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Oct-Dec 2014; Issue 4

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Price offers in this publication are valid through December 31, 2014, unless otherwise stated.

### NEW FEATURE!

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Our article on Ebola is expanded on our blog; which you can link to directly from the pages of this issue of Headline Discoveries.

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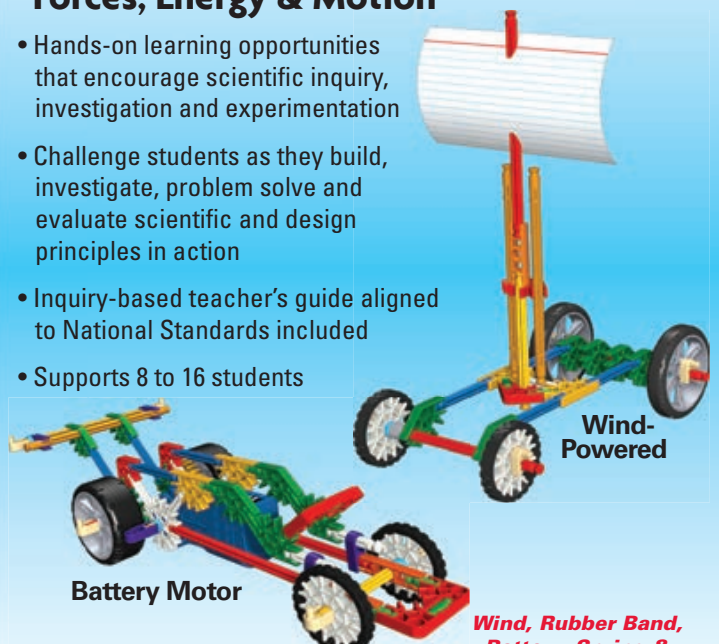


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# WEARABLE HEALTH MONITOR UNTETHERS PATIENTS FROM MONTIORS

By Samba Lampich

The hottest trend in fitness is not hot yoga or Crossfit but the emergence of wearable tech such as smart watches, health monitors, pedometers and activity trackers that keep you on track with your fitness goals.

## SMALLER AND LIBERATING

Now the healthcare industry is taking a closer look at how similar technology could revolutionize patient care.

Today, most patients in hospitals are hooked up to numerous machines and monitors via wires often leaving the patient with limited mobility.

But a British maker of wearable medical sensors seeks to market a device that resembles a bandage weighing half an ounce and can do the work of three or more machines. In 2013 Sensium Healthcare ran trials of SensiumVitals in hospitals in Michigan and California with positive reactions. The disposable patch is attached to the patient's chest and is capable of monitoring heart and respiratory rate as well as body temperature. It takes readings every two minutes and sends the data wirelessly to a nurse's station or handheld device.

## QUICKER DETECTION

The device also picks up changes in the patient's condition and sends this data out, immediately alerting the nurse or doctors who are able to respond quickly.

"Early feedback from patients and hospital staff at St John's has been very positive, with the device detecting deterioration in patients' conditions instantaneously, enabling intervention much sooner than normal," Toumaz CEO Anthony Sethill says in a company statement. "SensiumVitals represents a breakthrough in how patient care is delivered, setting a new, cost-effective standard for hospitals and also benefiting patients' recovery."

## A GAME CHANGER

The device has a battery life of five days which is enough to last a typical hospital stay and is disposable, reducing risk of contamination. The company said that the pilot program which ended in March 2013 provided early detection of deterioration in 12 percent of the 168 patients who took part in the study.

The device gained FDA 510(k) clearance in the US in July 2011 and is attracting interest from hospitals around the world.



Disposable SensiumVitals patch monitors heart rate, respiration and temperature

## VOCABULARY

- Deterioration
- Pedometer

## EXTENSION QUESTIONS

- What are some of the pros and cons of having a remote health monitor like the SensiumVitals?
- What other industries could benefit to wearable wireless technology such as the 'digital bandaid'?

# IS GREEN ILLUMINATION ON THE HORIZON?

By Colleen Salvatore

## BIOLUMINESCENT TREES MAY LIGHT THE WAY

We've all enjoyed evening strolls in the park with paths lit by street lights. Can you imagine a street or path illuminated not by street lights but by trees? This far-fetched fantasy may someday become a reality with genetically modified bioluminescent plants.

## NATURE'S NIGHTLIGHT

Dutch artist and innovator Daan Roosegaarde is combining his fascination with the luminescence of fireflies and jellyfish and the principles of biomimicry in the hopes of developing trees that actually glow in the dark and provide enough lighting to replace street lights. Roosegaarde explained, "When a jellyfish is deep, deep underwater it creates its own light. It does not have a battery or a solar panel or an energy bill. It does it completely autonomously."

His biomimicry quest led to a collaboration with Dr. Alexander Krichevsky, a biotech researcher from State University of New York, and founder of BIOGLOW™, a St. Louis-based biotechnology firm that developed the first light-producing plant. After several years of research, Krichevsky achieved a bioluminescence breakthrough when he spliced DNA from luminous marine bacteria within the chloroplast genome of a houseplant. The result was the Starlight Avatar™, the first autoluminescent ornamental plant.

More research is needed to make these plants commercially available given their two-to three month lifespan and intolerance to sunlight. The team will continue their work in the United States where it has received approval from the U.S. Department of Agriculture for the genetic engineering research. The European Union has strict regulations governing the use of genetically modified plants and this research work is prohibited.

## GLOWING NATURE PAINT

In a related bioluminescence project, Studio Roosegaarde is working on Glowing Nature, a noninvasive technique using 'biological paint' onto mature trees to create light-emitting foliage. The paint charges during the day and glows at night for up to 8 hours. Trial application of the material is scheduled to begin by the end of 2014

Studio Roosegaarde's visualization of a light-emitting tree with bioluminescent coating



## VOCABULARY

- Autoluminescence
- Biomimicry
- Bioluminescence

## EXTENSION QUESTIONS

- What impact could glow-in-the-dark plant life have on living creatures?
- What other benefits could bioluminescent paint have on the environment?
- Could tinkering with the genes of plants have unintended consequences with native plant species?



# TECHNOLOGY AND YOUR PETS

By Celeste Beley

Your four-legged best friend may be happy with the stick he found in the park, but today's pet parents have ever-growing access to technology to help monitor their pets' health and help keep them happy. While some may consider pet technology an extravagance, others welcome the innovations and are banking on their success.

## MORE THAN JUST A GAME OF FETCH

Fitbit's are all the rage these days, but what about your dog's sleep and exercise habits? A San Francisco-based company has a product that does just that. A collar attachment called Whistle monitors the time and length of walks, playtime and sleep. You can set goals for your pet and track progress, sync your veterinary reports and now even use the GPS tracker to find her if she's lost or just with another family member. Whistle allows pet parents a way to monitor their best friend's health just as a human may.

For the dog that consider playing fetch their favorite thing, there is iFetch. The automatic ball launcher is designed for indoor or outdoor play and is battery powered. Using a standard miniature tennis ball, dogs can place the ball in one hole and wait for it to launch across the room at one of three available distances.

