Volume 21 • December 2005

REACTIONS

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

Plan Now for National Engineers Week in February

Add Special Activities in Your Classroom

Do your students realize the impact on their everyday lives from engineering and engineers? Do they have any idea what engineers do? Do they have any information about the wide range of engineering careers available? Have your students considered the possibility of a career in engineering? Do you help students understand how the content of their science classes has practical application?

National Engineers Week, February 19-25, 2006, will provide an excellent opportunity for you to address these issues in your classroom. Many resources are available to help teachers develop plans to celebrate engineering week. With the help of these resources, you can reveal what engineers actually do, highlight the role of engineers and engineering disciplines in modern life, and draw attention to career opportunities in the engineering field. All of these activities can help emphasize to students the practical applications of scientific knowledge and math skills.

Engineers Needed/Teachers Face Challenge

While supply of engineers and demand for them varies, depending upon economic conditions and specific fields, it is fair to say that overall demand outpaces the supply of engineers graduating from American universities. In specific fields, such a nuclear engineering, the demand for graduates significantly outpaces supply. Reports periodically indicate that other countries are more successful in attracting students to careers in engineering than the U.S. In addition, statistics show that women are under-represented in engineering. As a result, educators have a unique challenge to introduce all students, particularly girls, to the field of engineering and help them develop an understanding of what engineers do.

Resources for Teachers

Students of all ages – high school, middle school, and elementary – can be introduced to the engineering field through many experiences. National Engineering Week organizers offer teachers access to a wide range of activities, resources, and information at www.eweek.org

Teachers will be interested in the page at http://www.eweek.org/site/Teachers/index.shtml which provides links to hands-on activities, printable bookmarks, and other resources.

At http://www.eweek.org/site/DiscoverE/eweek-srch.shtml you will find an Engineering Contacts Directory. Using this, you can search to see if engineers in your area have already volunteered to assist educators during National Engineering Week.

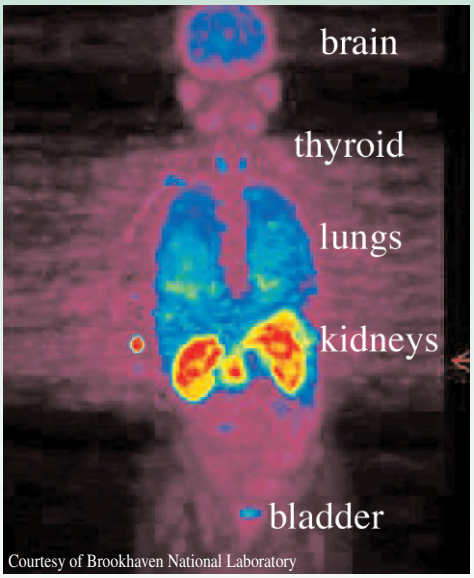
At www.discoverengineering.org, middle school students, parents and teachers will find a wealth of information about what engineers do and

...continued on page 2.

ENGINEERS WEEK® 2006
February 19-25

Biology/Medicine

PET Scan and Tracers Show Impact of Smoking on Lung Enzymes



Courtesy of Brookhaven National Laboratory

This portion of a whole-body PET Scan shows concentration of the enzyme MAO A in various body organs of a nonsmoker.

According to a study published in the September issue of the Journal of Nuclear Medicine, smoking appears to reduce a key enzyme in the lungs and may contribute to the damaging effects of smoking. The study, conducted at the U.S. Department of Energy's Brookhaven National Laboratory, used positron emission tomography (PET) scanning and a radiotracer. The study also showed that smokers had a lower concentration of the tracer in the bloodstream than nonsmokers. This has led to speculation that smokers and nonsmokers have different responses to therapeutic, anesthetic, and addictive drugs, administered by inhalation or intravenously.

Researchers used a tracer that binds to a specific form of the enzyme monamine oxidase (MAO A) to track the enzyme levels in nine smokers and nine nonsmokers. Using whole-body PET imaging, the researchers were able to measure movement and concentration of MAO A, a subtype of the enzyme crucial to mood regulation and one that breaks down chemicals that regulate blood pressure.

