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Apr/May 2011; Issue 2



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ENGAGE STUDENTS**

HUMAN SKIN VS. THE OZONE

**NEW SPECIES OF FISH
DISCOVERED**

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SCI-FLYING INTO THE FUTURE

By Alida Cataldo

It's taking us longer to get where we want to go by car. According to NASA's Langley Research Center, the speed on Los Angeles highways will fall by a third over the next 20 years to 22mph because of traffic congestion. As a result, the concept of a "flying car" is rapidly progressing from science fiction to required reality.

NASA, Lockheed Martin, Northrop Grumman and independent inventors have been working on developing a Personal Air Vehicle (PAV) for years. A number of PAVs have made it off the drawing board and into the sky. But technology, practicality and affordability are keeping them out of the regular person's garage... for now.

Langley's research indicates that most people want a PAV that essentially flies itself, and the avionics industry is responding. The latest Unmanned Aerial Vehicle (UAV) now being tested by the military can be programmed to take off, land, deliver supplies, wait to be unloaded and take off again — all without human intervention. And NASA's soon-to-be-tested "refuse to crash" technology will, when necessary, take control of a plane to prevent a collision, a stall or a spin.

The Next Generation Air Transportation System, to be introduced by NASA and the Federal Aviation Administration in 2025, will eliminate voice communications between air traffic controllers and pilots. Computers on the ground will send directional information right to cockpit displays.

Langley predicts that, with mass production, a PAV could cost between \$75,000 and \$100,000. Fuel costs are unpredictable, and it's not yet certain what type of fuel PAVs would use.

To keep maintenance and repair costs down, PAVs will be equipped with far more advanced diagnostic systems than those found in today's cars. Integrated Health Management technology, which helps machinery diagnose and maintain itself, may some day go so far as to help it actually repair itself.

Advances in avionics promise a PAV that will be so easy to fly that a little training and a valid driver's license can get you one. In the not-too-distant future, we'll be climbing into our own PAVs and traveling up to 200mph to destinations we choose and on schedules we prefer.



Gliding to work above earthbound traffic jams or traveling to and from a destination 300 miles away in a day won't be science fiction for much longer. NASA estimates that the Personal Air Vehicle (PAV) will be a reality in two or three decades.

ANEMIA VS. BLOOD PROTEINS: AND THE WINNER IS...

By Gwen Myslinski

Scientists from the Albert Einstein College of Medicine of Yeshiva University recently conducted a new animal study; the results showed protein found in blood can alleviate anemia — a deficiency of oxygen-carrying red blood cells. Additionally, they found that the protein, transferrin, also protected against an iron overload in mice with thalassemia — an inherited form of anemia that globally affects millions of people.

"People who have thalassemia or other types of anemia need frequent blood transfusions over many years to correct the problem," says Mary E. Fabry, Ph.D., professor of medicine at Einstein and a study author. "But the human body has no way to get rid of the massive amount of iron in the transfused blood, and the resulting iron overload — especially its accumulation in the heart and liver — is often fatal. Our study suggests that treatment with transferrin could prevent this."

Researchers suggested that using transferrin may extend to other types of anemia including sickle cell anemia and myelodysplastic syndromes, formerly known as preleukemia.

"The injected transferrin killed three birds with one stone," says Dr. Fabry. "It not only helped in depleting the iron overload that can be so toxic, but it recycled that iron into new red blood cells that ameliorated the anemia. Plus, those red cells survived for a longer time because they had fewer defects."

The researchers are cautiously optimistic that transferrin could have similar benefits for people.

"Before doing clinical trials, we need to work out a lot of details such as the proper dose of transferrin and the frequency of treatment," says Eric E. Bouhassira, Ph.D., another author of the study who is a professor of cell biology and of medicine, and the Ingeborg and Ira Leon Rennert Professor of Stem Cell Biology and Regenerative Medicine at Einstein. "But transferrin's striking effectiveness in reducing iron overload makes me hopeful that people with anemia could really benefit from it."



ABRACADABRA...IT DISAPPEARED!

By Merry Morris



Invisibility could be pretty cool. Imagine the things you could hide or the embarrassing situations that you could avoid if you could just disappear. While this is the stuff of legends and fantasy, science is actually moving toward making visible things disappear.

NO CLOAKS, WANDS OR MAGIC POWDER NEEDED

The secret to becoming invisible lies in the interaction of light waves and your brain, helped along by some tricky new materials.

Very simply, if light waves can be directed around an object and meet back up on the other side, visually the object has disappeared. Our brains would see what is

behind the object, not the object itself. Voila! According to our brains, that object simply is not there. Imagine water waves moving around a rock in a gentle brook. The waves seem to move smoothly around the object and meet back up on the other side. If we could make light waves do the same thing, in such a way that they rejoin perfectly just past the object, we could accomplish what was thought impossible.

Such a device that works on the microwave level has been fabricated by researchers at Duke University in Durham, N.C. A series of concentric rings less than one half inch high and five inches across, this "cloaking device" successfully guided microwaves around small objects. If our vision were in the microwave range, rather than the visible range, we would have "seen" an object in the center of the rings disappear.

A LITTLE HELP, PLEASE!

Enter some new materials that support these kinds of light tricks. Called metamaterials, they are light-benders not known in nature, developed by researchers at the Nano-Scale Science and Engineering Center at the University of California, Berkeley. Some of their properties will be used to ease light around the object to be rendered invisible.

IT'S A LITTLE TOUGHER IN THE VISIBLE RANGE...

It will be a long time before we can render large objects in the visible range invisible, but baby steps are being taken in this direction. Duke researchers have already crafted tiny cloaking devices for use in the visible range, but the objects they worked on were so small, we can't see them anyway. However, it may be just a matter of time before all kinds of things will just vanish before our eyes.

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Ingeniously Practical

SCRUB-A-DUB-DUB — WASH THOSE HANDS IN MORE THAN JUST THE TUB

By Rich St. Clair

Hands-on learning is important to childhood development. It helps children retain more of the material being taught; provides personal guidance from a caring instructor; stimulates learning in a friendly environment; and helps develop critical thinking skills. Because it is so important, the editors at Headline Discoveries thought it would be worthwhile to offer a simple experiment that can teach children about the importance of good hygiene and help understand the existence of microorganisms in their environment.



