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We are celebrating our tenth year of publishing current science news and information from our valued parters. Turn to the back page for more on Headline through the years and to catch up on one of our original articles!

STEM DESIGN CHALLENGE EXPANDS STATEWIDE FOR 2014

By Cara De Carlo

Last March at Duquesne University in Pittsburgh, PA, kids built robots designed to improve the world. Their feats were a part of the recently expanded Thermo Fisher Scientific STEM Design Challenge.

The annual STEM Design Challenge is a Thermo Fisher Scientific-sponsored challenge in the areas of science, technology, engineering, and mathematics (STEM). Students in grades 4 through 8 compete by using K'NEX™ kits and motors to solve a problem. The 2013 contest required teams to design robots that would make the world healthier, cleaner, and safer.

"There was one contraption that looked like a big Ferris wheel," said Spencer Todd, Vice President and General Manager of Doe & Ingalls. Todd was one of the judges of the 2013 competition.

"[The machine] picked up the balled up pieces of paper and flung them into a collection basket," Todd added. He explained that the students designed the robot to remove garbage from the sea floor.

Forty-three teams from schools in the Allegheny Intermediate Unit (IU) gathered for the first event in 2010, but the event grew to 90 teams in 2013.

"Thermo Fisher Scientific is giving money, a grant of $25,000, to expand the program to nine other IUs," said Director of Marketing and Product Management Jill Jones. She explained that the funding is for event costs as well as material costs for schools that cannot afford K'NEX.

As a result, the 2014 challenge in the Pittsburgh region will include teams from the Beaver County and Washington County IUs. The two top teams (per age division) in each IU will go on to compete at the state level against the top teams from other participating IUs in Pennsylvania.

"[The STEM Challenge] is fun and exciting but welcomes all abilities," Jones elaborated. "If you're an engineering type, you can do blueprints. There's also building and presenting."

"One group actually composed a song and dance routine for their project presentation," said Betty Woo, Vice President of Global Accounts and 2013 judge. "Their routine was more like a rap — completely unique — that told the story of how their invention would clear trash from the streets using solar power."

The 2014 STEM Design Challenge featuring K'NEX is scheduled for Friday, May 2, 2014, and will be held at Harrisburg University in Harrisburg, PA.

"Events like this bring meaning and relevance to traditional learning methods," said Woo.

WHAT IS YOUR STEM-Q?

- A girl has as many sisters as she has brothers, but each brother has twice as many sisters as brothers. How many brothers and sisters are in the family?
- A two-digit number, read from left to right, is 4.5 times as large as the same number read from right to left. What is the number?
- What is the next number in this series: 18, 46, 94, 63, 52?

TEEN INVENTS PALM-POWERED FLASHLIGHT

By Patti Dobranski

YouTube

Ann Makosinski and her invention, the "hollow flashlight."

A 15-year-old winner of the 2013 Google Science Fair was internationally recognized for finding a simple way to harvest clean, surplus energy literally in the palm of her hand.

"Humans are a great source of untapped thermal energy," said Ann Makosinski, who lives in Victoria, British Columbia. "My objective was to make a flashlight that runs solely on the heat of the human hand."

The teen successfully invented a flashlight that utilizes the thermoelectric effect to generate usable light without batteries. The thermoelectric effect is created when electrons flow between the cool and warm sides of a material and produce a small amount of electricity.

In late September, she won the top prize for "Innovation" in the 15-to-16-year-old category of the Science Fair, which was held in Mountain View, Calif. She beat thousands of other young scientists.

ECONOMICAL AND ENVIRONMENTALLY-FRIENDLY

Makosinski pointed to the age-old fear of discovering dead batteries when a flashlight is desperately needed, along with the environmental threat of improperly discarded batteries, as her motivators.

"Imagine how much money we would save and the amount of toxins leached into the soil... reduced... if we didn't use batteries in flashlights," she said.

Since the energy source is essentially endless and always available, her flashlight has dependable, cost-free operation. She acknowledged that while the entire human body was a great source of thermal energy, she could not work with it as a whole and instead concentrated on palm power.

AN IDEA TO BRIGHTEN THE FUTURE

The thermal flashlight is simply a prototype, Makosinski explained, but definitely a workable idea with impact and potential. Her materials included a hollow aluminum tube, some discounted Peltier tiles she found online, and an ordinary LED.

"The components in my device are quite strong," she said, noting she was aware production refinements would be made before marketing the product, such as waterproofing or more protective casing.

After some milliwatt calculations and tweaking of voltages and other components, she saw the glow of success.

While the light generated by the thermal flashlight was not enough to illuminate a room, it could definitely help someone find their keys at a darkened doorstep or read a page of a book. Further, the power lasted about a half hour in a 50 degree Fahrenheit environment – pretty impressive for this "handy" prototype!

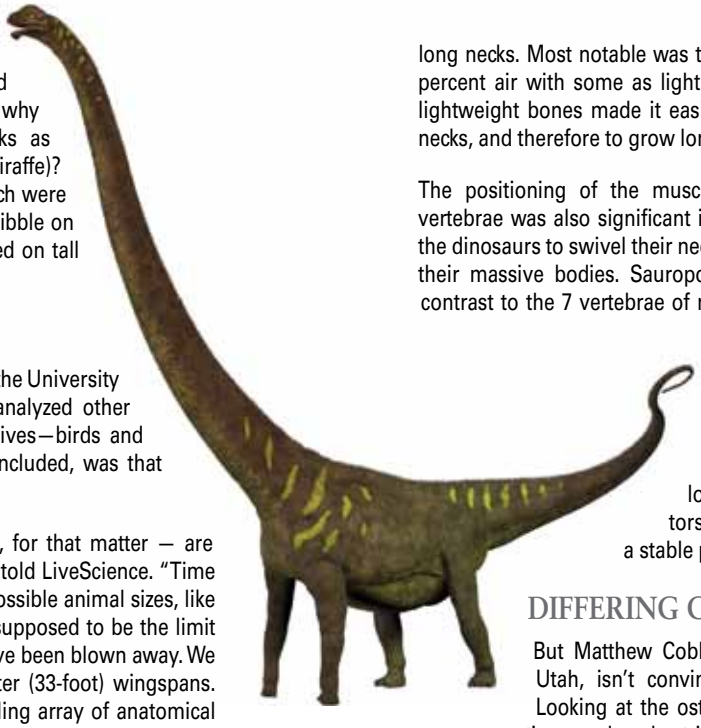
Makosinski envisions that the mechanics of her invention might be used in the future in other scientific applications such as medical devices.

CLASSROOM DISCUSSION

- What are some other ways thermoelectric power can be used?
- What are some downsides to the invention of the battery-free flashlight?

HOW DINOSAURS EVOLVED THE LONGEST NECKS

By Samba Lampich



The discovery of sauropods, or long-necked dinosaurs, created excitement and wonder in the scientific world. How and why did these gigantic creatures develop necks as long as 50 feet (six times longer than the giraffe)? Some scientists believe that sauropods, which were herbivores, evolved long necks in order to nibble on ground plants, but others believe they grazed on tall trees.

IT'S ALL RELATIVE

Michael Taylor, a vertebrate paleontologist at the University of Bristol in England, and his colleagues analyzed other long-necked creatures that were close relatives—birds and crocodilians. The secret, the researchers concluded, was that sauropods had mostly hollow neck bones.

