FRIDAY

7:30AM – 8:30AM

NABT First Timers' Coffee Break

JW Grand 7 (Level 3)
• Special Event • GA

First-time attendees are invited to learn more about NABT, the 2022 Professional Development Conference, and network with former "first timers." NABT Mentors will be available to answer your questions and help you make the most of your time in Indianapolis.

The NABT First Timers' Event is made possible through the generous support of

hhmi BioInteractive

8:00AM – 9:00AM

SPECIAL PROGRAMMING PRESENTED BY MINIPCR

3444 Build It to Understand It: An Active Learning, Low-Cost Approach to Electrophoresis and Micropipetting

JW Grand 3 (Level 3) • Biotechnology • MS, HS, GA

The new Bandit™ STEM Electrophoresis Kit allows students to assemble and use a high-quality electrophoresis system with well-thought-out labs, all at a price you didn't think was possible!

Bruce Bryan, miniPCR bio, Cambridge, MA

SPECIAL PROGRAMMING PRESENTED BY BIO-RAD

3439 PCR Amplified: Advanced Topics & Techniques

JW Grand 2 (Level 3) · Biotechnology · Hands-on Workshop (60 min) · HS, 2Y, 4Y

From dyes to droplets, learn what's new in PCR including quantitative PCR (qPCR, aka real-time PCR), droplet digital PCR (ddPCR), and applications for studying gene expression, disease outbreaks, and more.

Cassy Granieri, Damon Tighe, and Leigh Brown, Bio-Rad Laboratories, Hercules, CA

9:15AM – 10:15AM

GENERAL SESSION

Sarah Miller

See biography on page 9

Inclusive Learning through Scientific Teaching

White River Ballroom (Level 1) • Special Speaker (60 min) • GA

Achieving equity in science requires attracting and retaining students from diverse backgrounds. Despite decades of calls for action, change has been slow. Recommendations have largely focused on members of underrepresented groups themselves rather than on fixing the classrooms that drive many students out of science. Miller will shed light on how instructors can leverage scientific teaching practices and AJEDI (antiracist, just, equitable, diverse, and inclusive) principles to foster inclusive learning in biology.

10:30AM – 12:30PM

Chewing on Change

2022 NABT Evolution Symposium Presented by NCSE
201-203 (Level 2) • Evolution • Symposium (120 min) • HS, 2Y, 4Y

The Tales Teeth Tell Us: Decoding the Ancient Lives of Mammals

Teeth come in a variety of shapes and sizes and help us understand the evolutionary history of mammals. In addition, they can also paint a more vivid picture of the ecology of ancient mammals. By examining tooth shape and size, their chemical signatures, and even the microscopic wear patterns on teeth, paleontologists can assess the types of plants or prey consumed by prehistoric mammals. Using examples from ancient horses, tapirs, sabertooth cats, and marsupial lions, this session will explore ways we infer the ecology of extinct mammals, highlight how these efforts are relevant when assessing impacts of climate change on mammalian communities, and reveal cautionary conservation lessons that are of direct relevance to today.

Larisa DeSantis, Vanderbilt University, Nashville, TN

NCSE Teacher Workshop: Straight from the Horse's Mouth

Gallop through time to explore how variation within a population is an essential driving factor in natural selection. Teachers will explore a free lesson set highlighting the evolution of horses. Investigate how significant ecological change can result in dramatic speciation events by using an extensive collection of fossil evidence—horse teeth. Walk away with a hands-on activity grounded in primary evidence that utilizes a genuine paleontological scientific practice for analyzing how change occurs in a taxon over time. This NGSS-aligned storyline also works to resolve common misconceptions about orthogenetic evolution frequently reinforced on social media and inadvertently perpetuated in some educational settings.

Jennifer Broo, Mariemont High School, Cincinnati, OH and Lin Andrews, National Center of Science Education, Oakland, CA

2022 NABT EVOLUTION SYMPOSIUM

NCSE National Center for Science Education

Chewing on Change

The Tales Teeth Tell Us: Decoding the Ancient Lives of Mammals

Dr. Larisa DeSantis, *Vanderbilt University, Nashville, TN*

Join Dr. Larisa DeSantis, a vertebrate paleontologist, as she explores ancient teeth as a window into the evolutionary history of mammals and the relevance of that history today.

NCSE TEACHER WORKSHOP:

Straight from the Horse's Mouth

Jennifer Broo, Lin Andrews

Investigate how significant ecological change can result in dramatic speciation events by using an extensive collection of fossil evidence—horse teeth—as part of a freely available NCSE lesson set.

10:30AM – 11:45AM

3434 Writing for the ABT

104 (Level 1) • Curriculum Development • Hands-on Workshop (75 min) • HS, 2Y, GA

The editorial team of *The American Biology Teacher* will jointly present a workshop for all those who would like to be authors and/or reviewers with a practice review and article development session.

William McComas, ABT Editor, University of Arkansas, Fayetteville, AR

3278 American Association of Immunologists Teachers Research Program – Immunology Lessons for the Classroom

White River A (Level 1) • Curriculum Development • Hands-on Workshop (75 min) • ML, HS, 2Y

Learn how to bring the excitement of immunology research to students in the classroom with units presented by teachers from the American Association of Immunologists Summer Research Program for Teachers.

