collaboration between the two classes for the foreseeable future, and we look forward to seeing students mature as they move into the mentorship roles in this project.

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

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8. **Using Case Studies to Stimulate Discussion of the Impact of Microbiology**  
*Ipswich Room*


ASM Curriculum Guidelines encourage us to design activities that reveal to students the impact of microbiology. We have used case studies to stimulate discussion of current topics of microbiology to highlight the impact of microbiology. We will describe how we have used two case studies both of which were written to engage students in learning basic principles of bacterial genetics as “jumping off” points for discussion of topics that highlight the impact of microbiology. “The Farmer’s Dilemma” case activity asks students to explain to a farming community the genetics associated with creating a corn plant engineered to express a toxin that kills a common corn pest. We have used this to engage students in discussion of the current thinking associated with the planting of genetically engineered corn (Bt corn): is Bt corn safe for the environment? Is Bt corn safe for consumption? Is Bt corn marketable? Similarly we have used the case study “The Cow of the Future” to engage students in investigating the common practice of adding antibiotics to cattle feed. This case describes a researcher who has developed a genetically modified organism to be fed to cattle as a probiotic. The GM construct requires selective pressure from antibiotics. The “Cow of the Future” case provides opportunity to discuss: What are the benefits/risks associated with the addition of antibiotics to cattle feed on the cow? On the environment? On the consumers of milk and meat? And what are the ethical, political, regulatory implications of adding antibiotics to cattle feed? We will describe how we use an online environment to structure discussion in our large enrollment (300 students) general microbiology course of these questions and how we moderate students research and evaluation of current information with respect to currency, reliability, and relevance.

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

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**MICROBREW SESSION F: 12:10 PM - 12:25 PM**

1. **Microbial Interactions: Demonstration using Halophilic Archaea as Model Organisms**  
*Marblehead Room*

J.M. Braganca, K. Mani, B.B. Salgaonkar, and D. Das. BITS Pilani, Goa, India.

Microbes are in constant interaction with one another in any ecosystem which can be mutually or partially beneficial. However the interaction concepts are difficult to demonstrate in laboratory. Therefore, we have designed a laboratory module demonstrating the inhibitory or stimulatory interactions between various halophilic archaeal genera.

Halocins are bacteriocins produced by halophilic archaea, which act on other haloarchaeal members by lysing them. Halocin production helps the producers to compete against space and nutrients during adverse conditions. From our previous studies we had identified the producer and indicator strains. We then divided students into groups and each group was given one producer and three indicator strains. The anti archaeal activity against indicator strains was demonstrated by agar well diffusion method and top agar overlay assay. The antiarchaeal activity was seen as zones of inhibition and the diameters were measured. The halocin production was then quantified and expressed in arbitrary units (AU).

The anti archaeal substance was characterized for its thermal stability at temperatures of 60°C to boiling as well as its stability at low temperatures like 4°C, -20°C and -80°C. Halocin stability at pH varying from 2 to 12 and resistance/sensitivity against various proteolytic enzymes like trypsin, proteinase K and chemicals like acetone were checked. Final part of the module contained the demonstration of proteinaceous nature of halocin by performing SDS-PAGE followed by gel overlay assay with the indicator strain.

This module demonstrates the microbiology of extreme microorganisms especially archaea otherwise difficult in laboratory conditions, microbial interactions in an ecosystem and basic proteomics. This module can be demonstrated over two semesters. In first semester the students can be taken for a field trip, collecting samples, isolation and characterising the isolates. And in the second semester, students can carry out the screening for anti archaean activity and characterisation of the anti archaean substance.

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

Grand Ballroom IV

S.L. Crane. Rutgers University, New Brunswick, NJ.

Even students who contribute to scholarly research are often unaware of what it takes to get a paper published. Additionally, undergraduates sometimes do not write more than a single draft of a term paper, and those who do tend not to have their work critiqued. I have designed a peer review process that addresses these two issues. The exercise has been implemented in a mixed undergraduate/graduate upper-level microbial ecology course. Provided with basic guidelines, the undergraduate students (researchers) submitted rough drafts of their term papers. The graduate (reviewers), provided with an original manuscript and reviewers’ comments, reviewed the rough drafts. The instructor (editor) added comments and suggestions as necessary, and returned the reviews to the researchers. The final submission from the “researchers” included final drafts of their papers, along with detailed responses to their reviewers. This exercise provided students with a realistic experience of the peer review process, mandated they write a well-considered final draft, and substantially improved many of their papers. This exercise is currently being adapted for an introductory level microbiology course for nursing students and has the potential to be used in any course in which a research paper is required.

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

3. Teaching Hypothesis Testing to First Year Students in a High Enrollment Biology Course using Web-Based Resources

Hamilton Room

J.K. Krontiris-Litowitz. Youngstown State University, Youngstown, OH.

Many first year students in life science programs do not understand the concepts of hypothesis testing and are unable to apply these concepts to make decisions about questions in science. This essential skill set is part of the core competencies identified in the 2013 Vision and Change curricular recommendations. In this project I attempt to teach these skills in a first year biology course for biology and health science majors. The initial teaching strategy, a classroom lecture on hypothesis testing, proved to be ineffective at remediating this deficiency. A second strategy, which engaged students in a class research project where they served as experimental subjects, was more successful. I present here the framework for this strategy, an out-of-class web-based assignment where students performed a class experiment using an online game or cognition test, recorded and analyzed data, tested the data for significance, and reported results with conclusions. Preliminary assessment data showed that class knowledge, understanding, and application of hypothesis testing skills had improved by ~40% at the end of the semester, indicating that this assignment helped students achieve competency in a core skill and was more effective than the classroom lecture. Session participants will have the opportunity to test and comment on the activity during the session and to review preliminary evidence of student learning.

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

4. A 3-month Grant Proposal Writing Activity for Undergraduate Students

Essex Room

M.J. Massimelli. Claremont Mckenna, Pitzer and Scripps Colleges, Claremont, CA.

Writing a convincing research plan is a skill scientists should develop early in their careers. To develop this skill, we have developed a structured proposal writing and oral communication exercise for a small upper division Molecular Biology discussion class which is used instead of midterms and a final. The grant proposal exercise consists of a series of mini-assignments which are due every 1-3 weeks over the course of three months, which allow the students to progress towards writing their own grant proposal and oral defense.

The mini-assignments include: 1) topic and big picture research question selection; 2) students find 10 papers to cite and write a citation statement with formatted bibliography; 3) students take 3 weeks getting familiar with their topic and drafting their preliminary studies and significance; 4) after receiving feedback on assignment 3, students are instructed to re-write their background and significance and expand the proposal listing 2-3 specific aims. Successful NIH-grant models are discussed during class to exemplify the wording and details required to write specific aims. 5) Students keep polishing their preliminary studies, significance and aims and add the experimental design and methods they will use to answer each specific aim. Successful NIH-grant models are once again provided and discussed to serve as a model. 6) for extra points, students read each other’s work and provide comments regarding writing, ideas and approaches. 7) Students revise their drafts and prepare an oral presentation outline. 8) Students give a 10 min-PowerPoint talk explaining their proposals to an audience of students and faculty, answering questions about their topic, aims and approaches. 9) Students write a polished final proposal.

Most students are very receptive to this method because they like the idea of developing grant-writing skills with mini-assignments to keep them on track.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
5. Investigating Microbiomes Using Next Generation Sequencing and Novel Culturing Techniques
Gloucester Room

T.D. Paustian, R.S. Kurtz, and J.T. Roll. University of Wisconsin, Madison, WI.