"Extinct animals — and living animals, too, for that matter — are much more amazing than we realize," Taylor told LiveScience. "Time and again, people have proposed limits to possible animal sizes, like the five-meter (16-foot) wingspan that was supposed to be the limit for flying animals. And time and again, they've been blown away. We now know of flying pterosaurs with 10-meter (33-foot) wingspans. And these extremes are achieved by a startling array of anatomical innovations."

ADAPTATING TO SUPPORT A LONG NECK

Taylor and his team of paleontologists found that several adaptations supported long necks. Most notable was that sauropods' necks were made up of 60 percent air with some as light as bird bones. Taylor believes that these lightweight bones made it easier for sauropods' bodies to support long necks, and therefore to grow longer over time.

The positioning of the muscles, tendons and ligaments around the vertebrae was also significant in that it maximized leverage and allowed the dinosaurs to swivel their necks to eat what they needed before moving their massive bodies. Sauropods also had up to 19 neck vertebrae in contrast to the 7 vertebrae of nearly all mammals, which limit how long their necks can grow.

Sauropods also had small heads with no cheeks not clear how their swallowing and chewing is relevant. These small heads could be supported easily by long necks. In addition, the dinosaurs' giant torsos and four-legged stances helped provide a stable platform for their necks.

DIFFERING CONCLUSIONS

But Matthew Cobley, a paleontologist at the University of Utah, isn't convinced that sauropods had flexible necks. Looking at the ostrich, Cobley found that cartilage and soft tissue reduced ostriches' flexibility to the extent that dinosaurs wouldn't have been able to swivel their heads to feed. However, ostriches may not be an ideal analogy because, unlike sauropods or giraffes, they walk on two legs. Further research would be needed to firmly conclude not just how — but also why — sauropods evolved to have such long necks.

THE HOUSE THAT BARBIE® BUILT

By Samba Lampich

Looking through any toy catalog, it's easy spot toys that are marketed specifically to boys or girls.; Boys are shown playing with construction and assembly toys while girls cuddle with furry pets or fashion dolls. These images are reflected in the life choices that girls make in their higher education and careers. According to the U.S. Department of Commerce, women make up less than a quarter of all the STEM (science, technology, engineering, and mathematics) workforce in the U.S.

A NEW WAY TO PLAY

Alice Brooks, Jennifer Kessler, and Bettina Chen were master's students at Stanford studying mechanical engineering, neuroscience, and electrical engineering when they decided that they wanted to make sure that girls were engaged in STEM activities at an early age. Their hope was that introducing these topics early might inspire girls to pursue STEM-related careers in the future. And what better way, they thought, than with the toys that girls enjoy at an early age.

Alice Brooks tells Co.Design, "During our testing, we asked parents about the educational toys that they had previously purchased for their daughters. Their most common response was that educational toys are more often marketed to boys. We think girls should have the same access."

THE WIRED DOLLHOUSE

Brooks, Kessler and Chen took it upon themselves to inspire young girls and built a dollhouse with added tiny, electronic motors. The house, Roominate, is stackable, comes with furniture, and requires some assembly. The connecting color-coded wires run lights, buzzers and a fan.

"We started with a toy that girls already love, and added educational components that make the toy even more engaging," Alice Brooks tells Co.Design.

Alice Brooks and Bettina Chen

Roominate dreamhouse

HAVING PLAY OPTIONS

"We loved our dolls, stuffed animals, and Barbies growing up," Brooks tells Co.Design. "But, we also love our Legos, Lincoln Logs, Mastermind, and chess. With Roominate, we are showing girls that they can like both. Everything is an option."

The wired dollhouse allows girls to build on math and science skills by learning how circuits work and then using them to turn lights off and on or make fans spin.

Brooks, Kessler and Chen started a Kickstarter campaign hoping to raise $25,000 to sell Roominate online and at museums for $65.

CLASSROOM DISCUSSION

- How would you include STEM activities in other toys marketed towards girls?
- How would teaching STEM to an all-girls or all-boys class differ?

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SCIENTISTS BUILD A DREAM-READING COMPUTER

By Mona Simpson

Do you remember what you dreamed last night? In general, people forget half of their dreams within five minutes of waking and 90% of their dreams within 10 minutes. Scientists have developed a way to determine what people see while they dream.

Researchers wanted to match patterns in brain activity to things people see in their dreams. That way, scientists could predict what images the sleeping participants were seeing when they dreamed.

Scientists picked three participants to sleep for three hour blocks at a time. Participants were attached to two machines: an electroencephalography (EEG) machine and a functional MRI (fMRI). The EEG tracked the level of electrical activity in the brain in order to indicate when the participants were dreaming. The fMRI showed the pattern of blood flow in the brain. Once the participants began dreaming, scientists woke them to ask them what they were seeing in their dreams. The scientists woke each participant over 200 times to ask what they dreamed.

Next, the researchers divided the reported dreams into 20 of the most common types, and picked an image to represent each type. They showed these 20 images to the 3 participants and recorded their brain activity while each participant saw the image. Scientists did this so they could differentiate between the pattern of brain activity that resulted from the participant looking at the image and the brain pattern that resulted from general sleeping.

The most critical part of the research was taking all of the data and using it to find patterns to predict what the dreamers were seeing. The scientists fed all of their data into a learning algorithm, a computer program that could improve itself based on the data it was given.

When the scientists invited the three sleepers back, the algorithm selected which items it thought the sleeper was likely seeing, based on the sleeper's fMRI results. The algorithm guessed right about 60% of the time, which isn't perfect, but the results were more accurate than if they had been chosen by chance. The study pointed to the ability to determine what a person is dreaming. This is because broad classes of dreams have similar patterns of brain activity. Scientists hope to use this start to produce objective, consistent data that could unlock more information about dreams in the future.

CLASSROOM DISCUSSION

- What makes a pattern? What is the difference between a pattern and random objects?
- If you saw a line of people or objects, do you think you would be able to discover a pattern?

SPEED BUMPS CAN HELP DIAGNOSE APPENDICITIS

By Nishtha Jain

A famous proverb suggests, "Maybe life gives us speed bumps—just so we will slow down!"

Appendicitis is a well-known medical term, referring to swelling or inflammation of the appendix, a useless vestigial organ. The relationship between this common ailment and speed bumps is surprising!

WHAT HAPPENS IF NOT DIAGNOSED EARLY?

Diagnosing appendicitis in early stages remains a challenge due to its non-specific or atypical clinical manifestations. It becomes more severe if left untreated. With untreated appendicitis, the mortality rate is high, mainly because of the risk of rupture leading to infection and inflammation of the intestinal lining and eventual sepsis, (clinically known as peritonitis), which could be fatal. Earlier studies have found that risk of rupture in the following 12-hour period rises to 5% after 36 hours of untreated symptoms.

FINDINGS FROM A NOVEL STUDY

A recent study has claimed that feeling pain while travelling over speed bumps shows a high sensitivity (97%), but a low specificity (30%) for the diagnosis of appendicitis. The study was conducted on 101 adults who were referred to hospitals for suspected appendicitis on the basis of pain experienced while travelling over speed bumps. All participants were questioned within 24 hours of their journey to the hospital and were grouped as "speed-bump positive" if the speed bumps made their pain worse, or "speed-bump negative" if their pain remained the same or improved.

