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Fisher Science Education holds first Teachers Workshop—see page 6.

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FISHER SCIENCE EDUCATION**HEADLINE DISCOVERIES**

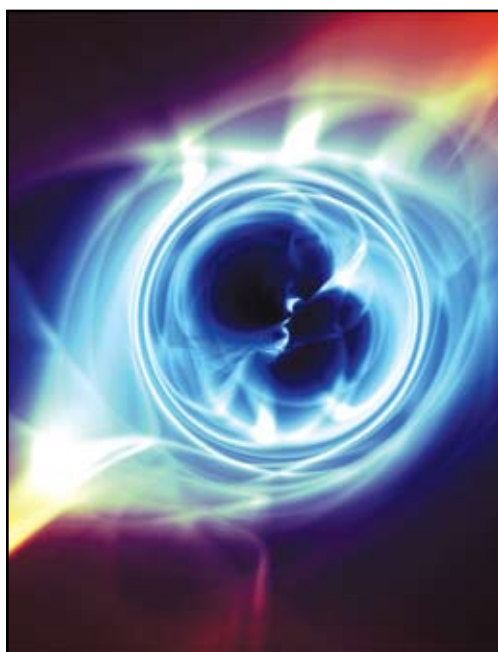
Making Science Matter®

RAISING MILLIONS OF EYES TO THE NIGHT SKIES**INTERNATIONAL YEAR OF ASTRONOMY 2009**

In 1609, an Italian physicist by the name of Galileo Galilei peered inquisitively into the eyepiece of a telescope—a crude instrument that he had created with a magnification of about 15-20X. Pointing it toward the night sky, he observed and recorded several lunar phenomena including craters and mountains on the moon, stars invisible to the naked eye, and various moons around Jupiter. Around the same time, astronomer Johannes Kepler published a lengthy, five-part document called *Astronomia nova*, which contained a ten-year long investigation of the motion of Mars.

Those achievements marked the beginning of a journey—a quest for celestial knowledge and discovery that continues to this day. To commemorate the 400th anniversary of these first recorded astronomical observations, the United Nations declared 2009 the International Year of Astronomy (IYA2009). This year-long global celebration, initiated by the International Astronomical Union (IAU) and UNESCO, held its opening ceremonies in Paris on January 15-16. It has included thousands of projects and public events at national, regional and global levels. The IAU also released a book and a movie that focus on the history of the telescope, as part of the event.

The overall vision of IYA2009 is to help people around the world to rediscover their place in the Universe through the sky, and thereby engage a personal sense of wonder and discovery. In keeping with that spirit of celestial rediscovery, let's take a look at some interesting stories in the world of astronomy, past and present...

**APOLLO TURNS 40**

This year, NASA is celebrating the 40th anniversary of the Apollo 11 mission, in which Neil Armstrong became the first human being to set foot on the surface of the moon. The Apollo program was originally set up by President Kennedy in 1961, with the objective of having the first human beings walk on the moon by the end of the decade. The first Apollo mission ended in disaster when the command module burned up and the three crew members were killed. Apollo's eighth mission orbited the moon successfully, despite a couple of close calls. After successful testing missions 9 and 10, it was time to attempt the first landing on the moon.

Finally, on July 16th, 1969, Neil Armstrong, Edwin "Buzz" Aldrin and Michael Collins took off from Cape Kennedy in Florida. Four days later, on July 20th, with millions watching the event on television, the spacecraft touched down, several miles west of their target point, with only 25 seconds of fuel remaining. As Armstrong stepped onto the lunar surface he uttered the famous words that would go down in history, stating that it was "One small step for man, one giant leap for mankind."

HUBBLE DISCOVERS THE UNIVERSE

On one notable New Year's Day, back in the "Roaring 20s," as most were recovering from their evening's festivities, a young man named Edwin Hubble stood before a group of astronomers at a Washington conference and presented a groundbreaking paper called *Cepheids in Spiral Nebulae*. It was on this day, January 1, 1925, that astronomers were officially informed that the universe had been discovered. After years of contentious debate, Hubble announced that our galaxy is not alone. How did he do it?

Using a 100-inch reflector, the largest telescope in its day, Hubble observed a pair of celestial clouds known as Andromeda and Triangulum, and focused on individual stars in the outer regions of the two mist-like clouds. Some of them turned out to be Cepheids, unique stars that dim and brighten like slow-blinking stoplights. He measured the time between blinks to calculate distance, and found something fascinating. The Cepheids were indicating that the Andromeda and Triangulum nebulae were very distant, located far beyond our galactic borders. This meant that the Milky Way, our galaxy, suddenly became just one of a multitude of galaxies in the vast expanse of space. Previous to this, our Milky Way was thought to be the entire cosmos. We knew of no quasars, no distant galaxies or exotic black holes. Hubble's discovery enlarged our vision of the universe, trillions of times over.

INTENSE HEAT KILLED WOULD-BE GALAXIES

New research suggests that our Milky Way galaxy survived a very close call – a massive "ignition" of the universe that occurred about half a billion years after the Big Bang. The findings were presented at an international conference on July 1, 2009 by scientists from Durham University's Institute for Computational Cosmology (ICC). According to their study, millions of potential galaxies failed to develop after they were exposed to intense heat from the first stars and black holes that were formed in the early universe.

While these multitudes of tiny galaxies, inside small clumps of dark matter, were blasted away by the heat, the Milky Way survived because it was already immersed in a large clump of dark matter that trapped gases inside it. The early Milky Way, which had begun forming stars, held onto the raw gaseous material from which further stars would be made. This material would otherwise have been evaporated by the high temperatures generated by the great ignition, which reached temperatures between 20,000 and 100,000 degrees centigrade.

Using computer simulations, the scientists examined the question as to why galaxies like the Milky Way have so few companion galaxies or satellites. The simulations suggested that multitudes of dark matter clumps should be orbiting the Milky Way, but they didn't form galaxies. According to Professor Carlos Frenk, Director of the ICC, the intense heat generated by the first stars and black holes evaporated gas from the small dark matter clumps, rendering them barren. He said that "only a few dozen front-runners which had a head start on making stars before the universe ignited managed to survive." Fortunately for us, the Milky Way was one of them!

NEW VOTE ON PLUTO

If you are a Pluto fan, you probably recall that fateful day back in 2006, when the International Astronomical Union (IAU) announced that Pluto was no longer a planet, and demoted it to the classification of a "dwarf planet." Since that time, there has been much debate, and a popular movement has arisen to have astronomers revisit and re-examine the classification of Pluto.

The IAU, which serves as the internationally recognized authority for assigning designations to celestial bodies, will hold its next general assembly in Rio de Janeiro, Brazil, in August 2009. Since less than four percent of the IAU's 9000 members participated in the vote to demote Pluto, many people feel that the sampling of experts was too narrow to serve as the basis for such an important decision.

First discovered in 1930, Pluto has long been admired by space enthusiasts for its unique beauty and remoteness. Small in stature, it measures about two-thirds the size of Earth's moon. (While Mercury is considered small at 3032 miles across, Pluto is tiny at only 1500 miles across.) Around 1992, astronomers discovered that Pluto is actually part of a large belt, which was later named the Kuiper Belt. This busy orbit is cluttered with over 70,000 icy objects about the size of asteroids. Astronomers began to suggest that perhaps Pluto is just another object floating along in the Kuiper Belt, and not a true planet.

To further complicate the situation, astronomers began discovering larger and larger objects in the Kuiper Belt, some of which were almost the size of Pluto. Then in 2005, an object was found, further out than the orbit of Pluto, that was estimated to be the same size, or even larger than Pluto. This body was named Eris, and was later classified, along with Pluto, as a dwarf planet.

As more and more objects are discovered in our solar system, the debate continues. Just how many planets do we have? And exactly what constitutes a "planet?" Pluto lovers can hope for a re-vote, but for now, we have in our solar system just eight planets, five dwarf planets, and some very large asteroids.

IYA2009: A GLOBAL CELEBRATION TO REMEMBER

So far, the International Year of Astronomy has been a huge success. National activities have pulled together hundreds of thousands of people in many countries for astronomy-themed events. An initiative called The Galileoscope Project is providing low-cost telescopes to thousands of people, making the skies accessible to all. The 100 Hours of Astronomy extravaganza is a planet-wide celebration involving over 100 countries and thousands of events. Dark Skies Awareness is an ongoing initiative to combat light pollution and raise awareness of the importance of deep darkness for the observation and study of the cosmos. October will see the launch of Galilean Nights, the follow-up to the 100 Hours of Astronomy presentation. The IAU and UNESCO are hoping that these and the many other events during this global celebration will help people across the world to discover the wonders of astronomy, and leave a legacy that lasts long into the future.

—Joe Giacobello

PROFILE

CHRISTA MCAULIFFE, 1948 TO 1986



The mention of Christa McAuliffe's name brings to mind both the promise as well as the hefty price of man's ambition to journey into space. Born in Framingham, Massachusetts on September 2, 1948 as Sharon Christa Corrigan, she embodied all of the ideals of NASA's much publicized Teacher-in-Space Project in the early 1980s. Most famously, she is quoted as having said, "I touch the future. I teach."

A mother of two and a veteran teacher who had worked in middle schools and junior high schools in Maryland and New Hampshire, McAuliffe joined the faculty at Concord High School in 1982. There she taught a variety of subjects in the social sciences including history, economics, law, and a self-developed course on the topic of "The American Woman". In a very short time, she built a reputation in her community as an enthusiastic, engaging educator whose adventurous spirit often led her to take her students on field trips where they could see the practical application of classroom lessons. It was this adventurous spirit that also led her to respond when, on August 27, 1984, then-President Ronald Reagan announced that the first civilian to fly into space would be a teacher. Selected from a pool of more than 11,000 applicants in July of 1985, McAuliffe was eager to bring her students and millions of others on what she dubbed "The Ultimate Field Trip."

This field trip was scheduled to take place as part of Space Shuttle Challenger mission STS-51-L, a mission for which the educator trained intensively over the several months prior to January 1986. Set to launch on January 22, the Challenger mission was delayed three times by weather and other factors. Ultimately, the mission was pushed to January 28, which happened to be the coldest day on which a launch had ever

been attempted. Seventy-three seconds into the flight, a leak in one of the solid rocket boosters caused an explosion—killing all seven astronauts onboard the spacecraft.

While these were not the only losses that had ever occurred in the history of the American space program (see page 1), the deaths of the Challenger crew deeply affected a generation of children who had watched the launch to share in McAuliffe's experience. Though tragically short, her life continues to inspire many—even twenty years later. A fearless visionary whose name now graces numerous schools, organizations, scholarships and even a crater on the moon, McAuliffe understood the role she would play in expanding the horizons of others. "You have to dream," she would say. "We all have to dream. Dreaming is okay. Imagine me... touching so many people's lives. That's a teacher's dream... a history teacher making history!"

—Edwin Schock

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LEADING EDGE ASTRONOMY

ULYSSES ENDS LONG ODYSSEY

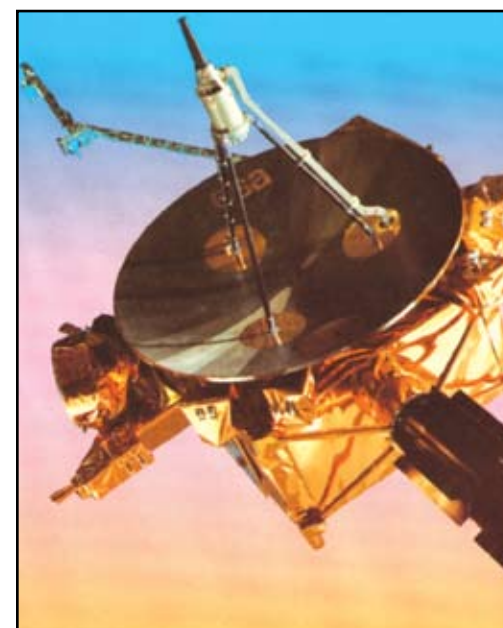
When you talk about the life of a machine, you generally mean its service life. But in the case of the *Ulysses* spacecraft launched by NASA and the European Space Agency almost two decades ago, it is hard not to think in more human terms.

Named for the hero of *The Iliad* and *The Odyssey*, the recently abandoned *Ulysses* probe shared at least one important trait with its legendary namesake. Both undertook perilous journeys that lasted far longer than planned. But whereas the Greek warrior and king may have been cursed to roam the Mediterranean for slighting the gods, one would have to call the *Ulysses* spacecraft's extended voyage an unqualified triumph for researchers.

Launched from the Space Shuttle *Discovery* in October of 1990, *Ulysses* was tasked with the job of examining our sun as it had never been seen before. Heading first to Jupiter, the probe used the gas giant's gravity to sling it out of the ecliptic plane into a high-latitude orbit around the sun. From this vantage, *Ulysses* was able to make six passes over the solar poles from 1994 to 2008, collecting enough data to produce the first-ever maps of the heliosphere in four dimensions (the three linear dimensions plus time).

The heliosphere is a large magnetic bubble in space carved out by the solar wind—a continuous stream of charged particles emanating from the sun. The heliosphere essentially defines the boundaries of our solar system, and the *Ulysses* mission has done much to expand our understanding of it over the last eighteen years. For example, scientists looking at the probe's data now believe that the Sun's magnetic field is much more dynamic than they had previously believed. This may explain why the solar wind does not always move as researchers had originally modeled it. *Ulysses* mission data also confirms that the solar wind is currently at its lowest recorded output—a concern given that it protects the Solar System from the effects of exotic radiation produced by other neighboring stars.

Eventually, *Ulysses* was expected to cease functioning as the cold of space froze its hydrazine fuel lines. However, the



spacecraft's controllers learned in 2008 that they could stave off this eventuality by performing short thruster burns every two hours. As a result, the probe was able to continue its mission for many more months—defying multiple predictions of its impending "death." Ultimately, the decision was made to actively shut down the probe to end the mission on June 30, 2009. The communications resources needed to contact the craft were much coveted, and the data flow had grown too small to justify continuation.

A controlled shutoff was scheduled for *Ulysses*'s final communication window of 17:35 CEST to 20:20 CEST on the 30th, at which point the probe would cease to transmit information and go into "monitor only" mode. Unlike the mythical *Ulysses* who did eventually make his way home at the end of *The Odyssey*, the *Ulysses* probe has been left to wander the void, a silent sentinel of our solar system.

—Edwin Schock

ROBO SAPIENS: THE SENSING, THINKING, AND ACTING ROBOTS OF ROBOWORLD™



The Carnegie Science Center in Pittsburgh recently opened roboworld, a permanent, hands-on exhibit showcasing cutting-edge robotic technology.

PITTSBURGH—From filling prescriptions and inspecting damage in sewer pipes to helping senior citizens and shooting hoops—the ‘bots at Carnegie Science Center’s roboworld do it all.

“It’s not just the Roomba anymore,” says Mike Marcus, referring to the unmanned vacuum cleaner popular with consumers. Director of Marketing and Community Affairs at the Science Center, Marcus continues: “We want people to become acclimated to interacting with robots on a daily basis.”

Located in Pittsburgh, the Carnegie Science Center’s roboworld consists of 30 permanent, hands-on exhibit stations featuring the world’s foremost innovations in robotic technology. Covering 6000 square feet of space, the Center proclaims it the largest and most comprehensive robotics exhibit in the world.

“There’s nothing like it,” assures Marcus.

Greeting visitors is one of the early exhibit favorites, RoboT-hespian “Andy,” who has quickly become the face of roboworld. At a touchscreen kiosk, children and adults interface with the socially interactive Andy and his high quality speech and visual recognition. They control his head movements, change the color of his cheeks, and choose from 10 pre-set questions to which he is scripted to respond.

Through the questions, Andy explains the theme of “sensing,” “thinking,” and “acting” that runs through the exhibition. “Sensing” exhibits demonstrate how robots collect data about the world, “thinking” exhibits show how they are programmed to process information and act accordingly, and “acting” exhibits show how robots grasp and use tools, collect materials, build, and more.

According to Marcus, local ties were instrumental in establishing roboworld. As one of the top three cities in the country for robotics research, the Pittsburgh area boasts several

first-class robotics programs—Carnegie Mellon’s Robotics Institute being the most notable—and 60 robotics companies. These, plus the right combination of funding and planning, came together at the right time to bring this major exhibit into existence.

The exhibit opened in June, presenting visitors with current and cutting-edge developments in robotics technology. A crowd favorite, the Air Hockeybot 1000 recalculates puck position 100 times per second to outscore even the most experienced air-hockey player. (“Pretty darn close,” Marcus answered when asked if Hockeybot wins every match.) The robot is one of only two existing prototypes in the world.