Materials Needed:

- Remel brand Tryptic Soy Agar Plates (Cat. No. R01920) – two per student
- Warm storage area such as a laundry room or near a water heater

Procedure:

1. Assign two Tryptic Soy Agar plates to each child – label one “clean” and one “dirty”
2. After recess or other activity, have the children lightly press their fingers/hands onto the surface of the “dirty” plate – replace lid
3. Have children wash their hands with soap and water
4. Have the children lightly press their hands onto the surface of the “clean” plate – replace lid
5. Collect the plates and store them for 24-48 hours in a warm, preferably humid area to allow the collected organisms to grow
6. After 24-48 hours, allow the children to view the colonies growing on both the “clean” and “dirty” plates

Results:

It is expected that the “dirty” plates will contain a significantly greater number of colonies than the “clean” plates. This difference not only illustrates the existence of microorganisms, but also reinforces the importance of proper hand washing.

Hand-washing Techniques

The wrong way:

- Rinse hands under a running faucet for 5 or 10 seconds without using hand soap. (**Poor Results**)

The right way:

- Rinse hands under a running water and then place soap in your palm
- Now scrub hands together working the soap around the fingernails, the back of the hands, around the fingers and up to the wrist. Do this away from the running water working the soap into a lather
- Work the soap around for **15 seconds** and then rinse the soap clear of hands
- Drying hands on paper towels is highly recommended
- Cloth towels need to be laundered regularly

THE GENETIC ADVENTURES OF BARBARA MCCLINTOCK

By Gwen Myslinski



Barbara McClintock was an avant-garde cytogeneticist (a person who studies the genetic structure and function of a cell, especially in chromosomes) who opened the door for future genetic, genomic and even cancer research.

She was born in Hartford, Connecticut on June 16, 1902, the third of Thomas and Sara McClintock's four children. Because of her independence, and to relieve some of the financial burden of her parents, Ms. McClintock moved to Brooklyn, New York to live with her aunt and uncle.

She attended Cornell University where she earned a B.S. (1923), M.A. (1925) and Ph.D. (1927) in botany. During her graduate work, she had the opportunity to take the few genetics classes offered, and there began her life-long love for the field.

LAYING THE GROUNDWORK

During her graduate and post-graduate work, she made her first significant contribution to the field of genetics. She developed cytological (cell biology) techniques that allowed her to identify each of the ten maize (corn) chromosomes. It was this initial discovery that laid the foundation for a series

of cytogenetic discoveries throughout her lifetime including: how genes are responsible for turning physical characteristics on or off, theories to explain the repression or expression of genetic information from one generation of maize plants to the next, the chromosome breakage-rejoining-bridge cycle that shows the rejoining of chromosomes is not a random event and it demonstrates a source of large-scale mutation, and the discovery of genetic transposition.

Her career was full of scientific breakthroughs in genetics, and as such, she received several prestigious honors and awards including:

- Only the third woman to be elected to the National Academy of Sciences (1944)
- First female president of the Genetics Society of America (1945)
- National Medal of Science from President Richard Nixon (1970)
- 12 Honorary Doctor of Science and one Honorary Doctor of Humane Letters recognitions
- 16 Significant scientific awards including:
 - Only woman to receive an unshared Nobel Prize for Physiology or Medicine, credited for discovering "mobile genetic elements" – 53 years after she discovered and published it (1983)
 - Kimber Genetics Award, National Academy of Sciences (1967)
 - Albert Lasker Basic Medical Research Award (1981)

Since her death on September 2, 1992 her legacy lives on as a widely written about topic in books and other literature for both adults and children; and the United States Postal Service has issued two separate commemorative stamps honoring her accomplishments.

ORGANISMS LURKING IN THE ENVIRONMENT

By Rich St. Clair

Offer students a way to get dirty in the classroom (without much of a mess to clean up), and teach them how to collect, cultivate and observe microorganisms present in the environment around them.

Materials:

- Remel 5mL Sanicult Swabs (Cat. No. R723141) - two per student
- Remel Tryptic Soy Agar (TSA) Plates (Cat. No. R01920) - two per student
- Warm, preferably humid, storage area such as a laundry room or near a water heater
- Latex gloves

Procedure:

1. Assign each student two swabs and two TSA plates – label one "clean" and one "dirty"
2. Allow students to swab one area they think will be clean (such as a cafeteria counter) and one area they think will be dirty (such as the bathroom floor) – label the plates accordingly
3. Swabbing procedure: Rub all sides of the moistened swab onto a one square inch section of the surface to be tested
4. Plating Procedure: Streak the swab gently onto the TSA plate using the traditional streak-plate method
5. Put plates in a warm place for 24-48 hours
6. After incubation, allow students to compare the clean vs. dirty plates.

Which one is really clean? Why?



Results:

Depending on the areas sampled, the results may vary. Have the students consider why certain surfaces they think would be clean are not and vice versa. For example, why would the bathroom sink be cleaner than the bathroom door handle? Perhaps because it is cleaned daily with detergent and the door handle is not.

AMEP AND FSE PRESENT FAMOUS SCIENTIST KIT -



BARBARA MCCLINTOCK

This Nobel Prize winner is best known for her work in Physiology. She was one of the world's most distinguished cytogeneticists. This small group activity works well in a group of 4-5 students. Four activities included in the lesson plan cover Pigment Patterns in Indian Corn, The Jumping Gene, Building DNA, and Loopy Genes. The included glossary and reproducible worksheets make this an excellent addition to the biology and botany classroom. A material list of common classroom supplies is included. Contains a 13 x 11" inflatable bust representing this scientist and provides 11 facts regarding her prestigious career. Grades 4-12. Ages 9-18.