The final laboratory for Microbiology majors, a capstone course, requires students to draw on their collegiate education and use it to collaboratively work on a research topic. This course is patterned after an independent research laboratory. Groups of four students formulate a research question, design experiments, perform them, and analyze the resulting data. Finding a research topic that undergraduates can quickly master, and will yield results in 16 weeks, can often be problematic. With the rapid advance of DNA sequencing technology, the cost, and technical skill required to generate data has now made it possible to carry out these experiments in the undergraduate laboratory.

In the past three years, our students have investigated the microbiomes of two insects, Manduca sexta and Reticulitermes flavipes. They have also explored the microbial community associated with soil from a site contaminated with coal tar. Students created ssRNA amplicon libraries, performed 454 sequencing, and analyzed the data generated using the bioinformatic package mothur. In addition to this metagenomic approach, students developed innovative methods to culture microorganisms from these environments. Isolates were then identified by ssRNA sequencing and bioinformatic analysis. These experiments created novel data on these communities and contributed to the research efforts of faculty on campus.

Two assignments were of particular value. One, an NSF-style research proposal helped the students understand the project and refine their experimental design. Two, a summary poster presentation, attended by faculty, postdocs and graduate students, showcased their efforts and was a powerful motivation for the students. In this presentation I will discuss the strategies for developing research topics, exercises for preparation of the students, technical roadblocks and solutions, and proposals and posters created by the students. Methods for adapting this type of laboratory to any undergraduate institution will also be discussed.

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

6. Reinforced Interactive Learning Using Publisher's Artificial Intelligence-Based Learning Modules Compared to Classical Homework Assignment-Based Learning
Grand Ballroom III

K.R. Qanungo and J.A. Greene. Trident Technical College, Charleston, SC.

Trident Technical College is the largest technical college in South Carolina and a teach 200 level Anatomy and Physiology in a two semester and Microbiology in a one semester format following a departmental syllabus. Most of the students seeking a career in health and allied sciences take these courses. Although more than 1500 students take the Anatomy and Physiology I (BIO210), the success rate is very low compared to BIO211 (Anatomy and Physiology II) and BIO225 (Microbiology). The American Society of Microbiology Assessment Residency 2013-14 made us aware of several innovative assignments like interactive assignments, flipped classroom technology that have gained much attention in the science pedagogy recently. Moreover our college is going to adopt a 7 week compressed format starting Fall 2014. Keeping this scenario in mind we implemented some new learning strategies to assess the success rate of the students. The learning and success outcomes of the BIO210 students using some of these strategies are presented. A subset of students of the Fall 2013 semesters were assigned conventional homework which include reading a specific chapter and answering short answer type of questions. As these assignments were “completion only” without being graded, students were very reluctant to complete these assignments. So in the recentpast we adopted a new strategy where the students are required to register to the publisher’s website. Using McGraw-Hill “Connect”, we delivered a very interactive computer-based homework assignment where the learning environment is based on the individual student’s success curve. This artificial intelligence-based assignment understands the student’s strong and weak areas and reinforces the better learning of the weak area by adjusting the assignment. The students are graded by the system (not scored for the course) in their learning ability specific to the chapter. These assignments were made mandatory before they can take any chapter quiz. In the current ongoing study, subsets of Fall 2013 and Spring 2014 students are being compared. The detailed data of the correlation of the assignment competency and success in each of the components of the overall course will be presented.

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

7. Preparing for Course Compression to a Seven-Week Format: Using a Tablet App and a Pre-Recorded On-line Lecture Presentation
Newburyport Room

M.M. Whitehurst and J.A. Green. Trident Technical College, Charleston SC.

Trident Technical College seeks to enhance Student Success by implementing a 7-week compressed schedule starting Fall 2014 Semester. Lecture course objectives will remain the same. Microbiology, BIO 225, will be offered in compressed format. We wish to confirm that enhancements for the compressed-
format three-hour lecture periods comprise academically productive classroom time. BIO 225 curriculum modification utilizes ‘active learning’ and ‘flipped classroom’ format. The ‘active-learning’ component utilizes an iPad tablet app (application). The ‘flipped classroom’ method requires students to complete preparatory material before attending class. Class time is utilized for lecture objectives discussion. Fall 2013 semester curriculum was presented in traditional style using MS PowerPoint slides addressing lecture objectives in the familiar ‘stage on the stage’ method. Departmental common final examination results from the standard 14-week Fall 2013 semester are available for comparison to the enhanced curriculum 14-week April 2014 final examination results. We plan to capture similar data in the compressed 7-week Fall 2014 semester. Two specific enhancements of BIO 225 academic time usage are ongoing during the Spring 2014 semester. The first enhancement employs an active-learning tool, the Centers for Disease Control and Prevention tablet iPad app, “Solve the Outbreak”, to present infectious disease epidemiology topics. The second lecture enhancement is a ‘flipped classroom’ use of required pre-recorded MS PowerPoint lecture presentations captured using a screen-recorder and editing program (“Camtasia”) and embedded in the course management system online platform (“D2L”). Recorded videos cover lecture objectives for the topic “Control of microbial growth using disinfectants”. Class time is available for discussion of relevant current events topics. To take advantage of the instructional opportunity presented by the College’s course compression strategy, major BIO 225 curriculum evolution is mandatory. Integration of pre-recorded video presentations and useful tablet applications allows coupling of class-time and asynchronous curriculum delivery in a vibrant manner.

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

### 8. Microbiology Recitations: Resuscitating Student Critical Thinking Skills

**Ipswich Room**

S. Yung and T. Primm. Sam Houston State University, Huntsville, TX.

A troubling trend we’ve noticed in our pre-nursing microbiology classes is a decline in the critical thinking skills of our students. Students seem much more comfortable memorizing facts (lowest level of Bloom’s taxonomy), and display very limited ability to use acquired knowledge to solve problems. It is essential for these future health care professionals to be able to use information from patients to understand and assess best care practices.

To help students develop these skills, we initiated recitation sessions in addition to the lecture and laboratory. At these voluntary once-a-week 90 minute sessions, we use active learning strategies to reinforce concepts and solve problems. Study skills are also practiced. Activities include concept mapping, flash card sorting, interactive games, and case studies. Student response to these sessions has been overwhelmingly positive, and it has been encouraging to see them develop confidence in applying information learned in the course.

In this Microbrew session, we will be discussing recitation structure and strategies for developing problem solving skills.

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

**LUNCH**

12:30 PM - 1:30 PM

*Grand Ballroom I & II*

**POSTER SESSION B**

1:30 PM - 2:30 PM

*North Shore Ballroom*

The 2014 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 22 key microbiological topics, and two key skills and are based on concepts put forth in the 2011 national 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. See page 68 for Poster Abstract Content and Pedagogy Grid. Abstracts are found in the *Journal of Microbiology & Biology Education, Volume 15*, Issue 1.
2-B
Implementation of an Introductory Biology Large Course Redesign Facilitated by Undergraduate Learning Assistants
T.C. Bates and J.M. Warner. The University of North Carolina at Charlotte, Charlotte, NC.

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

4-B
Biology Service Learning Increased the Success of Freshman Biology Majors at Academic Risk in the First Semester Biology Course
D.F. Fox. Spring Hill College, Mobile, AL.

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

6-B
Comparable Benefits of an Inquiry-Driven Introductory Biology Course and a Summer Research Experience
L.A. Gregg-Jolly and J.C. Sandquist. Grinnell College, Grinnell, IA.

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

8-B
Student Reaction to Nontraditional Teaching in a Test of CREATE on Seven Campuses
S.G. Hoskins¹ and L.M. Stevens². ¹City College of the City University of New York, New York, NY; ²University of Texas, Austin, Austin, TX.

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

10-B
Building Skills for Complex Problem Solving through Explicit Instruction
M. Leonard. Mount Mary University, Milwaukee, WI.