“An exhibit that focuses on technology is always changing,” Marcus explains. “We’re always thinking, ‘What piece needs to come off the floor and what can we put on?’”

Another cutting-edge exhibit shows ROBOT-Rx, used in hospitals around the country right now to match patients and their medications by use of an automatic bar code system. Visitors at the Carnegie get to play patient, selecting and scanning an I.D. card for the “pharmacist” to fill.

Developed by the Pittsburgh-based McKesson Corp., ROBOT-Rx is just one of the robots developed by local companies and highlighted in roboworld. The Educational Robot Company’s compact personal robot, Cye, races through the robot obstacle course, Integrated Industrial Technologies’ (I2T) software runs the Sketch Robot, and RedZone Robotics’ Solo robot inspects water and sewer pipes too small for humans. (The Educational Robot Company products are available for classrooms through Fisher Science Education.)

Local programs and research fuel the exhibition; simultaneously, its permanent home at the Science Center provides researchers a place to get public reaction. In the Robot Workshop, roboticists build and test their latest innovations behind a waist-high wall, protecting the prototypes from wear received by normal museum pieces while visitors get to see technology develop before their eyes.

Showcasing ongoing research is part of an aim to spark interest in robotics. The Science Center wants kids to get excited about robots, see the local university research, and realize the support available in the field.

“There is a tremendous growth opportunity for the robotics industry in Western Pennsylvania,” he says. “The challenge is to find the people to work in those fields.”

Outreach efforts have included a robot-naming contest, a robot dance competition, and a robot sleepover. Perhaps the most inspiring sight would be spotting an “exhibit” in action: right now, TUG, Aethon’s Automated Robotic Delivery System, transports materials, medications, and meals to patients at United Presbyterian Medical Center (UPMC) in Pittsburgh. Traveling pre-programmed routes, it uses sensors to avoid any unforeseen obstacles.

The applications for other featured roboworld ‘bots abound; currently, service robots assist seniors with everyday tasks and unmanned hazard bots search burning buildings and other places too hostile for humans.

“The science fiction concept of ‘robots taking over the world’ is not where we’re at,” he says. “This is going to improve quality of life.”

For more information, visit www.carnegiesciencecenter.com or www.visitroboworld.com.

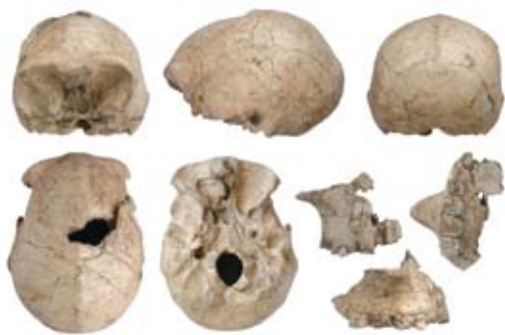
—Aprile Smith

Though established back in 2003, Carnegie Mellon’s Robot Hall of Fame existed only on a Web site prior to finding its permanent home in roboworld. A jury of scholars and researchers selects inductees, real and fictional. Now the Science Center houses full-scale, museum-quality replicas of all honorees. Some of the most noted are:

- NASA’s Mars Pathfinder Sojourner Rover (2003)
- R2D2 (2003)
- Astro Boy (2004)
- C-3PO (2004)
- Gort (2006)
- SCARA robot arm (2006)
- LEGO® Mindstorms (2008)
- NavLab (2008)
- DaVinci Medical Robot System (2009)
- T-800 Terminator (2009)

LOOKING BACK THROUGH FOSSILS

Have you ever wondered about the prehistoric world? What tread upon the face of our planet during those times? When and where did the dinosaurs exist? The answer for all these questions lies in one word—fossils. Fossils are the preserved remains of living beings, including plants and animals that existed several thousand years ago. Fossils provide records of past environments and provide vital information on evolution and the history of life on Earth.

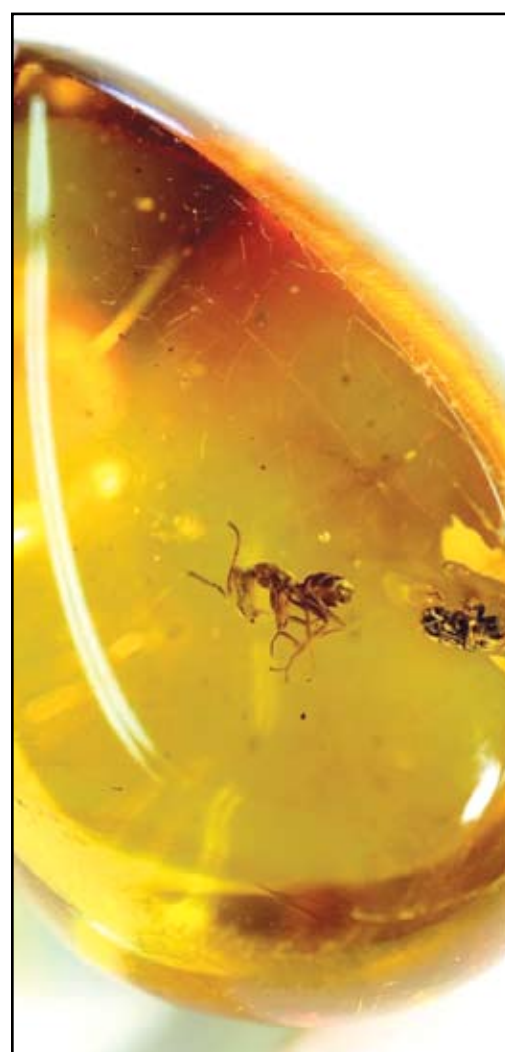


FORMATION OF FOSSILS

After the death of animals or plants, their remains either sank in mud or silt or were buried during a sandstorm. With the passage of time, more and more sediment settled on these remains and covered them. While the soft internal organs, muscle and skin decayed, the harder parts like bones, shells and teeth were encased within the sediment. These harder parts turned into a heavy, rock-like copy of the original animal called a fossil. Small bugs and insects turned into fossils in a different way. These organisms were trapped in the sap of a tree, and eventually this sap hardened and formed a semiprecious material called amber. Even today, entombed remains of organisms can be seen in some pieces of amber. Volcanic eruptions are also known to form fossils when animals are trapped in the hot ash flows.

AGE OF FOSSILS

If you ever wanted to know the age of a Tyrannosaurus, you would want to turn to a paleontologist for an answer. Fossil



Amber, a fossilized resin, can reveal in fine detail insects and small organisms trapped millions of years ago.

researchers rely on the methods of relative dating and radiometric dating to estimate the age of rocks and the fossils contained in them. While relative dating involves studying the strata of the rock and its appearance for information on fossils present within it, radiometric dating is based on the rate of decay of radioactive elements in rocks.

Fossils ranging from 3.5 billion-year-old microscopic Cyanobacteria (blue-green algae) to 10,000-year-old remains of animals have been found by paleontologists.

PROBING FOSSILS THROUGH CT SCANS

Practically, it is hard to visualize the entangled intrinsically delicate features of fossils without exposing them. Computer Tomography (CT) scanning helps provide an insight into the structural anatomy hidden inside a fossil. CT scans take images from different angles and transform a two-dimensional picture into an accurate three-dimensional replica of the fossil. This technology enables scientists to repeatedly examine rare specimens digitally without fear of damage.

Scientists at the European Synchrotron Radiation Facility (ESRF) were successfully able to virtually set free a 100 million-year-old wasp trapped in opaque amber. This was made possible thanks to a 1000-foot-wide particle accelerator machine that created intense beams of x-rays. Researchers at ESRF scanned chunks of dark amber obtained from Charentes, France, and found fossilized beetles, ants and other insects. They then magnified some of these creatures and created 3-D plastic models for scientists to observe them in detail. One of the researchers from ESRF, Paul Tafforeau, says that ants haven’t changed much over the years; an ant that lived 100 million years ago looked no different from an ant today.

CT scans can also be used to determine the age of extinction of creatures. Researchers from the Cornell Lab of Ornithology performed CT scans on the remains of an ivory-billed woodpecker in order to probe the debated reappearance of the extinct bird in 2005. The 3-D image of the bird helped

graphic artist Jeff Wang to digitally bring the bird back to life to help the probe.

The embryo of a horn-faced dinosaur that roamed the Gobi Desert was found within a sandstone-encrusted egg. Physically dissecting this egg for study could damage its fragile contents. Therefore, Amy Balanoff, a paleontologist at the American Museum of Natural History, CT scanned the embedded skeleton and digitally removed the embryonic bones from the egg. The information obtained from the scans and research suggested that the species contained within the egg could be *Yamaceratops dorn gobiensis*, a relative of the famed triceratops. But this species was a shorter cousin of the 30-foot-long dinosaur; in fact it measured only 6 feet in length!

Skulls of primates are known to provide ample details about the human race. But finding a complete, intact skull could well be a daunting task. Anthropologist Tim Ryan of Pennsylvania State University scanned the only known intact skull of a 35 million-year-old primate genus, *Rooneyia*, in order to study the inner ear architecture and the evolution of locomotion. He was able to study the internal structures of the skull in detail without causing damage thanks to the CT scan. Ryan’s study compared the specimen’s ear canals with present-day animals in order to determine the locomotion of the specimen.

THE PRECIOUS PAST

It is necessary to study our prehistoric past in order to know how the world has evolved over the ages. But most clues that provide us this information are invaluable and need to be preserved for posterity. Technology has empowered scientists and paleontologists to intrinsically study our past and provide insight into life that existed in those times without causing damage to the precious pointers of history.

—Hithaishi Bhaskar



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X-RAYS

In 1895, the German physicist Wilhelm Conrad Roentgen wanted to find out if he could see cathode rays escaping from a glass tube covered with black cardboard. During his experiment, he saw a glow in his dark lab several feet from the tube. When he realized that rays of light were passing through the cardboard onto a fluorescent screen, he realized that this new ray could penetrate solids and record images. Roentgen won the Nobel Prize in 1901 for his discovery.



CHOCOLATE CHIP COOKIES

When making a batch of chocolate cookies, the owner of the Toll House Inn, Mrs. Wakefield, found she was out of regular baker's chocolate. She used pieces of semisweet chocolate instead, hoping they'd melt and mix into the batter. They didn't. The Nestle Company bought the recipe and we are grateful.

THE MICROWAVE

In 1945, when Percy LeBaron Spencer of the Raytheon Company walked past a radar tube, the chocolate bar in his pocket melted. Curious, he put a bowl of popcorn in front of the tube to see what would happen. Of course, the popcorn popped, and microwave cooking was born.

POPSICLES

In 1905, 11-year-old Frank Epperson inadvertently left a mixture of powdered soda and water outside. Overnight, temperatures reached a record low. The next morning, that mixture was frozen to a stir stick. He patented the popsicle 18 years later.

POST-IT® NOTES

In 1970, chemist Spencer Silver was trying to develop a strong glue in a 3M research lab. He developed an adhesive that was good enough to glue two pieces of paper together,

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but the papers were easily "unstuck." He considered his research a failure. Four years later, a colleague coated markers with Spencer's glue to mark his places in a book. The markers stayed put but lifted off without damaging pages, and the Post-it Note was born.

—Alida Cataldo



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500g-1g Slotted Set	S40381A	122.00
1000g-10g Hook Set	S40300A	108.00
10N-0.1N Hook Set	S40210A	187.00
1000g-1g Set	S40215A	115.00
100g-10mg Set	S40208A	49.30
500g-1g Set	S01366	86.25
500mg-1mg Set	S01368	54.00
50g-1mg Set	S40393A	58.25



Henry Troemner, LLC

ONLINE COMMUNITIES OFFER RISKS AND REWARDS

According to an old African proverb, "It takes a village to raise a child." But what does that mean as, increasingly, the entire world is one global village on the Internet? For many educators, it has meant venturing into the world of social networking sites and online communities to leverage opportunities for collaboration. However, using sites like Facebook, MySpace, and Twitter for such purposes can be fraught with frustration and even danger. How do you integrate new media into your teaching that can be at once both deeply personal yet anonymous?

Content creators are the most invested of all the participants in any community, and many sites strive to encourage spectators to morph into creators. This can be a difficult balancing act, as the creative license that attracts many potential contributors can pose problems in a multi-generational environment. Many sites are, for example, largely self-policed. While this allows creators to feel greater ownership over the environment, it can also pose a potential problem if inappropriate or offensive content is not quickly flagged for removal.

More and more, educational outlets such as PBS, the National Geographic Society and others are creating their own separate online communities to establish a safe haven for teachers as well as students to share their insights. The establishment of separate educational online communities does not completely eliminate concerns about content appropriateness, but it does allow teachers and students to interact in an environment created for that purpose. It also permits teachers to demonstrate their online skills and savvy to their students and colleagues while allowing them to keep their work and personal lives in different spheres.

The technology is, of course, too new to say that there is a right way or a wrong way to utilize social networking tools in the classroom. But here are some questions to ask yourself when considering how and where to join or establish an online community with/for your students:

- What is the primary use of this environment and the primary goal of this community?
- How active are its participants?
- What types of profiles are displayed and how much personal information about me or my students will be visible globally?
- How is content reviewed for appropriateness?
- What media does it support and how can these media benefit me or my students?

Ultimately, these resources are tools and you will need to decide how those tools are best used in your classroom. Some would argue that the same tool you use to keep up with your old college roommates isn't one you should use to communicate with your students. While that debate continues, the benefits of online communities for teachers and school districts struggling with shrinking budgets is obvious—be it through the sharing of experiences and best practices or even video logs of exotic field trips. Just let common sense be your guide—sound advice for any globe-hopping adventure, be it via your travel agent or your ISP.

—Edwin Schock



OVERCOMING JET LAG: JUST A MATTER OF TIME (AND MATH)



Have you ever arrived at your destination—maybe a dreamed-about vacation spot—too tired to enjoy it for a few days?

That tiredness is jet due to lag, a desynchronization of your internal clock and the cues your body is getting in its new environment. Desynchronization makes it hard to sleep at night and harder to stay awake during the day.

But there is hope. Researchers at Brigham and Women's Hospital and the University of Michigan have developed a program for reducing the effects of jet lag. The software program helps resynchronize the body using a mathematical model that tells users when they should offset local cues with, for example, bright light.

The researchers used their computational method to imitate shifting sleep/wake schedules and develop appropriate timed light exposure schedules aligned with local time. The mathematical computation generated highly effective schedules quickly.

"Using this computation in a prototyped software applica-

tion allows a user to set a background light level and the number of time zones traveled to obtain a recommendation of when to expose a subject to bright light, such as the bright lights sometimes used to treat Seasonal Affective Disorder," said lead author Dennis Dean. "Although this method is not yet available to the public, it has direct implications for designing schedules for jet lag, shift work, and extreme environments, such as in space, undersea or in polar regions."

"This work shows how interventions can cut the number of days needed to adjust to a new time zone by half," said co-author Daniel Forger. The researchers are next going to add timed naps, caffeine and melatonin to reset the body's internal clock faster.

Resetting the body's internal clock to harmonize with its external environment is the most obvious (and natural) way to overcome jet lag. Scheduling timed light exposure to quicken that reset will mean the end of sleepless nights and daytime lethargy, and the beginning of enjoying the setting we're in.

—Alida Cataldo

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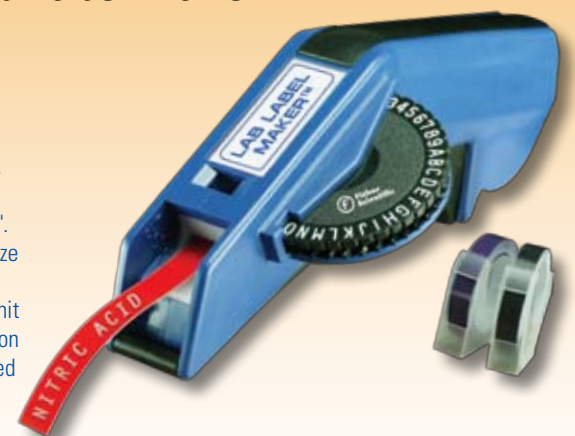


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FISHER SCIENCE EDUCATION HOSTS TEACHER WORKSHOPS

AT THERMO FISHER SCIENTIFIC OFFICES IN PITTSBURGH

PITTSBURGH—Fisher Science Education hosted its first ever onsite teacher workshop Tuesday, July 28, at its Thermo Fisher Scientific Park Lane site in Pittsburgh.

"We're not just here to provide products—we want to help support teachers," said Jill Jones, Category Manager of Fisher Science Education and one of the day's main organizers.

More than 50 teachers from local school districts came to see the latest classroom technology, attending sessions in one of three groups—Elementary Science, Middle/High School Science, and AP Biology.

