

# Friday

**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 Timer's Breakfast****Harbor Island 2 • Meal Function (Tickets Required) • GA**

NABT Conference “first-timers” are invited to learn more about the Professional Development Conference over complimentary breakfast. Each table will have an NABT leader available to answer your questions and help you make the most of your time in San Diego.

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

**10:15 AM – 12:00 PM****Book Signing with Sean M. Carroll****Pavilion****10:30 AM – 12:30 PM****△ INTRO BIO TASK FORCE****1667 • Intro Bio Task Force: The Pre-College Experience and Next Steps to Advancing Intro Bio****Nautilus 1 • Instructional Strategies • Symposium (120 min) • HS, 2Y, 4Y**

The IBTF will explore how pre-college intro bio courses and experiences (AP Biology, Dual Enrollment, MOOCs, etc.) influence undergraduate biology education. Additional discussions will focus on strategies that will utilize partnerships across K-16 to advance the ideal introductory biology experience.

Coordinated by the NABT Introductory Biology Task Force

**9:15 AM – 10:15 AM****GENERAL SESSION SPEAKER****Sean M. Carroll**

➔ See page 8 for biography.

**The Arrow of Time and the Meaning of Life****Grand Ballroom • Special Speaker • GA**

Nothing is more obvious about the nature of time than the fact that the past is different from the future. Physics ascribes this difference to the fact that entropy — randomness or disorder — increases with time. Dr. Carroll will talk about why this is so, a mystery that will lead us to the origin of the universe. He'll also talk about why the increase of entropy is responsible for all of the differences between past and future, from memory to aging. Finally, he'll discuss the relationship between entropy and complexity, and why it's not so surprising that complex life came into existence in a decaying universe.

Directly following the session, join Sean M. Carroll in the Exhibit Hall for a book signing.

**10:30 AM – 11:45 AM****SPECIAL PROGRAMMING PRESENTED BY****The MiniOne Systems****1726 • #JungleGenomics: Teaching Tropical Biology and Genetics in the Amazon Rainforest****Seabreeze 2 • AP Biology • Hands-on Workshop (75 min) • HS, 2Y, 4Y**

What do tamarin fecal samples, possum blood and giant snail eggs have in common? They all contain DNA. Learn how a field course barcoded DNA in the Amazon rainforest.

Mrinalini Erkenswick Watsa, MiniOne Systems/Field Projects International/PrimatesPeru

**1527 • System Dynamics Modeling: Constructing and Simulating Mental Models****Executive Conference 1 • Science Practices • Hands-on Workshop (75 min) • MS, HS, 2Y, 4Y, GA**

Build systems dynamics models using free online tools to model dynamic patterns characteristic throughout biological systems. Design computational models to confront and intervene in students' misconceptions about biological systems. BYOD

Jon Darkow, Seneca East High School, Attica, OH

**1590 • Climate Change and the Coughing Dog: Exploring Global Changes and Local Impacts Through a Phenomena-Based Case Study****Executive Conference 2A • Ecology / Environmental Science / Sustainability • Hands-on Workshop (75 min) • MS, HS**

Explore local connections to a global issue while taking on the role of a veterinary assistant in a small town in this phenomena-based unit examining climate change, populations, and ecosystems.

James Planey and Barbara Hug, University of Illinois at Urbana-Champaign, Champaign, IL

**8:00 AM – 4:00 PM****SPECIAL PROGRAMMING PRESENTED BY  
Bio-Rad Laboratories****All sessions in Executive Conference 2B**

All sessions: Cassandra Granieri, Bio-Rad Laboratories, Hercules, CA

**8:00 AM – 9:15 AM****1703 • Become a GMO Investigator**

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

Regardless of where you stand in the GM debate, wouldn't it be interesting to know which foods you eat are GM foods?

**10:30 AM – 11:45 AM****1704 • Are Increased Incidences of Infection the Result of Climate Change?**

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

Why does climate change matter? Find out which suspected microbes are associated with increased reports of infections and why they may be more common as the temperature on earth increases.

**12:00 PM – 12:30 PM****1708 • Ready or Not, Here it Comes! It's Biotechnology, the Science of Our Age. Are Your Students Prepared?**

AP Biology • 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.

**1:00 PM – 1:45 PM****1706 • Shifting Practices to Infuse Science and Engineering Practices with Common Core Strategies**

General Biology • Hands-on Workshop (45 min) • HS, 2Y, 4Y

This workshop will focus on illustrating the science and engineering practices described in the NGSS framework through the engaging pGLO Bacterial Transformation activity.

**2:00 PM – 3:15 PM****1705 • Conserving Panda Population: One Hormone Test Design at a Time!**

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

Come put your immunology and reproductive endocrinology systems knowledge basics to the test as you engineer a hormone detection system that can be utilized for Giant Panda Population Conservation efforts.

**3:30 PM – 4:00 PM****1707 • Precision Medicine – A Reality with Revolutionary Droplet Digital PCR (ddPCR) Technology**

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

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

**10:30 AM – 11:45 AM cont.****393 • Mission: Possible – Using Breakout Escape Room Games to Transform Teaching and Learning in a Science Classroom****Executive Conference 3A • 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

**1637 • Serenity Now! Keep Calm and Do Science with Real Data in the Classroom****Executive Conference 3B • Technology in the Classroom • Demonstration (75 min) • HS, 2Y, 4Y**We will demonstrate the free web application on QUBES called *Serenity* that brings data science into classrooms. Designed for education, *Serenity* puts real data into students' hands to do science.

Drew LaMar, College of William and Mary, Williamsburg, VA

**1424 • 5 Practices to Create Meaningful Discussions in Biology Tasks****Executive Conference 4 • Instructional Strategies • Hands-on Workshop (75 min) • GA**

Ever have an awesome task that falls flat when you discuss it as a class? Come learn about a strategy for orchestrating productive task-based discussions in a Biology class.

