

63rd Annual Meeting
October 25th- 26th, 2019

Hosted by



Syracuse, NY



Conference will take place in:

Life Sciences Complex/ Center for Science and Technology, 110 College Place, Syracuse, NY 13210

Sheraton Hotel – Syracuse University, 801 University Ave, Syracuse, NY 13210

<http://www.syracuse.edu/>

Driving Directions

From the airport: Transportation to the Sheraton is readily available via popular rideshare apps Lyft and Uber. Both will have drivers pick you up at the far right end of the terminal, in the overflow lot outside of terminal B baggage claim: <https://syraairport.org/parking-transportation/taxi/>. Taxis are available as well, but are less affordable.

Syracuse airport also has a variety of rental car options: <https://syraairport.org/parking-transportation/rental-cars/>

The Sheraton Hotel also has a free on-demand shuttle service for guests:

<https://www.marriott.com/hotels/maps/travel/syrsi-sheraton-syracuse-university-hotel-and-conference-center/>

Mon – Fri: 05:00 AM - 11:00 PM, Sat & Sun: 07:00 AM - 11:00 PM

Shuttle Phone: +1 315 4753000 Ext 0

Syracuse University Campus Map

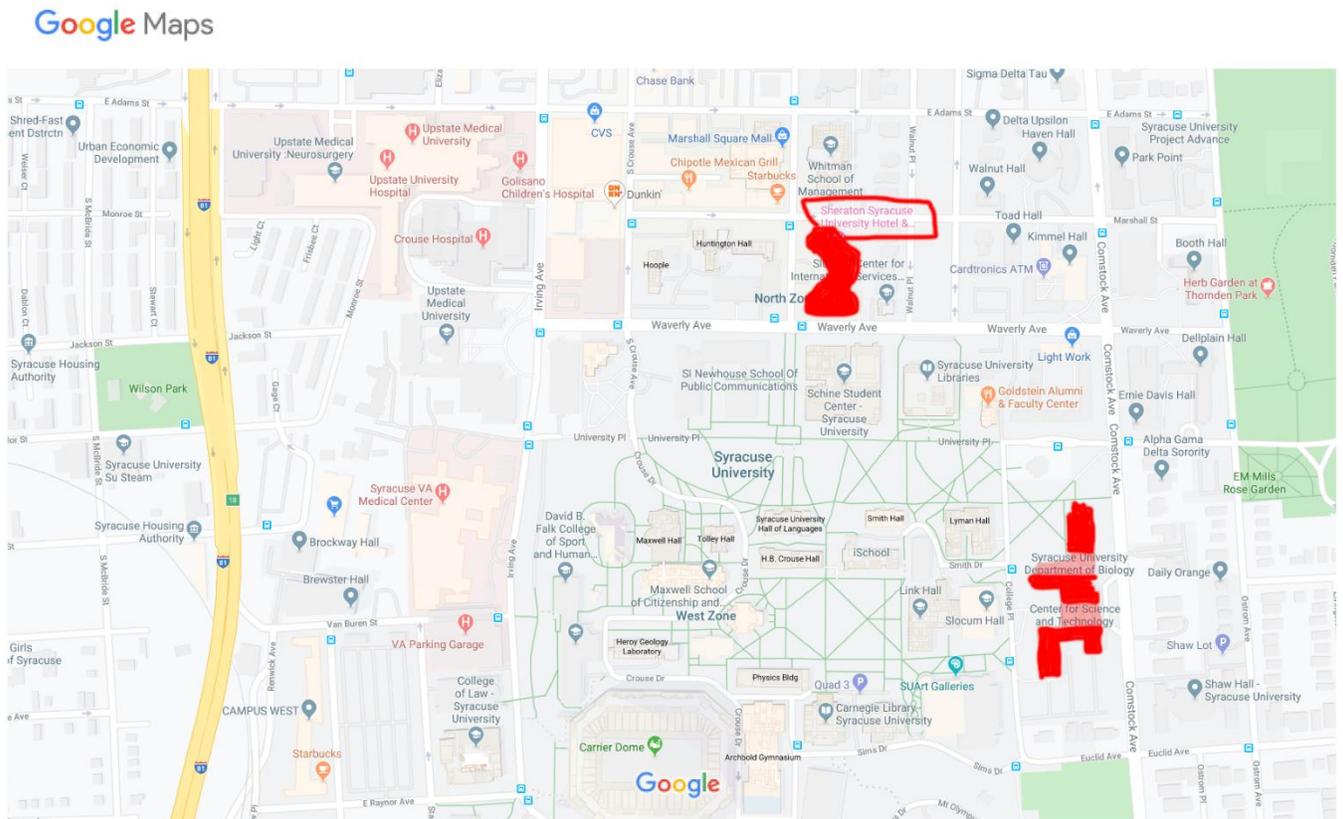
Parking: Sheraton offers on-site parking for \$16 Daily

Conference location:

Sheraton Hotel, **801 University Ave, Syracuse, NY 13210**

Life Sciences Complex (LSC) & Center for Science and Technology

110 College Place, Syracuse NY, 13210



Map data ©2019 Google 200 ft

Wifi Access

Campus visitors can use SU Guest Wi-Fi for access to the internet.

For Visitors and Guests: How to set up self-sponsored access (for one week)

1. You need a text-capable mobile phone to complete the process.
2. Connect to the AirOrangeGuest wireless network and wait for the Network Guest Service Portal to open on your device. If it doesn't open on its own, open your browser to the guest portal.
3. Follow the instructions.

For SU Guest Wi-Fi assistance

- Call the Information Technology Services (ITS) help desk at 315.443.2677 (during University business hours).
- Visit the ITS Service Center in 1-227 Center for Science & Technology, through the double glass doors off the Milton Atrium. For hours of operation visit <https://its.syr.edu/get-help/>.
- Email help@syr.edu. Please include your phone number so we can call you back.

EDUROAM

If you are visiting from another college, your school may be an eduroam Wi-Fi participant (<https://www.eduroam.org/where/>). If your college is part of eduroam, skip Guest Wi-Fi. Instead, use eduroam with your own school's email address and password to connect to Wi-Fi. See here for more info: <https://answers.syr.edu/display/network/Eduroam>

ACUBE's 63rd Annual Meeting Program Overview

Most sessions take place in either:

Life Sciences Complex/ Center for Science and Technology, 110 College Place, Syracuse NY, 13210

or Sheraton Hotel – Syracuse University, 801 University Ave, Syracuse, NY 13210

Thursday, October 24th

6:00–7:30 pm ACUBE Steering Committee Meeting

Friday, October 25th

8:00–9:00 am Registration, Breakfast, and Poster Set-Up
9:00–9:30 am Welcoming Remarks and Meeting Orientation
9:50–10:30 am Concurrent Presentations and Round Table Discussions (40 minute sessions)
10:40–11:00 am Concurrent Presentations (20 minute Sessions)
11:10–11:30 am Concurrent Presentations (20 minute Sessions)
11:45–12:40 pm Lunch and movie sponsored by HHMI BioInteractive
12:50–1:00 pm Keynote Introduction
1:00–2:00 pm Keynote Presentation by Professor Michelle K. Smith, Cornell University
2:10–2:50 pm Concurrent Presentations and Round Table Discussions (40 minute sessions)
3:00–3:20 pm Concurrent Presentations (20 minute sessions)
3:30–4:50 pm Concurrent Presentations and Workshops (80 minute sessions)
5:00–6:00 pm Poster Session and Cocktail Hour sponsored by JoVE
6:00–8:30 pm Dinner

Saturday, October 26th

8:00–9:00 am Breakfast with Bioscene
9:20–10:00 am Concurrent Presentations and Round Table Discussions (40 minute sessions)
10:10–10:30 am Concurrent Presentations (20 minute Sessions)
10:40–11:20 am Concurrent Presentations and Round Table Discussions (40 minute sessions)
11:30–12:30 pm ACUBE Members Meeting
12:30–2:00 pm Lunch and Awards
2:20–3:40 pm Concurrent Presentations and Workshops (80 minute sessions)
3:50–5:10 pm Concurrent Presentations and Workshops (80 minute sessions)
5:30–6:30 pm Steering Committee Meeting



Our Mission

Members of ACUBE share ideas and address the unique challenges of balancing teaching, research, advising, administration, and service. We are a supporting and mentoring community that provides professional development opportunities to:

- Develop and recognize excellence in teaching
- Incubate new and innovative teaching ideas
- Involve student research in the biology curriculum
- Advise and mentor students in and out of the classroom
- Enhance scholarship through our national, peer-reviewed journal *Bioscene*

Governance

President, Rebecca Burton, Alverno College

Past-President, Christina Wills, Rockhurst University

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Melissa Haswell, Davenport University

Holly Nance, College of Coastal Georgia

Heather Seitz, Johnson County Community College

Scott Shreve, Lindenwood University-Belleville

Local Arrangements Chair, Jason Wiles, Syracuse University – 315-383-2039 (cell)

Program Chair, Ryan Dunk, Syracuse University – 262-721-5102 (cell)

ACUBE gratefully acknowledges the support of the following exhibitors at the 63rd Annual Meeting:

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BIO-RAD

Keynote Speaker: Dr. Michelle Smith



Biography

Michelle K. Smith is an Associate Professor and discipline-based education researcher in the Department of Ecology & Evolutionary Biology at Cornell University. Her lab, along with her many collaborators, uses both quantitative and qualitative approaches to study three main research questions: 1) What are the origins of student conceptual difficulties in biology and how can instructors support students in overcoming these difficulties? 2) What aspects of peer discussion make it an effective learning tool? 3) What factors influence instructors' decisions about teaching? She is also the Editor-in-Chief of CourseSource, a peer-reviewed, open-access journal that publishes teaching resources that have been developed with evidence-based pedagogical techniques. Dr. Smith holds a B.S. from Hanover College, an M.S. from University of Dayton, and did her doctoral work at the University of Washington.