## MANAGING ONGOING NEEDS

Rover.com is a company that provides an alternative to traditional boarding kennels; connecting dog owners with local, insured pet sitters. Owners can log in to the site, choose dates and see available pet sitters and rates, but the reservations also come with guaranteed text and photo updates while you're away, plus premium pet insurance during the length of stay allowing owners to rest easy that their "fur baby" is in good hands.

A monthly subscription service for your dog, Barkbox.com sends toys, treats, gadgets and more to subscribers. Plans vary from \$19 to \$29 per month but the company aims to send high-end, high-quality products that you wouldn't find in your regular pet stores. The same company, Bark & Co, also manages BarkCare, a home-visit veterinarian service in New York and San Francisco, and BarkPost an online dog-centric news site.

Ultimately, pet owners are spending over \$50 billion annually on their four-legged friend's and technology is certainly a growing part of that. But time will tell what value technology has for our fuzzy friends.

### *iFetch in action*



### EXTENSION QUESTIONS

- Do you think pets can benefit from technology? Why or why not?
- What types of human-based conveniences do you think would be good to develop for our pets?

# VIDEO GAMES CAN BE GOOD FOR YOU, UNLESS...

By Lisa Jancarik

How much time are the kids in your life spending on console or PC games each day? Have you told them that they are poisoning their minds? Are you right? Well, according to a study out of Oxford University, the best answer may be "it depends."

Behavioral scientist Andrew Przybylski polled 4899 British kids ages 10 to 15 about their emotional states and video game habits. About 75 percent reported playing video games daily. He found that kids who play an hour or less per day of video games tend to be more social and satisfied with life than kids who play for longer periods. Kids who play for one to three hours per day have no benefit, and the kids who play more than three hours per day have some negative effects. It's not surprising to learn that too much time with Mario and Luigi is a problem. The surprise is that the kids who play about an hour per day are also more social and satisfied with life than are kids who play no video games at all.



## WHAT DOES THIS STUDY MEAN EXACTLY?

Przybylski has shown that there is a link between video games and mood, but this does not necessarily mean that one causes the other. He also emphasizes that other factors, like a child's family life and social life at school, are much larger contributors to mood.

He also believes that the benefits of playing video games are lost when time spent on them eats into important enriching activities. In other words, his research isn't an excuse to play Mario Kart instead of practice piano. Another way for a young player to lose the benefit is with exposure to game content that is too mature for them.

The Oxford study is important to researchers in this field because until now, they have been divided into people who think video games are good for kids and people who link them with violence in real life. However, this study shows that time spent on gaming is important, not just whether kids play them at all.

### VOCABULARY

- Behavioral science
- Mood
- Dyslexia

### EXTENSION QUESTIONS

- How might video games be helpful? They are thought to improve eyesight, help kids with dyslexia and even relieve pain.
- Do you talk about video games with your friends? Dr. Przybylski says that children may feel cut off socially if they can't participate in this kind of conversation with their peers.

Looking for another perspective on this topic? Read more on page 19.



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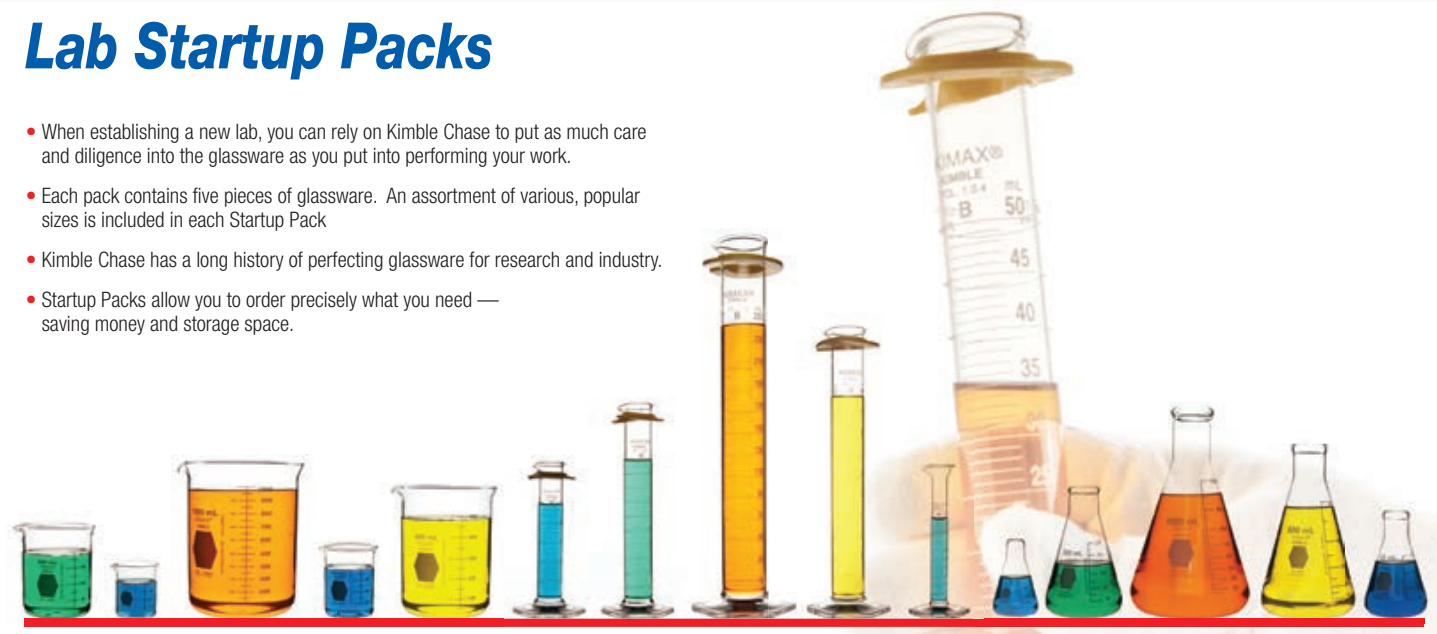
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# SUSPECTS' GENDER DETERMINED AT CRIME SCENE

By Mona Simpson



When a crime has been committed, investigators need clues quickly to identify suspects from what might be a long list. Fingerprints let them know who touched objects at a crime scene, but those prints can help identify people whose prints are already in a database. DNA can identify people using the tissues found at the crime scene, but that process requires time and an equipped laboratory.

## A NEW TOOL

Now biomarkers can let investigators quickly test evidence to determine the gender of a crime suspect at the scene of the crime using colorimetric assay.

Colorimetry measures color. A colorimetric assay measures the color of a sample against known colors. The sample may be colored already or it can be colored through a reaction. If we know that the intensity of color (absorbance) is proportional to the concentration of the substance being tested, then a colorimeter or spectrophotometer can find the concentration of the solute.

It is known that men and women vary slightly in their blood levels of creatine kinase (CK) and alanine transaminase (ALT). Evgeny Katz at Clarkson University, Potsdam, and Jan Haláček at the University at Albany, State University of New York, amplified the difference between male and female samples using a series of chemical reactions, until the final step uses a colored compound to allow the gender to be determined visually. The levels of these biomarkers, just like all biomarkers, can give unexpected results in ill or diseased individuals, in which case gender may be unable to be determined. But this extra amount of information gives investigators an edge in pursuing the right suspect.

