

HEADLINE DISCOVERIES

Nov/Dec 2013; Issue 4



Meet the STEM-Credibles!

SEE BACK COVER

**DO TIRED PEOPLE CRAVE
JUNK FOOD?**

**WHERE'S THE LAB-GROWN
BEEF?**

**CORAL FIGHTS BACK
AGAINST WARMING SEAS**

**RARE CORPSE FLOWER
BLOOMS**



Please visit
www.fisheredu.com/subscribehd
or scan this QR code to subscribe.

Supplier Index:

ALDEBARAN ROBOTICS	13
ALTAY SCIENTIFIC.....	6
AMERICAN 3B SCIENTIFIC	9
AMERICAN EDUCATIONAL PRODUCTS.....	2
BEL-ART	15
CORNING.....	15
DIVERSIFIED WOODCRAFTS	11
EDVOTEK	5
FISHER SCIENCE EDUCATION.....	2
FISHER SCIENTIFIC.....	10, 14
HB INSTRUMENTS	13
K'NEX.....	5
KEMTEC.....	15
KEN-A-VISION.....	9
KIMBLE CHASE	4
OHAUS.....	8
SPER SCIENTIFIC.....	10
SWIFT	12
THERMO SCIENTIFIC.....	7

Inside This Issue:

ASTRONOMY AND EARTH SCIENCE.....	11
BIOTECHNOLOGY.....	5, 14
CHEMISTRY.....	7
ELEMENTARY.....	3
ENVIRONMENTAL.....	13
LIFE SCIENCES.....	8, 12
PHYSICAL SCIENCE.....	10
STEM	3-4
TECHNOLOGY.....	9

Price offers in this publication are valid through December 31, 2013 unless otherwise stated.



Introducing the STEM-Credibles!

At Fisher Science Education, we believe science teachers are Superheroes Every Day! Meet our own STEM-centric heroes and learn more about each of them on the last page of this publication.

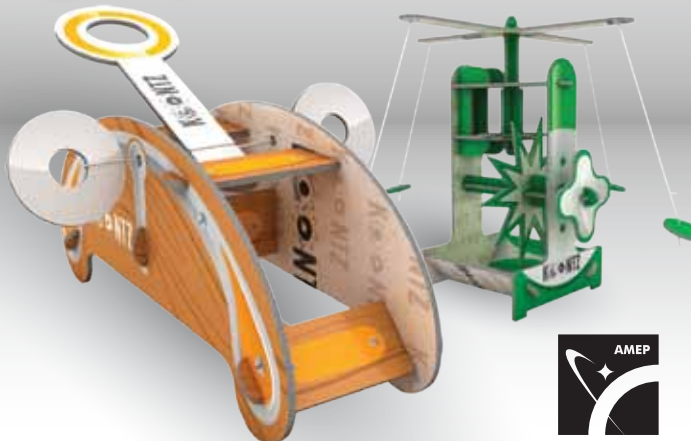
-Illustration by Michael Andrulonis

MADE OF
DURABLE,
RECYCLABLE
CARDBOARD!



Description	Cat. No.	Price
The Safe	S05067	12.95
The Merry Go Round	S05064	12.95
The Jet Car	S05071	12.95
The Combination Lock	S05068	12.95
The Kaleidoscope	S05061	12.95
The Periscope	S05062	12.95
The Clock	S05066	12.95
The Boomerang Wheel	S05070	12.95
The Chaotic Pendulum	S05065	12.95
The Teetering Penguin	S05069	12.95
The Catapult	S05060	12.95
The Walking Tightrope	S05063	12.95

Each title comes with simple step-by-step instructions and a fun activity guide.



Don't miss a single issue!
Subscribe to *Headline Discoveries* Today



Now available in both **Digital** and **Print** subscriptions!

Digital subscriptions are convenient, environmentally friendly and always **FREE**. Sign up to receive your **Digital** subscription at www.fishersci.com/subscribehd or scan this QR code.



New in 2014, **Print** subscriptions are now available — get all four issues of **Headline Discoveries** delivered right to your school or home address. Order now and get a **BONUS GIFT** with a new subscription.

Annual subscription rate: **\$14.95**

Order part #: **HDMagazine**

To order your **Print** subscription
call **1-800-955-1177**

F **Fisher Science
Education**

Part of Thermo Fisher Scientific

DO TIRED PEOPLE CRAVE JUNK FOOD?

By Joe Giacobello

We've all heard that proper sleep is important to our physical and mental well being, but here's another potential benefit that just might have you jumping under the covers extra-early tonight. It turns out that sleeping well can actually help keep you trimmer. A recent study revealed that people deprived of adequate sleep are more likely to experience changes in brain activity that can actually increase the urge to eat those indulgent, high-calorie foods. This means that eight hours a night can literally equate to "eight pounds lighter" for many people.