Keynote Address: The Benefits of Collaboratively Developing Lessons for the Undergraduate Biology Classroom

Using active learning instructional approaches increases student learning and decreases the failure rate. As a result, several national reports have advocated for a redesign in how undergraduate STEM courses are taught. One way to promote active learning is to support groups of instructors in: measuring student conceptual difficulties, iteratively designing active learning activities, evaluating student learning outcomes, and publishing the classroom activities. This talk will present research on the effectiveness of this professional development approach. Specifically, the work explores the efficacy of using student learning data to motivate faculty change and addresses questions such as: 1) How can we minimize time investment for faculty yet engage them in the development of an active learning lesson that positively affects student understanding? and 2) How does involvement in this process influence faculty willingness to try new instructional practices? To answer these questions, I will share a combination of student learning, classroom observation (using the Classroom Observation Protocol for Undergraduate STEM or COPUS), and faculty interview data. Taken together, this work describes a professional development model that connects faculty, helps them use data from their classrooms, and encourages them to try more active learning instructional techniques in class.

63rd Annual ACUBE Meeting Program
Syracuse University
Syracuse, New York
October 25th-26th, 2019

Thursday, October 25th, 2019		
6:00–7:30 pm	Steering Committee Meeting	LSC 106 (Lundgren)
Friday, October 25th, 2019		
8:00–9:00 am	Registration, Breakfast, and Poster Set-Up	Sheraton Ballroom
9:00–9:30am	Welcoming Remarks and Meeting Orientation	Sheraton Ballroom
9:50–10:30 am	Concurrent Presentations and Round Table Discussions (40 minutes)	
	Authentic Assessments: Do your tests align with your teaching practice?	Lyman 132
	Melissa Haswell, Ph.D., <i>Davenport University</i>	
	Motivational factors and barriers to faculty engaging in inclusive mentoring practices	CST 1-218
	Brittney N. Wyatt ¹ , Rita Margarida Magalhães ¹ , Scott Franklin ^{1,2} , Dina L Newman ^{1,3}	
	¹ <i>Center for Advancing STEM Teaching, Learning and Evaluation (CASTLE)</i> , ² <i>School of Physics and Astronomy</i> , ³ <i>Thomas H. Gosnell School of Life Sciences, College of Science, Rochester Institute of Technology</i>	
	New Approaches to Myoglobin Purification for Upper Level Laboratories	LSC 156
	James W. Clack, Ciara N. Phares, David Cool, & Mitali Madhok <i>Indiana University – Purdue University Columbus</i>	
	SUPA Biology Fall 2019 Seminar Meeting	Sheraton Ballroom
	Jason R. Wiles & Eric Young, <i>Syracuse University</i>	
10:40–11:00am	Concurrent Presentations (20 minutes)	
	Scientific Writing in Introductory Biology Courses: Strategies for Student Success	LSC 106 (Lundgren)
	Holly Nance, <i>College of Coastal Georgia</i>	
	Using Metacognitive Strategies to Improve Student Performance in Biology Courses	LSC 156
	Ashley M. Driver, <i>University of Wisconsin-Stevens Point</i>	
	Increasing the Freshman Retention Rates of Science Majors at Niagara University Through an Early Intervention Program	CST 1-218
	Virginia Glazier, <i>Niagara University</i>	
	Using Current Events and Creative Projects to Encourage Student Interest and Learning	LSC 100
	Melissa S. Anderson, <i>Lindenwood University - Belleville</i>	

11:10–11:30am	Concurrent Presentations (20 minutes)	
Students “check-in” and “warm-up” before doing group work to improve group dynamics and class participation in an infectious disease course		LSC 156
Laurieann Klockow, <i>Marquette University</i>		
Use of Pre-lecture Videos and Formative Quizzes to Improve Outcomes in an Introductory Biology Lecture Course		LSC 100
Sharon Thoma, <i>University of Wisconsin-Madison</i>		
Encouraging Undergraduate Confidence and Participation in Research Through Lower-division Course-based Undergraduate Research Experiences (CUREs)		LSC 106 (Lundgren)
Gerick Bergsma, Jennifer Duggan, John Silveus, Timothy Thomas, <i>California State University, Monterey Bay</i>		
Development of a formative peer observation protocol for STEM faculty reflection		CST 1-218
Tara Prestholdt, Heather Dillon, Carolyn James, Valerie Peterson, Stephanie Salomone, & Eric Anctil, <i>University of Portland</i>		
11:45–12:40 pm	Lunch and Movie sponsored by HHMI BioInteractive	LSC 001
*Movie starts at 12:00		
**Pick up box lunches outside of LSC 001 at 11:45		
12:50–2:00 pm	Keynote Presentation	LSC Atrium
Professor Michelle K. Smith, <i>Cornell University</i>		
"The Benefits of Collaboratively Developing Lessons for the Undergraduate Biology Classroom"		
2:10–2:50 pm	Concurrent Presentations and Round Table Discussions (40 minutes)	
Exploring Approaches to Engaging Undergraduates in Research: Differential Impacts on Students' Self-efficacy and Science Skills		CST 1-019
Kelly Schmid, <i>Syracuse University</i>		
Teaching the Students to be Teachers		LSC 011
Marlee B. Marsh, PhD, <i>Columbia College</i>		
New tools for measuring student learning outcomes for program assessment		LSC 001
Karen Klyczek, <i>University of Wisconsin- River Falls</i>		
Exploratory activities for understanding evolutionary relationships depicted by phylogenetic trees: united but diverse		LSC 106 (Lundgren)
Erin McCullough ¹ , Lauren Verdeflor ² , Alaina Weinsztok ² , Jason R. Wiles ¹ , Steve Dorus ¹		
¹ <i>Syracuse University</i> , ² <i>Syracuse University Project Advance</i>		

3:00–3:20 pm	Concurrent Presentations (20 minutes)	
Cover Boards as a Tool to Study Ecology George Todd, <i>Coastal Pines Technical College</i>		LSC 106 (Lundgren)
Creating an authentic research experience for undergraduate students with a wide range of laboratory and research familiarity Dr. Jodi L. Lancaster, <i>Elizabethtown College</i>		CST 1-019
Small steps towards a larger goal Sukanya Lodh, PhD, <i>Marquette University</i>		LSC 001
Herkimer College and the creation of a Science Zdegree as part of SUNY OER Program In New York Steven T Mezik, <i>Herkimer College</i>		LSC 200
3:30–4:50 pm	Concurrent Presentations and Workshops (80 minutes)	
Teaching Like a Pro in Your First Years Becky Burton, <i>Alverno College</i> ; Jason Wiles, <i>Syracuse University</i> ; Conrad Toepfer, <i>Brescia University</i>		CST 1-019
CourseSource Workshop Michelle K. Smith, <i>Cornell University</i>		LSC 001
Bio-Rad Focus Group		LSC 106 (Lundgren)
5:00–6:00 pm	Poster Presentations and Cocktail Hour Sponsored by JoVE	Sheraton Ballroom
1- Virtual Labstore: a tool to facilitate inquiry-based laboratory research education M.C. Morsink, O. Tysma, C. van der Valk, J. van der Griendt, W.B. van Leeuwen, A. van der Aar		
3- What's the point of learning biology? A triad redesign of a large-enrollment, non-majors freshmen biology course Sandi Connelly, Michelle Weatherell, Emily Coon-Frisch, <i>Rochester Institute of Technology</i>		
4- Pilot data from a tool to assess scientific interpretation skills Scott M. Shreve, <i>Lindenwood University-Belleville</i>		
5- A Course-based Research Experience on Endocrine Disruptors Aleksandra Kuzmanov & Julie Zwiesler-Vollick, <i>Lawrence Technological University</i>		

6- Integrating Independent Study Projects Into Animal Behavior Classes

Randi (Ruth) Darling, *Westfield State University*

7- Board game creation and team play to better understand and apply the biochemical concepts of amino acids, peptides, and proteins

Ashley Shaloo, *SUNY Alfred State College*

8- Identification of Wild-Harvested Morel Species by DNA Barcoding; an Inquiry-Based Laboratory for Students in Majors Level Genetics.

Patricia Conklin and Santanu Banerjee, *SUNY Cortland*

9- Benefits of the Undergraduate Teaching Assistant Experience in an Introductory Biology Laboratory Course and other STEM Courses

Frank R. Castelli, Mitra Asgari, and Mark A. Sarvary; *Cornell University*

10- Peer Leaders as Potential Role Models and the Impact on Perceived Student Learning Gains

Christina I. Winterton, Ryan D.P. Dunk, & Jason R. Wiles, *Syracuse University*

11- The Strategic Undergraduate STEM Talent Acceleration Initiative (SUSTAIN) at Syracuse University

Alia Thompson, *Syracuse University*

12- Using Hybridoma Cell Lines to Reinforce Student Learning in an Undergraduate Immunology Course

Christian Nelson, *SUNY Cortland*

13- Factors Affecting Christian Students' Persistence in STEM

Mia C. Pepi, Jason R. Wiles, and Ryan D.P. Dunk, *Syracuse University*

14- Leveraging natural history teaching collections to maximize student learning opportunities

Gerick Bergsma, Department of Biology & Chemistry, *California State University, Monterey Bay*

6:00–8:30 pm Dinner Sheraton Ballroom

Saturday October 26th, 2019

8:00–9:00 am Breakfast with Bioscene Sheraton Ballroom

9:20–10:00 am **Concurrent Presentations and Round Table Discussions (40 minutes)**

Surveying Biodiversity with iNaturalist CST 3-216
Lynn Swafford, *Wayne Community College*

Collaborative Design of a Tiered Introductory Biology Course to Meet the Needs of a Diverse Student Body CST 1-019
Dawn Carter, Elizabeth Dicesare, Dina L. Newman, Chris Widmaier, *Rochester Institute of Technology*

