Teaching Tomorrow’s Scientists
An ASCB Regional Meeting

May 31, 2019
University of Georgia, Athens
Coverdell Center for Biomedical and Health Sciences
Sponsors

Travel Award Sponsorships

UNIVERSITY OF GEORGIA
Center for Teaching and Learning

UNIVERSITY OF GEORGIA
Scientists Engaged in Education Research

minione SYSTEMS

Pearson

UNIVERSITY OF GEORGIA
Franklin College of Arts and Sciences
Division of Biological Sciences
Program

- **8:00 am** Registration and Coffee **sponsored by the UGA SEER Center**
- **9:00 am** Welcome and Plenaries **sponsored by the UGA Center for Teaching and Learning**—Room S175 Coverdell

Science research plenary by Dr. Dorothy Lerit, Assistant Professor of Cell Biology, Emory University School of Medicine: **Uncovering Novel Paradigms of Centrosome Regulation**

Dorothy Lerit

Education research plenary by Dr. Julie Stanton, Assistant Professor of Cell Biology, and Birook Mekonnen, Graduate Co-Researcher, University of Georgia: **Recognizing the Community Cultural Wealth of Successful Black Science Majors**

Birook Mekonnen and Julie Stanton

- **10:30 am** Break
- **11:00 am-12:30 pm** Posters--Coverdell Atrium
- **12:30-2:00 pm** Networking Lunch **sponsored by Macmillan**—Georgia Center
- **2:00-3:15 pm** Workshops Session 1
  - **Proteins don’t have to be boring** (Shane Austin, University of the West Indies)—Science Learning Center 145
  - **Using deliberative democracy in the introductory biology classroom** (Heather Tinsley, University of Montevallo)—Coverdell N104
  - **“I can be successful here!” Practical ways to promote inclusion in undergraduate education** (Erin Dolan, University of Georgia)—Science Learning Center 345
  - **Theoretical Frameworks 101: An Essential Part of Educational Research** (Julie Luft, University of Georgia)—Coverdell S141

2019 Regional Educators Meeting
3:15-3:45 pm  Break

3:45-5:00 pm  Workshops Session 2

- Including metacognition in our courses (Julie Stanton, University of Georgia)—Science Learning Center 345
- Building a science curriculum from the inside-out (Kari Dugger, University of Alabama at Birmingham)—Science Learning Center 145
- Preparing and applying for a teaching-focused academic position (Amy Abdulovic-Cui, Augusta University)—Coverdell N104
- Introduction to qualitative research (Jennifer Thompson, University of Georgia)—Coverdell S141

5:00 pm  Mixer—UGA Hotel and Conference Center

Campus Map
Poster 1
Presenter: David Blu, University of Georgia

Bioexpression and Fermentation Facility Virtual Pedagogy to Enhance Research (VIPER)
Authors: David Blum, James Moore

The problems in training students in biomanufacturing include access to expensive equipment, limited time for training due to the long periods of time required for some types of experiments and training methods may vary. One solution is the use of virtual reality (VR) for training students. VR has advantages which include (1) Simulations of expensive equipment; where users can interact with the system and simple controls can be displayed (2) Training first, then the underlying context; students go through the virtual experience then meet with the faculty member to gain context (3) Consistency in training methods; each student gets the same experience in the VR environment, thereby eliminating training deficiencies in traditional classroom settings.

The University of Georgia has existing resources that are being used to address training issues in biomanufacturing using VR. UGA Educational Resources Department (EduRes) has extensive experience with creating virtual reality applications as well as animation and videography. In addition, UGA houses the Bioexpression & Fermentation Facility (BFF) which is a World Class contract manufacturing organization comprised of a wide range of equipment located in 10,000 sq ft of lab space which is currently used for training and education/tours. The BFF director also directs the Master of Biomanufacturing and Bioprocessing which is a Professional Masters program (non-thesis) focused on building skills in biotechnology. BFF participates in the Excellence in Cell Manufacturing where UGA is working on an upstream bioprocess module focused on training on the Biostat A using VR technology.

Poster 2
Presenter: Amy Medlock, University of Georgia and the AU/UGA

Medical Partnership Lifelong Learning Skills and Introductory Biochemistry Teaching Strategies
Authors: Amy E. Medlock, Bethany Oseuke, Barbara Remmers, Janette R. Hill and Ron M. Cervero

Evidence supports the use of student centered active learning instruction, including case based learning, in STEM course for improved learning outcomes. While these active learning strategies have been shown to be beneficial, the means by which they affect student learning have not been investigated. Our objective in this study was to determine if a case based learning pedagogy in a large introductory biochemistry course enhances lifelong learning skills including self-regulated learning, adaptation of learning strategies and aspects of metacognition. Our study utilized a quasi-experimental design of three sections of a large undergraduate Introductory Biochemistry course. Students took a pre and post survey in the course composed of a Lifelong Learning scale, the Learning Climate Questionnaire and also some self-reported demographic information. Information was also collected on the respondent’s grade, GPA, and major via institutional data. Additionally, we also conducted several semi-structured interviews with former students. Validation of the Lifelong Learning scale on our population resulted in poor reliability and factor analysis supported more than one underlying factor as being measured. The perceived learning climate was different between the sections that used peer mentors and only case based instruction. Interview data suggest self-regulated learning is similar with the different teaching strategies investigated, but that student attitude about subject material differed. Overall, we were unable to reproduce the validation of the Lifelong Learning scale with our population of students. Alternate tools may be a better measure for our population to determine if teaching strategies alters affective aspects of student learning.
Poster 3
Presenter: Kevin Drace, Birmingham-Southern College