Sara Abeita, Lawrence Free State High School / Knowles Teaching Fellowship, Lawrence, KS and John Maddux, Festus High School, Festus, MO

10:30 AM - 12:30 PM

**2018 EVOLUTION SYMPOSIUM**

**1724 • Emerging Research in Evolutionary Biology**

**Nautilus 3 • Evolution • Symposium (120 min) • HS, 2Y, 4Y**

Join us for this talk featuring cutting-edge research in evolutionary biology, followed by a workshop on strategies to bring this authentic data into your classroom!

Presented by BEACON and ASN

**Cold Truths: Evolutionary Impacts of Winter on Terrestrial Ectotherms**

Climate change research historically focused on summer, and winter climate change was considered mostly beneficial due to amelioration of damaging cold. It is now becoming increasingly apparent that variation in winter conditions drives responses of many terrestrial organisms to climate change in complex ways, and that a mechanistic understanding of the impact of winter conditions is essential to identify vulnerabilities to climate change. We are working to untangle the complex interactions between cold hardiness and energetics in the winter, using a range of insect species, with the goal of understanding how winter shapes ecology and evolution.

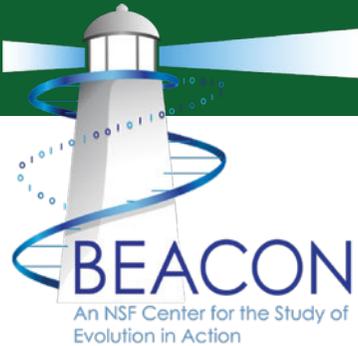
Caroline Williams, University of California Berkeley, Berkeley, CA

**Data Nugget Workshop: Waking up to Climate Change - Adaptation and Natural Selection in Ladybird Beetles**

*Data Nuggets* (<http://datanuggets.org>) are free classroom activities, designed to improve the scientific and quantitative abilities of K-12 students by providing them with authentic data collected by practicing scientists. In this workshop, we will introduce a Data Nugget that features data on the variability of cold coma recovery time in ladybird beetles. This Data Nugget will give students an opportunity to investigate the degree of variation in populations of ladybirds as they respond to changing temperature conditions.

Nikki Chambers, West High School, Torrance, CA and Elizabeth Schultheis and Melissa Kjelvik, Michigan State University, East Lansing, MI

## NABT 2018 EVOLUTION SYMPOSIUM



**BEACON**  
An NSF Center for the Study of Evolution in Action



**ASN**  
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.

Cold truths: Evolutionary impacts of winter on terrestrial ectotherms

Caroline Williams, University of California, Berkeley

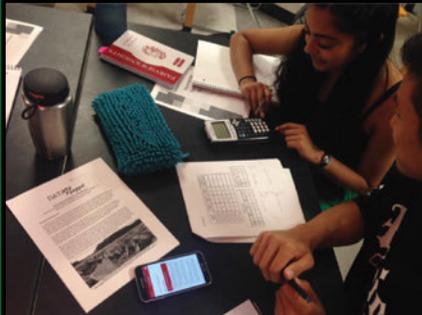
Caroline's talk explores the evolutionary and ecological responses of insect populations to winter climate change.

Data Nugget Workshop: Waking up to climate change

Nikki Chambers, Melissa Kjelvik, Elizabeth Schultheis

Following the talk, we will release a new Data Nugget featuring data on the variability of cold coma recovery time in ladybird beetles.





FRI

**8:00 AM – 4:00 PM****SPECIAL PROGRAMMING PRESENTED BY  
miniPCR****All sessions in Marina 5**

All sessions: Zeke Alvarez Saavedra and Bruce Bryan, miniPCR, Cambridge, Massachusetts

**8:00 AM – 9:00 AM****1714 • Lab in a Box: A Free Biotechnology Loaner Program from Genes in Space**

**Biotechnology • Workshop (60 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. Training, free PCR, gel electrophoresis curriculum and loans.

**10:30 AM – 11:45 AM****1716 • GLOW Labs: DNA Structure and Enzyme Activity Through Fluorescence**

**Biotechnology • Hands-on Workshop (75 min) • MS, HS, 2Y, 4Y**

A completely new approach to studying both DNA and enzyme activity in the classroom. Using fluorescence your students can now directly visualize the effects of temperature, pH, and genetic sequence on DNA structure.

**12:00 PM – 12:30 PM****1717 • Solving a Forensics Mystery Through DNA Analysis: D1S80 VNTR Lab**

**Biotechnology • Demonstration (30 min) • MS, HS, 2Y, 4Y**

Bring real DNA analysis into your forensics classroom. Students use their own DNA and PCR and electrophoresis to investigate if they can rule themselves out as a suspect.

**12:45 PM – 1:45 PM****1720 • Sickle Cell Genetics: Using Gel Electrophoresis to Investigate Molecular Genetics, Inheritance and Disease**

**Biotechnology • Hands-on Workshop (60 min) • MS, HS, 2Y, 4Y**

Engage your students by introducing fictional family dealing with the realities of sickle cell anemia. Rich extensions make this lab perfect for a wide range of abilities and backgrounds.

**2:00 PM – 3:15 PM****1718 • Are You a Night Owl? A Morning Lark? The Answer May Be in Your Genes...**

**Biotechnology • Hands-on Workshop (75 min) • MS, HS, 2Y, 4Y**

The miniPCR Sleep Lab links the genetic control of circadian rhythms to students' own DNA. Students explore a genetic association in an authentic research investigation.

**3:30 PM – 4:00 PM****1719 • LARP! Live Action Role Playing and the Biology Curriculum**

**General Biology • Demonstration (30 min) • MS, HS, 2Y, 4Y**

Kinesthetic learning is more than doing labs. Our curriculum director, a veteran biology teacher, will share his favorite activities to get students out of their desks and role-playing biological processes.

**10:30 AM – 11:45 AM cont.****1430 • The American Association of Immunologists Presents: AAI Teachers Research Program - Immunology Lessons for the Classroom**

**Marina 2 • AP Biology • Hands-on Workshop (75 min) • MS, HS**

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

Courtney Pinard and Megean Garvin,  
American Association of Immunologists,  
Rockville, MD

**371 • Marine Science Mania VII**

**Marina 3 • Ecology / Environmental Science / Sustainability • Hands-on Workshop (75 min) • MS, HS**

Do you, or are you planning to, teach a course in Marine Science? Experience hands-on activities designed to teach Marine Science, receive many giveaways, activities, and labs.