Scans showed that MAO A levels remained intact in peripheral organs but not in the lungs of smokers. Levels of MAO A were 50% lower in smokers lungs.

A previous study showed that, compared to nonsmokers, smokers have reduced levels of another subtype of the enzyme, MAO B, in the brain and a variety of peripheral organs.

Researcher Joanna Fowler noted a reduced rate of Parkinson's disease in smokers and a high rate of smoking among people with depression and those addicted to other substances. She said that the role played by MAO may be significant and should be investigated further.

...continued on page 3.

Classroom Ideas for Engineering Week

Investigate hands-on activities that give experience with the work of engineers. Use such activities in your classroom. OR, invite a local engineer to help you present them.

- Invite an engineer to visit your classroom. To find an engineer:
  - Contact an engineering society (see http://www.aaes.org/membership/index.asp for a list of some engineering societies) and ask for a classroom visit by an engineer who can highlight what engineers do and how they contribute to society. OR, contact the American Nuclear Society to see if a nuclear engineer is available in your area, by writing outreach@ans.org Act quickly with inquiries; arranging a classroom visit can take several weeks. Submit inquiries by January 30, 2006, or earlier!
  - Find out how many of your students have a parent who is an engineer. Invite one or several to come to your class and tell about their work.
  - Contact the engineering department of a local college or university, requesting a speaker who will talk about their engineering specialty or opportunities in engineering. (For a list of Universities with nuclear engineering programs, visit http://www.ans.org/links/index.cgi?c=edu)
- Provide your students with background information about types of engineering careers or direct them to web sites (such as http://www.ans.org/pi/edu/students/careers/ OR http://www.engineeringk12.org/students/default.htm) which provide this type of information.
- Provide students with a list of locations in your community or state which are related to engineering and encourage them to visit (See the "Sightseer's Guide to Engineering" in this issue.)
- Invite a former student who is studying engineering to talk to your current students about the engineering course work at his/her college or university and have him/her tell how to prepare for it while still in high school. ■

National Engineers Week

...continued from page 1.

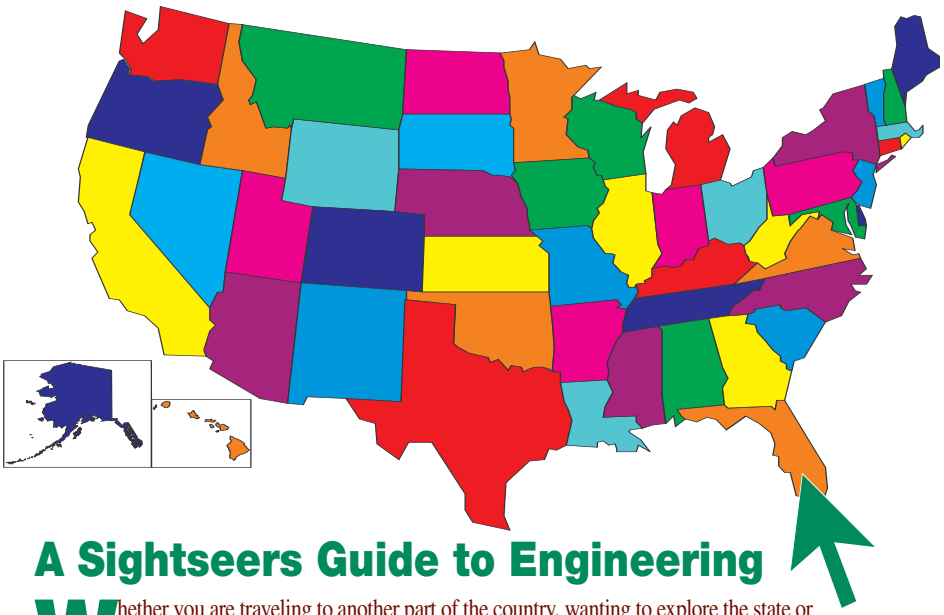
some of the major engineering specialties (see http://www.discoverengineering.org/aboutengineers.asp for a partial list of engineering specialties). There is also a collection of links to a wide range of activities.

