

FRIDAY

NOV 15



ABBREVIATION KEY

- E:** Elementary School
- MS:** Middle School
- HS:** High School
- 2Y:** Two-Year College
- 4Y:** Four-Year College
- GA:** General Audience

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7:30 AM – 8:45 AM

First-Timers' Breakfast

Sheraton Ballroom IV & V **LEVEL 4** • Meal Function (Tickets Required) • GA

First time attendees are invited to learn more about NABT and the 2019 Professional Development Conference during breakfast with NABT leaders. Each table will have an “NABT Mentor” to answer your questions and help you make the most of your time in Chicago.

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



8:00 AM – 9:00 AM

SPECIAL PROGRAMMING PRESENTED BY

Bio-Rad Laboratories

2687 Are Increased Incidences of Infection the Result of Climate Change?

Colorado **LEVEL 2** • Ecology / Environmental Science / Sustainability • Demonstration (60 min) • HS, 2Y, 4Y

Why does climate change matter for human health? Discover why rates of harmful infections may become more common as Earth's temperature increases.

Cassandra Granieri, Bio-Rad Laboratories, Hercules, CA

8:30 AM – 9:00 AM

SPECIAL PROGRAMMING PRESENTED BY

miniPCR

2710 Lab in a Box: A Free Biotechnology Loaner Program from Genes in Space

Missouri **LEVEL 2** • Biotechnology • Hands-on Workshop (30 min) • MS, HS

Learn about the free biotechnology loan program that brings hands-on DNA science into middle and high school classrooms across the USA.

Katy Martin, Mary Clark, and Zeke Alvarez Saavedra, miniPCR, Cambridge, MA

9:15 AM – 10:15 AM

GENERAL SESSION SPEAKER: SCOTT WILLIAMSON SPEAKER SERIES

Richard O. Prum

See page 8 for biography.

The Evolution of Beauty: Darwin's Really Dangerous Idea

Chicago Ballroom VI & VII **LEVEL 4** • Special Speaker • GA

After *The Origin of Species*, Charles Darwin published *The Descent of Man and Selection in Relation to Sex* in which he proposed the theory of sexual selection. To Darwin, the process included mating competition within one sex, and mate choice between sexes. Critically, Darwin viewed mate choice as a “taste for the beautiful” that was a distinct evolutionary mechanism from natural selection. Following Alfred Russel Wallace, the concept of sexual selection has been redefined as a variety of natural selection. This talk will revitalize the Darwinian view that mate choice is an aesthetic evolutionary process that results in traits that function through the subjective evaluations of other individuals. Recognition of the emergent aesthetic agency of animals allows us to understand the impact of sexual coercion and violence on sexual autonomy. Examples of this process will be drawn mostly from birds including birds of paradise, pheasants, manakins, ducks, and bowerbirds, but also extend to the evolution of human sexuality.

We are proud to feature Dr. Prum as part of the Scott Williamson Speaker Series. The series was established in 2017 by Brad and Carol Williamson to honor their son Scott, a gifted biologist who loved the challenge of the big questions in biology.

10:30 AM – 12:30 PM

AP Biology Symposium: Using Primary Source Papers and Data Points in AP Biology

Fountainview **LEVEL 3** • AP Biology • Symposium (120 min) • HS, 2Y, 4Y

Come and learn how to incorporate the use of primary source papers and data resources into the science classroom. We'll also discuss how to integrate the new science practices into assessments using the content of the recently released CED for AP Biology.

Coordinated by the NABT AP Biology Section's Professional Development Committee

10:30 AM – 11:45 AM

2588 Learn R, in R: Crash-course in using Swirl for an Easy Guide to Crunching Numbers

Arkansas **LEVEL 2** • Technology in the Classroom • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Don't let your fears or dated quantitative skills hold your students back! Come learn how to use and teach one of the hottest programming languages in Biology through approachable means!

Emily Weigel, Georgia Institute of Technology, Atlanta, GA

ABT Advisory Committee

Bridgeport **LEVEL 3** • Committee Meeting (75 min) • GA

William McComas, ABT Editor

APS SPEAKER SERIES

Neil A. Bradbury

See page 10 for biography.



Six Feet Apart

Chicago Ballroom IX LEVEL 4 • Special Speaker • GA

Patients with the genetic disease Cystic Fibrosis (CF) are asked to stay at least six feet apart from each other to prevent sharing debilitating lung infections. But CF not only affects the lungs, making breathing difficult. CF also affects the intestine and the ability to digest and absorb nutrients, and it also impacts on the ability of patients to have children. In short, CF affects every aspect of life. A deadly disease, CF also provides tremendous insight into the workings of the human body, and how things can go wrong. *Six Feet Apart* will take a journey through time from medieval witches, to heat waves in New York, to modern drug treatments. *Six Feet Apart* will also take a tour through the human body, showing how CF can illustrate fundamental biological processes, from middle school concepts of osmosis to college level ion transport physiology.

2671 Telling Engaging Stories with HHMI BioInteractive's Playlist & Storyline Lesson Planning Tools

Chicago Ballroom X LEVEL 4 •

Instructional Strategies • Hands-on Workshop (75 min) • MS, HS, GA

Storylines engage students in learning complex concepts. Explore HHMI BioInteractive lesson planning tools that organize the resources you know and love while discovering what others are using in their classrooms.

Valerie May, Woodstock Academy, Woodstock, CT and Kate Fisher, Oregon City High School, Oregon City, OR

SPECIAL PROGRAMMING PRESENTED BY Bio-Rad Laboratories

2688 The Opioid Epidemic: Decoding the Genetic Associations to Opioid Abuse

Colorado LEVEL 2 • AP Biology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

As the opioid crisis surges, researchers race to decode the genetics of opioid dependence. In this hands-on workshop, use fast DNA electrophoresis to evaluate genetic links and explore personalized medicine.

Cassandra Granieri, Bio-Rad Laboratories, Hercules, CA

NABT Awards Committee

Edgewater LEVEL 3 • Committee Meeting (75 min) • GA

Jason Crean, Committee Chair

2615 Using Polymerase Chain Reaction (PCR) to Diagnose Threats to Food Supplies

Erie LEVEL 2 • Biotechnology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Are pathogens in soil evenly spread across the United States? This session will introduce a Citizen Science project in partnership with the National Agricultural Genotyping Center.