Using reasoning is the key to solving challenging genetics problems		LSC 214
Jenny Knight, Austin Hammermeister Suger, Jennifer Avena, <i>University of Colorado Boulder</i>		
10:10–10:30 am	Concurrent Presentations (20 minutes)	
The Curious Construct of Active Learning in Biology Education Research		LSC 214
Emily Driessen ¹ , Jennifer K. Knight ² , Michelle K. Smith ³ , Brittany Woodruff ¹ , Cissy J. Ballen ¹ , ¹ <i>Auburn University</i> , ² <i>University of Colorado, Boulder</i> , ³ <i>Cornell University</i>		
How Inclusion is Communicated (or not) through the Course Syllabus		CST 1-019
Rita Margarida Quiñones de Magalhães, Dina L. Newman, and Scott Franklin, <i>Rochester Institute of Technology</i>		
The Longevity Games – Student research exposure through service learning		CST 3-216
Johnathan Millen, <i>St. John Fisher College</i>		
The Multimedia Classroom: Integrating Video Content into your Curriculum		LSC 106 (Lundgren)
Cesar Berrios-Otero, <i>Journal of Video Education</i>		
10:40–11:20am	Concurrent Presentations and Round Table Discussions (40 minutes)	
A Concept Framework for Improving Curriculum Design and Student Metacognition		LSC 214
Amanda Howard, Caitlin Reeves and Jennifer Walker, <i>University of Georgia</i>		
Employing Blended Team Project-Based Learning to Develop and Evaluate Student “Soft-Skill” Sets: Lessons Learned from a Microbiology Course		CST 1-019
Jason Andrus, <i>Meredith College</i>		
Hydroponics and Sustainability in the Biology Lab		LSC 106 (Lundgren)
Luciana Caporaletti, <i>Penn State University</i>		
11:30–12:30pm	ACUBE Members Meeting	Sheraton Ballroom
12:30–2:00 pm	Lunch and Awards	Sheraton Ballroom
2:20–3:40 pm	Concurrent Presentations and Workshops (80 minutes)	
Exploring the process of science and important biology concepts with anoles		LSC 214
Tara Jo Holmberg, <i>Howard Hughes Medical Institute</i>		
Implementing high impact practices using team-based learning		CST 1-019
Neil Haave, <i>University of Alberta, Augustana Campus</i>		

The Genomics Education Partnership: A community of practice that enhances research opportunities for students and faculty at diverse institutions		CST 3-216
Evan Merkhofer ¹ , Nighat Kokan ² , and the Faculty of the Genomics Education Partnership <i>¹Mount Saint Mary College, ²Cardinal Stritch University</i>		
3:50–5:10 pm	Concurrent Presentations and Workshops (80 minutes)	
PETLs: Design, Fabrication and Testing of Microfluidic Devices in the Classroom and Research Laboratory.		LSC 214
Fernando Ontiveros, PhD., <i>St. John Fisher College</i>		
Build-a-Course Workshop		CST 1-019
Rebecca S. Burton, <i>Alverno College</i>		
5:30–6:30 pm	Steering Committee Meeting	LSC 106 (Lundgren)

ABSTRACTS

Friday, October 25th, 2019

10:00–10:40 am Concurrent Presentations and Round Table Discussions (40 minutes)

Authentic Assessments: Do your tests align with your teaching practice?

Melissa Haswell, Ph.D., Davenport University

The Vision and Change movement has inspired STEM faculty members across the United States to move from the traditional instructor-centered teaching methods to student-centered teaching. Instead of emphasizing rote memorization of terminology and the minutia of scientific processes, student-centered instruction focuses on core concepts and scientific skills, which emphasizes inquiry-based learning, critical thinking, and creativity via active learning methods such as case studies, or other types of active learning modalities. However, faculty assessment of learning does not always align with teaching practice. In addition, there is often a focus on summative assessments (exams), with little use of formative assessments (in other words – how do you know the learning activity was effective?). This 40-minute presentation will provide instructors at all levels with the background knowledge required to incorporate meaningful, authentic assessments into your classes using the process of backward design. Several examples of both summative and formative assessments will be modeled throughout the presentation.

Motivational factors and barriers to faculty engaging in inclusive mentoring practices

Brittney N. Wyatt¹, Rita Margarida Magalhães¹, Scott Franklin^{1,2}, Dina L Newman^{1,3}

¹Center for Advancing STEM Teaching, Learning and Evaluation (CASTLE), ²School of Physics and Astronomy, ³Thomas H. Gosnell School of Life Sciences, College of Science, Rochester Institute of Technology

STEM faculty are agents of social influence that can impact a student's sense of belonging and participation in science. Faculty who mentor undergraduate researchers can play a role in student persistence in STEM majors, especially for underrepresented minority students. It is important then for faculty to engage in mentoring practices that are inclusive and create an authentic sense of belonging for diverse students. It is therefore critical to understand how to best support and encourage all faculty who mentor undergraduates to implement inclusive practices. Few studies, however, have investigated the motivations and decision-making processes that faculty experience when engaging in inclusive research mentoring. Our research questions directly probe faculty motivations and attitudes toward inclusive practices: 1) what motivational factors contribute to STEM faculty engagement in inclusive research mentoring and 2) what barriers do faculty encounter when they seek out support for inclusive mentoring? We interviewed 24 STEM faculty who participated in a program that aimed to increase faculty awareness on inclusive research and classroom practices, and used an identity framework and identity-based motivation lens to analyze their responses. Faculty were motivated to engage in inclusive mentoring based on: their willingness to connect with others (71%), inherent beliefs (67%), personal experiences (58%), a desire to become more competent in their position (54%) and the potential gain of resources (13%). The barriers that faculty described were primarily either resource-based (time) or identity-based (personal/communal beliefs and privileges), indicating that how faculty view their role as an inclusive mentor is influenced by their identities and by how others in the community view them. Therefore, to best support and engage faculty as inclusive mentors, identity-aligned workshops, activities or learning communities should be developed. These resources should provide faculty the time to connect with fellow mentors, be grounded in

evidence-based practices and be positively recognized by the institution and faculty community. Efforts to create a supportive environment for research mentors to learn inclusive mentoring techniques has the potential to create more inclusive research groups and therefore increase students' sense of belonging in science.

New Approaches to Myoglobin Purification for Upper Level Laboratories

James W. Clack, Ciara N. Phares, David Cool, & Mitali Madhok, *Indiana University – Purdue University Columbus*

Many Biochemistry and/or Cell Biology laboratories employ purification of Myoglobin (Mb) as an introduction to separation science and assessment of relative purity of proteins. The majority of these labs employ ionic shock and centrifugation to separate cytosolic proteins from membranes and organelles, followed by one or two chromatographic separations. Literature articles discussing the use of these techniques (Pugh & Schultz, 2002; Silverstein et al., 2015) report only a modest purification of Mb with relative purity ranging from 40% to 60%. We adopted this set of labs in 2017 in an upper level Cell Biochemistry lab with the hope that they would provide our students with valuable experience in separation science and protein visualization. However, our students have only occasionally achieved this level of Mb purity and have invariably had trouble completing each of the labs within the time frame provided. We decided to try to improve and streamline the Mb purification procedure in order to reduce student frustrations and improve the lab outcome.

We have added a simplified ammonium sulfate precipitation step that typically yields a Mb fraction that is 84% pure. This is followed by dialysis for 48 hours in order to remove the ammonium sulfate. We have also optimized a subsequent ion exchange chromatographic separation that typically yields fractions with $\geq 95\%$ purity. Along the way, we have reorganized the sequencing of labs, discovered means of reducing the amount of time spent on assaying for protein, and have adopted a novel method for quickly visualizing proteins in PAGE gels and immunoblots. We have also created a set of videos demonstrating the various techniques and analyses.

Observations on the reliability of certain techniques for determining relative purity will also be discussed.

10:50–11:10am Concurrent Presentations (20 minutes)

Scientific Writing in Introductory Biology Courses: Strategies for Student Success

Holly Nance, *College of Coastal Georgia*

Effective communication in the sciences is arguably more important now than ever. However, many biology students lack sufficient experience with oral and written communication in their introductory courses. Adding written assignments to laboratory courses can further be a burden on overloaded faculty, as these early assignments require more editing and reflect the steep learning curve among freshman and sophomore students. To meet this fundamental need for students, promote their success in writing, and reduce the time and effort spent evaluating student reports, I have adopted some strategies in my sophomore level Cell and Molecular Biology course over the past two semesters. These strategies include a detailed rubric, mandatory use of the college's Writing Center, time set aside in lab for peer-editing, the ability to review previous student papers, and early draft due dates to prevent procrastination. Since adopting and modifying these strategies in my course, I have seen the average score on the required lab report increase by a letter grade. Feedback from students has also indicated that early draft deadlines help keep them from procrastinating and ultimately perform better on the assignment. Such simple adjustments to a scientific writing assignment can greatly enhance the experience for both student and professor, making it easier to incorporate effective science communication early in the curriculum.

Using Metacognitive Strategies to Improve Student Performance in Biology Courses

Ashley M. Driver, *University of Wisconsin-Stevens Point*

A student approaches you because they didn't do well on an exam and are struggling to understand why. They spent significant time studying and yet couldn't seem to remember the material. It's an all too common scenario faced in courses ranging from introductory to advanced biology. So, what can we do to help? In my own experience I've observed a common link among these students: inefficient study strategies. Students often rely on passive methods of studying, where they gain recognition of material but cannot recall and apply detail. This inability to recognize mastery of material reflects a lack of metacognitive knowledge. For this session I would like to address how we, as biology instructors, can promote metacognitive knowledge in our courses. I will accomplish this by sharing a pilot study I'm conducting on the use of student generated test questions in a cell biology course. Additionally, I will be facilitating a short discussion on current practices and potential ideas to improve metacognitive awareness in (and out of) the biology classroom.

Increasing the Freshman Retention Rates of Science Majors at Niagara University Through an Early Intervention Program

Virginia Glazier, *Niagara University*

Nationwide significant efforts have been made to increase freshman STEM major retention rates, particularly for at-risk student populations. Colleges are increasingly developing multifaceted STEM programs designed to address several of the common issues that result in the attrition of first year science students. Typically these programs take the form of a course or seminar series that occur during the first semester of college. However for many students, an earlier point of intervention may be necessary. Niagara University has developed a summer program entitled "Early science opportunities at NU". We focused our efforts on underprepared science majors, particularly those from historically underrepresented groups. The program is a four daylong event that takes place prior to freshman move-in day. The "Early science opportunities at NU" program addresses topics including; transitioning to college, time management skills, stress management, note taking, science identity, peer mentoring, Microsoft office skills specific for the sciences, and science research opportunities at NU. Topics are presented by the science faculty allowing students to become more comfortable with their professors. Our assessment parameters for success include perception surveys, freshman GPA and freshman retention rates. We have just finished our second year of the program. Given the small cohort size we likely will need several years of data before we can determine efficacy of the program. Preliminary feedback from students suggests that students feel better prepared for their freshman year as science majors and more likely to engage with the science departments, as well as the greater University community.