A CURE for Civic Engagement
Authors: Kevin Drace, Pamela Hanson

The first-semester freshmen Introductory Biology laboratory at Birmingham-Southern College was recently transformed into a semester-long course-based undergraduate research experience (CURE). In the Metal and Antibiotic Resistance Evolution (MARE) project, students investigate the biological impacts of heavy metal contamination in soil from long-term industrial pollution. One of our objectives is to introduce new students to the historical context of our urban environment, while also discussing the role of scientists and a scientifically-literate public in addressing environmental injustice. The laboratory activities explicitly address both content knowledge (the biological impacts of heavy metals) and skill development (hypothesis development, data interpretation, etc.), and we attempt to help students see a clear connection between their research and our local community. Preliminary results suggest that by the end of this course, students are more likely to participate in discussions that raise issues of social responsibility and that they are more likely to stay informed of community events. Many of these students will go on to have non-scientific careers; however, this experience may contribute to their understanding of how science impacts their local community.

Poster 4
Presenter: Dennis Lee, Clemson University

“I can do this!” Cultivating Scientific Agency Through an Undergraduate Research Experience
Authors: Dennis Lee, Mallory Wright, Dylan Dittrich-Reed

Poster Studies have reported that participation in undergraduate research experiences (UREs) result in enhancement of science process skills. Beyond learning these skills, students should feel that they have the capability to apply these skills in science: a feeling of scientific agency. In this poster presentation, we describe how we designed a URE based on the norms of scientific knowledge production outlined by Longino (2002), and how this research experience affected one student’s feelings of scientific agency. To assess the effects of the URE, we compared the student’s written assignments from biology-related courses completed before and during the URE. This empirical comparison was paired with analysis of reflections written by the student during the URE. The resulting case study revealed the student’s shift from paraphrasing study conclusions in papers written before the URE to interpreting study data on her own in the paper written during the URE timeframe. The student explicitly states that this shift in writing style is due to feeling like she had “the ability to make [her] own conclusions.” The student attributes her development of scientific agency to 1) opportunities to develop scientific agency within the URE and 2) discussions of the norms of scientific knowledge production which gave her the tools to construct her own knowledge. These results suggest that incorporating the norms of scientific knowledge production into the design of UREs is important for development of scientific agency and that further research in this area is warranted.

Poster 5
Authors: Chrissy Spencer, Georgia Tech

Student Learning Gains from Biology Textbooks: an Open Education Resource Compared to a Commercial Textbook
Authors: Chrissy Spencer, Aakanksha Angra, Kata Dosa, Abigail Jones

Poster Open Education Resources (OERs) provide a no-cost solution to the college textbook conundrum of asking students to buy an expensive commercial text that only partially aligns with course content and learning goals. For any learning resource, students and faculty consider cost to student, learning outcomes, usage, and perception of the quality and accuracy. Here we made a direct comparison between OER and commercial textbooks by the same student in a controlled reciprocal design. We randomly assigned undergraduate students (n=40) without prior college-level biology coursework to a treatment sequence of exposure to an OER textbook followed by commercial textbook, or vice versa, across two different biological scenarios, with a different scenario for each resource type. Students completed a reading quiz while taking reading notes, drew from memory their interpretation of relevant biological concepts from a prompt, and completed a think
aloud interview, with output coded using inductive and deductive methods. Students performed similarly in both textbook types, regardless of content. Students take less time to answer reading questions from an OER textbook. Student learning gains align with other studies of OER research that find no decline in student learning with the switch from commercial to OER textbooks. Further analysis on behaviors surrounding commercial and OER textbook usage for the timing and approach to answer reading quiz questions will be informative about reading compliance and OER usage and perceptions. Evidence surrounding OER costs, outcomes, usages, and perceptions serves as a valuable incentive for faculty waiting for stronger evidence before considering an OER textbook intervention.

Poster 6
Presenter: Charmita Burch Georgia Gwinnett College, School of Science and Technology

Analysis of Students’ Decisions to Withdraw from Biology and Chemistry Gateway Courses
Authors: Charmita Burch, Latanya Hammonds-Odie Poster

The specific aim of this project was to better understand the reasoning employed by Biology and Chemistry majors as they determine whether to withdraw from the gateway courses. We have collected data from ten faculty members who have taught these courses and from 37 students who have withdrawn from these courses to explore the factors that students consider when making decisions to withdraw from an introductory course in their major. The research project was a mixed methods study employing focus groups, questionnaires, and interviews to collect data. The study was designed to document lived experiences of students instead of attempting to identify and test a causal relationship between variables as one would in an experimental research approach. Our findings indicate that faculty perceptions do not fully match the reasons that students give for withdrawing and that personal issues were the predominant reasons given in the students’ responses.