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

12-B
Outcome-Based Method to Assess Student Learning over Different Time-Scales

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

14-B
Immunological Tools: Engaging Students in the Use and Analysis of Flow Cytometry and Enzyme-Linked Immunosorbent Assay (ELISA)
L.E. Ott and S. Carson. North Carolina State University, Raleigh, NC.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Course design, Hands-on projects, Student learning

16-B
Do Student-Generated Visual Models Promote Learning because they are Active, Visual, or Both?
K.J. Quillin. Salisbury University, Salisbury, MD.

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

18-B
Increases in Core Concept Knowledge within a Comparative Genomics Multi-Section Introductory Laboratory Class

ASM Curriculum Guideline Concept(s): Evolution, Pathways
Pedagogical Category(ies): Course design

20-B
Bacteria in the Dirt: An Inquiry-Based Lab Curriculum in the First Biology Core Course

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

22-B
Mining Concept Inventory Data For Student Alternate Conceptions

ASM Curriculum Guideline Concept(s): Advancing STEM education and research
Pedagogical Category(ies): Student learning
Improvement in Data Interpretation Skills through Student-Centered Tutorials with Direct Assessment

H. Verkade. Monash University, Melbourne, Australia.

ASM Curriculum Guideline Concept(s): Pathways, Systems
Pedagogical Category(ies): Student learning

AUTHOR CORNER
1:30 PM - 2:00 PM
Jones & Bartlett Learning Booth – North Shore Ballroom

Sponsored by Jones & Bartlett Learning

Featured Author: Jeffrey Pommerville


Award-winning author, Jeffrey Pommerville provides his engaging and student-friendly writing style in the fully revised and updated fourth edition of the best-selling, Alcamo's Microbes and Society. Comprehensive but accessible, this new edition features new information on viruses and microbial groups, new data on microbes in agriculture and the environment, current applications of genetic engineering and biotechnology, and fully updated coverage of microbes and the human microbiome.

PRODUCT CORNER
1:30 PM - 2:00 PM
Manchester

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REFRESHMENT BREAK
2:00 PM - 3:00 PM
North Shore Ballroom

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AUTHOR CORNER
2:00 PM - 2:30 PM
McGraw-Hill Education Booth – North Shore Ballroom

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Featured Authors: Denise Anderson, Barry Chess, Kelly Cowan, and Kathy Talaro

Prescott’s Microbiology, 9th edition

Join Denise Anderson, University of Washington, and lead author of Nester's Microbiology: A Human Perspective;

Barry Chess, Pasadena City College, and co-author of Talaro/Chess: Foundations in Microbiology;

Kelly Cowan, Miami University of Ohio and author of Microbiology: A Systems Approach and Microbiology Fundamentals: A Clinical Approach;

And

Kathy Talaro, co-author of Talaro/Chess: Foundations in Microbiology.

Stop by the McGraw-Hill booth to talk to the authors, and see a demonstration of our proven effective adaptive technology.

PRODUCT CORNER
2:00 PM - 2:30 PM
Manchester

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Featured Product: Microbiology, 1e

This 1st edition offers an ideal balance between comprehensive, in-depth coverage of core concepts, while employing an engaging, narrative style that incorporates many relevant applications and a unique focus on current research and experimentation. Rather than presenting material as discrete pieces, Wessner, Dupont, Charles frames information around the three pillars of physiology, ecology and genetics; which highlights their interconnectedness and helps students see the big picture. Learn more here: www.wiley.com/college/sc/wessner/

MICROBREW SESSIONS III of III
2:30 PM - 3:30 PM
(7 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.
MICROBREW SESSION G: 2:30 PM – 2:45 PM

1. Using Cell Phones as a Tool for Assessing Laboratory Skills
   Grand Ballroom IV

   R.P. Anderson and L.M. Young. Ohio Northern University, Ada, OH.

   Assessment of laboratory skills is important but can be challenging. We have developed a simple system to assess pipetting skills, equipment use, and bright field microscope techniques using student cell phone pictures and a classroom electronic portfolio. In this Microbrew, we will present our assessment criteria, the results of our initial feasibility study to determine which artifacts to collect and the initial outcomes of the implementation the program. The students found using their phones to take micrographs and other images motivating and the process was easy to implement. Also, evaluating the portfolios could be done quickly and accurately.

   ASM Curriculum Guideline Concept(s): Laboratory competencies

2. A Team-based Review Activity: Tournament of Pathogens
   Ipswich Room

   F.P. Downes. Michigan State University, East Lansing, MI.

   The objectives for this two session, interactive classroom activity were 1) to review the characteristics of microbial pathogens and commensals covered in the course; 2) to use credible resources to investigate characteristics of newly introduced microbes; and 3) to exchange knowledge among team members and classmates. Team packets consisted of eight sheets, each sheet listing a microbe representative of organ system pathogens, bacteria groups or normal commensals. On day one, each team received a unique packet and teams were instructed to complete information for each microbe in their packets in class using any resource. Students were encouraged to share and correct teammates’ work. Near the end of the day one class period, each team submitted its response to a five question quiz intended to encourage full participation. On day two, teams were given the same randomly selected category from the Wheel of Morbidity and Mortality. Some categories directed the team to select similar microbes. Other categories required teams to search all options for Each team selected one microbe from their packet and used their most persuasive means, including cheers, songs, jokes, and references to the instructor, to convince the judges why their microbe was best in that category. A panel of judges selected the best team responses. A minor extra credit score was awarded based on judges’ votes. In addition to the opportunity to review a large body of material efficiently, this activity provided an occasion for stronger students to assist classmates. The instructor acted as the game show host providing categories and calling for team responses. This role enabled her to provide corrections and additional information about the microbes in the teams’ responses. The competition provided students and the instructor a venue to explore their passion for microbiology.

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

3. Teaching About Controversy and Scientific Discourse Using the Primary Literature
   Marblehead Room


   The ability to read and evaluate scientific literature is critical for student success in graduate school, medical school, and in the scientific work force. However, there is an aspect of the literature that can often be overlooked by students – its role as a place for scientific discourse. When new ideas are presented in the literature, there can be considerable discussion among scientists, and likely some controversy, about the veracity of these ideas and their place in the greater body of scientific knowledge. While recently discussions of this type have occurred on social media platforms, there has always been a place in the scientific literature itself for comment and criticism in the form of letters, personal communications, and research articles that refute another author’s findings.

   To investigate this, students were assigned a set of papers and letters that concerned some controversial
opportunities. Activities and strategies for introducing new activities, to explore ways to expand the existing different institutes to learn about the existing research going to provide opportunity to faculty members from projects and other scholarly activities. Session is engaged students in interdisciplinary research among STEM and non-STEM faculty members have Research Initiative through which collaborative efforts an overview of our institutional Undergraduate answer important questions. This session will provide students with actively contested questions, empirical observation, cutting-edge technologies, and the sense of excitement that comes from working to find controlled variables in their culminating experiments then allows laboratory sections to fix controlled variables in their culminating experiments in week three. All the while, they are being asked to develop appropriate hypotheses, which are ultimately tested using statistical means. This approach allows our students to slowly learn the different aspects of experimental design using a single topic to prepare themselves for more advanced topics in biology and microbiology. While allowing our students to design the experiments takes time, we have found that students appear much more engaged while in the laboratory, actively debate the various procedural options and come up with much more intelligent questions on the material.

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

4. Undergraduate Research Experience at Two Year Institutions
Newburyport Room

R.B. Kumar. Minnesota State University and College Systems (MCTC), Minneapolis, MN.