Using Current Events and Creative Projects to Encourage Student Interest and Learning

Melissa S. Anderson, *Lindenwood University - Belleville*

Active learning in biology courses is more important than ever. While participation and outside research are essential to student learning, it is often challenging to get students to seek out additional resources on their own and especially to bring that information back to the class. In this session I will share a "current events" project that I developed and have utilized in both my undergraduate microbiology for health sciences and advanced microbiology courses that provides students with the opportunity to identify relevant and timely examples of microbiology in the world, summarize information in writing, and discuss that information with the class. Additionally, I will share a cumulative assignment that I have used in lower and upper level microbiology courses

that requires students to show their knowledge in a creative final assignment. Both assignments are adaptable to other courses.

11:20–11:40am Concurrent Presentations (20 minutes)

Students “check-in” and “warm-up” before doing group work to improve group dynamics and class participation in an infectious disease course

Laurieann Klockow, *Marquette University*

In response to calls for implementing active learning in college-level science courses, group work is increasingly used and numerous studies have demonstrated evidence for its benefits including increases in student achievement, motivation, reasoning ability, and critical thinking. To realize the gains of group work, all students within a group must engage and contribute. Tanner et al explains that getting students talking can be thought of as “the common denominator of many innovative, active, inquiry based approaches to teaching” (Tanner 2009). Thus regardless of the group work strategy used (think-pair-share, team-based learning, etc), students must feel comfortable and willing to talk to one another. To get students comfortable talking, I found that implementing daily “Check-in” and “Warm-up” activities improved overall class participation and small group dynamics. The Check-in is a series of questions designed to prompt casual social interactions, often unrelated to course content. Each student in a group chooses one question to respond to within their group. The rationale is to create an environment where the students feel comfortable so that hopefully those feelings would transfer into the course activities and discussions. This brief 5 minute Check-in is followed by a content-based Warm-up activity designed to get the group thinking about the assigned reading. Once a week, the Warm-up was a group quiz but otherwise varied (ie concept map, draw pathways, etc) and was completed in under 10 minutes. The Check-in and Warm-up were adapted from those described by Melissa Parks in the National Teaching and Learning Forum. Whereas Parks used these techniques with her entire class in education courses to build rapport between instructor and students, I’ve adapted this concept to create effective group work cultures within student teams in my upper division biology course. In this session, I will describe the Check-in and Warm-Up activities as well as the rationale I give to the students on the use of these activities. I will also discuss evidence (quiz scores and surveys) that the use of the Check In increases engagement at the small group and whole class level, improves students’ attitudes towards group work, and increases learning.

Use of Pre-lecture Videos and Formative Quizzes to Improve Outcomes in an Introductory Biology Lecture Course

Sharon Thoma, *University of Wisconsin-Madison*

Biology 101 is a mixed-major introductory biology lecture course which serves about 1500 students a year; about 60% of students in the course plan to major in biological science and/or pursue medically-related careers. We have worked hard to balance the needs of students who are taking the course for breadth with those who need content to succeed in upper-level biology classes. Recent changes to the academic schedule at the University of Wisconsin resulted in fewer instructional days per semester, putting a strain on traditionally content-heavy classes such as ours. The loss of three lectures per semester, coupled with the need to teach specific content for our biology majors meant that we would have to sacrifice class sessions that used interactive learning and that tied together many concepts covered in the course. Class periods devoted to the human microbiome, the biology of cancer, and the ecology of Lake Mendota are some topics were are the chopping block; these topics are the most immediately relevant to student’s current lives, and the most interesting for all of their diverse interests and backgrounds. To pro-actively address anticipated negative consequences of fewer class periods on student outcomes, we developed numerous pre-lecture videos to familiarize students with

basic introductory material traditionally covered during lecture. Students were instructed to watch videos and complete a short (~5 question) online quizzes prior to coming to many lectures; in-class instruction was based on the assumption that students watched and understood the videos. The videos/quizzes had an immediate positive impact: students reported liking the videos, we were able to free up some time in lecture to cover the “interesting” material and to have pair-share time, and student outcomes on summative exams were improved over semesters when we did not have pre-lecture videos. I will share examples of videos and quizzes, show student feedback, and present exam data comparing semesters with and without pre-lecture videos, and talk about our future directions for our large lecture course.

Encouraging Undergraduate Confidence and Participation in Research Through Lower-division Course-based Undergraduate Research Experiences (CUREs)

Gerick Bergsma, Jennifer Duggan, John Silveus, Timothy Thomas, *California State University, Monterey Bay*

Engaging students in undergraduate research has been shown to have a positive impact on student performance and retention in STEM. However, many students do not engage in authentic research experiences until they are in their junior or senior years, reducing the potential for undergraduate research to impact student success. Faculty in the natural sciences at California State University, Monterey Bay (CSUMB) recently developed research-based courses in biology and environmental science specifically for first year (freshman and transfer) students to attract students and increase retention in our science majors. These spring semester courses focus on introducing novice researchers to basic research skills while working closely with faculty in short, local field research experiences in either wildlife biology or water quality monitoring. The courses serve as a tool for early disciplinary engagement, building relationships between first and second year students and faculty, and exposing students to potential major and career paths. The courses also aim to reduce students’ apprehension with engaging in research, and promote their confidence in their ability to pursue careers in science.

Importantly, the courses also encourage students to remain engaged in research, and provide scaffolding for future undergraduate research experiences. CSUMB has a well developed infrastructure supporting individually mentored undergraduate research and upper-division course-based undergraduate research experiences. Students participating in the new courses are better positioned to seek these opportunities and explore research-focused academic and career paths. Many students return to conduct research within our labs or pursue additional research experiences through summer research programs. The format of these courses has also allowed faculty the opportunity to test modules for integrating research into other courses, and explore new lines of research, creating additional independent student research opportunities.

Development of a formative peer observation protocol for STEM faculty reflection

Tara Prestholdt, Heather Dillon, Carolyn James, Valerie Peterson, Stephanie Salomone, & Eric Ancil, *University of Portland*

Faculty peer observation has seen increasing uptake in recent years, in some cases as an alternative or supplement to student teaching evaluations. While many universities encourage faculty peer observation, it is not widely used in a formal way for formative assessment. We outline the development of a new faculty peer observation protocol designed for formative assessment of evidence-based educational practices. The goal of the protocol is to foster reflective teaching practices.

2:10–2:50 pm Concurrent Presentations and Round Table Discussions (40 minutes)

Exploring Approaches to Engaging Undergraduates in Research: Differential Impacts on Students' Self-efficacy and Science Skills

Kelly Schmid, *Syracuse University*

Several approaches toward engaging undergraduates in scientific research are common at colleges and universities, including undergraduate research experiences (UREs) based in faculty research laboratories, course-based undergraduate research experiences (CUREs) of varying levels and types, and courses rooted in primary research literature that may be precursors to student research experiences. We examined the outcomes for students enrolled in UREs (N=12), CUREs (N=32), and a literature-based introduction to science research course (N=12) in a biology department at a large, private, research intensive university in the northeastern United States. Students enrolled in UREs and an authentic CURE with student-driven research had significant increases in science skills, but not in science self-efficacy. Students enrolled in the introductory research literature course had significant increases in all measured factors related to science self-efficacy. Students enrolled in a CURE that did not involve independent, student-driven research projects showed no significant overall improvement in either science skills or self-efficacy. We therefore recommend an introduction to science research through primary literature course as a way to build self-efficacy prior to CUREs and UREs, and possibly as a way to better match undergraduates with potential research mentors for future research engagement.

Teaching the Students to be Teachers

Marlee B. Marsh, PhD, *Columbia College*

Peer to peer tutoring is an excellent way to enhance student learning- both for the tutor and the student being tutored. In this roundtable, we will discuss best practices for training student tutors, and share ideas about how to enhance student tutoring on your campus- with and without a budget.

New tools for measuring student learning outcomes for program assessment

Karen Klyczek, *University of Wisconsin- River Falls*

One of the most challenging areas for life science departments attempting to implement the recommendations in “Vision & Change: A Call to Action” is developing an effective assessment plan that measures student learning outcomes across their academic careers. A variety of assessment tools aligned with Vision and Change have been published recently, which may make it easier for departments to achieve these goals. These tools include the BioCore guide, which describes core concepts as they are implemented in different areas of Biology, and the BioMAPS assessment tool that is based on the BioCore guide. A new tool, the BioSkills guide, similarly describes how the core competencies can be measured in classes. Other tools for core competencies are being developed. This roundtable discussion will include a brief overview of the schools available, and a discussion of strategies that departments might use for their programmatic assessment of student achievement.

Exploratory activities for understanding evolutionary relationships depicted by phylogenetic trees: united but diverse

Erin McCullough¹, Lauren Verdeflor², Alaina Weinsztok², Jason R. Wiles¹, Steve Dorus¹

¹*Syracuse University*, ²*Syracuse University Project Advance*

Evolution explains both the unity and diversity of all organisms, and developing students' ability to represent and communicate evolutionary relationships is an important component of a complete biology education. We present a series of student-centered, exploratory activities to help students develop their tree-thinking skills. In these activities, students use complementary phenotypic and molecular data to explore how to build phylogenetic trees and interpret the evolutionary relationships that they represent. This learning module is designed to engage students in the process of science, provide them with active learning experiences using online bioinformatics tools, and foster their appreciation for the evolutionary connections across the tree of life.

3:00–3:20 pm Concurrent Presentations (20 minutes)

Cover Boards as a Tool to Study Ecology

George Todd, *Coastal Pines Technical College*

Scientists often gain knowledge in biology effectively by interacting with the world outdoors. This is especially true in ecology. Although there are benefits of conducting research in controlled lab settings, gaining insight as to how organisms interact naturally with their environments often requires us to study them in those environments. I apply this principle in my college biology class that I teach to dual enrollment high school students in Blackshear, GA. During the ecology unit of my class each spring, I have my students carry out a biodiversity project for several weeks. This project was conceived based on some of my own published research done in grad school. Cover boards are used as a means of measuring various indices of biodiversity in a patch of forest adjacent to the high school. Just before the ecology unit begins, the students divide into groups and each group places two cover boards out in an array in the woods. I then have them try to characterize the exact location of the board through distance measurements to nearby physical features. After a few weeks pass to let wildlife acclimate, the students are taken out weekly to flip the boards and make observations of vertebrates utilizing the boards. I then have them try to create hypotheses as to why a given board yields several or no observations. Through this project, students learn what kinds of vertebrates inhabit the forest behind their high school as well as what forest structure variables may be driving the presence or absence of such animals.