Jane Hunt, EducationProjects.org, Dublin, OH and Zack Bateson, National Agricultural Genotyping Center, Fargo, ND

2649 Using the Sea Anemone *Aiptasia pallida* to Understand Symbiosis and Coral Bleaching

Gold Coast LEVEL 3 • General Biology • Demonstration (75 min) • HS, 2Y, 4Y

Introduce yourself to the sea anemone *Aiptasia*. Easy to care for, symbiotic like coral. Learn how to use it to develop experiments about Cnidarian biology, coral bleaching, and climate change.

Sara Sawyer, Glenville State College, Glenville, WV

SPECIAL PROGRAMMING PRESENTED BY miniPCR

2711 P51™ Glow labs: DNA Structure and Enzyme Activity through Fluorescence

Missouri LEVEL 2 • Biotechnology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Use fluorescence to directly visualize the effects of temperature, pH, and genetic sequence on DNA structure. Then see how inhibitors, concentration, temperature and pH affect the rate of enzymatic reactions. Go beyond building models; watch it glow!

Alex Dainis, Bruce Bryan, Katy Martin and Mary Clark, miniPCR, Cambridge, MA

10:30 AM – 12:30 PM

2019 NABT Evolution Symposium

Michigan B **LEVEL 2** • Evolution • Symposium (120 min) • HS, 2Y, GA

Using Genetics to Learn About a Favorite New Jersey Fish, the Striped Bass

Striped bass are economically and ecologically important. Migratory populations along the Jersey Shore could come from different spawning sites. In this study, we use genetic data to investigate these populations.

Megan Phifer-Rixey, Monmouth University, West Long Branch, NJ

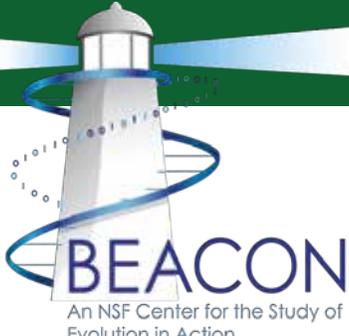
Data Nugget Workshop: Fishy Origins – Finding Out Where Fish Come From

In this workshop, we will share strategies for using Data Nuggets in the classroom and introduce one that features microsatellite data for various populations of striped bass.

Melissa Kjelvik and Elizabeth Schultheis, Michigan State University, East Lansing, MI and Chelsea Barreto, Summit Public Schools, Summit NJ

This symposium is made possible by the BEACON Center and The American Society of Naturalists.

NABT 2019 EVOLUTION SYMPOSIUM



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American Society of Naturalists

Emerging Research in Evolutionary Biology

Join us to hear about new research in evolutionary biology, and attend a Data Nuggets workshop to bring this authentic data into your classroom.

Using genetics to learn about a favorite New Jersey fish, the striped bass

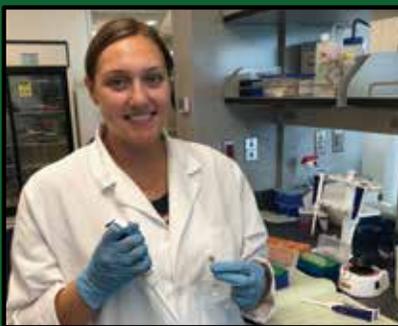
Megan Phifer-Rixey, Monmouth University

Megan's talk explores the use of genetic markers to identify the source populations of migratory striped bass.

Data Nugget Workshop: Fishy origins

Melissa Kjelvik and Elizabeth Schultheis

We will present & release a new Data Nugget where students work with microsatellite data to explore the origins & management of striped bass.





10:30 AM – 11:45 AM continued

2511 The Wolbachia Project: Discover the Microbes Within Using Freely Accessible Curriculum and Resources

Lakeview LEVEL 3 • Biotechnology • Symposium (75 min) • HS, 2Y, 4Y

Join Wolbachia researchers, educators, and students to study one of the greatest pandemics in the animal world. Learn how to easily incorporate biodiversity, molecular biology, and bioinformatics into your classroom.

Sarah Bordenstein, Vanderbilt University, Nashville, TN; Kerry O'Brien, St. Albans School for Boys, Washington, DC; Bob Kuhn, Centennial High School, Roswell, GA; Christine Girtain, Toms River Regional Schools, Toms River, NJ

2563 Vernal Pools and Pollinator Gardens: Wetlands Construction at Schools for Conservation and Education

Michigan A LEVEL 2 • Ecology / Environmental Science / Sustainability • Hands-on Workshop (75 min) • MS, HS

Wade into this EPA award-winning project in which grade 7-12 students build vernal pools and pollinator gardens as outdoor laboratories to study ecology and environmental science and restore critical habitats.

Chris Brothers, Falmouth High School, Falmouth, MA and Ian Ives, Massachusetts Audubon Society, Barnstable, MA

2470 Using Conceptual Models to Build Connections in Biology

Mississippi LEVEL 2 • Science Practices • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Participants will learn how to implement conceptual modeling in different classroom contexts. Workshop features include team-based modeling, grading and rubric development, and delivering efficient and effective feedback.

Jennifer Momsen, North Dakota State University, Fargo, ND; Elena Bray Speth, St. Louis University, St. Louis, MO; Sara Wyse and Steve Bennett, Bethel University, St. Paul, MN; Tammy Long, Michigan State University, East Lansing, MI

2605 Game On: Using Game Mechanics to Explore and Manipulate Scientific Models

Ohio LEVEL 2 • General Biology • Hands-on Workshop (75 min) • MS, HS

Come learn how we have adapted the mechanics of common games to have students analyze, manipulate, and defend scientific models in biology.

Lesley Shapiro, Keene State College, Keene, NH and Rudolf Kraus, Rhode Island College, Providence, RI

SPECIAL PROGRAMMING PRESENTED BY Nasco

2696 Forensic Science - A Fun Twist to a Traditional Dissection

Streeterville LEVEL 2 • General Biology • Hands-on Workshop (75 min) • MS, HS, 2Y

Make dissection more interactive and engaging with all of your students by learning how to add forensic science into your classroom. This workshop is designed for beginners and experienced educators.