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A FISH CALLED "PSYCHEDELICA"

By Joe Giacobello

What do you get when you cross a frog, a fish and a colorful bouncing beach ball? In January 2008, a group of divers swimming off an Indonesian island found the answer to this riddle when they stumbled upon a most unusual, striped fish that hops and seems to "bounce" along the sea floor like an inflated rubber ball. Images of the creature were sent to Ted Pietsch, a fish expert at the University of Washington, and he soon announced that a new species of frogfish had just been discovered.

UNIQUE APPEARANCE

Because of the coloring of its skin — a wild swirl of tan and peach stripes — the fish was named "psychedelica" (Latin name *Histiophryne psychedelica*). The intricate striped pattern, which covers the entire fish, acts as a camouflage, and seems to mimic the design of certain types of corals. While most frogfish are able to change their colors depending on the appearance of their environment, psychedelica's swirls and stripes always stay the same regardless of their surroundings. Additionally, the striped pattern of each fish is distinctive. Like a fingerprint, it is unique to each individual, allowing researchers to easily identify specific fish in the wild.

About 4 to 5.9 inches in length, the psychedelic frogfish is flabby and fleshy, with no scales. The thick folds of skin protect them from sharp-edged corals, as they navigate secretively through tiny nooks and crannies of the harbor reef. Unlike other frogfish, the psychedelica has a flattened face with eyes facing forward. Most fish have an eye on either side of their head, and see different views with each eye. But Pietsch speculates that psychedelica, with its forward-facing eyes, may actually have binocular vision — that is, vision that overlaps in front, similar to that of humans.



MOBILITY

Probably the most unique (and entertaining) feature of psychedelica is the awkward but fascinating way in which it propels itself along the sea floor — a movement that looks more like hopping and crawling than swimming. It moves by walking on its pectoral fins and then pushing off the sea floor while expelling water from tiny gill openings to propel itself forward, utilizing a sort of jet propulsion. As it is doing this, the fish takes on a ball shape, giving it the appearance of a beach ball erratically bouncing along with little control or direction. Oddly, no other frogfish has ever been observed "hopping" in this manner.

A favorite among marine enthusiasts, the psychedelic frogfish was named one of the top 10 species discovered in 2009. This hopping, bouncing, artistically painted fish is undoubtedly one of the most mysterious, elusive and beautiful creatures to inhabit the sea floor.

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SYNTHIA: THE FIRST LIVING COMPUTER-BORN GENOME

By Gwen Myslinski

Without "fringe" scientists, many of the greatest scientific discoveries of the modern world may have never been explored. From penicillin and the polio vaccine to Dolly the Sheep, scientists from all over the world are in a constant quest to tap into the unknown marvels of science. Exploring the undiscovered is something biologist Dr. J. Craig Venter is known for; he was on the team that developed the first human genome. Now he and his team of scientists at the J. Craig Venter Institute have successfully created the first living organism with a completely synthetic genome.

After nearly 15 years and \$40 million, Dr. Venter and his team were able to create the new life form, nicknamed Synthia, by:

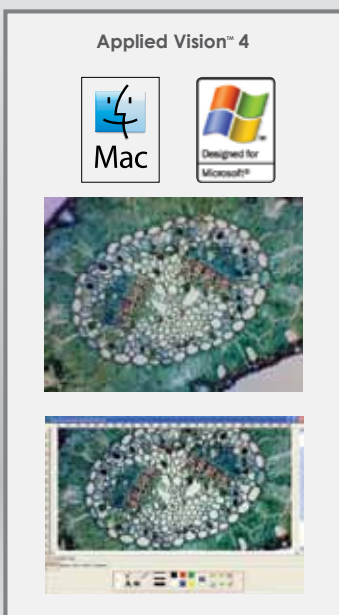
- Decoding the entire DNA of a bug that infects goats (*Mycoplasma mycoides*)
- Buying four bottles of chemicals that contain fragments of code
- Stitching the fragments together using yeast to build a synthetic copy of the original DNA
- Growing and dividing the artificial DNA into two daughter cells; one with artificial DNA, the other with natural DNA
- Allowing nature to take its course – antibiotics in the Petri dish killed all of the bacterium with the natural DNA, leaving the one with the synthetic DNA to multiply and thrive – and new life to be created

This achievement heralds the dawn of a new era which can, depending on one's outlook, benefit humanity by soaking up carbon dioxide from the atmosphere, developing bugs that produce clean biofuels, creating microbes that can help clean up oil slicks and manufacturing drugs like vaccines.

Some groups and organizations are concerned with the new discoveries, thinking the artificial organisms could escape into the wild and cause environmental havoc or be turned into biological weapons; other groups feel Venter and team are playing God. However, the online publication in the United Kingdom, Daily Mail, reported "The process was carried out on one of the simplest types of bacteria, under strict ethical guidelines. The research team insists that they cannot think of a day when the technology could be used to create animals or people from scratch."

To distinguish the natural DNA from the artificial DNA, the team deliberately inserted four sequences of DNA that serve as watermarks. These watermarks contain a code that translates DNA into English letters that allowed the scientists to literally write messages with the genes. When translated, the watermarks spell out the names of the 46 project researchers, quotations from various writers and scientists and a URL that anyone who deciphers the code can e-mail.

3.2 Mega Pixel Camera



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NEWEST ELEMENT HONORS COPERNICUS

By Joy Jones

You may be familiar with Nicolaus Copernicus, the Renaissance scholar credited with discovering the heliocentric model of the solar system, which identifies the sun, not the Earth, as the center of the universe. Chances are, however, that you've never heard of copernicium. More than 450 years after the death of Copernicus, he has been honored with the new chemical element bearing his name.