Currently, this technology has been developed for lab use, but efforts are being made to make this test field-ready. This test is not nearly as specific as DNA analysis, but its simplicity and the swiftness of results may make it immediately useful to determine the gender of criminals at the crime scene.

## VOCABULARY

- Assay
- DNA
- Absorbance
- Biomarkers

## EXTENSION QUESTIONS

- How would determining the gender of a crime suspect help investigators?



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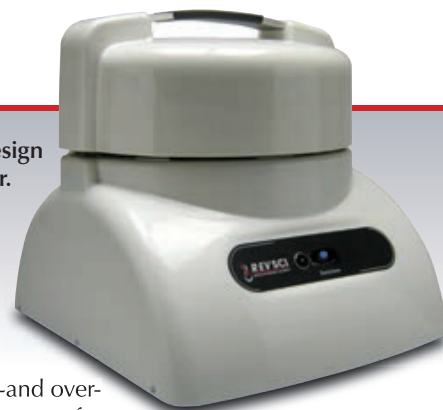
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# GENETICALLY MODIFIED MOSQUITOS TO COMBAT DENGUE FEVER IN BRAZIL



By Joe Spivak

Dengue Fever, Malaria, Chikungunya and Encephalitis are just a few of the dangerous diseases that can be transmitted via 'airborne' vectors: mosquitos. One species of mosquito in particular, *Aedes aegypti* is extremely adept at transmitting disease.

Dengue fever is transmitted when an *Aedes aegypti* mosquito bites a person infected with the disease then bites another person passing along the virus after a short incubation period. Untreated, the virus causes severe flu-like symptoms and can ultimately lead to death. At present, there are no vaccines or virus specific medications available to treat Dengue Fever.

## CREATING A SAFER MOSQUITO

Scientists from the British biotech firm Oxitech, have been using a unique approach to combat mosquito-borne Dengue Fever in Brazil: Genetically modified (GM) mosquitos. Here is how it works:



- Scientists cull the females and then release the GM males into the wild which then mate with Dengue Fever-carrying females and produce non-viable offspring.
- The offspring die in the larval stage, reducing the population of infected mosquitos, thus reducing the number of infections.

In a trial in the Brazilian city of Jacobina, Bahia, a swarm of the GM mosquitos was released into the wild. The results were astounding: within 6 months the population of dengue fever mosquitos was reduced by 79%! As a result, as on April 10th, 2014, Brazil became the first country in the world to authorize the widespread use of GM mosquitos. Other countries may be soon to follow as the Panama began testing this program in February.

As with any new solution, a level of skepticism exists. Misconceptions about the safety and efficacy of GM organisms and cost are factors detractors cite. However, with traditional methods like fumigation and insecticides having limited impact, scientists and governments have been forced to seek new solutions.

Dengue Fever affects over 390 million people in 100 countries and can be fatal. GM mosquitos reduce the need for chemicals and pesticides and have shown to be a promising piece in combating the spread of Dengue Fever. Further research could lead to this technique being employed to combat other debilitating diseases as well.

## VOCABULARY

- Vector
- Genetically Modified
- Epidemiology
- Dengue Fever
- Skepticism

## EXTENSION QUESTIONS

- Could other insects or animals be used as vectors to combat disease?
- Are concerns over GM organisms warranted?

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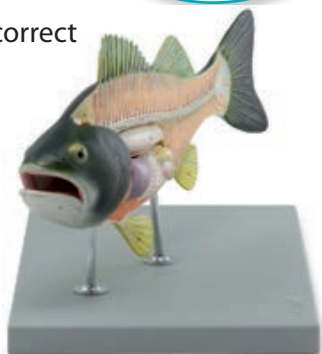


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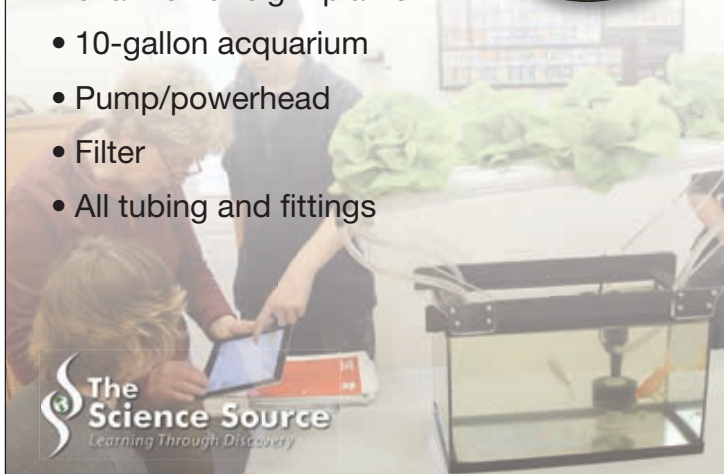
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S05262	Fisher Scientific RT Basic 220mm Top/U.S. Plug	5L	55 lb.	230 x 230 x 65mm	6w	\$271.60







# THE FACTS ABOUT EBOLA

By Lisa Jancarik



## UNDERSTANDING THE VIRUS AND DISPELLING MYTHS

*Ebola virus disease (EVD) coverage on the evening news or via Twitter feeds from news organizations sounds like the opening of a virus-disaster movie where most of the cast gets sick and dies. To provide some better perspective and sound information on ebola, this article is compiled from the websites of the Centers of Disease Control (CDC) in Atlanta, the World Health Organization and Doctors Without Borders, along with a few other reliable sources.*

### WHAT IS EBOLA?

Scientists have described five viruses they identify with the genus name "ebolavirus".

Of these, four of them have been documented in human patients. The fifth seems to affect nonhuman primates, like monkeys. To date, it's been thought that Ebola resided in an animal reservoir, that is, some species that didn't get sick but could transmit the virus to people. There is some thinking that a species of fruit bat may be the animal reservoir for ebola.

A new article in the journal Science says the current outbreak stems from person-to-person transmission, not animal-to-person. These conclusions drawn from genetic comparisons of ebola samples from patients are important because they tell healthcare workers what kind of prevention measures need to be in place. For example, teaching people in affected communities about the safe handling of bush meat or dead animals would be important if animals were the primary source of transmission for this outbreak. Safe practices regarding animals do matter (the animal reservoir is still a feature of the disease), but now healthcare workers know they must focus on safe burial practices and proper infection control techniques by healthcare workers themselves.

Microscopic view of the Ebola virus



### WHERE IS EBOLA?

Up to this point, cases of Ebola hemorrhagic fever have been confirmed in West African countries: Guinea, Liberia, Sierra Leone, Democratic Republic of Congo (DRC), Gabon, South Sudan, Ivory Coast, Uganda and Republic of Congo. The first case of Ebola occurred in 1976, in the DRC, and other outbreaks have occurred periodically since that time.

Although there have been two Ebola patients brought back to the United States after becoming sick in Africa, both were carefully quarantined. They were safely treated and discharged from the hospital, no longer contagious. Ebola cases have been reported in the U.S. population, but these have turned out to be false alarms. American public health officials at the CDC believe the United States will see little threat from the outbreak in West Africa.