Poster 7
Presenter: Lindsey Beebe, University of Georgia

Group-Based Active Learning in Undergraduate Anatomy and Physiology II Courses
Author: Lindsey Beebe

Traditionally, Anatomy and Physiology courses have commonly suffered from poor attendance, variable student preparation, and group problem-solving achievement. Over the last two decades, the importance of actively involving students in the learning process has been identified as an ongoing goal to help improve with these issues in a variety of courses. This semester (Spring 2019), group-based active learning activities were incorporated into two of the Anatomy and Physiology II sections that were offered at UGA. As part of this, students were initially presented material in a traditional lecture-based approach, focusing on four of the most difficult topics covered in A&P II. Students then completed an individual online-based quiz before coming to lecture to complete a group-based activity. During each of these activities, small groups worked to complete a series of questions which included simple memorization-based questions, as well as more complex application style questions. Although many students commented that they did not like this group-based approach, their understanding of these complex concepts seemed to improve from the previous course offerings. Comparison of mid-semester exam scores from Spring 2018 (no active learning sections) and 2019 showed that scores were either comparable or significantly higher after implementation of these group-based activities. These initial findings are intriguing and the incorporation of these active learning-based components will continue to be integrated not just into the Anatomy and Physiology II courses, but the Anatomy and Physiology I courses as well.
Poster 8
Presenter: Ashley Turner, University of Alabama at Birmingham
The Impact of Physical 3D Models as a Supplementary Instructional Tool on Student Learning and Perception of Molecular Genetics Concepts
Authors: Anil K. Challa, Ashley N. Turner

Models are invaluables parts of exploration and research in the sciences, and should be integral tools in teaching and learning. Our study seeks to examine the impact of 3D physical models on student learning and perception of concepts in molecular genetics. Students in a course-based undergraduate research experience (CURE) (n=38) explored the processes of DNA replication, transcription and translation through manipulation of models in conjunction with ‘wet lab’ experiments. We used questions and formats from previously validated concept inventories and created a short assessment tool to gauge comprehension of fundamental concepts. Students completed the assessment at three points during the semester, before and after model exposure and end of the semester. Class average and individual student improvement scores were analyzed. As part of the second assessment, students provided feedback on their beliefs and attitudes from their experience and identified specific misconceptions they were made aware of by working with the models. Performance results suggest that students have a better understanding of these biological processes after working with the models. Our method has allowed identification of weak areas for a given student to allow additional support to be provided on correcting misconceptions. Overall, students self-reported that models make concepts easier to understand, make learning fun and engaging, and are a great way to understand complex biological processes. We support previous efforts in creating and modifying models in the context of student-driven inquiry, and demonstrate that even minimal exposure to models and model building into existing science education can improve student learning.

Poster 9
Presenter: Shoshana Katzman, Georgia Gwinnett College
Implementation of Specifications Grading in a Sophomore Level Undergraduate Cell Biology Classroom
Authors: Shoshana D. Katzman, Jennell Talley, Elisabeth Javazon, Jennifer Hurst-Kennedy, Alessandra Barrera

Specifications (specs) grading is an instructional system developed by Dr. Linda Nilson in which mastery of specific educational outcomes is the basis for the final grade that a student earns in the course. Implementation of the types of assessments used for specs grading has shown to be beneficial for student learning and motivation compared to traditional grading systems. We designed a specs grading strategy in our sophomore level Cell Biology course, creating 20 unique learning outcomes (LOs). The grade earned in lecture depended on the number of LOs that the student mastered, where mastery is defined as achieving a score of 80% or higher on a quiz associated with that LO. If students were unable to master the content on their initial attempt, they could earn re-takes for each LO assessment by completing an assignment associated with the information covered in that LO. The ability to re-take assessments is a strategy used in specs grading to increase student effort and give the student more control over their grade. A student’s final class grade was dependent on the number of learning outcomes mastered combined with the grade earned on their final exam. Performance on the cumulative final exam could increase the total number of LOs earned or conversely decrease their grade depending on the exam score earned. Initial analysis of student attitudes towards this grading structure are positive. Here, we present our model for implementation of specifications grading and our long-term assessment plan.

Poster 10
Presenter: Allison DCosta, Georgia Gwinnett College
A study to assess students’ ability to design experiments in an Introductory Biology course
Authors: Allison D’Costa, Cindy Achat-Mendes, Candace Timpte, Judy Awong-Taylor, Latanya Hammonds-Odie, Patricia Huey, Elisabeth Javazon, Joshua Edwards and Tirza Leader.

The Principles of Biology I, BIOL1107K labs have been redesigned with a course-embedded undergraduate research experience (CURE) to provide multiple opportunities for students to learn and practice experimental design, a valuable STEM skill. As part of the CURE, students conducted in-depth investigations on two topics: (a)
effect of UV radiation on yeast survival, and (b) enzymatic reactions and factors affecting enzyme activity. Using minimal handouts and instruction, students had at least three opportunities to design controlled experiments iteratively. “Control” lab sections continued following a traditional lab manual that provides step-by-step style instruction, and students had only one opportunity to design a controlled experiment. A validated Experimental Design Ability Test (EDAT) was administered as a pre-test during the first week of the semester, and a post-test at the end of the semester. At the end of the semester, each student’s pre and post-test is graded by two faculty-members using a validated rubric. To prevent bias in grading, a blind study was developed in which four different versions of the EDAT test were created, and any two versions are administered to a course section by a person not affiliated with the course. Lessons learned, effectiveness of the assessment instrument, data analysis comparing control and CURE sections, as well as the impact of the CURE on building the targeted skill, will be discussed.