Thomas Froats, Prospect High School, Mount Prospect, IL

**1645 • Fixing a Broken Heart: A Cardiac Modeling and STEM Project**

**Marina 4 • Anatomy & Physiology • Hands-on Workshop (75 min) • HS, 2Y**

No better way to learn how oxygenated blood circulates than to engineer a solution for when it doesn't! Learn how to incorporate modeling and engineering practices into your curriculum.

Noelle Gilzow and Pam Close, David H. Hickman High School, Columbia, MO

# BIO-RAD Explorer

HANDS-ON INQUIRY-BASED SCIENCE EDUCATION

## NABT San Diego Workshop Schedule & Special Events

Join us at the Sheraton San Diego Hotel at Executive Conference 2B, for our free workshops

**Friday November 9** (all at Executive Conference 2B)

Visit Us  
at Booth  
#201

- 8:00–9:00 AM **Become a GMO Investigator.** Regardless of where you stand in the GM debate, wouldn't it be interesting to know which foods you eat are GM foods?
- 10:30–11:45 AM **Are increased incidences of infection the result of climate change?** Why does climate change matter? Find out which suspected microbes are associated with increased reports of infections and why they may be more common as the temperature on earth increases.
- 12:00–12:30 PM **Ready or not, here it comes! It's biotechnology, the science of our age. Are your students prepared?** Glowing cats? Designer babies! Empower students to be independent thinkers. Learn from a leader in biotechnology teaching, author J. Kirk Brown, how to build your lab program step-by-step with equipment, supplies, and student credentials. The first 40 attendees will receive a complimentary signed copy of Kirk's new biotechnology textbook.
- 1:00–1:45 PM **Shifting practices to infuse Science and Engineering Practices with Common Core Strategies.** This workshop will focus on illustrating the science and engineering practices described in the NGSS framework through the engaging pGLO Bacterial Transformation activity.
- 2:00–3:15 PM **Conserving Panda Population: One Hormone Test Design at a Time!** Come put your immunology and reproductive endocrinology systems knowledge basics to the test as you engineer a hormone detection system that can be utilized for Giant Panda Population Conservation efforts.
- 3:30–4:00 PM **Precision Medicine — a reality with revolutionary Droplet Digital PCR (ddPCR) technology!** 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.

**Textbook giveaway and signing with author J. Kirk Brown (limited supply) at the Bio-Rad booth #201**  
Thursday November 8 from 6:30–7:00 PM and Friday November 9 from 4:00–5:00 PM

### Special Events

**Bio-Rad is proud to provide support for an Invited Speaker Session.** Join us on Friday, November 9 from 10:30–11:45 AM in Nautilus 5 to learn more about the efforts to save endangered species through conservation and reproductive sciences.

**Learn more about giraffe reproduction and conservation at the After Hours Adventure at the San Diego Zoo** (Special ticketed event). Saturday Night November 10 — Special programmatic support provided by Bio-Rad.

Visit us at [bio-rad.com/NABT](http://bio-rad.com/NABT)  
Call toll free at 1-800-424-6723.  
Outside the U.S. contact your local sales office.

**BIO-RAD**

10:30 AM - 4:00 PM

SPECIAL PROGRAMMING PRESENTED BY  
**Carolina Biological Supply Company**

**All sessions in Marina 1**

All sessions: Ashley Faucette, Carolina Biological Supply Company, Burlington, NC

10:30 AM - 11:45 AM

**1713 • Genes and ConSEQUENCES: Unlocking the Power of DNA Sequence Analysis**

**Genetics • Hands-on Workshop (75 min) • HS**

Reinforce the central dogma of biology and give students basic bioinformatics tools. Use a case study approach with your students as they explore their given sequences and work to determine the location and role of their gene in a disease.

12:00 PM - 12:30 PM

**1712 • Arriving on the Scene: Collect and Analyze Evidence Like the Pros**

**Genetics • Hands-on Workshop (30 min) • HS**

Expose your students to the fascinating world of forensics using real-world techniques practiced by law enforcement. Keep your students captivated by analyzing and documenting evidence to recreate a crime scene.

2:00 PM - 3:15 PM

**1711 • Protein Necklace: Harnessing the Glow of Jellyfish**

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

This classroom exercise allows your students to isolate the green fluorescent protein (GFP) found in jellyfish. Show them that protein science can be engaging but not overwhelming with this activity.

3:30 PM - 4:00 PM

**1710 • AP® Biology Roundtable with Carolina Biological Supply**

**AP Biology • Demonstration (30 min) • HS**

You can make an impact! Join Carolina Biological Supply Company and give your feedback on current products and upcoming ideas. Door prizes and other opportunities to win will be available.

10:30 AM - 11:45 AM cont.

**1483 • Top 10 Biotech Stories of 2017/18**

**Nautilus 4 • General Biology • Demonstration (75 min) • MS, HS, 2Y, 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 and Madelene Loftin, HudsonAlpha Institute for Biotechnology, Huntsville, AL

**1515 • Teaching of Cell Respiration and Photosynthesis Does Not Have to Be Difficult**

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

As moderator of the NABT Facebook page, Bioenergetics and how to teach it is a common request. This session will provide a structure to teach CR and Photosynthesis.

John Moore, Taylor University, Upland, IN

**1466 • Biology Practices That Drive Thinking Forward**

**Spinnaker 1 • General Biology • Hands-on Workshop (75 min) • HS**

Explore the use of interactive biology manipulatives and engaging kits that get students figuring out biological concepts, while enjoying learning. Emphasis will be on “designed to discover” high school activities.

Rebecca Brewer, Troy High School, Troy, MI

**1428 • Using Mitotic Division to Introduce Statistical Hypothesis Testing in AP and IB Biology**

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

Turn the root tip mitosis lab into an opportunity to teach test of correlation and chi-squared so students are prepared to analyze more complex data.