Creating an authentic research experience for undergraduate students with a wide range of laboratory and research familiarity

Dr. Jodi L. Lancaster, *Elizabethtown College*

In any classroom or laboratory setting we encounter students with a range of experiences and competencies. In an upper-level, elective laboratory the range of abilities may be particularly vast. My 300-level Immunology laboratory draws a range of students (sophomores through seniors), with a variety of research experiences. Many of the students are seeking to fulfill a lab requirement, but have little experience with independent hypothesis-driven experimental design and have limited laboratory competencies and quantitative skills. Other students are taking the laboratory after completion of our capstone cellular biology experimentation course and participation in independent research. Therefore, I form groups comprised of at least one research 'veteran' and several 'newbies' to facilitate learning. The laboratory course then walks step-by-step through the research process. We start by reading and discussing the primary literature paper that explains development of the cell line used in the lab. Groups then develop a hypothesis based upon data provided in the original paper. Homework assignment require students to find additional primary literature articles related to their hypothesis. Students summarize these articles and through whole class discussion relate the published work to their research project. This provides relevant primary literature for their research paper. Multiple experiments that build upon data in the original paper are designed and completed by the groups. Various types and sets of data are collected (cell numbers, flow cytometry, ELISA) and analyzed. Hands-on in-class time for data management

and graphing in Excel is provided. Ultimately, students individually write a scientific paper based upon a detailed rubric. This approach has allowed me to provide a meaningful and authentic research experience for students with a range of experiences. The 'veteran' students take a leadership role in their group and are challenged to teach those with less laboratory experience. The 'newbies' gain confidence about the process of research. All students gain specific hands-on skills, quantitative competencies and soft skills related to team work and communication. Student feedback about the laboratory course is overwhelmingly positive.

Small steps towards a larger goal

Sukanya Lodh, PhD, *Marquette University*

Teaching in a classroom includes three components; successful delivery of information, encouraging student involvement and making sure that students retain the information. The ways to achieve each of these varies between class to class, depending on the class size, student diversity, course and even topics within a single course. I will be presenting some methods that I have used during my first year to be an effective educator, while teaching different courses that ranged from Introductory Biology, upper level Cell biology, Microbiology to multi session laboratory course, with the class size between 50-150 students.

I have used power point presentations with clear learning objectives, during lectures to present the main concept. However, in order to explain concepts better I have used white board, incorporated small animation and videos. Using various media during lecture helped us to enjoy the lecture time.

Now-a-days there are multiple programs available that encourage student participation and active learning. Having multiple choice questions, small discussion questions in every couple of slides helps students to get a break from the lecture as well as forces them to think and apply. Irrespective of the course, small think-pair-share activities are beneficial to any lecture session. I find it's beneficial to explain the correct answer after every question.

Finally, as educators we expect our students to retain the information. To achieve that, it is beneficial if the course-structure forces students to read assigned topics from textbook, beforehand. To introduce a complex concept, I have told the class to come prepared, as a random student will be asked to explain it. This small step helped both of us to achieve the common goal; understanding and retaining the information. Enforcing them to study regularly by having end of the lecture questions and giving credits when they show proofs of having regular group discussions outside helps students to develop study habits. Finally, having structured review sessions that encourages active participation, helped.

Teaching a course first time is always challenging in terms of applying pedagogy. However, using these small steps helped me to teach effectively during my first year.

Herkimer College and the creation of a Science Zdegree as part of SUNY OER Program In New York

Steven T Mezik, *Herkimer College*

SUNY's OER (Open Educational Resources) Services is a high-profile example of statewide cooperation among community colleges in support of student savings and faculty innovation. As part of the SUNY system, Herkimer College has taken a leadership role in the creation and implementation of OER in the college classroom. This talk will discuss the use of state funding to encourage these activities, including the state OER funding, grant program, and professional development offerings. The talk will also include the process where Herkimer College

developed multiple Zdegrees as part of the federal Achieving the Dream grant as well as the process to create a fuller OER science degree pathway for students.

3:30–4:50 pm Concurrent Presentations and Workshops (80 minutes)

Teaching Like a Pro in Your First Years

Becky Burton, *Alverno College*; Jason Wiles, *Syracuse University*; Conrad Toepfer, *Brescia University*

Which educational innovations have been validated by peer-reviewed studies and which have been debunked or never tested? How can you maximize the cooperation of students, peers, and administrators as you implement the best in innovative pedagogy? What effective and efficient strategies will allow you to focus your time and attention on what matters most? Where can you find excellent “turn-key” activities? Master teachers will facilitate a discussion on pedagogy, logistics, and careers for new and aspiring biology educators. Experienced educators are also welcome.

CourseSource Workshop

Michelle K. Smith, *Cornell University*

CourseSource is an open-access journal of peer-reviewed teaching resources for college biological science courses. A key feature of CourseSource is the alignment of our articles with learning goals and objectives that were developed by the associated professional societies. CourseSource provides authors with the opportunity to publish teaching materials in a high-quality format that documents their scholarly teaching efforts, accomplishments and innovations. This workshop will guide you through the components of a CourseSource article and get you well on your way toward producing and submitting your own lesson manuscript.

5:00–6:00 pm Poster Presentations

1- Virtual Labstore: a tool to facilitate inquiry-based laboratory research education

M.C. Morsink, O. Tysma, C. van der Valk, J. van der Griendt, W.B. van Leeuwen, A. van der Aar

Education in inquiry-based laboratory research needs to focus on defining the research question, posing the hypothesis, developing the experimental approach, performing laboratory experiments, and critically evaluating obtained results. In our current educational research courses, students receive a research question and a fixed list of available laboratory materials which are necessary to perform the experiments. Since these materials are presented at the beginning of the research module, the students’ line of thinking is already directed towards the ‘right’ experimental approach.

To allow the students to think more freely and circumvent the use of extensive materials lists, Virtual Labstore was developed.

This is an online three dimensional laboratory storage system which contains the complete collection of reagents and hardware present in our university, including product and price information. Students can walk around in Virtual Labstore and collect materials they need. Furthermore, Virtual Labstore supplies a virtual financial budget which limits the amount of materials students can collect. Afterwards, the teacher automatically receives an email with a list of the collected materials.

Additionally, students work in groups and communicate with their teacher to design their experimental approach. To facilitate social interactions independent of physical location, Virtual Labstore contains verbal and

non-verbal communication tools and provides teaching applications such as blackboard and PowerPoint screens.

Virtual Labstore was used in a research course in which students received a research question but were free to develop their own experimental approach. Interviews with students indicated that they appreciated the freedom during the design of the experimental approach. Using Virtual Labstore instead of fixed lists stimulated their thinking about the approach. Students acknowledged the practical value of Virtual Labstore as a virtual space in which all the available products are displayed and which can be accessed independently of physical location. Finally, students indicated that Virtual Labstore provided flexible, fast and informal communication about the experimental approach with their teacher.

In conclusion, Virtual Labstore facilitated an inquiry-based development of the experimental approach in our research course by providing an integrated, easily accessible laboratory storage system combined with a virtual teaching environment.

2- Development of a formative peer observation protocol for STEM faculty reflection

Heather Dillon, Carolyn James, Valerie Peterson, Stephanie Salomone & Eric Ancil, *University of Portland*

Faculty peer observation has seen increasing uptake in recent years, in some cases as an alternative or supplement to student teaching evaluations. While many universities encourage faculty peer observation, it is not widely used in a formal way for formative assessment. We outline the development of a new faculty peer observation protocol designed for formative assessment of evidence-based educational practices. The goal of the protocol is to foster reflective teaching practices.

3- What's the point of learning biology? A triad redesign of a large-enrollment, non-majors freshmen biology course

Sandi Connelly, Michelle Weatherell, Emily Coon-Frisch, *Rochester Institute of Technology*

The problem: The General Biology non-majors course needs to be more applicable / accessible for real world problems that people actually encounter in their lives. Historically the course has covered too much material in too little time, leaving many students (and instructors) frustrated and unsatisfied with the course. The details: The General Biology two-semester course in the TH Gosnell School for Life Sciences (GSOLS) at Rochester Institute of Technology (RIT) is the largest enrollment course taught in the school and includes a 3-credit lecture and 1-credit program optional lab. It is a biological survey course covering materials from basic biochemistry through evolution, anatomy, and physiology over the two semesters. The course is also a general education Natural Science Inquiry course, meaning that any student who is not a declared Life Sciences major may enroll in the course, causing increased numbers every year. In 2007, the fall enrollment was 175 students (two sections), while in 2018 the fall enrollment was 427 students (two sections). The significant increase in enrollment is attributed in part to increased enrollment at RIT, but also reflects an increase in the RIT programs/majors that are requiring the course as their "preferred" science elective. The background of the students is highly diverse, and the disparate nature of their interests (~70 different majors) compounds the instructional challenges associated with content delivery and assessment. Historically the General Biology course has been taught by one or two instructors in a traditional lecture format. This triad aims to change the pace and focus of the course to "streamline" the biology concepts, aligning content with the Vision and Change model, giving us time to better convey applicable biological concepts to the masses. The redesign is implementing a three-instructor, lecture-do-reflect model in which a given topic is covered in a single 75-minute class period (self-contained modules). Here we will present the overall design of the course and the details of two topic days. We welcome discussion of the redesign, and are happy to share strategies and resources, including our use of OER, JoVE Core, and multimedia classroom materials.

4- Pilot data from a tool to assess scientific interpretation skills

Scott M. Shreve, *Lindenwood University-Belleville*

The ability to read primary scientific literature, interpret scientific data, and evaluate the evidence supporting authors' conclusions are important skills to develop in science majors. They are not only relevant to the scientific careers of students, but also help to improve their overall scientific literacy. Interpretation of primary scientific literature, or the associated skills, are consequently included in the learning objectives of many biology programs. Summative assessment of these objectives is often done indirectly as part of a final research or review paper that can vary across the courses in biology program. Additional tools that provided a biology program with longitudinal data across the curriculum would be beneficial to program by providing additional evidence of student competency and by identifying parts of the curriculum where most learning gains occur. In spring 2019, I administered an instrument modified from Gormally et al (2012) to my introductory biology class and my senior-level evolution class at the beginning and end of the semester. The results indicated significant improvement in scientific interpretation skills across the biology curriculum, but no single segment of the curriculum showed significant changes in student scores. There were no significant changes in student confidence regarding reading the scientific literature, and post-semester Likert scores were uncorrelated with instrument scores in both courses. The pilot data suggest that the scientific instrument could serve as a framework for the development of a program-level assessment tool for scientific interpretation skills. In its current form, the instrument appears to be able to detect student improvement across the curriculum but not within individual courses or semesters, and so there would be minimal benefit to the program in deploying it at more than two or three points across the curriculum.