"From a teacher standpoint, they get exposed to new technologies, new methods, and ways of approaching science in the classroom," explained Charlie Lang, National Director of Sales for Fisher Science Education. "The real positive effect is not necessarily what you read out of a textbook. Fisher Science Education has a strength in being hands-on, and teachers, just like students, want to get their hands on these things."

While the small group size allowed a free flow of questions and answers, sessions were designed to be very hands-on. A favorite with the group, NeuLOG™ sensors are probes that combine a programmable real-time data sensor, logger, memory, and transmitter. Presenter Isaac Rosen left time in each session for teachers to try out these simple-yet-high-tech "toys."

"Our philosophy is really to have low cost," Rosen told the audience. "Each sensor is a data logger—you don't need any other equipment."

The teachers experimented with the probes, which work with PC software to turn raw data into graphs, value tables, text, and video clips.



Alex Emson (left) and Chris Fairfield (center) field a question from the AP Biology group.

Getting students interested in science goes hand in hand with hands-on instruction. According to Emson, technology is key in encouraging future scientists. "That actually helped me determine I wanted to go into biology," he said. "I loved the technology. From 10th grade on, I was hooked."

A similar fascination led to Ed McDonough's career in astronomy. "I was nine or 10 years old and got a telescope for Christmas," he said, talking about the first time he spotted Saturn. "I looked in the eyepiece, I saw those rings, and I was hooked."

A regional sales manager for Celestron®, McDonough discussed two products to help bring a nighttime sky into a daytime classroom: SkyScout® Personal Planetarium®, a handheld device that reports on almost any object in the sky, and the extremely portable FirstScope™ Telescope. A teacher could sign either product out to a student overnight to report back to the class.

"Looking through a telescope, you're not only looking across vast distances; you're also looking back in time," he told the audience with wonder. "When you look at an object in a telescope, you're seeing it not as it is now, but how it was 30, 40, 50, or 12-billion years ago. It's like a time machine."

A time machine is something a kid can get excited about. Likewise, David Doty, the AP high school science teacher leading sessions for Swift Optical®, described his students' excitement after using the Swiftcam II Imaging software.

"They started telling me things I didn't know," he explained. "Did you know the area of the nucleus is in direct proportion to the area of the size of the cell?" They had an outside interest."

Doty showed teachers how to make their classrooms digital and every day ways to incorporate digital and analog microscopes and cameras.

"You'll find out during parent-teacher night you're in trouble," Doty warned the crowd, "because the kids are using the computer to do science work when the rest of the family is trying to do email."

"It's peaked their interest, and they want to find out more."

Like many of the day's presenters, peaking student interest motivated Alex Molinich of Innovating Science™. He featured two of the company's more than 200 chemistry kits: The Hydrogen Fuel Cell Demonstration and the Electrochemical Remediation of Wastewater.

"Students get a better understanding than, 'Cars are cool; we made energy and watched 'em race down the hall,'" he said of the hydrogen fuel cell activity. "Our kits show them what really happened."

Molinich went on to describe educators' requests for reliable resources to turn today's headlines—the latest developments in science—into cutting-edge curriculum. "Teachers are told they have to 'teach green,' but they don't know how to teach green."

A textbook might take years of development, and in the meantime, teachers draw from Web sites of varying quality to meet their needs. According to Molinich, Innovating Science kits eliminate such guesswork, bringing timely topics to market faster with more comprehensive materials. Each kit provides a sufficient knowledge base with a teacher's guide and student handouts.

New Path® Curriculum Mastery® games and supplemental materials also respond to a demand in the market to address state standards.

"We took the standards and worked backward, actually wrote product, and developed it to those specific needs," said President Kurt Gelke. Developed by teachers using research-based techniques, the board game learning system covers the National Science Education Standards for grades one through 10.

"Curriculum Mastery Games recently earned the Teacher's Choice Award by Learning Magazine," Executive Vice President George Nassis added.

Designed for biology, Earth science, physics, and chemistry, each subject covers 25 topics in that science area. Games include review questions and an online component for teachers to make lesson plans, take-home assignments, and tests. Supplemental flip charts provide hands-on review for individual students or small groups.

Though science technology and content obviously dominated the day, presenters offered ways to apply products to other subject areas during their sessions.

New Path, for example, has a series of games addressing language arts, math, and social studies; representatives offered to send samples to anyone interested. Swift's analog and digital microscopes and cameras can be used in multiple study areas; such equipment also works perfectly for time-lapse video projects.

Debra Curry teaches sixth-grade reading at Pleasant Hills Middle School in the West Jefferson Hills School District. "It's good for story retell," she said, referring to post-reading or post-listening recalls in which readers or listeners tell what they remember. "If I had one of those in my classroom, you could put up writing prompts and all kinds of cool things."

"Events like today's are a good step in getting teachers excited about what's new in science. The goal is to have this excitement transfer into the classroom and to the students," said Ed Pesicka, Senior Vice President of Thermo Fisher Scientific. "The science education business is extremely important to us at Thermo Fisher Scientific, and it is also important for us to be involved with the community."

Technology Student Association offers one such way to get involved. Pennsylvania TSA Facilitator Dennis Gold explained ways for students to experience science, participate in STEM (Science, Technology, Engineering, and Mathematics) education, and compete at the local, state, and national level. The co-curricular club has 150,000 middle and high school students nationally (18,000 in Pennsylvania).

"Leadership, excitement, involvement—gives the student a way to apply what they've learned in the classroom, and creates an interest to stay in school," he said. "It creates a job interest, a career interest."



Steve Krynak presents the Thermo Scientific Nanodrop 1000.

Other sessions included Safety in the Science Classroom, led by Fisher Science Education Representative David Ispording, and Thermo Scientific Nanodrop™ 1000, led by Fisher Scientific Product Manager Steve Krynak. The day ended with a drawing for door prizes, ranging from balances to telescopes and DVD sets.

All teachers attending the workshop received 4.5 hours of continuing education credit. Every five years, a teacher in Pennsylvania must complete 180 continuing education hours to remain certified under the state's Act 48. Organizations wishing to grant Act 48 hours can apply through the Allegheny Intermediate Unit (AIU), the largest of 29 intermediate units across the state.

Organized as a not-for-profit branch of the Pennsylvania Department of Education, the AIU rarely approves for-profit agencies to grant Act 48 hours, according to AIU Events Specialist Amy Cribbs. Everyone at Fisher Science Education was honored to receive approval to present Act 48-approved workshops.

In addition to the continuing education credit, each teacher got a \$50 gift certificate for Fisher Science Education products. Most importantly, at the end of the day, attendants seemed satisfied their time was well spent.

"Coming to something like this gives me incentive to go looking for the money to get the technology," said Jerri Walter, who teaches fourth- and fifth-grade science at Divine Mercy Academy. "This pulls me in and gives me the knowledge that I need to keep abreast of what's going on."

"Teachers are always looking for resources they can use with their kids," commented Rich Gebrosky, a seventh- and eighth-grade teacher at Ingomar Middle School in the North Allegheny School District. "It seems like the things that we saw today are very cutting edge and definitely things I can use."

Participant Robert Naill agreed. The 10th- through 12th-grade chemistry teacher from Woodland Hills found the event well organized and worthwhile, saying he would return next year to see more innovations.

"And they weren't pushy about selling—the whole 'buy-our-product-just-because-it's-ours,' he added.

That's something Lang was glad to hear. "We really try to build our local sales team to do more than just bringing in catalogs and hawking products. Fisher Science Education is more than just equipment and supplies; we're teaching and training."

—Aprile Smith



David Doty demonstrates Swiftcam II Imaging software.

According to Rosen, the design aims for ease of use and cost effectiveness. Rather than making three probes for three different measuring ranges, one NeuLOG probe features the three ranges.

"I don't understand why any other company doesn't do it like that," he said. "Our philosophy is different."

Several sessions focused on incorporating technology with ease, even more complex applications like electrophoresis. Alex Emson, the North American Laboratory Equipment Division Sales Training Manager of Thermo Fisher Scientific, explored the process of electrophoresis with the Thermo Scientific Owl Separation System.

"We want to make sure teachers know they have access to the tools necessary to give kids the best opportunity," he said. During an extended information session for the AP Biology group, he covered what electrophoresis is, who uses it, and what equipment it requires.

"It's something we can take back and use in the classroom," Montour's Janet Morris said; she teaches 11th and 12th graders. "It's important for students to see some real life application, see what it's really like in the lab and the real world."

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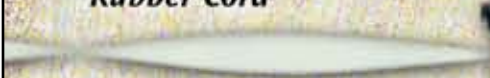
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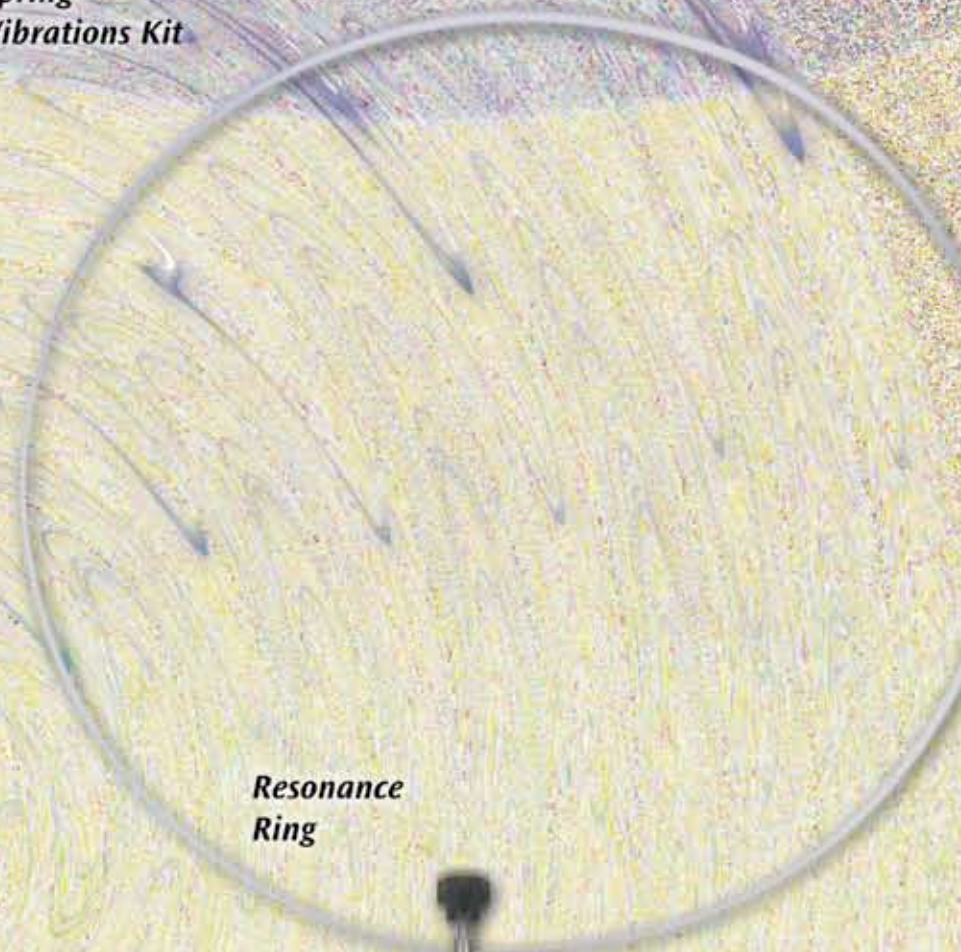
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SWINE FLU— FEELING THE STRAIN AGAIN



It's possible that there isn't anything new under the sun, not even the swine flu. A research paper published July 16 in the *New England Journal of Medicine* outlines nearly a century of history for the influenza H1N1 virus.

In 1918, while the flu pandemic commonly called the Spanish flu was spreading among humans, another illness in Cedar Rapids, Iowa was sickening pigs. The respiratory infection seen in pigs resembled but was much less severe than the illness that killed 20 million humans. Juergen A. Richt, Regents Distinguished Professor of Diagnostic Medicine and Pathobiology of Kansas State University, with colleagues from the Canadian Food Inspection Agency, the USDA and Mount Sinai School of Medicine, recently presented research supporting the hypothesis that the 1918 pandemic virus infecting humans and the virus causing the swine flu were the same. According to their findings, the 1918 virus was able to replicate in pigs but did not kill them, resulting in the current H1N1 lineage.

If it's nearly the same virus, where has it been for the past ninety or so years? There have been other flu outbreaks attributed to viruses also thought to be descendants of the 1918 virus. The American Midwest saw an outbreak in 1930. Another outbreak of the H1N1 virus strain occurred in 1957. The swine flu reemerged again in 1977 in Asia.

What's the "pig" deal about whether or not another animal can be infected with the virus? Animal hosts can serve as reservoirs for a virus. Recall that while the Spanish flu was killing 20 million human patients, the pigs at that time were experiencing only a mild respiratory illness. For a virus to persist and successfully spread, it needs a live host, not a dead animal. The study by Richt and others discovered that the 1918 strain caused only a mild illness in pigs but is lethal in ferrets, mice and macaques. That makes pigs a species in which that flu could "hide out" until it mutated again into a form that spreads among humans. Although birds are thought to be the ultimate source of the influenza viruses,

the scientific community watches pigs closely because they are able to catch both avian (bird) and human strains of flu viruses. While circulating in the pig population, a virus can encounter other viruses and trade genetic material in a process called genetic reassortment. It's thought that the current virus has been in the pig population, evolving and reassorting for a long time.

A study led by Rebecca Garten of the Centers for Disease Control (CDC) describes the results of sequencing full or partial genomes of 76 samples of the current virus, which at that time (May 2009) was reported to have afflicted 13,000 people. The paper, published in the journal *Science*, shows that the closest genetic relatives of the virus are swine flu strains from North America and Eurasia. The virus is made up of eight segments, all of which have been seen in flu strains before but not in the current combination. While the genetic material originated in avian and human strains as well as swine flu strains, all eight segments have been most recently seen in pigs.

The bad news is that the eight segments of the virus are significantly different from the close relatives identified. This finding means that the current swine flu virus had been evolving undetected within the pig population for some time before infections in people were reported. With a long stretch

between infections in the human population, the virus offers little warning to researchers tracking strains with an ultimate goal of creating vaccines.

There is more bad news out of Canada, where officials recently reported that the flu strain has crossed the species barrier again to return to the pig population. While there, the virus could again undergo genetic reassortment and further evolve. If another strain develops and begins to infect humans, it could be a deadlier form than the current one, which is reasonably mild in most reported cases. This is the scenario that is most worrisome to experts like Robert Webster of St. Jude Children's Research Hospital in Memphis. Specifically, he worries that the current swine flu will genetically reassort with a more deadly avian flu sometimes seen in China or Indonesia.

Vaccines are in development. The European Medicines Agency is accelerating the approval process with a goal of inoculating the European population beginning in August. The FDA approval process takes longer because more safety testing will be done. The American public may begin receiving the vaccine in October.

—Lisa Jancarik

IS A "PANDEMIC" A "PANIC-DEMIC"?

The World Health Organization officially declared the swine flu a pandemic on June 11. Despite what Hollywood medical thrillers might suggest, the term "pandemic" refers to the spread of the disease worldwide, not to the severity of individual cases.

According to the Centers for Disease Control (CDC), one million cases have been reported worldwide. Of that number, 300 American deaths have been confirmed as caused by the virus. New projections from the CDC suggest that as many as 40% of Americans could develop the swine flu, about twice as many as in a normal flu season. According to WHO, about 250,000 people worldwide die from the seasonal flu annually, meaning that in terms of incidence, this flu qualifies as a pandemic.

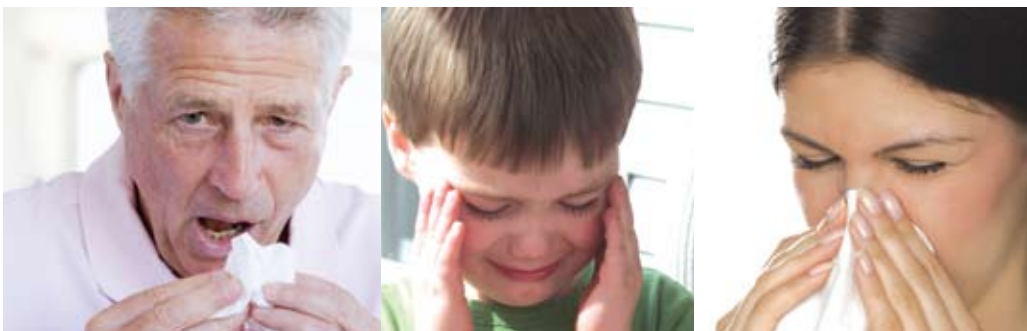
Most of the cases reported in the U.S. have been mild. In fact, some people may have had the swine flu but didn't get sick enough to even consider getting tested. Mild cases are cause for concern in one respect: people with mild illnesses of all kinds will overrun emergency rooms out of fear.