**Poster 11**
Presenter: Isi Ero-Tolliver, Hampton University

**STUDENTS’ USE OF MODELS TO CO-CONSTRUCT THEIR KNOWLEDGE IN A NON-MAJORS’ BIOLOGY COURSE AT AN HBCU**
Authors: Isi Ero-Tolliver

Scientific concepts involving biological concepts may seem difficult for biology majors and non-major to comprehend in the classroom. For many years, lectures have been taught in traditional ways that leave students with learning styles that emphasize rote memorization as a method for studying the material. This approach can produce students with deficits, misconceptions and gaps in their existing knowledge which they sometimes propagate with their peers. Recently, models and model-based reasoning have been at the forefront of innovative strategies for introducing scientific concepts to majors and non-majors for increased learning and mastery of the subject. This study explores and highlights the use of under-represented minority (URM) student-selected and student-generated models within a semester-long classroom. The goal was to increase minority, non-majors’ interest, engagement and learning gains within a large classroom. Undergraduate students assisted with teaching daily lectures with their uploaded, supplemental videos that included their models to make scientific ideas more salient in their minds along with their peers. Results showed that this style of teaching not only made the lectures more exciting and engaging for the students, but this approach also shifted the agency from the typical, instructor-facilitated “sage at the stage” approach towards a shared experience that was instructor-students facilitated with elements of active learning. In conclusion, through this students’ models-centered approach, our non-majors have experienced learning gains in biological concepts that is reported, analyzed and displayed in results of this study.

**Poster 12**
Presenter: Gunjan Gakhar, Washington State University Vancouver

**Microbial population at Washington State University Vancouver campus: A course-based undergraduate research experience in microbiology**
Authors: Issac Hernandez Gomez, Kristina Aguayo, David Beltran, Gunjan Gakhar

Most of the undergraduate students do not get an opportunity to participate in scientific research, an essential component of undergraduate training in biology. Research experiences benefit students by developing critical thinking skills, increasing resilience, and increased ability to navigate uncertainty. We describe a course-based undergraduate research experience (CURE) in microbiology laboratory class that generates students’ high level of interest towards their surroundings and microbes. During the course, students worked to identify microbial population present at Washington State University Vancouver campus. The students identified the heavily used buildings on the campus and collected samples from different areas of the buildings. They streaked the samples on individual agar plates and each student selected one of the predominant bacterial colonies for further experimentation.
Bacterial staining, and different selective and differential tests were performed by the students on the selected colony along with the controls for their identification. Bacterial DNA was extracted, followed by PCR and agarose gel electrophoresis. PCR samples were sent for Sanger sequencing. Students compared the staining and biochemical tests with the sequencing results. They investigated and provided explanations as to why any differences were found between the staining and biochemical tests, and the sequencing data. The course culminates in a lab presentation during which students present the identification of the unknown organism to peers, student teaching assistants, and instructor.

Poster 13
Presenter: Fran Norflus, Clayton State University

The use of an inquiry-based laboratory teaching approach using a biofuels assay
Author: Fran Norflus

In order to engage students in biology laboratory classes, teachers attempt to make the material relevant and use an inquiry-based approach where students are responsible for designing their own experiments. This project discusses how the Bio-Rad biofuels kit (catalogue #1665035EDU) was used in a biotechnology class to show a real world example of biotechnology but also to teach students about designing experiments and interpreting data. Students were able to pick a parameter to test and also needed to trouble shoot the experimental details at certain points. The basics of this experiment is that the enzyme cellulase breaks down cellulose, found in plant cell walls, into glucose which can be further converted into ethanol during the process of fermentation. Since the enzyme cellulase is found in a few organisms including plants and fungi, this system could ultimately be used to develop biofuels as an alternate source of energy.

In the class experiment, an artificial system was used. The enzyme cellobiase converts the artificial colorless substrate p – nitrophenyl glucopyranoside into the yellow colored product p-nitrophenol. The company provides purified cellobiase enzyme but it can also be obtained from an extract of mushrooms. Students used the company provided enzyme as well as extracts of different mushrooms and different parts of the mushrooms to determine which produced the most amount of cellobiase. Sample student data using enoki and shitaki mushrooms will be presented as well as suggestions on where students had difficulties with the experimental details and data analysis.”

Poster 14
Presenter: Dan Pierce, University of Richmond

Molecular signals leading to plant tumors: teaching structure/function using a bacterial histidine kinase in an undergraduate laboratory class B
Author: Daniel Pierce

The pathogenic bacterium Agrobacterium tumefaciens causes crown gall tumors in plants through the insertion of oncogenic DNA into the host genome. This process is the only known instance of inter-kingdom gene transfer and has been co-opted by the scientific community to develop transgenic plants. Pathogenesis is initiated by the recognition of molecular signals from a wounded plant. A histidine kinase, VirA, recognizes two of these signals—sugar and phenol—and begins a phosphorelay that leads to the induction of virulence genes. Although the structure of VirA has not been solved to atomic detail, I have developed a structural model that makes several predictions about how specific mutations should affect virulence induction and pathogenesis. To teach undergraduates about structure/function relationships and pathogenic strategies, I have developed several inquiry-based laboratory modules. First, students predict how different mutations might change signal reception using modeling software. Then, students can test these predictions using an assay where a virulence gene is replaced by lacZ, encoding for the β-galactosidase protein. Finally, these VirA mutations can be inserted into Agrobacterium as the sole source of VirA, and their overall effect on pathogenesis can be observed through tumor formation after co-cultivation of the plant and bacterium. Students who make these protein predictions and observe the eventual tumor growth report an increase in their understanding of the relationship between structure and function while gaining useful molecular biology and biochemical techniques.
Poster 15
Presenter: Julie Sonnenberg-Klein, Georgia Intitute of Technology