Kristen Dotti, Verde Valley School, Sedona, AZ

10:30 AM - 11:45 AM cont.

**1680 • CRISPR-Cas9: the Mechanism, Applications, and New HHMI Resources**

**Nautilus 2 • Biotechnology • Hands-on Workshop (75 min) • HS, 2Y, 4Y**

Hot off the presses - new CRISPR-Cas9 resources from HHMI BioInteractive!

Build a model, explore an interactive, and analyze knock-out genes based on sequence data to determine their functions.

Ann Brokaw, Rocky River High School, Rocky River, OH and Mark Randa, Cumberland County College, Vineland, NJ

10:30 AM – 11:45 AM cont.

## INVITED SPEAKER

## Ron Swaisgood

➔ See page 10 for biography.

### From Endangered to Vulnerable: A Personal Walk Through Two Decades of Science and Policy for the Giant Panda

Nautilus 5 • Biotechnology • Special Speaker • GA

How did the panda come to be “downlisted” from endangered to vulnerable? Dr. Swaisgood will share 20 years of his research on pandas and discuss how the panda measures up to International Union for Conservation of Nature (IUCN) criteria, how it came to be that the panda is no longer Endangered, and forward-looking conservation implications of downlisting. He will also provide an overview of the behavioral and ecological research he and his colleagues have conducted. Behavior research played a critical role in turning around the conservation breeding programs for pandas and how field research helped us gain a better understanding of the ecological factors and human disturbance that determine panda population size. He will then conclude with a brief horizon scan for where we are going in panda conservation in the future.

**BIO-RAD** is proud to provide support for the Invited Speaker Session.

### NABT Committee Meeting: Member Resources Committee

Room 511 • Committee Meeting  
(75 min) • GA

Catherine Ambos, Committee Chair

### NABT Committee Meeting: Pre-Service Teacher Committee

Room 514 • Committee Meeting  
(75 min) • GA

Julie Angle, Committee Chair

12:00 PM – 12:30 PM

### 1550 • Quantitative Modeling in Biology

Executive Conference 1 • General Biology • Paper (30 min) • HS, 2Y, 4Y

The Quantitative Undergraduate Biology Education and Synthesis (QUBES) project developed an assessment of quantitative modeling in biology. Results from a pilot of the assessment will be presented.

Robert Mayes, Georgia Southern University, Statesboro, GA

### 405 • The Results of Longitudinal Water Quality Monitoring of the Brandywine River, Chester County, Pennsylvania by High School Students

Executive Conference 2A • Ecology / Environmental Science / Sustainability • Paper (30 min) • HS, 2Y, 4Y, GA

Data analysis summary of a decade-long longitudinal water quality study conducted by high school students along the West and East Branches of the Brandywine River.

Dina DiSantis, Downingtown Area School District/Montgomery County Community College, Downingtown, PA

12:00 PM – 12:30 PM cont.

### 1495 • Tailoring Instruction to Low Level, Overaged, and Under-Credited Students

Executive Conference 3A • Instructional Strategies • Demonstration (30 min) • HS, GA

This session will review strategies that have been successful in engaging and challenging students who have struggled with traditional teaching methods. We will also review how to combat attendance issues.

Joseph McKeel, Independence High School, New York, NY

### 1465 • Independent Research in High School – Successes and Setbacks

Executive Conference 3B • Instructional Strategies • Demonstration (30 min) • Shows participants how to use data sets, equipment, online resources, etc. • HS

We will share our experiences in establishing and running our independent research course. What went well, what we would do differently, and what we plan for the future.

Todd Gordon and Daniel Barrientes, Concordia International School Shanghai, Shanghai, China

### 1445 • Contributing to *The American Biology Teacher*: A Hands-On Workshop

Executive Conference 3B • Curriculum Development • Hands-on Workshop (30 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 this practice article development and review session.

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

## 12:00 PM – 12:30 PM continued

**1472 • Zombie Outbreak! Students Learn Critical Thinking Through Creativity, Neuroscience, and Microbiology Concepts Used to Build a Better Zombie Outbreak Story****Marina 2 • General Biology • Hands-on Workshop (30 min) • HS, 2Y, 4Y**

The audience will see examples of flipped class activities for Zombie Outbreak course, and be challenged to build a more scientifically accurate Zombie Outbreak story than Hollywood using curriculum tools.

Stephanie Daugherty, University of Texas at Tyler, Tyler, TX

**408 • Plant-Based, Student-Centered, Self-Designed Independent Research Project****Marina 3 • Botany & Plant Biology • Demonstration (30 min) • HS**

Introduce a student-designed, independent research project on seed germination and plant growth. This project has been enhanced through collaboration with *Planting Science* ([www.plantingscience.org](http://www.plantingscience.org)).

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

**1644 • Integrating Cardiovascular and Respiratory Physiology with the Help of a Patient Simulator****Marina 4 • Anatomy & Physiology • Demonstration (30 min) • 2Y, 4Y**

This session presents an Anatomy & Physiology lab in which non-biology-major students diagnose the clinical condition of a “patient” based on cardiovascular and respiratory data.

Nadine Stecher, Wentworth Institute of Technology, Boston, MA

**1683 • Teach Regulation at Multiple Scales Using HHMI Data Points****Nautilus 2 • Science Practices • Hands-on Workshop (30 min) • HS, 2Y, 4Y**

Engage your students by using free HHMI Data Points on p53/cancer, dinosaurs/thermoregulation, and population dynamics to teach regulation at cellular, organismal, and ecosystem scales.

Natalie Dutrow, Salt Lake City School District, Salt Lake City, UT; Mary Wuerth, Tamalpais High School, Mill Valley, CA; and Bridget Conneely, HHMI BioInteractive, Chevy Chase, MD

**1687 • AP Biology, Then and Now****Nautilus 4 • AP Biology • Hands-on Workshop (30 min) • HS, 2Y, 4Y**

If you’ve taught AP Biology forever or are just starting to teach it, this session will give insight into where the course has been and where it is going.