SUGGESTION FOR MEDICAL PRACTITIONERS

This finding sheds new light on an important diagnostic technique that should be considered before starting the diagnostic processes for appendicitis. Speed bump pain, hence, either helps in diagnosing appendicitis more accurately or completely negates the necessity of starting the treatment. It may thus be concluded that questioning patients about their sensitivity to speed bumps along with other clinical symptoms should form part of the routine assessment for patients with suspected appendicitis.

CLASSROOM DISCUSSION

- What are some of the theories about the purpose of the appendix?
- What other vestigial organs does the human body have?

THE SEARCH FOR A CURE

By Celeste Beley

Cystic Fibrosis (CF) is a genetic disorder that causes the body to produce thick, sticky mucus that clogs the lungs and can lead to life-threatening infections as well as blocking the pancreas and prohibiting the enzymes that break down and absorb food. Patients are typically diagnosed before the age of two and 55% of the patient population is under the age of 18. In the 1950s, children with CF usually didn't make it to elementary school. Today, thanks to significant advancements in gene research and drug discoveries, patients with CF are living healthy, vibrant lives well into their 30s and beyond.

UNLOCKING THE MYSTERY

In August of 1989, news came that Francis Collins and Lap-Chee Tsui had discovered the gene that causes Cystic Fibrosis. Named the Cystic Fibrosis Transmembrane Regulator gene (CFTR), it produces a protein with only 1,479 amino acids; a healthy gene produces a protein with 1,480 amino acids. A cure using gene therapy seemed to finally be in reach, but ultimately those efforts failed and researchers were forced to find another way. Researchers found that CFTR has over 1900 distinct mutations, explaining why patients with the disease have such varying symptoms and severity (although most patients are affected by a mutation named Delta F508.) Support from large pharmaceuticals never came, and that's when the Cystic Fibrosis Foundation (CFF) stepped in.

TRIAL AND ERROR

Unheard of for nonprofits at the time, in 1994 CFF initially invested $3.2 million dollars with Aurora Biosciences Corp. to begin research on a chemical cure using high-throughput screening, through which they believed it was possible to find a molecule that would interact with the defective protein and correct it. They deduced they would need two drugs — one to "correct" the protein, and a second called the "doorman" that would allow the corrector drug to pass in and out of the cell. From 1994 through 2003, over 322,000 compounds have been tested. Beginning in 2002, Vertex Pharmaceuticals (who acquired Aurora in 2001) discovered VX-770 (the doorman) and VX-809 (the corrector). By 2007, VX-770 (soon to be renamed Kalydeco) started being used in clinical trials. The results were remarkable and the FDA approved the drug in 2012. Vertex is now conducting trials of the corrector drug, VX-809, in combination with Kalydeco. If this works, the combination would result in a cure for over half of CF patients (those with two copies of the Delta F508 mutation.) Vertex and other drug companies are also researching more potent and varied drugs to enable cures in 100% of all patients living with the varied mutations of Cystic Fibrosis.

The Cystic Fibrosis Foundation continues to fund more research for a cure for CF; from its initial investment, CFF has spent almost 300 million dollars to fund a cure. Almost every drug available to CF patients today was discovered with Foundation support. With support from researchers, parents, and advocates, it does appear a cure is within reach. To find out more about Cystic Fibrosis and the Cystic Fibrosis Foundation, visit www.cff.org.

CLASSROOM DISCUSSION

- What other diseases benefit from and may find cures using gene research and genetic therapies?
- What steps can you and your school take to help keep students with Cystic Fibrosis healthy? (hint: answers can be found at www.cff.org/LivingWithCF/AtSchool)

DOLPHIN REMEMBERS COMPANION AFTER 20 YEARS

By Patricia Rogler

We all know that humans, other primates, and even elephants have long memories, but a new study, conducted by Dr. Jason Bruck of the University of Chicago, shows that dolphins actually have the longest social memories of any animals that have been studied thus far in the animal kingdom.

SIGNATURE WHISTLE

Every dolphin has a signature whistle, a unique call that each dolphin has throughout its life (sort of like a human name). Dr. Bruck recorded the whistles of 53 bottlenose dolphins that had been raised in captivity at six different facilities. Many of the dolphins had spent time together over the years before being separated at different facilities. Paperwork gave the exact dates when these dolphins had been separated so it was an ideal group to study. Dr. Bruck played the signature whistles over underwater speakers and studied the dolphin's response. When Dr. Bruck played the signature whistle of a stranger, the dolphin did not respond and gave signs of quickly becoming bored. However, when Dr. Bruck played the signature whistle of an old companion, the dolphin would immediately react by hovering around and whistling back, trying to get a response.

ALLIE AND BAILEY

Allie and Bailey were raised together as juveniles in a facility called the Dolphin Connection. Long ago they had been separated: Allie went to the Chicago Zoo, and Bailey went to Bermuda. Yet Bailey recognized Allie's signature whistle immediately, even after more than two decades of being separated.

COMPLEX SOCIAL SYSTEMS

Dolphins are able to remember other dolphins regardless of relatedness or duration of the association. Because signature whistles never change, dolphins have the potential to have longer memories than humans, whose faces change as they age. Since a dolphin's life span in the wild is only 20 years, dolphins could have lifelong memories. Researchers believe that dolphins have such long memories because of their complex social systems: they join different social groups many times during their lives. Dr. Bruck said, "These results, paired with evidence from elephants and humans, provide suggestive evidence that sociality and cognition could be related, as a good memory is necessary in a fluid social system."

CLASSROOM DISCUSSION

- What could be the purpose of a dolphin's signature whistle?
- What are some of the possible reasons why animals would have long-term memories?

THE SCIENCE OF PET FOOD

By Celeste Beley

Dry pet foods first became popular during World War II, when tin rationing ended canning and the wide availability of canned pet food. Dry pet food is a blend of animal fats and meals with soy and wheat grains as well as vitamins and minerals. Since animals are not natural grain eaters, pet food manufacturers have developed "palatants"—powdered flavor coatings to entice animals to eat their pet food. Palatants can be compared to the powder coating found on Cheetos™. Without that coating, the snack probably doesn't taste like much, but with the powder it becomes a tasty snack.

Asking an animal to taste test a food has one major issue: the animal can't talk. Therefore, manufacturers rely on behavioral cues. They find that dogs rely more on the smell of their food to make a choice about what to eat and how much, whereas cats tend to rely on the taste of the food. Interpreting their behavior can be problematic. According to a researcher at AFB International, a company that makes flavor coatings, the highest compliment a dog can give is to vomit. When dogs really like a food's aroma, they tend to eat too much too fast resulting in bit of a mess. But for pet food researchers, it's a good sign.

Dog food research extends even beyond the actual taste test. At AFB, researchers ensure their animals have ample time to play with their peers, so researchers need to understand if the dog doesn't like the food, or is just distracted by its missing toy.

The real challenge for these researchers is to find a palatant that entices the dogs, while not overwhelming their owners. Dogs' noses can be 10,000 times more sensitive than their human owners. So aromas that may be appealing to humans are completely overpowering for a dog, and vice versa.

Pet foods tend to be highly complex and contain more nutritional value than many common "human" foods. A group called Center for Science in the Public Interest (CSPI) tested 36 common American protein products: awarding points for vitamins, calcium and trace minerals and subtracted for corn syrup and saturated fats. Alpo brand dog food was included in the rankings, scoring 30 points. What is remarkable is that it scores better than salami, pork sausage, fried chicken, shrimp, ham, sirloin steak, peanut butter, bacon and others. The top-scoring foods are all some form of animal liver, so AFB makes liver the main ingredient in all their palatants.