**Vertically Integrated Projects – Scalable Multidisciplinary Undergraduate Research**

Authors: Ed Coyle, Julie Sonnenberg-Klein

The Vertically Integrated Projects (VIP) Program unites undergraduate education and faculty research in a team-based context, and programs have been established at 35 institutions in the US and abroad. VIP provides a rich, cost-effective, scalable, and sustainable model for multidisciplinary project-based learning. The learning experiences are rich because students work with faculty for multiple semesters and years, with returning students training new students and taking on leadership roles. The model is cost-effective, because students earn academic credit instead of receiving stipends. The program is scalable because faculty work with teams of students, with an average of 16 students per team. Most importantly, the model is sustainable because faculty benefit from the efforts of their teams, and teams become integral parts of their research. This poster provides an overview of the VIP model, along with examples of biology-related VIP teams at the Georgia Institute of Technology.

Poster 16
Presenter: Jason O'Donnell, University Of Georgia

**Answering the call for experiential learning**

Author: Jason O'Donnell

There is a need to incorporate more experiential learning opportunities in the undergraduate biology curriculum. Traditionally, students obtain such experiences through an apprenticeship in a local research laboratory. However, there is a limited number of these opportunities which makes it important to implement alternative ways to increase the availability of experiential opportunities for students. Course-based Undergraduate Research Experiences (CUREs) have proven to be an effective alternative, because they use a classroom setting to engage entire classes of students in authentic research.

The Division of Biological Sciences has modified a pre-existing upper-level biology laboratory course into a CURE using evidence-based teaching practices that provide a meaningful and authentic research experience to over 200 students a year. Students in the course, Basic Skills in the Laboratory, participate in a research project through a collaboration with Dr. Zachary Wood, a research faculty member in the Department of Biochemistry and Molecular Biology. In this course, students study an enzyme, Ketopantoate Reductase, that has been identified as an antibacterial drug target. In addition to advancing science, students learn how to effectively communicate their data through scientific writing and oral presentations. As a result of these modifications, this course has been accredited as an experiential learning and writing-intensive course.”

Poster 17
Presenter: Lisa Limeri, University of Georgia

**“Where’s my mentor?!” A taxonomy of negative mentoring in undergraduate life science research**

Authors: Lisa B. Limeri, Muhammad Zaka Asif, Benjamin Bridges, David Esparza, Trevor T. Tuma, Daquan Sanders, Alexander Morrison, Pallavi Rao1 Joseph Harsh, Adam Maltese, Erin L. Dolan

Undergraduate research experiences have been championed for promoting student growth and development. Mentorship is an integral part of undergraduate research, as effective mentorship maximizes the benefits undergraduates realize from participating in research. Yet, there has been almost no research on instances when mentoring is less effective or even problematic, even though prior research on mentoring in workplace settings
suggests negative mentoring experiences are common. Here we report the results of a qualitative study to define and characterize the phenomenon of negative mentoring in undergraduate life science research, which we present as a taxonomy. Undergraduate researchers in our study reported actively harmful behaviors of their mentors as well as the absence of positive mentoring behaviors, both of which they perceive as detrimental to their psychosocial and vocational development. These results are useful to mentors for reflecting on ways their behaviors might be perceived as harmful or unhelpful. The results can also serve as a foundation for developing a quantitative measure to study the prevalence and impact of negative mentoring in undergraduate research.

**Poster 18**
Presenter: Paula Lemons, University of Georgia

**DeLTA: Department and Leadership Teams for Action**
Authors: Paula P. Lemons, Tessa C. Andrews, Peggy Brickman, and Erin Dolan

The DeLTA project aims to shift the thinking and culture of undergraduate STEM education at the University of Georgia. We aim to adopt new core commitments that align with national calls to expand the use of evidence-based teaching, create departmental and institutional structures that support evidence-based teaching, and promote inclusion and diversity. Our approach is multi-level; we are convening and supporting the work of faculty, departmental leadership, and upper administrators. Faculty will work in Instructional Action Teams (IATs) to expand the use of evidence-based teaching practices in introductory courses across STEM. Each IAT will engage in work focused on assessments, data on student learning, and active-learning lessons. Trained local facilitators will guide the IATs. Department leaders will collaborate across units as a Leadership Action Team to develop and enact new ways of supporting, evaluating, incentivizing, and rewarding evidence-based teaching at the department level. For example, we expect departments to revise their policies and practices for evaluating teaching for promotion and tenure. Strategic Action Teams of administrators will work opportunistically to align university incentive structures with teaching reform. Our approach is informed by social cognition and cultural theories of change. We are conducting research to determine the degree to which thinking and actions relevant to STEM education change over the course of the five-year initiative. We are gathering multiple lines of evidence to examine patterns and drivers of change across levels. In this presentation, we will describe the initiative, provide examples of action team work, and highlight early successes and challenges.

