Sally Ride Science/NSTA Symposium: From Astrobiology to Zoology: Igniting Students' Interests in Science Careers
Saturday, March 29, 2008

1:30 PM – 1:55 PM

Welcome, Introductions, Goals for the Symposium

Al Byers, Assistant Executive Director of Government Partnerships and e-Learning, NSTA
Flavio Mendez, Symposia and Web Seminars Director, NSTA

- About NSTA Symposia
- Agenda/Goals
- Forms/Logistics/Introductions

Dr. Tam O'Shaughnessy, Executive Vice President of Content, Sally Ride Science
Brenda Wilson, Vice President of Content and Out-of-School Programs, Sally Ride Science
Jim Brown, Master Science Teacher, Sally Ride Science
Julie Miller, Master Science Teacher, Sally Ride Science

1:55 PM – 2:15 PM

Why Encourage Science Careers?

Dr. Tam O'Shaughnessy

Learning Outcomes:

After participating in the presentation and activity,

- Participants will list three reasons explaining why it's important for all students to have a solid background in science and math.
- Participants will give reasons why boys and girls interest in science wanes as they grow older—and girls in numbers greater than boys, though they have equal interest and aptitude in science and math when they are young.

2:15 PM – 2:30 PM

What Do Scientists Look Like?

Brenda Wilson and Jim Brown

Learning Outcomes:

After participating in the presentation and activity,

- Participants will describe three examples of women and men of different backgrounds who are engaged in science and engineering.
- Participants will discuss science as a human endeavor—and list at least three basic human skills that the work of scientists depends (e.g., creativity, teamwork, open-mindedness, and reasoning.)
- Participants will describe three common misconceptions students have about who scientists are and what scientists do.

2:30 PM – 3:25 PM

A Framework for Igniting Interest in Science Careers

Dr. Tam O'Shaughnessy and Julie Miller

Learning Outcomes:

After participating in the activity,

- Participants will describe the four parts of the framework for igniting students' interests in science and science careers.

- Participants will discuss two ways to implement each part of the framework for igniting students' interests in science.
- Participants will compose a list of a diverse set of science careers to illustrate the wide range of science careers available to their students.
- Participants will describe what happens when carbon dioxide from the air dissolves in the ocean.
- Participants will describe how to embed science career investigations into science discussions or activities.

3:25 PM – 3:40 PM
Break

3:40 PM – 4:50 PM
Helping Students Get to Know Themselves
Brenda Wilson, Jim Brown, and Julie Miller
Learning Outcomes:
After participating in the presentation and activity,

- Participants will list three ways they can help students discover personal characteristics.
- Participants will list three things that students can learn about themselves through doing hands-on science.
- Participants will communicate the process of technological design, identify problems for technological design, and design a solution(s).

4:50 PM – 5:15 PM
Map Out Your Future
Brenda Wilson and Jim Brown
Learning Outcomes:
After participating in the activity,

- Participants will describe ways to guide students in thinking about their interests and mapping out their goals (coursework, extracurricular activities, tentative college majors, etc).

5:15 PM – 5:35 PM
How Will You Use This in Your Classroom?
Jim Brown and Julie Miller
Learning Outcomes:
After participating in the presentation and activity,

- Participants will develop specific ways to incorporate ideas from this symposium into their classrooms.

5:35 PM – 6:00 PM
Final Words

- Post-assessment form
- Evaluation form/Survey/Credit info
- NSTA Web Seminars
- Drawing of door prizes

National Science Education Standards Addressed:
Content Standards, 5-8

Content Standard A:
Science as Inquiry
As a result of activities in grades 5-8, all students should develop

- Abilities Necessary to do Scientific Inquiry
  - Identify questions that can be answered through scientific investigations.
  - Design and conduct a scientific investigation.
  - Use appropriate tools and techniques to gather, analyze and interpret data.
  - Develop descriptions, explanations, predictions and models using evidence.
  - Think critically and logically to make the relationship between evidence and explanations.
  - Recognize and analyze alternative explanations and predictions.
  - Communicate scientific procedures and explanations. Use mathematics in all aspects of scientific inquiry.
- Understandings About Scientific Inquiry
  - Different kinds of questions suggest different kinds of scientific investigations.
  - Current scientific knowledge and understanding guide scientific investigations.
  - Mathematics is important in all aspects of scientific inquiry.
  - Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.
  - Evidence, logical arguments, scientific principles, models, and theories. The scientific community accepts and uses such explanations until displaced by better scientific ones. When such displacement occurs, science advances.
  - Science advances through legitimate skepticism.
  - Scientific investigations sometimes result in new ideas.

