NASA ASTROBIOLOGY INSTITUTE
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EPO: Marine Biological Laboratory

These are the Education and Public Outreach activities for the Marine Biological Laboratory.

Living in the Microbial World teacher workshop

Living in the Microbial World is a one−week intensive hands−on workshop for middle and high school teachers, grades 6−12. Our objective is to prepare middle and high school teachers to teach students and other teachers about the importance of the microbial world by incorporating hands−on microbiology activities into existing curricula. During the workshop, resident and visiting scientists from within the Woods Hole community present teachers with background information and current research developments on topics related to the importance of diversity of microbes in natural environments and microbial processes in the biosphere. In addition to presentations, teachers spend most of the time in a teaching laboratory, engaging in easy and inexpensive hands−on activities that exemplify basic principles of microbiology. During the workshop, teachers hear six lectures from research scientists highlighting the role of microbes in maintaining the biosphere, the origin of ecosystems, biomineralization and chemolithoautotrophy, extremophiles, protist diversity and fungal biology, and symbiosis. Teachers took field trips to the MBL's Marine Resources Center and the Great Sippiwissett Marsh in Falmouth to see microbial mats. Days were structured to include one lecture per day, and the balance of the time was spent doing hands−on activities in the lab. Evening sessions highlighting available Internet and video resources and a tour of the Josephine Bay Paul DNA sequencing facility also took place. Activities included: a demonstration of capturing magnetotactic bacteria; an investigation of fungal biology using an inquiry approach; culturing of basidiomycetes using sawdust culture techniques; making simple agar media; soil sample dilutions; making Winogradsky columns; construction of plankton nets, Uhlig extractors, and coverslip traps for collecting microorganisms; observation of termite hindgut microbes; and demonstration of the effects of naturally produced antibiotics on microbial growth. Three lab options involving culture and isolation of bacteria were offered simultaneously: culture and isolation of luminescent bacteria, culture and isolation of lactic acid bacteria, and culture and isolation of antibiotic−resistant bacteria from alfalfa sprouts. Astrobiology teaching materials were highlighted in a one−hour demonstration of the Website microscope and in an exploration of other Astrobiology URLs. Teachers received Life on Earth and Elsewhere? Educator Resource Guide, micro*scope and Astrobiology bookmarks, and planet cards. This workshop is offered yearly. Two sessions have been offered during the reporting time:

August 11−17, 2002, and August 10−16, 2003. Between both sessions, 41 middle and high school teachers attended.

Life and Living in Space teacher workshop

This three and one−half day workshop for teachers focused on various current topics in planetary protection and space life sciences, including microbe detection on equipment destined for spaceflight, growing plants in space, the gravitropic response in plants, and effects of spaceflight and microgravity on the human body. Norm Wainwright (Marine Biological Lab and Johnson Space Center) described his work on developing a rapid detection system for bacteria using the enzyme cascades found in the blood of the horseshoe crab Limulus and the rock crab. He also demonstrated extracting blood from Limulus and showed the clotting response of the blood in the presence of bacterial lipopolysaccharide. Robert Phillips (Colorado State University and NASA Life Sciences Outreach) gave a lecture on trends in food and nutrition in space and the effect of spaceflight on the physiology, anatomy, and life cycles of a variety of organisms. Mary Musgrave (University of Massachusetts Amherst) presented an overview of her research into the problems of growing multiple generations of plants in space, in particular the fertilization of plants and production of viable seeds. Lab activities included testing the effectiveness of different cleaning methods on equipment surfaces and assessing the results using enzyme cascade reactions. We also explored the effect of induced gravitational effect on plant growth (Which Way to Grow? activity), and observed the response of the human vestibular system to spinning motion. Participants were 25 middle and high school teachers. Materials distributed included the Life on Earth and Elsewhere? Educator Resource Guide, planet cards, and Astrobiology bookmarks.

Forams Through Time and Space: Astrobiology Teacher Workshop

This one−and−a−half day workshop focused on the biology of forams and their use in reconstructing past environments and as biostratigraphic markers. Twenty−five middle and high school teachers attended. Feedback solicited by written evaluation was positive, although teachers asked for more time to devote to the topic.

Online Article for Fathom.com

Rebecca Gast authored an article for a general audience entitled "Life in the Antarctic: Protistan Biodiversity," which appears as part of the Fathom.com Website for online learning.