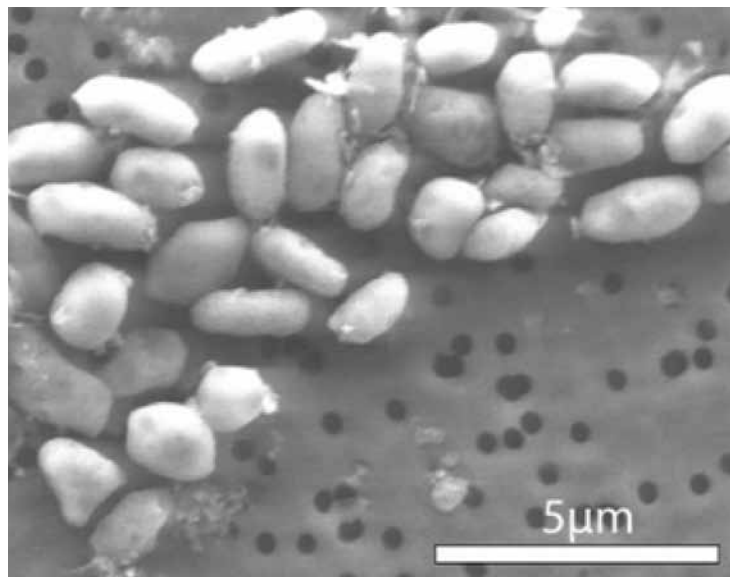
Copernicium, first discovered in 1996 by German scientists, was given its official name on February 19, 2010 by the IUPAC, International Union of Pure and Applied Chemistry (the organization that establishes universal terminology for use by chemists all over the world). In the 14-year interim, scientists had been working to validate the discovery, i.e., confirm that other scientists performing the same experiment could obtain the same result, in this case, the same substance.

All of the known elements are listed in the Periodic Table of the Elements, each with its own chemical symbol and number. Copernicium, with the symbol Cn and atomic number 112, now holds the title of "heaviest named element." An atomic number of 112 means that every atom of copernicium has 112 protons in its nucleus.

SUPER-HEAVY COPERNICIUM DECAYS IN LESS THAN A MILLISECOND

The team of German scientists led by Sigurd Hoffman created copernicium in the laboratory by blasting atoms of lead (each with 82 protons) with zinc isotopes containing 30 protons using a Universal Linear Accelerator. This 120-meter-long instrument can accelerate atoms at a rate of up to 10 percent of the speed of light. Copernicium, like other super-heavy elements (elements heavier than uranium, with 92 protons), is unstable, decaying within a fraction of a thousandth of a second of its formation.

Scientists nonetheless are excited about the discovery, anticipating that even heavier elements may be able to be created in the future. Nuclear chemist Paul Karol of Carnegie Mellon University expresses hope that copernicium might be a stepping stone: "We might find something that is stable and has unusual applications." In fact, elements 113 through 118 have already been discovered; if they are officially confirmed, copernicium may not hold the heavyweight title for long.



CHANGING A LAW OF PHYSICS: THE TEMPERATURE THAT FREEZES WATER

By Alida Cataldo

Those of us in the northern states watch winter temperatures carefully. We know that when temperatures approach 32°F (0°C), we need to prepare for icy and/or snowy weather. Or do we? Scientists at the Weizmann Institute of Science in Rehovot, Israel, found that water can be made to freeze at different temperatures by applying electrical charges.

The experiment began with four crystal discs placed inside four copper cylinders. One disc gave the water a positive charge, another a negative charge and two none. As the room temperature was lowered, water droplets appeared on the crystals, then froze at -12.5°C with no charge, at -19.4°F (-7°C) with a positive charge, and at -0.4°F (-18°C) with a negative charge.

Water holds its own charge. Its oxygen atom and two hydrogen atoms bind by sharing electrons, which have a negative charge. The oxygen atom attracts more electrons, so it has a more negative charge. Since the protons (positive charge) of the hydrogen atom aren't equivalent to its electrons, hydrogen atoms have a more positive charge. These differences led scientists to believe that the freezing point of water could be changed.



If water contains no dust particles, it can be "supercooled" to -40°C/F without freezing. Dust particles allow water to freeze at our "normal" 32°F because ice crystals form around them. Supercooled water can actually freeze as it's heated if the rising temperature also changes the surface charge. On a negatively charged lithium tantalate surface, for example, supercooled water freezes immediately when the surface temperature reaches a positive-charge temperature of 17.6°F (-8°C).

Scientists were surprised by the fact that a positively charged surface froze supercooled water from the bottom up and a negatively charged surface froze it from the top down. They think this happens because negatively charged oxygen atoms are drawn to positively charged surfaces and positively charged hydrogen atoms are drawn to negatively charged surfaces.

Understanding and controlling the temperature at which water freezes can make a huge difference in cryopreservation, agriculture, species conservation and even weather. One day, we might be able to preserve more cells and tissues, prevent the the freezing of crops, end extended droughts and inhibit extinction of cold-blooded animals.

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Iso-Amyl Acetate (Banana Oil)	09/15/1999	80.00 ml	123-92-2	Red	UN1104	C ₇ H ₁₄ O ₂	130.186				
Isopropyl Alcohol 70% soln (Rubbing Alcohol)	05/15/2010	1000.00 ml	Mixture	Red	UN1219	Mixture					
Isopropyl Alcohol 99%, ACS (2-Propanol)	09/05/2010	500.00 ml	67-63-0	Red	UN1219	(CH ₃) ₂ CHOH	60.096				
Isopropyl Alcohol 99%, ACS (2-Propanol)	06/15/2010	1500.00 ml	67-63-0	Red	UN1219	(CH ₃) ₂ CHOH	60.096				
Methanol 70% Solution	09/15/2010	400.00 ml	Mixture	Red	UN1230	Mixture					
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CATS: A SURPRISING USE OF PHYSICS

By Valinda Huckabay

UNTIL RECENTLY, HOW CATS DRANK REMAINED A MYSTERY.

While humans are able to close their mouths and create suction to drink, most animal species can't do this. Dogs, for instance, scoop up liquid with their tongue, but cats use the principle of fluid dynamics to quench their thirst.

This conclusion came from a three-year study in which a team of scientists researched the natural process all cats use to drink. The results of their experiment were published in the November 11, 2010 online edition of the journal *Science*.