There are many teaching and learning practices that are beneficial to students. However, some active learning practices are high impact that educational research suggests increase rate of student retention and engagement. One of such practices is undergraduate research experience for students. Many colleges and universities are now providing research experiences for students in all disciplines. At Minneapolis Community and Technical College, we initiated undergraduate research initiative (URI Co-directors: Dr. Renu Kumar and Dr. Rekha Ganungar) that provides students with opportunities to explore research. With strong support of different student organizations, science faculty, at the institution are reshaping their courses to connect key concepts and questions with students’ early and active involvement in systematic investigation and research. The goal is to involve students with actively contested questions, empirical observation, cutting-edge technologies, and the sense of excitement that comes from working to answer important questions. This session will provide an overview of our institutional Undergraduate Research Initiative through which collaborative efforts among STEM and non-STEM faculty members have engaged students in interdisciplinary research projects and other scholarly activities. Session is going to provide opportunity to faculty members from different institutes to learn about the existing research activities, to explore ways to expand the existing activities and strategies for introducing new opportunities.

Discussions will provide an opportunity to share best practices implemented by attendees and will potentially lead to collaborations among different institutions. I would share different techniques (PURE, CURE and SURE) and strategies that have worked at our institutions to develop undergraduate research programs and facilitate discussions about funding opportunities to support research at two-year institutions that will guide future directions.

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

5. Learning to Create Science – Using Enzyme Kinetics to Teach Experimental Design
Gloucester Room


All too often introductory laboratory courses follow the so-called cookbook. Using this approach, students are given step-by-step procedures and are asked to complete tasks in order to obtain a known answer. It has been our experience that students who have only used this approach in the laboratory setting are then unable to design their own experiments when asked to do so. We have thus designed a three week laboratory module for biology laboratory classes based around the topic of enzyme kinetics which leads the students through the process of experimental design. Starting in the first week they are given the opportunity to discuss and design aspects of various experiments. In addition to teaching experimental design and giving the students multiple opportunities to utilize design principles, each of these experiments then allows laboratory sections to fix controlled variables in their culminating experiments in week three. All the while, they are being asked to develop appropriate hypotheses, which are ultimately tested using statistical means. This approach allows our students to slowly learn the different aspects of experimental design using a single topic to prepare themselves for more advanced topics in biology and microbiology. While allowing our students to design the experiments takes time, we have found that students appear much more engaged while in the laboratory, actively debate the various procedural options and come up with much more intelligent questions on the material.

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

6. Constructing a Paper Model of an Antibody Molecule
Grand Ballroom I & II

F.N. Norflus. Clayton State University, Morrow, GA.

It is frequently difficult for students to understand the process of alternative splicing and how it is used to create a vast array of different antibody molecules. It
is explained that the host cell needs many types of antibodies to fight the numerous types of pathogens. This topic is covered in immunology classes, as well as in some microbiology classes. At the most basic level, the students are taught that antibodies have heavy and light chains and constant and variable regions and that the host cell can make many different types of antibodies by combining these regions. At the more advanced level, the students are taught that the heavy chain is formed by randomly joining together different V, D, J and C regions. The light chain is also formed by randomly selecting various V, J and C regions. This process creates great diversity. However, just drawing the segments on the board or looking at a picture showing how these segments join, is not always an effective teaching strategy.

To use more active learning approaches to explain this topic, I constructed paper models for each student that contained the DNA corresponding to the different V, J and C segments of the light chain of the antibody. The students were then told to work independently, randomly select one region from each of the areas (in different colors), cut them out and then tape them together to produce their final product. The V and J sequences then chosen by each student was written on the board and the class discussed how it was amazing that no one had the exact same sequences. It showed how the variability was produced and inherent in the original DNA strand.

The participants in this workshop will have a chance to make their own light chain antibody molecules.

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

### 7. A Stepped Writing Approach with Laboratory Reports

**Grand Ballroom III**

T.P. Primm, A. Lynne, and S.B. Yung. Sam Houston State University, Huntsville, TX.

Writing is a critical skill expected from a University education, and technical writing is particularly challenging, with its demand for accuracy and conciseness. The inquiry-based learning laboratory component of our pre-nursing and majors microbiology courses requires an end-of-the-semester report that spans experiments from seven lab periods. The exploratory experiments focus on the skin microbiome of a model organism. These courses are writing-intensive, as part of our Writing-Across-the-Curriculum initiative. Students, many of whom have limited science backgrounds and poor writing skills, find this report a daunting task. We have been utilizing a stepped writing approach to support students while keeping high standards. The assignment is broken into multiple steps, each with specific feedback mechanisms, to guide students through the writing process. These steps include initial summarization of data, writing an appropriate background and introduction, peer review, and revisions for technical accuracy and formatting through teaching assistant comments. Editing steps include utilizing the university Writing Center for correction of spelling and grammar, thus preventing this from being a burden on the instructors. We will share our experience with developing the stepped approach and seek input from others who have similar activities in their courses.

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

**American Academy of Microbiology Topic:** The Human Microbiome

### MICROBREW SESSION H: 2:50 PM – 3:05 PM

1. **Undergraduate Research Course within a Pre-allied Health Microbiology Course: Design and Preliminary Results**

   **Newburyport Room**

   A.M. Barral and H. Makhluf. National University, San Diego, CA.

   As first year pilot partners of Yale’s Small World Initiative (SWI), National University (NU) adapted the SWI research-based course framework to an 8-week accelerated pre-allied health microbiology course.

   Through the SWI, students perform antibiotic discovery research from soil bacteria of their local environment. Students acquire microbiology skills including aseptic techniques, isolation of pure cultures, use of selective and differential media, Gram staining, and selected biochemical tests. Emphasis is given to research methodology, record keeping, data analysis and presentation. Pre- and post course CURE and POS survey data are collected centrally through Yale, with IRB approval required for each institution.

   Our hypothesis is that a research-based curriculum can be adapted to accelerated courses using a carefully designed and streamlined design, as well as the student satisfaction would be similar to more traditional course deliveries.

   To test this, 1) we modified an existing Introductory Microbiology course by blending the research-based course outline with laboratory skill activities required as part of the pre-allied health curriculum, and 2) performed a preliminary assessment of the Classroom Undergraduate Research Experience using onsite surveys and course evaluations.

   We found that 1) the SWI curriculum could be adapted to an 8-week accelerated schedule, with students obtaining and preliminarily characterizing antibiotic-producing soil isolates, and 2) students expressed satisfaction about doing real life research.

   When pre-surveyed on the likelihood that they’ll be research scientists, 90% were unlikely to do so, 10% undecided. In post-surveys, 27% considered a
Masters degree in the life sciences, 13% an MD degree, and 13% a Ph.D. in a biology-related field such as infectious diseases. The course was found to be “exciting, really peak interest in research and molecular biology.”

We will present NU’s implementation curriculum and share lessons learned and best practices.

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

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### 2. Small World Initiative: Crowdsourcing Antibiotic Discovery a Pilot Partner Perspective

**Marblehead Room**

**D.M. Hartman.** Baylor University, Waco, TX.

This year our lab is a pilot partner with the Yale University Small World Initiative. The purpose of this design is to excite the imagination of undergraduates and encourage a hands-on approach to understanding scientific concepts with “real-world” applications. It is an opportunity for freshman and sophomore students to apply basic lab techniques to soil analysis and isolation of soil microbes. The ultimate intent is to retain students in STEM, by having them participate in science through development of experiments, documentation of discoveries and learning experiences in a lab notebook, and discussion of observations and results. Science is fun, never boring.