Catherine Walsh, College Board, New York City, NY

**1587 • Biology Best Bets XVII****Spinnaker 1 • General Biology • Hands-on Workshop (30 min) • HS, 2Y, 4Y**

Join us, teacher-to-teacher, for a collection of biology learning experiences. This year we’re focusing on student engagement, team building, and NGSS phenomena and modeling. Adapt them for your needs!

Suzanne Black, Inglemoor High School, Kenmore, WA; Nancy Monson, West Linn High School, West Linn, OR; and Jennifer Lockwood Armstrong, Newbury Park High School, Newbury Park, CA

**NABT Committee Meeting: Retired Member Committee****Room 511 • Committee Meeting (30 min) • GA**

Dennis Gathmann, Committee Chair

**NABT Committee Meeting: Social Media Committee****Room 514 • Committee Meeting (30 min) • GA**

John Moore, Lead Moderator

## 12:45 PM – 1:45 PM

**AP Biology Section Luncheon****Harbor Island 1 • Meal Function (Tickets Required) • AP (SOLD OUT)**

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

Sponsored by 

**Two-Year College Section Luncheon****Harbor Island 2 • Meal Function (Tickets Required) • 2Y**

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

**Four-Year College and University Section Luncheon****Harbor Island 3 • Meal Function (Tickets Required) • 4Y (SOLD OUT)**

Do you teach at a four-year college or university? Join faculty, education researchers, graduate students, and others for some networking and nourishment. The lunch will include a meeting to highlight projects and initiatives of the section, including a special presentation of the Four-Year College & University Section Awards.

2:00 PM – 4:00 PM

**10th Annual Biology Education Research Symposium**

**Nautilus 1 • Instructional Strategies • Symposium (120 min) • HS, 2Y, 4Y**

NABT is proud to present the 10th year of the 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 of the symposium will be a traditional presentation of papers by individual or co-authors lasting 15 minutes each.

➔ Full abstracts are available on page 38 and proceedings will be published online at [www.nabt.org/2018-Research-Symposium](http://www.nabt.org/2018-Research-Symposium)

Coordinators: Jaime Sabel, University of Memphis, Memphis, TN and Suann Yang, SUNY Geneseo, Geneseo, NY

**1670 • NABT AP Biology Symposium**

**Nautilus 4 • AP Biology • Symposium (120 min) • HS, 2Y, 4Y**

Asking good questions is central to the practice of being a scientist, yet we often struggle to ask good questions in the context of teaching students to be scientists. Join us for an interactive session to focus on the design and development of questions that prepare students for instruction, assist students with instruction, and assess student mastery of concepts after instruction. We'll then focus on instructional strategies that help participants learn how "doing biology" incorporates both skills and content.

Coordinated by the NABT AP Biology Section

2:00 PM – 3:15 PM

**1625 • Genome Engineering and Ethical Issues – Tackling the Scientific and Ethical Questions in the High School Classroom**

**Executive Conference 1 • Biotechnology • Hands-on Workshop (75 min) • MS, HS, 2Y**

Learn about the latest topics in genome engineering not yet in your classroom textbooks – including the scientific and ethical questions, CRISPR, and the history of the eugenics movement.

Robin Bowman and Floryc Romero, Personal Genetics Education Project - Harvard Medical School, Boston, MA



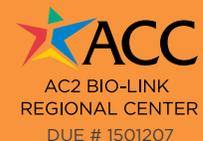
**BIO-LINK AT 20:  
BUILDING THE EDUCATION  
ECOSYSTEM TO HELP INSTRUCTORS  
HELP STUDENTS TO  
BIOTECH-CAREERS**

SANDRA PORTER, PHD,  
BRIDGETTE KIRKPATRICK, PHD, JENNIFER LAZARE,  
PAULA SUMNER, LOUISE PETRUZZELLA

**LOCATION: Marina 5**  
**DATE: November 10, 2018**  
**TIME SLOT: 9:00AM-10:15AM**

Come learn about new ideas in educating the biotechnology workforce! Bio-Link and AC2 Bio-Link Regional Center representatives will discuss resources for teaching including an interactive movie, curriculum, a teacher mentor network, biotech incubators, college-run service labs, undergraduate research, and immunobiotechnology.

Join our session and learn how you can be involved!



2:00 PM – 3:15 PM continued

## INVITED SPEAKER

**Tatum Simonson**

➔ See page 10 for biography.

**Cross-Population Insights into Hypoxia Adaptation and Maladaptation****Nautilus 5 • Anatomy & Physiology • Special Speaker • GA**

Human populations at high altitude have been challenged by low oxygen for hundreds of generations and show unique physiological responses to this environmental stress, some of which are associated with genomic signatures of adaptation. Our integrative studies in Tibetans and Andeans provide evidence for both genetic adaptations and physiological changes that are shared and unique to these populations and aim to elucidate how this variation relates to differences in human responses to hypoxia.

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**1603 • Aye-Ayes, Baobabs and Cheetahs: Applying Lessons from Conservation in Madagascar & Namibia to Your Classroom Projects****Executive Conference 2A • Ecology / Environmental Science / Sustainability • Hands-on Workshop (75 min) • HS, 2Y, 4Y**

Learn about two unique African countries, Madagascar and Namibia, and the relationships between their biodiversity, population density, environmental philosophy, and conservation efforts. Explore projects using this information with your colleagues.

Ann Burke, The Academy of Science & Entrepreneurship, Bloomington, IN

**1451 • Meeting the Needs of EL's in the Science Classroom****Executive Conference 3A • Instructional Strategies • Hands-on Workshop (75 min) • MS, HS, GA**

How do we support EL's learning Biology? We will find instructional resources within the research-based ELA/ELD Framework, and examine tools or strategies (many tech-based) to meet the needs of ELs.

Franz Ruiz and Annika Goodin, Grossmont Union High School District, El Cajon, CA

**1642 • Sketch Notes - Getting Students to Create Their Own****Executive Conference 3B • Instructional Strategies • Hands-on Workshop (75 min) • GA**

Many of us have seen clever, creative, and beautifully done sketch notes, but they're almost always done by teachers. Come learn how to help students develop this skill.