ACTION STEPS TO PREVENT SPREAD OF FLU

On August 7, 2009, the Centers for Disease Control and Prevention issued the following recommendations:

These steps should be followed ALL the time and not only during a flu pandemic.

- Educate and encourage students and staff to cover their mouth and nose with a tissue when they cough or sneeze. Also, provide them with easy access to tissues and running water and soap or alcohol-based hand cleaners. Remind them to cover coughs or sneezes using their elbow instead of their hand when a tissue is not available.
- Remind teachers, staff, and students to practice good hand hygiene and provide the time and supplies for them to wash their hands as often as necessary.
- Send sick students, teachers, and staff home and advise them and their families that sick people should stay at home until at least 24 hours after they no longer have a fever or signs of a fever (without the use of fever-reducing medicine).
- Clean surfaces and items that are more likely to have frequent hand contact such as desks, door knobs, keyboards, or pens, with cleaning agents that are usually used in these areas.
- Move students, teachers, and staff to a separate room if they become sick at school until they can be sent home. Limit the number of staff who take care of the sick person and provide a surgical mask for the sick person to wear if they can tolerate it.
- Have Personal Protective Equipment (PPE) such as masks available and ensure the equipment is worn by school nurses and other staff caring for sick people at school.
- Encourage early medical evaluation for sick students and staff at higher risk of complications from flu. People at high risk of flu complications who get sick will benefit from early treatment with antiviral medicines.
- Stay in regular communication with local public health officials.



Visit www.flu.gov for additional guidance on recommended actions if the flu conditions become worse and for planning/communication steps for the 2009/2010 school year.

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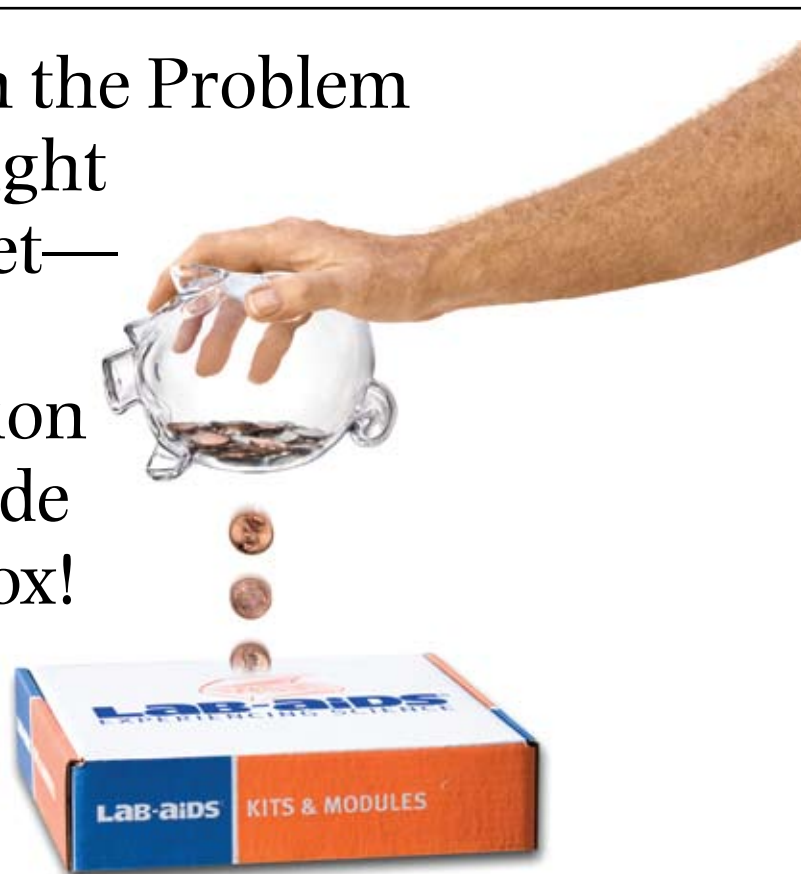
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THE NOT-SO-SWEET EFFECT OF ARTIFICIAL SWEETENERS ON OUR ENVIRONMENT

In an effort to promote better health, artificial sweeteners, which add sweetness without calories, have become widely accepted. They are used in a broad range of food products, from sodas to breakfast cereals, as well as in drugs and sanitary products. The human body does not fully absorb them, so the residue from consuming foods containing them is excreted and ends up in wastewater.

But what happens when wastewater containing these products is processed through the standard treatment methods?

HOW WASTEWATER TREATMENT WORKS

The wastewater that comes from homes, businesses, and runoff must be treated before it can be safely returned to the environment. Wastewater, collected and routed through sewer lines, is processed in treatment plants to remove harmful bacteria, chemicals, particles, and other pollutants. Typical treatment of common pollutants involves an initial primary screening and settling process (40-50% removal) and a secondary process (85-90% removal). In many systems, these processes are followed by disinfection, significantly reducing bacterial concentration. Advanced processes can be added; for example, soil aquifer treatment, in which the water is allowed to percolate through soil, theoretically removing much of the remaining impurities. But artificial sweeteners are not typical pollutants.

A RECENT DEVELOPMENT

In Karlsruhe, Germany, Marco Scheurer, Heinz-Jürgen Brauchand, and Frank Thomas Lange (from the Water Technology Center) developed a new analytical method for detecting pollutants in treated wastewater. Using this new method, the researchers were able to look for seven different artificial sweeteners in treated water. They applied their ana-

lytical method to water from two sewage treatment plants and a soil treatment system.

They were able to detect four of those seven artificial sweeteners in the water samples they collected: acesulfame, cyclamate, saccharin, and sucralose. These results indicate that even with the advanced treatment techniques of the soil aquifer site, the artificial sweeteners were not removed from the water.

WHY ARTIFICIAL SWEETENERS MATTER

The potential health risks of artificial sweeteners have fueled a long-running debate. Long-term exposure to artificial sweeteners can induce a multitude of symptoms, including headaches, depression, anxiety, mood swings, wheezing and coughing, skin irritations, nausea, diarrhea, and an increased risk of bladder cancer.

As Scheurer said, "Due to the use of artificial sweeteners as food additives, the occurrence of artificial sweetener traces in the aquatic environment might become a primary issue for consumer acceptance."

A SILVER LINING?

For other scientists, the fact that sweeteners, especially acesulfame, travel through the treatment system without being broken down is an important characteristic: it proves that domestic sewage was part of the waste stream. According to Dr. Ignaz Buerge, an environmental chemist at the Swiss Federal Research Station in Schloss, Switzerland, "We now have a marker of domestic wastewater which can be used in tracing pollution."

—Valinda Huckabay

HIGH SCHOOL GOES HIGH TECH

Mrs. Xan Simonson, Biotech Specialist for the Mesa Public Schools Biotech Academy, is a remarkable teacher. Her diverse experience includes serving in the field of Medical Investigating (often referred to as CSI), earning certification in Career and Technical Education in Agriscience, and teaching for 23 years for Mesa Public Schools. Her most recent role with Mesa Public Schools has been to develop and coordinate the Biotechnology Program for the Mesa Public Schools Biotech Academy. This academy, part of the Mesa High School in Mesa, Arizona, fosters a small learning community of students within a curriculum that focuses on bioscience and research. Each academy student participates in college preparatory coursework that is rigorous and relevant to real-world science applications.

INTRODUCING THE NANODROP

Mrs. Simonson has incorporated the Thermo Scientific NanoDrop™ Spectrophotometer, a unique UV-Vis instrument typically utilized in labs that conduct research in such diverse fields as drug discovery, genomics, proteomics and molecular diagnostics, into the curriculum for her high school students.

STUDENT EXPERIENCE PROMPTED PURCHASE

Academy students were first introduced to the NanoDrop while participating in summer research internships. Their positive feedback prompted Mrs. Simonson to purchase a NanoDrop for their school, where it is used in Biotechnology I and II, as well as in an independent research class. Mrs. Simonson has also introduced other high school teachers to the NanoDrop while leading teacher-training sessions.

UP-TO-DATE EQUIPMENT

According to Simonson, "the students are thrilled and excited to be using up-to-date equipment and protocol." Although they received their NanoDrop very late in the 2008-2009 school year, Mrs. Simonson anticipates broadening the application of the NanoDrop in their curriculum this year. In Biotechnology I, for instance, "we will use it mainly to determine the concentration of DNA extracted from a variety of



sources, such as salmon testes, plants, human cheek cells, and bacteria." For students in the higher-level independent research class, the availability of this instrument means that students "can perform most of their experiments onsite rather than having to travel to the university."

HIGH SCHOOL TREND

Other high schools may soon provide similar opportunities to their students, because as Mrs. Simonson explains, this type of experiment "can be performed by high school students under the direction of trained high school teachers."

—Pam Sherwood

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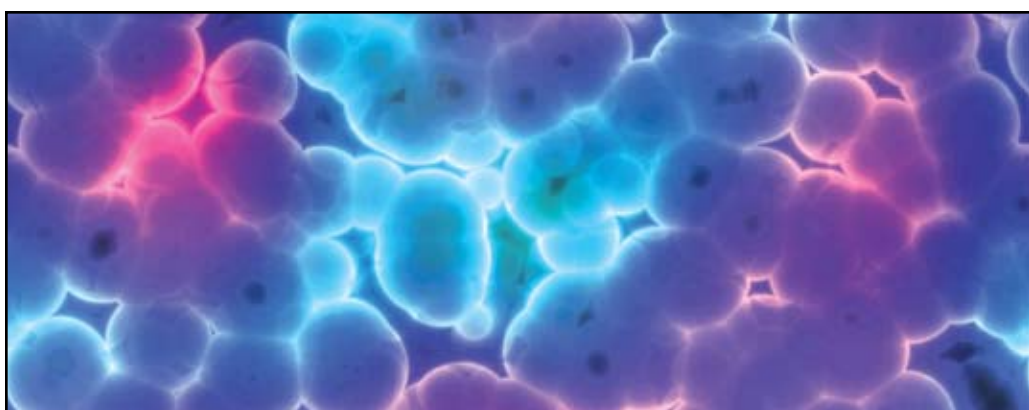
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NANOPARTICLE "TROJAN HORSE" MAY SOON REPLACE CHEMOTHERAPY



Researchers at the University of Central Florida have successfully engineered a nanoparticle "Trojan horse" that could someday target and destroy tumors, sparing patients from toxic, whole-body chemotherapies.

Assistant Professor J. Manuel Perez and his colleagues successfully modified nanoparticles—ultrasmall objects—to carry the drug Taxol® to malignant cells only, allowing targeted cancer treatment without harming healthy cells. Taxol, which is widely used in chemotherapy, is often the cause of negative side effects because it is dispersed throughout the body and damages healthy tissue as well as cancer cells.

The "Trojan horse" effect was achieved by utilizing a new chemistry called "click chemistry" to attach the vitamin derivative folic acid to the nanoparticles. Cancer cells consume folic acid in high amounts, allowing the nanoparticles to specifically seek out particular tumors and other malignancies. The result: targeted cancer treatment without harming healthy cells.

Cancer cells in the tumor connect with the engineered nanoparticles via cell receptors that can be regarded as "doors"

or "docking stations." The nanoparticles then enter the cell and release their cargo of iron oxide, fluorescent dye, and chemotherapy drugs. Due to the fluorescent dye and iron oxide magnetic core, the nanoparticles may be viewed via optical imaging and magnetic resonance imaging (MRI). This allows the physician to see exactly how the tumor is responding to treatment.

Dr. Perez works at UCF's NanoScience Technology Center and Chemistry Department and in the Burnett School of Biomedical Sciences in the College of Medicine. It is his hope that nanotechnology will eventually be used to help diagnose, image and treat cancer and infectious diseases.

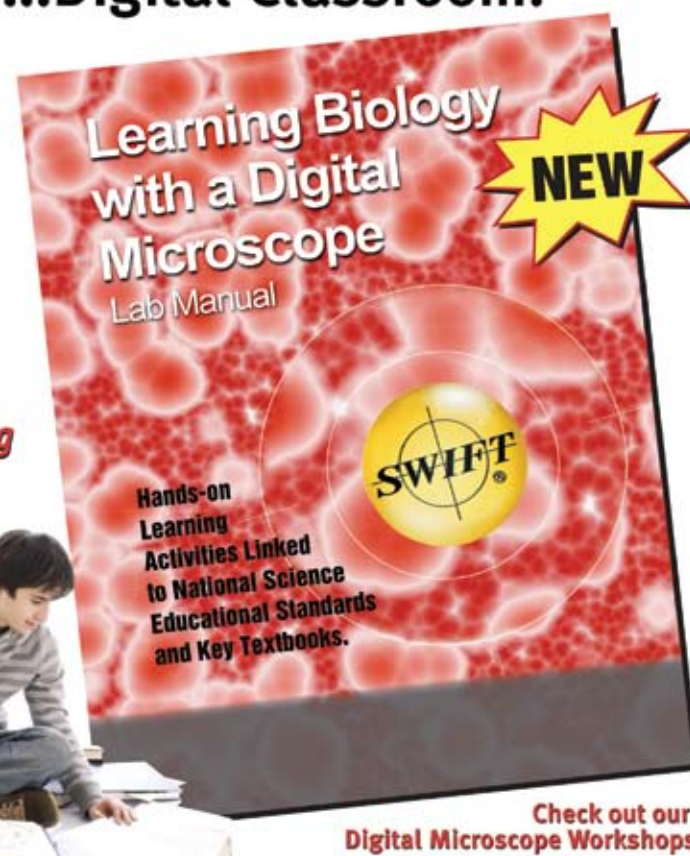
"Although the results from the cell cultures are preliminary, they are very encouraging," Perez said. "Our work is an important beginning, because it demonstrates an avenue for using nanotechnology not only to diagnose but also to treat cancer, potentially at an early stage."

—Sandra D. Bledsoe

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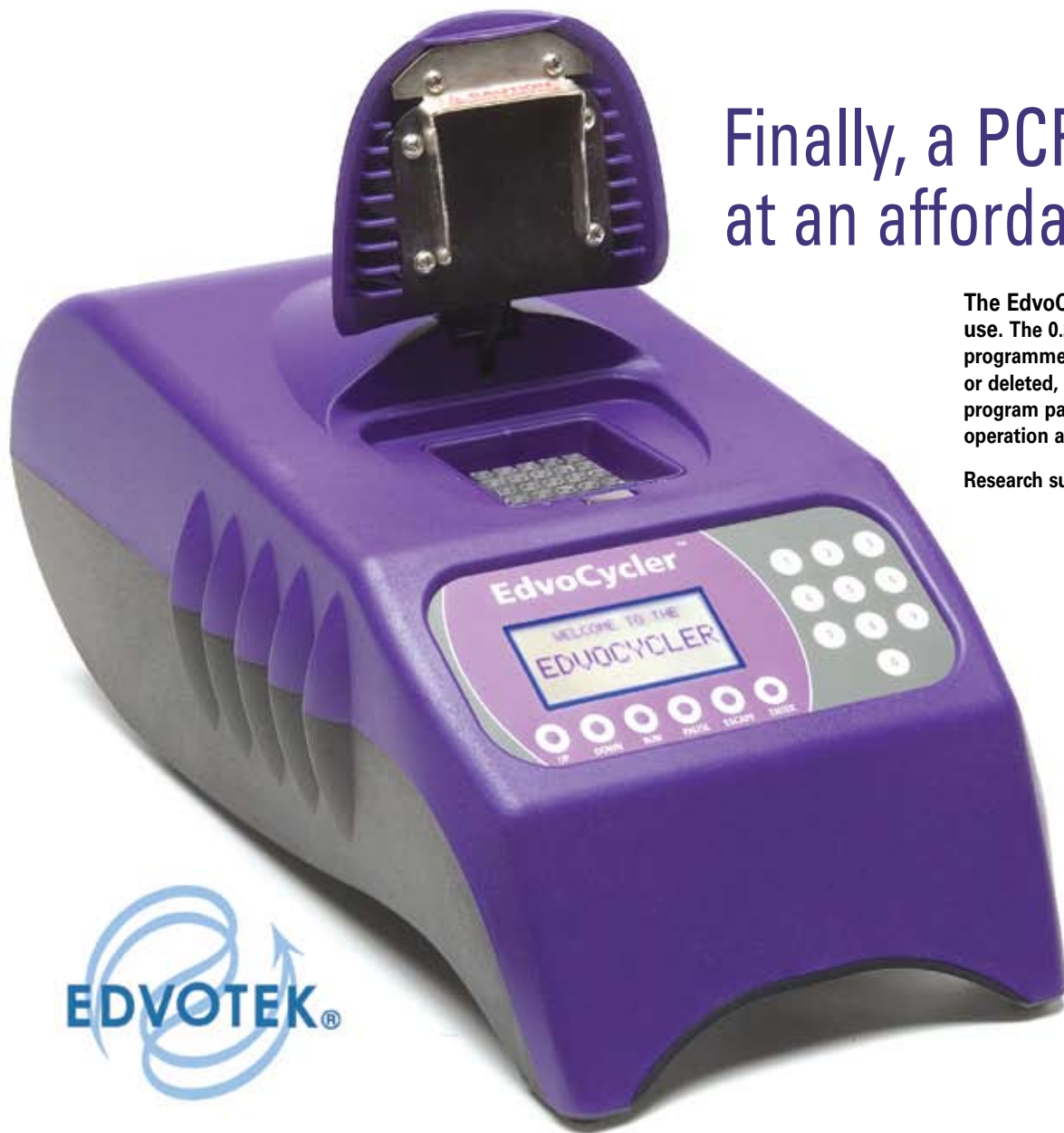
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Research supported in part by NIH SBIR NCRG Grant #5R44RR18670.