Students do the actual soil collection, gross soil analysis, preparation of serial dilutions and spread plates. Microbes that exhibit zones of inhibition on spread plates are isolated and run through basic biochemical and molecular tests for identification. Students use a simple patch plate test to assess antimicrobial activity against 6 ESKAPE pathogens, *Enterococcus faecalis, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumanii, Pseudomonas aeruginosa*, and *Enterobacter cloacae*. Ethyl acetate extractions are prepared from agar. Extracts are tested by a modified Kirby Bauer method to assess zones of inhibition against the same 6 ESKAPE pathogens.

Students work in groups of 3-4 and present their findings as a poster at our university’s Scholars Day. This provides an opportunity for students to take ownership of their work, describe their methods to other students and scientists, and to explain the significance of their findings. Their “take home message” is, “Science is engaging, Science is fun, Science is relevant.”

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

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### 3. What’s in that SCOBY?: Independent Projects using Isolation Techniques, Biochemical Tests and Microscopy to Characterize Kombucha and Kefir Microbial Communities

**Grand Ballroom IV**

**L. Olendzenski.** St. Lawrence University, Canton, NY.

Independent projects in the introductory microbiology lab allow students to gain experience with experimental design, basic microbiology techniques and oral and written presentation of original findings. Fermented foods provide a readily available and relatively safe system for microbial investigations. With the current popularity and availability of artisanal fermented foods, it is easy to obtain complex microbial communities used as starter cultures for kombucha and kefir. Kombucha starts as sweetened tea that is fermented by a Symbiotic Community of Bacteria and Yeast (SCOBY) that can be purchased as a starter culture or regenerated from commercially available kombucha drinks. The mature SCOBY community forms a cohesive cellulose pellicle that allows it to sit on the surface of the tea. Yeast ferment sugar to alcohol and CO2. *Glucosacetobacter, Lactobacillus* and other bacteria produce gluconic, acetic and lactic acid. Kefir is a fermented milk beverage created by kefir grains; the community of yeast and bacteria, including lactic acid bacteria, contributes to ethanol, acid and CO2 production. For these experiments, pairs of students fermented their own batches of kombucha or kefir outside of the laboratory (in dorm rooms and kitchens) and then brought subsamples into the microbiology lab for testing. In the lab, students used standard techniques of serial dilution, isolation onto agar containing bromcresol purple as a pH indicator and biochemical tests available in the lab to characterize and quantify isolated organisms. Students studied variables such as comparison of two different available SCOBY on the fermentation of kombucha and the effect of different milk type on kefir grains. In this Microbrew I will share the techniques used and results we obtained and look for ways that the identification of the organisms involved can be improved.

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

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### 4. Engaging Students through an Open-Ended Microbial Identification Project

**Gloucester Room**

**J.R. Powell.** Gettysburg College, Gettysburg, PA.

Savvy microbiology students quickly realize that professors or professionally-designed lab manuals tend to set up experiments so that each of the provided strains exhibits one of the possible phenotypic outcomes of the test(s) studied on that day. The laboratory period degenerates from a time of exploration and mastery of concepts to a race to match the different species, by process of elimination, with the possible results to obtain the Right Answer and leave as quickly as possible. Even the classic “unknown” lab usually consists
whose identities are known to the professor. At Gettysburg College, we have made simple adjustments to classic lab exercises so that the students are required to master a canon of microbiology techniques in the context of a guided research project. In the course of the semester, they learn the importance of good controls for the valid interpretation of their data. They see how not all experiments give clear-cut results and so the strongest conclusions are often arrived at via multiple replicates and multiple approaches. They learn that they must be responsible for and confident in their data since the Right Answer is not known even by the professor. The students complete their research experience by writing a primary research paper as if for publication. Students in this course have expressed a better understanding of the process of science, high levels of mastery of basic techniques, and a strong sense of ownership of their projects.

ASM Curriculum Guideline Concept(s): Advancing STEM education and research, Laboratory competencies
American Academy of Microbiology Topic: The Human Microbiome

5. A Semester-Long Project in Reducing Student Personal Plastic Usage
Grand Ballroom III

S.M. Richart. Azusa Pacific University, Azusa, CA

The Liberal Education and America’s Promise (LEAP) initiative has developed learning outcomes for liberal arts education that include students cultivating a sense of social responsibility “through ethical reasoning and action.” Taking a virtue ethics approach, students in lower-level general microbiology (both nursing majors and biology majors) were challenged to monitor and limit their usage of plastic during the semester in an attempt to foster the virtue of temperance toward plastic consumption, while also recognizing that plastics are not readily biodegradable by microorganisms. The assignment was introduced in the 3rd week of class by way of a very short reading assignment from Microbe Magazine, which briefly outlined the lack of biodegradation of ocean plastics by marine microbes. Once the microbiological and ecological problem was discussed in class, students were responsible for keeping an ongoing journal of weekly entries in which they were to reflect on their plastic usage, their awareness of the ubiquity of plastic, their ability to limit their plastic usage, and how their self-imposed limitations affect their lives in an attempt to provide them opportunities for “low stakes” writing assignments. Students turned in their journal entries at the very end of the semester. Throughout the semester, the assignment was connected to other biological topics, like metabolism, and students were sometimes given a chance at the beginning of class to talk to each other about their project and share with the class.

6. Active Learning & Modeling Activities to Teach Immunology Concepts
Grand Ballroom I & II

A.H. Williams, H. Masonjones, and R. Waggett. University of Tampa, Tampa, FL.

Active learning and modeling teaching tools have been used successfully in my classroom to teach Immunology concepts. Two of these techniques I created, The Deadly Hershey’s Kiss & the Construction paper activity, have been used routinely and successfully in upper division Immunology and Microbiology for Allied Health courses. I will introduce these techniques briefly at the Microbrew session. I will focus the Microbrew discussion on the third recently developed tool called INFECTION, an Immunology Board Game, to receive feedback and suggestions for use in the college classroom. I have presented this tool to middle and high school teachers as part of a Science Math Masters grant funded by the Florida Department of Education and administered by University of Tampa faculty in partnership with K-12 educators and administrators in Florida. Although the game was developed for middle and high school teachers, it is adaptable to all levels and useful in the college classroom or lab for modeling concepts such as primary and secondary response, vaccinations, specificity, autoimmunity, and HIV. The INFECTION game utilizes a lymph node as the game board, case study scenarios, different colored balls as B cells, T cells, and antigens, clothespins as antibodies, a foam “pacman” ball as a macrophage, and a roll of the die to move you to the next Immune step to clear the infection. As you wait for each individual immune step, microbes are doubling (represented by pinto beans) and the game is a race between microbes doubling and antibody production. The game can be used to visualize and model several important immune concepts including vaccinations, B cell, T cell, and antigen specific interactions, HIV, autoimmunity, and would be appropriate to use in courses where Immunology concepts are discussed including Microbiology, Immunology, Introductory Biology, and Non-majors Biology.

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

7. Size Matters!?! Teaching Size and Scale in Introductory Biology/Microbiology
Ipswich Room

M.S. Wollenberg. Kalamazoo College, Kalamazoo, MI.

One challenge to teaching biology, and specifically microbiology, is getting meters tall students to think at the scale of a micrometer-long cell or a nanometer-wide molecule. Although undergraduate students at all levels have a general sense of the relative size of biological entities (e.g. viruses and bacteria are much
smaller than humans but are bigger than molecules), few of these same students can articulate a proportional or comparative sense of size.

For example: If an E. coli cell was as big as an average human, how large would one of that E. coli’s ribosomes be? (Similar width to a half-dollar coin) How about a macrophage? (Similar length to a blue whale) Or the length of the human large intestine? (Similar distance from Chicago to Boston, as the crow flies)

This Microbrew session will demonstrate one simple and flexible active learning strategy that I use to teach size and proportion to students in introductory biology and microbiology classes. This strategy involves the use of a classroom wall-sized, labeled number line that spans roughly 12 or more orders of magnitude. The number line activity allows for both kinesthetic and visual learning of relative proportions.