Mike Criscitiello, American Association of Immunologists, College Station, TX

3296 Teaching Human Ecology with Models and Simulations

White River B (Level 1) • Ecology / Environmental Science / Sustainability • Hands-on Workshop (75 min) • ML

Discover inquiry-based simulations and modeling activities that explore complex interactions between people and the environment, including population growth, global land and water use, wildlife habitats, and interdependent relationships in ecosystems.

Marni Landry, Grand Canyon University, Phoenix, AZ

SPECIAL PROGRAMMING PRESENTED BY PIVOT

3440 Phenomena-Based, Active Learning with Pivot Interactives

White River C • Technology in the Classroom • Demonstration (75 min) • MS, HS, GA

See the newest ways Pivot Interactives gives biology teachers tools to actively engage students in science practices through phenomena.

Eric Friberg, Pivot Interactives, Mendota Heights, MN

3329 Student Designs for a Sustainable Future – Explore Biodiversity Conservation in a Place You Choose

White River D (Level 1) • Ecology / Environmental Science / Sustainability • Hands-on Workshop (75 min) • ML, HS, 4Y

Explore the Half-Earth Map and a new feature that lets you and your students draw or paste your own area of interest to decide about its conservation potential.

Dennis Liu, E.O. Wilson Biodiversity Foundation, Potomac, MD and Selim Tlili, Rudolph Steiner School, New York, NY

3384 Formative Assessment: The Other F Word

White River G (Level 1) • Instructional Strategies • Hands-on Workshop (75 min) • ML, HS

Learn examples of fun, fast, and easy formative assessments to use in the classroom for AP and on-level. You won't see shoulder partners or think-pair-share here.

Julia Drake and Linda Alloju, Plano West Senior High School, Plano, TX

3361 Teaching AP Biology in Community for Social Justice: Authentic Science and Justice-oriented Approaches Through Inquiry

White River J (Level 1) • AP Biology • Hands-on Workshop (75 min) • HS

Join us for uplifting, interactive discussion featuring AP Bio-aligned lessons that engage students in collaborative, meaningful ways so the AP science practices can become a personal toolkit of empowerment.

Kirstin Milks, Bloomington High School South, Bloomington, IN and David Upegui, Central Falls High School, Central Falls, RI

SPECIAL PROGRAMMING PRESENTED BY BFW PUBLISHERS

3453 Efficiently Teaching the Science Practices in AP® Biology

204-205 (Level 2) • AP Biology • Hands-on Workshop (75 min) • HS

This session will provide AP® Biology teachers ideas, bell ringers, and activities for numerous opportunities to practice the process of science and much more (assessment etc!) throughout the school year.

Jim Smanik, Sycamore High School, Montgomery, OH

Justice, Equity, Diversity & Inclusion (JEDI) Inclusion Committee

206 (Level 2) • Committee Meeting (75 min) •

Enya Granados, Committee Chair

SPECIAL PROGRAMMING PRESENTED BY HUDSONALPHA

3366 Challenge Accepted!!

302-303 (Level 3) • General Biology • Hands-on Workshop (75 min) • ML, HS

Utilize a single digital resource to address both agricultural and human health challenges. Participants will rotate through a smorgasbord of HudsonAlpha's Biotech Timeline-based lessons.

Jennifer Hutchison and Madelene Loftin, HudsonAlpha Institute for Biotechnology, Huntsville, AL

10:30AM – 11:45AM CONT.

3323 Student Success in the Community College Ecosystem

304-306 (Level 3) • Science Practices • Symposium (75 min) • 2Y

A panel of two-year college faculty will share how they promote student success and faculty scholarship at their institutions, providing recommendations to those looking to do similar work.

Cleo Rolle, Capital Community College, CT; Vedham Karpakakunjaram, Montgomery College, MD; Jayme Dyer, Durham Technical Community College, Durham, NC; Ranya Taqieddin, St. Charles Community College, St. Louis, MO; Merrie Richardson, Southcentral Kentucky Community & Technical College, Bowling Green, KY; Sheela Vemu, Waubonsee Community College, Aurora, IL; Andrew Lee, Northern Virginia Community College, Alexandria, VA

Member Resources Committee

308 (Level 3) • Committee Meeting (75 min) • GA

Catherine Ambos, Committee Chair

3322 Climate Anxiety? You're Not Alone: Teaching Climate Science While Addressing Student Environmental Despair

309-310 (Level 3) • Ecology / Environmental Science / Sustainability • Hands-on Workshop (75 min) • ML, HS

Attendees will walk through a climate change task designed to teach an already anxious generation of future scientists while addressing environmental despair with a toolkit of trauma-informed practices.

Erin Capra, West High School, Salt Lake City, UT; Erin Smith, Berkeley High School, Berkeley, CA; Lucas Risinger, West Albany High School, Albany, OR

SPECIAL PROGRAMMING PRESENTED BY BIO-RAD

3457 Hands-On Chromosomal Gene Editing with the Out of the Blue CRISPR Kit

JW Grand 2 (Level 3) • Biotechnology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

CRISPR's most relevant uses require more than just knockouts! In this hands-on workshop, you'll use CRISPR-Cas9 to cut and repair an E.coli chromosomal gene while learning about essential experimental controls.

