

reform effort. This developing partnership among universities, colleges, and science education organizations is led by the Institute for Global Environmental Strategies and the Center for Educational TechnologiesTM at Wheeling Jesuit University. ESSEA's mission is to improve Earth system science education. ESSEA has developed three Earth system science courses for K-12 teachers. These online courses guide teachers into collaborative, student-centered science education experiences. Not only do these courses support teachers' professional development, they also help teachers implement Earth systems science content and age-appropriate pedagogical methods into their classrooms. The ESSEA semester-long courses are open to elementary, middle school, and high school educators. After three weeks of introductory content, teachers develop content and pedagogical and technological knowledge in four three-week learning cycles. The elementary school course focuses on basic Earth system interactions between land, life, air, and water. The middle school course stresses the effects of real-world events-volcanic eruptions, hurricanes, rainforest destruction on Earth's lithosphere, atmosphere, biosphere, and hydrosphere, using "jigsaw" to study the interactions between events, spheres, and positive and negative feedback loops. The high school course uses problem-based learning to examine critical areas of global change, such as coral reef degradation, ozone depletion, and climate change. This ESSEA presentation provides examples of learning environments from each of the three courses.

ED12B-0140 1330h POSTER

Earth System Science Online: An Innovative Course for Non-traditional Students, Offered by Hampton University

Dianne Q. Robinson¹
(Dianne.Robinson@hamptonu.edu)

Frank Kozusko¹ (Frank.Kozusko@hamptonu.edu)

Barbara H. Maggi¹ (Barbara.Maggi@hamptonu.edu)

¹Hampton University, Interdisciplinary Science Center PO Box 6142, Hampton, VA 23668, United States

Hampton University (HU), a historically black university, is currently offering an innovative online course, Earth System Science Online, for teachers, future teachers, non-science undergraduate majors, and mature non-traditional students continuing their education. Supported by NASA and offered by the Interdisciplinary Science Center at HU, this course targets students interested in an asynchronous web-based learning environment. Often these students are working adults, such as those in the HU religious studies program, or undergraduate athletes who need the flexibility of taking their courses online in the evenings. Participants of this course earn three hours of science credit either graduate or undergraduate through their online explorations of the geosphere, hydrosphere, and atmosphere. The incorporation of specific problem-based case studies, allows students to investigate weather phenomena, deforestation, and the various instruments and satellite data systems that are used to collect and analyze this data. This web-based course utilizes the unique capabilities of the web allowing students to work at a self-regulated pace and at times most convenient to their schedules. The course delivers all lectures, text readings, and course assignments online. Assignments are given on a weekly basis, and participants are expected to conduct independent research that will enrich their online experience. The nature of the web allows the students to easily integrate text and graphics into their assignments and have access to their classmate's work. Participants meet online weekly and interact as a team.

ED12B-0141 1330h POSTER

ESSEA On-Line Earth System Science Course at California State University Northridge

G. Simila¹ (gsimila@csun.edu)

N. Herr² (norm.herr@csun.edu)

K. Berry² (kenneth.berry@csun.edu)

¹Department of Geological Sciences, CSUN 18111 Nordhoff St., Northridge, CA 91330

²Department of Secondary Education, CSUN 18111 Nordhoff St., Northridge, CA 91330

The ESSEA on-line Earth System Science course at California State University Northridge has been coordinated with the Los Angeles Unified School District since 2000. We have offered the three educational modules (K-4, 5-6, 9-12), one module per semester. The teachers have utilized these courses for both credential and service credits. The impacts on the teacher's

classroom were: teachers were educated in Earth System Science (ESS) Analysis and problem-based learning, some teachers implemented the concepts and associated lesson plans, and the student's awareness of ESS improved. Our challenges have included the strategies for teacher recruitment, participation, and retention. The high school module has been incorporated into a course for the geology option in secondary teaching. The geology students have developed an ESS module for the 1994 Northridge earthquake. The course has related connections to our California Science Project and Eisenhower/ Improving Teacher Quality program for in-service teachers, and the new California science standards.