During this Microbrew, attendees will participate in one demo of this activity and I will hand out my template for it and some proportional size estimates I’ve used for my teaching in the past. I will discuss how this activity can be easily adapted to different learning goals and classroom timeframes depending on the topic taught and needs of the instructor.

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

**American Academy of Microbiology Topic:** The Human Microbiome

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### MICROBREW SESSION I: 3:10 PM – 3:25 PM

1. **Let’s Draw an Immune Response! A Collaborative Learning Strategy to Integrate the Cellular and Molecular Aspects of the Immune Response Against Different Pathogens**
   **Grand Ballroom I & II**

   **M. Borrero.** University of Puerto Rico - Rio Piedras Campus, San Juan, PR.

   One of the goals of the Introduction to Immunology course is to understand the cellular and molecular events that occur upon first-time infections (primary responses). The effector mechanisms involved in a primary response vary according to the pathogen causing the infection. Textbooks traditionally focus their presentation of primary responses against extracellular bacteria and virus. I designed an in-class assessment activity in which students were required to draw all the cellular and molecular events that occur in a primary immune response, from infection to clearance, to different types of pathogens. Students teams of 4-5 were randomly assigned a pathogen category (e.g., virus, protozoa, extra- or intra-cellular bacteria, fungi, helminths, etc.). A total of 2-3 groups worked independently for each pathogen. Each group received a sheet of easel pad paper and markers. Students researched and explained to each other the different aspects that needed to be represented in their drawing. This activity was planned to last approximately 20-30 minutes. However, students were so enthusiastic and excited about their work that they asked to remain working for the full class period (i.e. 80 minutes). At the conclusion of the class, each team took a picture of their drawing and these were posted in the course’s electronic platform. A representative drawing for each pathogen category was presented and discussed in class. It is noteworthy that all of my 100+ students were actively engaged in this activity and it became the highlight of the semester. Students’ interest, participation and motivation increased; they researched the primary literature and felt empowered of their knowledge. Moreover, I was able to assess their understanding of the immune response and had them apply the concepts developed throughout the semester to the different pathogen scenarios that were not previously considered in the course.

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

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2. **Teaching Microbiology Through Civic Engagement**
   **Marblehead Room**

   **S.M. Hinsa-Leasure.** Grinnell College, Grinnell, IA.

   To connect students to our local community and environment, I have partnered with farmers to investigate microbial communities and antibiotic resistance associated with hog manure. I have incorporated these civic engagement activities into mentored student research projects and into classes at all levels of our curriculum. A majority of our studies have focused on two local hog concentrated animal feeding operations (CAFOs) and one open-air hog farm. Students have visited the sites to see up-close how the hog industry is run in our state. We have enumerated *Escherichia coli* and *Enterococcus* from manure, soil that has been impacted by manure, and sediment from streams into which the soil drains to assess the spread of fecal bacteria. Our isolates are tested for antibiotic resistance through culture assays and PCR analysis. We have also extracted total DNA from CAFO hog manure to determine the prevalence of several main classes of antibiotic resistance genes. The farmers are provided with copies of our studies and more importantly they are involved in open and on-going discussions of antibiotic resistance associated with animal agriculture. My goal of these activities is to have students take the skills they have learned in the laboratory, such as sterile technique, dilution plating, PCR, and DNA extraction, together with concepts they have learned in class, to address an important environmental challenge. Through these civic engagement activities we are able to discuss the importance of conducting research free from pre-conceived ideas and projected outcomes. Students are introduced to our complex animal agriculture system, see where their food comes from, and begin to understand how choices they make may impact the environment.

**ASM Curriculum Guideline Concept(s):** Impact of microorganisms, Advancing STEM education and research
3. Praying Mantis: Enhancing Learning Processes Through Intentional Lab Activity Design

Grand Ballroom IV

H.A. Makhluf and M.R. Maxwell. National University, La Jolla, CA.

Undergraduate research opportunities and collaborative assignments are considered high impact educational practices. Experts believe that providing students with research projects early on in their educational journey will lead to better learning outcomes, student retention and higher graduation rates.

We tested the hypothesis by replacing a traditional textbook protocol with an authentic research activity. Students were asked to determine the mantis microbiome and postulate possible influences of the microbiome on the behavioral phenotype of the adult female species, in those native to California (Stagmomantis limbata) versus those introduced from Europe (Mantis religiosa) and the Mediterranean rim (Iris oratoria). Finally, they were encouraged to formulate new hypotheses pertaining to this activity.

While there were many similar colonies in mantises sharing the same habitat or living in captivity possibly in shared quarters, students did find unique colonies in Mantis religiosa and Stagmomantis limbata. This sparked genuine student interest in the scientific process, from sequencing the unique bacterial species and identifying it at the molecular level, to possibly performing adoptive bacterial transfers to test their proposed hypothesis.

Surveys were used as indirect measures of assessment, while inquiry, analysis and critical thinking rubrics were used for evaluating the quality of students’ work. Mean % score per student was above 80%, which met the acceptable target achievement. 86% of students believed that they would be capable of applying their critical thinking skills acquired in the course. Moreover, more than half responded that they would consider pursuing a career in science. In fact, three participants communicated their strong interest to complete research projects later with the professor. In summary, the intentional design of a lab activity that borrows from students’ environments may provide a greater impact that not only emphasize the importance of the characteristics and methodologies of research and scholarship, but may spurn students on to further critical thinking, collaboration and creative work.

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

4. Turning Student Microbial Diversity Surveys into Peer-Reviewed Publications

Newburyport Room

S.C. Nold. University of Wisconsin-Stout, Menomonie, WI.

Managing teaching and research obligations can be challenging. One way I engage students while accomplishing research goals is to ask them to generate original, publishable data. I then harvest those data (often from many semesters) and share them with the larger research community. Using molecular techniques, my students studied cyanobacteria and their associated phage in Lake Huron, grasshopper evolution, honey bee gut microbial diversity, and the microbes associated with Varroa destructor, a honey bee parasite. We are now working on investigating the bacterial diversity in a phosphorus-impacted lake. In all cases, the data have been disseminated through scientific outlets and some resulted in peer-reviewed publications (three so far and counting!). Students keep a patent-friendly laboratory notebook, extract, amplify, clone, and sequence DNA from natural samples, use bioinformatics tools (KEGG, GenBank BLAST, treeing programs) to analyze data and generate figures and tables for publication, write materials and methods sections for the laboratory work they perform, and think about their discoveries and personal development during formal reflection exercises. This approach differs from other open-ended inquiry approaches in that its goal is publication of student findings. Students sense the authenticity of the experience and respond admirably. We are now successfully using this approach in a non-majors biology course. This presentation will share approaches that allow publication of student findings, touch on assessments of student learning and development, and explore how aspects of individual scholarly activities can be applied to classroom-based research experiences.

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

5. Life in a Column: From Lab Course to a Diverse Research Lab Experience

Gloucester Room

S.T. Parks. Georgia State University, Atlanta, GA.