### HOW DOES SOMEONE GET EBOLA?

Transmission occurs from human to human through contact with the blood, bodily fluids or organs of an infected person. According to the World Health Organization (WHO) website, family members who have performed burial rites on infected people may have become infected themselves by handling the body. Healthcare workers who have not practiced careful infection control protocols have also been infected. Doctors, nurses and other healthcare workers, as well as the family members of patients, are most likely to contract the disease themselves because they are the most likely to have contact with the infected person's bodily fluids.



to continue the conversation, please go to [www.headlinesciencenow.com/ebola](http://www.headlinesciencenow.com/ebola) or use your smartphone to link via this QR Code

# ISOLATED AMAZON TRIBE MAKES FIRST CONTACT

By Samba Lampich

In June 2014, a group of tribesmen from a previously unknown Brazilian tribe waded across an Amazon river and made their first contact with villagers in 20 years.

## FIRST CONTACT

The group of five young men and two women wore only loin cloths and were armed with bows and arrows. The native group identified as the Rio Xinane, who are part of the Panoan linguistic emerged from their home in the Peruvian rainforest and made contact with Ashaninka local people of northern Brazil.

The Brazilian government's National Indian Foundation (FUNAI) dispatched linguists and health experts to assist the tribe. They told interpreters that they had been attacked and driven from their homes by loggers and drug traffickers. They said some of their relatives had been killed and their homes burned.

Video shows the tribesmen accepting bananas, axes and blades from local villagers. One is also shown handling a gun but it isn't known if he returned to the forest with the weapon.

## DRIVEN FROM THEIR HOMES

It is believed that cocaine-growing gangs and illegal loggers are pushing deep into the Brazilian-Peruvian forest and encroaching on the indigenous tribes' lands and using deadly force to remove them. However, it is not clear if the loggers and traffickers are the main cause driving the tribesmen from their home.

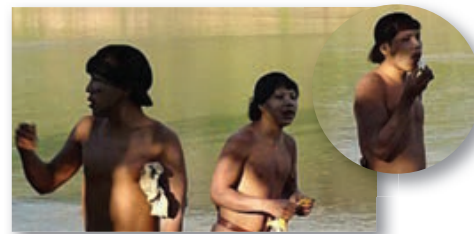
"We do not have this consolidated information, we do not know exactly the reason they had established this specific contact. We believe that with greater communication we can better understand the reasons," said a representative from FUNAI.

Anthropologist Terri Aquino told Brazilian news site G1, "These people are in search of technology. This is important to their lives, because there is an internal "war" between them and the contact with other non-indigenous groups."

## A DANGEROUS NEW WORLD

But the gangs and loggers are not the only looming danger to the tribe's survival. Contact with the outside world is also perilous as many of the isolated tribes lack immunity to common diseases and are vulnerable to the viruses. Some of those who ventured out to seek help caught a serious respiratory disease, a major killer of isolated indigenous people. They have since recovered but are still at risk, and the governments of Peru and Brazil are warning people to keep away from tribesmen to avoid spreading diseases.

According to Survival International, there are believed to be about 100 uncontacted tribes and 77 of these tribes live in Brazil. The group is running a petition calling for better resources to protect indigenous peoples' way of life.



Three members of a previously uncontacted tribe who made contact with a team of Brazilian researchers on June 30.

## VOCABULARY

- Indigenous
- Linguistic
- Anthropologist
- Respiratory

## EXTENSION QUESTIONS

- What other factors, other than loggers or drug traffickers, could affect people who rely on the land for their livelihood?
- Who are thought to be the most genuinely isolated people on Earth and how have they maintained this isolation?

# NEW TESTS AUTHENTICATE ORGANIC PRODUCE

By Mona Simpson



The market for organic food is large and steadily growing. From 2002-2011, the industry grew an average of 19% per year. Global sales for organic foods reached over \$63 billion in 2011, and the United States is the single largest market for organic food.

Organic foods cost an additional 50% to 100% more than conventional foods. But organic certification methods in the United States only certify the farm or handling facility, not each apple or asparagus spear being produced.

With such profit at stake, it is important to develop and maintain the ability to verify that consumers are getting the organic produce they expect. There are methods currently in use to authenticate certain foods, but those methods are not 100% reliable. Researcher Monika Hohmann and her colleagues from the Bavarian Health and Food Safety Authority and the Wuerzburg University used nuclear magnetic resonance (NMR) to evaluate and authenticate honey, olive oil and tomatoes.

Researchers studied 361 samples of one type of tomato (*Solanum lycopersicum*) over 7 months and found that they could identify differences in the NMR results for organic versus conventionally produced tomatoes that could authenticate organic tomatoes correctly 100% of the time. The data they developed provides a good starting point for verifying organic tomatoes, and more work using their techniques could help inspectors identify other incorrectly labeled produce and stop organic food fraud.

## VOCABULARY

- Organic
- Nuclear magnetic resonance

## EXTENSION QUESTIONS

- Why are organic foods considered desirable?
- What types of products are eligible for organic certification?

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## THE SMELL OF MONEY

By Lisa Jancarik

An estimated \$30 billion in illegal cash crosses U.S. borders into Mexico annually. Border Patrol has the daunting job of finding it before it leaves, and last year, U.S. officials seized \$106 million. The Department of Homeland Security recently put out a public call for currency detection devices. KWJ Engineering responded with a money-sniffing instrument. The Bulk Currency Detection System (BCDS) relies upon gas chromatography/mass spectrometry (GC/MS).

GC/MS uses a small sample that is vaporized and transmitted via carrier gas through a tube coated with a solid chemical. The solid chemical is selected according to the sample to be separated. The sample chemical least likely to bind to the solid chemical elutes (i.e., comes out of the tube) first, the next least likely to bind second, and so on. The separated components tell the user what makes up the sample.

Gas chromatography is ideal for compounds like the ones American dollars emit. According to Dr. Joseph Stetter of KWJ Engineering, their device can identify the chemical fingerprint of money in less than a minute.



### CHALLENGES TO USING GC/MS

Stetter's firm had to figure out how to find the dollar's chemical signature. To identify the "smell" of money, they sealed one hundred used \$1 bills in a chamber and warmed them to release vapors. The chemicals that showed up in all the results make up the smell of money. As it happens, this chemical signature comes from several aldehydes, furans and organic acids in parts per million (for security reasons, no one is allowed to publish the exact mix).

The BCDS trial period won't begin for another two to three years. Then, officers will use the proposed design, a backpack with a wand to wave over clothing or into baggage or vehicles. Detection of a high intensity of the chemical signature would indicate the presence of cash and allow illegal dollars to be seized.

### FACTOIDS

- Usually, these efforts involve sniffer dogs, who require training and may get sick. Dogs also have a limited ability to communicate, even with their trained handlers.
- Border patrol agents need a device that works at least as well as a dog for it to become practical. It has to be portable and rugged enough for a range of environments. Plus, it has to allow for processing right at the border.

