

CASE Conference 2014

Advancing STEM Education

Workshop Session Summaries:

Title: *Discover Now: Searching for Extrasolar Planets with Planet Hunters*

Presenter: Jamie Kern, Observatory Manager

Affiliation: Bridgewater State University

Planethunters.org is an experimental website that uses the power of human pattern recognition to search for exoplanets – planets that orbit around stars outside the Solar System. It provides a unique opportunity for any member of the public to contribute with no previous experience in astronomy, and is in itself a powerful teaching tool. In this workshop, we will learn how to use Planet Hunters to find planets and take a crash course in interpreting stellar light-curves. Students will benefit by seeing that they can make an active contribution to science right now, while learning (or reinforcing) how to read graphs.

Title: *Glow Sticks: Affinity Chromatography for Protein Purification*

Presenters: Dr. Donald DeRosa, Director

Dr. Carla Romney, Director of Research

Affiliation: Boston University School of Medicine CityLab

Green fluorescent protein (GFP) is a popular choice for teaching about proteins and protein chemistry. While hydrophobic interaction chromatography is often used to purify GFP, immobilized metal ion affinity chromatography (IMAC) is more efficient and results in purer yields. CityLab has modified the IMAC protocol for use in its popular SummerLab biotechnology program. In this hands-on workshop, participants will lyse E.coli bacteria that have been transformed to produce histidine-tagged GFP and learn how the IMAC technique can be used to purify GFP.

Title: *Green Chemistry: Applying the "Science of Solutions" in the Lab*

Presenter: Kate Anderson, Director of Education

Affiliation: Beyond Benign

Green Chemistry is a set of core principles and tools that enable chemists to prevent pollution at the molecular level. Learn how to incorporate green chemistry principles into your labs while teaching the same core chemistry concepts and expanding your students understanding of how chemistry connects to their everyday lives.

Title: *How Climate Change Affects Life on Earth*

Presenter: Janine Chuckran, CityLab and Watershed Access Lab Educator

Affiliation: Bridgewater State University

Learn the effects of climate change on marine and land organisms with a focus on hands-on classroom science activities. Try your hand at some interdisciplinary classroom activities that you can take back to demonstrate principles involved in climate change- International and local issues will be discussed. The target audience is grades 5-12, but activities can be adapted for other audiences.

Title: *iPad Technology in the Classroom*

Presenters: Patricia Emmons, PhD, Associate Professor, Elementary and Early Childhood Education

Jeri Katz, PhD, Professor, Special Education and Communications Disorders

Sarah Thomas, Assistant Professor, Secondary Education and Professional Programs

Affiliation: Bridgewater State University

The use of computer technology has dramatically improved how teachers and schools carry on the business of learning. This workshop will help prepare you to bring iPad technology into your classroom and will provide specific examples of how iPads can bring teaching and student learning to the next level. Participants are encouraged to bring their iPad to the session, as well as ask questions about the challenges and benefits of using iPads in the classroom.

Workshop Session Summaries (continued):

Title: *Modeling Science Practices and Inquiry in the Next Generation Science Classroom*

Presenters: Amy O'Donnell, STEM Liaison

William Day, IT Liaison

Affiliation: Rhode Island Technology Enhanced Sciences Program, RITES, University of RI, RI College, and the Chariho, Cranston, Johnston, Providence, South Kingstown, Westerly and Woonsocket Public School Districts.

RITES will present a series of hands-on, inquiry-based Investigations supported by online materials with embedded assessments that capitalize on having students work as scientists. The Investigations have been developed by collaborating teams of scientists and K-12 master teachers. The highlighted investigations feature the use of models and simulations and expect students to construct understandings of scientific principles by gathering and interpreting data; forming questions; and testing hypotheses; and using evidence to support claims. Teachers will move through learning stations that span all disciplines and feature a variety of scientific practices.

Title: *Producing Thinking Students without Pain*

Presenter: Gayle Lewis, Math Department Head

Affiliation: The Carroll School, Waltham and Lincoln

The Carroll School uses games and puzzles to enhance lessons and promote discussions in math class. You will experience and discuss such activities and their connections to math instruction during this interactive presentation. The target audience is grades 2-5, but activities can be adapted for other audiences.

Title: *Integrating Green Technology into your Classroom*

Presenter: Meghan Abella-Bowen, Director, SAGE Project

Affiliation: Bristol Community College

Sustainability and Green Technology are hot topics today. But what exactly is green technology and how do you integrate it into your science and engineering courses? Using various resources from the BCC SAGE Lending Laboratory this workshop will provide basic demonstrations and classroom activities on how energy efficiency, wind power, and/or solar energy can be integrated into your classroom.