HIGH-SPEED PHOTOGRAPHY REVEALS THE REAL ACTION

These modern-day researchers – Roman Stocker and Pedro Reis from the Massachusetts Institute of Technology (MIT), Sunghwan Jung of Virginia Polytechnic Institute and Jeffrey Aristoff of Princeton – used high-speed photography to examine how cats drink in close detail. Initially, the scientists thought that the roughness of a cat's tongue was the main factor in pulling up liquid, but as it turns out, the smooth tip of a cat's tongue plays the more important role. They discovered that when cats lap any liquid, they extend their tongues straight down curled backward in a J shape, allowing the smooth tip of their tongue to touch the liquid first.



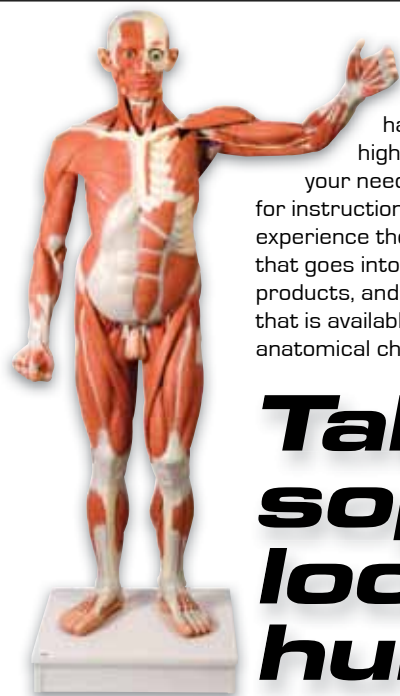
WHY THIS WORKS

Two forces of physics are at work when a cat drinks: inertia, the tendency of a liquid to continue moving once started, and adhesion, the property of a liquid to stick to a smooth surface.

As the smooth tip of the cat's tongue touches the surface of the liquid, adhesion causes the liquid to stick to it. Then inertia pulls a column of liquid up as the tongue rises. Before gravity can overcome the rising column of liquid, the cat closes its mouth to catch a drink. Cats lap at precisely the rate that gets them the most liquid for the effort expended. At four laps a second, domestic cats are able to drink about five teaspoons of liquid in a minute. Big cats like tigers have larger tongues, so they lap less than two times per second to get the same results.

LOOKING FORWARD

This study was begun out of curiosity, rather than to develop a practical solution, but the scientists involved say that there could be useful implications to this intriguing research. In the field of soft robotics, for example, applications are often modeled after naturally flexible structures in nature such as elephant trunks, octopus arms and even cat tongues, says Stocker. According to Aristoff, there's great interest in creating robots that can walk on water, and this research could help there as well. "To us, this study provides further confirmation of how exciting it is to explore the scientific unknown, especially when this unknown is something that's part of our everyday experiences," states Reis.



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DIRTY BOMBERS BEWARE, U.S. HAS DIAPERS THAT CAN HELP REPAIR

By Gwen Myslinski

Disposable diapers have recently been transformed into a crime-fighting ally that can aid in the cleanup of a dirty bomb, should one go off in the U.S. These diapers are filled with tiny crystals that are comprised of a material called sodium polyacrylate that is so absorbent, it can soak up hundreds of times its weight in liquid. Scientists from the Argonne Chemical Engineering Division in Argonne, IL were able to use this liquid-sucking material and modify it into a gel, which can be used to clean up certain types of radioactive toxins after a terrorist attacks with something like a dirty bomb.

"The polymer gel we use to absorb the radioactivity is similar to the absorbent material that's found in disposable diapers," Michael Kaminski, lead scientist of the project, explained. "When exposed to a wetting agent, the polymers start to cross-link, forming something like a structural scaffold that allows the gel to absorb an incredible amount of liquid."

After a dirty bomb explodes, it sends radioactive materials into the air, contaminating any surface it comes into contact with. "If a radioactive device were activated in public, the primary concern would be widespread contamination," said Kaminski. "This contamination is particularly hard to remove in buildings made from brick or concrete, where the pores, or holes, in those materials make it easy for radioactive materials to become trapped."

The Argonne team of scientists has developed a three-step procedure that can decontaminate and safely capture and dispose of any radioactive elements in outdoor porous structures. The first step is to spray a wetting agent and the super-absorbent gel onto the contaminated surface. After the wetting agent causes the bound radioactivity to resuspend in the pores, the gel sucks the

radioactive material from the pores and holds on to it. Finally, the cleanup team vacuums the gel and disposes of it accordingly, leaving minimal traces of the radioactive elements behind.

This technique is more ideal than current radioactive decontamination operations because "right now, it is common practice to demolish the contaminated materials in hopes of getting rid of the radioactivity. Our technique would allow surfaces to be preserved, which means that we wouldn't have to deface monuments or buildings just to remove the radiation," said Kaminski.



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NEW BUILDING BLOCK EXPANDS THE DEFINITION OF LIFE

By Joy Jones

Scientists have long regarded six building blocks as the basis for all life forms on Earth: carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur. However, recent NASA-funded astrobiology research has uncovered an organism that is able to thrive and reproduce on Earth using an unlikely starting material: the toxic chemical arsenic.

Dubbed strain GFAJ-1, the new microorganism belongs to the common group of bacteria Gammaproteobacteria. It was discovered in the harsh environment of California's Mono Lake, which is characterized by high alkalinity, high salinity and high arsenic content due to its isolation from fresh water sources for 50 years.

MICROBE GROWS ON ARSENIC-RICH DIET

Scientists grew the microbe on a diet that was light in phosphorus, but rich in arsenic. Phosphorus, a component of DNA and RNA, is considered essential for all living cells. When the phosphorus was removed from the microbe's environment altogether, it continued to grow, substituting arsenic for phosphorus in its cell components. Unexpected? Yes. Because although arsenic is chemically similar to phosphorus, it is considered poisonous to most life forms on Earth.

According to Felisa Wolfe-Simon, NASA's lead researcher for the project, scientists have known that certain microbes can breathe arsenic, but using it for growth is an entirely new phenomenon. The critical issue was to verify that the arsenic became integrated into the organism's biochemical makeup, e.g., DNA, proteins and cell membranes, which the study did. The implications are that a life form using arsenic could occur naturally, either on Earth or in some arsenic-rich environment.