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NEW SYSTEM PREVENTS SURGICAL SPONGE LOSS

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Surgical sponges assist in protecting tissue and organs from damage and absorbing blood and other fluids during the operation. Hundreds of thousands of surgical sponges are used in procedures by large hospitals every year.

Even though surgery and sponges work well together, serious problems can occur if they don't part ways once surgery is over. Medical personnel sometimes make the mistake of leaving surgical sponges inside the patient once the procedure is over. At major hospitals and medical centers, these sorts of accidents happen at least once a year. Oddly enough, a patient would probably have fewer problems with a missed needle than a missed sponge—unlike a medical instrument, the material of a sponge is porous and more conducive to infection.

Historically, surgical staff have had to rely on manual counting, but besides the room for error (studies have shown miscounts of sponges as high as 1 in 8 surgeries), the sponges can also become stuck together with blood and body fluids, making an accurate count extremely difficult. If all the sponges cannot be found, a costly x-ray has to be done to locate them.

A Pittsburgh-based company, ClearCount Medical Solutions, however, has come up with an innovative, hi-tech answer to these problems with its SmartSponge® System. Developed by an operating room nurse, the system utilizes FDA-approved Radio Frequency Identification (RFID) to count and locate surgical sponges during all steps of an operation.

Each individual sponge arrives from the manufacturer with its own special identification chip. Before the procedure, every sponge is scanned as an "In" by the system. After the sponges have been used in the surgery, they are disposed of in a special container with a sensing device that counts all those sponges that are "Out." Whether the sponges are clumped together or blood-soaked doesn't matter as the system automatically scans and reads them.

Once the surgery is complete, if the number "In" does not match the number "Out," the system calculates the number of "Finds." The SmartWand is then used to locate the missing sponges inside the patient. The user scans the wand over the patient's body until the missing sponges are digitally "seen" through the organs or tissues and located by their ID tags.

If the SmartSponge system is successful on the market, ClearCount plans to expand internationally and hopes to be the standard system for hospitals in the next five to ten years. In fact, they are "counting" on it.

—Jason Akerman



Besides the obvious and potentially fatal safety issues here, surgical sponge errors can cost the hospital both financially (the hospital has to pay for the re-operation and for the legal costs) and in unwelcome publicity. Further, the surgical staff can also be held personally liable.

TEEN DIAGNOSES HER OWN MEDICAL CONDITION IN SCIENCE CLASS



Students like Jessica Terry (not shown) can discover points of Scientific interest in their classrooms and labs.

Students often cannot see the connection between their classroom studies and "real life." But in the case of one teen, Jessica Terry, the link could not be any more clear. A simple test that she performed during a science project changed her life, and impacted her very health, in a way that she never could have imagined.

Terry, a typical 18-year-old attending the Eastside Catholic High School in Bellevue, Washington, had suffered for many years with bouts of abdominal pain, diarrhea, vomiting and fever. Unable to eat, she lost weight and often had to miss school. Despite testing, her doctors simply could not find the cause of her mysterious illness. Consulting with several physicians over the years, she was told that she had everything from irritable bowel syndrome to ulcerative colitis. "There were just no answers anywhere...I was always sick," she told reporters.

But one day, as Jessica worked on a project for her AP science class, Biomedical Problems, she looked at slides of her own intestinal tissue and spotted something that years of

pathologists and gastroenterologists had somehow missed. She observed a large, darkened clump of cells surrounded by red dots of stained white blood cells in the process of engulfing surrounding cells—a granuloma, a potential indicator of Crohn's disease.

"She was pretty excited about finding the granuloma," said Mary Margaret Welch, Terry's science teacher. "She said, 'Ms. Welch! Ms. Welch! Come over here. I think I've got something!' " Suspecting that Jessica had indeed found something significant, Welch immediately snapped a photo of it on the microscope and sent it to a pathologist, a physician who interprets and diagnoses the changes caused by disease in tissues and body fluids. According to Welch, "within 24 hours, he sent back an email saying yes, this is a granuloma."

Doctors were impressed with her finding. "Granulomas are oftentimes very hard to find and not always even present at all," said Dr. Corey Siegel, a bowel disease specialist at Dartmouth-Hitchcock Medical Center. "I commend Jessica for her meticulous work."

Although she is relieved to find out her correct diagnosis, Jessica now must deal with the reality that she has a very serious disease. Crohn's is an incurable, though treatable, condition characterized by extreme inflammation of the gastrointestinal tract. It often leads to ulcers, malnutrition, and a considerable amount of pain and discomfort.

Despite the diagnosis, Jessica is optimistic about her future. She is currently writing a children's book on Crohn's disease and plans to begin nursing school in the fall. An inspiration to young science students everywhere, a real-life connection with a life-altering result that both student and teacher will never forget!

—Joe Giacobello



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Grocery stores across the United States and as far away as Australia are giving neighborhood schools bushels of apples. No, not the red, green or yellow fruits from the orchard, but the personal computer variety—and that's not all. In addition to a gallon of milk and a dozen eggs, food shoppers can acquire printers, televisions, microscopes, and physical education equipment for their community schools courtesy of "Apples For the Students."

This 20-year-old fundraiser is a cooperative effort by school suppliers and local retailers, and ranks as one of the largest private sector educational initiatives. To date, "Apples for the Students" has distributed more than \$250 million in much-needed hardware, software and learning tools to participating schools.

Grocery shoppers need only provide their school identification number and shopper value card number, either online or using a toll-free number provided by the retail store or school, and they can begin accumulating points toward purchases. Participating grocers will contact area schools and provide all resources for administering the program, including publicity tools and rewards order forms. "Apples for the Students" coordinators can track their school's progress and choose to redeem accumulated points at any time during the 24-week program.

Faculty and parents of Boyce Middle School, a 5th-6th grade middle school in Pittsburgh, Pennsylvania, give high praise to the program offered by local retailer Giant Eagle. During the 2008-2009 academic year, the school accumulated enough points for a DVD camcorder, a portable projection screen, an LCD multimedia projector cart, a fraction calculator/classroom set, timers and playground balls. "It's like found money," says PTA President Sally Ondrejko. "Parents spend what they would normally spend on food, and their children reap the rewards."

"Apples for the Students" is the recipient of the prestigious Presidential C-Flag Award, which recognizes outstanding community service efforts by private sector businesses. Today, with so many institutions struggling with reduced funding, these apples will feed a lot of classrooms.

—Terri Sota

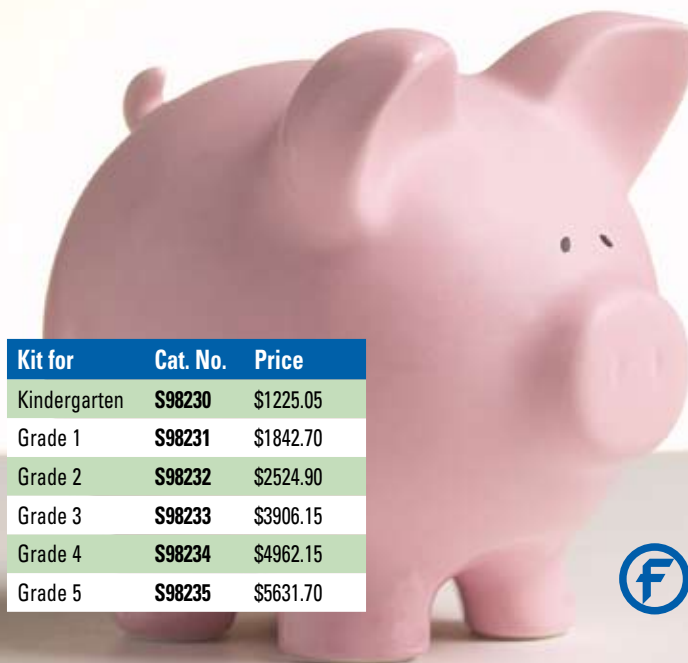
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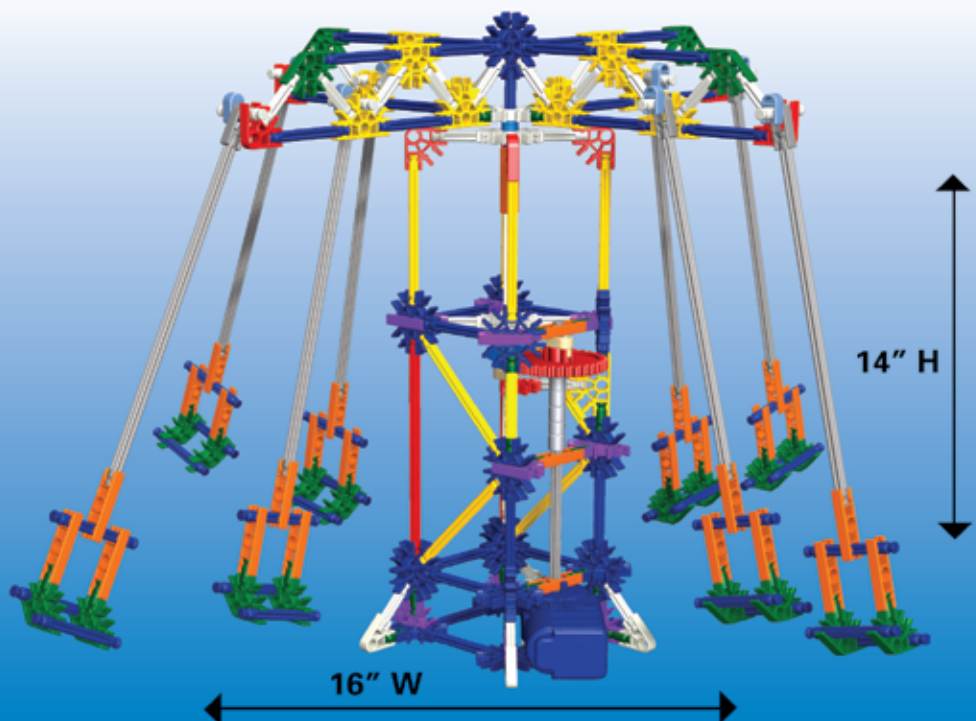
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ARRA GIVES TITLE 1 PROGRAMS A WELCOME BOOST



Title 1 programs derive their existence from the Title I of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6301 et seq.). As amended, this legislation attempts the following:

- Ensure that high-quality academic assessments, accountability systems, teacher preparation and training, curriculum, and instructional materials are aligned with State standards
- Meet the educational needs of low-achieving children from a variety of conditions that stand in the way of comparable achievement as those not so challenged
- Close the achievement gap between high- and low-performing children
- Hold schools, local educational agencies, and States accountable for improving the academic achievement of all students, and identifying and turning around low-performing schools
- Strengthen accountability, teaching, and learning by using State assessment systems
- Provide greater decision-making authority and flexibility to schools and teachers in exchange for greater responsibility for student performance
- Provide children an enriched and accelerated educational program
- Promote school-wide reform and ensure the access of effective, scientifically based education design
- Elevate the quality of instruction
- Afford parents substantial and meaningful opportunities to participate

With the advent of the American Recovery and Reinvestment Act of 2009, the funding landscape for education has been altered, and, for a change, the clouds on the horizon bear a silver lining for education reform. Clearly this change is for the good. However, the sobering fact is that, as good as these opportunities will be for stoking the engines of educational progress, the funding is not ongoing and, as a one-time source of financial relief, must be used with wisdom.

One of the areas in which ARRA funding can create a profound impact is in Title 1 programs. These programs are outgrowths of legislation to improve academic achievement of the disadvantaged. The challenge of this goal has been exacerbated by a chronic lack of state and federal level funding.

Now, the ARRA provides \$10 billion in new funding for programs under Title I, Part A. To meet the stimulus commitment, the ARRA requires Title 1 funds to be spent quickly to save and create jobs. Other principles guiding the distribution and use of Title 1 funds include providing benefit to student achievement through school improvement and reform; ensuring transparency, reporting, and accountability; and investing one-time ARRA funds to provide long-term benefits independent of ongoing funding requirements.

These are lofty goals that certainly cannot be met by even a very large one-time financial bonus. But for educators serving in some of our nation's lowest-achieving schools, the stimulus package funding, combined with Title 1 program structure and goals, can provide the first glimmer of financial hope in a very long time.

—Merry Morris

GLOBAL WARMING—STILL A HOT TOPIC

KEEPING OUR PLANET WARM

Viewed from an extraterrestrial vantage point, our planet is a beautiful blue orb—its vibrant blue scarcely obscured by its atmosphere. In sharp contrast to some other planets, Earth's atmosphere is very thin. Its importance, though, cannot be underestimated—and changes to its composition are likely to be reflected in the physical and biological nature of our planetary home.

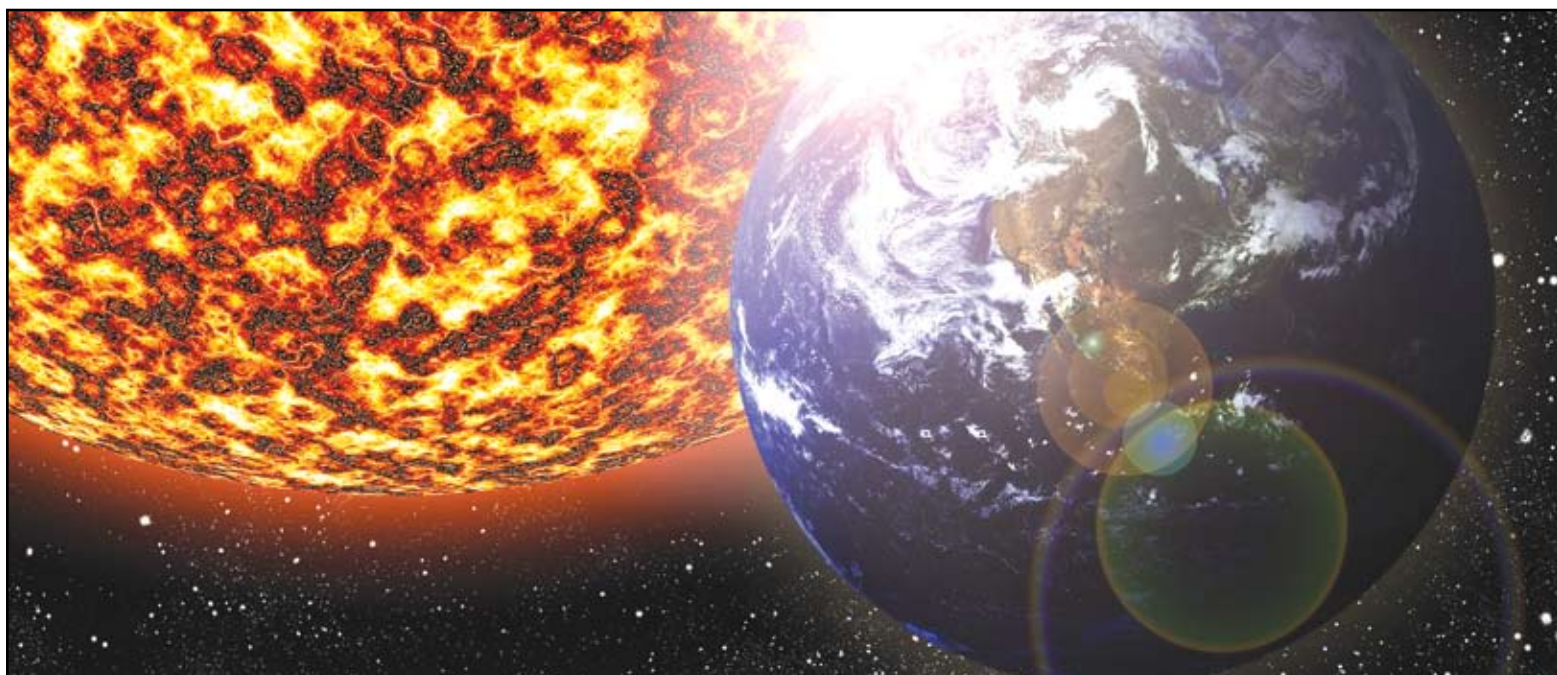
Our atmosphere is critical in determining the type and abundance of life on Earth. According to estimates, without an atmosphere, we would be experiencing a very chilly -18°C global temperature.

