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REACTIONS

FROM THE AMERICAN NUCLEAR SOCIETY TO TEACHERS INTERESTED IN THE NUCLEAR SCIENCES

Observing the World Year of Physics 2005

Consider Special Activities in Your Classroom

In 1905, a young physicist, who was working as a patent clerk because he hadn't found a job teaching science, published a number of papers – papers that reshaped our notions of time and space and laid the foundation for the most famous equation in science. For Albert Einstein, 1905 was certainly a year where he had a "hot streak."

A century later, it is appropriate that 2005 has been declared the *International Year of Physics* by the United Nations, designated as the *World Year of Physics* by the International Union of Pure and Applied Physics, and designated as *Einstein Year* by some countries. This year-long observation is being marked by cultural and scientific events that promote physics.

This special year will provide science teachers with a unique opportunity to celebrate the genius and inspiration of this identifiable individual. (Einstein's image is familiar even though students may not realize WHY he is important.)

More importantly, WYP2005 will give every teacher an opportunity to help students understand the important role physics plays in our daily lives.

Content taught in most science classes will provide some outstanding opportunities to identify and highlight the role of physics. There is the possibility of a special lesson or two focusing on how physics is integral to your subject matter and has a significant impact on our daily lives.

If you are not sure how you might do that, help is available.

A web site titled *World Year of Physics 2005, Einstein in the 21st Century* is available at http://www.physics2005.org/ This site provides access to a collection of information and resources. It contains event ideas for the community, for teachers, and for physicists and physics departments. The site also lists a collection of WYP projects and classroom projects.

Einstein Year 2005 is the name given by the UK and Ireland for their celebration of this special year. At http://www.einsteinyear.org/ you can hear Einstein's voice, play a computer game, and learn more about Einstein Year as it will be observed in UK and Ireland.

Looking for a list of reasons the students should care about physics? A web site offered by Eisenhower National Clearinghouse provides a unique list that includes: airplanes, baseballs, cell phones, digital cameras, electricity,

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Resources Available to Help Teach About Engineering

In our modern world, engineers play some role in virtually everything we touch, wear, eat, see and hear. Engineers help design the buildings in which we live and work, make changes to food before it reaches us in the supermarket, design the rides at amusement parks, create the highways on which we travel, design our automobiles, make contributions to the sounds we listen to on radio or CD, help assure quality images on our TV sets and computers, etc.

There are many career opportunities in engineering. Students can pursue their interests in any branch of engineering – civil, electrical, automotive, materials, industrial, aeronautical, chemical, mechanical, nuclear, and other specialized areas.

Due to a shortage of new engineers, some engineering specialties, such as nuclear engineering, have developed programs that reach out to inform students about career opportunities.

If students don't understand the role of engineers, they aren't likely to consider engineering as a career option. Students should learn that although science and math are crucial to engineering, science and engineering are different. Scientists study and investigate things that already exist; engineers are involved in creating new things that haven't been seen or didn't exist before.

Statistics show that women and minorities are under-represented in engineering. So, some special efforts may be required to assure that these groups learn of the challenges and rewards of the engineering profession and are encouraged to pursue a career there.

The challenge for teachers is how to craft lessons and experiences that will reveal the career opportunities available and give students a clear sense of the engineering process. You don't have to be an engineer to accomplish those two goals. Fortunately, too, help is readily available.

Engineering is Elementary

Teachers of elementary or middle school may be interested in "Engineering is Elementary" (EIE) story books from the Museum of Science, Boston. Each storybook is narrated by a child character from a different country or racial/ethnic background. By interacting with an adult who is an engineer, the child character explores one field of engineering. Readers are encouraged to take part in an activity which relates to the field of engineering being explored. The Museum is planning to

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World Year of Physics 2005

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golf balls, kites, lasers, microwave ovens, plasma TV screens, and virtual reality. Visit the site at http://www.enc.org/features/calendar/unit/0,1819,268,00.shtm
You will find links to Classroom Calendar entries; each entry provides information and additional web links. The links include references to the slinky, the frisbee, and several notable physicists.

The Libraries of the University of Buffalo have produced an interesting web exhibit, "Albert Einstein and the World Year of Physics 2005." It is filled with links to a wealth of information available on the web. Visit the site at http://ublib.buffalo.edu/libraries/asl/exhibits/einstein

At http://www.bnl.gov/bnlweb/pubaf/WYoP/, Brookhaven National Laboratory has a page about its observance of the WYP. The page includes a tour of physics discoveries made at Brookhaven.