### VOCABULARY

- Elute
- Gas chromatography
- Vaporize
- Chemical signature



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# THE AMAZING HUMAN SKIN

By Joe Spivak

Quick question: What is the largest organ of the human body? If you said 'the skin', give yourself a +1. The skin, consisting of the epidermis, dermis and subcutaneous fat layer (hypodermis), is the largest organ of the human body...and arguably one of the most vital to your survival.

In a recent article, scientists outlined some critical functions of the skin. They are: diagnosis of disease, olfactory function, elasticity, temperature regulation, protection and immunity.

**Health monitor.** The skin can be a very powerful indicator of an individual's health. Skin should be "warm, pink and elastic" to the touch. Pinch yourself. Go ahead, not too hard though. Did you notice how your skin turned white for a couple seconds and then returned to its natural color? That is called 'capillary refill' and it is a technique used to quickly assess a person's cardiovascular function. Two-to-three seconds indicates your heart and lungs are working efficiently. Any longer, and well, you should probably stop reading this and seek medical attention.

**Olfactory function...**who 'nose' what that means? That's right, scientist have shown that olfactory receptors embedded in the skin can help you perceive odors (smell) in your environment.

**Elasticity...**ever wonder where your little brother or sister came from? Me too, although I am betting on Mars for my little sister. Anyway, skin has an amazing ability to stretch. This is best seen in a pregnant woman's belly. The elastic fibers that slowly stretch prevent the skin from tearing and allow it to bounce back after nine months.

**Temperature regulation.** It only takes a few minutes of kickball before you notice the sweat starting to form on your skin. The dilation of blood vessels in response to heat allows water to escape the body as sweat. The water then evaporates from the skin, cooling the body as it does. Did you know you can sweat up to three gallons of water per day? It is a good thing, without it, you wouldn't last long in the summer heat!

**Protection and immunity.** Arguably your skin's most important function is protection: from the sun, microbes and viruses. Your skin forms what is called 'The

Primary Line of Defense' and is both a mechanical and chemical barrier against the world. You are constantly under assault from UV rays, bacteria and parasites. Your skin keeps them from harming you. Sebaceous glands in the skin secrete protective anti-bacterial oils, melanin blocks UV rays and skin continuity prevents harmful pathogens from entering your body.

Yep, the skin is a pretty amazing feat of biology. It protects you, keeps you cool, can indicate your overall health and, oh yeah, we would look pretty weird without it!



## VOCABULARY

- Epidermis
- Hypodermis
- Subcutaneous
- Olfactory
- Cardiovascular system
- Dermis
- Sebaceous gland

## EXTENSION QUESTIONS

- How is the skin a chemical and mechanical 'primary line of defense'?
- Can you think of any more functions of the skin? Communication? What diseases can it help diagnose?



# PESSIMISM IS GOOD FOR YOU!

By Celeste Beley

Are you ever criticized for being too positive in a stressful situation? Or maybe too negative in a positive situation? According to several studies, pessimists may have an edge when it comes to living a longer.

“All too often in the literature and in the public conversation, we want people to be more than 90% optimistic,” said Dr. Dillip Jeste, professor of psychiatry and neuroscience at the University of California San Diego. “That’s not good. It is much better to have a balanced perspective and have some pessimistic streak in your personality in order to succeed.”

There are even definitions for different types of optimism and pessimism.

- **Dispositional Optimism/Pessimism** is a tendency to hold positive or negative expectations about the future. More plainly, you may refer to it as the glass half full vs. the glass half empty.
- **Explanatory Optimism/Pessimism** is a style of explaining why bad things happen. In this type, pessimists will often blame themselves, where optimists will blame external factors.
- **Defensive Pessimism** is a strategy that can be used to manage anxiety. In this type, pessimists tend to think through all the negative outcomes of a situation in order to avoid them.
- **Strategic Optimism** is the opposite of defensive pessimism. When confronted with a stressful situation, a strategic optimist tends to distract from it rather than overthink the situation.

## LIVING A CAUTIOUS LIFE

In a study published last year, findings showed that older people with a pessimistic view of the future tended to live longer and healthier lives than those that have a positive outlook. For participants 65 and older, researchers found that the likelihood that they would survive or remain healthy increased about 10% for those who had a

more pessimistic view. They attribute the increase to a likelihood that those people would invest in precautionary measures.

Studies in children surprisingly showed similar results. A long term study over 8 decades found that pessimistic kids were living longer lives. Researchers attribute the result to optimistic kids taking more risks such as smoking or drinking.

Dr. Jeste still believes in a balance of optimism and pessimism and avoiding extremes.

“One should be more optimistic than pessimistic but not 100% optimistic,” said Dr. Jeste. “I don’t know what the perfect balance is but maybe something like 70-30.”

Erin O’Mara, Assistant Psychology Professor at University of Dayton sums it up well, “I think that pessimism, to the extent that it allows you to accurately assess what’s happening in your life, is important.”



## EXTENSION QUESTIONS

- Do you think the 70/30 balance is the right ratio? What do you think is the correct ratio?
- Are you an optimist or pessimist? What types do you recognize in yourself?

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# WALK OR RUN WITH SOLEPOWER!

By Mary Rose Thomas-Glaser

We all know that walking and running are good for our health and waistline. The energy our bodies require to move is generated by burning calories which helps to control weight. Did you know that you also generate enough mechanical energy with each step to power a light bulb, yet most of it is wasted on shoe wear?

## HARNESSING THE POWER OF HUMAN MOTION

In 2012, Hahna Alexander and Matt Stanton were among of a group of engineering students at Carnegie Mellon University tasked with developing a product that would benefit their fellow students for a class project. The team designed a shoe that captured energy generated by walking to power LED shoe lights and enhance student night-time safety on campus. The innovative concept earned the group an "A" on the project.

Alexander and Stanton realized the potential to build on the class project success, devising an improved design that could store more power and benefit people around the globe. SolePower was launched in 2012 with support from the CMU Project Olympus and startup accelerator AlphaLab to develop insoles capable of harnessing walking energy to power mobile phones.

They were able to shrink the size of components and create an all-weather, water-resistant insole that can be cut-to-fit. Together the insole and battery pack weigh just five ounces. With \$60,000 from a Kickstarter campaign, SolePower is ramping up release of its inaugural insoles later this year.

SolePower was honored as a winner at the Popular Science's 2014 Invention Awards: "recognition of the innovative, functional, and practical qualities the SolePower insoles have and their ability to make a positive impact in the world."

## HOW SOLEPOWER WORKS

1. Energy from each heel strike is converted by a drive train into rotational energy which spins magnetic rotors.
2. Spinning rotors induces an electrical current in the wire coils
3. Generated electricity travels the wire to a lithium-ion polymer battery pack secured on the shoelaces

Currently a 15-mile walk charges a smart phone.



## EXTENSION QUESTIONS

- What are your ideas for wearable products that could generate energy?
- What are the different types of energy? What are the ways the energy is stored?

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# “BAMBI” BACKPACK DESIGNED TO BUILD BRIDGES FOR MILITARY

By Mary Rose Thomas-Glaser

Today's U.S. Special Tactics Battlefield Airmen forces are highly trained, in peak physical condition and equipped with 150 pounds of gear, weapons and body armor to conduct rescue and assault missions around the world. Often these missions involve challenging physical obstacles such as scaling high walls, crossing waterways and rooftops, or quickly rescuing and transporting injured victims — tasks that require strong, versatile, portable tools. Traditionally standard 40-pound aluminum ladders have been used, but they're a bulky and heavy burden for personnel already loaded with gear.