Cassy Granieri, Damon Tighe, and Leigh Brown, Bio-Rad Laboratories, Hercules, CA

SPECIAL PROGRAMMING PRESENTED BY MINIPCR

3443 Bringing Real CRISPR-Cas9 to Your Class with Accessible Tools: In vivo and In vitro!

JW Grand 3 (Level 3) • Biotechnology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

See our multiple approaches to CRISPR-Cas9 Alter DNA and change a phenotype in bacteria with Knockout!™. Manipulate DNA *in vitro* with Chopped!™. Try our free resources too!

Bruce Bryan, miniPCR bio, Cambridge, MA

3432 Interactive Video Builder: A New HHMI BioInteractive Tool for Enhancing Learner Engagement

JW Grand 4 (Level 3) • Instructional Strategies • Hands-on Workshop (75 min) • HS, 2Y, 4Y

We will introduce a tool for creating interactive videos that ask learners about their thinking. We will also experience, build, and design a lesson plan that integrates an interactive video.

Annie Prud'homme-Généreux, Capilano University, North Vancouver, BC, CAN and Mark Nielsen, HHMI BioInteractive, Fort Collins, CO

12:00PM – 12:30PM

SPECIAL PROGRAMMING PRESENTED BY XR GURU

3462 Using Virtual Reality for Science Education

104 (Level 1) • General Biology • Hands-on Workshop (30 min) • ML, HS, 4Y

Learn about best practices for integrating virtual reality in your science class, and personally view the VR content in a headset.

Doug Smith, XR Guru, Dublin, OH

3307 A Cancer Case Study Storyline and PLC Research Lesson

White River A (Level 1) • General Biology • Hands-on Workshop (30 min) • HS, 2Y, 4Y

Enjoy conversation about our Cancer Storyline and PLC research lesson collaboration with the University of Chicago Comprehensive Cancer Center EYES (Educators and Youth Enjoy Science) teacher research experience.

Steven Rogg, Coherent Learning Design, Lindenhurst, IL; Basia Galinski, University of Chicago, Chicago, IL; Pam Wagner, Chicago Public Schools, Chicago, IL

12:00PM – 12:30PM CONT.

3394 Some Like it Hot: Extremophiles of Yellowstone National Park

White River B (Level 1) • Ecology / Environmental Science / Sustainability • Hands-on Workshop (30 min) • ML, HS, GA

Engage students in evidence-based argumentations using extremophiles of Yellowstone National Park. This presentation describes a lesson designed to strengthen students' understanding of resource availability, even in the harshest of ecosystems.

Julie Angle, Oklahoma State University, Stillwater, OK

3297 Budburst Community Science: Observing Plants in a Changing World

White River C (Level 1) • General Biology • Hands-on Workshop (30 min) • HS, 2Y, 4Y

Budburst is a community science project that engages people in investigating local plant phenomena. Learn how your class can participate in authentic research while exploring plants, ecosystems, and climate change.

Sarah Jones, Chicago Botanic Garden, Glencoe, IL

3313 Bringing Mock Surgeries to Dissection

White River D (Level 1) • Anatomy & Physiology • Demonstration (30 min) • HS

In this session, we will discuss how we add mock surgeries and suturing to our dissections of hearts, lungs, kidneys, cow eyes, and fetal pigs.

Ken Bateman and Carolyn Spangler, Wellesley High School, Wellesley, MA

3420 Operating Without a Net: Using Drones and Other Technologies to Provide Course-Based Undergraduate Research Experiences

White River G (Level 1) • Instructional Strategies • Demonstration (30 min) • 4Y

This session will explore novel approaches to the use of technology as a tool to help develop research skills in undergraduate biology courses. This is special presentation from the winner of the 2021 NABT Four-Year College & University Biology Teaching Award.

Jason Bruck, Stephen F. Austin State University, Nacogdoches, TX

3330 Breaking Bonds Does NOT Release Energy: Addressing Misconceptions About Energy in Biology

White River J (Level 1) • General Biology • Demonstration (30 min) • ML, HS, GA

Biology often takes shortcuts that foster misconceptions about energy. Wendy Johnson will share examples from the course she created to help 9th graders develop an accurate understanding of energy in biological processes.

Wendy Johnson, Kentwood Public Schools, Kentwood, MI

SPECIAL PROGRAMMING PRESENTED BY BFW PUBLISHERS

3452 On Time: A Hands-On Workshop Exploring the History of Earth and Life

204-205 (Level 2) • Evolution • Hands-on Workshop (30 min) • HS, 4Y, GA

In this workshop, we will do an activity together that introduces students to the long sweep of Earth's history, key events in evolution, and a sense of time and scale.