Content Standard B:
Physical Science
As a result of their activities in grades 5-8, all students should develop an understanding of

- Properties and Changes of Properties in Matter
  - A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances often can be separated into the original substances to form new substances (compounds) with different characteristic properties. In chemical reactions, the total mass is conserved. Substances often are placed in categories or groups if they react in similar ways; metals are an example of such a group.
  - Chemical elements do not break down during normal laboratory reactions. There are more than 100 known elements that combine in a multitude of ways to produce compounds, which account for the living and nonliving substances that we encounter.
- Motions and Forces
  - The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.
  - An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.

- If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in the speed or direction of an object's motion.

Content Standard C:
Life Science
As a result of their activities in grades 5-8, all students should develop understanding of

- Populations and Ecosystems
  - A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.
  - Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some micro-organisms are producers—they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.
  - For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.
  - The number of organism an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

- Diversity and Adaptations of Organisms
  - Millions of species of animals, plants, and microorganisms are alive today. Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry.
  - Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in enhance survival and reproductive success in a particular environment.
  - Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the earth no longer exist.

Content Standard E:
Science and Technology
As a result of their activities in grades 5-8, all students should develop the ability to

- Abilities of Technological Design
  - Identify appropriate problems for technological design.
  - Design a solution or product.
  - Implement a proposed design.

  - Evaluate completed technological designs or products.
  - Communicate the process of technological design.
- Understandings About Science and Technology
  - Scientific inquiry and technological design have similarities and differences. Scientists propose explanations for questions about the natural world, and engineers propose solutions relating to human problems, needs, and aspirations. Technological solutions are temporary; technologies exist within nature and so they cannot contravene physical or biological principles; technological solutions have side effects; and technologies cost, carry risks, and provide benefits.
  - Many different people in different cultures have made and continue to make contributions to science and technology.
  - Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity, distance, location, size, and speed. Technology also provides tools for investigations, inquiry and analysis.
  - Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.
  - Technological designs have constrains. Some constrains are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.
  - Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.

Content Standard G:
History and Nature of Science
As a result of their activities in grades 5-8, all students should develop understanding of

- Science as a Human Endeavor
  - Women and men of various social and ethnic backgrounds--and with diverse interests, talents, qualities, and motivations--engage in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.
  - Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity—as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.
- Nature of Science
  - Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. Although all scientific ideas are tentative and subject to change and improvement in principle, for most major ideas in science, there is much experimental and observational confirmation. Those ideas are not likely to change greatly in the future. Scientists do and have changed their ideas about nature when they encounter new experimental evidence that does not match their existing explanations.

- In areas where active research is being pursed and in which there is not a great deal of experimental or observational evidence and understanding, it is normal for scientist to differ with one another about the interpretation of the evidence or theory being considered. Different scientists might publish conflicting experimental results or might draw different conclusions from the same data. Ideally, scientists acknowledge such conflict and work towards finding evidence that will resolve their disagreement.
- It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists. Evaluations include reviewing the experimental procedures, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternatives explanations for the same observations. Although scientists may disagree about explanations of phenomena, about interpretations of data, or about the value of rival theories, they do agree that questioning, response to criticism, and open communication are integral to the process of science. As scientific knowledge evolves, major disagreements are eventually resolved through such interactions between scientists.

- History of Science
  - Many individuals have contributed to the traditions of science. Studying some of these individuals provides further understanding of scientific inquiry, science as a human endeavor, the nature of science, and the relationships between science and society.
  - In historical perspective, science has been practiced by different individuals in different cultures. In looking at the history of many peoples, one finds that scientists and engineers of high achievement are considered to be among the most valued contributors to their culture.
  - Tracing the history of science can show how difficult it was for scientific innovators to break through the accepted ideas of their time to reach the conclusions that we currently take for granted.