To find more resources, you can simply type "World Year of Physics" into your web browser's search function and find additional information. ■

In 1999, *Time* magazine listed Einstein in The Time 100. You can read the profile they printed at http://www.time.com/time/time100/scientist/profile/einstein.html

Space/Biology/Medicine

Astronauts' Children Unlikely to Inherit Cosmic Ray-Induced Genetic Defects

Earth's atmosphere and magnetic field prevent most cosmic rays from reaching earth. Cosmic rays can cause more severe cell damage than X-rays and gamma rays and are thus more likely to result in gene mutations or cancer. Astronauts, traveling beyond these protections, may be at risk for serious health risks.

Brookhaven National Laboratory biophysicist Richard Setlow and collaborators set out to investigate how cosmic-ray exposure of astronauts might affect their future offspring. The researchers used Medaka fish. These small fresh-water fish are native to Japan, South Korea, and China. Male Medaka fish were exposed to one of two types of high energy nuclei – either iron or carbon – to simulate cosmic rays.

After exposure, the males were mated to non-exposed females. Embryos were collected for several months and studied under a microscope. The Medaka fish were particularly suited to this study because the covering for the embryos is clear, making it possible to observe mutations visually within a few days of fertilization.

Researchers looked for signs that the sperm cells of the fish had been damaged. They noted dead embryos, which pointed to lethal mutations, and compared them to color mutations, which indicated permanent, but not lethal genetic damage. Researchers found that mutations from exposure to iron and carbon nuclei were more frequent than mutations in fish exposed to gamma rays. They also found that lethal mutations were more frequent than color mutations, indicating that sperm cells in male astronauts exposed to cosmic rays are more likely to die (causing temporary sterility) than to undergo a non-lethal mutation that could pass on to offspring. ■


Courtesy Brookhaven National Laboratory

Richard Setlow, with one type of fish he uses in his research.

For more information about the study, visit
http://www.bnl.gov/bnlweb/pubaf/pr/PR_display.asp?prID=05-43

This issue of *ReActions* available online with all URLs "hot linked" for easy access to resources — INCLUDING BONUS STORY ! Go to http://www.ans.org/pi/edu/teachers/reactions/

While there, sign up for email notification of future online issues of *ReActions*.

Get information about ANS Teacher Workshops http://www.ans.org/pi/edu/teachers/workshops/ Listings change as new workshops are scheduled.

For basic information about nuclear science and technology, visit www.aboutnuclear.org

Resources Available to Help Teach About Engineering...continued from page 1.

develop three new books each year. A press release with more information about the EIE storybooks and how to obtain them is found at http://www.mos.org/doc/1443

TeachEngineering

TeachEngineering is an effort to provide useful resources suitable for grades K-12. The site is found at http://www.teachengineering.com A digital library offers teacher-tested and standards-based engineering content for use in math and science classrooms. Materials involve hands-on activity and inquiry-based lessons. The curricula is intended to encourage and inspire students to learn math and science because they are tools needed to solve problems in the real world.

ASEE Engineering K-12 Center

The American Society for Engineering Education (ASEE) offers a web site with information for students and educators. Located at http://www.engineeringk12.org/ the site has a survey for K-12 teachers and offers "Engineering in the K-12 Classroom: An Analysis of Current Practices and Guidelines for the Future." Teachers can sign up for a free monthly e-newsletter with ideas on how to make math and science "come alive" for students.

ENC Focus

In an issue of ENC Focus, an article, that was directed toward teachers at the high school level, discussed ways to connect students to a future in engineering. It provides practical insight from a teacher at a technology academy. He describes a partnership program between the school and engineers from a local consulting company. The article contains descriptions and access information for additional materials related to engineering. (*URL below).

As you explore these resources, you will find additional materials and links to new resources. And, you can utilize classroom visits (or perhaps collaborations) by engineers in your community. You may have one or more students whose parents are engineers; they may be willing to make a classroom visit to explain their particular specialty or simply to talk about how engineers work.

Exposure to the world of engineering may help stimulate some of your students to new levels of effort in science or math. ■

*http://www.enc.org/features/focus/archive/ideas912science/document.shtm?input=FOC-003736-index

For information about careers in nuclear science and technology, visit http://www.ans.org/pi/edu/students/careers/

Nuclear Sciences

Project #70

Radioisotopes in Industry

This project/demonstration will help students understand how radioisotopes are used in industry for gauging or other uses.

