64th Annual Meeting
October 24th- 25th, 2020
On-line meeting via Zoom

ACUBE's 64th Annual Meeting Program Overview

Please note that all times are in CDT

Friday, October 23rd

3:00-4:30pm ACUBE Steering Committee Meeting

Saturday, October 24th

9:00- 9:15 am	Welcoming Remarks and Meeting Orientation
9:20-10:40 am	Concurrent Presentations and Workshops (80 minute sessions)
10:50-11:10 am	Concurrent Presentations (20 minute sessions)
11:20-12:00 pm	Concurrent Round Table & Discussions (40 minute sessions)
12:00-1:00 pm	Break for lunch
1:00-2:00 pm	Keynote with Dr. Bryan Dewsbury
2:10-2:50 pm	Concurrent 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	Zoom Happy Hour

Sunday, October 25th

9:00-9:20 am	Concurrent Presentations (20 minute sessions)
9:30-10:10 am	Concurrent Round Table & Discussions (40 minute sessions)
10:20-10:40 am	Concurrent Presentations (20 minute sessions)
10:50-11:10 am	Concurrent Presentations (20 minute sessions)
11:10-11:40 am	Bioscene meeting
11:40- 12:10 pm	ACUBE members meeting
12:10-1:00 pm	Break for lunch
1:00- 1:20 pm	Concurrent Presentations (20 minute sessions)
1:30-2:50 pm	Concurrent Presentations and Workshops (80 minute sessions)
3:00-3:20 pm	Concurrent Presentations (20 minute sessions)
3:30- 4:30 pm	Poster presentations
4:30-4:50 pm	Awards and closing remarks
5:00-6:00 pm	Steering committee meeting

Our Mission

Members of ACUBE share ideas and address the unique challengees 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, Jason Wiles
Past-President, Rebecca Burton, Alverno College
Executive Secretary of Finance, Greg Smith, Lakeland University
Executive Secretary of Membership and Website Editor, Christina Wills, Rockhurst University
Secretary, Paul Pickhardt, Lakeland University
Historian, Conrad Toepfer, Brescia University
Editor of Bioscene, Robert Yost, Indiana University Purdue University
Social Media Chair, Ryan Dunk, Syracuse University

Steering Committee

Heather Seitz, Johnson County Community College
Ashley Driver, University of Scranton
Holly Nance, College of Coastal Georgia
Scott Shreve, Lewis and Clark Community College
George Todd, Coastal Pines Technical College

Local Arrangements Chair, Christina Wills, Rockhurst University
Program Chair, Jessica Allen, Rockhurst University

ACUBE gratefully acknowledges the support of the following exhibitors at the 64th Annual Meeting:

Keynote speaker: Dr. Bryan Dewsbury

Biography

Bryan Dewsbury is an Assistant Professor at the University of Rhode Island. His (Science Education and Society) Research program focuses on questions relating to identity constructs, bias, relationships, and the effects of those variables on learning in students (K-PhD). Dr. Dewsbury is interested in how students (especially those in underrepresented groups) develop perceptions of the world and others, and how these perceptions might in turn affect their engagement with science content, career choices, and ultimately their academic performance. Central to the formation of these constructs are the presence of hidden biases, stereotype threat, and mindset. Dr. Dewsbury uses a variety of qualitative and quantitative methods to deduce the effects of these forces, and partners with local schools and URI to implement interventions that have proven to be effective. He is ultimately interested in helping to re-frame the education discussion to better address questions of equity and community-building, with the belief that the solutions to these are equally important to student exposure to content. His work addresses pressing issues such as student retention in STEM fields (especially in higher ed), the under-representation of minority groups in certain STEM fields, and the role of affect domain in student learning gains. He then uses his research results to develop curricula that are more inclusive of these new understandings of what makes students successful.

Keynote Address: The Social Context of Teaching and Learning

The promise and pursuit of education is a liberating exercise to the extent that its stakeholders are positioned to unleash its potential. Using evidence from an Introductory Biology classroom we will discuss how social factors can impact classroom outcomes, but ways in which inclusive pedagogies can mitigate potential negative externalities. Implications for inclusive approaches writ large will also be discussed.

64th Annual ACUBE Meeting Program

October 24-25th Online meeting via zoom

Friday October 23th		
3:00-4:30 pm	Steering committee meeting	Zoom Room A
Saturday October 24th		
9:00-9:15am	Opening remarks and meeting orientation	Zoom Room A
9:20-10:40am	Concurrent Presentations and Workshops (80 minutes)	
Build-a-Course Workshop Rebecca S. Burton, *Alverno College*		Zoom Room B
How science works: teaching the personal and dynamic nature of science Rosie Bolen, *Mount St. Mary's University*, and Kathryn S. Jones, *Howard Community College*		Zoom Room C
Cell Collective: Computational modeling and simulation designed with the classroom in mind Ehren Whigham, *University of Nebraska-Lincoln* and Dane Bowder, *Doane University*		Zoom Room D
10:50-11:10am	Concurrent Presentations (20 minutes)	
Use of a short, in-class, open-ended free response activity to assess student understanding of the cell membrane in an undergraduate physiology course Kristen LW Walton, *Missouri Western State University*		Zoom Room B
Important things to know on how to publish successfully in Bioscene. Robert Yost, *Bioscene editor*		Zoom Room C
Maintaining Active Learning with Collaborative Group Work in Online Learning Environments Jamie Dyer and Ryan Elsenpeter, *Rockhurst University*		Zoom Room D
11:20am-12:00pm	Concurrent Round Table & Discussions (40 minutes)	
New Kits to Teach CRISPR: Both Hands-on and Online Resources Available Ian Harwood and Delquin Gong, *Bio-Rad Laboratories*		Zoom Room B
Knerdy Innovations in Biology Courseware: Filling Knowledge Gaps with Knewton Alta *The Wiley Team*		Zoom Room C
Course-Based Undergraduate Research During and Beyond COVID-19 Alita R. Burmeister, Melanie Bauer, and Mark Graham, *Yale University*		Zoom Room D
12:00-1:00pm	Break for lunch	
1:00-2:00	Keynote address "The Social Context of Teaching And learning" with Dr. Bryan Dewsbury	Zoom Room A
2:10-2:50	Concurrent Round Table & Discussions (40 minutes)	
Roundtable Discussion: Teaching CRISPR, COVID and More Ian Harwood, Delquin Gong and George Chenaux, *Bio-Rad Laboratories*		Zoom Room B
Doctor in the house: Improving undergraduate critical thinking skills through diagnosing medical case studies Robin Forbes-Lorman, *Ripon College,* and Julia A Lily		Zoom Room C
Can evolution misconceptions be corrected? Lynn Swafford, *Wayne Community College*		Zoom Room D
3:00-3:20	Concurrent Presentations (20 minutes)	
Beachcomber Shell Ecology Goes Online Kathleen A. Nolan, *St. Francis College* and Jill E. Callahan, *St. Peter's University*		Zoom Room B

What criteria do students use to form research groups and how do these criteria relate to students' learning and attitude towards group work? Mitra Asgari, *Arizona State University*, Amy E. Cardace and Mark A. Sarvary, *Cornell University*	Zoom Room C
Academic Advising in a Pandemic: Lessons Learned Laura Salem and Annie Lee, *Rockhurst University*	Zoom Room D
3:30-4:50 Concurrent Presentations and Workshops (80 minutes)	
Hands-on Molecular Biology Labs at Home. Teach DNA Structure, Gene Expression, and Enzyme Kinetics Remotely Ally Huang, *miniPCR bio*	Zoom Room B
Improving visual literacy using PyMOL, augmented reality and LEGO bricks® Swati Agrawal, *University of Mary Washington*, Shane Austin, *The University of West Indies*	Zoom Room C
Do We Really Want Our Students to be Scientists? Brittney N. Wyatt, *Utah Valley University*	Zoom Room D
5:00-6:00 Zoom Happy hour	Zoom Room A
Sunday October 25th	
9:00-9:20 Concurrent Presentations (20 minutes)	
A simple risk assessment of raw milk consumption in a college Microbiology course Jose de Ondarza, *Plattsburgh State University of New York*	Zoom Room B
The Genomics Education Partnership: a nationwide collaborative CURE that offers online-based research opportunities for students and faculty at diverse institutions Judith Leatherman, *University of Northern Colorado*, Nighat Kokan, *Cardinal Stritch University*, Evan Merkhofer, *Mount Saint Mary College*, David Lopatto, *Grinnell College*, Wilson Leung, *Washington University in St. Louis*, Laura K. Reed, *University of Alabama* and *The GEP Faculty Community*.	Zoom Room C
Using 3D printing to model the light reactions of photosynthesis Barbara Hass Jacobus, Jordan McQueen, Karen Smiar and James Mendez, *Indiana University-Purdue University Columbus*	Zoom Room D
9:30-10:10 Concurrent Round Table & Discussions (40 minutes)	
A model for a hyflex majors-level high enrollment Principles of Biology laboratory V. Christine Minor and Lauren E. Stoczynski, *Clemson University*	Zoom Room B
Resilient Classrooms Mitigate Student Resistance Neil Haave, *University of Alberta, Augustana Campus*, Cosette Lemelin, *University of Alberta*	Zoom Room C
Interdisciplinary teaching and active learning approaches for an energy conservation theme in biology, physics, and chemistry courses Joanna Cielocha, Nancy Donaldson, Lisa Felzien, and Michael Marvin, *Rockhurst University*	Zoom Room D
10:20-10:40 Concurrent Presentations (20 minutes)	
Utilizing loop-mediated isothermal amplification to detect the presence of Escherichia coli: an inquiry driven undergraduate laboratory module Courtney Lappas, *Lebanon Valley College*, Brandon Roy, *Cornell University*, Eric Ryndock, *Millersville University*	Zoom Room B
Data-driven Research Projects for Undergraduates – CODE Program Michele C. Morris - *HudsonAlpha Institute for Biotechnology*	Zoom Room C
Top reasons that science majors cite for withdrawing from STEM gateway courses Latanya Hammonds-Odie, Charmita Burch, Allison D'Costa, Clay Runck, David Pursell, Tirza Leader, and Judy Awong-Taylor, *Georgia Gwinnett College*	Zoom Room D
10:50-11:10 Concurrent Presentations (20 minutes)	
An Apple for all! Implementing 21st century technology to achieve improved outcomes for students in General Biology. Kristin Picardo and Katie Sabourin, *St. John Fisher College*	Zoom Room B