As powerful as our sun is, only about half of its radiation hitting the Earth is infrared radiation, responsible for direct heating. The remaining radiation is of a higher frequency and provides warming only once it hits the Earth. The transformation of these higher frequencies into infrared radiation is important because it can be captured by the atmosphere, and thus not all lost into space. This heat-trapping effect of the atmosphere keeps Earth's average temperature at a toasty $+13^{\circ}$ to $+15^{\circ}\text{C}$ range. Responsible for this heat retention are the "greenhouse gases"—water vapor, carbon dioxide, ozone, methane, nitrous oxide and chlorofluorocarbons.

But many scientists say there's a flip side to this atmospheric action. When the heating-trapping potential of the atmosphere is augmented by increasing levels of greenhouse gases, higher average global temperatures result. While certainly there are short-term events that can affect global temperature, it's the impact of man-made greenhouse gas pollution—largely from economic development, population growth and energy usage—that's fueling an alarming rate of global warming.

WHAT WOULD HAPPEN IF...

There is much speculation on the possible effects of unchecked increases in atmospheric CO_2 levels and global warming. These include rising sea levels, reduced snow



cover, melting polar ice caps, extreme weather, increased evaporation, local climate alterations with effects on habitats and ranges, changes in disease patterns, and more. It is thought that most consequences of global warming follow from the physical changes, for example, projected sea level rise, higher temperatures and alterations in rainfall patterns. As if these effects were not enough to worry about, there are effects of global warming that could act in positive feedback interactions to increase effects of climate change.

According to the Intergovernmental Panel on Climate Change (IPCC), global average temperature rose $0.74 \pm 0.18^{\circ}\text{C}$ during the past century and is likely to get worse faster than expected. IPCC reports indicate that the effects of global warming will vary from one region to another. Where less warming occurs (up to $3^{\circ}\text{C}/5^{\circ}\text{F}$), net benefits may be seen, but other areas will experience overall irreversible, negative costs. Already, some scientists say, certain species' popula-

tions are evolving in response to a warming planet in ways that affect survival behavior, and many of those species best able to survive are ones we might consider "pests."

SKEPTICS REMAIN

However, many remain unconvinced that a warming trend is occurring, suggesting that no real increase in temperature has been observed. Others suggest that any apparent warming is fallacious for any one of a number of reasons, including flawed global temperature calculations, resulting from "contamination" of land-based temperature measurements by heat from developed areas. Mathematical models, the basis of computer projections, are subject to scrutiny and debate. These complex sets of differential equations are based on certain fundamental assumptions that are then used to project future conditions by calculating winds, heat transfer, radiation, relative humidity, surface hydrology, heat and

moisture flux, ocean currents, salinity and their many interactions. The inputs and outputs can be debated endlessly.

A RESOLUTION IN OUR LIFETIME?

Among the naysayers, many are concerned about economic dislocations that could result from efforts to reduce greenhouse gases and propose to do nothing until the science is compelling and irrefutable. However, supporters of greenhouse gas reductions believe time is of the essence; some fear the sheer speed of climate change could overtake the fittest species. The phenomenon, they say, when evolution cannot keep pace with climate change is well known: extinction.

—Merry Morris



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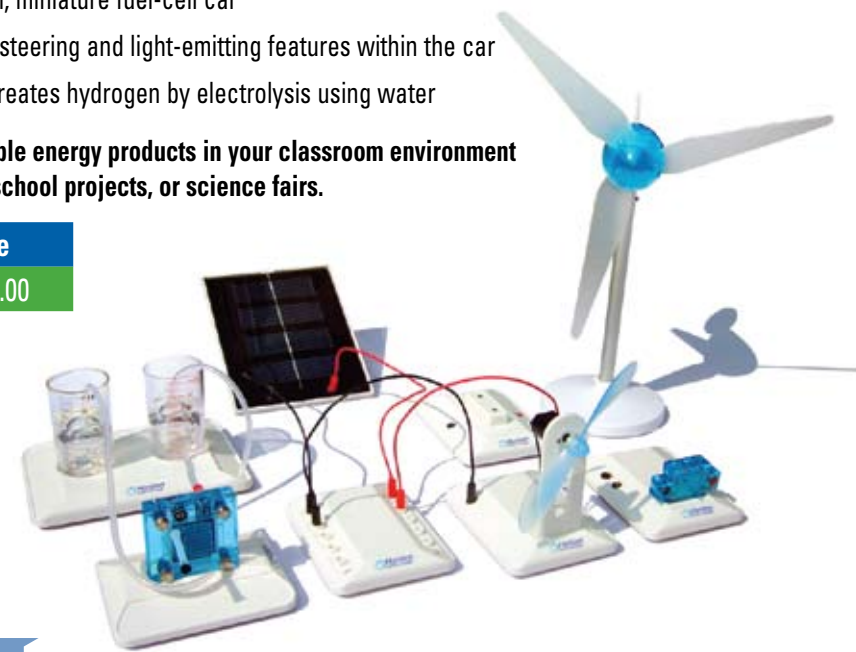
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GREEN GAZETTE

CO₂-EATING CEMENT?

Cement, a vast source of planet-warming carbon dioxide, could be transformed into a means of stripping the greenhouse gas from the atmosphere, thanks to an innovation from British engineers.

UK-based Novacem has developed a new type of cement based on magnesium silicates that requires less heating than traditional Portland cement and absorbs CO₂ as it hardens.

Traditional cement-making produces greenhouse gases from the intense heat generated and energy consumed to cook its raw materials, such as limestone.

Novacem's cement could revolutionize the cement industry, changing it from a "significant emitter to a significant absorber of CO₂," according to Novacem chief scientist Nikolaos Vlasopoulos.

The new cement has found support and funding from the UK cement industry as well as environmental groups. Construction companies are investigating its commercial viability.

GREEN BIT: The 2 billion tons of cement produced annually worldwide comprise 5% of global greenhouse gas emissions—more than the aviation industry.

GREENER HOTELS

If your summer vacation included a stay in a hotel, motel, or even a bed-and-breakfast, you may have found a card in your room asking you to reuse your bath towels to save water. This is one way that the commercial lodging industry is going greener.

The Water Conservation Hotel and Motel Program (Water CHAMP) in Southwest Florida is one example that helps innkeepers to save water and money while practicing more efficient housekeeping and landscaping. The free program provides training and materials to hoteliers. A key element is



its linen and towel rescue program that launders bed linens and towels every third day unless requested otherwise by guests.

In 2008, more than 420 participating properties saved more than 177 million gallons of water, or an average of 17 gallons per occupied room per day. A similar program is designed for the restaurant industry.

GREEN BIT: Ever noticed that you have to ask for that glass of water at some restaurants? The server isn't being rude, but green: every glass of water served requires two glasses worth of water to wash it. That's why many eateries now serve water only upon request.

WATER LEVELS FALLING... AND RISING

A look around our nation's lakes finds good and bad news.

First the bad news from Lake Mead, NV. Drought conditions have reduced the nation's largest reservoir to approximately 57% of its full volume. Located on the Colorado River 30 miles southeast of Las Vegas, NV, Lake Mead was formed by the creation of Hoover Dam. The lake stretches for 110 miles behind the dam and holds approximately 28.5 million acre feet of water. Lake Mead is a primary source of water for communities in Nevada and Southern California as well as a prime recreation venue for boaters, fishermen and

swimmers. Declining water levels have resulted in increased shorelines and the appearance of small islands in the shallower parts of its base.

The news from the Great Lakes is much brighter, as scientists report that the three largest lakes—Superior, Huron and Michigan—have risen since late 2007 and appear to be reversing a decade-long downward trend that battered the maritime industry. Lake Erie, the shallowest of the Great Lakes, recorded an above-average depth in June 2009 as well.

Lake water levels are cyclical, as the Great Lakes' data attests. Record high levels in the 1980s were followed by deep drops in the 1990s that caused cargo freighters to substantially lighten their loads. Scientists attribute the higher levels to colder, wetter weather in the past few years with heavy ice coverage spotting the lakes during the coldest months.

GREEN BIT: The Great Lakes account for nearly 20% of the world's fresh surface water.

THIS ROUND TO THE SPOTTED OWL

In the Pacific Northwest, the eternal struggle continues between preservationists and loggers over forest habitat for the Spotted Owl, a bird listed as "threatened" on the U.S. Endangered Species Act.

Score one round for the owl in July, when Ken Salazar, U.S. Secretary of the Interior, called a 2008 Fish and Wildlife Service plan to reduce critical owl habitat in favor of logging interests "legally indefensible."

The plan, known as the Western Oregon Plan Revisions (WOPR), would open large tracts of mature forest—habitat to the protected birds—to commercial logging in a region that relies on that industry to fuel its economy.

An Interior Department investigation concluded that "improper political influence" under the previous Administration may have potentially jeopardized the decision-making process that led to WOPR. Interior found that environmental impact studies had not been completed as per federal law, and that an administration official's influence may have undermined the integrity of the initiative.

Salazar stated, "Now at a time when western Oregon communities were already struggling, we face the fallout of the previous Administration's skirting of the law and efforts to taint scientific outcomes. It is important that we act swiftly to restore certainty to timber harvests and to protect vital timber infrastructure in these tough economic times."

Seeking to strike a balance between the economic needs and environmental factors, Secretary Salazar sought to avoid having WOPR land in drawn-out litigation that could further cripple the local economy. Working together with federal, state and local officials as well as scientists, Salazar foresees a thoughtful, cooperative long-range plan for management of old-growth forests that considers sustainable economic development, water quality, and habitat for species like the spotted owl.

Interior has sought to have WOPR vacated in federal court. If the decision is overturned, the redesignated acreage would revert to the control of the Bureau of Land Management, while a new plan for managing these timberlands is developed. (www.doi.gov/interior)

GREEN BIT: The Barred Owl is the eastern cousin to the Spotted Owl, which is found in the western United States.

—Dan Skantar

VOLCANO – A DRAGON INSIDE THE EARTH

Have you ever seen or heard the Earth coughing up? Well, if you haven't, then welcome to a phenomenon called the volcano. In its simplest terms, a volcano can be described as a mountain with a tunnel connecting the top to a pool of molten rock below the surface of the earth. When the pressure within the Earth becomes high, eruptions occur from within this tunnel. Gases and rock shoot up through the opening on the top of the mountain and spill over. These eruptions result in lateral blasts, lava flows, hot ash flows, rock falls, mudslides, avalanches, tsunamis, falling ash and flash floods. Volcano eruptions are known to wipe out entire civilizations.

VOLCANIC ERUPTIONS THROUGHOUT HISTORY

History has been witness to numerous volcanic eruptions, some intense and some not so intense. Some of the deadliest ones have been chronicled below.

China: 260 Million Years Ago

According to a study by Paul Wignall of the University of Leeds, a volcanic eruption in what is now present-day China may have caused mass extinction of civilization some 260 million years ago. This eruption unleashed nearly one-half million cubic kilometers of lava. Wignall and his team of researchers were able to pinpoint the exact timing of the eruption thanks to a layer of fossilized rock that showed mass extinction of marine life.

Under the Sea: 93 Million Years Ago

Undersea volcanic activity triggered a mass extinction of marine life during the dinosaur age 93 million years ago. The eruptions choked off the ocean's oxygen supply and buried a thick mat of organic matter on the sea floor, which has become a major source of oil today. Researchers attribute this event to the shift of tectonic plates, setting off a spike of undersea eruptions.



Idaho: 12 Million Years Ago

A volcanic eruption that took place in southern Idaho some 12 million years ago is said to have killed many animals like three-toed horses, ancient camels and barrel-bellied rhinos in North America. Paleontologists have found remains of these extinct species buried together in Nebraska. Spewing a blanket of ash all over the western USA, this eruption instantly killed several animals, while many others suffocated slowly as a result of the ash that hung in their lungs. These animals were uncovered at Ashfall National Park near Royal, Nebraska.

Yellowstone: 2.1 Million Years Ago

It is little known that lying underneath one of the United States' largest and most picturesque national parks—Yellow-

stone National Park—is one of the largest "super volcanoes" in the world. This site has produced three major eruptions—a gigantic caldera-forming blast that occurred in the region 2.1 million years ago, another that followed 700,000 years later and a third 700,000 years after that. Although we have not heard of any major eruptions in the recent past, this is still considered to be a dormant volcano. There is every possibility that this present-day landmark might explode again.

Lake Toba, Indonesia: More than 70,000 Years Ago

If we are to believe Professor Stanley Ambrose of the University of Illinois, then we are all the descendants of the 10,000 survivors of the catastrophic Toba eruption that took place in Indonesia. This volcanic eruption that occurred 70,000 years ago in present day Lake Toba is the second-largest known eruption in history. Lake Toba, the largest volcanic lake in the world, is itself a result of a giant caldera left behind by this eruption.

Santorini, Greece: 1645 B.C.

The popular myth in Plato's story about the lost city of Atlantis has its origin in the volcanic eruption in Santorini, Greece, more than 3500 years ago. This eruption is known to have buried the Minoan town of Akrotiri, but preserved buildings, beautiful mosaics and winding roads.

Vesuvius, Italy: A.D. 79

Mount Vesuvius entered the history of volcanology with an eruption in A.D. 79 that buried the Roman cities of Pompeii and Herculaneum, resulting in more than 10,000 deaths. An eyewitness account of this eruption is credited to the Roman historian, Pliny the Younger.

Tambora, Indonesia: A.D. 1815

The most powerful eruption in known history took place less than 200 years ago. This eruption, 100 times more intense than the Vesuvius eruption, killed more than 100,000 people

and emitted 400 million tons of gas into the atmosphere. The cloud of ash caused the average global temperature to drop, causing the year 1816 to become known as "the year without a summer."

Pelée, Martinique: A.D. 1902

The French city of Pelée woke up to a catastrophic volcano on May 8, 1902. This tourist destination town on the Caribbean was entirely destroyed, and approximately 28,000 inhabitants were killed. Gas, ash and rock burst into St. Pierre at more than 100 miles per hour, spelling doomsday for this town.

Pinatubo, the Philippines: A.D. 1991

The second-largest volcanic eruption of this century, and by far, the largest eruption to affect a densely populated area, occurred at Mount Pinatubo on June 15, 1991. It killed 800 people, left 100,000 homeless and caused half a billion dollars worth of damage. As a result of this eruption, about 20 million tons of sulfur dioxide was thrown into the air in a cloud of volcanic ash scattered hundreds of miles across.

One of the global effects felt due to this volcanic eruption was the release of aerosols that blocked some of the incoming sunlight, causing a cooling effect that dropped temperatures by a degree Fahrenheit worldwide.

Although volcanoes have unleashed destruction throughout history, we cannot deny the fact that they are also the forces of creation. Volcanoes have helped shape Earth's landscape. Many mountains, islands and plains were built by volcanic eruptions. Earth's first oceans and atmosphere were formed from the gases given off by volcanoes. In turn, oceans and atmosphere created the environment that made life possible on our planet.

—Shilpi Pradhan



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CAN SATELLITES FORECAST EPIDEMICS?

We all know satellites are used in forecasting weather conditions, tracking traffic, and communication controls. But did you know the information obtained from satellites may forecast diseases, too? Satellites do not follow trails of viral or bacterial infections or notice the sudden growth of parasite-bearing insects in an area. Then, how can we harness their power to study diseases? Well, if not direct monitoring of the causes of diseases, satellites can help predict disease outbreaks by analyzing data related to climatic and environmental changes from affected sites. They can also be used to monitor factors that breed diseases, such as stagnant water or humidity.

THE RIFT VALLEY FEVER

Let's look at a devastating outbreak of Rift Valley fever, for example.

In December 1997, the Garissa district of northeastern Kenya was hit by a widespread outbreak of Rift Valley fever. This largest documented outbreak of its time involved five countries and caused 100,000 domestic animals and 90,000 human infections cases with hundreds of deaths.