So the next time you chose a dry food for your pet just remember that what smells good to you, may have a completely opposite effect on your pet. And in the end, they just may be eating better than you.

CLASSROOM DISCUSSION

- Would you or have you ever tried pet food? Why or why not? If you have tried it, what did it taste like?
- What flavors do you think dogs prefer? What flavors do cats prefer? Discuss how they are the same or different.

OLIVE OIL: AN ELIXIR FOR ANCIENT ARCHITECTURE

By Mary Rose Thomas-Glaser

York Minster cathedral in England is made of limestone which is vulnerable to pollution.

You've probably heard of the health benefits of olive oil for the heart, skin and hair. But did you know that olive oil may save historic buildings from deterioration caused by pollution?

For centuries, limestone has been hewn from quarries around the world and used for the construction of landmark buildings and statues such as the pyramids in Egypt, cathedrals in Europe and national monuments in the United States. No matter the location, since the beginning of the Industrial Revolution all of these structures have been plagued by the effects of air pollution. Sulfur dioxide and nitrogen oxide emissions form acid rain that decays limestone, eroding detail from carved stone and causing it to crack and crumble over time.

SLICK SOLUTION

Building preservationists have long sought an economical and effective coating to protect buildings from moisture and pollutants on the outside, yet allow air on the inside to prevent deterioration. Now a team of researchers from Cardiff University in Wales and the University of Iowa may have found the answer in olive oil — a liquid valued as a medicine, sacred offering and cooking ingredient since antiquity.

Olive oil contains between 55 and 83 percent oleic acid, a long chain, monounsaturated fatty acid. Its chemical structure is inherently hydrophobic (water-repelling) and naturally responds to changes in ambient temperatures.

A research team led by Karen Wilson in Cardiff developed a blend of olive oil and fluorinated substances that can be applied as an extremely thin layer, just a nanometer or one billionth of a meter thick! The coating covers even the smallest cracks in limestone yet allows it to breathe, preventing mold growth and efflorescence, or formation of salt deposits.

The coating was applied to samples from several historical structures including York Minster, one of the largest English gothic cathedrals built in the 1260s. Samples were then exposed to sulfuric acid to simulate acid rain pollution. X-ray analysis showed that the olive oil coating protected the calcium minerals with little formation of destructive gypsum deposits. According to Wilson, the trial results are very promising. "Such coatings could have a significant impact on stone conservation, affording readily applied, conformal barriers to protect historic limestone from weathering by gas phase and particulate sulfur oxide pollutants."

HANDS-ON ACTIVITY

- Simulate limestone degradation in your classroom using an egg and vinegar. Eggshell is made of calcium carbonate ($CaCO_3$), the same chemical as limestone. Acetic acid in vinegar mimics acid rain. Watch the bubbling as $CaCO_3$ converts first to carbonic acid (H_2CO_3) and then to carbon dioxide (CO_2). Within an hour, the eggshell will dissolve.

THE MICHELANGELO OF ARACHNIDS

Newly discovered spider sculpts gigantic doppelganger

By Mary Rose Thomas-Glaser

Phil Torres

The decoy is about the size of an outstretched hand.

Imagine building a realistic replica of yourself over four times your size without tools or equipment. Could you do it? Seems impossible, yet a newly discovered spider in the Peruvian Amazon has mastered this remarkable task.

DETRITUS DECOY

During an exploration in the Peruvian rainforest, a team led by entomologist Phil Torres stumbled upon a web about the size of an outstretched hand with what appeared to be a dead, fungus-covered spider. On closer inspection, however, the team realized the one-inch arachnid was nothing but a decoy constructed from leaves, forest debris and dead insects. The real spider, only five millimeters in size, sat behind the "corpse."

With amazing anatomical precision, the tiny spider had created a supersized self replica complete with a head, thorax and eight legs. While hiding behind the decoy, the spider vibrated the entire web to animate the decoy and create an illusion of a larger, more threatening arachnid to distract prey, ward off potential predators or perhaps both.

A NEW SPECIES?

Did team Torres discover a new species? Well, they aren't quite sure yet. The team shared their findings with arachnologist Linda Rayor at Cornell University who confirmed that the spider was indeed unusual. "The odds are that this [species] is unidentified," she said, "and even if it has been named, that this behavior hasn't previously been reported."

The genus of *Cyclosa* includes the Trashline Orb Weaver spider, which gathers debris to create decoys in the web. Their clumpy replicas, however, lack the anatomical detail seen in the Peruvian spiders. But unique behavior alone is not indicative of a new species. More information is needed, and Torres and his team plan to return to the Amazon site to collect spiders.

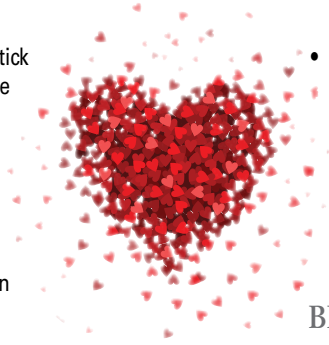
An average of three new species is discovered daily in the Amazon rainforest! Stay tuned to learn if this Peruvian spider will be added to the Amazon's treasure trove of biodiversity.

CLASSROOM DISCUSSION

- If this spider is a new species, what would you name it and why?
- What other animals use decoys, mimicry, or deception to survive or hunt?

WHAT MAKES PEOPLE FALL IN LOVE?

By Mona Simpson



Do opposites REALLY attract? Do birds of a feather REALLY stick together? Some say that when it comes to love, there is no rhyme or reason. Are any of these questions and statements actually true? Helen Fisher, a biological anthropologist at Rutgers University, conducted a study to determine just that.

According to Dr. Fisher, people tend to gravitate towards others who share a similar background, level of intelligence, and/or attractiveness. After that, personality plays a role in picking an individual partner.

First, she determined there are four neurochemical systems — those for dopamine, serotonin, testosterone and estrogen/oxyotcin — that are reliably tied to personality trait. High levels of certain brain chemicals influence our personalities and can affect an individual's desire and effort to achieve rewards in life, such as love.

Fisher then designed a questionnaire to determine which physiological system is dominant in a given person. She posted the questionnaire on a dating website and observed which mate the 28,000 men and women chose.

BRAIN CHEMISTRY

Participants answered a questionnaire to determine their personality types and were then compared to the personality of their romantic partner. The research looked at four types:

- **Builders** (with high serotonin levels) are self-controlled, sociable, cautious and have less anxiety and more close friends.
- **Directors** (with high testosterone levels) are self-confident, competitive, analytical, emotionally contained and tough-minded.
- **Explorers** (with high dopamine levels) are intellectually curious, energetic, mentally flexible and creative.
- **Negotiators** (with high estrogen/oxytocin) are nurturing, empathetic, generous and trusting, with good linguistic skills. (Both testosterone and estrogen are present in both sexes, even though they are known as the male and female hormones.)

BIRDS OF A FEATHER…

The research revealed that Builders and Explorers frequently were drawn to people who had the same personality type, and shared the same traits.

"They like their own type," Fisher said of these two groups.

Meanwhile, Directors and Negotiators were usually attracted to their each other; the self-confident, competitive Directors were attracted to the nurturing, empathetic Negotiators.