Teaching a microbiology laboratory course online immediately James F. Graves, *University of Detroit Mercy*	Zoom Room C
Using Group Exams to Improve Student Learning Scott M. Shreve, *Lewis and Clark Community College*	Zoom Room D
11:10-11:40 Bioscene meeting	
11:40-12:10 ACUBE meeting **First call for committee nominations** **Next years meeting overview** **Out of this world teaching ideas**	

12:10-1:00 Break for lunch	
1:00-1:20 Concurrent Presentations (20 minutes)	
Why students do not turn on their video cameras during online classes and an equitable and inclusive plan to encourage them to do so Frank R. Castelli and Mark A. Sarvary, *Cornell University*	Zoom Room B
"Is this bullst?" – creating an interdisciplinary learning community to increase information literacy for non-STEM majors** Elizabeth Harrison, *Kennesaw State University*, Tom Lilly and David Minchew, *Georgia Gwinnett College*, Adrienne Button, *Emory University Oxford College*	Zoom Room C
The Culturally Responsive Science Teaching Practices of Undergraduate Biology Teaching Assistants Hillary A. Barron and Sehoya Cotner, *University of Minnesota*	Zoom Room D
1:30-2:50 Concurrent Presentations and Workshops (80 minutes)	
Teaching Like a Pro in Your First Years Becky Burton, *Alverno College*, Conrad Toepfer, *Brescia University*, Jason Wiles, S*yracuse University*	Zoom Room B
A moment can change your mind: mindfulness and mindset interventions to increase success and persistence in STEM Melissa Goodwin, Sara Goodman, Noveera Ahmed, Michelle Erklenz-Watts, and Kristin Picardo, *St. John Fisher College*	Zoom Room C
Fostering Inclusive Learning Environments in STEM Natalia Caporale, Michael Moore, Jana Marcette, *iEMBER*	Zoom Room D
3:00-3:20 Concurrent Presentations (20 minutes)	
Student Perceptions of Scientific Reading and Writing Ability in a Comparative Physiology Course Christina Wills, *Rockhurst University*	Zoom Room B
Development of the Community College Research in Education and Scholarly Teaching (CCREST) Program Heather Seitz and Jean Ann Vickers, *Johnson County Community College*	Zoom Room C
	Zoom Room D
3:30-4:30 **Poster presentations**	**Zoom Room A**
4:30-5:00 **Closing Remarks Awards**	**Zoom Room A**
5:00-600 **Steering committee meeting**	**Zoom Room A**

ABSTRACTS BY CATEGORY

20-minute Presentations

10:50-11:10 SATURDAY OCTOBER 24th

Use of a short, in-class, open-ended free response activity to assess student understanding of the cell membrane in an undergraduate physiology course

Kristen LW Walton, *Missouri Western State University*

Students in an upper division, stand-alone physiology course at Missouri Western State University are required to have completed a freshman-level introductory cell biology course and a sophomore-level genetics course as prerequisites. These prerequisite courses include discussion of the eukaryotic cell membrane and basic properties and functions of the membrane. However, many students remember the basic information about membrane structure but have difficulty relating that structure to membrane function and related topics in our physiology course, including vesicular transport, primary and secondary active transport, osmosis, and current flow across the membrane. To gain a better understanding of what students recall about the cell membrane before beginning in-class discussion about membrane structure and function, students were given an open-ended prompt, "What do you know about the structure and function of the animal cell membrane?" The students were allowed to work in small groups or alone if they preferred, and could generate their response as drawings, written statements, or both. They were given 10 minutes to construct a response. These student responses were analyzed using the conceptual framework for the "cell membrane" core concept recently published by Michael and Modell (Adv Physiol Educ 2019). 100% (19 out of 19) submissions included a drawing or description of the cell membrane as a phospholipid bilayer, and 84% of submissions included integral and peripheral membrane proteins. However, other components of the "cell membrane" conceptual framework were included much less frequently or not at all. While 58% of the responses listed diffusion or osmosis, only 32% listed active transport, and less than 10% mentioned vesicular transport, cell-cell or cell-matrix junctions, maintenance of solute concentration inside versus outside the cell, or cell-to-cell communication. No responses explicitly included simple diffusion of lipid-soluble molecules, membrane receptors, ion channels, or physical separation/compartmentalization of the cell. Several responses had errors, such as incorrect labeled of the fatty acid tails of phospholipids as hydrophilic. This quick activity provides valuable information about what students recall from prior coursework and what concepts need to be revisited before moving into more detailed discussion of cell membrane function.

Important things to know on how to publish successfully in Bioscene.

Robert Yost, Bioscene editor

Robert Yost, current editor for Bioscene, will discuss how to prepare a manuscript for Bioscene, submission dates, publication dates, and the review process. Join us for this interactive discussion.

Maintaining Active Learning with Collaborative Group Work in Online Learning Environments

Jamie Dyer and Ryan Elsenpeter, *Rockhurst University*

Due to the coronavirus pandemic, many of our courses have had to move into the virtual teaching landscape. This switch in delivery mode has resulted in dramatic changes in the class environment. Learning to navigate this new educational medium in a short period of time has presented many challenges, including trying to maintain an active learning environment that includes high impact teaching practices, including collaborative group assignments. Incorporating such practices into freshman-level biology courses with numerous students presents additional problems, as incoming student knowledge varies widely and more reluctance to working in groups and contributing ideas is observed in this population. During this session, we will provide examples that we have been using to promote active

learning and collaborative group problem solving in a general biology course, as well as open a discussion to allow for sharing of additional tools, methods, and experiences for enhancing learning in biology courses and development of interpersonal skills through online learning environments.

3:00-3:20 SATURDAY OCTOBER 24th

Beachcomber Shell Ecology Goes Online

Kathleen A Nolan, *St. Francis College*, and Jill E. Callahan, *St. Peter's University*

Collections of seashells were used to simulate real populations. Two collections of seashells were ordered online, (Sanibel Island, Florida, and Pacific Northwest) and one was collected on a beach in St. Augustine, Florida. From pictures taken, students were asked to determine: 1. Species richness and 2. Species diversity using the Simpson's Reciprocal Index using these collections. Comparisons were made of all three populations, and students generated hypotheses that might explain differences in species diversity among all three areas. Additional exercises that could be conducted by students include rank-order abundance curves and species accumulation curves.

During our presentation, we will share our handout with pictures with the participants. The answer keys will also be provided. We will go through how we determined species richness and demonstrate how to calculate Simpson's Reciprocal Index of diversity. We will also show how to calculate a rank abundance curve and species accumulation curve. We will share geographical information about each of the three areas, and show how this information can help the students to analyze their data as to why one area might be more/less species rich/diverse than another area. We will also provide information about additional references that might help the participants conduct additional online ecology labs/exercises with their students.

What criteria do students use to form research groups and how do these criteria relate to students' learning and attitude towards group work?

Mitra Asgari, *Arizona State University*, Amy E. Cardace and Mark A Sarvary, *Cornell University*

This research project explores how self-selected student groups are formed and how group composition relates to student attitudes about group work. Previous research has shown benefits of both self-selected and teacher-selected student groups, and we aim to uncover more detail about how self-selected groups function in practice. We utilize a matched pre-post design to examine how student group work attitudes change over a semester. We analyzed survey data to study the criteria students use to form groups, the demographic composition of the resulting groups, and how student attitudes towards group work vary. Students were also asked about content knowledge, demographics, and how they formed their research group. The data was collected in a large-enrollment biology laboratory course over two semesters (n=600) at an R1 research university over two semesters. Preliminary descriptive analyses showed that "students sitting next to me" (57%) was the most common factor in forming research groups. We also studied instances of demographic isolation within groups, and find the isolation of female, underrepresented minority, and first-generation in 20%, 29%, and 28% of groups formed, respectively. These percentages fall within the range we found among a simulation of randomly assigned groups as well. Finally, we will utilize a multi-level linear regression to account for group clustering when estimating the effects of demographic variables on students' group work attitudes scores. This study can provide valuable information about the criteria students use when forming groups, how demographics are concentrated in these groups, and how these group concentrations relate to student outcomes.