James Morris, Brandeis University, Waltham, MA

Retired NABT Members Committee

206 (Level 2) • Committee Meeting (75 min) • GA

Dennis Gathmann, Committee Chair

3271 Hot and STEAM-Y: The "A" in STEAM: Expanding Vision of How Science is Taught

302-303 (Level 3) • Instructional Strategies • Hands-on Workshop (30 min) • GA

Participants will learn art integration strategies to enhance student engagement. The strategies are from the ARTeacher program developed by the University of Arkansas and Crystal Bridges museum.

Linda Stocker and Matthew Holden, Fayetteville High School, Fayetteville, AR

3325 Disabilities and the Life Sciences: Equity, Inclusion, and Universal Design

304-306 (Level 3) • Instructional Strategies • Paper (30 min) • HS, 2Y, 4Y

Universal Design is a collection equity-driven strategies, techniques, and practices that assist educators in providing inclusive opportunities to diverse learners in the classroom, including disabled students.

Tara Jo (TJ) Holmberg, Northwestern Connecticut Community College, Winsted, CT

Awards Committee

308 (Level 3) • Committee Meeting (75 min) • GA

Jason Crean, Committee Chair

3310 Connecting Scientific Learners through Science Buddies

309-310 (Level 3) • Curriculum Development • Hands-on Workshop (30 min) • ELEM, HS, GA

Bringing science into the classroom is important, why not bring high school and elementary students together to teach, foster relationships, and add excitement into the classroom?

Alyce Myers, Lafayette Jefferson High School, Lafayette, IN

12:00PM – 12:30PM CONT.

SPECIAL PROGRAMMING PRESENTED BY BIO-RAD

3459 Track Disease Spread Using Modeling and Gel Electrophoresis

JW Grand 2 (Level 3) • Biotechnology • Hands-on Workshop (30 min) • HS, 2Y, 4Y

Put your epidemiologist hat on and determine the transmission mode of a new virus using molecular data, patient histories, and clues hidden in a restaurant.

Cassy Granieri, Damon Tighe, and Leigh Brown, Bio-Rad Laboratories, Hercules, CA

SPECIAL PROGRAMMING PRESENTED BY MINIPCR

3445 miniPCR Sleep Lab: Are You a Night Owl? Or a Morning Lark? Ask Your Genes!

JW Grand 3 (Level 3) • Genetics • Hands-on Workshop (30 min) • HS, GA

Link the genetics of circadian rhythms to students' own DNA. Use PCR and gel electrophoresis to connect a complex trait to an engaging phenotype in this authentic research investigation.

Bruce Bryan, miniPCR bio, Cambridge, MA

3433 HHMI BioInteractive's Assessment Builder: A Crowdsourced Database to Facilitate Assessment for Learning

JW Grand 4 (Level 3) • Instructional Strategies • Hands-on Workshop (30 min) • HS, 2Y, 4Y

We will demonstrate the capabilities of HHMI BioInteractive's Assessment Builder, a crowdsourced database of high-quality questions intended to improve learning in AP Biology and undergraduate introductory biology.

Angela Hodgson, North Dakota State University, Fargo, ND

12:45PM – 1:45PM

NABT Lunch Break

Griffin Hall (Level 2) • Meal Function (60 min) • Free • GA

Everyone is invited to pick up a boxed-lunch in Griffin Hall (2nd Floor) and join a section event, meet up with friends, or find a quiet spot to relax and recharge.

BE SURE TO GRAB YOUR LUNCH IN GRIFFIN HALL BEFORE HEADING TO THE SECTION & LEVEL LUNCHEONS!

Elementary & Middle-Level Teachers Luncheon

JW Grand 1 (Level 3) • Meal Function (60 min) • Free • ELEM, ML

Grab your lunch and meet up with other elementary and middle-level teachers at this informal networking lunch designed to help you connect with colleagues.

AP Biology Section Luncheon

JW Grand 7 (Level 3) • Meal Function (60 min) • Free • AP

Grab your lunch and meet other AP Biology teachers in a friendly, informal setting to share insights, ask questions, and build community. You may even get to meet some of your favorite AP colleagues in person. The luncheon includes a special presentation of the *Kim Foglia AP Biology Service Award*.

Sponsored by miniPCR bio

High School Teachers Luncheon

JW Grand 8 (Level 3) • Meal Function (60 min) • Free • HS

If you teach funny freshmen, serious seniors, and/or everyone in-between, you will want to grab your lunch, grab a seat, and connect with other high school biology teachers in this informal setting.

Sponsored by HudsonAlpha Institute for Biotechnology

Two-Year College Section Luncheon

JW Grand 9 (Level 3) • Meal Function (60 min) • Free • 2Y

Join a supportive community of two-year college educators to share your strategies, your struggles, and your successes. The winners of the *Two-Year College Biology Teaching Award* and the *Professor Chan Teaching Award* will also be recognized.

Four-Year College & University Section Luncheon

JW Grand 10 (Level 3) • Meal Function (60 min) • Free • 4Y

Faculty, education researchers, graduate students, and anyone associated with four-year colleges and universities are invited to network with colleagues and learn about section programs and opportunities. There will also be a special presentation of the *Four-Year College & University Section Awards*.