At http://www.eweek.org/site/Engineers/zoom.shtml you will find resources for elementary students (grades 2-6) as part of ZOOM™ INTO ENGINEERING, a collaboration of National Engineers Week and the producers of the popular kids' public television show ZOOM™. Some of the materials here may refer to engineer volunteers as the anticipated presenters, but teachers may also find them useful or seek help from engineers in their community.

Nuclear Engineering Information

Information about careers in nuclear engineering is found at http://www.ans.org/pi/edu/students/careers/. Links are provided to additional information, including universities offering degrees in nuclear engineering. Additional information about nuclear Engineering, including profiles of seven nuclear engineers, is available at http://www.careercornerstone.org/nuclear/nuclear.htm ■

Visit http://www.teachengineering.com/ to access resources for teaching about engineering.



A Sightseers Guide to Engineering

Whether you are traveling to another part of the country, wanting to explore the state or region where you live, or just enjoying a virtual tour, you can find interesting and sometimes surprising information on "A Sightseer's Guide to Engineering."

This guide provides you either geographic or topical listings of interesting sites to visit and gives access to specific information about each. All sites have some connection to engineering. Visit the guide at www.engineeringsights.org You'll find listings related to architecture, agriculture, physics research, manufacturing companies with an engineering focus, and much more.

If you dig into the guide a bit, you'll even discover how the manufacturer of a "horse trough/hog scalder" became a well-known name in the bathroom/kitchen decor and design field. ■

Why focus on engineering with middle school or high school students?

- Engineers, scientists and advance-degree technologists constitute only 5% of America's workforce of 132-million, yet more than half of Americans sustained growth over the past 50 years has come from this sector.
- Less than 15% of U.S. high school students have taken the prerequisite courses to pursue a scientific or technical degree in college.
- Only 5.5% of high school seniors plan to pursue an engineering degree.
- Women account for 55% of all undergraduates, yet only 20% of engineering undergraduates.
- Women make up 46% of the total workforce, yet only 24% of the jobs in engineering, science and technology
- Approximately 10% of engineers nationwide are women. ■

Based on Information from National Engineers Week Foundation.

"Making Engineers Cool" A Searchable Database of Engineering Outreach Programs

American engineers are leaders in innovation and their work helps assure our safety, health, and economic growth. Yet, in an time when the output of engineering graduates in Asia and Europe is increasing, freshman enrollment in American undergraduate engineering has been fairly static for a number of years. University engineering educators, eager to draw more students into the pipeline, are conducting a variety of engineering outreach programs with some suitable for all parts of the K-12 population.

The American Society for Engineering Education (ASEE) has created a free, searchable database of these outreach programs. The database allows teachers to search nationwide for programs that match their needs. Listings range from lesson plans and materials for teachers to engineering summer camps for students.

The database, titled "Making Engineers Cool," is located on the ASEE web site <www.engineeringk12.org> and can be found directly at http://www.engineeringk12.org/educators/making_engineers_cool/search.cfm ■

Upcoming Workshops and Exhibits

Salt Lake City, Utah - ANS Teacher Workshop
Saturday, February 11, 2006,
7:45 AM to 5:00 PM
Full-day workshop; an introduction to the basics of radiation and nuclear science and technology, including hands-on activities.; an introduction to robotics and robotic applications. Space limited.
Pre-Registration Required;
Registration Deadline is January 27, 2005
Cost: **$25 registration fee**
(refunded upon completion)
Information and registration available at
http://www.ans.org/pi/edu/teachers/workshops/

Tucson, Arizona - ANS Teacher Workshop
Sunday, February 26, 2006, 7:45 AM to 5:00 PM
Full-day workshop; an introduction to radiation, nuclear science and technology, and their applications. Hands-on activities included. Space limited.
Pre-Registration Required;
Registration Deadline is February 13, 2006
Cost: **$25 registration fee**
(refunded upon completion)
Information and registration available at
http://www.ans.org/pi/edu/teachers/workshops/