Academic Advising in a Pandemic: Lessons Learned

Laura Salem and Annie Lee, Rockhurst University

Academic and pre-professional advising involves making personal connections with students. The pandemic provided some challenges to the regular process of working with students as academic advisors. During this presentation we will

share our lessons learned with working with large populations of students interested in health care careers. We will share challenges, resources, and student feedback.

9:00-9:20 SUNDAY OCTOBER 25th

A simple risk assessment of raw milk consumption in a college Microbiology course
Jose de Ondarza, *Plattsburgh State University of New York*

Microbiology is a requirement of several degree programs that allows students to investigate topics such as food production, preservation and safety. One topic that garners attention in journals, on-line blogs and popular media is the sale and consumption of raw milk. This is particularly pertinent in light of the growing movements of "localvores", organic food proponents, and additive-free eating. Yet, few students seem to have more than a basic understanding of the risks associated with raw milk consumption. A lab-based Microbiology course offers a unique and effective tool to address this subject in a hands-on setting.

Goals and Objectives: This lab-based activity is designed to have students complete a risk assessment of the human consumption of raw (unpasteurized) milk. At the end of this activity, students will be able to draw conclusions about the safety of raw milk based on their own lab evaluation of raw and pasteurized milk samples.

Methods: Milk samples are obtained from local dairy farm as well as pasteurized milk purchased in a local store and assayed in a blind study to obtain a total heterotrophic count as well as a coliform count. Each student group performs this assay on each milk sample without knowing the sample source. Following incubation for 48h at 35C, colony counts on TSA and VRBA were done and data shared.

Results: While total bacteria vary greatly (depending on the age of the milk sample), pasteurized milk samples never tested positive for coliforms in over 20 years of repeating this experiment. In contrast, raw milk samples contained between 1 – 50 coliform bacteria per ml each time, with only one exception: a raw milk sample that was collected from a single cow, with no coliforms observed.

Conclusions: While raw milk may be safe for human consumption, repeated testing of raw milk samples obtained from milk tanks on local farms demonstrably show the presence of coliforms, providing a powerful argument for the pasteurization of milk and milk products which may otherwise not catch on among young adults whose source of information includes many unsupported claims about the benefits of raw milk via the internet.

The Genomics Education Partnership: a nationwide collaborative CURE that offers online-based research opportunities for students and faculty at diverse institutions
Judith Leatherman, University of Northern Colorado, Nighat Kokan, Cardinal Stritch University, Evan Merkhofer, Mount Saint Mary College, David Lopatto, Grinnell College, Wilson Leung, Washington University in St. Louis, Laura K. Reed, University of Alabama and The GEP Faculty Community

The Genomics Education Partnership (GEP; https://thegep.org) is a growing collaborative community of practice that provides authentic Course-based Undergraduate Research Experiences (CUREs) in genomics. Our members include faculty from over one hundred and fifty institutions, including community colleges, primarily undergraduate institutions, minority-serving institutions, and research-intensive universities. We have created curriculum which provide beginning and advanced undergraduate students the opportunity to investigate and discover what eukaryotic genes look like in their genomic context, and to become more sophisticated users of bioinformatics tools. For example, the "Understanding Eukaryotic Genes" curriculum modules (https://doi.org/10.24918/cs.2017.13) are focused on beginning

students and stress gene structure, while "A Hands-on Introduction to Hidden Markov Models" (https://doi.org/10.24918/cs.2016.8) introduces advanced students to the use of machine learning in computational gene predictions. GEP students learn how to utilize multiple lines of evidence (e.g., sequence alignments, gene predictions, RNA-Seq data) to construct gene models that contribute to our shared comparative genomics projects on the evolution of Drosophila Pathways, the Drosophila Muller F element, and venom proteins in parasitoid wasps. Students who contribute gene annotations to these projects can be eligible for authorship on our research publications. The GEP is leveraging the relative low cost, ease of scalability, and portability of our projects to continue providing students with research opportunities in online settings during the COVID-19 pandemic.

The large consortium of faculty implementing a GEP CURE in a variety of ways has also provided opportunities for educational investigations. Through the use of faculty logs, assessment of student learning gains, and responses to surveys and focus groups, we have examined actions that impact student learning. Recent findings show that our students experience "formative frustration", where initial failure, followed by exploration, re-evaluation, adjustment, and re-analysis becomes a beneficial learning experience. The low-cost, low-stakes structure of genomics investigations encourage faculty to let their students experience this formative process.

We are currently recruiting new faculty members, and we have developed online faculty training. Please contact us at https://thegep.org/contact/. Supported by NSF IUSE-1915544 and NIH IPERT-1R25GM130517-01 to LKR.

Using 3D printing to model the light reactions of photosynthesis

Barbara Hass Jacobus, Jordan McQueen, Karen Smiar, and James Mendez, *Indiana University-Purdue University Columbus*

The future of 3D printing provides endless possibilities to innovate, create, and modify how learning can take place in a classroom. Models are particularly useful in helping students picture complex events that occur at molecular level that are not easily observed first-hand. We have designed a 3D-printed model that allows students to "split" water and follow the movement of the released electrons (ball bearings) through the light reactions of photosynthesis. Students use a 3D-printed sun with an embedded magnet to pass the electrons through Photosystem II, down an electron transport pathway where ATP is generated, as visualized by an LED that lights up when the electrons pass through the tunnel, into Photosystem I, and finally down a second electron transport pathway where the electrons are captured to form NADPH. Based on student input, an illustrative overlay guide was designed to complement the textbook in use in the classroom and direct students in guiding their electrons through the model. We are integrating this technology into introductory biology courses and assess its utility in increasing students' understanding of the complex light reaction pathway.

10:20-10:40 SATURDAY OCTOBER 25th

Utilizing loop-mediated isothermal amplification to detect the presence of Escherichia coli: an inquiry driven undergraduate laboratory module

Courtney Lappas, *Lebanon Valley College*, Brandon Roy, *Cornell University*, Eric Ryndock, *Millersville University*

The amplification of nucleic acids is a fundamental tool utilized in various scientific disciplines, including Molecular Biology, Immunology, Microbiology and Genetics. A working knowledge of the techniques utilized to amplify nucleic acids is therefore arguably one of the most valuable tools imparted to undergraduate students. However, due to the time and technology required for traditional PCR and its derivatives, it is not always possible to include such methodologies in undergraduate laboratory curricula. Loop-mediated isothermal amplification (LAMP), a technology that has become increasingly utilized in a variety of laboratory and field settings during the past two decades, is an

alternate method of nucleic acid amplification that is rapid, sensitive and performed under isothermal conditions. We will describe an adaptable, inquiry-driven laboratory module that is focused on the detection of Escherichia coli DNA via LAMP amplification. The main objectives of the exercise are: to introduce students to LAMP, to help students develop the ability to apply the scientific method to scientific questions, to guide students as they develop the ability to identify the most appropriate methodology to use in the investigation of scientific questions, and to train students to critically evaluate scientific data. This laboratory module has been successfully completed by undergraduate students in an upper level Molecular Biology course.

Data-driven Research Projects for Undergraduates – CODE Program

Michele C. Morris - HudsonAlpha Institute for Biotechnology

The opportunity for an undergraduate student to participate in an authentic research project can be invaluable to their learning, self-confidence, and graduate school acceptance. But research projects can be expensive and limited to the few students a lab can effectively mentor. The Characterizing Our DNA Exceptions (CODE) program introduces an alternative option using computational biology and protein modeling tools to conduct genetic research. The HudsonAlpha Institute for Biotechnology initially developed the CODE project for Alabama schools and is now to expanding its reach. HudsonAlpha is a non-profit genomics research institute with an Educational Outreach team that leverages the science and business activities on campus to design innovative experiences, products, and digital applications that educate society and prepare the future workforce.

CODE is creating a network of faculty from smaller universities who share an interest in computational biology, protein modeling, and STEM education reform. The project works to introduce bioinformatics, research skills, active learning, and research-driven coursework at these small institutions. Facilitators are trained (virtually or in-person) in the methods and tools needed to lead their students through a computational exploration of DNA variants of uncertain significance. Working with HudsonAlpha researchers and educators, students use computational analyses to determine the biological relevance of variants from patient samples, as well as explore other topics of interest. Variants of uncertain significance are often identified by genomic sequencing. CODE students research the available literature on the genes containing these variants, build three-dimensional computer models of the proteins, run molecular dynamics simulations to predict variant impact on protein behavior, and then analyze their data and share their results with the scientific community. Other student projects include collaborative approaches to characterize all the VUSs in a single gene and provide that data for future studies. Findings that indicate a potential pathological impact by a variant can be further studied with biological assays by additional collaborators. We believe that participating in a data-driven bioinformatics research project such as CODE will increase student awareness and interest in computational biology, as well as their self-efficacy, achievement, and persistence in science fields.