2:00PM – 3:30PM

13th Annual Biology Education Research Symposium

201-203 (Level 2) • Instructional Strategies • Symposium (120 min) • 2Y, 4Y, GA

NABT is proud to present the 13th Annual Biology Education Research Symposium. Presentations were accepted through a double-blind review process that was open to biology instructors and education researchers at all levels. The format for the symposium is a traditional presentation of papers by individual or co-authors lasting 15 minutes each.

See page 34 for the full listing

3377 Creating and Implementing Quantitative Biology Lessons with QB@CC, Beneficial for Both Faculty and Students

304-306 (Level 3) • General Biology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Experience quantitative biology Open Educational Resources first as learners and educators, and then as creators. Learn about the QB@CC community and ways to collaborate with the network.

Jennifer Adler, Maysville Community and Technical College, Cynthiana, KY; Melanie Lenahan, Raritan Valley Community College, Branchburg, NJ; Sarah Prescott, BioQUEST/ University of New Hampshire, Raymond, NH; Vedham Karpakakunjaram, Montgomery College, Rockville, MD

2:00PM – 3:15PM

SPECIAL PROGRAMMING PRESENTED BY BIOZONE

3466 BIOZONE Showcase NEW titles for AP Biology, NGSS Biology, and APES

104 (Level 1) • General Biology • Demonstration (75 min) • HS

BIOZONE's new worktexts for AP Biology, NGSS Biology, and APES provide a robust alternative to the traditional textbook paradigm. Attendees receive a FREE print copy plus a one-year eBook licence.

Richard Allan, BIOZONE International, Hamilton, Waikato, NZ

3294 Isn't It Just XX and XY? Helping Students Build Scientific Models of Human Assigned Sex

White River A (Level 1) • General Biology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

High school and college students actively build and refine models to explore high-interest scientific data, leverage critical reasoning, and uncover how assigned sex and gender are culturally situated globally.

Kirstin Milks, Bloomington High School South, Bloomington, IN; Brittany Franckowiak, Wilde Lake High School, Columbia, MD; Enya Granados, Russell County High School, Seale, AL

3291 "Place Based Wikis" - Get Students Excited about Collaborative, Ongoing Ecology Fieldwork

White River B (Level 1) • Ecology / Environmental Science / Sustainability • Hands-on Workshop (75 min) • ML, HS, 4Y

Ever struggle getting an authentic fieldwork project off the ground? Setting up an easy "Wiki" using Google Sites can help students engage in meaningful, collaborative research year after year!

Erika Mitkus, Governor's Academy, Byfield, MA and Sara Abeita, Lawrence Free High School, Lawrence, KS

SPECIAL PROGRAMMING PRESENTED BY EDVOTEK

3436 Teaching the Polymerase Chain Reaction in One Lab Period

White River C (Level 1) • Biotechnology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Want to learn today's top biotechnology techniques? Join us for a hands-on exploration of PCR and electrophoresis in one hour using the EdvoCyclerJr and the EDGE!

Maria Dayton and Danielle Snowflack, Edvotek, Washington, DC

3391 Beyond Mitosis: Utilizing Cancer Case Studies to Explore Cell Growth and Health Inequities

White River D (Level 1) • General Biology • Hands-on Workshop (75 min) • HS

Discover cancer-based lesson plans and teaching resources that engage students and support opportunities for student voice and discourse.

Regina Wu and Jeanne Chowning, Fred Hutch Cancer Center, Seattle, WA

3385 Strategies to Improve Student Writing in Biology

White River G (Level 1) • Instructional Strategies • Hands-on Workshop (75 min) • HS, 2Y, 4Y

To develop student scientific writing skills related to the science practices, participants will engage as learners to explore classroom-ready strategies and resources, and as educators to reflect and share ideas.

Ann Brokaw, Rocky River High School, Rocky River, OH

13th Annual Biology Education Research Symposium

2:00PM – 3:00PM
201-203 (Level 2)

The symposium is coordinated by the NABT Four-Year College & University Section's Research Committee

Papers will be posted online at nabt.org/Proceedings-Research-Symposium

SPECIAL PRESENTER

Kristy L. Daniel
Texas State University, San Marcos, TX

Recipent of the 2022 NABT Four-Year College & University Section's Research in Biology Education Research Award.

Do You See What I See?

Researchers often use visual representations (e.g., graphs, diagrams, pictures) to communicate scientific data, especially when supporting instruction. This style of visual communication relies on the intended receiver's ability to make sense of the visual inputs in manners consistent with scientific thinking. Unfortunately, learners are not always comfortable communicating with visualizations, and they do not always interpret and understand the represented science as intended. We refer to how well learners make sense of and use visual depictions of science as their representational competence. Low levels of representational competence can limit learning outcomes. Ignoring students' self-efficacy and ability to use and develop scientific representations can prevent them from developing expertise in their field. I developed and tested a 20-item Likert-type instrument to measure participant self-efficacy in their communication of scientific visualizations (ECSV). I used rigorous approaches to establish content and face validity and reliability ($\alpha \geq 0.95$) of the instrument. I used biology student mean scores on the ECSV pre/post instruction to document statistically significant differences in science communication self-efficiency using visualizations. By identifying self-efficacy involved in communicating science visualizations, we can better inform instructional practices. Improvements in representational competence are one step in maximizing our potential to improve science literacy.