Materials

- flashlight
- six sheets of paper (8? x ll inches)
- transparent glass bottle or jar
- milk or colored liquid to fill the glass bottle or jar

Procedure:

A) Lay a flashlight on a table. Darken the room and turn on the flashlight. Hold a sheet of paper in the beam of light (about one foot from the flashlight). How much light goes through the paper? Now hold two sheets of paper in the position. How much light goes through? Add sheets of paper until no light can be seen through the stack of papers.

Compare the light beam to particles or rays being given off by a radioactive isotope.

Ask students if they can explain how it might be used to gauge the thickness of metal, plastic, or paper coming from a manufacturing plant. *[When the capability of a particular radioactive emission to penetrate a substance (metal, plastic, paper, etc.) is known, the amount of that emission that can penetrate a sample of the material can be used to determine the thickness of that particular sample.]*

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Teacher Resources

Science Training Program Directory on Web

Science Service Inc. offers an online catalog of enrichment programs in its Science Training Programs Directory for Teachers and Students (STP). The STP provides listings for pre-college students and teachers on its site at www.sciserv.org/stp

Training programs listed in the directory cover a variety of scientific disciplines and are offered at a variety of institutions. The site allows visitors to search programs by location, grade level, type of assistance and special groups. ■

Lesson Plan Ideas Online

Thinking of a creative new way to present subject content information to your students is an ongoing challenge. When you need help or just seek some stimulation., you might try visiting an internet site that presents the shared experience of many teachers.

At www.lessonplanspage.com you will find access to more than 2500 free lesson plans in a wide variety of topics.

At www.discoveryschool.com you will find lessons plans, teaching tools, and information about relevant TV programs. The Curriculum Center on that page promises activities, worksheets, puzzles, quizzes and more for science teachers.

At www.edhelper.com you will find a variety of lesson plan ideas arranged by topics.

Of course, your expertise will enable you to adapt whatever lesson plans you find to meet the needs of your students and to best utilize the resources you have available locally. ■

New Website Provides Textbook Reviews

The Environmental Literacy Council (ELC) has announced a new website to help educators choose science textbooks. The Council's focus is to foster environmental literacy and the website is a part of that effort. The new site is http://sciencetextcentral.org/

Scientists will play a role in the reviews by examining books for scientific accuracy; teachers will review for effectiveness as teaching resources. Teachers may post their reviews based on experience using the textbooks.

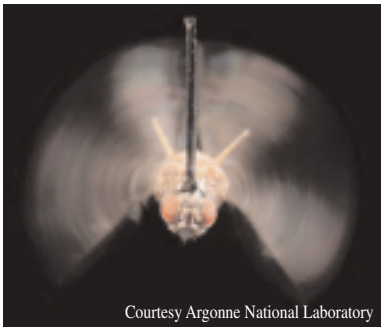
ELC is an independent, non-profit organization dedicated to improving the knowledge of K-12 teachers in environment-related sciences. You can learn more about ELC at www.enviroliteracy.org ■

ENC Online Offers Resources

ENC Online is a valuable resource for K-12 math and science teachers located at http://www.enc.org It is a service of the Eisenhower National Clearinghouse for Mathematics and Science Education, located at The Ohio State University.

Each week, ENC FOCUS highlights a topic for math and science teachers. It is found at http://www.enc.org/focus/ There is an archive of past issues at http://www.enc.org/features/focus/archive/ A special feature focusing on Classroom Ideas for Science, 5-8 is available at http://www.enc.org/features/focus/archive/ideas58science/ Another special feature focusing on Classroom ideas for Science, 9-12 is available at http://www.enc.org/features/focus/archive/ideas912science/ ■

X-Ray Images of Flies' Wing Muscles May Contribute to Medical Research



Courtesy Argonne National Laboratory

X-Ray images capture tethered fruit fly in flight.

Brilliant X-rays from the Advanced Photon Source at Argonne National Laboratory and a "virtual reality flight simulator" for flies have combined to help researchers investigate how the flies' muscles are able to generate sufficient power for flight.

How the wing muscles of flying insects generate enough power to enable flight is not completely understood. Insects, unlike other animals, do not need a nerve impulse for every muscle contraction; their muscles can be stimulated by stretch. It has been a mystery how these "stretch-activated muscles" are turned on and off at high speed – as quickly as 5/1,000 of a second. This means that the wings move back and forth 200 times each second.

Researchers used intense X-rays to observe changes in the crystal-like configuration of molecules responsible for generating the rapid muscle contractions. Using a resolution of 6/100,000 of a second for their X-rays and a special way of tethering the fly, researchers were able to capture X-ray images at different stages of muscle contraction.