National Science Teachers Association Astrobiology short course

Lorraine Olendzenski participated in the NSTA Astrobiology Short Course organized by Lisa Brown and Angela Phelps by leading a questioning circle involving microbial mats from Guerrero Negro and Rio Tinto water samples, and presenting the micro*scope Website. The program consisted of a mix of hands−on activities presented by EPO personnel and content presentations by scientists. Other presenters included Catherine Tsairides (Ames), Jackie Allen, Kay Tabola and Marilyn Lindstrom (JSC), Krisstina Wilmoth, Darlene Gadd and Daniella Scalice (NAI Central), Jim Kasting (Penn State), Andrew Steele (Carnegie) and Pamela Harmon (Voyages Through Time). 50 middle and high school teachers participated and received micro*scope bookmarks, instructions for the questioning circle activity, and flyers describing this year's Living in the Microbial World course at the MBL.

Development of Microscope Web site

The Microscope Website, developed through the Astrobiology Institute at the MBL (Woods Hole), is an innovative biodiversity bioinformatics Web site that greatly improves access to information about microbes; it is the single best resource for high−quality, downloadable, digital light micrographs of microbes. Presently, the site contains software to manage names and classification; a classification of protists and bacteria; dynamic outlinks for internet searching; original data about microbes; a comprehensive classification of all protist genera and prokaryotes, including 4500 images of microbes with explanatory text; and a variety of educational resources, including Lucid taxonomic guides. Information in the site can be accessed by habitat, cell shape, alphabetic list of genus name, and formal classification. We are continuing to expand and improve the site for larger public promotion by ensuring that all aspects work properly. We are adding educational material, including hands−on classroom activities already developed by NAI at MBL, glossary terms, and a tutorial for using Lucid guides. We will be adding a database of available K−12 hands−on activities in microbiology that details which aspects of the National Science Standards are met by each activity.

Presentation to University of Southern Connecticut Teachers

Lorraine Olenzendski met with 16 middle and high school teachers from all disciplines enrolled in the Southern Connecticut State University Institute for Science Instruction and Study (ISIS) Master's Degree Program. An overview of MBL Astrobiology research and education activities as well as an introduction to the Roadmap of the NAI was given during the one and one−half hour session. Classroom teaching materials were distributed.

Classroom presentations on Microbial Mats

Lorraine Olendzenski met with three 7th grade classrooms (45 students total) for 40 minutes each at Falmouth Academy to discuss the importance of microbial mat communities to the study of astrobiology. Students were asked "What do you know about microbial mats?", engaged in a questioning circle

with microbial mat samples, viewed a video on microbial communities (From Bacteria to Biosphere), and discussed slides showing modern microbial mats, stromatolites and the early fossil record.

American Society for Microbiology Teacher Science Day

Lorraine Olendzenski presented a 1.5 hour workshop as part of the American Society for Microbiology Teacher Science Day in College Park, MD. Hands on activities included a questioning circle using microbial mat samples, and the "What is Life?" activity from the Educator Resource Guide. An overview of the NAI, MBL Astrobiology research and education activities, and the micro*scope Web resource in microbial diversity was also presented.

National Association of Biology Teachers

Lorraine Olendzenski demonstrated the micro*scope Website at the National Association of Biology Teachers Annual Convention. Demonstrations were held continuously in the exhibit hall, at the Astrobiology section of the NASA Education booth.

Teacher Course: Current Topics in Ocean Research

Astrobiology Team members participated in a course for local Cape Cod High School teachers entitled "Current Topics in Ocean Research". We participated in a three hour module that focused on MBL Astrobiology Research, NAI educational resources and a tour of our high throughput DNA sequencing facility. Lorraine Olendzenski gave an overview of NAI and presented NAI educational resources, including micro*scope. Ashita Dhillon presented "Molecular Characterization of Sulfate Reducers from Guaymas Basin". Virginia Edgcomb gave a talk entitled "The Invisible Majority − Eukaryotic Microbes of the Deep Sea". Teachers toured the DNA sequencing facility and learned about the equipment and steps involved in template purification and DNA sequencing.

NSTA Astrobiology Short Course

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Science Fair Judging: Falmouth Academy

MBL Astrobiology Team Members Linda Amaral Zettler, Lorraine Olendzenski, Hilary Morrison and Ashita Dhillon participated as judges for the middle school science fair at Falmouth Academy. Each judged three projects and interacted with student researchers individually by discussing the completed projects.