ARES (Authentic Research Experience in Science): An Assesment of their Effect on High School Students' Self Efficacy and Perceptions of Science

Daniel Shay and Teresa Eggleston, North Central High School, Spokane, WA

In order to improve persistence in STEM careers, STEM teachers need to apply methods that build confidence and an appreciation for the nature of science. While it is well documented that inquiry driven, project-based learning improves a number of these student outcomes, there is no clear framework in place for the development of new project-based learning curricula. The Authentic Research Experiences in Science (ARES) framework was developed by North Central High School educators to help create long-term, project-based modules that reflect the teacher's specific research interest and technological capacity. This study tested the effect an ARES-aligned project had on student confidence and perceptions of biology. Using the ARES framework, we developed a semester-long, project-based curriculum in which students investigated the microbiome of local mosquitoes using an Oxford Nanopore minION sequencer. A 24-item self efficacy survey and a 31-item science perceptions survey (CLASS-Bio) were administered before and after the project, and the normalized change analyzed. We found that the average normalized change for each of the three categories of student confidence grew from the pre-survey to the post-survey, and the most notable shifts in perceptions were those pertaining to the strategies used to solve biological problems and the connections biology has to the real world.

The Impact of Practice Exams on Undergraduate Biology Majors

Kendra Wright, University of Memphis, Memphis, TN

Metacognition is the act of thinking about thinking. The way students think about what they learn and how they learn affects their overall cognitive process. Students who are aware of their understanding and how to regulate their metacognition are more likely to change their studying habits. Practice exams contribute to how students gauge their understanding and in what ways students reevaluate their studying habits. Being able to identify what you know versus what you do not know is one way that practice exams provide guidance to students. Through deliberate practice, students can test their knowledge and focus their studying on certain material. In this study, we examine whether students' attitudes towards practice exams change as they progress to upper-division courses. Study findings show that students used practice exams in various ways in introductory biology courses. Findings also showed that upper-division students relied on their prior experiences with practice exams to help build upon their critical thinking skills to answer higher Bloom's level questions. Further, practice exams had a long-lasting impact on how students learn. These findings describe how providing students with practice exams not only builds their metacognitive skills but also contributes to what information they accept in their working memory.

Patterns for Managing Potential Conflict Between Religion and Evolution Among Muslim Undergraduate Biology Students

Rahmi Aini, Middle Tennessee State University, Murfreesboro, TN; Sara Brownell, Arizona State University, Tempe, AZ; and M. Elizabeth Barnes, Middle Tennessee State University, Murfreesboro, TN

Evolution is foundational to biology and yet controversial among undergraduate biology students. However, no research has explored views within Muslim student populations in the United States and patterns for how they may manage potential conflict between their religion and evolution. Using a mixed-method approach, undergraduate Muslim students enrolled in 47 introductory biology classes, filled out surveys of evolution acceptance, evolution understanding, and perceived conflict between their religion and evolution (n=270). Further, students explained their views on the relationship between religion and evolution (n=180). We conducted a k-means cluster analysis and qualitatively analyzed open-ended responses to examine how Muslim students manage potential conflict. We found three groups that represent the patterns of these students. First, the reconciliation group consists of 14% students who had high evolution acceptance and understanding and low perceived conflict between their religious beliefs and evolution, 2) the conflicted group consists of 26% of students who had low evolution acceptance and understanding and high perceived conflict between their religious beliefs and evolution, and 3) the uncertain group contains 60% of students who had average scores for all variables. This indicates that Muslim students may benefit from evolution instruction that incorporates religious cultural competence in evolution education.

2:00PM – 3:15PM CONT.

3418 Task Verbs: Helping Students Understand Them and Use Them in FRQs

White River J (Level 1) • AP Biology • Demonstration (75 min) • HS, GA

The 2019 Course-and-Exam-Description contains definitions of verbs used in exam items. Learn how to help students respond to FRQs using the task-verb descriptions.

Catherine Walsh, College Board, New York, NY

SPECIAL PROGRAMMING PRESENTED BY EXPERT TA

3461 An Online Homework Solution and an Ecosystem of Assignable Shared Resources for Intro Biology

204-205 (Level 2) • General Biology • Demonstration (75 min) • 2Y, 4Y, GA

Join us to see an overview of the Expert TA Introductory Biology online homework platform that pairs with OpenStax Biology. We will also introduce our ecosystem of assignable shared resources.

Jeremy Morton, Expert TA, Tulsa, OK

Informal Science Committee

206 (Level 2) • Committee Meeting (75 min) • GA

Committee chair to be named.

3397 Race, It's Not a Thing: Facing Racism Through the Study of Genetics

302-303 (Level 3) • Genetics • Demonstration (75 min) • ML, HS, 2Y

Leverage prior knowledge and teach complex themes in genetics while facing racism head-on. Explore methods of teaching through the lens of social justice.