Top reasons that science majors cite for withdrawing from STEM gateway courses

Latanya Hammonds-Odie, Charmita Burch, Allison D'Costa, Clay Runck, David Pursell, Tirza Leader, and Judy Awong-TayloGeorgia Gwinnett College

At Georgia Gwinnett College (GGC), an open access, four-year state college, 30-40% of students who were enrolled in the introductory science courses for majors did not complete that course. A significant question that needed to be answered was how educational institutions, and more specifically how GGC, can meet the demands for greater numbers of STEM graduates to fill the technologically advanced jobs of the future. The specific aim of this project was to better understand why students withdraw from gateway (introductory) courses in their major in spring and fall 2019 and spring 2020. This research project was a quantitative methods study employing questionnaires to collect data. We solicited the participation of approximately 850 undergraduate students who withdrew from one or more gateway course(s) in spring 2019, fall 2019, or spring 2020. The questionnaire covered reasons for and timing of the withdrawal decision.

Additionally, students were questioned about their use of on-campus and online resources. We will present our analysis of the responses from 65 students. This work is funded and supported by a grant from the National Science Foundation under NSF Award No. 1623779. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

10:50-11:10 SUNDAY OCTOBER 25th

An Apple for all! Implementing 21st century technology to achieve improved outcomes for students in General Biology.

Kristin Picardo and Katie Sabourin, *St. John Fisher College*

During the 2019-2020 academic year, St. John Fisher College piloted an Apple iPad 1:1 initiative. Major goals of the initiative, now in year 2, are to achieve a level of equity by providing the exact same tools in the hands of every student, improved communication and collaboration between students and faculty, reducing paper use in support of sustainability goals on campus, and to focus on critical thinking using the SAMR model to enhance and transform the educational experience.

In this session, we will provide an overview of our pilot experience to include results from student and faculty surveys, student performance in General Biology, challenges encountered, and Ah ha! moments. We will also briefly review the specific apps and methods used to fully integrate the iPads into the classroom and will share student-created videos of how they used the technology. Participants need not be in a similar situation with Apple technology to appreciate what we share, as we aim to generalize our findings to the use of technology broadly in the classroom.

Providing common technology in the hands of students and a General Biology instructor in a pilot study revealed promise for moving students out of academic difficulty. The instructor for the General Biology course for majors taught using the Apple iPad, Apple pencil, and Bluetooth keyboard. All students in one of the two sections taught by this same instructor had the exact same technology for their use during the entire semester. After performing the worst of all sections of the course (6 among 3 instructors) on exam 1, the section using a common technology in class had a higher average exam score in the course by the end of the semester. While the student performance data collected in the pilot are difficult to tease away from other variables for this specific cohort of students, their satisfaction and perceptions on the experience were overwhelmingly positive. Based on this and findings from other courses that were part of the larger campus pilot, the institution will be moving forward with a 1:1 initiative.

Teaching a microbiology laboratory course online immediately

James F. Graves, University of Detroit Mercy

With the development of the coronavirus pandemic and the closure of the campus, it became necessary to teach microbiology laboratory for nursing and science students online. Several companies leased impressive learning management systems and others sold kits so that a student could do experiments at home. To deal with the situation quickly, an online course was constructed by using Blackboard Inc. course management software, email and the cell phone. Outlines in PowerPoint with recorded talks, scanned handouts for experiments that included the results, internet links to videos, and photographs served as material to students for asynchronous study. For virtual stain unknowns, virtual streak plates for a grade and lab reports the students could use handouts, books and internet, but were required to perform the exercises by themselves synchronously. Virtual stain unknowns existed in the form of a photograph of bacteria, instructions and short questions. For virtual steak plates, students drew sketches of an agar

plate inoculated by the quadrant technique, before and after incubation, answered short questions, and submitted a photograph. Students wrote reports for selected experiments because the writing of laboratory reports was an important educational activity. Reports required Purpose, Materials and Methods, Results and Discussion in a Word document. Quizzes consisted of multiple choice questions delivered online with use of the Respondus LockDown Browser and Monitor automated proctoring system. Questions were presented one at a time, without backtracking and quizzes submitted automatically. Instead of a culture unknown (which requires several weeks of bench work), the students, in pairs, made library research posters with PowerPoint on identification of infection-causing microorganisms. Interestingly, on the virtual stain unknown and streak plate exercises students would make the same mistakes as those done in the real laboratory. Internet disconnection for students during online quizzes was a problem. Some students felt that the amount of work for the online course was excessive. An online microbiology laboratory course does have educational value, but hands-on laboratory skills still need to be developed to fulfill objectives.

Using Group Exams to Improve Student Learning

Scott M. Shreve, *Lewis and Clark Community College*

Lecture exams and mid-terms are commonly used to assess student learning in the classroom. I have made several efforts to make exams part of the learning process for students, without clear results. Collaborative learning has been linked to increased student achievement, and I decided to see if the benefits of collaborative learning could be obtained from traditionally summative exams. I examined the effect of group lecture exams on individual final exam and pre-post assessment scores in an upper-level evolution course during spring 2020. Exam and assessment performances were compared to students taking all individual exams in spring 2019. Scores on the lecture exams were significantly higher when taken as group exams in 2020 than as individual exams in 2019. This is expected as the stronger students are positively influencing the grades of the other students. Individual final exams, however, did not differ between 2019 and 2020 (78.8% vs. 77.5%, $p=0.78$). Post-semester assessment scores were slightly higher in spring 2020, but this was not statistically significant (79.0% vs. 87.3%, $p=0.0897$). The changes in the course format, especially in regard to exam delivery, necessitated by the coronavirus pandemic make it difficult to draw any conclusions about individual vs. group exams. However, there is no strong evidence that group lecture exams negatively impart performance on an individual final exam.

1:00-1:20 SUNDAY OCTOBER 25th

Why students do not turn on their video cameras during online classes and an equitable and inclusive plan to encourage them to do so

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

After transitioning to emergency remote instruction in response to the COVID-19 pandemic, our introductory biology course shifted all in-person laboratory sections into synchronous class meetings held via the Zoom teleconferencing program. Out of consideration for students, we established a policy that video camera use during class was optional, but encouraged. However, by the end of the semester, several of our instructors and students suggested that a lack of student camera use diminished their educational experience. We surveyed students to better understand why they did not turn on their cameras. We discovered several reasons including, being concerned about personal appearance and

other people being seen in the background, having a weak internet connection, and it being the social norm, as well as others. This information was used to develop strategies to encourage –without requiring– camera usage while promoting equity and inclusion. Broadly, these strategies are to not require camera use, explicitly encourage usage while establishing norms, address potential distractions, engage students with active learning, and understand your students' challenges through surveys. While the demographics and needs of students vary by course and institution, our recommended strategies will likely be directly helpful to many instructors and also serve as a model for gathering data to develop strategies more tailored for other student populations.

"Is this bullst?" – creating an interdisciplinary learning community to increase information literacy for non-STEM majors**

Elizabeth Harrison, *Kennesaw State University*, Tom Lilly and David Minchew, *Georgia Gwinnett College*, Adrienne Button, *Emory University Oxford College*

Today more than ever, the ability to acquire, evaluate, and use information is essential for our students not only because of the overwhelming amount of information they are exposed to in their classes and in their lives, but also because acquiring and using information is a fundamental part of life in the 21st century. Unfortunately, our students frequently demonstrate that they are not gaining the information literacy competencies needed to thrive in the 21st century. They often have limited understanding of what information is and how it is produced and valued, nor do they have the tools and strategies to effectively find and evaluate information and use it to effectively solve problems. Without these literacy knowledge practices and dispositions, our students will not be adequately prepared to meet the demands that are going to remain a central feature of their lives and careers. Learning communities are a high impact pedagogical practice that help students form relationships with other learners, learn how concepts can be applied across disciplines, and enhance student engagement and success. We used the learning community model to improve information literacy skills in our non-major biology students. Professors across three disciplines developed a learning community that was first implemented in Fall 2019 for students enrolled in Biological Sciences II (for non-STEM majors), English Composition I, and Introduction to 21st Century Information. The overarching goal of this learning community was to teach our students information literacy by explaining how to detect and deal with bulls**t in scientific and public discourse. We developed interdisciplinary assignments, communicated regularly about student progress, and evaluated students' communication skills, information literacy, and intercultural awareness. By the end of the semester, students were able to differentiate between different sources of information, research information from various perspectives, and effectively communicate about scientific topics.

The Culturally Responsive Science Teaching Practices of Undergraduate Biology Teaching Assistants

Hillary A. Barron and Sehoya Cotner, *University of Minnesota*

Utilizing pedagogies of empowerment such as culturally responsive science teaching (CRST) in undergraduate classrooms can mitigate the gatekeeping phenomenon often seen in science. Teaching assistants (TAs) engage in more one-on-one time with students than most faculty in undergraduate biology education, yet minimal pedagogical training is offered to them. Therefore, training for improved pedagogical knowledge is important for TAs, but training for culturally responsive science teaching is critical as TAs have broad and lasting impacts on students. Using constructivist grounded theory methods, this study explores the ways training for culturally responsive science teaching impacted undergraduate biology teaching assistants. This study applied grounded theory methodology to develop a theoretical understanding of the TA's experiences. Four major themes describing the ways in which TAs enacted CRST emerged from these data: Funds of Knowledge, Differentiated Instruction, Reducing Student Anxiety, and Intentional Scaffolding.

Additionally, two major themes describing the things that impacted TAs' abilities to enact CRST emerged: Targeted Supports in CRST and TA Relationships with Students. Collectively, these themes have broad and important implications for the ways in which undergraduate science education can be reimagined to be more inclusive and culturally responsive.