Though the organism cannot technically be considered an "alien life" form according to Paul Davies, co-author of a report appearing in the journal *Science*, its discovery will nonetheless have far-reaching implications. The findings may open new frontiers in disease mitigation, the study of evolution, the search for extra-terrestrial life and more. And of course, there will need to be a revision of existing biology textbooks.

Perhaps most important, this study proves that alternate biochemistries for life are no longer the stuff of science fiction.



MAMMOTH DISCOVERY IN COLORADO

By Patricia Rogler



On October 14, near Snowmass, Colorado, an unsuspecting bulldozer driver working for the Snowmass Water and Sanitation Department got the surprise of his life during a routine construction project when he stumbled upon gigantic

ribs sticking out of the ground. Luckily, he was savvy enough to realize he might have made an important discovery and contacted the Denver Museum of Nature and Science. It turns out he had made a very important discovery — one of the most significant scientific discoveries in Colorado history.

FIRST JEFFERSON'S GROUND SLOTH

Since mid-October, museum scientists working at the Snowmass site have unearthed 600 bones from 20 different animals and six different species, including mastodons, bison, mule deer, tiger salamanders, Columbian mammoths and the very first Jefferson's ground sloth discovered in Colorado. This is also the first time a site in Colorado has contained both mammoth and mastodon bones. The bones were lying in four and a half feet of peat, partly decayed animal matter, which can preserve bones for thousands of years without fossilizing them.

A WINDOW INTO THE ICE AGE ECOSYSTEM

In addition to the discovery of animal fossils, the Snowmass site contains insects, plant life and wood from over 12,000 years ago. These discoveries will give scientists a well-rounded view of life during the Ice Age and a window into the whole Ice Age ecosystem. Due to the fact that this site is located at an elevation of 8874 feet, it also provides scientists with information about Ice Age life at an elevation that has been largely absent from the fossil record.

With the excavation of the site only halfway completed, experts are predicting that this site could be as significant as the La Brea Tar Pits and could become one of the top five sites in North America. However, it will take the Denver Museum of Nature and Science as much as two years to display the collection due to the long and involved preservation process.

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WILL CORAL REEFS GO THE WAY OF THE DODO?

By Gwen Myslinski

The undersea brilliance ringing islands of the tropics are a draw for travelers worldwide. Warm ocean breezes, scintillating, silky sand and crystal clear waters delight the senses but cannot electrify the nerve endings like the kaleidoscopic colors of the coral reefs. Imagine, now, the loss of those vivid hues...if the reefs bleached to white and then disappeared? The death of the reefs may only be decades away.

According to Professor Peter Mumby of the University of Exeter, U.K., coral reefs have been on the planet for over 400 million years and make up less than one quarter of one percent of the Earth's marine environment. However, they are the world's most diverse marine ecosystem and include 25 percent of known marine species, which consist of 400 species of fish, 700 species of coral and thousands of other plants and animals.

CAUSE FOR DESTRUCTION

"Coral reefs are made up of thin layers of calcium carbonate (limestone), which have been secreted over thousands of years by billions of tiny, soft-bodied animals called coral polyps," informs Mumby in *Science Daily*.

When environmental factors go beyond the norm (i.e., increased water temperature, water acidification, etc.), the coral and algae symbiosis can disintegrate, which bleaches the algae white. Once this happens, the coral is no longer receiving an adequate energy source and it dies.

Michelle Paddock of Simon Fraser University reports that, in addition to such environmental factors, other factors like overfishing are another cause of the reef's degradation. Paddock's research shows that both large-and small-bodied species have been on a significant decline since 1995.



WHY THEY'RE IMPORTANT

Coral reefs are an important entity to many. According to Dr. Simon Donner, who is funded by the National Sciences and Engineering Research Council, "hundreds of millions of people who live in the tropics depend on coral reefs for food, income, tourism and shoreline protection." And, without the coral, the amount of carbon dioxide in the water could rise dramatically, and that could effect a domino-like fall of other marine ecosystems, according to Texas A&M's OceanWorld program and the International Programme on the State of the Ocean. Finally, coral reefs are important because they act as a coast protector from strong currents and waves by slowing the water down before it gets to shore (hence another common name for coral reefs, barrier reefs).

HOW TO SAVE THE CORAL REEFS

Dr. Donner adds that "The outlook isn't completely bleak." He goes on to state: "No one is predicting that the coral reefs will go extinct; they will continue to survive, but only in certain habitats, such as shaded areas. The reality is a general loss of coral cover and a breakdown of the physical structure of reefs."

NEW OZONE BUSTER MAY GENERATE HARMFUL IRRITANTS

By Joy Jones

If you've always thought of ozone as the layer of the atmosphere that protects us from damaging sun's rays, you're about to see this substance in a new light. Ozone is an alternate form of the oxygen gas we breathe, with three atoms of "O" forming a molecule rather than two. Ozone present at the Earth's surface is commonly known as air pollution, and it can creep indoors and irritate our lungs just as it does outdoors.

AN ALL-NATURAL OZONE SCAVENGER

The levels of ozone inside buildings are considerably lower than those outside because ozone gas breaks down into other substances when it collides with objects found indoors. Surprisingly, scientists have recently discovered that one such object is human skin. When ozone is exposed to oils in human skin, a chemical reaction takes place, changing the molecules of ozone, and possibly, the molecules of oil as well.

In the new study, scientists collected dust from the bedrooms of 500 children living on the Danish island of Fyn. Scientists were surprised to find that this dust contained, along with many other substances, cholesterol and squalene, a fat that makes up 10 percent of the oil in human skin. They postulated that the chemicals in the outer layer of skin that is shed every two to four weeks

become part of the "dust" content in the room. As the skin flakes cover the surfaces of objects in the room, e.g., furniture, squalene allows those objects to break up ozone just as the skin on our bodies does.

Furthermore, because squalene is highly volatile, there may also be an amount that enters the air from intact skin, and coats the walls and other surfaces.