A decade later, another outbreak struck Kenya, but it was halted before the disease could unleash its full deadly potential. For this time around, the country was better prepared with warnings from NASA.

Investigators at the Goddard Space Flight Center in Greenbelt, Maryland, part of NASA, forewarned the authorities in Kenya that they had a problem. They were repeatedly issued warnings in September, October and November 2007, consecutively. Around the time of the onset of the epidemic, the Kenyan health ministry was able to dispatch teams to the concerned areas to circulate mosquito nets and caution the village leaders and religious authorities to curb people from slaughtering and consuming animals.

Yet, this second outbreak of the disease killed 300 people in Kenya, Somalia, and Tanzania, but the numbers could have been much higher if the authorities had not taken appropri-

ate heed to the warnings. According to Kenneth Linthicum of America's Department of Agriculture, the number of deaths was likely to have been more than 600 had the timely warning not been issued.

DISEASE-SPREADING MODEL

The ability to forecast such epidemics was possible because of a model developed by Dr. Linthicum that addressed how diseases spread. The model was run using the data tapped from satellites.

Researchers took note of the fact that the first outbreak of Rift Valley fever was preceded with an increase in surface temperatures in the equatorial part of the Indian Ocean by half a degree. This rise in temperatures led to heavy and continued rains, cloud cover and warmer air in the Horn of Africa. The extra showers produced hordes of blood-sucking mosquitoes, which lived long enough for the pathogenic virus to develop to the point which facilitates easy transmission.

In September 2007, the researchers noticed a sequence happening in the ocean and suspected the same consequences to follow.

VEIN LINK

The conventional ways of predicting epidemics have heavily relied upon ground fieldwork, which is not only a costly affair, but time consuming, too.

It has been found that processing the data obtained from satellites is much more economical. Satellites are capable of transmitting abundant information on temperature, precipitation, vegetation cover and even the health, moisture content and chlorophyll production of plants. This is a highly useful combination of variables, as noticed by Prof. David Rogers, an expert in ecology and disease at the Oxford University.

During his research, Prof. Rogers was able to associate levels of photosynthesis detected from satellites to the size of a vein in the wings of the tsetse flies that are found in



West Africa. Measurement of this vein shows the health and size of fly population and, in turn, indicates the likelihood of outbreaks of sleeping sickness due to tsetse-borne parasitic diseases which kill tens of thousands of Africans every year. This clearly shows that epidemics can be forecasted using satellite data without collecting even a single fly on the ground.

HARNESSING SATELLITE DATA

Jacques-André Ndione, a researcher at the Centre de Suivi Ecologique, a government public-health agency in Dakar, Senegal, points to a study conducted with the help of satellite monitoring in West Africa which demonstrated that malaria is inclined to spread quicker in suburban localities than in cities and slums.

As per satellite data, the reason for this is that the suburbs have more stagnation points like backyard ponds and puddles. Apart from counting the number of such small water bodies, satellites can also measure their longevity, salinity

and mud content and thus determine how breeding-friendly they could turn out to be.

Africa is not the only place to have benefited from satellite monitoring. According to Renaud Lancelot who leads the EDEN project (a group of laboratories and public-health agencies in 24 European and African countries), satellite research has shown a "significant risk" of dengue fever, malaria and Rift Valley fever entering Europe. Chikungunya, a mosquito-borne virus indigenous to tropical Africa and Asia, has already arrived in Albania and Italy. Could this be an indicator of things to come?

Forecasting can predict climatic conditions that are often associated with a higher risk of outbreaks and may improve disease control. The use of satellite data in relation to the eruption of a disease is, thus, a promising tool in predicting outbreaks weeks or months before they occur and can help save thousands of lives.

—H. Daisy Rani Devi

NATIONAL IGNITION FACILITY - A MAJOR MILESTONE IN ASTROPHYSICS

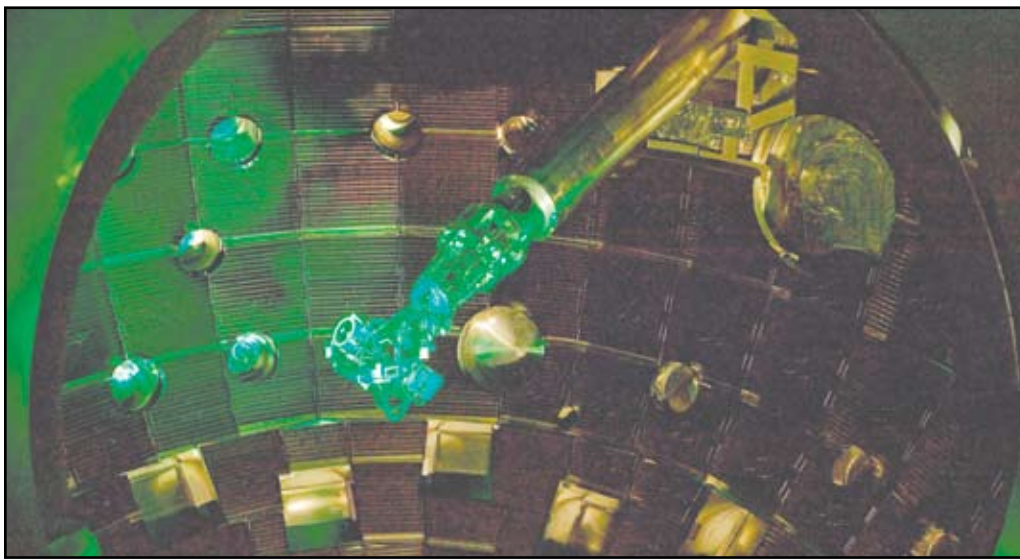
Have you ever wondered what could be the most powerful machine on the planet? What could such a machine be used to achieve? Scientists at the National Ignition Facility at Lawrence Livermore National Laboratory in Livermore, CA, plan to develop a device that is capable of simulating a nuclear-weapons test.

The process carried out by NIF involves directing the intense energy of 192 laser beams onto pellets made of frozen hydrogen. This would result in the pellets undergoing nuclear fusion, the same process that causes stars to shine, provides the life-giving energy of the sun and causes hydrogen bombs to explode.

Although the original idea behind forming the NIF was more scientific, as a prototype for fusion-based power stations, its resemblance to bombs made American politicians look at it from a national security and nuclear weaponry perspective. Since the USA had suspended testing of its nuclear weapons in 1992, it could consider the NIF as an alternative since this facility provided a way for America to carry out nuclear weapons testing without actually testing any weapons. The testing would rather be conducted through subcritical tests that would not involve full nuclear detonation and computer simulations of explosions.

CREATING A MINIATURE STAR ON EARTH

The idea for the NIF grew out of efforts to generate fusion burn and gain in the laboratory. The technique uses convergent beams of laser light to ignite small fusion explosions and produces extraordinarily high temperatures and pressures—tens of millions of degrees and pressures many billion times greater than Earth's atmosphere. Such conditions presently are known to exist only in the cores of stars and planets and in nuclear weapons.



HOW DOES IT WORK?

The NIF is designed primarily to focus 192 laser beams on a gold cavity with a small pellet containing micrograms of the hydrogen isotopes of deuterium (a heavy form of hydrogen with nuclei consisting of a proton and a neutron) and tritium (even heavier hydrogen with a proton and two neutrons). This pellet is chilled to just a degree or so above absolute zero. This would in turn create a plasma-radiating x-ray that heats the outside of the pellet and blows off the outer layer. This will cause the rest of the pellet to implode, which will cause the fuel inside to compress and heat further, and finally result in a self-sustaining burn called ignition.

CAN THIS REALLY WORK?

Although physicists hope that the NIF will be able to achieve a nuclear-fusion reaction that produces more energy than

it takes to ignite, even if only a fraction of a second, critics denounce the massive expenses involved in this experiment and are skeptical about the objectives of this machine.

But if this machine is successful, it will provide a major advance to not just bomb scientists, but also astrophysicists, for they will be able to simulate the conditions of giant planets, stars and supernovae with the help of this machine. The applications of this research can be diverse. Besides the ultimate goal of creating an energy source, the facility can also provide hints as to what happened during the Big Bang, a tricky theory to test out in the lab. Full-fledged experiments that test nuclear fusion as a source of power seem likely to happen only around 2025.

By demonstrating the ability to attain fusion ignition in the laboratory, NIF will lay the groundwork for future decisions about fusion's long-term potential as a safe, virtually unlim-

Facts About the National Ignition Facility

- On January 26, 2009, the final line replaceable unit (LRU) was installed, completing one of the final major milestones of the NIF construction project
- On February 26, 2009, for the first time, NIF fired all 192 laser beams into the target chamber
- On March 10, 2009, NIF became the first laser to break the megajoule barrier, firing all 192 beams and delivering 1.1 MJ of ultraviolet light, known as 3 omega, to the target chamber center in a shaped ignition pulse; the main laser delivered 1.952 MJ
- It is hoped that the main experiments will start in June 2010, when the theory of nuclear fusion will be tested

ited energy source. Also fusion produces no greenhouse gases and is environmentally more benign than fossil-fuel or nuclear-fission-based energy. This experiment could lead to enhanced understanding of astrophysics, hydrodynamics, plasma physics, and other sciences.

THE FUTURE

Nobody can really predict the success or failure of this facility and if it can or cannot make enough energy for ignition. From the beginning, the project faced several delays and setbacks. Budgetary constraints also affected its progress since it was not especially popular with politicians. It may still take years of experimentation before we see any real results from this facility.

—Prathima Ramachandra

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At a time when pharmaceutical companies and dietary supplement makers have created pills or capsules in response to almost every ailment known to man, food researchers are discovering new evidence showing the best preventive medicines may in fact grow on trees. Researchers have discovered that apple peels are rich with antioxidants—those health-promoting warriors that neutralize harmful compounds like free radicals inside the body.

The phrase “An apple a day keeps the doctor away” may have more truth to it than you think. Traditional advice on eating the apple peel was based mainly on its fiber content, with the peel of one apple packing more than 75% of your daily recommended dietary fiber. Now, Cornell University food researcher Rui Hai Liu, Ph.D. has developed a patented process for making dried apple peel powder (DAPP®). Research has shown the peel of an apple (as is the case with many fruits) contains dozens of cancer-killing compounds (triterpenoids) and antioxidants. Triterpenoids have the ability to inhibit or kill cancer cells in laboratory cultures.

This research has inspired a new energy-food product called AppleBoost™. Jim Leahy and Dave Copeland of Leahy Orchards, headquartered in Churubusco, NY, took Lui's research and incorporated it into one of their existing products. In 2008, AppleBoost products gained the distinction, “Certified for Sport,” from NSF International, a not-for-profit, nongovernmental organization. With the successful completion of all imposed requirements, these products have been approved by the NSF International Athletic Banned Substances Certification Program.

Commercially launched at the 2008 Beijing Summer Olympics, AppleBoost was made available to dieticians for the U.S. Olympic Committee, who armed athletes with 6000 tubes of AppleBoost. The AppleBoost Energy snack tubes have the equivalent nutrients of one medium size apple peel blended into applesauce. These convenient, squeezable,



freezable tubes are designed for people on the go. Want more convenience? Also available are DAPP capsules that provide the equivalent nutrients of one medium-size apple peel. They come in two flavors: mango-peach and wild-berry.

AppleBoost has steadily increased its sales over the last year and hopes to expand into school lunch programs nationwide. While AppleBoost is the first company to incorporate Lui's apple powder into food, other companies may start to develop similar products.

The average U.S. consumer eats approximately 20 pounds of apples a year—that's about one apple every four days. Now, in powder form, Lui's dried apple peel powder has the potential to start showing up in everyday products from baby food to breakfast cereals and energy bars. An apple a day may still hold true, but dried apple peel powder makes apple (and apple peel) goodness easier than ever to add to our diets.

—Brienne McCurley



GOODNIGHT, MORNING PEOPLE

It's still dark. I'm semi-conscious and comfortably cuddled in between a thin quilt and a pillow barricade. Outside my window, morning birds are beginning to chirp. I'm annoyed, but optimistic there is still time. I burrow deeper and deeper into my blankets and anxiously await the inevitable. The anticipation is torture.

My alarm sounds and I open-palm crack the snooze button with pinpoint accuracy. My eyes remain closed. The routine repeats itself (in loud five-minute intervals) for the next twenty minutes or until my palm becomes sore. Bullied from bed, I zombie-walk to the kitchen and make coffee. I wouldn't recommend direct contact or communication at this point—it's best to just leave me be.

The good news is that I'm not lazy, inconsiderate or preternaturally surly—I just have longer circadian rhythms than those self-proclaimed morning people who jump out of bed and do yoga. I may snap at you, but it's not my fault.

The circadian rhythm, a 24-hour period that dictates the sleep/wake cycle, is a person-specific succession that greatly influences whether we wake up and smile or wake up and snarl. These rhythms allow us to anticipate and prepare for precise and regular environmental changes like daylight and nightfall.

Stanford University sleep studies have indicated that the self-identified morning-person population possesses short circadian rhythms. This means they sleep through their peak hour of sleepiness and wake up feeling refreshed and well rested. Similar studies have identified that the groggy, snooze-button-loving population possesses circadian rhythms of a much longer variety. This means they wake up right around their peak hour of sleepiness, chart higher levels of melatonin, and feel it is appropriate to shoot the evil-eye at their unsuspecting (and probably undeserving) housemates. They may snap at you, but it's not their fault.

Temperament aside, body temperature and hormone levels also vary between the different sleep groups. Early-risers have lower morning body temperatures and higher morning cortisol levels. Late-sleepers maintain a much higher morning body temperature and a much lower morning cortisol level. Because cortisol helps the body process glucose and fat for energy, more morning cortisol means more morning pep.

Regardless of what circadian rhythm cycle you were fortunate enough to inherit, the bottom line is clear—scientific study has lovingly provided us with the perfect scapegoat for the morning mood-swing.

Use this knowledge wisely.

—Angela Rydeski

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A CASE FOR THE MEANDERING MIND

The human brain is arguably the most complex organ in the natural world. Yet studies on mind wandering show that we find it difficult to stay focused for more than a few minutes on even the simplest tasks. Don't worry—mind wandering is one of the things that makes us human.

Two types of wandering minds

Although most of our mind wandering is harmless, as in when you mull over a problem while munching on a cheeseburger, problems can occur when those thoughts distract you from something important. Jonathan Schooler, a psychologist at the University of California in Santa Barbara, is one of the leading researchers on mind wandering. He has shown that there are two kinds of mind wandering: 1) when you realize that you've started thinking about something else, and 2) when you're so caught up in your thoughts that you're not even aware you've strayed from the task. Schooler calls this second kind of mind wandering "zoning out."

When our minds wander, we're less in touch with the outside world. We're more likely to make mistakes, fail to encode memories, or miss a connection. As Schooler sees it, we start out with the goal of achieving whatever task we're focused on, but because our minds are so complex, no single task uses our entire thinking ability at any given moment. In the gaps that occur while we're focused on a task, our minds tend to intersperse other thoughts, like replaying fond memories, solving personal dilemmas, or making plans for the future. Occasionally one of those stray thoughts hijacks our attention and pulls us away from the primary task at hand.

Research says...

One of the most common tasks that demands concentration is reading. Even doing that, people's minds wander 15 to 20 percent of the time. Schooler and his colleagues conducted an experiment in which they asked college students to read the opening chapters of *War and Peace* on a computer monitor, and tap a specific key whenever they realized they were not thinking about what they were reading. On average, the students reported that their minds wandered 5.4 times in a 45-minute session, or about 13 percent of the time.

Michael Kane, a psychologist at the University of North Carolina at Greensboro, conducted an experiment in which he sampled the thoughts of students eight times during the day for a week. The volunteers carried devices that beeped at random times and asked them questions. He found that on average, they were not thinking about what they were doing 30 percent of the time.

Psychologists have discovered other influences that affect the frequency of mind wandering. Jonathan Smallwood, a colleague of Schooler's at UC Santa Barbara, conducted another experiment in which he instructed test subjects to tap a key every time they saw a new number appear on a computer screen, but to hold off tapping if the number was three. The more quickly the numbers appeared, the less often the subjects' minds wandered. But as people practiced the task and became more familiar with it, their mind wandering increased. Smallwood also found that a person's mood affects how much their mind wanders. If he showed a group of subjects a short video about a sick dog just before they performed a task, for example, they spent more time mind wandering than did a group that had watched a comedy clip immediately before the same task.