3:00-3:20 SUNDAY OCTOBER 25th

Development of the Community College Research in Education and Scholarly Teaching (CCREST) Program
Heather Seitz and Jean Ann Vickers, *Johnson County Community College*

The CCREST program is an NSF funded project (IUSE #1711693) to support community college STEM faculty in the Kansas City metro region engage in work on the Scholarship of Teaching and Learning (SoTL). The overarching goals of the CCREST program are to create an opportunity for faculty to be trained in the practices of SoTL and be supported for their research work. We are further interested in how this support increases community college faculty engagement in publishing and presenting their educational research findings.

The CCREST program includes training in scientific teaching practices and scholarly research design in the classroom. Following this initial training, the faculty participants are supported throughout the school year with a faculty learning community. The final component of the program is a capstone training to help faculty analyze their data, discuss the appropriate use of statistical analysis in educational data, and prepare their results for publication or presentation.

Through implementation of the program we have collected baseline teaching practices data using the COPUS method as well as the ATI instrument. In addition to teaching practices evaluation, we have analyzed data supporting faculty participation and evaluation of the training workshops. Finally, lessons learned from faculty and program directors highlight the challenges faculty face in implementing SoTL in the community classroom environment.

Student Perceptions of Scientific Reading and Writing Ability in a Comparative Physiology Course
Christina Wills, Rockhurst University

After the completion of curriculum reform in 2016 to more align with Vision and Change, Rockhurst University's General Physiology course was transformed from a test centered mammalian (primarily human) physiology course into a writing intensive comparative physiology course taught in the Fall odd years. Students were assigned: a weekly writing task that focused on writing to diverse audiences, three literature reviews (on plants, fungi, and animals), and a final poster presentation on a topic not covered in the course. A survey on student perceptions of reading scientific literature and scientific writing skills was administered on the first and last days of class. In response to a semester of a writing intensive course, students indicated that they perceived an overall increase in their comfort level writing to different audiences, their ability to read and understand scientific literature, and their ability to write scientifically. Students also perceived that their overall writing skill levels increased over the semester.

40-Minute oral presentations

11:20-12:00 SATURDAY OCTOBER 24th

Course-Based Undergraduate Research During and Beyond COVID-19
Alita Burmeister, Melanie Bauer and Mark Graham, *Yale University*

Course-based Undergraduate Research Experiences (CUREs) address the limited number of early, authentic research opportunities available and retain more college students in STEM. With the outbreak of the COVID-19 pandemic, the national CURE education landscape changed quickly and dramatically with limited time for planning new curricula. This situation presented a unique window to explore how CUREs change in newly-online environments and whether

activities from such courses can be used to enrich research-based learning more generally. To do this, we used a qualitative approach through focus group interviews of CURE instructors to capture and analyze instructors' options on translating into online formats. We asked participants to focus on the knowledge, attitudes, and skills -- apart from those directly requiring in-person experimentation -- that would be important for students to develop as professional research scientists. Across all focus groups, instructors identified 51 research-enriching learning objectives and constructed 17 course activities using the backwards design method. In this 40-minute talk, we will present these activities and instructors' insights for possible, immediate use during the 2020-2021 academic year as universities continue to face sudden shifts back to online instruction. We will also discuss the potential for many of these learning objectives to be useful beyond COVID-19 to enrich students' experiences in both research-based and traditional laboratories.

New Kits to Teach CRISPR: Both Hands-on and Online Resources Available

Ian Harwood and Delquin Gong, *Bio-Rad Laboratories*

CRISPR is revolutionizing science, but reliably and affordably teaching CRISPR-Cas9 gene editing in course laboratories has been difficult. In this talk, how students can learn the science, math, and ethics of CRISPR gene editing and genotyping using hands-on experiments, mechanistic and mathematical modeling, and bioinformatics will be introduced.

Bio-Rad's new award-winning Out of the Blue CRISPR and Genotyping Extension kits includes laboratory activities that use CRISPR-Cas9 to change bacteria colonies from blue to white, PCR and gel electrophoresis to confirm gene editing, and free on-line resources including modeling the molecular mechanism and designing CRISPR therapies for diseases using bioinformatics.

A prize will be raffled: attendees need to attend to be eligible to win. For more information visit http://www.bio-rad.com/outoftheblue and http://www.bio-rad.com/teachcrispr

Knerdy innovations in biology courseware

The Wiley Team

Wiley is proud to debut Concepts of Biology for non-majors courses at ACUBE. Alta is Knewton's fully integrated, adaptive learning courseware. A complete course solution, Alta is designed to optimize the way students study and learn while completing assignments. All of Alta's content — including instructional text and video, examples and assessments — is organized by learning objective and served up at the precise moment a student needs it. Alta helps students achieve mastery in your course. If a student struggles on an assignment, Alta recognizes their knowledge gap immediately and provides just-in-time remediation — even when it requires reaching back to prerequisite concepts. Alta is $39.95 and provides students with everything they need to complete their course. Registered attendees will receive a Knewton Alta Knerd t-shirt.

2:10-2:50 SATURDAY OCTOBER 24th

Roundtable Discussion: Teaching CRISPR, COVID and More

Ian Harwood, Delquin Gong and George Chenaux, *Bio-Rad Laboratories*

In this roundtable facilitated by scientists and staff of the Bio-Rad Explorer education program, attendees are invited to participate in discussions on teaching CRISPR gene editing and emerging CRISPR technologies, advanced diagnostics techniques including multiplex PCR, quantitative PCR (qPCR), and droplet digital PCR (ddPCR), and skills in-demand by employers including product development, manufacturing, and quality control/quality assurance.

A prize will be raffled: attendees need to attend to be eligible to win.

From CRISPR to COVID, Bio-Rad's R&D scientists are developing and using cutting-edge technologies for use in undergraduate courses, academic research, and industrial and diagnostics applications.

For more information about the Bio-Rad Explorer education program, visit http://www.explorer.bio-rad.com

Doctor in the house: Improving undergraduate critical thinking skills through diagnosing medical case studies
Robin Forbes-Lorman, *Ripon College* and Julia A Lily

Students in undergraduate anatomy and physiology courses are not often exposed to clinical examples of homeostatic imbalances, particularly ones that provide an opportunity for the diagnosis of a medical case. Last spring, a senior undergraduate student and I designed a set of medical cases that required students to integrate their content knowledge of multiple organ systems, practice critical thinking related to diagnostic processes, and communicate effectively. Students were given a patient's symptoms and medical record, and are asked to determine the patient's illness, its cause, and a treatment approach. Over several weeks, students used deductive reasoning to diagnose the primary and underlying condition of their patient and prepare a formal report on their patient's condition and their recommended treatment. In addition to requiring students to apply their prior knowledge, this lesson introduced homeostatic imbalances in a unique way and also has the potential to be revised to ask students to consider common cognitive biases that occur during medical diagnosis. I will present an overview of the lesson and then ask for feedback and facilitate a discussion about similar activities that others have done. Particularly, I am interested in discussing other ways that instructors incorporate similar (or perhaps better) activities and reflection on these activities.

Can evolution misconceptions be corrected?
Lynn Swafford, Wayne Community College

Most biology students have preconceived ideas about what evolution is and how it works. So in my general biology for non-majors courses, I use pre-tests to help determine what these initial misconceptions are. Then after covering evidence and mechanisms for evolution, my students complete a group activity in which they work together to research and correct common misconceptions about evolution. At the end of the semester, I also give a post-test to figure out what evolution concepts my students are still struggling with. Come learn about these three activities, find out which evolution misconceptions are the most difficult to overcome, and contribute your own suggestions to a discussion on how to correct evolution misconceptions.

9:30-10:10 AM SUNDAY OCTOBER 25th

A model for a hyflex majors-level high enrollment Principles of Biology laboratory
V. Christine Minor and Lauren E. Stoczynski, *Clemson University*

Fall 2020 presents a unique and difficult challenge to many of us who are trying to provide students with in-person but safe experiences in the face of COVID-19. As Fall approaches, instructional targets continue to shift; therefore, laboratories, as well as other classes, must be flexible, for both online and in-person access. At our institution, students have a choice regarding HOW they attend classes and this choice may flex from week to week. The ability to choose makes laboratory instruction especially challenging. Our approach includes deconstructing traditional in-person labs into their constituent components of tactile skills, experimentation/inquiry, and data analysis skills. Content related experimentation/inquiry and data analysis skills were tested for online delivery during the summer using the LMS with instructor support available. Tactile skills are being delivered in a hyflex in-person mode. In this presentation we will illustrate how we "deconstructed" each lab, how we approached all of our learning outcomes through this model, how

we flex as needed, and how we manage logistics of moving large numbers of students (approximately 600 students and 12 TAs) through the process. We will also address lessons we have learned from preparing for this approach that can be applied to biology laboratory curriculum construction no matter what situation we find ourselves teaching in the future.