**Poster 19**
Presenter: Christine Fleet, Emory & Henry College

**Use of a cohort model to promote STEM retention at a small liberal arts college**
Author: Christine M Fleet

Evidence from DFW (D, Fail, Withdraw) rates in introductory science courses at Emory & Henry College and other institutions shows that many students who enter college with an interest in Science, Technology, Engineering and Math (STEM) fields have difficulty persisting. In response to this concern, in the fall of 2017, Emory & Henry began a STEM cohort program, recruiting students with an interest in STEM fields, grouping them together in their first-year seminar and relevant STEM courses, and offering peer and professor mentoring as well as social activities and field trips to graduate programs and engineering facilities. While other institutions have instituted a variety of similar programs to try to improve STEM retention (for example, Wilson, et al. 2012), many of the published studies focus on large, public institutions rather than small, private liberal arts colleges. Thus, we want to see what kinds of programming will be effective with our environment and student population. This poster will report preliminary information on the structure of our cohort program, initial results for first-year retention and plans for future support of STEM students at our institution.
Poster 20  
Presenter: Kimberly Chambers, Concord University  
**Cloning and Expression of a GFP Human ?-Tubulin Fusion Protein to Visualize Microtubules in Mammalian Cells: A Semester-Long Undergraduate Molecular and Cell Biology Laboratory Project**  
Authors: Kimberly Chambers and Corrina Robertson

A laboratory curriculum was developed to introduce undergraduate molecular and cell biology students to multiple techniques commonly used in the field in the context of an extended laboratory project. Over the course of the semester, the students clone the human ?-tubulin (TUBA1B) cDNA into a green fluorescent protein mammalian expression vector (pEGFP) and express it in mammalian cells. The localization of the fusion protein is then visualized using fluorescence microscopy. Using this fluorescently-labelled recombinant protein, students then observe the effects of nocodazole on microtubule networks in cells. Finally, students complete an exercise that exposes them to the field of bioinformatics. As this project is part of an undergraduate course, it is designed for all skill levels and is accessible for numerous students. It allows students at a small liberal arts institution to acquire skills in many molecular and cell biology experimental techniques and gain a research-like experience. The project provides students with a conceptual understanding of various techniques and how they can be used in conjunction to answer scientific questions. Additionally, students develop analytical and critical-thinking skills. Each week students interpret data and assess the reliability of their results. Unlike traditional “cookbook” labs, students are asked to recall and relate data from week to week over the course of the entire semester. At the end of the semester, students communicate their results in a conference-like poster presentation and discipline-appropriate scientific paper.

Poster 21  
Presenter: Sarah Anderson, Emory University  
**An Antibiotic Resistance Locus Controls a Phenotypic Switch in Acinetobacter baumannii**  
Authors: Sarah E. Anderson, Philip N. Rather

Acinetobacter baumannii is a Gram-negative opportunistic pathogen that exhibits widespread antibiotic resistance, primarily due to the acquisition of mobile elements. Many strains of A. baumannii, including the highly virulent isolate AB5075, exhibit a phenotypic switch controlling colony opacity and virulence. Opaque (O) variants of AB5075 are virulent in mice and predominate in human infections, whereas translucent (T) variants are avirulent. These variants interconvert, but our research has shown that AB5075 produces multiple subpopulations of O variants, which convert to T at different rates. In particular, AB5075 produces a low-switching O (LSO) variant, which switches to T at a ~1,000-fold lower rate than the “normal” O. To determine the mechanism controlling switching rate, whole genome sequencing was performed on normal and LSO variants. This revealed a tandem duplication in an antibiotic resistance integron in the normal O variant. Copy number of this region was shown to positively correlate with switching frequency in multiple normal and LSO variants. Overexpression of this region, and particularly the aadB gene, was sufficient to increase switching in LSO variants. Site-directed mutagenesis revealed that AadB catalytic activity and protein production were dispensable for stimulating switching, suggesting that something else encoded in this region is responsible for the phenotype observed. Further overexpression studies were used to pinpoint the genetic region controlling switching. Understanding the regulation of O to T switching in A. baumannii is critical to fully comprehending the virulence of this recalcitrant pathogen, and could eventually lead to novel anti-virulence therapeutics for these infections.
Poster 22
Presenter: Latanya Hammonds-Odie, School of Science and Technology, Georgia Gwinnett College

Impact of Career Exploration Activities on Strategic Career Planning for Georgia Gwinnett College Biology Program Alumni: Short-term Outcomes

Author: Latanya Hammonds-Odie

The curricula in the three of the four Biology major tracks at Georgia Gwinnett College does not prompt students to consider and reflect on their preferences, talents, strengths, and aptitudes in preparation for continued professional development following graduation with a B.S. in Biology. I have observed that GGC Biology majors in their senior year are unable to answer fundamental questions about the next steps that they will take to attain stated career goal(s). Graduating Biology majors entered college professing a career goal, but many do little to investigate the required steps to enter such a career.

Targeted assignments were part of an action research project into two upper-level Biology major courses that I taught in Spring 2016, Spring 2017, Summer 2017, and Fall 2017. These assignments were designed to encourage students to assert some personal agency and to engage in the process of career exploration. The specific research questions that this action research project investigated were:

What impact will specific assignments and activities have on senior Biology majors’ ability to:

• Communicate in an effective manner with institutional officials to gather information about a Biology field-related position or educational program in a biological field?

• Identify a career that aligns with his/her talents, undergraduate GPA, exam scores, and aptitudes?

• Articulate in a personal statement his/her rationale for desiring a particular career?

• Strategically detail the next steps on his/her career path, including alternate routes, if needed (low GPA and/or exam scores)?

• Accomplish the next steps on his/her career path?”