Angela Little, Westside Christian High School, Tigard, OR

**1631 • The Phenomena Finder: An Interdisciplinary Tool for Use in Designing NGSS-Aligned Curriculum Materials****Executive Conference 4 • Curriculum Development • Hands-on Workshop (75 min) • ES, MS, HS**

Experience what phenomena based instruction feels like as a learner. Explore and contribute to a digital resource used in designing NGSS aligned phenomena based curriculum materials.

Barbara Hug, James Planey, and Natasha Capell, University of Illinois, Champaign, IL

**1521 • Weaving Biotech Into the Curriculum****Marina 2 • Biotechnology • Hands-on Workshop (75 min) • HS**

Examples of how biotechnology can be used throughout the year to reinforce concepts. Allow students to see it as a collection of tools/science practices that are integral to understanding biology.

Robert Dennison, Independent Consultant, Houston, TX

**1468 • Aquaponics and Citizen Science: Promoting Systems-Thinking and Career Readiness****Marina 3 • Ecology / Environmental Science / Sustainability • Demonstration (75 min) • MS, HS, 2Y**

Examine a global crisis and model a sustainable solution using aquaponics. Integrate open-access, NSF-funded, NGSS-aligned, STEM curricula to increase engagement and promote deep learning through case studies and citizen science.

Jessica Day, Institute for Systems Biology, Seattle, WA and Shari Carswell, Mayde Creek High School, Houston, TX

**1665 • Salk Institute for Biological Studies Education Outreach Presents: Communicating Science, Taking Research Findings to the Classroom****Marina 4 • Instructional Strategies • Demonstration (75 min) • MS, HS**

The Salk Institute is internationally renowned for biological research. We have a variety of resources for both local and out of area teachers to bring research science into your classroom.

Dona Mapston, Madison Dodds, and Amy Knight, Salk Institute Education Outreach, La Jolla, CA

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## 10TH ANNUAL BIOLOGY EDUCATION RESEARCH SYMPOSIUM

2:00 PM – 4:00 PM • Nautilus 1

**Student Anxiety Varies Among Demographic Groups and Impacts Persistence in Introductory Biology Courses**

Benjamin J. England and Elisabeth E. Schussler, The University of Tennessee, Knoxville, TN; Jennifer R. Brigati, Maryville College, Maryville, TN

Students respond to classroom activities and achievement outcomes with a variety of emotions, which can impact student success. One emotion students experience is anxiety, which can negatively impact student persistence. This study investigated the relationship between classroom anxiety and persistence in the major. Students in introductory biology classes self-reported their general course anxiety, intention to stay in the major, and demographic variables. Higher general course anxiety at the beginning and end of the semester was associated with intention to leave the major (N = 122), particularly for females and those with fewer AP courses. Students with consistently higher general anxiety were more likely to be female and freshman. Further research should identify what factors differentially impact student anxiety and how instructors may be able to mediate anxiety through reform of pedagogical implementation.

**Can Two-Stage Exams Improve Retention and Decrease Achievement Gaps?**

Nathan L. Kirk & Lori J. Kayes, Oregon State University, Corvallis, OR

Two-stage exams are summative assessments taken in two parts: 1) a traditional individual exam and 2) a group exam. These exams encourage collaborative discussion to promote deeper thinking and understanding of classroom material, transforming exams into additional learning experiences. Two-stage exams can improve student performance, learning, long-term retention, and even reduce student test anxiety. We implemented a two-stage exam in a ~1,100 student Principles of Biology for Majors course. To assess the efficacy of the group exam, we examined changes in student performance for questions differing in their level Bloom's level taxonomy. We also measured short-term and long-term knowledge in subsequent courses. In self-reported data, a majority of students felt they benefitted from group discussions, better understood and remembered content, and retained more of the material when they had questions on the group exam and individual exam versus on the individual exam only. Scores increased on questions in the group exam compared to the individual exam demonstrating peer instruction and productive discussion of material within a majority of the groups. There were even increases among top performing students indicating the exam was helpful for a majority of students by facilitating useful classroom discussion and increasing their performance.

**Towards A More Human(e) Genetics Education: Learning about Human Genetic Variation Reduces Racial Bias**

Brian Donovan, BSCS Science Learning, Colorado Springs, CO

Biology education is in the business of teaching about human genetic difference. And, experiments have found that when people overestimate the amount of genetic difference between racial groups it causes them to exhibit increased racial bias. However, there is apparently no experimental research that explores whether the converse is true. When people learn scientifically accurate information about the nature and extent of genetic and phenotypic variation across and within human races can such learning reduce racial bias? We explore this question. We randomized middle and high school aged students (N = 166) into separate classrooms to learn for an entire week either about the topics of: (1) human genetic variation and racial controversies in the media; or (2) climate variation and climate controversies in the media. Across two counterbalanced experimental replications, we demonstrate that when students learn about genetic and phenotypic variation in racial groups it causes a decrease in racial bias. Furthermore, we find that 22% of the reduction in racial bias caused by teaching about human genetic variation is transmitted through perceptions of human genetic variation. The implications of these findings for biology education are discussed.

**SPECIAL GUEST PRESENTER**

Sara Brownell, Arizona State University, Tempe, AZ

*Recipient of the 2018 NABT Four-Year College Section Research in Biology Education Award*

## 10TH ANNUAL BIOLOGY EDUCATION RESEARCH SYMPOSIUM

2:00 PM – 4:00 PM • Nautilus 1

### Secondary Biology Misconceptions: Using 23 Years of Test-Data to Inform Pedagogy

Travis Fuchs, West Point Grey Academy, Vancouver, Canada and Mike Arsenault, Lakefield College School, Lakefield, Canada

Of all ideas students come to a science classroom with, some do not match those of the scientific community and can lead to misunderstandings. We will call these ideas misconceptions. Contemporary education literature views misconceptions as resources for learning. As such, we employed an action research methodology and compiled a reference guide of misconceptions to more effectively plan our biology courses. Using the University of Toronto's National Biology Competition, we identified 130 misconceptions from a national sample (111,238 students, 1,181 questions) over many years (1995–2017). We will present 21 of these misconceptions, highlighting their ability to inform pedagogy and commenting on the persistent nature of some throughout our sample.