Resilient Classrooms Mitigate Student Resistance

Neil Haave, University of Alberta, Augustana Campus

We know that active learning promotes student learning outcomes (Freeman et al, 2014). Despite our best intentions, however, some students continue to resist our implementation of active learning (Tolman & Kremling, 2017). Two important issues are critical to mitigating student resistance to learning. One is that instructors must carefully consider how they facilitate active learning with their students (Finelli et al, 2018). The other is that although many consider resilience to be a quality developed within students, recent research suggests that resilience is a product of our environment (Ungar, 2019) suggesting that how we construct our classrooms can have a large impact on our students' resilience for learning. This presentation invites participants to discuss how instructors may best respond to students' resistance to learning by better facilitating the learning activities we implement in our classes and designing our courses for resilience.

Citations

Finelli, C. J., Nguyen, K., DeMonbrun, M., Borrego, M., Prince, M., Husman, J., Henderson, C., Shekhar, P., & Waters, C. K. (2018). Reducing student resistance to active learning: Strategies for instructors. Journal of College Science Teaching, 47(5), 80–91.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. Proceedings of the National Academy of Sciences of the United States of America, 111(23), 8410–8415.

Tolman, A. O., & Kremling, J. (Eds.). (2017). Why students resist learning: A practical model for understanding and helping students. Stylus Publishing, LLC.

Ungar, M. (2019). Change your world: The science of resilience and the true path to success. Sutherland House.

Interdisciplinary teaching and active learning approaches for an energy conservation theme in biology, physics, and chemistry courses

Joanna Cielocha, Nancy Donaldson, Lisa Felzien, and Michael Marvin, *Rockhurst University*

Interdisciplinary teaching initiatives across science disciplines are an effective way to tie together curricula for both students and faculty. Designing meaningful and engaging activities that span science disciplines is challenging and forces faculty to grapple with their own misunderstandings and knowledge gaps, allowing a better grasp of the student experience. We have formed a collaborative faculty group representing the disciplines of physics, physics of medicine, molecular biology, ecology and organismal biology, biochemistry, and chemistry. We have focused on the topic of energy and taken the approach that connecting the concept of energy conservation with energy transfer in our disciplines may be achieved through a shared set of tangible energy transfer examples from physics; big picture, ecological concepts from biology; energy conversions in photosynthesis and cellular respiration in biology and biochemistry; and chemical reactions in biochemistry and chemistry. We have also developed diagrams and graphical models to help students see connections among our classes and to assist with their construction of knowledge about big-picture, conceptual ideas that are woven through our disciplines. Our approaches build on active learning models developed in our Physics of Medicine program at Rockhurst University. In this presentation, we will share our common examples, diagrams and graphical models as well as the iterative process of developing pre and post assessments methods to examine student learning and attitudes. Initial results from our most recent assessment approach include

General Biology I (cellular and molecular topics), General Biology II (energy transfer in an ecosystem), General Biochemistry I (energy transfer during metabolism), and Physics of Medical Imaging (full course integration of energy topics).

80-minute workshops/roundtables

9:20-10:40 AM SATURDAY OCTOBER 24th

Build-a-Course Workshop
Rebecca S. Burton, Alverno College

A step-by-step workshop starting with valid outcomes and working through authentic assessments, clear criteria, and effective rubrics. Bring your ideas for a new class and leave with a plan.

How science works: teaching the personal and dynamic nature of science
Rosie Bolen, Mount St. Mary's University, and Kathryn S. Jones, Howard Community College

Numerous studies have shown that material presented in activities that students find emotionally engaging and personally relevant contributes to student success. This workshop will introduce participants to two free, ready-to-use resources designed to increase student engagement. The resource Scientist Role Models from Howard Hughes Medical Institute's (HHMI) BioInteractive allows students to explore profiles of diverse field and laboratory scientists and choose one researcher study in depth. In this activity, which is appropriate for both majors and non-majors, students are guided by a worksheet to investigate the scientist's research and write about what they learned. An advanced version of the handout, in which students read primary literature authored by the scientist, is available for upper-level students. Instructors can supplement the HHMI BioInteractive profiles with information from the Scientist Spotlights Initiative web resource. This activity personalizes the process of science by learning about the lives and work of diverse scientists, helps students feel like they belong in science and promotes inclusion in the classroom. The AAAS Science in the Classroom resources introduces students to the authentic, dynamic nature of science by making primary literature accessible to a broad audience. This site provides undergraduate students (and their professors) scaffolding of journal articles by providing extensive annotations and supplementary materials, including embedded videos and data-driven activities. The articles reflect a variety of topics that are relevant to students' lives. Participants in this workshop will experience both of these resources from the perspective of the student and will get implementation suggestions from facilitators who have used these resources in their classrooms. Participants will also have the opportunity to explore different activities available for these two resources and reflect on how they could use them in their classrooms.

Cell Collective: Computational modeling and simulation designed with the classroom in mind
Ehren Whigham, *University of Nebraska-Lincoln*, Dane Bowder, *Doane University*

Cell Collective (https://cellcollective.org) is a free, web-based, research-grade modeling platform adapted to engage students in creating and simulating dynamic models of biological processes. The ability to use modeling and simulation is identified as a Core Competency by Vision and Change. The use of modeling and simulation emphasizes higher-order cognitive skills, positioning students to be critical and reflective thinkers proficient in problem-solving and effective communication.

In this workshop, participants will experience, as a student, how to build a model of a biological system. That model will then be used to simulate the behaviors of the system. Comparing the behavior of the system under varied conditions helps students gain insight into the mechanism of the phenomenon. When used in a classroom, students will make and test predictions and faculty can highlight elements of experimental design.

Participants will gain confidence and experience in computational modeling which can be leveraged in their courses through self-contained, guided exercises. Cell Collective laboratories are suitable for introductory through upper-level classes and are readily completed in either an in-class or remote setting. We will end with descriptions of the varied ways Cell Collective has been leveraged in courses.

3:30-4:50 PM SATURDAY OCTOBER 24th

Hands-on Molecular Biology Labs at Home. Teach DNA Structure, Gene Expression, and Enzyme Kinetics Remotely
Ally Huang, miniPCR bio

We invite you to participate in a hands-on session of our BioBits Central Dogma Lab. You will visualize the flow of genetic information and monitor transcription and translation in real-time through fluorescent readouts. Because the labs uses cell-free freeze-dried technology, minimal equipment is required and the protocol is quick and straightforward - perfect for learning about the central dogma of molecular biology right in your own home. We will also discuss how other core concepts such as DNA structure and enzyme activity, and practical applications like micropipetting and serial dilutions, DNA amplification and the fundamentals of fluorescence can be explored using the P51 Molecular Viewer platform.

You will receive a P51 molecular view and all the reagents needed to perform the experiment. Limited to 15 participants.

Improving visual literacy using PyMOL, augmented reality and LEGO bricks®
Swati Agrawal, *University of Mary Washington*, and Shane Austin, *The University of the West Indies*

Students pursuing biochemistry and cell biology courses encounter several examples of proteins and nucleic acids in classes. These examples vary in complexity and the level of detail they are required to study, often the textbook or learning resource will contain cartoon images of the protein. Each image encodes lots of information and relies on several discipline specific norms; including, use of color, shapes, patterns and illustrations that the students have only previously seen as drawings. This makes obtaining information from these illustrations difficult for some students.

We have developed a series of active learning strategies to enhance visual literacy of our students. Replacing traditional lecture-based instruction with hands on engaged learning has significantly improved student perception of complex 3 dimensional architecture of proteins and Nucleic acids and their interactions. This is mainly because this teaching method provides a tactile way to interact with structures that are usually only shown in 2D using pictures. During the proposed workshop, participants will take part in two guided activities based on themes in glycolysis and Krebs cycle and learn how to incorporate active learning strategies using protein databank (PDB) and the molecular visualization tool PyMOL and Augmented reality. We will share step by step lesson modules prepared to ease student familiarity in navigating and exploring information found on Protein Data base. Participants will learn how to use pymol in classes to teach key concepts in macromolecule structure and function. Relation of the structural features of proteins to their function is one of the underpinning themes in the study of proteins in both biochemistry and cell biology. Therefore, being able to predict how proteins will be affected by mutation or modification is important. Using LEGO® bricks as metaphors, instructors will build models to explain this, and also learn how to guide students to generate suitable models that represent the various facets of proteins' functions and processes. Finally we will guide them through a

series of easy to use protocol to prepare renderings of proteins and nucleic acids in order to visualize it using Augmented reality.

Do We Really Want Our Students to be Scientists?
Brittney N. Wyatt, *Utah Valley University*

As the college population becomes increasingly diverse, there is an important need to create inclusive, welcoming STEM environments for all students to succeed in science. This success might come in the form of a student who transforms into a scientist, science person, science learner, or someone who feels connected to the scientific community at the end of their educational experience. Students that identify with science are more likely to persist in their STEM courses and continue on to STEM-related careers. However, how this identification has been defined and measured varies between studies. As educators and researchers, what does science identity mean to us and what does it mean to our students? Do we want our students to identify as a scientist or as a science learner? Based on preliminary data, entry-level students describe scientists through classic stereotypes (intelligent, analytical, curious), while students who have either been exposed to an intervention or are at the end of their undergraduate career, describe scientists as learners. Students who stereotypically describe scientists do so because of how their previous science courses have influenced them. Through analysis of introductory biology textbooks, scientists are mentioned in terms of their actions (classify, determine) and by historical references of primarily white men. All of which could prevent students from identifying with science. In this workshop, participants will review science identity theories and assess preliminary results on how high school, introductory biology, and senior-level biology students view scientists. Possible interventions such as research projects, scientists spotlights, and growth mindset assessments to promote student science identity will be discussed. The workshop will also include time to network with fellow educators and researchers on the importance of assessing science identity that benefits our students, which ultimately might mean something other than being a scientist.