STAYING IN LOVE

While personality is a key factor as to why people fall in love, Fisher says staying in love requires "the simple ability to overlook everything you cannot stand in someone."

CLASSROOM DISCUSSION

- How could understanding the different personality types help you interact with people in a more effective way?

3D HOLOGRAPHIC CAMERA IS A LIFE SAVER

By Samba Lampich

A digital camera fitted with the right filters could one day reveal bloodstains hidden behind layers of paint.

Firefighters always put their lives on the line to rescue victims trapped inside burning buildings. One of the biggest challenges they face is blinding smoke which obscures the people they are trying to save. Now, a new technology developed by researchers in Italy could allow them to see through thick smoke and blinding flames.

LOOKING THROUGH FIRE

The researchers have been working on a digital imaging system that will capture infrared signals in 3-D and convert them into holographic real-time video.

Current infrared camera systems can see through smoke and spot heat signatures from living bodies, but their sensitive detectors are blinded by the infrared radiation emitted by flames. When this happens, the camera cannot distinguish between a person's heat and that of the surrounding flames.

"IR cameras cannot 'see' objects or humans behind flames because of the need for a zoom lens that concentrates the rays on the sensor to form the image," says Pietro Ferraro of the Consiglio Nazionale delle Ricerche (CNR) Istituto Nazionale di Ottica in Italy.

The new technology eliminates the need for a zoom lens, allowing it to remain uncompromised by radiation from flames and smoke.

CREATING HOLOGRAMS

Holograms, such as those used on ID or credit cards, are created by splitting a laser beam into two separate beams by passing it through a half-silvered mirror. The two beams, an object beam and reference beam, pass through lenses that make them expand. When the reference beam and reflected object beam are recombined, they create an interference pattern that encodes the 3-D image.

The new system allows a beam of infrared laser light to be widely dispersed throughout a room, passing through smoke and flames unhindered. The IR lights reflect off objects and people in the room and is recorded by a holographic imager and decoded, resulting in a live 3-D movie of the room and objects in it.

NEXT STEPS

The researchers now need to move the system out of the lab and test it in real-life firefighting scenarios. To do this, they need to make a portable tripod-based system for both the laser source and IR camera.

It may even be possible to install the system inside of buildings, tunnels or oil platforms where smoke and flames would hinder rescue efforts using traditional IR and thermal camera equipment.

Other applications for the new imaging system include uses in the biomedical field.

"Besides life-saving applications in fire and rescue, the potential to record dynamic scenes of a human body could have a variety of other biomedical uses including studying or monitoring breathing, cardiac beat detection and analysis, or measurement of body deformation due to various stresses during exercise," Ferraro says.

HOW TO MOVE AN ENTIRE BRIDGE

By Samba Lampich

SellwoodBridge.org

Truss span and detour piers prior to move, 2012

On January 19, 2013, hundreds of onlookers gathered in the blustery morning to watch a remarkable engineering feat: An 87 year-old bridge weighing 6.8 million pounds was moved, in one piece, from one location to another.

TOO DANGEROUS TO MAINTAIN

The Sellwood Bridge in Multnomah County, Oregon was built in 1925 across the Willamette River. It was never designed to carry 30,000 cars a day or accommodate the heavier weight of trucks and buses. The bridge also had two-lanes which were narrow with no shoulder or median, and was at a high risk of structural failure in an earthquake.

Years of heavy traffic load and the continuing movement of an ancient landslide on the slopes above stressed the integrity of the structure. In 2004, cracks were discovered in the concrete girders and vehicles weighing more than 10 tons were banned from using the bridge, which helped to slow the growth of the cracks.

Regular repairs, including wrapping the concrete in heavy plastic bandages to avoid chunks of concrete falling into the river, were not enough. On a federal bridge-safety scale of zero to 100, the Sellwood Bridge was rated a two.

Multnomah County commissioners approved a $299 million design for a new bridge in July 2012 and county engineers began to prepare to move or 'translate' the old bridge to serve as a detour while the new one was built.

CHALLENGES AND SOLUTIONS

However, the Sellwood Bridge's rare design proved to be a challenge. The one-piece, 1,100 foot, 3,400 ton truss had to be moved all at once, instead of disassembling it and moving the smaller pieces to a new location for reassembly. Complicating the transition further, the east end needed to be moved 33 feet and the west end 66 feet, it was not a straight-across move. This was to accommodate the new bridge which would be wider at the west.

HOW THEY DID IT

Engineers used 10 sliding jacks, 40 lifting jacks and a central control system that lifted and pushed the bridge a couple of inches at a time toward its new location. About 25 crew members on the bridge communicated via radio to to determine the timing push of powerful hydraulic jacks. The bridge's weight-bearing points, already lifted by other jacks, slid horizontally along special beams coated with Teflon pads to ease resistance. To make the pads even slicker, they were dabbed with a coating of Dawn liquid detergent.

Multnomah County Engineer Chuck Maggio described how they would monitor the move, "We've got five survey laser targets, 10 GPS sensors, 30 stress-strain gauges, 10 sets of smart levels and about 30 sets of eyeballs up there. We're definitely keeping track of what's happening."

The bridge travelled at about six feet per hour and the entire move took about 12 hours.

The old Sellwood bridge will be used as a detour route, known in engineering as a "shoofly" bridge, until the summer of 2015 when work on the new bridge is expected to be completed.

POLLUTION TAKING THE BITE OUT OF NATURE'S CARNIVOROUS PLANTS

By Patti Dobranski

Numerous studies link the vegetarian diet to longevity in humans. However, when you season this diet with pollution in carnivorous plant habitats, it creates a different dynamic. A peculiar vegetarianism emerges that appears to be anything but life sustaining.

HOW IS THIS POSSIBLE?

Scientists at Loughborough University in England recently discovered that pollution spiked nitrogen levels in rainfall that fed the boggy areas of Northern Europe where carnivorous roundleaf sundew plants reside. Since their natural nitrogen source is their insect prey, the plants abandoned their carnivorous ways when they got their fill via rainfall.

Even though they absorbed this needed nutrient, these naturally carnivorous plants are essentially weakened and vulnerable in nitrogen-saturated environments dominated by the perfectly-adapted vegetarian foliage. Scientists also found the normal pinks and reds of carnivorous plants actually changed to green, while stickiness on the leaves used to trap prey diminished.

SCARY STUFF

Any change in nature or the ecosystem can indeed be alarming, especially when the known source is a pollutant.

Dr. Jonathan Millett, the lead scientist in this European study, wrote this in his report on the findings: "In the sites with more nitrogen deposition, these plants now get much more of their nitrogen from their roots, but they still have to bear the residual costs of being carnivorous, and other plants without these will be better able to survive."

Carnivorous vegetation also has a role in balancing the ecosystem. Pitcher plants, another meat-eating species, contribute nutrients to their drier environments, as well as sustenance for other plants and animals. Their presence supports insect populations by offering nectar and feeds insect evolution by devouring those lured into their traps.

HOW DID THIS HAPPEN?

Power plant and transportation emissions triggered atmospheric nitrogen that falls with the rain and saturates the earth. Samples from carnivorous plants living in various bogs showed they obtained 57 percent of their nitrogen intake from insects in areas of light pollution, but just 22 percent in ground laden with heavy pollution. This conversion to green also helps researchers locate areas where pollution levels are highest.