Jordan Nelson and Carrie Simmons, Nasco, Fort Atkinson, WI

2421 Hypothesis Testing and the Meaning of Statistical Significance

Superior A LEVEL 2 • AP Biology • Demonstration (75 min) • HS, 2Y, 4Y

Learn the rationale behind hypothesis testing methods like Student's t-Test and Chi-square. A classroom activity comparing leaf surface areas will be presented. Bring a computer or calculator.

Robert Cooper, Pennsbury High School, Fairless Hills, PA

2492 Introducing inquiryHub Biology: A Phenomenon-Based High School Curriculum Aligned to the Next Generation Science Curriculum

Superior B LEVEL 2 • Curriculum Development • Hands-on Workshop (75 min) • HS

This workshop will introduce high school biology teachers to the inquiryHub biology curriculum, a full-year curriculum co-designed by teachers and researchers that is aligned to the Next Generation Science Standards.

Bill Penuel, University of Colorado Boulder, Boulder, CO and Samantha Agoos, Denver East High School, Denver, CO

2431 Visual Notetaking for Science Educators

Wrigleyville LEVEL 3 • Instructional Strategies • Hands-on Workshop (75 min) • GA

Want to engage ALL students in new ways while optimizing their thinking capacities? Discover more about the what, how, and why of visual note-taking. No artistic experience required. Pinky promise.

Wendi Pillars, Jordan-Matthews High School, Siler City, NC

12:00 PM – 12:30 PM

2592 Can a Devaluation of Grades Lead to an Increase in AP Student Engagement & Success?

Arkansas LEVEL 2 • AP Biology • Demonstration (30 min) • HS, 2Y, GA

Have you ever been frustrated with students concerned with grades over learning from assignments? Come learn about a philosophy that helped students shift their focus from grades to reflective learning.

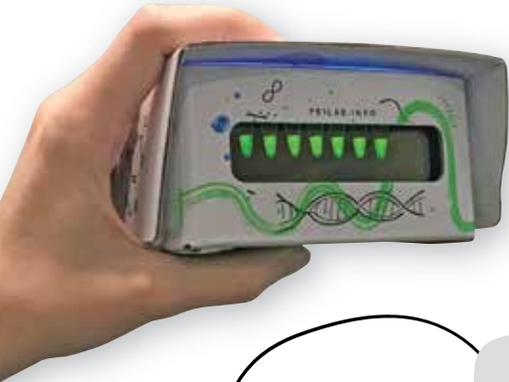
Faith Nelson and Matt Kirkpatrick, Oak Park and River Forest High School, Oak Park, IL

Retired Member Committee

Bridgeport LEVEL 3 • Committee Meeting (30 min) • GA

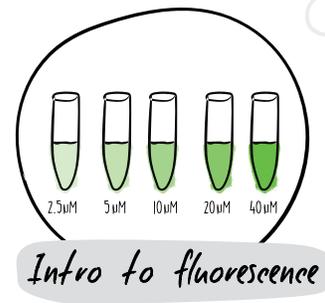
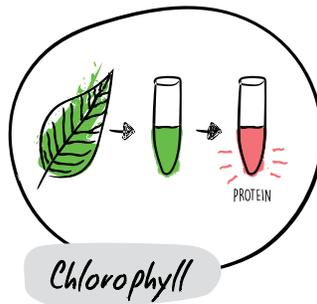
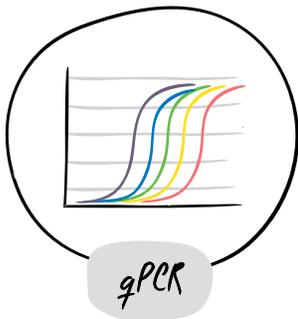
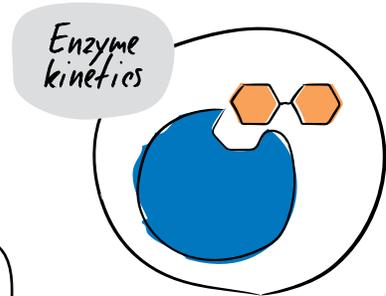
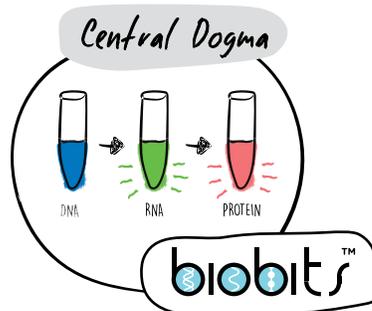
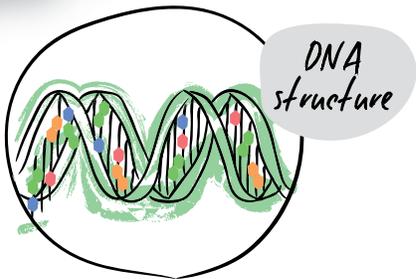
Dennis Gathmann, Committee Chair

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12:00 PM – 12:30 PM continued

2663 HHMI Biointeractive's Online Professional Learning Course on Evolution for High School Teachers

Chicago Ballroom X LEVEL 4 •

General Biology • Hands-on Workshop (30 min) • HS

This course is designed to strengthen content knowledge, model sequencing Biointeractive resources into coherent storylines, and explore resources from a student perspective. You can also receive a certificate for completion!

Mark Eberhard, St. Clair High School, St. Clair, MI and Laura Bonetta, HHMI, Chevy Chase, MD

SPECIAL PROGRAMMING PRESENTED BY Bio-Rad Laboratories

2689 Ready or Not, It's Coming! Biotechnology, the Science of Our Age. Are Your Students Prepared?

Colorado LEVEL 2 • Biotechnology • Demonstration (30 min) • HS, 2Y, 4Y

Glowing cats? Designer babies! Empower students to be independent thinkers. Learn from a leader in biotechnology teaching how to build your lab program step-by-step with equipment, supplies, and student credentials.

Cassandra Granieri, Bio-Rad Laboratories, Hercules, CA

Social Media Committee

Edgewater LEVEL 3 • Committee Meeting (30 min) • GA

John Moore, Lead Moderator

2607 Making It Personal: How to Teach Cancer With Personalized Medicine

Erie LEVEL 2 • Biotechnology • Demonstration (30 min) • HS, 2Y

We will feature a suite of biology lessons, taught through a social justice lens, which include pgEd materials, a lab with HeLa cells, and making pedigrees with gel electrophoresis.