1:30-2:50 PM SUNDAY OCTOBER 25th

Teaching Like a Pro in Your First Years
Rebecca S. Burton, *Alverno College*, Conrad Toepfer, *Brescia University*, Jason Wiles, *Syracuse 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.

A moment can change your mind: mindfulness and mindset interventions to increase success and persistence in STEM
Melissa Goodwin, Sara Goodman, Noveera Ahmed, Michelle Erklenz-Watts, and Kristin Picardo, *St. John Fisher College*

This workshop will demonstrate class-based mindfulness and mindset interventions and activities that can be infused throughout a STEM curriculum and students’ college experience. Activities include a ‘mindful minute’, reflective journaling, and cognitive reframing and strategizing practices regarding content as well as lived experience.

Our NSF funded research demonstrates the effectiveness of an academic experience infused with mindfulness (a practice known to lead to structural and functional changes in the brain) and mindset exercises (a practice known to lead to differential responses to challenge and difficulty) on increased persistence and success in biology and chemistry for academically talented, economically challenged students. By coupling strategic mindset selection training with

mindfulness practice, students and educators alike can learn to take advantage of a momentary pause in order to make a metacognitively appropriate shift in motivational framing of a task or challenge. Early findings indicate 100% retention and academic success of NSF S-STEM supported students in the program, even in the midst of the disruption throughout the ongoing global pandemic.

One activity we will share is the 'mindful minute'. In a seminar course for first-year S-STEM scholars, students were first introduced to the concepts of mindfulness and mindset. They were then asked to regularly apply the practice of mindfulness to specific situations they encountered along their first year in their STEM classes and transition to college life. To do so, the group decided on a particular challenge they had in common. They then explored what a growth mindset response might be, a fixed mindset response, and how to harness the power of the 'pause' to make a decision about the best way to move forward.

In this workshop, we will describe the literature behind the neuroscientific basis for applying mindfulness and mindset practices to student learning which will become the content we use in our activity together. We will model how educators can use these practices in their classrooms as well as in their own professional development. To do so, we will invite participants to create concept maps and apply the reflective practice strategies we use when teaching content with our own students.

This material is based upon work supported by the National Science Foundation under Grant No.1833904. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Fostering Inclusive Learning Environments in STEM

Natalia Caporale, Michael Moore, Jana Marcette, *iEMBER*

Despite increases in the diversity of students who enroll in undergraduate STEM majors, this diversity is still not present in the American STEM workforce. This disparity is largely due to the disproportionate attrition of STEM of students of color, women, and students with disabilities due to a variety of systemic, institutional barriers. [RC1] Sense of belonging and the feeling of being included in the science community have been shown to play key roles in promoting retention of students in STEM. Classrooms are the first formal introduction of most students to STEM disciplines, and as such, they can be considered as micro-ecosystems of STEM. Creating inclusive environments in STEM classrooms can increase students sense of belonging and has the potential to promote student retention. In this workshop, participants will engage with each other to examine their own perspectives of the meaning of inclusion and how these perspectives shape their goals and classroom practices. This discussion will be followed by the presentation of several tools and strategies for creating inclusive and supportive classrooms including: (1) ways to gently encourage active participation of all students in the classroom; (2) reflection prompts to examine their own biases and how those biases may impact their teaching; (3) discussion of the importance of non-content related instructor talk in framing activities and classrooms. Subsequently, participants will engage with each other to discuss these tools as well as the barriers that they may encounter when trying to apply them as well as potential strategies to address those barriers. This workshop is aimed at everyone interested in learning more about inclusion and how to foster inclusive environments. This workshop is organized by members of the iEMBER (inclusive environments and metrics in biology education research) network. This network focuses on promoting inclusive learning environments in STEM by fostering discussions and research collaborations among professionals from STEM, science education and social sciences.

Poster presentations

Special place assignments: connecting ecological concepts to each student's unique locale through scaffolded portfolio assignments

Anne CS McIntosh and Jody Rintoul, *Augustana Campus, University of Alberta*

Many biology courses include standard forms of assessment such as midterm exam(s) and a final exam in the lecture portion of the course, and a series of lab assignments that students complete over the semester. In addition to active learning activities in the lecture portions of biology courses, we think it is important to provide alternative forms of assessment that can help to reinforce concepts that students learn about in both lecture and lab. In introductory ecology courses and those that build on them, a central learning objective is for students to be able to describe and explain how abiotic and biotic environmental factors interact to contribute to the ecological properties (structure) and processes (function) that are observed from the scale of an individual organism up to a biome. In this poster we will introduce two 'special place' assignments that provide undergraduate biology students with opportunities throughout the semester to make linkages between course topics and a physical place that has unique value for them. In our introductory ecology course students respond to a series of questions for each topic, and in our more advanced community ecology course, students must additionally reference journal articles related to each of the ecological concepts we are focused on in class, and formulate research questions related to their special place. In both special place assignments, these scaffolded learning opportunities culminate in creation of a final portfolio document that applies the ecological concepts that students have learned to interactions within each of their special places. Our goal with these assignments is that by anchoring concepts and ideas to a special physical place, our students can more meaningful comprehend the importance and relevance of the information they learn about. This will in turn open the door to new ecological ideas and questions that will further student learning beyond the classroom.

Student Designed Study Resources for Human Anatomy and Physiology Cat Dissections

J.T. Cornelius

As an undergraduate honors project in human anatomy and physiology at Rockhurst University, I developed a supplemental resource to assist students through a cat dissection as such activities provide an excellent hands-on opportunity to study anatomy. The goal of my project was to compile and create various sources to aid in the dissection of a cat for an undergraduate human anatomy and physiology course. This turned into a lab manual/study guide resource to direct students through the dissection process and emphasize conceptual learning. This dissection guide was created with the intent to support students learning and to guide them through the detailed process of dissections. The guide I created is composed of checklists, color coding activities, practice quizzes, supplemental YouTube videos, and application/recall exercises to facilitate the study of human anatomy and physiology. Through this project I was able to understand and expand on the importance of proper adaptations of learning materials to aid in the further expansion of anatomical concepts as well as increasing my own understanding of the material.

The influence of habitat complexity on crayfish foraging behavior

Randi (Ruth) Darling, *Westfield State University*

I teach an animal behavior course where students conduct independent research projects; however using live animals for research is challenging at a small university. Often, students choose to conduct a laboratory project over a field project believing that it will be easier to observe animals and control variables, but it can be difficult and

expensive to acquire and maintain animals. If students work with vertebrates, there are added complications such as obtaining Institutional Animal Care and Use Committee (IACUC) approval and training. Additionally, following IACUC regulations often involves resources that we do not have. Because of these complications, I suggest to students that they consider an invertebrate species for their projects. In particular, crayfish are a species that are easy to obtain and care for, have low mortality, and exhibit interesting behavior that can be observed over several weeks. This article describes an inquiry-based research activity examining the influence of habitat complexity on crayfish foraging. This activity is well suited for students in ecology, animal behavior or invertebrate biology classes and gives students flexibility in the hypothesis they test and the methods they use, while providing a framework that lets them successfully complete a behavior project.

Foundations of STEM success: Using a cohort model with mentoring and supplemental instruction to enhance STEM student success

Katie Burgess, Alicia Murillo, William Moran, and Darrin Smith, *Avila University*

Avila University's Advancing Cohorts of Excellence in STEM (ACES) NSF Program is designed to improve retention, graduation, and overall academic success of its scholars. S-STEM scholars are low-income, academically talented students majoring in Biology, Biochemistry and Molecular Biology, Computer Science, or Software Engineering. The ACES Program has implemented support services that include a cohort model, common coursework with course-specific supplemental instruction, STEM seminars, STEM resource center, and faculty, peer, and professional mentorships. The program is working to improve data analytics by creating a STEM Student Success Dashboard, which will facilitate monitoring and analysis of on-track indicators by discipline, student subgroup, and dosage of support services. Furthermore, a qualitative analysis of the lived experiences of S-STEM scholars is being conducted to determine how the student support resources and activities aid in meeting the grant objectives. Preliminary findings demonstrate that S-STEM scholars had increased first year retention compared to non-S-STEM students and analysis of second-year retention and graduation rates is ongoing. (NSF Award #1643549)

Virtual science camp: maintaining community connections during the COVID-19 pandemic

Daniel Kiernan and Pearl Fernandes, *The University of South Carolina*

Campus connections with local schools continue to be an important part of the mission of many institutions of higher education. For many years now, our division of science, mathematics and engineering has functioned in a general support role for many local schools. For example, we play a unique role aiding STEM-focused programming in both the public and private sectors. As we do this, we also work to build bridges with young people in the hope that our institution will be on their mind when they someday make decisions about collegiate education. One way our university has supported STEM in our local area has been to offer a summer STEM-based camp for the last 10 years. This camp offering has drawn out local students to campus each summer to experience STEM under the direction of various professors in the lab setting. This past summer because of the COVID-19 crisis, many programs that reach the community including programs of higher education were canceled. This presentation focuses on the success of our virtual STEM camp to continue to reach young people and build connections between our institution and our local community. Initial data indicates that this virtual venue functioned as a viable option for colleges and universities to continue to support local schools and STEM education. All who want to build deeper connections between your science department/division and your local community are encouraged to attend.