Poster 23
Presenter: Lawrence Blumer, Morehouse College

Research Immersion Improves Outcomes for Underprepared Freshmen

Authors: Alexandra Peister, Lawrence S. Blumer

Our implementation of the Howard Hughes Medical Institute, Science Education Alliance, Phage Hunters curriculum (www.seaphages.org) at Morehouse College differed from the implementations at other colleges and universities. We intentionally limited our enrollment to entering freshmen who were deemed underprepared to begin a biology major based on SAT scores. These students were not permitted to initially enroll in a traditional gateway survey-type biology course (BIO 111). Underprepared students were invited to apply for our Phage Hunters course to assess the effectiveness of this research immersion experience on their future success in BIO 111. Six cohorts (N=90) of Phage Hunters students have taken the gateway majors course permitting us to compare their academic performance to peers (N=45) who were similarly underprepared first-time freshmen but who did not participate in Phage Hunters, and to non-peers (N=182) all other students in the same gateway course. Phage Hunters students had a significantly greater pass rate (A,B,C grades) and a significantly lower withdrawal rate than did their peers. Compared to non-peers, Phage Hunters has a significantly lower withdrawal rate and no significant difference in pass rates. These findings indicate that an authentic research immersion experience can dramatically improve student outcomes for underprepared students and consequently improve freshmen student retention.
Poster 24
Presenter: Heather Tinsley, University of Montevallo

**Using Deliberative Democracy in the Introductory Biology Classroom**
Author: Heather N. Tinsley

Both Deliberative democracy is an approach to decision making in which stakeholders explore complex issues using meaningful and informed dialogue. Rather than taking a majority rules approach, deliberative democracy encourages participants to listen to each other’s thoughts, research and weigh facts, and consider trade-offs before attempting to reach a consensus. In the classroom, deliberative democracy is a powerful tool that deepens students’ learning, encourages authentic communication, promotes critical thinking, and fosters civic-mindedness. Because it places scientific literacy within the broader context of the social and ethical considerations that often dominate the public conversation, deliberative democracy is particularly effective in the science classroom, helping students better visualize and understand the complex scientific issues currently facing our society. During this session, participants will learn about deliberative democracy pedagogy and see two different ways it has been used in the introductory biology classroom at the University of Montevallo. Participants will then be exposed to the deliberative democracy process through participation in a guided exercise deliberating the strengths and weaknesses of this approach and its potential utility at the participants’ home institutions. Participants in this workshop will gain insight into deliberative democracy pedagogy and will carry away actionable plans for employing this approach in their classrooms.

Workshop Session 1
Presenter: Erin Dolan, University of Georgia

**“I can be successful here!” Practical ways to promote inclusion in undergraduate education**
Author: Erin Dolan

“Do you want to teach and mentor undergraduates in a more inclusive way, but aren’t sure how to get started? Are you looking for more practical strategies to promote equity and inclusion in your courses and/or your research group? Are you fairly comfortable with teaching equitably and inclusively in your “lecture” courses, but you are not sure how to transfer these strategies into lab course instruction or undergraduate research experiences? If you answered yes to any of these questions, then this session is for you. By the end of this session, you will be able to:

- Define “inclusive learning environment”
- Identify and distinguish among learning environments and experiences that foster or undermine inclusion
- Apply practical strategies to improve inclusion in various types of undergraduate learning environments, including undergraduate research”
**Proteins don’t have to be boring**  
Author: Shane Austin Workshop

To make the most of this highly interactive session, participants are asked to bring 3-5 lecture slides or a current teaching resource used in the teaching of protein structure-function relationships (e.g. hemoglobin structure and function, the catalytic triad of chymotrypsin etc.). No examples are too simple or too complicated.

Most cell biology and biochemistry courses teach protein structure-function relationships using two-dimensional images. These images which are common in textbooks and lectures often do not fully convey the spatial reality of the protein to students and are perceived as boring to some. Practical/Lab sessions provide an opportunity to reach students who these images do not but such sessions are not always possible. This workshop endeavours to equip instructors with tools and techniques to effectively demonstrate protein structure and relate this to protein function. Participants will learn how they can effectively generate interesting protein visualisations for their lectures or course content. Focus will be placed on generating content that compliments current teaching resources and activities, rather than totally reinventing teaching material. Participants will be engaged by making representations of proteins from paper models and Lego bricks. This will be complemented by using the protein visualisation software PyMOL to generate instructional videos. At the end of this workshop, every instructor should walk away with a protein visualisation technique they can incorporate in their course to improve student engagement and more importantly understanding of protein representations.

**Theoretical Frameworks 101: An Essential Part of Educational Research**  
Author: Julie Luft

An important part of conducting educational research involves the selection and use of a theoretical framework. This is one of the most critical elements in an education study, and it is often overlooked by researchers. A theoretical framework is different from a conceptual framework and literature reviews, which are prevalent in educational studies. As an educational researcher, it is important to grasp how a theoretical framework can guide the study design, give meaning to the collection and analysis of data, and enhance the discussion associated with the study. In this session, we will explore how different theoretical frameworks give meaning to an educational study. Connecting to this exploration will be a discussion of the purpose of theoretical frameworks, how to identify a theoretical framework, and the collection and analysis of data based upon a theoretical framework. If time permits, we may explore how epistemological views and theoretical frameworks work together. This session is appropriate for educational researchers who have not contemplated the potential role of theoretical frameworks, or who are unfamiliar with theoretical frameworks.