Although squalene devours harmful ozone molecules, the news is not entirely good. The results of an Austrian study showed that while the mixing of skin oils and ozone gets rid of ozone, it may be creating another type of dangerous pollutant known as 4-OPA (4-oxopentanal), a carbonyl. Preliminary toxicology tests have led researchers at the National Institute for Occupational Safety and Health in Morgantown, WV to believe that 4-OPA may actually be more harmful than the ozone it replaces.

According to William Nazaroff, an indoor-air quality expert at the University of California, Berkeley, (the skinny) concentrations of these compounds may not pose a problem in homes with just a few occupants. Highly populated spaces — subways, airplanes and schools — may be another matter.

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TECHNOLOGY AT WARP SPEED

By Brianne McCurley and Gwen Myslinski



Notebooks, tablets, mobile devices — oh my! It's hard to believe anyone ever survived the daily tasks of life without the technology we all take for granted. How did anyone communicate without e-mail or texting, or research information before the Internet? It might be hard to imagine, but people did it for tens of thousands of years. Now, it seems as though the latest model of whatever is being updated and replaced a week later. "The pace of change, the pace of innovation, goes faster and faster with each passing year. So, we used to see major changes every three to four to five years. Now, we're seeing major changes every six to 12 months, according to Lance Ulanoff, Editor-in-Chief of PC Magazine.com.

Just think about the technological advances in the last 50 years alone (many of which most couldn't imagine life without today):

- TV Remote Control and Microwave (1955)
- Smoke Detector and ATMs (1969)
- Personal Computer (1977)
- GPS (1978)
- World Wide Web (1989)
- MP3 Player (1993)

Today's warp speed innovation occurs in areas that everyone can see (cell phones and computers) and areas that no one may really know or understand, including Augmented Reality (AR).

Augmented Reality modifies what people can see, hear and feel. It distorts the illusion of something that is computer-generated or real. An AR experience created for the 2009 film "Transformers: Revenge of the Fallen" has seen over two million people access it through www.weareautobots.com. Since the launch, thousands of people have recorded themselves and then posted the videos on YouTube. The SixthSense augmented reality system lets you project a phone pad onto the palm of your hand and dial a telephone number — without using the actual phone. Augmented Reality is somewhat similar to the first-down line you see super-imposed on the television screen during a football broadcast.

Smart phones, such as the iPhone™ and Android™, have Augmented Reality apps available for download.

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HABIT OR HABIT-FORMING?

By Merry Morris

Everywhere we look we see people interacting with the latest technology — and who can blame them? Phones are getting smarter, it's not just birds that twitter, pads aren't just paper anymore. We are increasingly accustomed to having thousands of our favorite songs at our fingertips and getting "pinged" with new messages at any time of the day or night.

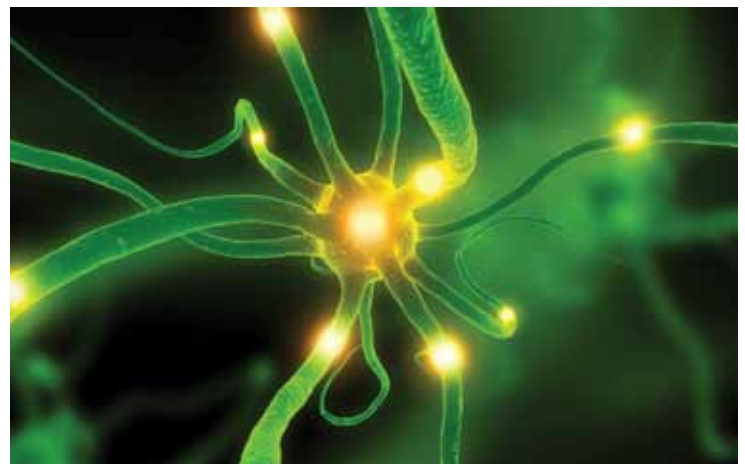
But is being so up-close-and-personal with technology a good thing? Are we controlling the technology or has technology begun to control us? Not that there is a Big Brother who is micromanaging us, sending subliminal messages through our e-mail, but is there something about our brains that makes some of us so tied to our phones or MP3 players that we are uncomfortable without them?

ARE WE BECOMING TECHNO-ADDICTS?

Using our techno-gadgets, we can be instantly connected, but anonymous; friendly, but aloof; chatty, but saved from the social conventions that usually accompany conversation. It's not surprising that we could become dependent on such an easy form of interaction — pop in and out of the social milieu on our own whims. On the flip side, we might worry when we're not connected. In a business context, if we don't check our PDAs every five minutes during a meeting, that critical message may escape our immediate attention.

THE COMPULSION TO CONNECT

The pathways in the brain that reinforce compulsive technology behaviors are the same that bolster substance abuse. Consider an extreme example, Internet gambling. The high from gambling is the result of dopamine flooding the brain's pleasure centers, which can lead the gambler to repeat the pleasurable activity again and again, even when it becomes damaging to his wallet and then to his



life in general. But for a less dramatic case, use of technology, can we consider our desire to log on, answer the ping or pop in our ear buds as true addiction? Or just problem behavior?

If the same types of treatments that help "true" addicts, in turn are effective dealing with compulsive technology use, which many are, is that proof enough? Or must techno-compulsives meet all the same criteria as other addicts: cravings, compulsive use, neglecting other responsibilities, withdrawal, etc.? Experts differ on the answer, but perhaps the best thing we can do in the meantime is to remember that we can enjoy the pleasurable effects of dopamine by getting up and going outside, and even by talking to each other face-to-face!

GENOMES: THE HUMAN BODY SHOP MANUAL

By Gwen Myslinski



In 1990, the U.S. Department of Energy and the National Institute of Health, along with the United Kingdom, France, Germany, Japan, China and India, instituted a scientific research project, the Human Genome Project. The primary initiative of the project was to map and understand the genetic makeup of human beings and to find the genetic root of disease, and then develop treatments.