Bonnie Nieves, Nipmuc Regional High School, Upton, MA

OBTA Directors & Regional Coordinators

308 (Level 3) • Committee Meeting (75 min) • GA

Mark Little, Committee Chair

3287 Using BLAST and CLUSTALW as a Model for Evolution

309-310 (Level 3) • AP Biology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

BLAST and CLUSTALW model evolution by aligning DNA or protein sequences. Students will use online databases, analyze sequence alignments, compare local and global alignment, and create and compare phylogenetic trees.

Kaitlan Hinesley, Roncalli High School, Indianapolis, IN

SPECIAL PROGRAMMING PRESENTED BY BIO-RAD

3460 The Plight of the Bumblebee: Studying Bee Genetic Biodiversity Using DNA Barcoding

JW Grand 2 (Level 3) • Biotechnology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Taxonomy in action: use visual cues and biotechnology techniques to sort bumblebees into separate species. Experience how PCR, sequencing, and bioinformatics help scientists distinguish bee species.

Cassy Granieri, Damon Tighe, and Leigh Brown, Bio-Rad Laboratories, Hercules, CA

SPECIAL PROGRAMMING PRESENTED BY MINIPCR

3446 Using Synthetic Biology to Explore the Central Dogma, Protein Structure, and Mechanisms of Antibiotic Resistance

JW Grand 3 (Level 3) • Genetics • Hands-on Workshop (75 min) • HS, 2Y, GA

Use the cell-free BioBits® system to experiment directly with concepts that have previously been inaccessible in most high school laboratories. Simple to implement, authentic molecular investigations with bright fluorescent readouts!

Bruce Bryan, miniPCR bio, Cambridge, MA

3429 Developing and Using Models with HHMI BioInteractive Resources to Understand Systems at Varying Scales

JW Grand 4 (Level 3) • Science Practices • Hands-on Workshop (75 min) • HS

Modeling helps students gain a deep understanding of complex systems across scales. Using cellular/molecular biology and ecology activities, we will explore using models to construct explanations and make predictions.

Christina Bowers, Amherst College, Amherst, MA and Jeannie Long, Girls Preparatory School, Chattanooga, TN

3:30PM – 4:00PM

3346 Blood Sugar Balance - A Glucose Metabolism Model for Diabetes Education

White River A (Level 1) • General Biology • Hands-on Workshop (30 min) • HS, 2Y, 4Y, GA

The Blood Sugar Balance is a web-based glucose metabolism model that allows for acquisition of game data that allows students to understand the interplay of diabetic status, food choices, and accessibility

Atom Lovecloud and Joan Griswold, University of Washington, Seattle, WA

3305 3D Learning for a Sustainable World

White River B (Level 1) • Ecology / Environmental Science / Sustainability • Hands-on Workshop (30 min) • HS

Engage in inquiry-based, hands-on activities to explore human ecology topics including population, resource use, climate change, and ecosystem health. Receive practical lessons to go beyond the textbook.

Norman Leonard, Pike High School, Indianapolis, IN

3:30PM – 4:00PM CONT.

3360 "The Tree of Life" A Game to Develop Scientific Argumentation of Evolution Among University Students

White River C (Level 1) • Evolution • Paper (30 min) • 2Y, 4Y, GA

A board game designed to overcome obstacles to understand biological evolution among university students. Using the Evolution Theory as a tool to develop scientific argumentation in future teachers.

Roger Araujo Llamas, Stockholm University-Uppsala, Uppsala, SE

3372 Simple Tools to Demonstrate Ventilation Changes in Restrictive and Obstructive Pulmonary Diseases

White River D (Level 1) • Anatomy & Physiology • Hands-on Workshop (30 min) • HS, 2Y, 4Y

Readily available items are used to demonstrate the changes in ventilation due to restrictive and obstructive pulmonary diseases. Lung volumes and capacity will be investigated; spirometry data will be assessed.

Pat Clark, IUPUI, Indianapolis, IN

3381 Evaluating Student Work in the Science Classroom: Standards-Based Scoring & Teacher Calibration

White River G (Level 1) • Science Practices • Demonstration (30 min) • HS

Attendees will see how we selected and scaled our standards for SBG and how we assess students. We will also share teacher calibration strategies.

Karen O'Connor and Brett Erdmann, Stevenson High School, Lincolnshire, IL

3319 Who Do You Turn To? High School Students' Sources of Knowledge about Science

White River J (Level 2) • Nature of Science • Paper (30 min) • ML, HS, GA

This research examined how high school science students chose sources of knowledge for science-related questions during a card sort activity. We'll share how students think about expertise, science, and controversy.

Kathryn Green and Claude Gonzalez, Clarke Central High School, Athens, GA; Lisa Borgerding, Kent State University, Kent, OH

SPECIAL PROGRAMMING PRESENTED BY EXPERT TA

3463 Custom Digital Publishing for Instructors and Building Editable Interactive Textbooks with Expert TA

204-205 (Level 2) • Curriculum Development • Demonstration (30 min) • 2Y, 4Y, GA

Join to learn about Expert TA's approach to custom digital publishing and the ability for instructors to create a custom, interactive textbook based on the current OpenStax Biology text.