**Using Deliberative Democracy in the Introductory Biology Classroom**  
Author: Heather N. Tinsley

Both Deliberative democracy is an approach to decision making in which stakeholders explore complex issues using meaningful and informed dialogue. Rather than taking a majority rules approach, deliberative democracy encourages participants to listen to each other’s thoughts, research and weigh facts, and consider trade-offs before attempting to reach a consensus. In the classroom, deliberative democracy is a powerful tool that deepens students’ learning, encourages authentic communication, promotes critical thinking, and fosters civic-mindedness. Because it places scientific literacy within the broader context of the social and ethical considerations that often dominate the public conversation, deliberative democracy is particularly effective in the science classroom, helping students better visualize and understand the complex scientific issues currently facing our society. During this session, participants will learn about deliberative democracy pedagogy and see
two different ways it has been used in the introductory biology classroom at the University of Montevallo. Participants will then be exposed to the deliberative democracy process through participation in a guided exercise deliberating the strengths and weaknesses of this approach and its potential utility at the participants’ home institutions. Participants in this workshop will gain insight into deliberative democracy pedagogy and will carry away actionable plans for employing this approach in their classrooms.

Workshop Session 2
Presenter: Kari Dugger, University of Alabama at Birmingham

Building a Science Curriculum from the Inside-Out
Authors: Kari J. Dugger, Samantha Giordano-Mooga, N. Robert Estes, Tyler Wright, Kristin Chapleau, Brooke Walker, Katie Defnall

Workshop In the proposed workshop, we will introduce Simon Sinek’s idea of “The Golden Circle” to more effectively lead your academic program. The “Golden Circle” proposes, when developing a new product (or in our case, courses, advising strategy or curriculum) there are 3 questions that must be answered: Why, How, and What? According to this model, Sinek believes companies work from the outside-in, that is, they identify their “What” before identifying their “Why”. By beginning with the “Why,” we understand our core beliefs and drives us to produce better quality products. The Biomedical Sciences program has implemented this model while developing a meaningful curriculum over the last 5 years. During this session, we will describe our approach to developing a meaningful curriculum/course and advising strategy with “the Why” of the faculty, staff and students. The learning objectives for this workshop include: The participants should 1) Be able to define Simon Sinek’s “Golden Circle” in the context of course and/or curriculum development, 2) Identify how they can use the “Golden Circle” approach for their curriculum or course development, 3) Demonstrate their own “Golden Circle”, and develop actionable plans with measurable goals to implement their “Golden Circle” plan. Participants will receive worksheets defining the “Golden Circle” to aid in the development of their own. Our faculty and staff will field ideas during the action plan development process. Ultimately, this workshop should help any faculty or staff looking to update their advising strategy, curriculum or implementation of new strategies within a course.

Workshop Session 2
Presenter: Jennifer Thompson, University of Georgia

Introduction to Qualitative Research
Author: Jennifer Jo Thompson

This workshop provides a brief introduction to qualitative research in the context of biology education research. The intention is to give educators and education researchers the foundation to be able to read qualitative papers, understand the contributions of qualitative research, and identify the places where qualitative research may be valuable to your research agenda. We will examine the contributions of qualitative research as a valuable approach for (a) developing foundational knowledge, (b) interrogating and validating other research, and (c) investigating issues that are difficult to quantify – like personal experience and unfolding polices and
processes. Attendees will learn about the benefits and limitations to several common approaches to collecting qualitative data – and how to purposefully sample participants and cases to effectively answer your research questions. They will also develop a basic understanding of how to analyze qualitative data using the Framework Approach to content analysis developed by Richie and Spencer. Finally, we will examine several approaches for strengthening the validity of qualitative research.

**Workshop Session 2**
Presenter: Amy Abdulovic-Cui, Augusta University

**Preparing and Applying for a Teaching Focused Academic Position**
Authors: Amy L. Abdulovic-Cui Workshop

This workshop will focus on different aspects of preparing and applying for a teaching focused academic position. Applying for an academic position can be overwhelming and somewhat terrifying. In this workshop we plan to discuss many aspects of the application process from preparing yourself for the position to writing a strong and effective cover. We will discuss the different types of faculty positions and the percent effort associated with the different types of positions. In small groups we will look at advertisements associated with the different type of positions and discuss how to decide if the position is the type of job you are looking for. We will provide examples of teaching statements and CV to the small groups and have the workshop participants work in groups to discuss the positives and negatives of the documents. Finally we will lead a small panel discussion on what to expect in the interview and the importance of getting teaching experience and networking with other college educators.

**Workshop Session 2**
Presenter: Julie Stanton, University of Georgia

**Including Metacognition in Our Courses**
Author: Julie Dangremond Stanton

Students with awareness and control of thinking can learn more and perform better than students who are not metacognitive. Students with strong metacognitive skills can identify concepts they do not understand and select appropriate strategies for learning those ideas. Metacognitive students know how to implement selected strategies and carry out plans for learning. They can also evaluate and adjust their plans based on outcomes. Metacognitive skills are important for learning biology, but many undergraduates have not yet developed these abilities. In this workshop, we will explore ways to help students develop their metacognitive skills by including metacognition in our courses. Through individual and small group activities, workshop participants will: 1) explain the value of metacognition for undergraduate learning in biology, 2) modify a self-evaluation assignment to encourage metacognition in their students, and 3) develop a short classroom activity that gives their students the opportunity to practice a metacognitive skill. This workshop will be informed by current research in undergraduate metacognitive development and will be broadly applicable to any biology course.