Julie Boehm and Ken Bateman, Wellesley High School, Wellesley, MA

2518 Shark Attack! An NGSS Storyline on Homeostasis and Body Hierarchy

Gold Coast LEVEL 3 • General Biology • Hands-on Workshop (30 min) • MS, HS, GA

An NGSS storyline on homeostasis and body hierarchy will be presented. Teachers are guided through the storyline and receive all materials for the unit. Storyline creation is also discussed.

Amber Willis, Harbor Teacher Preparation Academy, Wilmington, CA

SPECIAL PROGRAMMING PRESENTED BY miniPCR

2712 Sickle Cell Genetics: Using Gel Electrophoresis to Investigate Molecular Genetics, Inheritance and Disease

Missouri LEVEL 2 • Genetics • Hands-on Workshop (30 min) • MS, HS, GA

Help a fictional family obtain a molecular diagnosis with this rich activity that can be easily tailored to classrooms ranging from middle school science to Advanced Placement Biology and beyond.

Bruce Bryan, Alex Dainis, and Mary Clark, miniPCR, Cambridge, MA

2616 Why Do Students Leave Lab Early? Our Journey Into Learning More About Anatomy Lab

Lakeview LEVEL 3 • Anatomy & Physiology • Paper (30 min) • 2Y, 4Y, GA

Come listen to our progress in identifying how leaving an open, standalone, anatomy lab affects students grades, chances of success, and more!

Lance Forshee and Sarah Monson, Southern Utah University, Cedar City, UT

2654 Do a BioBlitz with Your Students!

Michigan A LEVEL 2 • Ecology / Environmental Science / Sustainability • Demonstration (30 min) • MS, HS, GA

A BioBlitz is specific time to record as many species as possible in a given area. In this workshop, I will share my experiences using a BioBlitz with my students.

Eric Rude, Pocatello High School, Pocatello, ID

2619 Using Modeling and Feedback in AP Biology

Mississippi LEVEL 2 • AP Biology • Hands-on Workshop (30 min) • HS

Join us to see how students are using stop motion studio in our course to model concepts and how we assess them. Be prepared to try it out for yourself!

Karen O'Connor, Christina Palffy, Brett Erdmann, and Amerigo Carnazzola, Stevenson High School, Lincolnshire, IL

2553 The Last Days of Ötzi

Ohio LEVEL 2 • General Biology • Hands-on Workshop (30 min) • ES, MS, HS

Use the rich story of “Ötzi the Iceman” as a platform to integrate forensics and anthropology in an investigative setting. Perform pollen analysis to learn more about this ancient murder.

Lindsay Barone, Cold Spring Harbor Laboratory - DNA Learning Center, Cold Spring Harbor, NY

SPECIAL PROGRAMMING PRESENTED BY PASCO scientific

2694 Photosynthesis and Respiration: Light and Dark Reactions Quantified with Technology

Old Town LEVEL 3 • General Biology • Hands-on Workshop (30 min) • MS, HS

Use a Carbon Dioxide sensor and graphing software to develop a model of how plants cycle energy and matter during photosynthesis and respiration under different light conditions.

Barbara Pugliese, PASCO scientific, Roseville, CA



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12:00 PM – 12:30 PM continued

2512 Formative Assessment Strategies for the Biology Classroom

Superior A LEVEL 2 • Instructional Strategies • Hands-on Workshop (30 min) • MS, HS, GA

Come learn how to integrate paper and/or electronic formative assessment techniques into classroom routines, practice preparing formative assessment prompts, and help students track their progress toward mastery of learning objectives.

Molly Proudfit, Notre Dame Academy, Park Hills, KY

2575 Use Community Engaged Learning in Biology Classrooms to Promote Interdisciplinary “Big Picture” Understanding

Superior B LEVEL 2 • Instructional Strategies • Paper (30 min) • HS, 4Y, GA

Community engaged learning involves students in local issues and develops big picture understanding – while students acquire and apply biology content! Learn how CEL can be successful in YOUR classroom.

Renee Clary, Mississippi State University, Mississippi State, MS

2502 Grow Your Students’ Understanding with PlantingScience

Wrigleyville LEVEL 3 • Botany & Plant Biology • Hands-on Workshop (30 min) • MS, HS

Try out the labs, get tips for planning in your classroom, and hear about my experience with PlantingScience to get your students planning and conducting inquiry investigations with working plant scientists.

Aubrey Mikos, Ottawa Township High School, Ottawa, IL

12:45 PM – 1:45 PM

SPECIAL PROGRAMMING PRESENTED BY miniPCR

2713 Bringing Molecular Genetics to your Biology Classroom with miniPCR

Gold Coast LEVEL 3 • Biotechnology • Hands-on Workshop (60 min) • HS, 2Y, 4Y

miniPCR bio is the leader in bringing PCR and gel electrophoresis into classrooms with affordable, innovative, hands-on tools and activities. Learn how the miniPCR machine makes classroom biotechnology faster, simpler, and more intuitive than ever before.

Bruce Bryan, Robert Dennison and Ruth Gleicher, miniPCR, Cambridge, MA

Two-Year College Section Luncheon

Sheraton Ballroom I LEVEL 4 • Meal Function (Tickets Required) • 2Y

Help support the two-year college community by sharing your successes, challenges, epiphanies, and best practices. The winners of the *Two-Year College Biology Teaching* and *Prof. Chan Teaching Award* will also be recognized.

Four-Year College & University Section Luncheon

Sheraton Ballroom II LEVEL 4 • Meal Function (Tickets Required) • 4Y

Join faculty, education researchers, graduate students, and others to learn more about the programs, initiatives, and opportunities available from the section. This meeting included a special presentation of the *Four-Year College & University Section Awards*.