ED12C MCC: 3012 Monday 1340h

Polar Attraction: Linking Polar Science With Education and Outreach I (joint with C)

Presiding: S L Pfirman, Barnard College, Columbia University; R E Bell, Lamont-Doherty Earth Observatory

ED12C-01 1345h INVITED

Writing About Polar Regions for the General Public

Gabrielle Walker (011 44 7968 065698; gabrielle.walker@rbi.co.uk)

New Scientist, 151 Wardour Street, London W1F 8WE, United Kingdom

The Earth's polar regions hold an extraordinary attraction for members of the general public. In recent years, tales of polar exploration and derring-do have come to the public's attention through films, documentaries, novels and biographies of the early explorers. But the modern scientific exploration of Antarctica and the Arctic remains much less accessible to the lay public, and is often relegated by newspapers and magazines to disaster stories for instance the discovery of a hole in the ozone layer over Antarctica, the disintegration of polar ice shelves because of global warming or even tragic accidents involving scientists themselves. As Features Editor of New Scientist, I visited Antarctica twice under the NSF science media program and made several research trips to the Arctic, each time writing magazine pieces about my experiences for the public. I have also recently published a popular book "Snowball Earth" about ancient ice, aimed at the intelligent lay person. I will discuss several different writing approaches for integrating descriptions of scientific research with the romance of Antarctica and the Arctic, in order to stimulate the imagination of lay people who are afraid of science, but ready to be captivated by ice.

ED12C-02 1405h INVITED

A Journalist's View From the Bottom of the Earth

Richard Harris (202 513-2786; rharris@npr.org)

National Public Radio, 635 Massachusetts Ave, NW, Washington, DC 20001, United States

Each year, a few journalists travel to Antarctica under the aegis of the National Science Foundation, to report about research at the ends of the earth. National Public Radio science correspondent Richard Harris took that trip in November, 2000. Listeners, readers and viewers are fascinated by exotic locales, so a trip to the ice provides an ideal backdrop to report on topics such as limnology and glaciology, which are otherwise unlikely to make the news. Journalists have to be flexible and creative - just as the researchers do - to overcome constraints imposed by weather and logistics. In this case, a trip to the West Antarctic Ice Sheet was canceled at the last minute and replaced with a trip to study the chemistry of an icebound lake in the McMurdo Dry Valleys. But the essential ingredient for a compelling story remained the same: Scientists, willing to endure hardship to pursue their passion.

ED12C-03 1425h INVITED

The Marketability of Mass Media: Why Newspaper Readers in Texas Want to Hear About Polar Research

Alexandra Witze (214-977-8347; awitze@dallasnews.com)

Dallas Morning News, P.O. Box 655237, Dallas, TX 75265, United States

Stories about exploration and adventure play well in any market, even if they are about science, a topic traditionally loathed by journalists. In April 2003 I traveled with the National Science Foundation to cover research activities at the North Pole Environmental Observatory. Surprisingly, audiences in the Southwest couldn't get enough of hearing about researchers from the Northwest drilling holes in the ice at the ends of the earth. I discuss the challenges of gathering stories in a polar environment, the reaction from the general public, and ways to increase the visibility of earth sciences in the mass media.

ED12C-04 1445h INVITED

The Role of Science Museums in Polar Outreach and Education

Mary Miller¹ (415-561-0347; marym@exploratorium.edu)

Paul Doherty¹ (pauld@exploratorium.edu)

Noel Wanner (noelw@exploratorium.edu)

¹Exploratorium, 3601 Lyon Street, San Francisco, CA 94123, United States

Research sponsored by NSF and other funding agencies in the Antarctic and Arctic are the equivalent of NASA's space program. The public is fascinated by the exotic landscape, the hardship and adventure facing scientists who work in extreme environments, and the remote, inaccessible locations. To take maximum advantage of the potential for public outreach, scientists and funders must increase access and the flow of information to media and schools as well as institutions involved in public science education, such as science museums. The Exploratorium, an interactive science museum in San Francisco, received support from the Artists & Writers program of the Office of Polar Programs, NSF, for a 6-week webcast expedition to Antarctica in 2001/2002. Science Producer Mary Miller will describe the project Live from Antarctica: Scientific Journeys from McMurdo to the South Pole. The project involved daily live Internet broadcasts to the museum floor and out on the World Wide Web and an extensive website and museum activity center.