While traditional lab courses may include both standard and inquiry-based experiments, many lack cooperative and authentic lab experiences. Such experiences are important for microbiology students and burgeoning researchers. A lab series was created to engage students in an authentic research endeavor. In this novel lab environment, students constructed Winogradsky columns using common soil and water sources for all columns. During the initial column incubation, students learned traditional methods for identification of microbial strains including staining, microscopy, biochemical methods and 16S-rRNA sequencing. Concurrently, students submitted mini-proposals to experimentally challenge and
assess their individual columns. Students were encouraged to use both basic identification methods and more advance modes of study to pursue and study the effect of such challenges, including enrichment with nitro-compounds, hydrocarbons, acids and other environmental stressors, within the columns. The students were required to maintain accurate lab notebooks regarding their experiments and progress. All students participated in weekly lab meetings, in which lab groups shared progress and assisted with trouble-shooting and improving experimentation among their lab-mates. At the end of the semester, students gathered in a conference to present and share their data and conclusions. By engaging in weekly meetings and a final conference, students were able to construct a snapshot of the microbial diversity, including phylogeny and metabolism, in the soil and water used to construct the Winogradsky columns. By using a common soil and water source, students were able to observe an array of diversity within individual columns and extrapolate towards the tremendous microbial diversity in the initial soil and water samples. Equally important to the data obtained, the students engaged in a collaborative effort through discussion, trouble-shooting, weekly meetings and the summative conference. Such efforts enabled students to go beyond a traditional laboratory course experience and participate in an authentic research experience within an undergraduate lab.

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

6. Big Problems: A Solution to Teaching Microbiology in the Age of "Omics" Systems Biology
Grand Ballroom III

S.B. Stockwell. James Madison University, Harrisonburg, VA.

Flipped classroom models relinquish class time for team-learning and complex problem solving, but often instructors are left in a quandary about how to structure class activities for maximum impact and engagement. Here I present a “big problems” model for writing simultaneous-response team activities. That is, using a real-world complex problem as a scaffold for exploring otherwise difficult topics to “teach” in a traditional microbiology class—molecular methods, troubleshooting, and data analysis, contextualizing biotechnology into a social framework, and systems thinking. One such activity was built upon the ongoing Haitian cholera epidemic and used to explore topics such as microbial pathogenesis, Next Gen sequencing and genomics, single nucleotide polymorphisms (SNPs) and phylogenetic trees, ethical reasoning, epidemiology, and the analysis of potential intervention methods using biological network and Susceptible-Infected-Recovered (SIR) modeling. Students are guided through and immersed in the problem through the use of video and newspaper clippings and radio podcasts. Along the way, data is revealed, conclusions are drawn, and decisions are made in the form of rapid-fire team simultaneous-reporting. This session will explore what it takes to construct and implement “big problem”-based team activities at the whole and partial-course level—from inspiration to classroom management to student assessment.

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

EVENING FREE
3:30 PM

EXHIBITOR AND POSTER TAKE-DOWN
3:30 PM - 4:00 PM
North Shore Ballroom

BUSES LOADED TO ASM2014 FIELD TRIP - REGISTERED PARTICIPANTS ONLY
3:45 PM - 4:00 PM
This is a ticketed event and badges will be marked with “asm2014 field trip” for registered attendees and serve as bus tickets.

Field Trip Buses Sponsored by John Wiley & Sons, Inc.

ASM2014 KEYNOTE SESSION & RECEPTION
5:00 PM - 8:30 PM
Boston Convention Center
Grand Ballroom East and West

Keeping Signals Straight inside Bacteria
Michael T. Laub, Massachusetts Institute of Technology

Good Fences Make Good Neighbors: How We Maintain Symbiotic Relationships with Our Intestinal Bacteria
Lora Hooper, UT Southwestern Medical Center

Climate Change and the Unravelling of Microbial Partnerships in the Ocean
Ove Hoegh-Guldberg, ASM Lecturer, The University of Queensland

BUSES LOADED TO THE DOUBLETREE BY HILTON BOSTON NORTH SHORE
8:45 PM
SUNDAY, MAY 18

NETWORKING BREAKFAST - FREE FOR ALL!
7:00 AM - 7:45 AM
Grand Ballroom I & II

You are on your own! Take a chance. Sit at a table where you recognize no one. Experienced faculty, introduce yourself to a first-timer. First-timers, hobnob with a speaker or ASM leader. Go outside your comfort zone! You never know, you may meet a collaborator or a friend for life. Many close friendships were born and nurtured at an ASMCUE meeting.

CLOSING PLENARY LECTURE
8:00 AM - 10:30 AM
Grand Ballroom I & II

ASMCUE and asm2014 Joint NextGen Microbiologist Plenary Session

This is a joint interactive lecture where the asm2014 education plenary session will be live-streamed to ASMCUE attendees.

Convener:
Joanne M. Willey, Hofstra University

Facilitating and Disrupting Student Engagement: What Do We Know and How Do We Know That?
Daniel D. Pratt, University of British Columbia and 2012 Imogene Okes Awardee for Outstanding Research in Adult Education

Teaching Your Students to Think Like a Microbiologist: Let Them Practice What You Preach
Erica L. Suchman, Colorado State University and 2013 Carski Foundation Distinguished Undergraduate Teaching Award

Integrating Authentic Research into the Life Sciences Curriculum at Public Research Universities
Erin R. Sanders, University of California, Los Angeles and Center for Educational Innovation in the Life Sciences

Crazy for CREs
David J. Asai, Howard Hughes Medical Institute

Helping Diverse Students Transition from Undergraduate to Graduate Classes - an

Intensive, Inquiry-Based Laboratory Course
Alison E. Gammie, Princeton University and 2013 William A. Hinton Research Training Awardee

The pace of discovery in microbiology continues to accelerate, with new sequencing and imaging technologies allowing questions to be answered that would not even have been asked 10 years ago. The implications of these discoveries have ramifications throughout science. Soon it may seem incredible that organismal biology was ever taught without reference to the microbial partners that every organism relies upon or that climate science was ever taught without reference to the microbial world that is responsible for driving nutrient cycles. At the same time, advances in the science of education and learning – combined with an ever-expanding menu of ways to package and convey information – mean that new teaching approaches can be evaluated for effectiveness, disseminated, and put into practice more easily than ever before. How can microbiology capitalize on this moment of opportunity to revolutionize microbiology education – ideally leading the way for other science educators? What have empirical studies taught us about how people learn, what attracts students to the sciences, and what keeps them there? How can undergraduate microbiology education, even in major research universities, be transformed from passive knowledge transfer into an active, creative experience? How can the culture of research be changed so that teaching is seen as an integral part of being a successful scientist? How can the essential role of microbes be incorporated as a central theme in biology education? Every microbiologist, at every career stage, has a stake in the quality of microbiology education. Whether you already teach biology, are considering a career in teaching, mentor graduate students, or simply want to know more about how microbiology is being taught in effective and innovative ways, you will be richly rewarded by the talks in this session.

CONFERENCE WRAP-UP
10:45 AM -11:15 AM
Grand Ballroom I & II

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

END OF CONFERENCE
11:15 AM
STAYING INVOLVED WITH ASM AFTER ASM CUE

STAY IN TOUCH
- Sign up for EduAlert and receive announcements and updates from ASM Education
- Sign up for electronic table of contents (eTOC), *Journal of Microbiology & Biology Education (JMBE)*
- Sign up for electronic table of contents (eTOC), *MicrobeLibrary (ML)*
- Sign up for Microedu listserv and discuss issues around teaching, learning, & career development
- Sign up for ASM Division W and join the ASM educator community

SHARE YOUR WORK – Submit:
- Abstracts and presentations to:
  - ASM Conference for Undergraduate Educators
  - ASM Branch or ASM Regional Branch Meeting
  - Division W Poster Sessions, asm2015
- Manuscripts to *Journal of Microbiology & Biology Education*
- Resources to MicrobeLibrary.org:
  - Questions to Critical Thinking Question Database
  - Visuals to Gallery, Visual Media Brief and Protocol Collections
- Learning activities to the K-12 Classroom and Outreach Collection
- Applications to the NSF/ASM Biology Scholars Program (ASM BSP), ASM Undergraduate Research Fellowship (ASM URF), NSF/ASM Leaders Inspiring Networks and Knowledge (ASM LINK)