FACING POSSIBLE EXTINCTION

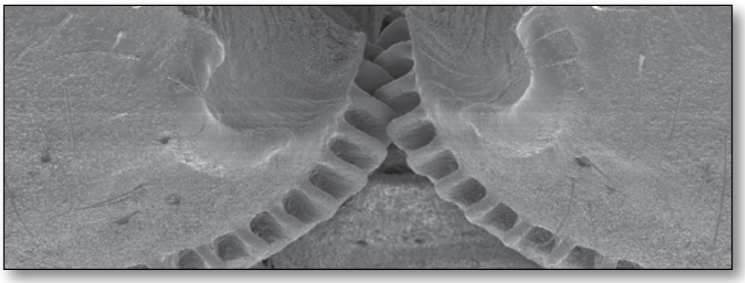
Reduced abundance and possible extinction of some carnivorous plants are possible scenarios if the issues associated with pollution are not addressed. Millett's study focused on the roundleaf sundew, which is currently not in danger of extinction. This does not preclude the disappearance or significant reduction of other carnivorous species. In the grand scheme, nitrogen pollution has become a global problem with "large and real" impacts on ecosystems, Millett said.

CLASSROOM DISCUSSION

- How is this change in diet detrimental to the food chain and ecosystem?

GEARED UP BUGS JUMP FASTER AND FURTHER

By Mona Simpson



Burrows and Sutton, University of Cambridge

The intermeshing gears on the hind legs of a planthopper insect are shown in this scanning electron micrograph image.

Imagine that you're a tiny bug trying to get away from a hungry predator. You can jump, but if you jump slowly, not far enough, or in the wrong direction, you might just end up as dinner. Young planthoppers face this dilemma every day, but they have a physical feature that helps them avoid danger: They have gears.

BUGS GEARED TO JUMP

Scientists in England have studied a small jumping bug called a planthopper, whose scientific name is *Issus coeleoptratus*. This bug, common in Great Britain, has an unusual feature. Immature planthoppers' bodies grow interlocking mechanical gears made of cuticle on their back legs to help them jump straighter, faster and further. The gears are located at the top of the first segment of the bug's back legs.

WHY GEARED JUMPS ARE IMPORTANT

The teeth of the gears mesh to keep the legs aligned as the planthopper jumps, so it doesn't accidentally shoot off to the left or the right. If they didn't have precise coordination, the bugs would spin as they jumped. This gear mechanism ensures the bugs jump fast and far in the right direction, which is critical when trying to jump away from danger.

The insect's gears are even more remarkable because of the shape of the teeth of the gears. Each tooth of the gear is curved like a shark's fin and fits precisely in one place with the opposing set of gears. Researchers noted that this asymmetrical tooth shape provides less friction between the gears. Just a little bit of friction can slow the planthopper significantly because it's so small. The asymmetrical tooth shape is used for powerful movement in just one direction: forward, away from predators.

Adult planthoppers loose these gears and get frictionless feelers instead when they molt from nymphs into adults. It's thought that adult planthoppers don't need these gears because their leg coordination and strength is greater than young planthoppers; adults are faster and control their direction better.

INSPIRING TECHNOLOGY

The discoveries may have an impact on the development of tiny gears going into the future. Scientists and engineers may be able to use the blueprint of the planthopper's geared legs to create tiny machines using 3D printing technology.

CLASSROOM DISCUSSION

- What problems might there be with having such a precise system to control the jumping of planthoppers?
- What are some advantages of metamorphosis in insects?

MATH JOBS BUILD AND DESTROY PLANETS

By Cara De Carlo

Concept artist Andrea Dopaso's creation of the Red Planet in Star Trek: Into Darkness.

Majoring in math might sound unexciting but in today's visual movie and gaming worlds, upper-level calculus rules. Math animates summer 3D sci-fi blockbuster movies and realistic role-playing video games.

"I seem to specialize in the area of mayhem," software engineer Nafees Bin Zafar told Dana Mackenzie of Societyforscience.org (December 19, 2012). Bin Zafar uses mathematics to write software for movies including "The Day After Tomorrow," "2012," and "Madagascar 3."

MOVING THE VIRTUAL EARTH

"We have to make this stuff behave correctly," Bin Zafar explained to Mackenzie. Likewise, he uses the physical properties of "stuff" as inputs in complex matrices that pertain to 3D motion.

Imagine the sinking of Los Angeles in the movie "2012." To create the scenes, Bin Zafar pretended the buildings and structures were made of virtual Legos. This allowed him to estimate what forces would act on each block, allowing other engineers to write the conditions under which buildings would crumble and lands would slide. The team's complex mathematics even accounted for spatial concerns so that bricks wouldn't pass through each other during a building collapse.

CREATING FANTASY WORLDS

Math doesn't stop at realism. Math creates the stuff of dreams.

"I wanted to make [a red forest] work," said renowned visual effects supervisor Roger Guyett in a May 20, 2013 report by Ian Failes for fxguide.com. Guyett was describing the red forest on Planet Nibiru in 2013's "Star Trek: Into Darkness ".

Guyett's team used a Chaos Group program called V-Ray to render a red jungle around Captain Kirk and Dr. McCoy (the pair had been filmed on a partial-foliage set). Rendering software generates images from models, but the "vividness" comes from computational operations like ray tracing. Ray tracing is a technique that traces light paths through planes of pixelsand simulates how it would behave when hitting objects. The result is stunning realism in movies like "Star Trek."

Industrial Light & Magic animation supervisor Paul Kavanaugh told Failes more about the Nibiru Forest scene. Kavanaugh explained how ILM rendered CG versions of Kirk and Bones as they jumped over a cliff. The rendering even included a "cloth sim," which accounted for the movements of the characters' green robes.

The bottom line is that great movies require mathematical complexity. The "numbers don't lie" to your eye said Kavanaugh.

"We want to make people feel like they're really there," Guyett summarized.

CLASSROOM DISCUSSION

- What are equations of motion?
- How can you use real data to derive an equation of motion?

STOMACH MICROBES PROMOTE WEIGHT LOSS

By Joe Giacobello

You've tried exercise, starvation and just about every fad diet on the market to shed those extra pounds, but the mystery remains: What is the best solution for getting rid of that gut? In a recent study, scientists may have stumbled across the answer in an unusual place – your stomach. It seems a certain type of microbe mix in the intestines can help keep extra weight off – at least in laboratory animals.

BENEFICIAL MICROBES

It's been long known that a wide variety of microbes, including bacteria, fungi and other living things in our intestines help to keep us healthy in a number of ways. They play a critical role in digesting our food, metabolizing drugs and maintaining our overall good health. Disruptions in these microbial communities are related to a variety of conditions including obesity, inflammatory bowel disease, vaginal infections and gum disease. Now, new evidence suggests that some of these microbes may help us to maintain a healthy body weight.

OBESITY GERMS

In a recent experiment, researchers extracted microbes from the defecation of both thin and obese people and implanted them into the intestines of several lab mice. During the experiment, the mice were fed the same foods in the same quantities. After a two-week span, the mice that received microbes from the stool of thin people experienced no change in weight,but the mice that received obese microbes became plump. How the microbes helped digest the food determined if the mice maintained their weight or put some on.

THIN MOUSE, FAT MOUSE

The scientists also wanted to find out which of the microbes those from the thin or obese – would dominate if both were present in the same intestine. To get a concrete answer, they placed both the fat and thin mice together in the same cage. Since mice are coprophagic (eat their own feces), the two types of gut microbes spread rather quickly. The result? The thin mice stayed thin. But the mice who originally received the obese microbes (and now the thin microbes) stopped gaining weight!