Sponsored by



AP Biology Section Luncheon

Sheraton Ballroom III LEVEL 4 • Meal Function (Tickets Required) • AP

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

Sponsored by



1:00 PM – 1:45 PM

SPECIAL PROGRAMMING PRESENTED BY Bio-Rad Laboratories

2690 Think Like an Engineer in Your Biology Class

Colorado LEVEL 2 • International / Global Education • Hands-on Workshop (45 min) • HS, 2Y, 4Y

Incorporate NGSS engineering practices in your biology class by challenging students to address world hunger. Students will consider constraints and design an evidence-based treatment plan (solution) for protein-energy malnutrition.

Cassandra Granieri, Bio-Rad Laboratories, Hercules, CA

2:00 PM – 4:00 PM

11th Annual Biology Education Research Symposium

Fountainview LEVEL 3 • Instructional Strategies • 2Y, 4Y, GA

NABT is proud to present the *Annual Biology Education Research Symposium*, which it now in its 11th year! Presentations were accepted through a double-blind review process that was open to biology instructors and education researchers at all levels. The format of the symposium is a traditional presentation of papers by individual or co-authors lasting 15 minutes each.

See page 36 for full listing

2:00 PM – 3:15 PM

2479 Mission: Possible - Using Breakout and Escape Room Games to Transform Biology Teaching and Learning

Arkansas LEVEL 2 • Instructional Strategies • Hands-on Workshop (75 min) • MS, HS, GA

Can you think “outside of the box” to break into a locked box? Learn how to facilitate and design content-based games to challenge and engage your students.

Chris Chou, Longmont High School, Longmont, CO

Nominating Committee

Bridgeport LEVEL 3 • Committee Meeting (75 min) • GA

Donald French, Committee Chair

2467 Top 10 Biotech Stories of 2018/19

Chicago Ballroom IX LEVEL 4 • General Biology • Symposium (75 min) • MS, HS, GA

Want to include cutting-edge biotech discoveries in your classroom? See Dr. Lamb present the top 10 findings in genomics and biotech in student-friendly language and receive your FREE Guidebook.

Neil Lamb, HudsonAlpha Institute for Biotechnology, Huntsville, AL

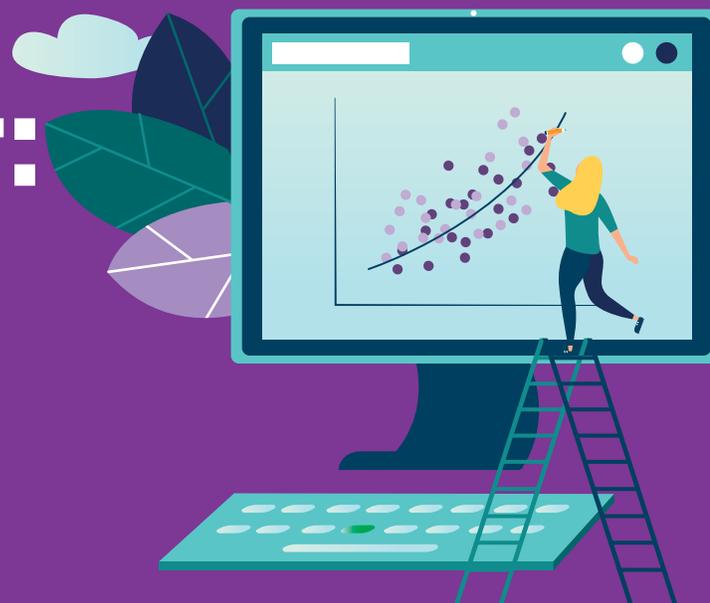
2665 Getting Students to Ask (Good) Scientific Questions with HHMI BioInteractive Resources

Chicago Ballroom X LEVEL 4 • Science Practices • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Explore ways to help students practice writing their own phenomena-based scientific questions, design appropriate experiments, and develop and analyze questions from scientific papers that involve cause and effect.

Paul Beardsley, Cal Poly Pomona, Pomona, CA; Bernice O'Brien, Bainbridge Island School District, Bainbridge Island, WA; Mark Nielsen, HHMI, Chevy Chase, MD

Warning: contains graphic material



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2019 Biology Education Research Symposium

2:00 PM – 4:00 PM

Fountainview

LEVEL 3

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

Proceedings will be posted online at www.NABT.org.

Student Results from an Efficacy Trial of a New NGSS Evolution Unit that Integrates Heredity

Louisa A. Stark, Dina Drits-Esser, Sheila A. Homburger, and Molly Malone University of Utah, Salt Lake City, UT; Joseph Hardcastle, Jo Ellen Roseman, and George E. DeBoer, AAAS Project 2061, Washington, DC; Kristen M. Bass, Rockman et al, San Francisco, CA

We report on student pre/post assessment results from efficacy testing of a new seven-week, five-module, freely available unit that integrates heredity and evolution. *Evolution: DNA and the Unity of Life* supports students in building a coherent understanding of evolution through analysis and interpretation of skill-level-appropriate data about phenomena in published scientific research and the construction of evidence-based arguments. Ideas are framed through crosscutting concepts throughout the unit. Results from the nationwide randomized controlled efficacy trial with 38 teachers (19 in each condition) and their students ($n=1,165$ treatment, $n=1,094$ control) indicated that students who used the new curriculum showed significantly greater pre/post gain scores with a moderate effect size than students in the control condition (NGSS business-as-usual) in their understanding of evolution and their argumentation-writing competencies. We describe the unit, the efficacy trial research design, and student testing results from multiple choice and constructed response items.

The Effect of Argumentation Upon Student Content Knowledge and Perception of Science in a Middle School Science Classroom

Aaron E. Kidd and Elizabeth Allan, University of Central Oklahoma, Edmond, OK

Since the release of the 2012 Framework for K-12 Science Education, educational institutions have been tasked to increase scientific literacy through the implementation of more robust science standards. The Framework identifies three key dimensions of science education: Scientific and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The Scientific and Engineering Practices are composed of a variety of broad science-oriented skills such as engineering, mathematics, and argumentation. Research has clearly indicated the efficacy of engineering in fostering science education. However, the effectiveness of argumentation has not been fully explored, particularly in middle-level classrooms. In the spring semester of 2019, 151 7th grade science students participated in two treatment and three control science units. In treatment units, students were presented a unit-specific phenomenon and provided a limited time frame to develop an explanation. Classes then engaged in student-led argument sessions to debate and further develop their proposed models. Pre and post-assessment results indicated greater content knowledge growth occurred in Honors courses during treatment units while mid-low level classes showed little difference regardless of unit type. Despite generally positive student responses through randomly selected interviews however, overall interest in science was not significantly impacted by participation in treatment sessions.