Indianapolis, Indiana, HASTI convention
Hoosier Association of Science Teachers, Inc.,
February 8-10, 2006
ANS will have an exhibit at the conference and offer a 90-minute workshop.
Conference registration is handled by HASTI.
Information about the HASTI conference is available at
http://www.hasti.org/convention/convention.html or
http://www.hasti.org/

The list of
Teacher Workshops supported by ANS,
changes regularly, visit the site often at
http://www.ans.org/pi/edu/teachers/workshops/

PET Scan and Tracers

...continued from page 1.

For a details of the study, visit
http://www.bnl.gov/bnlweb/pubaf/pr/PR_display.asp?prID=05-84

For information about Positron Emission Tomography (PET), go to:
http://www.bnl.gov/pet/
http://www.radiologyinfo.org/content/petomography.htm
http://www.petscaninfo.com/
http://science.howstuffworks.com/nuclear-medicine2.htm
http://www.bioteach.ubc.ca/Biomedicine/LookingInsideTheBody/

Project #71

Using Paper to Teach the Half-Life Concept

Teaching the concept of half-life of radioactive materials is usually easier and more effective with some type of hands-on activity.

At many workshops conducted by ANS, we've provided experience with one or two half-life activities involving candy.

In one, licorice or a similar candy is placed on a graph paper and the height marked. Then, as progressive "half-lives" are recorded, the licorice is cut in half and its new height marked on the graph at the appropriate time.

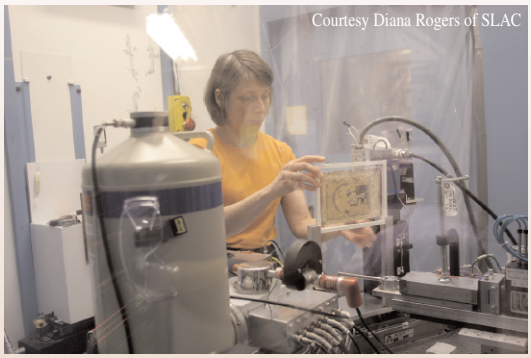
A second approach utilizes a popular brand of chocolate candy which has a hard sugar coating in a variety of colors with letters printed on one side of the candy. Each participant begins with a plastic bag containing ten candies. These are dumped out onto a surface; all candies on which the letters are showing on the top are removed, to simulate radioactive decay. A record is made of the number of candies remaining. Then the process is repeated, until all candies have been removed. At the end of the activity, the data from ten people is gathered and used to illustrate that randomness exists in radioactive decay, yet when the data is accumulated and graphed, it will show a typical half-life curve.

While these approaches are useful, some teachers either don't want to use candy in the classroom, or they are prohibited from doing so by school district rules concerning the use of food items in the classroom.

Continued next page

Eureka!
X-ray Examination Reveals Text of Archimedes Treatise

In 2005, scientists at the Stanford Linear Accelerator Center might well have wanted to shout, "Eureka!" (I have found it!), as an echo of the ancient and legendary exclamation by Archimedes. According to legend, while taking a bath, Archimedes reached a moment of insight that enabled him to solve the puzzle of whether or not the King of Sicily had been cheated by a crown-maker who might have slipped in some silver in place of gold. Then, according to the story, too excited to remember his clothes, Archimedes made that famous dash down the streets shouting "Eureka!" as he celebrated the solution he had discovered.


Courtesy Diana Rogers of SLAC

Abigail Quandt, head of book and paper conservation at The Walters Art Museum, puts a framed page of the Archimedes parchment into a holder that moves in front of the x-ray beam.

Using the x-ray light from the linear accelerator, the scientists were able to make visible for study an ancient text that had long been hidden. What they "discovered" was an early transcription of Archimedes's mathematical theories – a transcription probably copied onto parchment by a scribe in the tenth century. Unfortunately, during the twelfth century, the parchment had been rubbed or scraped down and reused as the pages for a prayer book. The resulting document, called a palimpsest (from the Greek meaning "rubbed smooth again"), made portions of the original text inaccessible.