The research uncovered unsuspected interactions of various proteins as the muscles stretch and contract. As a result, researchers are relating the muscle power to changes in molecular structure.

The ability to engineer changes in the genetics of fruit flies may make it possible to investigate more specific questions in future research.

A researcher explained that the data from the experiments suggest new ways to study cardiac muscle in other animals. The ability to genetically alter flight muscles in the flies may make it possible to use them as models for studying inherited human heart disease. ■

For more information and to see a "movie" of the fly study, visit http://www.anl.gov/Media_Center/News/2005/news050121.html

Nuclear Sciences

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B) Place a transparent glass bottle or jar on the table. Direct the light beam from a flashlight through it. Hold a piece of paper on the side of the jar or bottle that is opposite the light source. Have someone fill the bottle with milk or a colored liquid while you observe the light coming through (onto the paper, or even through the paper).

By watching the light that comes through the bottle, is it possible to determine the height of the liquid in the bottle?

Ask students to describe how radiation might be used to operate an automatic shut-off valve for a tank being filled with liquid. *[With no liquid in the tank, the radioactive emissions could easily travel from one side to another. As the tank filled, some of the emissions would (potentially) be blocked by the liquid. It would be possible to set the shut-off valve to operate when the radioactive emissions fail to penetrate or move across the tank.]*

Variation: If you have a Geiger counter and a radioactive source, you can try adapting this activity using a radioactive source rather than a beam of light. Some possible radioactive sources include: beta or gamma discs from a science supplier; a piece of red Fiestaware (which gives off alpha, beta and gamma radiation); a camping lantern mantle (with thorium in it). You will use the Geiger counter to measure the radiation that passes through either the paper or the jar. *Before utilizing this variation in class, you will need to experiment to determine what distances to use between the radiation source and the Geiger counter for observable results.* You may want to consider using **both** the light beam and the radiation sources for the demo – the visible light to provide a "model" and the radiation for a more direct demonstration. ■

Project #70 is adapted from Classroom Project #24, which appeared in an earlier issue of the ReActions Newsletter

Physics

Physics Meets the Music Room

We live in a world filled with sound. We want to enhance some sounds for our listening pleasure and sometimes we want to block out other sounds. Many physics courses deal with the basics of sound.

An interesting web page provides a place to glean new ideas and information related to sound, room construction and sound system design. At www.thesoundpage.com, a web site which was recognized by the Exploratorium, you will find a rich array of resource materials.

The creator of this page, Art Ludwig, is a retired engineer with interesting credentials (including a Ph.D. in engineering) who is also a music lover. The information ranges from detailed equations to basic considerations in building his music room. ■

Biology/Medicine —

Radiation 'Seed Therapy' Beating Prostate Cancer

A long term study has found that using radiation 'seed therapy' shows cure rates equal to, or better than, traditional surgical procedures for prostate cancer. In this treatment procedure – also called brachytherapy – surgeons implant capsules of radioactive material about the size of a grain of rice in a cancerous prostate.

The study was based on a review of data on more than 1,700 prostate cancer patients with non-metastatic disease. Of those patients, more than 80 percent were treated with brachytherapy and the rest received traditional surgery.

According to the study, the cure rate for high-risk patients was 88 percent for those treated with brachytherapy, compared with 43 percent for those receiving traditional prostatectomy surgery.

A recent poll of urologists found that the percentage performing brachytherapy rose from 16 percent in 1997 to 56 percent by 2003. ■

For more information, see http://www.healthcentral.com/newsdetail/408/524428.html

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Bonus Story!

Biology/History of Science

Historical Anatomies Available on Web

New developments are staples in the world of science, as are the ways we explain and visualize science content. Things as basic as anatomical illustrations have changed over the centuries.

"Historical Anatomies on the Web" http://www.nlm.nih.gov/exhibition/historicalanatomies/home.html provides access to a portion of the rich collection of high quality images from important anatomical atlases at the History of Medicine Division of the National Library of Medicine.

This web site offers internet users access to high-resolution downloadable scans of selected important images from the Library's collection which dates from the 15th to the 20th century. Images were chosen for their historical and artistic significance. The emphasis is on the images rather than text. Large JPEG files are available for download.

There is no charge for the use of images. All of the scanned works are in the public domain and may be used for publication providing proper credit is given. Details are on the site.

A more in-depth history of anatomy is found in a related online exhibition called "Dream Anatomy." That can be found at http://www.nlm.nih.gov/exhibition/dreamanatomy/index.html ■