Engaging and Assessing Biology Students in Science Communication

Jason Wack, Collin Jaeger, Shupeí Yuan, and Heather E. Bergan-Roller, Northern Illinois University, DeKalb, IL

Communicating science to a general audience (SciComm) is an important scientific skill widely practiced by scientists. It is important that scientists do SciComm as it can impact decision making by the public and inform public policies. Recently, seminal reports have indicated that SciComm is a practice in which students should become competent. Unfortunately, students have few opportunities to engage in SciComm partially due to a lack of a framework that can help instructors facilitate such activities. We present a framework of the essential elements of effective SciComm that synthesizes previous work to describe the who, why, what, and how of SciComm. We applied the framework to a lesson for undergraduate biology and assessed its effectiveness. The lesson uses an introduction, assignment sheet, and worksheet to guide students through planning, producing, describing, and reflecting upon their SciComm. We assessed the effectiveness of the lesson by quizzing students on their knowledge of SciComm and asking their perceptions. Students performed well particularly on elements used in the lesson. Moreover, students reported that the lesson improved their understanding of SciComm and biological content. This work can be used by practitioners and researchers to understand how to engage students in important scientific practice.

Activities in Voluntary PLTL Complement Active Learning Lectures and Appeal to Students with Diverse Attitudes Towards Learning

Troy R. Nash, Mercer University, Macon, GA and Suann Yang, State University of New York at Geneseo, Geneseo, NY

Because Peer-Led Team Learning (PLTL) is an effective academic support system, examining the effect of curricular context and what influences student attendance are critical considerations for voluntary PLTL programs. We predicted that if active learning occurs during class, structured PLTL sessions may not benefit learning because the PLTL activities would be redundant with those in class. We also expected students to be more likely to attend voluntary sessions if they had a growth mindset and positive attitude toward group work, because these students would be receptive to the feedback and collaborative activities of PLTL. We were surprised to find that, for an active-learning, introductory biology course, students who attended structured sessions more frequently had a greater improvement in performance than those who attended less frequently. This suggests that structured activities in voluntary PLTL are not redundant with those that occur in class. We also found that mindset and collaborative attitude did not explain attendance. Thus, fixed mindset and negative attitudes toward collaboration do not hinder student participation. We conclude that the value of additional practice in PLTL is not diminished by active-learning lectures, and these sessions will be attended by students with a variety of mindsets and attitudes toward collaboration.

Fear of Negative Evaluation and Student Anxiety in Community College Active Learning Science Courses

Virginia R. Downing, Katelyn M. Cooper, Logan E. Gin, and Sara E. Brownell, Arizona State University, Tempe, AZ; Jacqueline M. Cala, Chandler-Gilbert Community College, Chandler, AZ

Anxiety is increasingly common and can have negative impacts on college science students. Particularly, as we transition our classes to active learning, studies have demonstrated that anxiety can have both negative and positive effects on students. To our knowledge, all of the studies exploring the relationship between active learning and student anxiety in college science have been conducted exclusively at four-year institutions. Understanding the educational practices as well as the challenges facing students in community college science courses is critical because the attrition rates of students pursuing science careers are higher at community colleges compared to four-year institutions, particularly in STEM fields. Studying factors, such as student anxiety, that may negatively affect student persistence in science, will further elucidate ways in which community colleges can maximize student success. In this study, we examined the factors that influence student anxiety in active learning community college science courses. We interviewed 29 community college students enrolled in active learning science courses and asked students' to explain why specific aspects of active learning increased or decreased their feelings of anxiousness. We found that active learning can either increase or decrease students' anxiety depending on the techniques being used.

2:00 PM – 3:15 PM continued

**SPECIAL PROGRAMMING
PRESENTED BY
Bio-Rad Laboratories**

2691 It's in Their DNA! Teach Personalized Medicine with Students' Own DNA

Colorado LEVEL 2 • Genetics • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Experience a hands on classroom activity where students work with their own genes and PCR in the context of personalized medicine, the wave of future disease treatment.

Cassandra Granieri, Bio-Rad Laboratories, Hercules, CA

OBTA Directors & Regional Coordinators Meeting

Edgewater LEVEL 3 • Committee Meeting (75 min) • GA

Mark Little, National Program Coordinator

2460 Connecting Natural Selection and Speciation

Erie LEVEL 2 • Evolution • Hands-on Workshop (75 min) • HS

What drives life's diversification? NGSS-designed curriculum materials that examine speciation as a process and employ an authentic inquiry into a possible divergence in *Rhagoletis* flies. Free at <https://teach.genetics.utah.edu/content/evolution/speciation>

Louisa Stark, Genetic Science Learning Center at the University of Utah, Salt Lake City, UT

2647 Exploring the Cell Cycle, Cancer, and a "Guardian" Gene

Gold Coast LEVEL 3 • AP Biology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Use the phenomenon of cancer and regulatory genes to explore the cell cycle. Use on-line resources and analyze data to support a CER. Free classroom-ready materials from HHMI are provided.

Dana Navarro, Thousand Oaks High School, Thousand Oaks, CA

**SPECIAL PROGRAMMING
PRESENTED BY
miniPCR**

2714 miniPCR qPCR Lab: Principles of Quantitative PCR

Missouri LEVEL 2 • AP Biology • Hands-on Workshop (60 min) • HS, 2Y, 4Y

This hands-on lab offers students an introduction to the world of quantitative PCR. Using low cost tools, students are able to visualize amplification of DNA and calculate relative concentrations of DNA template. No gels needed!

Bruce Bryan, Robert Dennison and Ruth Gleicher, miniPCR, Cambridge, MA

2419 BioBuilder PCR: Why did the Engineered Golden Yeast Lose their Ability to Produce Beta-carotene?

Lakeview LEVEL 3 • Biotechnology • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Golden Yeast are engineered for beta-carotene production, turning them orange. However, some white, yellow, and red colonies are produced, showing a breakdown in the biosynthetic pathway, tested here with PCR.