Jeremy Morton, Expert TA, Tulsa, OK

Professional Development Committee

206 (Level 2) • Committee Meeting (30 min) • GA

Committee chair to be named.

3327 Starting Simple with Cladistics

302-303 (Level 3) • Evolution • Demonstration (30 min) • HS, 2Y

Explore how to have students dive into cladistics. After explaining the basics of cladistic vocabulary to students, we dive right in with characteristics of dogs.

Alice Scheele, Patrick Henry High School, Ashland, VA

Nominations Committee

308 (Level 3) • Committee Meeting (75 min) • GA

Bob Melton, Committee Chair

3269 A Model for Recruiting and Retaining Hispanic Students in STEM Fields

309-310 (Level 3) • General Biology • Paper (30 min) • ML, HS, 2Y

Learn how to create a pipeline, beginning in elementary school, to engage Hispanic students in STEM fields.

Kelly Moore and Elesha Goodfriend, Walters State Community College, Morristown, TN

NABT Book Club: FUZZ

Alcove (Level 3) • Special Program • Discussion (30 min) • GA

Join the inaugural NABT Book Club. This year we are reading *FUZZ: When Nature Breaks the Law* by Mary Roach. Mary will also participate in an online Q&A on December 9th. This meeting will help determine format and formality for the community read.

SPECIAL PROGRAMMING PRESENTED BY BIO-RAD

3458 Personalized Medicine: CRISPR Therapies Transforming Medicine Now!

JW Grand 2 (Level 3) • Biotechnology • Hands-on Workshop (30 min) • HS, 2Y, 4Y

Discover some of the most exciting CRISPR medical applications in development, including those for CAR-T and immunotherapies, and how students can model CRISPR-Cas9 chromosomal gene editing to treat disease.

Cassy Granieri, Damon Tighe, and Leigh Brown, Bio-Rad Laboratories, Hercules, CA

3:30PM – 4:00PM CONT.

SPECIAL PROGRAMMING PRESENTED BY MINIPCR

3447 Sickle Cell Genetics: Using Gel Electrophoresis to Investigate Molecular Genetics, Inheritance, and Disease

JW Grand 3 (Level 3) • Genetics • Hands-on Workshop (30 min) • ML, HS

Help a fictional family obtain a molecular diagnosis using gel electrophoresis. In the process, explore connections to protein structure, Mendelian genetics, mutations, genetic disease, evolution, and more!

Bruce Bryan, miniPCR bio, Cambridge, MA

3431 Modeling Epidemics: Using an HHMI BioInteractive Simulator to Study Real Outbreaks

JW Grand 4 (Level 3) • General Biology • Hands-on Workshop (30 min) • HS, 2Y, 4Y

We will use an online simulator to model and visualize the spread of an infectious disease in a population. We will build and analyze graphs using data from authentic outbreaks.

Nadeene Riddick, HHMI BioInteractive, Chevy Chase, MD and Annie Prud'homme-Généreux, Capilano University, North Vancouver, BC, CAN

4:00PM – 5:00PM

NABT Leader Meet & Greet

JW Grand 5-6 (Level 3) • Committee Meeting (60 min) • GA

This is your chance to get more involved with the NABT Community. Learn more about different opportunities from NABT committee chairs, section chairs and regional cordinators.

4:00PM – 5:30PM

Exhibit Hall Closing Reception

JW Grand 5-6 (Level 3) • Special Event • GA

It's last call in the NABT Exhibit Hall. It is also your last chance to visit booths, talk to exhibitors, and get those freebies for the classroom. This special reception will include drawings for the *Treasure Hunt* and *Find the President Contest*.

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4:15PM – 5:00PM

SPECIAL PROGRAMMING PRESENTED BY MINIPCR

3448 Using Molecular Tools to Identify Antibiotic Resistance Genes in Environmental DNA (eDNA)

JW Grand 3 (Level 3) • Ecology / Environmental Science / Sustainability • Demonstration (45 min) • HS, 2Y, GA

Contribute to a national monitoring program tracking the spread of antibiotic resistance in the environment. Choose locations, collect soil, and probe for genetic signatures of common antibiotic resistance genes.

Bruce Bryan, miniPCR bio, Cambridge, MA

5:00PM – 7:30PM

HHMI Night at the Movies: WILD HOPE

White River Ballroom (Level 1) • Special Event (Dinner Provided) • GA

Join us for a sneak peek of *WILD HOPE*, a new series of short films from HHMI Tangled Bank Studios highlighting the intrepid changemakers who are working to restore and protect our planet. Each half-hour episode inspires audiences with stories of bold interventions, unexpected alliances, and nature's resilience. Whether tapping oysters to clean New York City waters and prevent flooding, or growing coffee to save Mozambican rainforests, the series reveals how local action can spark powerful change—and provides a refreshing dose of hope in an increasingly cynical world.

Following the screening, join HHMI Vice President of Science Education and Head of Tangled Bank Studios, Sean B. Carroll, and scientists from the films for a lively discussion about the importance of showcasing successes, and the power of positive storytelling to change the narrative, create a sense of community, and inspire hope.

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