URL: <http://www.exploratorium.edu/origins/antarctica>

ED12C-05 1505h

Integrating Research and Education in NSF's Office of Polar Programs

Robert A Wharton¹ (rwharton@nsf.gov)

Renee D Crain¹ (rcrain@nsf.gov)

¹National Science Foundation National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230, United States

The National Science Foundation invests in activities that integrate research and education, and that develop reward systems to support teaching, mentoring and outreach. Effective integration of research and education at all levels can infuse learning with the excitement of discovery. It can also ensure that the findings and methods of research are quickly and effectively communicated in a broader context and to a larger audience. This strategy is vital to the accomplishment of NSF's strategic goals of ensuring a world-class science and engineering workforce, new knowledge across the frontiers of science and engineering, and the tools to get the job done efficiently and effectively. The NSF's Office of Polar Programs sponsors educational projects at all levels of learning, making full use of the variety of disciplinary and interdisciplinary studies in the polar regions to attract and invigorate students. An array of efforts from the Arctic and Antarctic scientific communities link research activities with education. There has been an advance from the beneficial but isolated impacts of individual researcher visits to K-12 classrooms to large-scale developments, such as field research experiences for teachers and undergraduate students, online sharing of polar field experiences with rural classrooms, the institution of interdisciplinary graduate research programs through NSF initiatives, and opportunities for minority and underrepresented groups in polar sciences. The NSF's criterion for evaluating proposals based upon the broader impacts of the research activity has strengthened efforts to link research and education, resulting in partnerships and innovations that infuse research into education from kindergarten through postdoctoral studies and reaching out to the general public. In addition, the Office of Polar Programs partners with other directorates at NSF to broaden OPP's efforts and benefit from resources and experience in the Education and Human Resources Directorate, the Geosciences Education program, the Environmental Research and Education program and others. This presentation will provide an overview of the direction of science education in the Office of Polar Programs and highlight some important and long-lasting ventures. It is intended to encourage the Arctic and Antarctic scientific communities to look for additional avenues to bridge their research with education.

ED12C-06 1520h

Frigid air and frozen oceans: Educational outreach opportunities in Arctic ocean-ice-atmosphere research

Donald K Perovich¹ (603-646-4255;
donald.k.perovich@crrel.usace.army.mil)

Louis A Codispoti² (codispoti@hpl.umces.edu)

Jane Hawkey² (hawkey@hpl.umces.edu)

¹ERDC-CRREL, 72 Lyme Road, Hanover, NH 03755, United States

²Center for Environmental Center for Environmental Science (UMCES, Horn Point Laboratory, Cambridge, MD 21613, United States

Arctic research provides a marvelous venue for educational outreach activities. The polar regions, with snow and ice, months-long winter nights and summer days, and marine mammals such as seals, whales, and polar bears, has an intrinsic sense of adventure and interest. This interest provides an entry point for educational outreach activities, but does not guarantee success. Arctic researchers studying ocean-ice-atmosphere interactions have used a myriad of techniques for educational outreach activities: web sites, classroom visits, lectures, news articles, and e-mail correspondence from the field. One such web site, <http://arcsoaii.hpl.umces.edu/outreach.htm>, has been developed as a clearinghouse for researchers to share ideas, strategies, and techniques. For K-12 outreach, developing an ongoing effort with several classroom visits over the school year, is particularly effective. Classroom visits with brief lectures, replete with pictures, followed by an experiment or activity make it relatively straightforward to convey the enthusiasm and excitement of polar research. A more difficult task, however, is to integrate outreach activities into the curriculum. Collaborating with teachers is essential to achieve this integration. In public lectures, it is productive to first capture the audience's attention by describing what it is like to work in the polar regions, then discuss the science. It is important to distill the science to one or two key concepts and present them clearly and concisely. A recurring theme was that not only were outreach activities fun and satisfying, but they also enhanced the researchers understanding of the material.