Title: *STEM to STEAM*

Presenter: Erin M. Escher, NBCT

Affiliation: Brown University and Portsmouth Middle School, RI

In this class we will look at the Next Generation Science Standards, Practice #2. Participants will realize the artistic potential that they and their students have to make a model. We will also find out how to take a STEM lesson and make it STEAM. We will review a technology enhanced investigation with a hands on research project that incorporates the sculpting of model clay eggs and the engineering of bird nests.

Title: *Supermarket Space Science: Scale of the Solar System and Impact Cratering*

Presenter: Jamie Kern, Observatory Manager

Affiliation: Bridgewater State University

The Bridgewater State University Observatory currently runs several astronomy workshops that can be adapted to a classroom setting. In this session, we will experience two of these workshops: Scale of the Solar System and Impact Cratering. Each activity requires only inexpensive supermarket items, but corrects common misconceptions about planets, stars and gravity while providing a stimulating hands-on experience. These activities currently target K-5 students, but can be altered for older audiences.

Workshop Session Summaries (continued):

Title: *Teach Proteins before DNA!*

Presenters: Kathy Vandiver, Director, Community Outreach Education and Engagement Core
Amanda Gruhl, Coordinator, Community Outreach Education and Engagement Core

Affiliation: Center for Environmental Health Sciences, Massachusetts Institute of Technology (MIT)

Typically students are confronted with protein synthesis before they know much about proteins. Participants will use LEGO® molecules to become familiar with amino acids and protein structure. LEGO® amino acids can be used to teach all four levels of protein structure for advanced students. They can also be used to teach the most basic concepts about proteins, all in an enjoyable way. Watch an introductory demonstration here:

<https://techtv.mit.edu/videos/15547-introduction-to-proteins-in-class-demo>

Title: *Using Watershed Studies to Teach Ecological Concepts*

Presenters: Angela Cunard, Teacher and Science Coordinator
David Bonneau, Teacher
Matthew Wills, Teacher

Affiliation: Seekonk High School

The “Exploring Communities & Ecosystems Project” began with one student, an exploration of all of the possible Watershed labs and data that could be utilized for ecological study in 2005. Since then, it has grown to serve up to 150 students each year. In this workshop, learn how to provide students with a relevant, meaningful inquiry-based learning experience that supports curriculum standards now and in the future. Also presented will be ideas for partnering with stakeholders in your community, community educational outreach and ongoing studies of your local waterways.

Plenary Session Summary:

Title: *STEM Plan 2.0 and the Classroom: Statewide Movement Powered Through Local Action*

Speaker: Allison Scheff, Executive Director of STEM and the Governor's STEM Advisory Council

Affiliation: Massachusetts Department of Higher Education

STEM Plan 2.0, Expanding the Pipeline for All, was released in November 2013. While the plan is broad and general in scope, action is intended to place locally to fit the needs of you and your students. This session will focus on elements of the STEM Plan that can be implemented at the classroom level and will ask participants to share strategies that they use in the classroom that helps further the goals of STEM Plan 2.0.

Keynote Address Summary:

Title: *Pushing the Limits: Microbial Life at Deep-Sea Hydrothermal Vents*

Speaker: Julie Huber, PhD, Associate Scientist and Associate Director

Affiliation: Josephine Bay Paul Center at the Marine Biological Laboratory

The world's oceans are teeming with microscopic life forms, encompassing a staggering amount of diversity. Although they are largely invisible to the naked eye, microbial communities of untold diversity dominate nearly every corner of our oceans, from the deepest marine sediments to the sun-drenched coral reefs. Despite their crucial role in elemental cycling and earth's evolution, the marine microbial world remains vastly under-sampled, and our understanding of these microbial communities severely limited.

The deep-sea is one of the least explored parts of the microbial world, and until only 30 years ago, scientists believed that because it was devoid of sunlight and plants, there was no life there. The discovery of thriving animal and microbial communities at the Galapagos spreading ridge in 1977 changed our fundamental perceptions of life on planet Earth. The chemistry of hydrothermal vents creates many habitats for microbial and animal communities, all of which are intimately linked to and dependent on the geochemistry of their environment. These organisms encounter many conditions that we humans consider too extreme- too hot, too toxic, too little oxygen- but microbes seem to find a way and continue to push the limits of life.

Keynote Address Summary (continued):

An impetus for studying life at deep-sea hydrothermal vents is that life may have originated and evolved near hydrothermal systems, and that organisms currently living in these likely analogues of early habitats may still harbor characteristics of early life. In addition, microbes unique to the hydrothermal vents could provide insight into metabolic processes, strategies for growth, and survival of life on solar bodies with a water history, such as Mars and Jupiter's moon Europa. With a sample size of only one, the search for life beyond Earth must begin with life as we know it on Earth. Using examples from research expeditions around the globe, we will explore this extreme life on Earth at deep-sea hydrothermal vents.