Faculty responses to COVID-19 emergency remote teaching transition better with experience or training

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Beginning in early March, U.S. higher education institutions moved classes online in response to the coronavirus disease 2019 (COVID-19) pandemic. Developing an online course often takes months of planning, and quickly transitioning a course online may not provide instructors with enough time to do so effectively. The support provided to faculty to transition their classes online varied nationwide (Crawford et al. 2020). We surveyed over 100 biology faculty across the country to gauge their preparation for and experiences with emergency remote teaching to better understand faculty experiences during times of crisis. Each participant revealed if they had taught online before COVID-19 and if they received formal training for online teaching during or after the COVID-19 transition. Faculty described the difficulties and benefits they encountered teaching online, along with a memorable moment from teaching during the COVID-19 pandemic. Their responses were read multiple times to identify emerging themes, independently coded by two researchers and reviewed for consensus. We used decision tree forests to identify the most polarizing themes for experienced vs. inexperienced online teachers and instructors who did vs. did not receive training. More than 65% of faculty surveyed had never taught online before COVID-19 and those inexperienced faculty were three times more likely to struggle with engaging students online. Experienced online teachers were almost four times more likely to have a memorable moment associated with kindness. By August, 41% of faculty surveyed had not received formal training in online teaching. Faculty who did not receive formal training were twice as likely to describe a negative memorable moment, while faculty who received formal training were less likely to struggle with fostering a sense of community in their virtual classroom. The most common academic difficulty faculty encountered was student engagement, followed by transitioning to a virtual class. Our results demonstrate the positive impacts that experience and formal training had on faculty and students and underline that training for online teaching should prioritize how to engage students online and virtual activities that foster community. Finally, it highlights the importance of rapid re-training of faculty during an educational emergency so they are better prepared.

Face-Face to Online: Reflections during the COVID-19 Pandemic

Pearl Fernandes and Daniel Kiernan, *University of the South Carolina*

Face-face teaching has been the traditional method of learning for students. A face-face class provides a structured learning environment where students attend the lecture in a classroom setting at a set time and interact with their peers and the instructor. The COVID-19 pandemic caused an abrupt shift from face-face to an online learning environment.

A reflection study was conducted on biology majors who had to switch class to an online format on goals, challenges, and skill sets from the online class. Students were asked if they had achieved their goals at the end of the semester. The majority of the students felt that they achieved their goals but had to work more in an online class. Students who did not feel they achieved their goals reported that the lack of a structured environment and lack of good time management skills affected their goals.

Students reported that they learned better when they were around their peers or had in-class discussions. Challenges that all students faced in an online class were self-motivation and staying focused. Nearly all the students said they missed the full experience of being and learning in a classroom setting.

The biggest skill that students took away from the online class and the pandemic was flexibility. They feel that adapting to change is vital to success. Other skill sets that they learned were self-motivation, organization and strategies to become an independent learner. Students relieved their stress with online learning and the pandemic by interacting with their peers through social media and taking breaks between learning by exercising. Overall, students felt that they learned more about themselves and how to enhance self-care so they could achieve success as independent learners.

Competency-based testing improves class performance in a large-enrollment introductory biology class

Joseph Ankrom and Michelle Withers, *Binghamton University*

Unlike formative assessments which happen during the learning cycle and provide immediate feedback on learning that allows both the teaching and student to make necessary corrections, summative assessments tend to occur at the end of a unit when finding out that a student has failed does not provide opportunity for improvement. Although we often tell students that failure is part of the learning process, we do not assess our classes as if this is true. If students fail an examination early in the semester but attain competency on the material by the end of class, the early failure is typically calculated as part of their final grade for the course. Why do we care if a student learns the material immediately or if it takes multiple tries as long as they attain an acceptable level of proficiency by the end of the course? Competency-based testing allows educators to drive learning with summative assessments in much the way formative assessments work. This approach provides a trial-and-error format for students to test, learn what they know and do not know, correct misunderstandings, fill in knowledge gaps, and/or practice necessary skills, and re-test. We replaced a traditional testing paradigm with competency-based testing in a large-enrollment (>200), introductory biology class at a research university. Students were primarily first-semester freshmen roughly equally split between male and female. The class was taught using evidence-based teaching strategies where students spent roughly 70% of their time engaged in active, collaborative work answering polling questions, solving problems or case scenarios, and/or engaging in model-based reasoning exercises. In the traditional testing format, students took four midterms and one final examination composed of multiple-choice, matching, True/False, fill-in-the-black and short answer questions. In the competency-based format, students took two midterms and a final examination similar to the traditional examinations, however, they also took online examinations every two weeks that were composed of isomorphic questions that allowed them the opportunity to test and correct their understanding. Student performances increased in courses using the competency-based testing approach.

The Mobile Summer Institutes: Addressing institutional barriers to teaching reform
Michelle Withers, Robert Bills, Elias Miller, and Joseph Ankrom, *Binghamton University*

While research has demonstrated the benefits of active learning on student performance, the majority of post-secondary STEM educators still rely heavily on passive lecture formats. This disconnect results from many factors, including lack of training and institutional support and incentive structures for improving teaching. Pedagogical training addresses the first issue but, alone, cannot overcome institutional barriers to teaching reform. The Mobile Summer Institutes on Scientific Teaching (MoSI) is a place-based adaptation of the successful National Academies Summer Institutes (SI) intended to address both individual and institutional barriers to change. Two workshops, one for administrators and one focused on strategic planning, were added to the original SI format, based on Henderson's 4 Categories of Change Strategies. During the facilitated strategic planning session, MoSI participants identify aspects of a campus that would make it ideal for student learning, then determine where their campus falls short of the ideal. They then develop strategic plans to address one or more of the shortcomings. Notably, nearly every institution has identified teaching evaluation as a barrier to implementing active learning strategies. This issue was incorporated into the strategic plans of every pilot MoSI. The program has expanded to serve over 30 post-secondary institutions representing a variety of types, and while strategic plan topics have become more diverse, teaching evaluation continues to be a common focus. In this study, we are using grounded theory thematic analysis to determine the relationship between a variety of factors such as institution type, participant demographics, level of administrative support, etc., and the types of barriers identified and incorporated into strategic plans.

Redesigning the Undergraduate Human Anatomy and Physiology Course to Align with Vision and Change
Amy K. Hebert, Merrilee F. Guenther, and Corey Shaffer, *Elmhurst University*

Much work has been done to incorporate the guidance of Vision and Change (AAAS 2011) into the undergraduate biology curriculum, however little has been done for human anatomy and physiology courses. At Elmhurst University, we set out to redesign our course to better align with Vision and Change and incorporate more student-centered learning. Course learning objectives derived from the Human Anatomy and Physiology Society (HAPS) were mapped to core concepts (also referred to in class as the "Big Ideas of Biology": evolution; structure and function; information flow, exchange, and storage; pathways and transformations of energy and matter; and systems) and homework was designed to guide students through objectives. Course meetings consist of infrequent small lectures on the big ideas with the majority of class time dedicated to small group review of objective homework, case-studies, and other application-based activities. An assessment was designed and will be administered as a pre- and post-test to measure student ability to relate the core concepts/Big Ideas to the learning outcomes of the course. The goal of this work is to enhance student understanding of the relationship of Anatomy and Physiology to the core concepts of biology, while also improving overall student performance and critical thinking skills.

A Peer Observation Rubric for Integrating Cultural Awareness into our Classrooms

Tara Prestholdt, *The University of Portland*, Heather Dillon, *The University of Washington*, and Stephanie Bartlett, *The University of Calgary*

This poster highlights a peer observation rubric that can help answer questions such as what new knowledge and tools we need about different cultures and pedagogies and how might our classroom activities create dialog and deeper knowledge of people and places.

Nipped in the Bud: COVID-19 Reveals the Malleability of STEM Student Self-Efficacy

Kirkwood M. Land, *University of the Pacific*, Eileen K. Camfield, *University of California*, Merced and NaTasha Schiller, *Wingate University*

When a global pandemic hits in the midst of a longitudinal study of biology student success, researchers can unearth rich information about student resilience. By sharing case studies from two demographically different mid-sized 4-year institutions, this article illustrates the aspects of student academic efficacy that were undercut by the shift to emergency remote instruction (ERI) in introductory biology courses in spring 2020: agency and belonging. By assessing student predictions of exam performance and analyzing themes from 276 student narrative efficacy surveys, the authors highlight the power of a careful balance between cognitive and social interventions to help students recover. Students in this study showed a 50% loss of efficacy after ERI (mid-semester) but were able to improve to at least 75% above starting efficacy after instructor mediated responses. Thus, the authors also show how academic efficacy highly is malleable. In turn, they demonstrate a new assessment model that uses student narrative writing to reveal "invisible" threats to students' perceptions of their capacity to succeed. Finally, they generalize from their findings to provide recommendations for effective strategies for supporting those students for whom every semester feels like a pandemic.