Because Archimedes ideas are recognized as being amazingly advanced for his time, his writings are of interest. This document, called the Archimedes Palimpsest, was of importance because it is the only known source for two treatises that Archimedes developed in the 3rd Century B.C.

The Archimedes Palimpsest was previously studied using a variety of methods, including ultraviolet light (to highlight the hidden ink), in an effort to reveal evidence of the original text. Yet, twentieth-century forgeries of medieval art totally obscured portions of the pages where the original text had appeared.

When Ewe Bergman, a scientist at Stanford Synchrotron Radiation Laboratory (SSRL), learned that the original ink on the parchment contained iron he had a "Eureka!" moment of his own.

...continued on page 4.

Nuclear Sciences

Continued from page 3.

Using Paper

Here we offer the option of using a standard 8-1/2" x 11" sheet of paper that has been pre-printed to demonstrate half-life.

At http://www.ans.org/goto/phl/ you will find a page titled, Half Life of Paper. Print that page and refer to it.

Students are asked to enter the number for the day of their birth and multiply by 2000 to get a number of "radioactive atoms" with which they begin. (This illustrates that different samples have different quantities of radioactive atoms. It also allows students to work in small groups without copying from each other.)

The teacher determines a time period for the half-life (20 or 30 seconds, for example). When "half-life" is called, the students fold the paper in half at the broken line, cut or tear to separate the two parts, and record the number of radioactive atoms they would have left (in the box for first half-life).

When the next "half-life" is called, students fold the paper to separate the first half-life box from the second half-life box. Then, they tear or cut the paper in half again, and record the number of radioactive atoms remaining. The process is repeated until the seventh half life is reached..

The remaining pieces of paper can be arranged in sequence to demonstrate how the number of radioactive atoms declines with time.

During the activity, two things remain the same: the time for each half life and the fact that the paper was divided in half each time. Two things change during the activity: the number of radioactive atoms and the amount of decrease each time (amount of decrease was smaller each time). ■

Want to Avoid Typing URLs?

■ This issue of ***ReActions* is available online** with all URLs "hot linked" for easy access to resources without typing detailed web addresses. Go to **http://www.ans.org/pi/teachers/reactions**

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

Eureka! Text of Archimedese Treatise

...continued from page 3.

Bergman's work at SSRL involves measuring the extremely small concentrations of iron in proteins. He thought it would be possible to read the original test on the parchment with x-rays. As a result of his insight, curators at Walters Art Museum, where the manuscript is located, and collaborators at Stanford University decided to use synchrotron x-rays in an effort to peer through the forged art.

EUREKA!

As expected, when the x-ray light from the synchrotron, tuned to a specific energy, hits the iron pigment, the traces of iron fluoresce. Then, a special detector, set to capture the fluorescence from the iron, records the results. Where two texts overlap, the signal from the iron ink is stronger; this may enable researchers to separate the texts. ■

For detailed information about the research and how x-rays enabled the scientists to read medieval ink, visit http://www2.slac.stanford.edu/tip/2005/may20/archimedes.htm

For a delightful animation of Archimedes, information about his life and work, information about the conservation of the Archimedes Palimpsest, and the significance of the original text, as well information about The Walters Art Museum (home of the manuscript), visit http://www.thewalters.org/archimedes/index.html

To see a creative series of cartoons depicting Archimedes and his "Eureka!" moment, visit http://www.thewalters.org/archimedes/images/kaltoon/kal1.html

For information about the Stanford Synchrotron Radiation Laboratory, visit http://www-ssrl.slac.stanford.edu/

December 2005

ReActions
555 N. Kensington Avenue
La Grange Park, IL 60526-5592

Nonprofit
Organization
U.S. Postage
Paid
Permit No. 139

In This Issue:

- National Engineers Week
- Archimedes Text Revealed
- Upcoming Workshops and more...

Details Inside!

The Future is in the Atom