To solve this equipment challenge, the U.S. Air Force Research Laboratory issued the University Design Challenge to engineering students at 16 universities and three military academies. Their mission was to develop a portable, lightweight, multipurpose tool that could traverse a variety of obstacles over a 20-foot gap and was simple to deploy, reusable and able to hold 350 pounds. Each team received \$20,000 and had nine months to complete their design.

Teams competed in a field test with their equipment prototype on an obstacle course designed with a variety of gaps at Elgin Air Force Base in Florida. The winner of the competition was BAMBI —the Break-Apart Mobile Bridging and Infiltration device — designed by seven Utah State University students and two faculty. According to Byard Wood, professor of mechanical and aerospace engineering at USU, “We were able to take it out of the backpack, assemble it, cross multiple gaps and then reassemble it in six minutes.”



## WHAT SET BAMBI APART?

BAMBI's simple yet ingenious modular design consists of six interlocking sections that can be transported in a 4 pound backpack and quickly assembled into a 22-foot long bridge structure. Its carbon fiber and foam core construction is strong enough to hold 350 pounds yet at 27 pounds is extremely lightweight. And its rough, sandy finish provides traction for better footing in slippery conditions and when climbing.

As winners of the challenge, USU is expected to receive a \$100,000 grant to refine development of BAMBI for military use.

## Backpack Bridge



## VOCABULARY

- Ingenious
- Modular
- Prototype

## EXTENSION QUESTIONS

- What makes carbon steel so much stronger than other materials? What other products are made of carbon steel?
- What training is required for the elite military Special Forces? What missions do they conduct?

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Neutralit	5.0 to 10.0	100	S07767	24.10		
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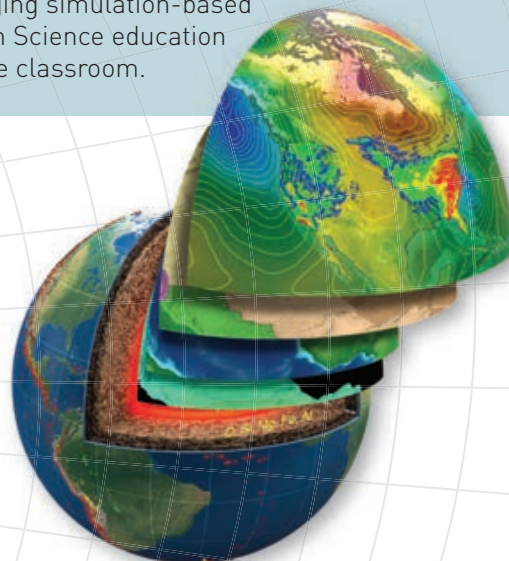
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## TURTLE TEARS A TASTY TREAT?

By Amy O'Donnell

Seeing a colorful flock of butterflies perched on the head of a turtle is an unusual sight. What draws these lovely insects to their reptilian roost? A sip of turtle tears.

### A SEARCH FOR SODIUM

In the rain forest surrounding the western Amazon, sodium is in short supply. This area has less available sodium than other areas of the Earth because the Atlantic Ocean is more than 1000 miles to the east and the Andes Mountains block windblown mineral particles from the Pacific Ocean to the west. This environmental scarcity may have inspired a remarkable behavior. Butterflies, and bees as well, have been observed drinking the tears from the eyes of yellow-spotted river turtles. According to Phil Torres, a researcher at the Tambopata Research Center in Peru, the insects probably use the tears as a source of salt.

Carnivores, such as the turtles, are able to get the sodium that they need from the meat in their diets. However, herbivores like butterflies and bees may have a more difficult time getting all of the salt they need. Researchers agree that the need for sodium may be a reasonable explanation for the butterflies' behavior. Some turtle

species are known to excrete excess salt through their tears. Additionally, macaws in the western Amazon are known to lick clay, perhaps as a source of sodium and other minerals. The drinking of turtle tears has not been observed often outside of the western Amazon. Torres plans to study the phenomenon further to see if the butterflies are getting additional minerals or even amino acids from the tears.

### WHAT ABOUT THE TURTLES?

Does the butterflies' behavior have any negative impact on the turtles? The drinking itself probably does not hurt the turtles. The butterflies do not take much from the turtles, as they uptake salts by placing the proboscis in the tears and passively absorbing the minerals. However, the flocks of butterflies crowding around a turtles' eyes may interfere with their ability to see the approach of large predators.

Many animals exhibit behaviors that allow them to survive in extreme conditions. Butterflies in the western Amazon demonstrate that a few tears may be a necessary part of life.

### Butterflies sipping the turtle's tears



### VOCABULARY

- Proboscis
- Amino Acid
- Carnivore
- Herbivore
- Phenomenon

### EXTENSION QUESTIONS

- What are other examples of animal adaptations to environmental scarcity?
- How would you describe the relationship between the butterflies and the turtles?





# DEEP IMPACT AND ARMAGEDDON FOR REAL

By Amy O'Donnell

## LIGHTING UP THE RUSSIAN SKY

It was sunrise in the city of Chelyabinsk, Russia on a cold February morning in 2013 when early morning commuters were taken by surprise from a visiting UFO. At first, witnesses suspected it to be a missile. Was this an attack? After leaving a bright trail in the sky the ten-ton projectile with a downward striking angle suddenly blew up overhead. The explosion sent bystanders to their knees, and those in their cars or next to glass windows found themselves covered in shards. More than 1500 people reported medical injuries, and the total damage region-wide was estimated to be \$3 million dollars.

Astronomers were quick to jump on the case knowing that this was indeed a visitor from outer space — a meteor — the kind too large to burn up on its way through the atmosphere but small enough that rotating forces prevented it from hitting the ground.

How big was the Chelyabinsk meteor compared to the estimated gargantuan 10-kilometer object that wiped out most living things following the Cretaceous period? Scientists do not know for sure, but similar to the process of calculating how large a dinosaur-killing impact would have been, they guess roughly 20 meters in diameter. Though relatively small, this recent threat is no doubt a wakeup call for our society.

## HOW CAN WE PROTECT OURSELVES?

Certainly the first step in preparing ourselves against potentially hazardous objects (PHOs) is to find them. Astronomers are looking, but now private organizations are funding exclusive searches because current programs do not have enough eyes on the sky. If an imminent impact is detected early enough we now have the technological ability to save ourselves, something our ancestors did not have.

## Artist's conception of gravity tractor drawing asteroid away from Earthbound trajectory



Scientists and engineers have been tossing around ideas for decades: deflection, destruction, but probably most likely is a gravity tractor. Given enough warning, an international collaborative team could launch a rocket with a payload containing significant mass. After catching up to a PHO it would navigate beside the space rock and over time slowly manipulate the object's orbit away from an Earth impact.

## VOCABULARY

- Meteor
- Gravity tractor
- Cretaceous period

## EXTENSION QUESTIONS

- What could have been done for Russian residents if there was an early warning system put into place?
- What is the difference between a PHO and a NEO (near Earth object)?