Lindsey L'Ecuyer, Andover High School, Andover, MA

2456 The American Association of Immunologists Presents: Teachers Research Program – Immunology Lessons for the Classroom

Michigan A LEVEL 2 • AP Biology • Hands-on Workshop (75 min) • 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.

Courtney Pinard, American Association of Immunologists, Rockville, MD and Mike Criscitiello, Texas A&M University, College Station, TX

2676 Using Evolutionary Medicine to Enhance Your Teaching and Your Students' Learning

Michigan B LEVEL 2 • Evolution • Hands-on Workshop (75 min) • GA

Evolutionary medicine focuses on human health and disease from evolutionary and comparative biological perspectives. This session will explore how evolutionary medicine can engage your students in the study of evolution and other aspects of biology.

Barbara Natterson-Horowitz, UCLA Medical School & Harvard University, Los Angeles, CA; Robert Perlman, University of Chicago, Chicago, IL; Jay Labov, National Academies of Sciences, Engineering, and Medicine (retired), Vienna, VA

2484 CUREs: How to Create & Incorporate a Collaborative Ant-based Project to Teach Science Practices

Mississippi LEVEL 2 • Science Practices • Hands-on Workshop (75 min) • HS, 2Y, 4Y

Discover interdisciplinary research and learn how to bring fieldwork and genetics to life in your classroom! Handouts and data files provided. Bring a computer if possible.

Carrie Bucklin, Southern Utah University, Cedar City, UT and Laurie Mauger, Duke University, Durham, NC

2578 From Cave Paintings to Moon Shots: Exploring the Spectrum of Models in Biology Education

Ohio LEVEL 2 • General Biology • Hands-on Workshop (75 min) • HS, 4Y, GA

The best opportunities for teaching and learning often occur while building and refining models. Let's unpack simple, complex, and dynamic models designed to help students make sense of biological systems.

Ryan Reardon, Jefferson County International Baccalaureate, Irondale, AL and Jon Darkow, Seneca East High School, Attica, OH

2:00 PM – 3:15 PM continued

**SPECIAL PROGRAMMING
PRESENTED BY
Edvotek**

**2705 Introducing Your Students
to Gene Editing with CRISPR**

Streeterville LEVEL 2 • Biotechnology • Hands-on Workshop (75 min) • MS, HS, 2Y

CRISPR as a gene editing tool is an incredible biotechnology breakthrough. Here, we'll review the biology behind CRISPR-Cas technology and examine the use of gene therapy to treat Cystic Fibrosis.

Kelly Barford, Edvotek, Washington, DC

**2428 Creating and Implementing
NGSS Storyline Units to Increase
Student Engagement**

Superior A LEVEL 2 • Instructional Strategies • Hands-on Workshop (75 min) • MS, HS, GA

Storylines led by engaging phenomena improve student engagement. Group hunting in lions, tusklessness in elephants, disappearing sea otters, and the plight of Tanzanian albinos can anchor instruction in meaningful ways.

Kathlyn Van Hoeck (retired), Marion, IA and Jason Crean, Lyons Township High School, Western Springs, IL

**2516 Mapping Biodiversity to Make
Conservation Decisions Using The
Half-Earth Project Map**

Superior B LEVEL 2 • Ecology / Environmental Science / Sustainability • Hands-on Workshop (75 min) • MS, HS, 4Y

A team-based mapping activity turns E.O. Wilson's call to save half the planet for nature into a design challenge for students. Participants get a set of maps to take home.

Dennis Liu, E.O. Wilson Biodiversity Foundation, Durham, NC; Amanda Briody, Baltimore City Public, Baltimore, MD; Jim Clark, Next Generation Science Innovations, San Lorenzo, CA



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2:00 PM – 3:15 PM continued

2408 Contributing to *The American Biology Teacher*: A Hands-on Workshop

Wrigleyville LEVEL 3 • Instructional Strategies • Hands-on Workshop (75 min) • 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 and University of Arkansas, Fayetteville, AR

3:30 PM – 4:00 PM

2432 A Lesson on Race and Human Diversity: Culturally Relevant Pedagogy in the Biology Class

Arkansas LEVEL 2 • Instructional Strategies • Paper (30 min) • HS, 2Y, 4Y

In this study, we exam how high school biology teachers present controversial topics related to human diversity through the lens of Culturally Responsive Pedagogy.

Uchenna Emenaha, Kerry Ademosu, and Paige Evans, University of Houston, Houston, TX

NABT Archival Committee

Bridgeport LEVEL 3 • Committee Meeting (30 min) • GA

Jill Maroo, Committee Chair

2670 How Science Works: An Interactive Tool to Engage Student Thinking About the Process of Science

Chicago Ballroom X LEVEL 4 • Nature of Science • Hands-on Workshop (30 min) • MS, HS, 2Y

Teachers will investigate the dynamic and iterative nature of science through an engaging interactive tool that helps students dislodge the misconception that science is a simple linear recipe.

Kim Parfitt, Central High School, Cheyenne, WY and Mark Nielsen, HHMI, Chevy Chase, MD

3:30 PM – 4:00 PM continued

SPECIAL PROGRAMMING PRESENTED BY Bio-Rad Laboratories

2692 Precision Medicine - A Reality with CRISPR and Revolutionary Droplet Digital PCR (ddPCR) Technology!

Colorado LEVEL 2 • Biotechnology • Hands-on Workshop (30 min) • HS, 2Y, 4Y

ddPCR technology is a precision medicine tool and its sensitivity makes it well-suited to “Liquid Biopsies” to detect rare cancer mutations and when combined with CRISPR technology is revolutionizing medicine.

Cassandra Granieri, Bio-Rad Laboratories, Hercules, CA

NABT Pre-Service Teacher Committee

Edgewater LEVEL 3 • Committee Meeting (30 min) • GA

Julie Angle, Committee Chair

2472 Modeling to Mastering

Erie LEVEL 2 • General Biology • Demonstration (30 min) • HS

This session will include basic hands-on, interactive student models that classroom teachers can create and use to enhance understanding. These tools, along with instruction, will lead to mastery of content.