FUTURE IMPLICATIONS

Clearly, the trim microbes won the battle, but there was a twist: These thin-person microbes were only effective if the mice consumed a low-fat diet. If they ate high-fat, low fiber foods, the benefits of the microbes were diminished and the mice gained weight. So, while gut germs influence how the body turns food into fuel, eating the right diet is still important in maintaining a healthy weight. Researchers hope this new study may help them to identify microbes that can be added to an individual's diet to help them lose weight. This would be great news for the thousands of people who are struggling to shed those extra pounds.

CLASSROOM DISCUSSION

- Other than diet, what lifestyle changes can be made to reduce obesity, particularly in children?
- What other "beneficial microbes" live within our bodies? In what ways do they help us?

RUST CATALYZES A BRIGHTER FUTURE FOR RENEWABLE ENERGY

Merry Morris

TRY CAPTURING A SUNBEAM OR TRAPPING THE WIND IN A BOTTLE...

That sounds charming and poetic, but it's a very practical problem for renewable energy systems. The sun sets, but people still need energy. The wind may blow a gale during the night, but who is awake to use it? How can we store that energy for later that day or weeks later?

Now, some amorphous and distinctly unglamorous oxides developed by scientists Curtis Berlinguette and Simon Trudel of University of Calgary may help overcome the difficult "intermittent power" problem.

ENTER HYDROGEN

Hydrogen (H_2) is a powerful fuel — more energy-dense that gasoline — that can be created by the action of electricity on water. An electrolyzer uses electricity to split water into its parts — hydrogen and oxygen — releasing the gases that can be used as fuels. "Renewable electrolysis" uses "renewable electricity" to produce hydrogen by passing an electrical current through water.

ENTER FUEL CELLS

Fuel cells combine hydrogen and oxygen to produce electricity, heat and water. They store energy transformed from other sources, like renewable electricity, so it can be converted for later use or even diverted to power other devices, such as vehicles.

ENTER CATALYSTS

Imagine, then, a renewable energy system outfitted with an electrolyzer to create hydrogen as the solar energy is generated. With a fuel cell in place, the energy transformed from solar to electric to hydrogen is available to heat a house or drive a truck. So, are all the problems are solved?

Not just yet ... the trick is to accomplish the splitting of water efficiently without expending a lot of energy to get the process going. For that, a catalyst is needed to provide an extra boost. Fortunately, catalysts are usually needed in very small amounts; unfortunately, these precise crystalline structures are rare, expensive and sometimes toxic.

RUST TO THE RESCUE

Enter the new class of catalysts developed by Berlinguette and Trudel. These catalysts are effective, produced at a tiny fraction of the cost of traditional counterparts and based on common ferrous oxide, cobalt and nickel. They are amorphorous, rather than crystalline, but the chaotic structure serves to increase their reactivity. Work is proceeding to expand the options for these new catalysts. As work advances in this area, we may see the feasibility of renewable energy systems skyrocket. Not bad for a bit of rust!

CLASSROOM DISCUSSION

- Name one drawback of renewable energy systems. How would you attack that obstacle to find a solution?
- Investigate other catalysts. What do they have in common? How to they differ from each other?

MILAN'S VERTICAL FOREST WILL HELP CLEAR THE AIR

By Cory Bickel

Imagine living in a beautiful green forest, with swaying tress and chirping birds right outside your window – in the middle of the busy city of Milan, Italy. The buildings of the Bosco Verticale, or "Vertical Forest," designed by architect Stefano Boeri will soon make this possible. The two towers are 365 and 256 feet tall, and will house 900 trees, 5,000 shrubs and 11,000 smaller plants — enough to cover more than 107,000 square feet of forest — that will grow in terraces covering the buildings.

SKY SCRUBBERS

The air in Milan is some of the most polluted in Europe, so the city is in dire need of more trees to clean things up. The plants growing on the Bosco Verticale will help to remove carbon dioxide from the air and add oxygen, as well as trapping dust and adding humidity. Besides increasing air quality, the plants will bring other benefits. They will decrease noise and wind for the buildings' residents and provide shade to lower cooling costs during the hot Milan summers. Many birds and insects will also be able to find homes among them.

The buildings are environmentally friendly in other ways. The plants will be watered using recycled greywater from the buildings' sinks and showers, reducing water use and waste production. The buildings will also use different types of solar methods to generate energy, lowering their overall energy consumption.

The buildings are expected to be completed in 2013, and residents can begin moving into their arboreal apartments soon after. The new tenants can feel good that besides being beautiful, their new homes are helping to make the city of Milan a better, cleaner and healthier place to live.

Boeri Studio

An artist rendering of the finished skyscrapers

CLASSROOM DISCUSSION

- What are some other ways to clean up pollution in cities?
- Would you want to live in a building like this? Why or why not?
- ling.com/2013/02/milans-vertical-forest-will-help-clear-the-air/

SCIENTISTS NOT IMMUNE TO GENDER BIAS

By Christina Phillis

Despite that fact that scientists are trained to reject subjective criteria, a study conducted by researchers at Yale University found that scientists are not immune from gender bias. When professors at American universities evaluated student candidates for jobs, they were less likely to offer women mentoring or jobs. When a job was offered, the salary was lower.

Researchers asked 127 scientists to review job applications of identically qualified male and female students. It was found that both male and female scientists rated men higher on a variety of criteria and were more likely to hire the male student.

Digging a little deeper, researchers set out to determine whether the bias among researchers might help to explain why fewer women than men have careers in science. About 200 academic researchers were asked to judge the same application from a senior undergraduate student applying for a lab manager position. The applicant was randomly assigned a female or male name. Both men and women were more likely to hire the male and were willing to pay him $4,000 more than the woman.

"I think this shows just how subtle and pervasive these cultural stereotypes are. There has been a feeling that women are underrepresented in the sciences because of personal or lifestyle choices, but it is clear that gender bias is also present," said Corinne A. Moss-Racusin, postdoctoral associate in molecular, cellular, and developmental biology and psychology at Yale, in a Yale News article.

THE SOCRATIC METHOD

This study was originally published last summer, but the questions it raises were revisited in a New York Times article by Eileen Pollack who was one of the first two women to earn a Bachelor of Science degree in physics from Yale in 1978.

In the article she explains the insecurities that led her away from pursuing a graduate degree despite graduating summa cum laude, Phi Beta Kappa, with honors in physics. She interviews hesitant students as well as female professors who have excelled in academia, including Jo Handelsman, lead author of the study and professor of molecular, cellular and developmental biology at Yale.