### Implementation of BioInquiry: A Leader Course Producing Perceived Learning Gains

Aimée K. Thomas, Don Hauber, Frank Jordan, Kim Mix, Patricia Dorn and Craig Hood, Loyola University New Orleans, New Orleans, LA

Persistence in and success matriculating through STEM curricula is a major challenge for many of today's students, especially those traditionally underrepresented in these fields (AAAS 2011). After a comprehensive departmental program review revealed that retention and graduation rates of Biology majors had declined significantly over the past two decades, we reviewed the biology education literature, met with STEM experts, conducted a critical review of the Biology major curriculum, and created a new first course utilizing high-impact teaching practices and training in fundamental skills and competencies needed by all life scientists. This three-year study included 154 biology majors who completed a pre/post Student Assessment of Their Learning Gains. We used an ANOVA to determine if there were significant differences among questions pre/post course. Students significantly increased their perceived understanding of all content and process skills questions. Student success and matriculation in STEM fields, particularly Biology, is important for many reasons, namely producing health care professionals and research scientists. Leader courses focusing on the process of science rather than content have been successful at other institutions and so far, we have found this to be true as well.

### The Process of Science Identity Development: Esperanza's Persistence in the Face of Adversity

Michele Mann, The University of Texas at Austin, Austin, TX

Biology degrees are not equally accessible to all people. There is a disparity in STEM degree attainment for URM (under-represented minorities) and whites even though the same rate of these student groups begin STEM degrees. Thus, there is a need to have a better understanding of the challenges faced by URM or in this case Latino(a) students and how the development of a science identity increases their likelihood of completing a biology degree. This case study of a Latina looks at the connection between her developing a science identity and her pursuit of a STEM degree. Parental support, science extracurricular activities, and being part of a science community are all ways that students can build their own science identity. However, these factors are more likely to be absent for students from underrepresented groups. For this case, it was found that the practice of science, as opposed to doing school science, proved critical for Esperanza's (pseudonym) development of an identity. She was also a part of a science community thickening her science identity, which has been associated with the perseverance in STEM majors. Understanding the work of science identity development can help mitigate the leaking STEM pipeline.

## 2:00 PM – 3:15 PM continued

**1672 • Extending HHMI BiolInteractive's Sex Verification of Athletes Click & Learn to Discuss Biological Sex and Gender****Nautilus 2 • Anatomy & Physiology**  
• Hands-on Workshop (75 min) • HS, 2Y, 4Y

Teach human development, sex determination, and gender in biological and social contexts, including genotype variation and resulting anatomical phenotypes, using case studies of methods used to assess sex of athletes.

Holly Basta, Rocky Mountain College, Billings, MT; David Julian, University of Florida, Gainesville, FL; and Melissa Csikari, HHMI BiolInteractive, Chevy Chase, MD

**410 • Meeting *Homo naledi*: Discovering and Teaching About Our Newest Fossil Relative****Nautilus 3 • Evolution • Demonstration**  
(75 min) • MS, HS, GA

Learn about *Homo naledi*, the greatest hominin fossil discovery since “Lucy” and discover how to bring this ongoing research into your classroom in ways that were impossible until recently.

John Mead, St. Mark's School of Texas, Dallas, TX and Becca Peixotto, Perot Museum of Nature & Science, Dallas, TX

**1467 • PlantingScience: Growing Students' Science Understanding Through Independent Investigations and Online Mentoring****Seabreeze 1 • Science Practices**  
• Hands-on Workshop (75 min) • MS, HS, 2Y

PlantingScience.org is a free online resource for teachers. Take part in activities showing how students' understanding of science grows using increasingly independent investigations supported by online mentoring by research scientists.

Catrina Adams, Botanical Society of America, Saint Louis, MO and Anne Westbrook, BSCS, Colorado Springs, CO

**SPECIAL PROGRAMMING PRESENTED BY****Labster****1727 • Reimagining Biology Education with Gamified Virtual Labs****Seabreeze 2 • Technology in the Classroom**  
• Hands-on Workshop (75 min) • HS, 2Y, 4Y

In this session we will demonstrate how gamification, use of simulations, virtual reality and storytelling can be leveraged to improve lab prep, learning outcomes, retention of information, motivation & self-efficacy.

**1557 • Designing Effective Introductory Biology Labs: Fostering a Spirit of Inquiry****Spinnaker 1 • General Biology**  
• Hands-on Workshop (75 min) • HS, 2Y, 4Y

Come and explore how to redesign your introductory biology labs to foster student engagement, a creative mindset, independence of thought, effective collaboration, and scientific intellectual and communication skills.

John Peters, College of Charleston, Charleston, SC

**1635 • Visualize It: Using Molecular Models to Predict the Effects of Mutations on Protein Function****Spinnaker 2 • Biotechnology • Demonstration**  
(75 min) • 2Y, 4Y

In this session, we will demonstrate how to identify the sites of pathogenic mutations using ClinVar, locate the corresponding protein structures, and use molecular modeling to explain the pathogenic phenotype.

Sandra Porter, Shoreline Community College, Seattle, WA

**NABT Committee Meeting: Awards Committee****Room 511 • Committee Meeting**  
(75 min) • GA

Jason Crean, Committee Chair

**NABT Committee Meeting: ABT Advisory Committee****Room 514 • Committee Meeting**  
(75 min) • GA

William McComas, ABT Editor

## 3:30 PM – 4:00 PM

**1618 • Science Con-Artists, Fake News & Alternative Facts****Executive Conference 1 • General Biology**  
• Paper (30 min) • HS, 4Y, GA

In the public media, people claim scientific expertise and authority when they have none. Learn their common tricks and how to prepare students to be savvy consumers of science.