Jessica Walus and Kaarin Schumacher, Woodbury High School, Woodbury, MN

2638 Using Past AP Free Response Questions Effectively to Improve Student Writing and AP Test Scores

Gold Coast LEVEL 3 • AP Biology • Hands-on Workshop (30 min) • HS

This session will provide a method for using the released AP Biology FRQs that will help students better interpret questions and answer them in a clear and concise manner.

Christina Palfy and Karen O'Connor, Adlai E. Stevenson High School, Lincolnshire, IL

2458 Anatomy and Physiology in 8 Weeks?

Lakeview LEVEL 3 • Anatomy & Physiology • Demonstration (30 min) • 2Y, 4Y

Eastfield College has transitioned to two 8-week terms per semester. Learn how we adapted instruction and how student performance has been impacted in Anatomy and Physiology. Come share your experiences!

Jessica Kerins, Eastfield College, Mesquite, TX

2561 Data Interpretation Activities for Examining the Health Effects of Flavored Electronic Cigarettes

Michigan A LEVEL 2 • AP Biology • Hands-on Workshop (30 min) • HS, 2Y, 4Y

Conduct and receive activities that enable students to analyze experimental data from studies assessing the impact of e-cigarette flavorings on the structure and function of the respiratory immune system.

Dana Haine, University of North Carolina – Chapel Hill, Chapel Hill, NC

2680 Bacterial Survivor: An Interactive Game that Combats Misconceptions about Antibiotic Resistance

Michigan B LEVEL 2 • Microbiology & Cell Biology • Hands-on Workshop (30 min) • GA

We developed an active learning exercise called “Bacterial Survivor” in order to combat misconceptions about antibiotic resistance in a large undergraduate non-majors microbiology course.

Brinda Govindan, San Francisco State University, San Francisco, CA

3:30 PM – 4:00 PM continued

2612 Dance, Draw, Act - The Art of Using Student-build Models to Drive Learning

Mississippi LEVEL 2 • Instructional Strategies • Hands-on Workshop (30 min) • 2Y, 4Y

Come and see how we use both cognitive and kinesthetic student-build models to transform learning of difficult concepts, to drive content and skill acquisition, and as formative assessments.

Dessislava Dimova, Franklin High School, Somerset, NJ and Lee Furguson, Allen High School, Allen, TX

2544 Scenario-Based Learning

Ohio LEVEL 2 • General Biology • Demonstration (30 min) • MS, HS

Learn how to help your students master science and engineering practices using real-world, relatable scenarios that create a deeper understanding while also fostering interest and appreciation for biological concepts.

Kellie Dean, Paige Lehman, Kim Lubecke, and Jenna Aronson, Adlai E Stevenson High School, Lincolnshire, IL

SPECIAL PROGRAMMING PRESENTED BY PASCO scientific

2695 Advanced Biology with a Wireless Spectrometer

Old Town LEVEL 3 • AP Biology • Demonstration (30 min) • HS, 2Y, 4Y

Learn how a Spectrometer can help your students investigate the enzymatic activity of peroxidase, relate plant pigments to photosynthetic activity, and determine whether algae beads are predominantly photosynthesizing or respiring.

Barbara Pugliese, PASCO scientific, Roseville, CA

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– *Jeremy E. Miller '17, NYCC MSHAPI Graduate*

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3:30 PM – 4:00 PM continued

SPECIAL PROGRAMMING
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EducationProjects.org

2704 **Food Security, Sustainability, the Environment: What in the WORLD is going on?**

Streeterville LEVEL 3 • Instructional Strategies • Hands-on Workshop (30 min) • MS, HS

Come learn how to engage students with investigative learning around these topics. Join a growing national network connecting you to free STEM resources and leadership opportunities.

Jane Hunt and Heather Bryan,
EducationProjects.org, Columbus, OH

2436 **A PBL-Based Public Health Course for At-Risk Students**

Superior A LEVEL 2 • Instructional Strategies • Demonstration (30 min) • HS

This session will reflect upon a science-based public health elective designed for at-risk students. Emphasis will be placed upon using real-world, problem-based learning to increase engagement.

Ryan Lacson, Galena R2 Schools, Galena, MO

2639 **Pitfall Traps and Diversity Indices: Applying Quantitative Reasoning to Test Edge Effect Theory**

Superior B LEVEL 2 • Ecology / Environmental Science / Sustainability • Hands-on Workshop (30 min) • HS, 2Y, 4Y

Learn how to reinforce quantitative reasoning (QR-C) problem-solving skills in the context of species richness, diversity, edge effect, and conservation as students collect and analyze real field data.

Paul Strode, Fairview High School, Boulder, CO

2548 **Using Primary Literature to Teach Writing to High School and Early College Students**

Wrigleyville LEVEL 3 • Instructional Strategies • Demonstration (30 min) • HS, 2Y, 4Y

This session presents a strategy for using papers to teach organization and characteristics of scientific writing. Focusing on form and inspiration rather than content, it broadens primary literature's accessibility.

Hannah Chapin, SAAS Seattle Academy, Seattle, WA

3:30 PM – 4:15 PM

SPECIAL PROGRAMMING
PRESENTED BY
miniPCR

2715 **Making Mendel Molecular: Add Genotyping to Wisconsin Fast Plant labs!**

Missouri LEVEL 2 • AP Biology • Hands-on Workshop (45 min) • HS, 2Y, 4Y

Use modern molecular techniques to investigate mendelian inheritance in Rapid Cycling *Brassica rapa* (also called Fast Plants). An excellent addition to your current Fast Plants investigations or as a stand-alone lab.

Bruce Bryan, Robert Dennison and Ruth Gleicher, miniPCR, Cambridge, MA

4:00 PM – 5:30 PM

Exhibit Hall Closing Experience

Riverwalk A & B LEVEL 1 • Special Event • GA

It's last call in the Exhibit Hall, and your last chance to talk with exhibitors and get those freebies you promised you would bring back. Join us for prize giveaways and more!

5:30 PM – 8:00 PM

HHMI Night at the Movies

Chicago Ballroom VI & VII LEVEL 4 • Special Event • GA

HHMI BioInteractive (www.biointeractive.org) and NABT are pleased to host the 9th Annual *HHMI Night at the Movies with Sean Carroll*. Join Dr. Carroll and special guests for the premiere of a new release and discussion. This free red-carpet event will begin at 5:30 PM with a reception including free food and drink.

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