The \$3 billion, 13-year project was expected to take 15 years to complete; however, a working draft of the genome was announced in 2000 and a complete one in 2003, two years earlier than planned. Researchers discovered:

- There are approximately 20,500 genes in human beings – the same range as a mouse, and twice as much as a roundworm
- Between 1.1% to 1.4% of the genome's sequence is coded for proteins
- The human genome has substantially more segmental duplication than other mammalian genomes
- At the time of publishing, less than 7% of protein families appeared to be vertebrate specific

While the interpretation of the genome data is still in the initial stages, many researchers believe this information will provide pertinent information to make scientific advances in medicine and biotechnology including genetic tests to determine a person's predisposition to a variety of illnesses like breast cancer, cystic fibrosis, liver disease and others. Additionally, some are using the genetic codes to develop long-term treatments for diseases like Alzheimer's disease and a variety of cancers.

Francis Collins, the former director of the National Human Genome Research Institute, stated that "the genome could be thought of in terms of a book with multiple uses. It's a history book – a narrative of the journey of our species through time. It's a shop manual, with an incredibly detailed blueprint for building every human cell. And it's a transformative textbook of medicine, with insights that will give healthcare providers immense new powers to treat, prevent and cure disease."

2011 EARTH DAY

By Diana E. Gannon

Just when green things are once again pushing their way up through the dirt, we get ready to celebrate a very significant birthday: Earth Day, which falls on Friday, April 22, 2011. Celebrating its 41st year, Earth Day, also known as World Environment Day 2011, is a reminder to all that it is important to focus on sustaining and protecting the planet we know as home.

Earth Day's theme for 2011 is "A Billion Acts of Green." The plan is to register a billion acts performed by individuals or organizations to conserve the environment before the Earth Summit in Rio de Janeiro in 2012.

EARTH DAY 2011 ACTIVITIES:

- "Trees for the Earth" campaign seeks to match the 2010 record of planting one million trees all over the world
- "Athletes for the Earth" plans to match popular Olympic and professional athletes with environmental issues
- "Women and the Green Economy" (WAGE) encourages female business leaders to promote a green economy
- "Arts for the Earth" promotes sustainability through community art education

The original Earth Day, instituted in 1970, was the brainchild of Wisconsin Senator Gaylord Nelson who lobbied for a national "teach-in" day after he witnessed the horror of the 1969 Santa Barbara oil spill. Senator Nelson sought to remedy the nation's apathy toward environmental disasters that did not happen in "their own back yard." Media coverage helped to publicize Earth Day, and environmental groups that had been promoting these causes for years suddenly felt united in a common goal. The resulting grassroots movement started on college campuses

with protests against the erosion of the environment and spread to include 20 million Americans who participated in Earth Day that first year.



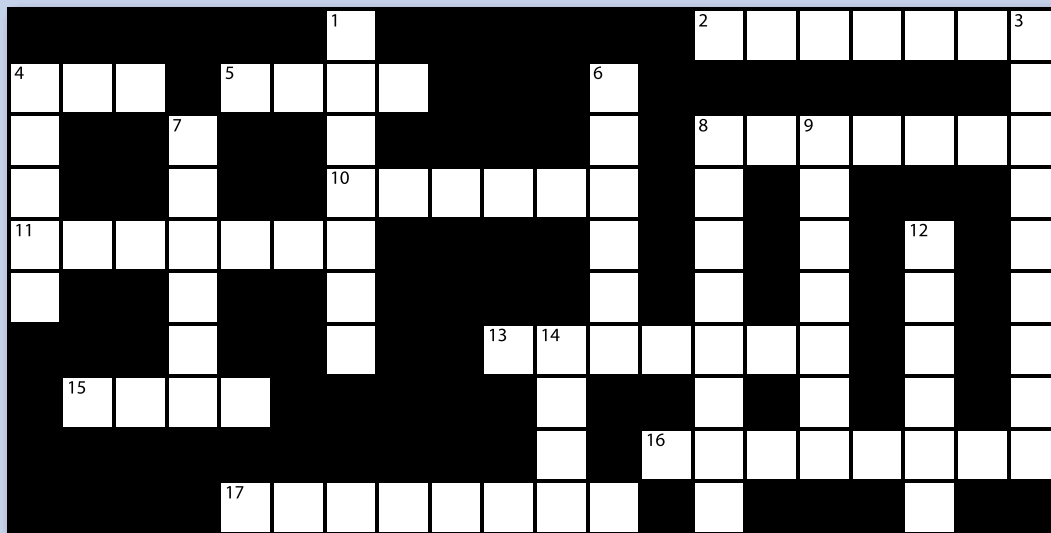
For this Earth Day, and every other day, see how you can help to save the planet and make a "green" difference.



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Across

- 2. Superheavy elements have greater atomic mass than this element (p. 11)
- 4. The Snowmass site contained bones from how many different species? (p. 16)
- 5. Barbara McClintock discovered cytological techniques in what commonly named vegetable? (p. 6)
- 8. New building block used by recently discovered microorganism (p. 16)
- 10. Ozone is an alternate form of which chemical element (p. 19)
- 11. How many "Acts of Green" is the goal for Earth Day 2011? (p. 22)
- 13. Frogfish expert Ted _____ (p. 8)
- 15. Particles that help water freeze (p. 11)
- 16. In certain activities, _____ floods the brain's pleasure centers (p. 21)
- 17. A _____ device renders objects invisible (p. 4)

Down

- 1. What city was the team from that developed a gel that can clean up some radioactive materials? (p. 15)
- 3. In 1955, the TV remote control and what other electronic device was invented? (p. 20)
- 4. Students testing for environmental organisms use two _____, one clean and one dirty? (p. 6)
- 6. In 1990, the Department of Energy, National Institute of Health and others started the Human _____ Project (p. 22)
- 7. Coral reefs are made up of soft-bodied animals called coral _____ (p. 18)
- 8. Two forces of physics are at work when a cat drinks: inertia and _____ (p. 14)
- 9. Name of the first synthetic genome (p. 9)
- 12. Name of NASA's personal air vehicle concept (p. 3)
- 14. _____ overload, especially in the heart and liver, can be fatal. (p. 3)



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