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# DRIVING INTO A GREENER FUTURE

By Colleen Salvatore

## PAVING AMERICA'S ROADWAYS WITH SOLAR PANELS

It sounds like something out of a sci-fi movie— driving an electric car that's illuminated by a highway and also generates electricity, melts ice and snow and displays messages. Such a cruise may one day be possible with Solar Roadways.

## SPEEDING INTO THE FUTURE

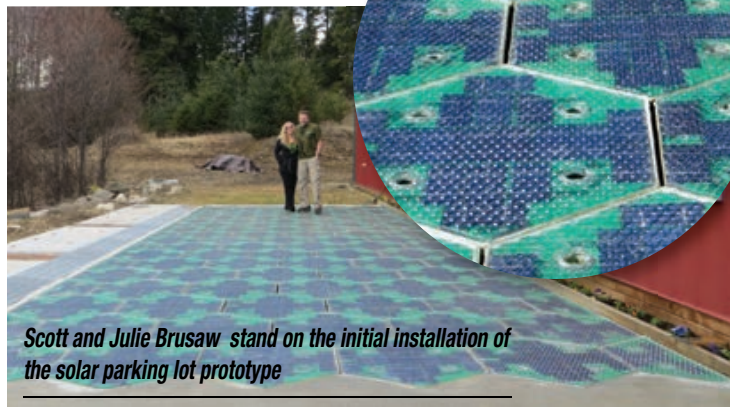
When Scott and Julie Brusaw see a paved roadway, they envision a smart highway with electricity-generating solar panels instead of asphalt or concrete. Through their start-up company, Solar Roadways, they are working to develop cost-effective solar pavers from recycled materials that would house solar panels and circuit boards. The Brusaws like to think big and hope to one day create a "a nationwide system could produce more clean renewable energy than a country uses as a whole."

To this end they've developed a hexagonal glass-covered tile strong enough to hold a 250,000-lb. load. Bumps developed on the glass offer more traction than asphalt. A 12 x 36 ft. prototype has been constructed in the Brusaw's hometown of Sandpoint, Idaho, capable of generating approximately 3600 watts of energy. The goal is to create a system that can pay for itself.

Down the road, plans include tiles constructed with heating elements to melt snow and ice throughout the winter, recharge electric cars and power LEDs for lighting or to display messages. The Solar Roadways founders aren't limiting their plans to the thousands of miles of open road. They believe that their solar tiles will be able generate electricity for use in our homes and businesses and power lighting for parking lots and streets.

## MANY BUMPS IN THE ROAD

Major barriers need to be overcome before roads can be paved with solar tiles. Pavers cost an estimated 50 to 300 percent more than traditional road surfaces. Will the glass surface provide sufficient traction and strength for varying weather conditions and heavy vehicles? What will be required for paver upkeep and to maintain the electrical infrastructure? Will animals be attracted to the heat of the roads and create additional hazards? Clearly more research is needed before a cruise on the smart highway becomes a reality.



Scott and Julie Brusaw stand on the initial installation of the solar parking lot prototype

## EXTENSION QUESTIONS

- What are other applications for solar-powered tiles?
- What impact would the installation of a solar-powered roadway have on the work force?



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## COMPUTER GAMES MAY BE THE BEST MEDICINE

By Colleen Salvatore

### FOR TREATING DEPRESSION IN ELDERLY PATIENTS

Can you imagine a doctor recommending that your grandparent play computer games to treat depression rather than prescribing medication? A new study suggests that computer games may prove to be the best medicine for geriatric depression patients.

### MOOD-LIFTING ALTERNATIVE TO MEDICATION

Over 6.5 million Americans over 65 suffer from clinical depression. Conventional treatment has centered on prescription antidepressants, which often have little or no effect or cause negative side effects in elderly patients. In fact, only one third of elderly patients feel better with antidepressants.

Approximately 40 percent of elderly patients with depression also suffer from deterioration of executive function which governs memory, reasoning, problem solving, planning and organizing. Because these patients are only half as likely to respond to antidepressants, Sarah Shizuko Morimoto, a neuropsychologist researcher from Weill Cornell Medical College in New York, theorized that improving executive function could also aid geriatric depression.

Morimoto asked a group of 11 patients aged 60 to 89 who had previously shown no improvement with antidepressants, to play computer games for 30 hours over a four-week period. In one game, patients pressed a button whenever bouncing balls on the screen changed colors to test reaction speed and accuracy. In another game, patients rearranged several word lists into various categories to test their attention and accuracy. The level of difficulty for both games increased with time and player ability.

Results were compared to 33 patients in a separate study treated with the antidepressant escitalopram and indicated an equal level of effectiveness in a shorter timeframe.

According Morimoto, "Our findings suggest that the health and functioning of the brain circuits responsible for executive function are important for the recovery from depression. This computer therapy could be used by itself or in conjunction with antidepressant drugs. It could be extended to other mental disorders by reprogramming it to target the brain circuits found impaired in these disorders."



### VOCABULARY

- Depression
- Reprogramming
- Executive function
- Neuropsychologist
- Geriatric

### EXTENSION QUESTIONS

- What impact do computer games have on teens? Does it differ from that of the elderly?
- Research anatomy of the human brain. Which part control executive function? Which other brain regions might have a role in depression?

Looking for another perspective on this topic? Read more on page 4.



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## SOLVING THE WORLD'S WATER CRISIS, ONE PAGE AT A TIME

By Colleen Salvatore

On a hot summer day, nothing quenches your thirst more than a tall glass of ice cold water. We take for granted how clean drinking water is readily available with a turn of a spigot. Almost one billion people worldwide, however, lack access to clean drinking water. In fact, 3.4 million people die each year from water-related diseases, and 20 percent of children under the age of five in rural developing countries die from waterborne diseases.

### A REAL PAGE TURNER

WATERisLIFE, a non profit organization, DDB New York, an advertising agency, and Dr. Theresa Dankovich, a chemist with the University of Virginia and Carnegie Mellon University, partnered to find a cost-effective, simple method to provide clean drinking water for people in developing counties. The collaborative result is The Drinkable Book, a manual that teaches safe water habits and actually produces potable water.

The Drinkable Book has been designed with pages made of special filter paper coated with silver nanoparticles that kill microorganisms such as cholera, E. coli and typhoid, major causes of preventable, and often fatal, waterborne diseases. In laboratory tests, the filter successfully removed 99.99 percent of bacteria, achieving a drinking water quality level comparable to that of the United States.

The filter is a simple system to use — simply tear out a perforated page, insert into a slot in the filter box (supplied with the book) and pour contaminated water through the filter. Clean water is produced in seconds and captured in the reusable box. Each “filter” page can be reused up to 30 days, and one book can last up to four years.

### WORDS TO LIVE BY — LITERALLY

The Drinkable Book serves two purposes — creating clean drinking water and educating individuals about safe drinking water habits. Fundamental hygiene messages, such as the importance of regular hand washing and keeping drinking

water away from human and animal waste and garbage, are printed on each page in a safe, food-grade ink.