5- A Course-based Research Experience on Endocrine Disruptors

Aleksandra Kuzmanov & Julie Zwiesler-Vollick, *Lawrence Technological University*

Endocrine disruptors, chemicals that interfere with the synthesis and function of hormones in the body, are an important public health concern. Although many of the endocrine disruptors have been linked to developmental, reproductive, neural and other disorders, our understanding of their impact on human health is still limited. In the Cell Biology Laboratory course, students have an opportunity to use two different model systems to evaluate potential endocrine disruptive effect of environmental chemicals. First, students use an in vitro cell culture model – human adrenal cortex cell line (H295R). This cell line produces testosterone and estradiol, and is widely used to identify chemicals that adversely affect synthesis of these hormones. Following exposure to a nonlethal dose of a potential endocrine disruptor (PED), students measure the amount of estradiol and testosterone secreted by the cells using a competitive enzyme-linked immunosorbent assay. Moreover, to assess the effect of the PED on the reproductive health, in the context of a multicellular organism, students use a nematode *C. elegans*. To evaluate the in vivo effect of the PED, self-fertilizing *C. elegans* hermaphrodites are exposed to varying concentrations of the PED from early embryogenesis to adulthood. During the egg-laying period, laid fertilized eggs are counted using a dissecting light microscope and the brood size is compared to the control. This course-based research module not only engages students in discovery-based scientific research within the curriculum, but also enhances their understanding of scientific literature and research process.

6- Integrating Independent Study Projects Into Animal Behavior Classes

Randi (Ruth) Darling, *Westfield State University*

Gaining hands-on experience developing hypotheses, designing experiments, conducting research, and analyzing and presenting results are important skills for biology majors to develop. However, often students do not have many opportunities to learn how to develop and test their own hypotheses. I teach a three-hundred level Animal Behavior class that is designed to provide students with an opportunity to gain experience designing and conducting their own independent research projects. In this presentation, I will discuss how I integrate independent research projects into an upper division Animal Behavior class that I teach. I will also provide some examples of past independent research projects that students have conducted, and I will discuss some of the challenges involved with supervising student research projects.

7- Board game creation and team play to better understand and apply the biochemical concepts of amino acids, peptides, and proteins

Ashley Shaloo, *SUNY Alfred State College*

Students in upper-level biology courses can usually differentiate between macromolecules (i.e. carbohydrates, proteins), but often struggle with the higher order understanding of how each interacts at the biochemical and cellular level. This board game assignment was developed to help undergraduate-level biochemistry students better understand proteins. As a team, students developed a colorful and creative board game with an interactive mode of play that integrated at least 25 general questions on amino acids, peptides, and proteins. A rubric was adapted from ReadWriteThink to help assess learning outcomes. Out of a single classroom, between four to five board games were constructed. The final assessment included a 2.5 hour period over which the students played each other's games and assessed them on quality of play, learning outcomes, and difficulty.

8- Identification of Wild-Harvested Morel Species by DNA Barcoding; an Inquiry-Based Laboratory for Students in Majors Level Genetics.

Patricia Conklin and Santanu Banerjee, *SUNY Cortland*

Most mushrooms sold in the supermarket are commercially cultivated. However, mushrooms of the species *Morchella* (morels) are typically wild harvested. The harvesting of wild morels for retail sale has grown into a multimillion-dollar industry. Despite the popularity of morels, mycologists are unclear as to the total number of different species and subspecies as they can be difficult to distinguish based on outward morphology. In addition, there has been little investigation regarding the species that are commonly being harvested by moral foragers for commercial sale.

In this laboratory exercise that spans three 3-hour laboratories, the students (in groups of 3 – 4) conduct DNA barcoding on dried morels purchased from vendors such as Earthy Delights and Spice Jungle. In the first week they extract DNA and PCR amplify either ITS or EF1 using degenerate primers. The instructors clean up the PCR products and send the samples for sequencing. In week 2, the students learn how to manipulate their raw DNA sequences and then use alignment tools at the *Morchella* sequence database (<http://www.westerdijkinstituut.nl/morchella/>) to make an identification of their sample at the level of genus and (possibly) species. Using available online phylogenetic tools the students then discover how their sample barcode is related to other morels in the database. From these bioinformatic analyses the students develop an understanding of DNA databases, sequence alignments and also key molecular phylogenetic concepts. In the third week the students submit a completed worksheet and also present their findings to the other groups in their laboratory section. The worksheet assesses the students' general understanding of DNA barcoding and also the depth of their analysis with regards to their barcoding results. The presentations and worksheets focus not only on the specifics of the DNA barcoding and associated phylogenetic analysis, but also on the ecology of the morel genus (and species if possible) that was identified, including its known local habitat and geographical distribution.

9- Benefits of the Undergraduate Teaching Assistant Experience in an Introductory Biology Laboratory Course and other STEM Courses

Frank R. Castelli, Mitra Asgari, and Mark A. Sarvary; *Cornell University*

Undergraduate teaching assistants (UTAs) are known to provide benefits to the students they teach, but there have been few studies examining how UTAs themselves benefit from the experience and how the graduate teaching assistants (GTAs) that they assist benefit. We have developed and are continually improving a teaching assistant program for undergraduates in an inquiry-based introductory laboratory biology course that enrolls upwards of 400 students each semester. Each lab section of up to 18 students is led by a GTA laboratory instructor who is assisted by one UTA. UTAs also hold office hours. Our team of about 12 UTAs work closely with their GTA mentors and attend a weekly pedagogical training meeting. We will discuss the benefits and challenges of this UTA program from multiple perspectives, partly measured through UTA surveys, GTA surveys, and student evaluations given throughout the semester. We will also present some results of a related educational research project examining how the benefits of the UTA experience in biology courses, including ours, compares and contrasts with those in other STEM disciplines including chemistry, physics, and computer science.

10- Peer Leaders as Potential Role Models and the Impact on Perceived Student Learning Gains

Christina I. Winterton, Ryan D.P. Dunk, & Jason R. Wiles, *Syracuse University*

Peer-led Team Learning (PLTL) is an active learning method that has been associated with a wide range of student benefits in various university settings across multiple science disciplines. The success of PLTL has been attributed to its fostering of peer interactions as students collaborate in small groups under the guidance of a peer leader who has recently completed the same course. Given the unique role of a peer leader, their interactions with students can influence the students' perceptions of the course. As peer leaders often develop close rapport with students, we would expect them to be well-attuned to students' learning gains and needs. In this study, students attending PLTL sessions associated with an introductory biology course were asked to fill out a modified version of the Student Assessment of Learning Gains (SALG) survey, which indicates their perceived learning gains. The peer leaders were also asked to fill out the SALG survey for each of their students to indicate their perceptions of the students' individual learning gains. A comparison of these results allowed us to identify students and leaders who were most aligned in their assessment of individual student learning gains. In addition to the SALG survey, students responded to an open-ended questionnaire regarding whether they viewed their peer leader as a role model, notable actions by the leader during sessions, and how the leader's style of communication has impacted their learning. The students who reported the highest perceived learning gains had SALG scores that aligned more closely with their peer leader's assessments than those that had low perceived learning gains (Welch's 2-sample t-test: $t = 7.63$; $df = 135.38$; $p \ll 0.001$). Additionally, students who view their peer leaders as a role model have significantly higher perceived learning gains than those who do not view their peer leader as a role model (two-way ANOVA: $F = 4.13$; $df = 1, 111$; $p = 0.044$). There is some support that this trend is stronger for students who have declared majors within a STEM program versus those who have not, but the interaction is not significant (two-way ANOVA: $F = 2.88$; $df = 1, 111$; $p = 0.092$). We also report qualitative analyses which provide insight into the behaviors, teaching methods, and attributes common to peer leaders who were viewed as role models by their students. These results can inform active learning strategies that involve peer leaders and mentors by giving peer leaders potential tools to becoming more aligned with their students and their learning needs, while students benefit from having an accessible role model in the STEM field.

11- The Strategic Undergraduate STEM Talent Acceleration INitiative (SUSTAIN) at Syracuse University

Alia Thompson, *Syracuse University*

12- Using Hybridoma Cell Lines to Reinforce Student Learning in an Undergraduate Immunology Course

Christian Nelson, *SUNY Cortland*

In an attempt reinforce immunological principles and engage students in hands-on learning, a multi-week laboratory exercise was designed to demonstrate the structure and function of antibodies as well as their usefulness in immunology and molecular biology research. Students learn and perform tissue culture of antibody-producing hybridoma cells sourced from a publicly available hybridoma bank. Following cultivation, antibodies are then harvested and characterized using standard molecular biology techniques. Students also investigate antibody structure and antibody-antigen interactions using the three-dimensional molecular graphics program Chimera and Western blotting. Students then design experiments that use their antibodies to help answer biological questions, such as characterizing intracellular organelle structures using immunofluorescence microscopy. Students generate laboratory reports based upon their results, and will present their research findings as poster presentations in future iterations of this laboratory exercise.

13- Factors Affecting Christian Students' Persistence in STEM

Mia C. Pepi, Jason R. Wiles, and Ryan D.P. Dunk, *Syracuse University*

Similar to women and underrepresented minority groups, Christian students in are another population susceptible to stereotype threat in science and, therefore, an impeded sense of belonging within STEM (Strayhorn, 2012). As a result, retention of these students could be lower. A developed sense of belonging in STEM is important for further motivation and persistence of these students (Hausmann, Schofield, & Woods, 2007).

Christian students do not differ in performance within STEM fields compared to their nonreligious peers. However, if stereotype threat is explicitly presented to Christian students in science before completing a task, underperformance and misidentification with science can result (Rios, Cheng, Totton, & Shariff, 2015). The absence of stereotype threat, or if students are able to perceive it as false, is an important factor for overall retention and success.

Here, we present a framework to be used to analyze the persistence of Christian students within Biology. To do so, we will interview advanced biology students and code their responses for themes to understand how Christian students persist within biology, and within STEM more generally.