ED12D MCC: 3012 Monday 1600h

Astrobiology Education: Bridging the Gap Between Scientists and Educators (joint with B, P)

Presiding: D M Scalice, NASA

Astrobiology Institute; **K Wilmoth,**
NASA Astrobiology Institute

ED12D-01 1625h

Real Science for Real Science Teachers: Providing Astrobiology Science Content and Contemporary Pedagogy for Today's Educators Online

Erika G Offerdahl¹ (520-626-9480;
eofferdahl@as.arizona.edu)

Edward E Prather¹ (520-626-9480;
eprather@as.arizona.edu)

Timothy F Slater¹ (tslater@as.arizona.edu)

¹University of Arizona - Department of Astronomy, 933 N Cherry Ave, Tucson, AZ 85721, United States

As teachers strive to improve the way science is taught in the classroom, many are turning to the interdisciplinary science of astrobiology as a way integrate inquiry effectively in the science classroom. However, it is generally recognized that teachers do not often have easy access to understandable and usable cutting-edge science to enrich their science lessons. Through the generous support of the NASA Astrobiology Institute (NAI), middle and high school teachers have the opportunity to learn current and provocative scientific results within the context of astrobiology as well as receive training in pedagogically sound methods of incorporating astrobiology appropriately in the classroom. In Astrobiology for Teachers, a 15-week on-line distance learning course co-sponsored by NAI, the National Science Teachers Association (NSTA) Professional Development Institute, National Teachers Enhancement Network (NTEN), Montana State University, and the Department of Astronomy at University of Arizona, teachers engage in a virtual classroom facilitated by an integrated teaching team of educators and scientists using a standards-based, inquiry curriculum. The collaborative nature of the course encourages, demonstrates, and enhances a professional exchange among scientists

and educators which, in turn, fosters implementation of innovative science teaching in today's classroom.

URL: <http://shiraz.as.arizona.edu>

ED12D-02 1630h

The Challenges of Collaboration Across Professional Cultures

Lisa Faithorn (650-604-4251;
lfaithorn@mail.arc.nasa.gov)

NASA Astrobiology Institute, NASA Ames Research Center Mail Stop 340-1, Moffett Field, CA 94035, United States

I currently work as a cultural anthropologist researching and facilitating collaboration among members of a scientific "virtual institute." The NASA Astrobiology Institute (NAI) is focused on establishing a "culture of collaboration" that encourages and supports productive exchange among those representing a variety of disciplines who are pursuing key questions in the field of astrobiology. Within the context of NAI, interdisciplinary collaboration is important not only between those with expertise in the specific sciences that are part of the astrobiological research arena. Also very important is collaboration between these scientists and the educators who are striving to bring deeper awareness of and knowledge about astrobiological research findings to students of all ages and to the general public. As a member of this panel, I will offer an anthropological perspective on the diverse challenges that are associated with bridging across disciplinary, as well as geographical and institutional boundaries, and discuss the steps that are necessary to the development and maintenance of an effective culture of collaboration. Specific emphasis will be on the challenges that must be addressed in order to create effective collaborative relationships between those immersed in different professional cultures.

ED12D-03 1635h

Educators Experiencing Research - Benefits for the Classroom

Joyce Stark (509-837-2601;
jepstark@sunnyside.wednet.edu)

Sunnyside High School, 1110 S. 6th Street, Sunnyside, WA 98944, United States

I have been involved with two Planetary Society geology expeditions looking for evidence of asteroid impacts. We worked in Belize and Italy with teams of international scientists from various scientific fields. Through the REVEL program, I spent two weeks onboard the RV Atlantis studying hydrothermal vents off the coast of Washington. I worked with an interdisciplinary team of scientists and graduate students and was involved in designing my own research project. As an educator I have designed activities for my students which were based on these research experiences. My students became aware of the type of science taking place in this "cutting-edge" research. I have learned to work in a team and have encouraged my students to work in that manner as well. The contacts that I have made have provided sources of information, borrowing equipment and other research opportunities. This research experience also supports my high school research science program.