The Drinking Book has the potential to save millions of lives. Prototypes are being field tested, and fundraising is underway to support large-scale production.

**One of the pre-perforated sheets is a filter that will last one month (individual use), or 100L of water.**



### VOCABULARY

- Potable water
- Waterborne
- Prototype
- E. coli

### EXTENSION QUESTIONS

- What other aspects of a person's life can change when drinking water is made easily accessible?
- How could The Drinkable Book be valuable in developed countries as well?



# 2014 GULF OF MEXICO “DEAD ZONE” IS 5052 SQUARE MILES

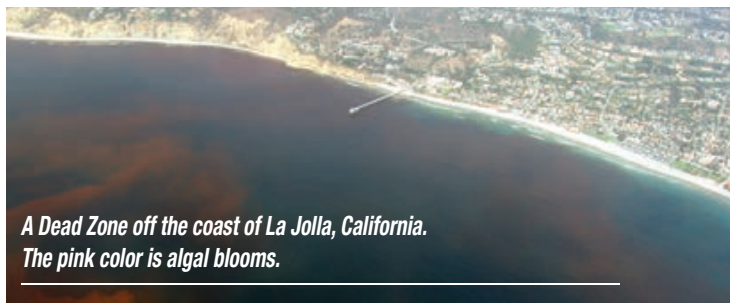
By Amy O'Donnell

An area of low oxygen or hypoxia, commonly known as the “dead zone,” has appeared in the coastal waters of the Gulf of Mexico since 1972. The size of the dead zone varies from year to year. This year’s dead zone, measured from July 27 to August 2, is roughly the size of Connecticut.

## HOW ‘DEAD ZONES’ FORM

The dead zone is caused in part by nutrients that are washed into the Gulf of Mexico from the Mississippi River. These nutrients may come from a variety of sources, including fertilizers from agriculture, golf courses, and suburban lawns, as well as discharge from sewage treatment plants. These excess nutrients cause algal blooms. As the algae die and decompose, oxygen is consumed, leading to low levels of oxygen in the water.

Seasonal stratification of the less dense, warmer freshwater over the denser, colder deep ocean water also contributes to hypoxic conditions in the Gulf. The layering prevents the oxygen-rich water on the surface from mixing with the oxygen-depleted deep water, allowing low oxygen levels to persist.



A Dead Zone off the coast of La Jolla, California. The pink color is algal blooms.

## IMPACTS OF HYPOXIA

Sea life cannot survive the low-oxygen conditions in the dead zone. Adult fish, shrimp, and other mobile animals survive by migrating to water with higher oxygen levels. However, less mobile animals like younger fish, mussels, and crabs cannot escape hypoxic conditions and ultimately die. This loss of life reduces biodiversity and also diminishes the available food supply when oxygen levels rise and the larger fish and shrimp return. In addition to disrupting the ecosystem, the dead zone hurts the fishing and tourism industries in the Gulf.

Scientists are working to shrink the size of the dead zone by reducing the amount of nutrients washed into the Gulf. The size of this year’s dead zone was smaller than both the five-year average of 5500 square miles and 2002’s record 8481 square miles. However, scientists had hoped to reduce the dead zone to only 1900 square miles by 2015. Based on the size of this year’s dead zone, that goal is unlikely to be met.

Hypoxia does occur naturally in waters around the world. However, hypoxic conditions are occurring in shallow coastal waters more often as human nutrient inputs increase. There are as many as 550 dead zones throughout the world. The dead zone in the Gulf is the world’s second largest.

## VOCABULARY

- Hypoxia
- Stratification
- Algal bloom
- Biodiversity

## EXTENSION QUESTIONS

- What can be done to reduce nutrient runoff into waterways?

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# ARE YOU READY FOR SOME REAL-TIME PLAYER STATS?

By Mary Rose Thomas-Glaser

For football fanatics, fantasy football players and coaches alike, it's a dream come true – RFID tracking chips that transmit real-time statistics on a player position, speed, direction, distance and force of impact directly to game broadcasters.

Players in this season's Thursday night games at 17 National Football League (NFL) stadiums will wear shoulder pads embedded with two, quarter-sized RFID tags – one to provide location data and the other to determine orientation. RFID tags will also be carried in referees' back pockets and affixed atop the chains on the field to mark yardage, allowing players and equipment to be tracked to within six inches. For now, the game ball will not be equipped with a tag.

Data transmitted by the tags will be captured 25 times per second, collected by a server and instantly correlated to the players. In less than one second, data will be analyzed and sent to the NFL Network for display in graphics on the live broadcast (with standard two-second delay). Viewers will have access to inside, "next generation" stats previously unavailable to fans, for instance, how far a receiver actually ran with dodges and side steps versus simply yards gained or the speed of a running back to avoid a tackle.

Next year, the NFL plans to outfit players with chips that will track health measurements such as heart rate, temperature and lung capacity to supplement game play data.

## WHAT IS RFID TECHNOLOGY?

Radio-frequency identification (RFID) uses tags attached to objects to electronically store and wirelessly transfer data using electromagnetic fields to a receiver that "reads" the information. Since it was patented in 1983, RFID chips have become increasingly miniaturized and easier to conceal and use. Scientists at Bristol University in the United Kingdom, for example, attached RFID tags measuring just 3mm long to the backs of ants to monitor their movement.

Applications for RFID technology have become widespread, and microchips are now used to find lost animals, transmit payment on toll roads, capture times at sporting events, record power usage, and track inventory in warehouses and shipment.

*The RFID transmitters is placed inside the shoulder pads of each player.*



## VOCABULARY

- Embedded
- Electromagnetic fields
- Yardage
- Patented

## EXTENSION QUESTIONS

- What do you think are new uses for RFID technology?
- Research electromagnetic radiation. Do you think we should be concerned about health effects of exposure to electromagnetic fields?

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## GENETICIST

Some children look like one parent, while others look like both parents; some siblings practically look like identical twins, while other siblings couldn't look more different. Why are some genes passed down through generations, while others aren't? Ask a geneticist.

A geneticist studies genes and tries to understand how characteristics are inherited by a new generation of a species. Why might someone be interested in such a field? Geneticists are working to tell us how we can decrease the chances of a child inheriting a genetic disease. They work with agriculture to create plants with new genes, such as ones that resist drought; some work in the law field, using their genetics background to mold new laws regarding the production of genes. A geneticist understands and works with genes, but in what context he or she works with genes is able to be defined individually.

A student interested in genetics should consider taking biology and

chemistry courses in high school. In college, it may be possible to major in genetics. If a college or university does not offer genetics as a major, a budding geneticist should consider biology, biochemistry, or chemistry as fields of study. If research is in the future, statistics is also an important course to take. Many geneticists go on to earn either a masters or doctorate in genetics, though not all choose this course of action. It is also possible to earn a dual M.D./Ph.D. for genetics, allowing geneticists to do broader medical work.

According to healthcare-salaries.com, the average geneticist in the United States earns \$55,080-\$82,620 per year. However that number varies greatly among geneticists with bachelors, masters or doctorate degrees. Good news: according to a Georgetown University study of the economics of college majors entitled "What's It Worth?" 99 percent of genetics majors are employed after graduation.

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