14- Leveraging natural history teaching collections to maximize student learning opportunities

Gerick Bergsma, Department of Biology & Chemistry, *California State University, Monterey Bay*

Natural history collections have long represented the soul of biological education and research. Large research universities and major museums use their extensive collections to create worldclass educational and research opportunities, but smaller, teaching-focused institutions rarely have the resources or need to maintain large collections. The collection and curation of natural history specimens for teaching, however, can be used to augment curriculum and create learning resources, and enhance student training and professional development. We have recently focused on expanding the biological teaching collection at California State University, Monterey Bay, with particular interest in expanding our holdings of local species relevant to our biodiversity and natural history courses. We began by creating a new practical lab course in zoological specimen preparation, where students practice creating vertebrate study skins, wet preserving marine invertebrates, and pinning

insects. We focused on low impact collecting practices, including salvage and donation of specimens to reduce our need for live collecting. The influx of new specimens soon allowed us to develop curation internships, where students master identification and taxonomic classification techniques while cataloging our holdings. Our expanded collection is now a valuable resource for our natural history and biodiversity courses and has allowed us to develop several new lab modules and learning resources, including field and laboratory guides and a digital image collection. With new display cases, our collection is now more accessible, and we hope to employ the displays as opportunities for students to engage in natural history interpretation and scientific illustration.

Saturday October 26th, 2019

9:20–10:00 am Concurrent Presentations and Round Table Discussions (40 minutes)

Surveying Biodiversity with iNaturalist

Lynn Swafford, *Wayne Community College*

The citizen science project iNaturalist allows anyone to document and learn about organisms around them. I have developed a lab activity that utilizes iNaturalist to survey the biodiversity on our college campus. All students need is a smartphone on which they can download the free iNaturalist app. To begin this activity, students go outside to a designated area and search for plants, animals, and fungi. They photograph these organisms and then use the app to identify them to the best of their ability. Data from the entire class on location and classification of the organisms are compiled. Students must study this dataset and determine the best way to display it graphically. They also think about what kinds of scientific questions can be answered by using the data they collected. I first implemented this lab in my non-major biology classes with the intent of increasing student interest in science and nature. Non-major students in both my seated and online sections have enjoyed this activity. They like searching for living things and discovering just how many different species are actually around them all the time. I have now also modified this activity for biology majors. At the end of the semester, these students must classify all organisms to kingdom and phylum using the knowledge they gained on biodiversity. Come learn about iNaturalist and my lab activity, discuss other citizen science projects, and share your ideas.

Collaborative Design of a Tiered Introductory Biology Course to Meet the Needs of a Diverse Student Body

Dawn Carter, Elizabeth Dicesare, Dina L. Newman, Chris Widmaier, *Rochester Institute of Technology*

Designing Introductory Biology courses to meet modern content requirements and the needs of a freshman class that is diverse in their high school preparation, socio-economic background, and confidence in their abilities is a challenge. We will share our experiences as a “teaching triad” working to develop a two semester course sequence that is divided into two sections based on prior preparation.

Our goal is to create an introductory experience that engages all students, fosters a sense of belonging in the life sciences community, and lays a foundation for further study in any biological field. To determine the content of the courses, we reorganized them to align with the Vision and Change core concepts and Biocore concept statements. This common language and framework across all courses was then used to build course outlines and learning objectives that were differentiated based on Bloom’s level targets. Different course materials (e.g. textbooks, in-class activities) allow alignment of content while meeting students where they are. Both versions of the sequence rely on evidence-based pedagogies and shared laboratory activities.

Participants in this roundtable discussion will gain insight into the collaborative processes we employed to

analyze the current courses, make decisions about changes, and decide how available resources would be utilized to ensure success.

Using reasoning is the key to solving challenging genetics problems

Jenny Knight, Austin Hammermeister Suger, Jennifer Avena, *University of Colorado Boulder*

We have been characterizing in detail the processes students use when solving genetics problems in order to understand how to better help students learn this challenging skill. In an initial study, we showed that among the many strategies students use when solving problems, only explaining their reasons for an answer significantly predicted correctness. Two other metacognitive processes, planning out their solutions and checking their work were also associated with correctness, though not as strongly.

Following this outcome, we implemented an intervention using instructor-modeled problem solving. At eight different time points during the semester, instructors explained how to use these three impactful processes (planning, reasoning and checking) and demonstrated their use while solving problems. Students then answered and documented their steps to similar problems on practice questions and exams during the semester. At the end of the course, they self-reported the strategies they commonly used, the strategies their instructor suggested they use, and whether they found the strategies helpful.

In over 1500 answers from 244 students, almost ½ the students consistently used reasoning in solving problems. The number of correct reasoning statements a student made while solving a problem and the number of practice problems a student completed in preparation for quizzes were the only significant predictors of student performance at the end of the course. Higher use of planning and checking in solving problems did not ultimately predict student performance. Overall, students reported instructor suggestions as helpful (avg. 4.6 +/- 1.0; Likert scale of 1-6). However, only about 1/3 of students self-reported using all three of the instructor-suggested strategies and even fewer actually used the strategies together in solving a single problem. When asked to explain the utility of the instructor suggestions, only 7 students discussed reasoning and checking, while 19 students discussed planning. There was a positive correlation ($r=0.23$; $p<0.05$) between reporting planning as helpful and the actual use of planning in solving problems, but no significant correlations for reasoning or checking.

We preliminarily conclude that even with explicit recommendations, students generally fail to remember and use key problem-solving strategies, although their use of reasoning consistently predicts higher performance.

10:10–10:30 am Concurrent Presentations (20 minutes)

The Curious Construct of Active Learning in Biology Education Research

Emily Driessen¹, Jennifer K. Knight², Michelle K. Smith³, Brittany Woodruff¹, Cissy J. Ballen¹,

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Biology instructors who teach undergraduate courses have increasingly embraced the use of active learning (AL) instructional practices (Aragón et al. 2018; Pfund et al. 2009). Given the term AL often elicits interest and excitement among biology instructors, we explored what this term means to the community through the investigation of two research questions: (1) How is the term AL defined in the context of undergraduate biology classrooms?; (2) What AL strategies do instructors use in the context of undergraduate biology classrooms? To answer these questions we searched for literature that included the term AL and was published between 2016 and 2018 in any of the following three journals: Life Sciences Education, the Journal of Microbiology & Biology Education, and CourseSource, and we surveyed members of the Society for the Advancement of Biology Education Research (SABER), via the listserv. The literature searched articles (N=148) and the listserv responses (N=105) were then analyzed for AL definitions and strategies, and these were categorized. The most common category among the articles reviewed was “did not provide a definition of AL definition but did provide examples

of specific AL strategies,” and the second most common category was “no definition of AL or list of relevant strategies provided.” Of the articles that did define AL (N=27), the most popular definition category was “students interacting or engaging with the material,” followed by the definition that emphasizes what AL is not: “not traditional lecture.” These definitions were echoed by the survey respondents. Concerning AL strategies, 62% of the articles mentioned any. The most common strategy (32%) was the use of a personal response system (e.g., clickers), followed by group work (to complete a specific learning task; 30%) and group discussions (of a particular question posed by the instructor; 18%). Survey participants noted the AL strategies they used in biology classrooms were think-pair-share (69%), use of personal response systems (e.g., clickers) (49%), and case studies (33%). Since findings showed AL means different things to different authors/survey respondents, those who use AL should define what they mean and what strategies they are using.

How Inclusion is Communicated (or not) through the Course Syllabus

Rita Margarida Quiñones de Magalhães, Dina L. Newman, and Scott Franklin, *Rochester Institute of Technology*

What does your syllabus communicate about you and your class? Syllabi are often the gateway to a course and the introduction to its instructor. They are usually the first class element students see and interact with, and many students determine whether or not they will “fit” in the class from their perusal of the syllabus. With increasing numbers of students leaving STEM majors, and many indicating a lack of sense of belonging as their main reason, we need to consider how syllabi set the tone for the entire class. Unfortunately, faculty rarely consider the purpose of this document and its implications. Syllabi seldom include much beyond a basic information sheet, acquainting the student with the basic course information, required reading, grade scale, and evaluation information. Revisions typically center on changing dates (mainly exams and major assignments). Research indicates misalignment between what faculty and students think are the main components of a syllabus. And while length on its own is not a good metric of quality, syllabi that are limited to 2-3 pages are unlikely to provide the students with enough information to help them succeed academically in the class, or to convey a sense of belonging to the student. While there is some literature on syllabus analysis, few studies have focused on STEM disciplines. This study examined syllabi from faculty in a College of Science in order to investigate differences in syllabi structure between disciplinary content and level, and to investigate the level of inclusion seen from the syllabi. Interviews with faculty determined their attitudes toward inclusion, and classroom observations evaluated their practices. We found a misalignment between the extent of faculty desire to be inclusive and welcoming and the content and tone of their syllabi. Instructors who are quite progressive and inclusive in the classroom may set a cold, exclusionary tone in the syllabus. Elucidating this misalignment will allow faculty to align their practice and move their behavior from intention to application. We provide recommendations for improving these documents and establishing a more welcoming environment. Future work will examine how student attitudes are influenced by revised syllabus design.

The Longevity Games – Student research exposure through service learning

Johnathan Millen, *St. John Fisher College*

Application of course material and research based on said material is not frequently found in courses designed for non-majors. In the Science of Aging we bring together student from a wide variety of majors and elders from local senior communities of varied backgrounds in a service-learning experience. Over the course of a semester students work with their elder collaborators in the Longevity Games to apply classroom knowledge, gain insight on the aging process, and to develop a personalized longevity plan. During the Games students and elders work together to accomplish 4 goals. First, they participate in a variety of simple test and games to establish baseline biomarkers of longevity (ie. segmental muscle mass, balance, and working memory). Next in-depth interviews are done to determine which longevity attributes the elders want to maintain or improve. Games and interview

data are used by the students to research peer reviewed non-invasive interventions shown to positively affect the biomarkers of longevity. Upon professor and elder approval, students work to train their elder collaborator in the new longevity techniques they have researched. Finally, after training and at-home implementation of their personal longevity plan, the student and elders work together revisiting the biomarkers of longevity. During the Longevity Games students are exposed to the application of course material, independent research on a variety of age related biological topics and develop an understanding of the scientific method in research science.