Brain-scanning evidence supports the theory that mind wandering is linked to the overall function of our brains. Schooler and Smallwood, in collaboration with Alan Gordon of Stanford University and neuroscientist Kalina Christoff from the University of British Columbia, put volunteers in a functional magnetic resonance imaging (fMRI) scanner and asked them to perform the press-a-key-unless-you-see-three task. The subjects reported incidents of mind wandering 43 percent of the time. During those mind-wandering episodes, the scanner showed brain pattern activity quite different from when the volunteers were focused on the task. The scans indicated that the regions of the brain that are active when we're in "idle" are also the parts that become active during certain kinds of self-referential thinking, such as reflecting on personal experiences or picturing yourself in the future.

Even more telling is the idea that zoning out promotes creativity. John Kounios of Drexel University and his colleagues have done brain scans on volunteers that capture the mo-



ment in which they have the sudden insight for solving a word puzzle. Many of the regions in the brain that become active during those creative flashes belong to the same areas that are active during mind wandering.

How it benefits us

The fact that all of these activities induce the same brain pattern activity suggests that mind wandering is not just useless mental static. Instead, Schooler proposes that mind wandering allows us to work through or process information to solve problems and reach goals. The intriguing thing is that some of what we regularly process are immediate issues, while others are in the future. We've managed to evolve our thinking so that we can switch between handling the here-and-now and contemplating our long-term objectives.

Of course, being permanently zoned out has its downside. It is one thing to drift away for a few lines of *War and Peace*. But if you're pondering where you'll be in five years as you drive through a busy intersection, it may not be the best thing for your future. Our brains elegantly navigate between near- and long-term thinking, monitoring our own awareness to make sure that we don't miss something vital.

Perhaps, Schooler and Smallwood argue, the secret to a good life is finding the balance between the two, the rhythm that brings harmony to the different time scales in which we live.

—Valinda Huckabay

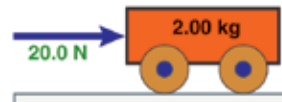
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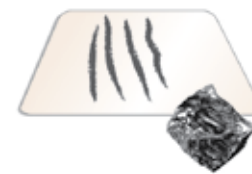
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MEMORIES: TRUTH OR PERCEPTION?

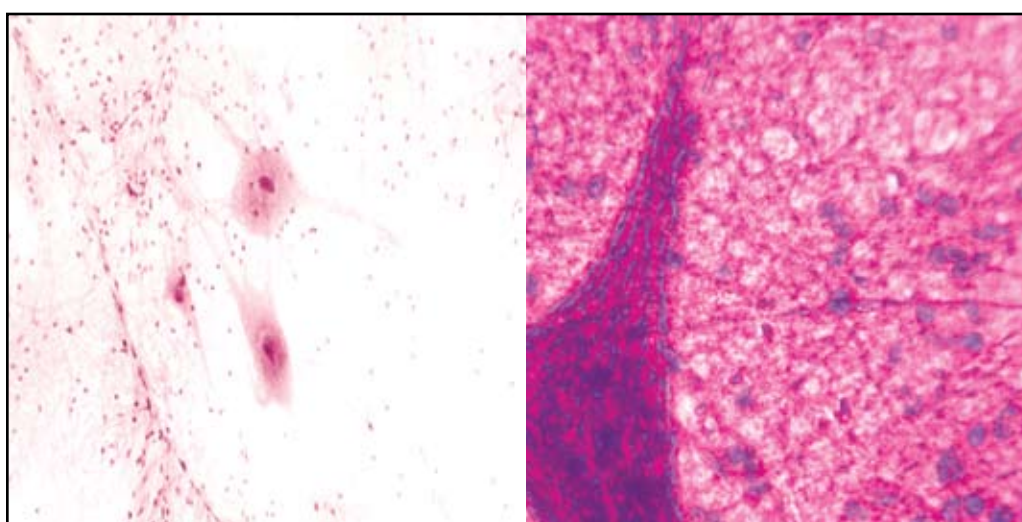
Until recently, long-term memories were thought to be physically etched into our brains, permanent and unchangeable. But how stable are our memories? Does the very act of remembering something change our memories of it?

Traditional thoughts about memory

In the 19th century, the pioneering neuroanatomist Santiago Ramón y Cajal theorized that information was processed in our heads each time an electrical impulse traveled across a synapse (the gap between one nerve cell and the next). Memories were made or altered, he proposed, when structures near the synapse changed.

More specifically, neuroscientists believe that memory forms when specialized nerve cells, called neurons, are activated by glutamate (one of the brain's main neurotransmitters) and an electrical pulse (what happens in the brain as a response to sensory stimulation). These electrical pulses cause glutamate to pop out of one neuron and travel across the synapse to activate another neuron by binding to receptors on the other neuron's surface. This triggers biochemical responses that cause a specialized glutamate receptor (NMDA) to spring open and allow calcium ions to flood the neurons. The ions stimulate dozens of enzymes that literally reshape the neurons by opening up additional receptors and forming more synapses and new protrusions that contain still more receptors and synapses. The neurons become more sensitive to each other, and a memory is built at the cellular level.

These biochemical changes take time, so for up to a few hours, the new memory is like wet cement—forming, but not quite set. Once the process is over, though, the memory is said to be "consolidated." In the textbook description, neuroscientists talk of memory the way geoscientists describe mountains—built through a dynamic process, but once established, almost impossible to reshape quickly except by extraordinary means.



Radical new concept reshapes how we remember

Hundreds of psychology experiments now being conducted suggest that this description of memory as merely a neurally encoded record of experiences is too simplistic a view. Psychologists are finding that instead of being a perfect movie of the past, memory is more like a shifting collage, continually being renovated by experiences that influence our recollection. The science of memory has become conflicted: if a memory is hard-wired into brain cells, why is it so easy to alter many years after the fact?

One of the most exciting and controversial findings in recent neuroscience, discovered by Karim Nader of McGill University, is that we alter our memories just by remembering them. Nader attended a lecture given by Eric Kandel, a neuroscientist with Columbia University who was awarded the Nobel Prize for his theories on memory. That lecture inspired Nader to ponder these questions: What actually happens when we recall the past? Does the very act of remembering undo what happened? Does a memory have to go through

the consolidation process again? At that time, Nader was studying neurobiology under noted memory researcher Joseph LeDoux, and eventually persuaded LeDoux to allow him investigate this intriguing field of study.

To test his theory, Nader modified a simple memory experiment. He conditioned rats to associate a tone with an electric shock to their foot. When they heard the sound, even weeks later, they froze in fear. Nader played the tone to the conditioned rats while simultaneously injecting them with a protein-synthesis inhibitor. His theory was that this would effectively prevent a new memory from forming by prohibiting alteration of the synapses. If the current model of memory was true, the chemical would have no effect on the rats, since their memory of the tone-electricity conditioning was already consolidated. What happened instead was that the rats' memory of the conditioning disappeared—when Nader sounded the tone, the rats didn't freeze in fear. He had effectively altered existing memory in the conditioned rats.

Nader's results ultimately deflate the credibility of memory-based accounts, such as eyewitness testimony, lifetime

memoirs, and personal journals. If his proposed theory is correct, every time we remember an event, we will potentially be adding new details, shading the facts, pruning and tweaking the experience, and all without realizing it.

Hope for the suffering

With this new understanding of memory has come the even more startling possibility of new ways to control it. Most people who survive accidents or attacks are able to move on, but for sufferers of post-traumatic stress disorder (PTSD), the event they experienced haunts them repeatedly, with equal or greater vividness and associated terror. "PTSD really can be characterized as a disorder of memory," says McGill University psychologist Alain Brunet, who studies and treats psychological trauma.

Brunet is working on an experimental treatment for PTSD using the common blood-pressure drug, propranolol. Collaborating with Harvard psychiatrist Roger Pitman, who was the first to try propranolol for PTSD, the McGill group has treated about 45 patients, ranging from soldiers to rape victims. They administer a low dose of propranolol and have the sufferer think about the incident that is torturing them. The idea is that as the victim recalls the trauma, the drug blocks the action of adrenaline and the subsequent strong response in the patient, severing their powerful emotional link to that event. The person remembers the trauma, but with little or no stress. In this way, the memory of the event is actively reshaped so that the terror is stripped away, but not the facts. After a series of treatments, most patients found that their symptoms declined by half and stayed that way, even six months later.

Researchers must still prove whether this form of memory restructuring will have lasting and long-term effects on their patients. If so, these treatments could offer hope to millions of people suffering from PTSD and other disorders. "There is no such thing as a pharmacological cure in psychiatry," Brunet says, "but we may be on the verge of changing that."

—Valinda Huckabay



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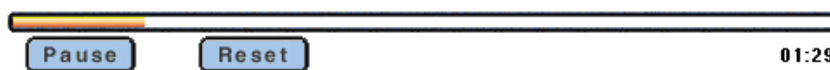
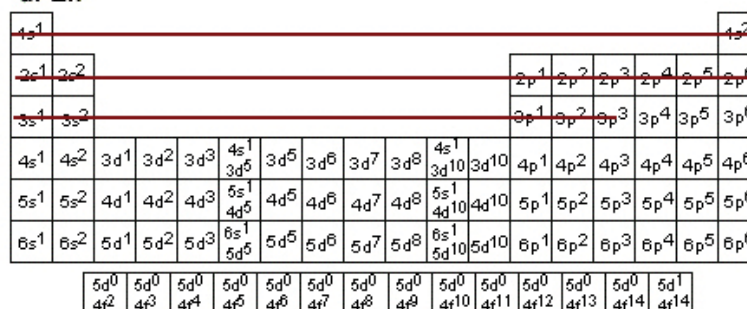


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- a. P 15 e⁻s: [Ne] 3s²3p³ e. S²⁻
 b. Ni f. Na⁺
 c. Ta g. Ti⁴⁺
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BOOK REVIEW

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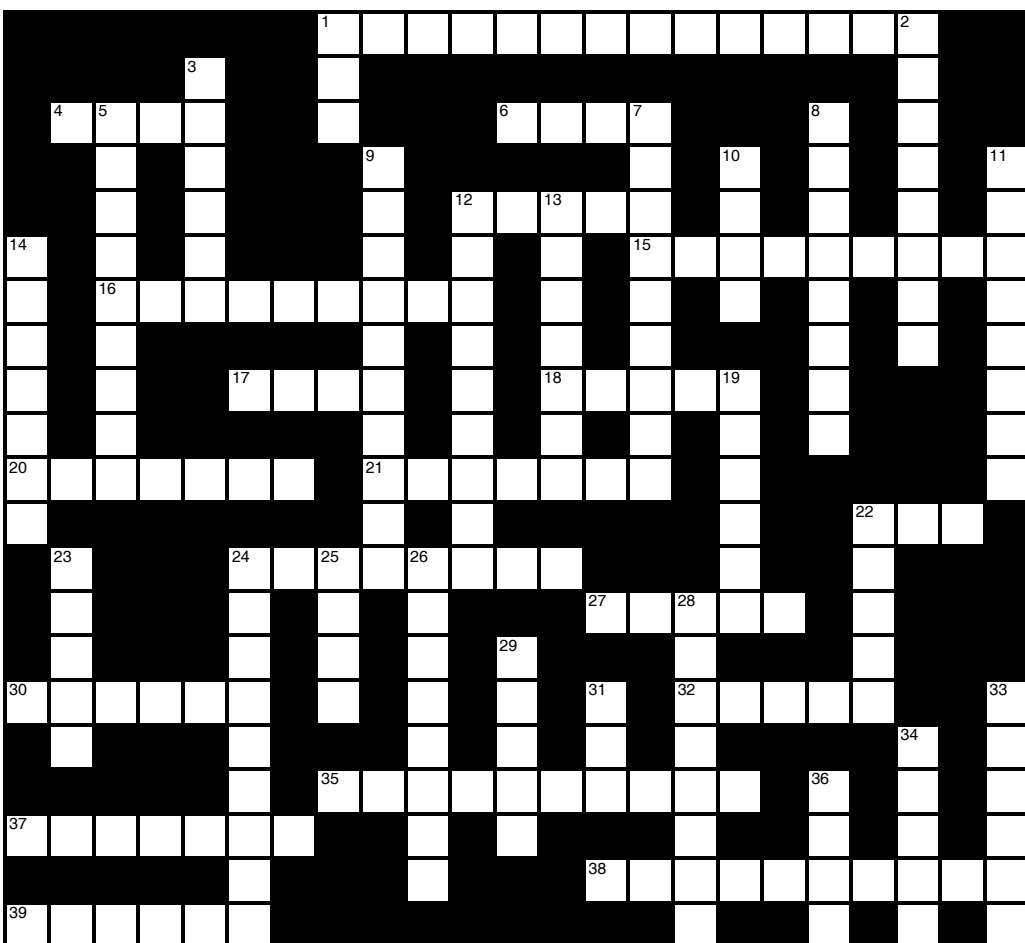
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ACROSS

- One who learns about the forms of life that existed in former geologic periods is known as a _____. (Page 3)
- On the average, Americans eat one apple every ____ days. (Page 20)
- The NIF is designed primarily to focus 192 laser beams on a ____ cavity with a small pellet containing micrograms of the hydrogen isotope deuterium. (Page 18)
- Water vapor, carbon dioxide, ozone, methane, nitrous oxide and chlorofluorocarbons are considered greenhouse _____. (Page 14)
- The _____ rhythm is the 24-hour period that dictates the sleep/wake cycle. (Page 20)
- In addition to North America, on what other continent can "Apples For The Students" be found? (Page 13)
- When subjects were shown a sad video before performing a test task, their minds wandered ____ than when they were shown a funny video. (Page 21)
- The new energy-food product called AppleBoost™ is made from apple _____. (Page 20)
- When selected for NASA's Teacher-in-Space Project, Christa McAuliffe was teaching at ____ High School in New Hampshire. (Page 2)
- "Apples For The Students" is offered by _____ stores. (Page 13)
- Every glass of water served in a restaurant requires ____ glasses worth of water to wash it. (Page 15)
- The first outbreak of Rift Valley fever was preceded with _____ of half a degree in surface temperatures in the equatorial part of the Indian Ocean. (Page 17)
- Early risers have _____ morning body temperatures and higher morning cortisol levels. (Page 20)
- Edwin _____ announced on January 1, 1925 that our galaxy is not alone. (Page 1)
- Roentgen won the _____ Prize in 1901 for his discovery of x-rays. (Page 4)
- The _____ account for nearly 20 percent of the world's fresh surface water. (two words) (Page 15)
- Vesuvius eruption buried the Roman cities of _____ and Herculaneum. (Page 16)
- An artificial sweetener that is very resistant to degradation in sewage treatment. (Page 9)
- A nuclear _____ reaction takes place in the National Ignition Facility and generates enormous amount of energy. (Page 18)

DOWN

- Animal in which the current pandemic influenza virus is thought to have arisen. (Page 8)
- The Carnegie Science Center's roboworld has three themes: sensing, _____, and acting. (Page 3)
- Gastrointestinal disease that teen diagnosed in herself. (Page 11)
- Sponges assist in protecting tissue and organs from damage and absorbing blood and other fluids during an _____. (Page 11)
- The Ulysses space probe was launched from the Space Shuttle _____ in October of 1990. (Page 2)
- Producing cement generates more greenhouse gas emissions than the _____ industry. (Page 15)
- Christa McAuliffe was one of seven astronauts to die on the ill-fated final voyage of the Space Shuttle _____. (Page 2)
- Johannes Kepler published a lengthy treatise on the motion of this planet. (Page 1)
- Term referring to the global spread of an infectious agent. (Page 8)
- The large, darkened clump of cells that the student observed was a _____. (Page 11)
- A _____ is the gap between one nerve cell and the next. (Page 22)
- The Mesa Public Schools _____ Academy focuses on bioscience and research. (Page 10)
- Artificial sweeteners in wastewater can indicate the presence of domestic _____. (Page 9)
- Researchers have successfully modified nanoparticles to carry the drug _____. (Page 10)
- Chikungunya is a mosquito-borne _____ indigenous to tropical Africa and Asia. (Page 17)
- Sponges accidentally left in a patient after surgery can be a source of _____. (Page 11)
- When Mrs. Wakefield of the Toll House Inn ran out of baker's chocolate, she created chocolate _____ cookies. (Page 4)
- The Ulysses mission was a joint project of NASA and the _____ Space Agency (or ESA). (Page 2)
- When students were asked to read *War and Peace*, they reported that their minds _____ about 13 percent of the time. (Page 21)
- Many space enthusiasts object to the demotion of this former planet to "dwarf planet." (Page 1)
- Experiments can determine the concentration of _____ extracted from many sources. (Page 10)
- A favorite robot at roboworld is the Air _____ Bot 1000. (Page 3)
- The _____ tube was the precursor of the microwave. (Page 4)
- About _____ the Sun's radiation that reaches our planet is infrared radiation. (Page 14)



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