ED12D-04 1640h

Scientist - Educator Partnerships

Edna DeVore (650-960-4538; edevore@seti.org)

SETI Institute, 2035 Landings Drive, Mountain View, CA 94043, United States

Science is the quest for knowledge about the natural world, and scientists are often characterized as driven by curiosity and the desire to discover, traits they share with children exploring the world through youthful eyes. In contrast, formal science education at the pre-college and college levels frequently distills the joy of scientific research and discovery into a body on known facts, laws, and disciplinary studies, losing the excitement of doing science. When scientists partner with teachers and other educators, there is an opportunity for engaging students and the public with scientists and their research projects. Further, scientists provide expertise to create up-to-date and accurate materials for use in classrooms, science centers, and youth groups. Scientists also see engagement with teachers, students, and the public through science centers as a means of growing the next generation of scientists to continue the work. Often this process is facilitated by science education professionals who work at the interface between the worlds of scientific research and formal and informal education. The partnership between the research scientist and the science education professional can result in improved science education for a broad community of teachers, students and the public.

ED12D-05 1645h

NASA Astrobiology Institute Scientist/Educator Bridges

Kristina L. Wilmoth (1-650-604-6137;
Kristina.L.Wilmoth@NASA.gov)

NASA Astrobiology Institute, MS 240-1 NASA Ames Research Center, Moffett Field, CA 94035, United States

NASA has engaged in many educational programs and projects, and one major focus of the Office of Space Science's priorities in establishing education and public outreach (E/PO) programs has been the inclusion of scientists in those efforts. However, the construction of scientist/educator teams remains a major challenge in NASA education efforts. The NASA Astrobiology Institute (NAI) seeks to build bridges between these two professions in ways that are respectful of the expertise of each in bringing astrobiology content to K-12 classrooms. Several of the NAI's Lead Teams, collaborative interdisciplinary research groups pursuing core questions in astrobiology and providing education and training, include teachers and other experts in education to focus their E/PO efforts while also integrating the unique scientific expertise of their teams. This approach is not without its challenges and difficulties. Communication, accuracy, inclusion, funding, and the larger science education reform efforts are among them. There is tremendous work to be done in the arena of winning mutual respect and inclusion of both scientists and educators in providing NASA content to K-12 audiences. NAI is engaged in a series of attempts through the venues of both science and education conferences where such understanding may be built. This panel discussion represents one of these efforts.

URL: <http://nai.arc.nasa.gov>

ED12D-06 1650h

The Role of Scientists in Science-Educator Partnerships

Cherilynn A Morrow (720 974 5828;
camorrow@colorado.edu)

Space Science Institute, 4750 Walnut Av, Suite 205, Boulder, CO 80301, United States

Vital to meeting the need for improved science education is the involvement of scientists in collegial partnership with science educators in both formal and informal settings. This is especially true in Astrobiology where the multi-disciplinary nature of the realm provides both educational opportunities and challenges. This paper will address barriers and pathways to successful scientist participation in educational partnerships through a collection of concrete examples of astrobiologists in education.

URL: <http://www.spacescience.org>

ED12E MCC: 3012 Monday 1700h

Bringing Extrasolar Planets to Teachers, Students, and the Public (joint with P, PA)

Presiding: E K DeVore, SETI

Institute; **A Gould,** Lawrence Hall of
Science, University of California,
Berkeley

ED12E-01 1700h INVITED

Discovering New Worlds

Debra Ann Fischer (415-338-1697;
fischer@stars.sfsu.edu)

San Francisco State University, 1600 Holloway Dept Physics and Astronomy San Francisco State University, San Francisco, CA 94132, United States

Since 1995, more than 100 planets have been discovered orbiting nearby stars. I will present an overview of what we've learned and speculate about exciting discoveries on the horizon. Many classroom projects have been developed to teach astronomy at the middle school through high school level. I will highlight a few favorite projects that provide a good foundation for understanding key concepts. Examples of projects using data from our website will also be presented.

URL: <http://exoplanets.org>