The Multimedia Classroom: Integrating Video Content into your Curriculum

Cesar Berrios-Otero, *Journal of Video Education*

Over 50% of U.S.-based STEM students don't finish degrees in their declared fields - Roughly half switched their majors to non-STEM subjects, while the rest left college without any degree or certificate at all. While the reasons are complex and multifactorial, many argue that the teaching methods have not kept up with the way today's students learn. Given its complexity text-based approaches to teaching science only get us so far particularly when freshmen who are now entering college have grown up with the internet, with many identifying as visual learners. As a result, online videos are a natural fit for them. Come learn about JoVE's extensive library of videos, how it can improve your teaching and how to integrate it into your curriculum!

10:40–11:20am Concurrent Presentations and Round Table Discussions (40 minutes)

A Concept Framework for Improving Curriculum Design and Student Metacognition

Amanda Howard, Caitlin Reeves and Jennifer Walker, *University of Georgia*

A concept framework is tool for both instructors and students, created to help (re)design courses and promote meaningful learning for students in face-to-face and online courses. The framework is a categorical outline of broad concepts that cover all content in a single course. For faculty, the framework can be used in a backwards design approach (Wiggins and McTighe, 2005) for creating new courses or used to help identify proper alignment of content in a current course with multiple instructors and/or to help identify content that may be lacking/overlapping with subsequent courses. For students, a concept framework provide a broad view of content to help connect topics over the semester and into future courses. The framework may be applied in a variety of ways by students thus a survey was taken over three semesters (both face-to-face and online) to identify how students approached and utilized the course framework. Presentation and discussion of the concept framework will include 1) understanding the development and implementation of a concept framework 2) how the framework could assist in student metacognition and how students from the survey utilized the framework, and 3) how faculty within departments can potentially utilize frameworks for curriculum design and alignment with departmental learning outcomes and/or national organizations' curriculum guidelines.

Employing Blended Team Project-Based Learning to Develop and Evaluate Student “Soft-Skill” Sets: Lessons Learned from a Microbiology Course

Jason Andrus, *Meredith College*

Part of a college faculty member's role is providing candid evaluations of students. Potential employers and admissions board members rely on these frank assessments to make decisions that can impact their organizations. With the bulk of Biology majors at Meredith College seeking employment in the life-science industry or admission into graduate programs upon graduation, it is pertinent to recognize what attributes hiring professionals value in employment seekers. Meredith College's fortunate location within the Research Triangle Park has provided me with the opportunity to learn what companies are identifying as traits of highly desirable job candidates. Based on information gathered from professional contacts, panels, mock interviews and on-site visits over the past 10 years, a consistent theme regarding the predominant importance of "soft skills" in job candidates emerged. These skill sets, namely collegiality, creativity, responsibility, communication, time management and the ability to give and receive critical feedback, are generally not readily evaluated in a traditional classroom experience. As such, a blended project based learning environment was pioneered across two sections of a Microbiology course to facilitate the development and evaluation of both subject matter comprehension and interpersonal skills. Projects were developed to allow students to explore the content as they would for a scenario they may encounter in their professional lives: grant writing, consultation, and creation of educational content. These projects also allowed students to inject their creativity and natural talents into the deliverables. Furthermore, students would submit weekly updates on their progress, as well as identify threats to project completion by the target due date. Finally, students were required to evaluate and provide constructive criticism for their team members once projects were finalized. This session will present the strengths and challenges identified from this team project-based learning experience. Additionally, project descriptions, rubrics, and samples of student work will be shared.

Hydroponics and Sustainability in the Biology Lab

Luciana Caporaletti, *Penn State University*

Understanding and thinking critically about sustainable practices is one of the top learning objectives in biology and ecology courses. The need for resource conservation is growing. Non-biology as well as biology students are increasingly aware of preserving resources for future generations. It is in our best interest to educate students about how the average consumer can practice and support sustainability. In areas where soil and water are limited, it may be favorable to use a hydroponics growing system. For most students, growing plants hydroponically is something completely new to them. In my lab, students use this system to design an experiment. This assignment works well for introductory biology students because students learn how to collect and present data. It also fosters critical thinking and collaboration. Relevant biology topics that can be presented in conjunction with this assignment include characteristics of life, chemical context of life, plant cells, membrane transport, plant nutrition, photosynthesis, respiration, bioremediation, sustainable agriculture, and conservation. To get the most benefit from this assignment, I partner with the writing center and the library to make sure that students master the art of finding and reading relevant journal articles, as well as writing a paper that is coherent and informative. Students also learn how to use APA format.

My presentation will demonstrate how to easily set up a hydroponics system that can be used in any biology laboratory. I will present student learning outcomes and provide ideas for assessment, including a rubric for the report. I will also present ideas for using this project for fundraising and community service. I will provide a brief Q & A at the end of my presentation and attendees will have electronic access to my materials. The first 10 attendees will receive a free packet of seeds.

2:20–3:40 pm Concurrent Presentations and Workshops (80 minutes)

Exploring the process of science and important biology concepts with anoles

Tara Jo Holmberg, *Howard Hughes Medical Institute*

The story of the evolution of *Anolis* sp in the Caribbean is a powerful case study in science practice, evolution, and adaptation. HHMI BioInteractive's Origin of Species: Lizards in an Evolutionary Tree collection provide students an introduction to the processes of science both in the field and laboratory. Students use interactive and hands-on classroom activities to explore evolutionary trade-offs, test questions of phylogenetic relationships, and investigate "what-if" scenarios through *Anolis* species in the Caribbean.

Participants in this workshop will explore some of the resources offered for students including inquiry of real-world questions. Using images and data from scientists in the field, students are provided opportunities to assess the importance of accuracy and precision in measurement, test various hypotheses using genomics and other data, and evaluate advantages and disadvantages of each survey method. Finally, extensions will be provided to examine sexual selection and territorialism.

Implementing high impact practices using team-based learning

Neil Haave, University of Alberta, *Augustana Campus*

Team-based learning (TBL) is a highly structured version of the flipped classroom that incorporates two of AAC&U's high impact practices: learning communities and collaborative assignments (Haave, 2014). Thus, TBL is able to promote student learning outcomes (Carmichael, 2009) by facilitating students' retrieval practice using two-stage tests and active learning through the in-class application of their pre-class preparation. This workshop will give participants first-hand experience with the readiness assurance process which is the first phase of a TBL module. Other TBL components (stable teams, in-class applications of learning, and the role of peer evaluation) will also be discussed in terms of how they are implemented and how they contribute to the strength of this active learning strategy. Strategies to address student concerns and help prepare students for the experience will be considered.

The Genomics Education Partnership: A community of practice that enhances research opportunities for students and faculty at diverse institutions

Evan Merkhofer¹, Nighat Kokan², and the Faculty of the Genomics Education Partnership

¹*Mount Saint Mary College*, ²*Cardinal Stritch University*

Since 2006, the Genomics Education Partnership (GEP; <http://gеп.wustl.edu>) has incorporated authentic genomics research experiences into the undergraduate curriculum, introducing thousands of students to eukaryotic gene structure, comparative genomics, and the evolution of *Drosophila*. Our 100+ participating institutions include community colleges, primarily undergraduate institutions, minority-serving institutions (MSIs), historically black colleges and universities, and research-intensive PhD-granting institutions. For many faculty and their students, the accessible, immersive curriculum and custom bioinformatics tools represent a unique opportunity to participate in genomics research. GEP faculty benefit from membership in a national network of like-minded colleagues and professional development opportunities that include training, research, and publication in peer-reviewed journals.

The GEP provides a wide array of materials for faculty to implement with students at any level. This workshop will utilize the GEP "Understanding Eukaryotic Genes" modules (available on CourseSource at <https://doi.org/10.24918/cs.2017.13>) to show how they can be applied in a high school or college classroom or lab to help students grasp difficult biological concepts, such as eukaryotic genome structure and alternative splicing. Furthermore, we will demonstrate how faculty can engage undergraduate students in GEP research projects that can lead to co-authorship on scientific publications: resolving sequencing/assembly problems and

generating high-quality gene models for GEP analyses.

The GEP is actively recruiting additional faculty members, especially from community colleges and MSIs, to participate in regional and national (in person or online) professional development to use the GEP curriculum in their classrooms. Further, the GEP is seeking science partners to collaborate with GEP members on funding and development of additional projects, and science education partners to collaborate on curriculum development and assessments. Please contact us through the contact forms at http://gep.wustl.edu/contact_us. Supported by NSF IUSE-1431407, NSF IUSE-1915544, and NIH IPERT-1R25GM130517-01.

3:50–5:10 pm Concurrent Presentations and Workshops (80 minutes)

PETLs: Design, Fabrication and Testing of Microfluidic Devices in the Classroom and Research Laboratory.

Fernando Ontiveros, PhD., *St. John Fisher College*

The field of bioengineering brings together applied physics and chemistry concepts to enhance our understanding of biological processes. Students can greatly benefit from an introduction to the synergy between these fields. There are many opportunities to bring bioengineering into the classroom in an engaging fashion. One of them is microfluidics. Researchers utilize microfluidic devices to control molecules, cells, organs and whole organisms in channels and chambers measured in tens to hundreds of micrometers. Borrowing techniques from the microprocessor industry, microfluidics have become a powerful tool for the biologist to solve challenges in cell culture, imaging, bioassays, mechanobiology, diagnostics and other experimental and applied settings. Adopting this technology, however, has been difficult for the average biology researcher and instructor. Standard techniques for the fabrication of microfluidic devices can be expensive, and a certain degree of technical expertise is required. With these challenges in mind, our group has developed a rapid, robust and inexpensive methodology that allows both scientists and students to fabricate custom devices (PETLs) in their laboratories and classrooms. The versatility of this technique allows instructors to use PETLs to teach basic biological concepts in the classroom and at the same time conduct basic research in their field of study. This workshop will: i) provide an introduction to the field of microfluidics, ii) describe classroom activities and semester-long projects and iii) impart hands-on training on the methodology. Following the presentation participants will be able to easily adopt and adapt PETLs microfluidics in laboratories and classrooms at their home institutions.

Build-a-Course Workshop CST 1-019

Rebecca S. Burton, Alverno College

Need to design a new course? Don't just grab the textbook and use the table of contents. This workshop will be a hands-on opportunity to develop course outcomes, criteria, rubrics, and an assessment plan.

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