CLASSROOM DISCUSSION

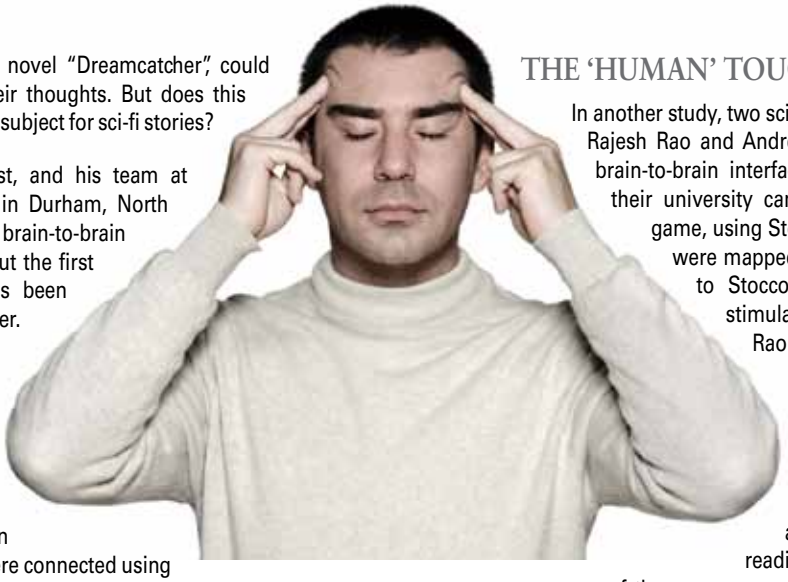
- What is one way that universities can minimize gender bias?
- Name and discuss the accomplishments of a successful female scientist.

IS TELEPATHY REAL?

By Ritwika Bhattacharya

"Duddits", in Stephen King's famous novel "Dreamcatcher", could communicate with his friends via their thoughts. But does this make sense in real life too, or is it just a subject for sci-fi stories?

Dr. Miguel Nicolelis, a neurobiologist, and his team at the Duke University Medical Center in Durham, North Carolina, have demonstrated the first brain-to-brain interface. This may not be telepathy but the first of its kind where one mammal has been reported to read the thoughts of another.



A MIND 'RAT'-TLER

The scientists at Duke trained two rats to press a particular lever when given a light signal, and were rewarded a sip of water when performed. They were then placed in separate chambers and their brains were connected using arrays of microelectrodes inserted into them. One of the rats was given the signal, on which it pressed the lever and earned a reward. The brain activity of this rodent, the "encoder", was delivered to the other rat, the "decoder", via electrical stimulation. But this rodent was not given any visual signal. On pressing the correct lever, this rodent would earn a reward and the encoder would earn an additional reward. The encoder was denied the reward if the other failed to press the correct lever. This enabled the encoder's brain signals to become clearer and eventually, the decoder rodent achieved a success rate of about 70%.

THE 'HUMAN' TOUCH

In another study, two scientists at the University of Washington, Rajesh Rao and Andrea Stocco, conducted the first human brain-to-brain interface. Situated in two different parts of their university campus, Rao was able to play a video game, using Stocco's hands. The signals of Rao's brain were mapped, sent via the internet and transmitted to Stocco's brain using transcranial magnetic stimulation. Stocco's hands moved everytime Rao thought of making a certain move.

'MIND' THE FUTURE

These studies of brain-to-brain communication are still at nascent stages. However, with such studies also arise huge ethical concerns of reading into other people's brains. But most of these concerns may be overestimated as these studies only involve the motor function area of the brain. These studies open up vast possibilities for research and ideas such as a senior surgeon performing a surgery using the motor functions of a junior, or it could also benefit communication in quadriplegics or ALS patients. The prospects could be innumerable.

CLASSROOM DISCUSSION

- What could be the use of such studies and would they benefit the world?
- What ethical concerns arise from such studies?

HAPPY BIRTHDAY, HEADLINE DISCOVERIES!

By Celeste Beley

In the Spring of 2004, Fisher Science Education launched its first issue of Headline Discoveries. We wanted to create a publication that contained information on science news, classroom tools and offers and information from our valued suppliers. And we've come a long way since that first issue!

The first issue featured a cover story titled "Life on Mars?", which highlighted the landing of NASA's Opportunity Rover as well as earlier orbiters. Additional articles included how DNA is expanding forensic science, answering the question: Is Chocolate a Vegetable?, a point/counterpoint on changing the food pyramid and an article about the physics of baseball. Ten years later, DNA is a pivotal element in the field of forensic science, the food pyramid has been completely changed and we know that chocolate isn't a vegetable ... but still wish it was! We'll explore how science has changed in the last 10 years using these and other articles as examples in a new feature this year called "Where Are We Now?"

We've changed a lot over the years. From the newspaper print of the first issues, to our magazine style format and our new digital magazine with enhanced features and information, our goal has always been to provide you with a fast way to learn about science news and a tool to use in your classroom.

So how are we doing? We want to hear from you on what you think and how you're using Headline Discoveries! Please visit our Facebook page to provide feedback, or tweet our superhero Buster at @BusterFisherSci to tell us what you think.

SIGNIFICANT MILESTONES:

- **March 2004** — Headline Discoveries is introduced as a newspaper publication. 2500 copies are distributed through Fisher Science Education Sales Representatives
- **January 2011** — new magazine style format is introduced, replacing the newspaper format. Issues are now published four times per year
- **March 2012** — our first science superhero is introduced on the cover
- **November 2012** — our digital magazine format is published for the first time
- **November 2013** — the STEM-credibles appear as a group for the first time on the cover of Headline Discoveries

WHERE ARE WE NOW?

DNA: EXPANDING FORENSIC SCIENCE

By Samba Lampich

Ten years ago, forensic science was becoming a familiar field largely due to the rise of crime scene TV shows. These popular shows followed forensic scientists using DNA profiling to solve crimes or decade old mysteries. The concept of using a drop of blood to identify a criminal or provide concrete evidence in court was new and thrilling audiences everywhere. But what today may be a common technique and tool in forensic science wasn't conceivable just ten years ago.

QUICKER RESULTS

In the real world, DNA processing takes weeks and sometimes even months. Time-sensitive cases like serial sexual assaults or murders, familial relationship verification in citizenship and immigration, human-remain identification in mass disasters or law enforcement investigation require quick results. But now, a machine called RapidHIT 200 Human DNA Identification System can process DNA in just under two hours. Conventional DNA analysis requires the use of three machines, but this new technology combines them all into one. According the manufacturer, the RapidHIT requires only three minutes to generate five DNA profiles. The output from the system is compatible with local, state and national human identification databases, making it faster and easier to see if the profile already exists and identify the individual. RapidHIT machine is only available in a few agencies in the country.

WARRANTLESS DNA COLLECTION

In 2013, the Supreme Court of the United States held that officers can take and analyze a cheek swab of the arrestee's DNA as part of their booking procedure. Before this ruling, DNA samples from suspects could only be collected if the officers had warrants. Twenty-eight states and the federal government now take DNA swabs after arrests and compare their profiles to the CODIS database hoping to solve crimes or identify people.

STORE MUSIC AND MORE IN DNA

In January 2013, UK researchers reported they can now encode Shakespeare's sonnets and excerpts from Martin Luther King Jr.'s "I Have A Dream" speech in DNA which can last for tens of thousands of years.

"We already know that DNA is a robust way to store information because we can extract it from wooly mammoth bones, which date back tens of thousands of years, and make sense of it," Nick Goldman, co-author of the study at EMBL-EBI, said in a statement. "It's also incredibly small, dense and does not need any power for storage, so shipping and keeping it is easy."

The technology uses strands of artificial DNA synthesized and encoded by a machine to create the zeros and ones of digital technology to store the data for later retrieval.

The most expensive part of the process is reading the DNA because of the machines it requires. The researchers hope that the cost will come down soon and families could be able to store those vacation family photos or wedding videos in DNA.

CLASSROOM DISCUSSION

- What are some of the limitations of DNA profiling?
- What industries might benefit from being able to store large amounts of data in a small amount of DNA?

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