Douglas Allchin, University of Minnesota, Saint Paul, MN

**396 • Teach Your Students to Think Like a Scientist!****Executive Conference 2A • Science Practices**  
• Hands-on Workshop (30 min) • HS

Explore two of our best classroom practices that we use to actively get our students thinking outside of the box. Participants are encouraged to bring their best practices as well!

Jennifer Jones and Matthew Shapiro, The Episcopal Academy, Newtown Square, PA

**3:30 PM – 4:00 PM** continued**1490 • 10 Brain-Based Classroom Hacks for Individualized Learning****Executive Conference 3A • Curriculum Development • Hands-on Workshop (30 min) • MS, HS**

Learn the top 10 research-based activities that will increase deep learning and help create individualized lessons for students. Reach all learners with these differentiated lesson ideas.

Kirsten Landry, Kent Denver School, Englewood, CO

**1609 A River Ran Through It – How to Survive a Natural Disaster and Save the Semester****Executive Conference 3B • General Biology • Paper (30 min) • 2Y, 4Y, GA**

A panel discussion with LSC-Kingwood professors about how they dealt with the

challenges of reorganizing the semester in the aftermath of Hurricane Harvey.

Betsy Morgan, Heather Scherr, and Brian Shmaefsky, Lone Star College-Kingwood, Kingwood, TX

**1636 • Visualizing Student Thinking Using the NGSS Approach****Executive Conference 4 • General Biology • Hands-on Workshop (30 min) • MS, HS**

Get your students excited to think and learn beyond the storyline. The goal of this workshop is to provide teachers with usable lessons and rubrics that incorporate NGSS activities.

Elizabeth Gonzalez and Bernadette Castaneda, Montclair High School, Montclair, CA

**1614 • “Bugs on Bugs”: An Inquiry-Based, Collaborative Activity to Illustrate the Existence and Diversity of Gut Flora of Arthropods****Marina 2 • General Biology • Hands-on Workshop (30 min) • 2Y, 4Y, GA**

“Bugs on Bugs” is an inquiry-based research project in which students from two different courses collaborate, and both investigate arthropod and microbial.

Jeanelle Morgan and Swapna Bhat, University of North Georgia, Oakwood, GA

**HHMI NIGHT AT THE MOVIES WITH SEAN B. CARROLL****Friday, November 9, 2018****Reception 4:30 p.m.** Pavilion*Food and Drink Provided***Screening 5:45 p.m.** Grand Ballroom

hhmi | **BioInteractive**

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3:30 PM – 4:00 PM *continued***1607 • A Coral Conundrum: Linking Genetics and Environmental Science****Marina 3 • Ecology / Environmental Science / Sustainability • Hands-on Workshop (30 min) • MS, HS, 2Y**

Use a simulated DNA microarray to analyze the effect of rising sea temperatures on coral reef ecosystems. Leave with free resources to use immediately in your classroom!

Courtney Behrle, BioNetwork, Raleigh, NC

**1463 • The Doctor Is In!****Marina 4 • Anatomy & Physiology • Hands-on Workshop (30 min) • HS**

Learn about some new activities for your anatomy classroom that allow students to have inexpensive, hands-on fun while they learn about medicine and forensics!

Laura Woerner, Saint James School, Montgomery, AL

**1729 • HHMI's Interactive Winogradsky Column: Linking Ecosystems to Metabolism****Nautilus 2 • Microbiology & Cell Biology • Demonstration (30 min) • 2Y, 4Y**

Facilitate hypothesis generation and experimental design using HHMI's Interactive Winogradsky Column. Learn how to use this new resource with student-made columns to connect ecological concepts with bacterial metabolism.

Dave Westenberg, Missouri University of Science &amp; Technology, Rolla, MO and Mark Nielsen, HHMI, Chevy Chase, MD

**375 • Making Evolution Stick: Using Active Learning and Sticky Notes to Teach the Mechanisms of Evolutionary Change****Nautilus 3 • Evolution • Hands-on Workshop (30 min) 2Y, 4Y, GA**

Participants will go through a hands-on activity using sticky notes to teach fundamental mechanisms of evolutionary change using active learning in small groups. This presentation is by the 2018 Huxley Awardee.

Kathleen Grogan, Pennsylvania State University, University Park, PA

**1514 • Rosalind Franklin and the Discovery of the Structure of DNA: Using History to Help Students Understand Nature of Science****Spinnaker 1 • Nature of Science • Paper (30 min) • HS, 2Y, 4Y**

Our study examined whether and how incorporating the historical story associated with discovering the structure of DNA coupled with the explicit, reflective approach affect undergraduates' understanding of NOS.

Peng Dai, Mallinson Institute for Science Education, Kalamazoo, MI

**NABT Committee Meeting: Archival Committee****Room 511 • Committee Meeting (30 min) • GA**

Carrie Jo Bucklin and Jill Maroo, Committee Chairs

**NABT Committee Meeting: Nominating Committee****Room 514 • Committee Meeting (30 min) • GA**

Donald French, Committee Chair

## 4:00 PM – 5:30 PM

**Exhibit Hall Closing Reception Pavilion • Special Event**

It's last call in the NABT Exhibit Hall. That means it's your last chance to talk with exhibitors and get those freebies for the classroom. Join us for a special reception, prize giveaways, and more!

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## 5:30PM – 8:00PM

**HHMI Night at the Movies featuring Sean Carroll****Grand Ballroom • Special Event (Tickets Required)**

HHMI BioInteractive and NABT are pleased to host the 8th Annual *HHMI Night at the Movies with Sean Carroll*. Join Dr. Carroll for the premiere of a new feature-length film, followed by a discussion with the filmmakers. This free red-carpet event will begin at 5:30PM with a free reception.

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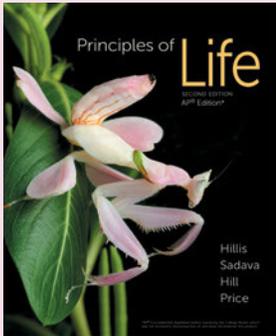


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