REVIEW - Serve as a reviewer for:
- Manuscripts, *Journal of Microbiology & Biology Education* and resources, *MicrobeLibrary*
- Abstracts and travel grants, ASM Conference for Undergraduate Educators
- Abstracts and travel grants, Annual Biomedical Research Conference for Minority Students (ABRCMS)
- Applications, ASM undergraduate student research fellowships (ASM URF)

MENTOR – Lend your expertise and support:
- A first time attendee, graduate student, fellow or pre-tenured faculty member at ASM CUE
- Another faculty member at a 2- or 4-year institution in your area
- A new or prospective ASM Biology Scholar or ASM Science Teaching Fellow
- An undergraduate student interested in the
  - ASM Undergraduate Research Fellowship
  - Annual Biomedical Research Conference for Minority Students
- A prospective member in your department or from a former workplace who’s interested in teaching
- A graduate student interested in ASM student professional development opportunities
  - ASM Science Teaching Fellows
  - ASM Kadner Institute in Preparation for Careers in Microbiology
  - ASM Scientific Writing and Publishing Institute

LEAD – Every member a mentor; every CUE attendee a leader.
- Encourage and support colleagues to participate in ASM Education
- Sponsor a brown bag lunch for graduate students, fellows and faculty on best educational practices
- Sponsor a career day, research symposium and ASM student chapter for students
- Sponsor a session and represent ASM at a biology teacher and/or student meeting
- Sponsor education topics at science meetings, blending science and education
  - ASM regional branch meetings
  - Scientific conferences
  - Annual Biomedical Research Conference for Minority Students (ABRCMS)
  - asm2015 in New Orleans, Louisiana
- Build a collaborative team of diverse expertise and resources such as undergraduate educators (pedagogy and students) and scientific researchers (science, trainees, facilities and equipment)
  - ASM/NSF Leader Inspiring Networks and Knowledge (ASM LINK)
  - ASM/NSF Biology Scholars Program
  - ASM Undergraduate and Graduate Research Fellowships

SHOW APPRECIATION
- Have coffee with your dean and show appreciating of his/her support in ASM CUE and education reform
- Be certain to describe best ideas, plans to incorporate new thinking, and lead colleagues and students

Contact education@asmusa.org for more information.
Poster Abstract Author
Content and Pedagogy Grid

**Aligning ASMCUE Abstracts to Biological Concepts**

The 2014 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 22 key microbiological topics, and two key skills and are based on concepts put forth in the 2011 national 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.

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*21st Annual ASM Conference for Undergraduate Educators, Danvers, Massachusetts*
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ASM/CDC Postdoctoral Research Fellowship
Two-year research experience at a CDC laboratory
Application Deadline: January 15

ASM Robert D. Watkins Graduate Research Fellowship
Three-year research experience at home institution
Application Deadline: May 1

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URL: www.asm.org/students and www.asm.org/postdocs
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- Responding to reviewer comments
- Learning how to be a good reviewer

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Questions?

URL: www.asmgap.org • E-mail: asmgap@asmusa.org
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Call for Abstracts
- Must be an undergraduate sophomore, undergraduate junior, or senior; postbaccalaureate student; or graduate student as of November 12, 2014
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Type of Award | Award Covers
--- | ---
Partial Travel Awards | Housing
Full Travel Awards | Registration, housing, and air travel

Important Deadlines
Abstract Submission | September 5, 2014
Travel Award Application | September 5, 2014
Judges’ Travel Subsidy Application | September 26, 2014
Discount Registration | October 21, 2014

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SLAMD is peer-reviewed multiple choice questions designed especially for interactive learning using audience response systems. These questions are also of value for pre- and post-tests or traditional exams, and may be used in the classroom or laboratory or online in blended-and distance-learning experiences.

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Biology Scholars is sponsored by the ASM Education Board with support from the National Science Foundation (Grant #1022542).
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Medical Biotechnology
Authors: Bernard R. Glick, Cheryl L. Patten, and Terry Delovitch

In this jargon-free, easy-to-read textbook, the authors demystify the discipline of medical biotechnology, and illustrate how biotechnology has radically changed the way we think about health care. This textbook focuses on the role of biotechnology in human medicine, and describes the development of tests and treatments that are currently available or that will be available in the near future.

Audience: Premed and medical students, dental students, and professionals.

Print: 978-1-55581-705-3 | eBook: 978-1-55581-889-0
List and ASM Member Price: $120

Principles of Microbial Diversity
Author: James W. Brown, North Carolina State University

A microbial diversity course is considered one of the three core courses of a complete microbiology education. Principles of Microbial Diversity is based on the author’s senior-level lecture/lab course Microbial Diversity, which he has been teaching for over 20 years. The book focuses on the major phylogenetic groups of bacteria and archaea and offers a practical guide to molecular phylogenetic analysis, information on how to create and interpret phylogenetic trees, and the utility of the phylogenetic perspective in modern microbiology.

Audience: Senior undergraduate students majoring in microbiology, genetics, or biology.

Summer 2014. Hardcover, 540 pages est., full-color illustrations, glossary, index.
Print: 978-1-55581-442-7 | eBook: 978-1-55581-851-7
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AMERICAN ACADEMY OF MICROBIOLOGY presents two sessions at ASMCUE 2014

FAQ: THE HUMAN MICROBIOME

Curtis Huttenhower
Harvard University
Friday, May 16
11:30am

HOW MICROBES CAN HELP FEED THE WORLD

Gwyn Beattie
Iowa State University
Linda Kinkel
University of Minnesota
Friday, May 16
2:00pm

COMING TO ASMCUE 2015 ...

Microbe-Powered Jobs
How Microbiologists Can Help Build the Bioeconomy

- What could microbe-powered industries do?
- How do we educate the workforce for a microbe-powered industry?
- What sort of training would best prepare students to contribute to microbe-powered industry?
- What else does this sector need to thrive?

Preview the report: http://bit.ly/MicrobePoweredJobs
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The American Society for Microbiology (ASM) presents a collection of classroom activities that facilitates the incorporation of microbiology for targeted learning groups (K-4, 5-9 & 9-12 graders).

All activities include:
• teacher and student handouts
• practical tips to complete the activity
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• materials needed and sources to obtain them
• safety requirements
• ideas for assessment

Great for:
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• 4-H and Scout groups
• Science fairs
• Teacher training exercises

www.asm.org/educators
email: education@asmusa.org

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ASM-LINK Provides:

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• Travel Awards for researchers to attend two national STEM education conferences, ASM Conference for Undergraduate Educators (ASMCUE) & Annual Biomedical Research Conference for Minority Students (ABRCMS)
• Professional Development Workshops to enhance your mentoring and research programs

Join ASM in a strategic initiative to increase diversity in molecular, cellular, and microbial biological sciences.

ASM-LINK is sponsored by the ASM Education Board with support from the National Science Foundation Directorate for Biological Sciences (grant # 1241970).

For more information, visit: www.asmlink.org
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• 1.5-day workshop for 20 participants in a “situated apprenticeship” ON YOUR CAMPUS.
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• Workshop addresses PCAST and Vision and Change recommendations.
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ASM M(icro)OOCs

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ASM Guidelines for Biosafety in Teaching Laboratories: Building a Culture of Biosafety

**July 2014**
Writing a Teaching Philosophy Statement: Documenting Your Perspective on Teaching and Learning

**August 2014**
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To learn more visit: facultyprograms.org

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- Teaching science to an undergraduate student audience
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- Student-centered, active and engaged learning
- Students as research collaborators

Application Deadline: September 12

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  - 978-0-321-79438-3
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  - 978-0-13-224011-6
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