BRAIN STUDY

This first-ever study of brain activity in relation to food among sleep-deprived individuals was conducted by Matthew Walker and colleagues at the University of California in Berkeley. The research team studied the brain patterns of 23 subjects using functional magnetic resonance imaging (fMRI), first following a night of sound, restful sleep, and then after a night of no sleep. The results were fascinating. After sleep deprivation, there was increased activity in the amygdala — the area of the brain that helps control the motivation to eat. There was also decreased activity in three areas that help, among other things, to process odor and flavor signals. In addition, subjects rated photos of high-calorie foods

as more desirable after no sleep than after a good night's rest.

EVOLUTIONARY BENEFIT

According to Laurent Brondel at the University of Burgundy in Dijon, France, being extra-hungry when deprived of sleep could once have offered an evolutionary advantage. At higher latitudes, many animals are deprived of sleep due to the long summer days — but they use these extra hours awake to eat more food, which ultimately helps them survive the shorter days of winter when food is scarce.

GOOD SLEEP IS THE KEY

While this craving for food by the sleep-deprived brain may have once been a vital adaptation, today it is no longer seen as a benefit to our health. While the body does require more energy when a person stays awake longer, the less-healthy foods that become more desirable after sleep deprivation provide many more calories than what are needed. Clearly, the best message that comes from this study is one of making the right choices regarding proper rest each night. "Early to bed" may be your best key to eating the right foods and keeping off those extra pounds off.



CLASSROOM DISCUSSION

- What are other benefits of a good night's sleep?
- How can a lack of proper sleep be dangerous to our physical well being?

SCIENTISTS CREATE WORLD'S LIGHTEST MATERIAL

By Samba Lampich



Carbon aerogel sitting on the stamen of a flower

A team of scientists from at Zhejiang University in China have created the world's lightest material. Carbon aerogel has a mass of only 0.16 milligrams with a density one sixth that of air. A piece the size of a mug can sit on a flower without crushing it.

To understand just how light it is, consider that if an average adult man was made entirely out of carbon aerogel, he would weigh only 0.025 pounds — less than a tablespoon of salt.

HEAVY-DUTY USES

Lead scientist Dr. Chao Gao says carbon aerogel can absorb up to 900 times its own weight in liquid. This characteristic means the material has the potential to be used in pollution control, such as in oils spills or in water and air purification. Current products can only absorb 10 times their own weight in organic solvent.

Carbon aerogel is also durable and highly elastic, which allows it to bounce back when compressed making it a suitable material for energy storage, insulation, catalytic carrying and sound-absorption.

Dr. Gao says carbon aerogel is similar in structure to carbon sponge. His team created the material by starting with a semi-solid gel of carbon nanotubes and graphenes then converted it into a solid using a freeze-drying process. This process makes aerogel production easier, more convenient and possible in mass production.

OTHER FASCINATING MAN-MADE MATERIALS

Artificial Spider Silk

A Japanese startup called Spiber decoded the gene responsible for the production of fibroin in spiders, which is the key protein used to create the super-strong strands of silk. The company then created bioengineered bacteria that feed on sugar, salt and other micronutrients to quickly produce fibroin. A single gram of fibroin produces 5.6 miles of silk.

Molecular glue

Researchers from the University of Oxford created molecular glue inspired by flesh-eating bacteria, *Streptococcus pyogenes*. Inspired by single protein that the bacteria use to bind and invade human cells, they developed the molecular glue that contains a new protein which forms covalent bonds when in contact with a partner protein. The bond was so strong that when a sample was tested, the equipment used to measure strength broke before the glue bond.

GLOWING SHEEP FIGHT AIDS

By Cara De Carlo

Funcionador IPRAYUJ, Calveiro

Counting sheep at night is getting easier. Thanks to genetic research, the sheep now glow.

The glowing sheep were born in October of 2012 at Uruguay's Institute of Animal Reproduction. Alejo Menchaca and a team of scientists modified each sheep's genome using DNA from an Aequorea-genus jellyfish. The sheep expressed the jellyfish gene in the form of a fluorescing protein.

Interestingly, the glowing sheep were healthy, according to an April 2013 report on Fox News Latino. As of that time, the fluorescent flock was roaming the fields and grazing normally.

Menchaca told Fox News Latino that the glowing sheep project was a fine-tuning phase in a larger quest for glow-in-the-dark stock. Other research groups have produced glowing cats, dogs, fish, monkeys, mice and more.

So, what's the purpose? Why are we spending time and money to make animals glow?

According to Helen Sang and Bruce Whitelaw of



the Roslin Institute at the University of Edinburgh, glowing genomics equals AIDS research.

"The application of the new technology suggested in [our] paper is to develop the use of genetically modified cats for the study of feline immunodeficiency virus (FIV), providing valuable information for the study of AIDS," the scientists told Alok Jha in a 2011 report in The Guardian.

Basically, genetically modified animals can be "models" of human diseases. The AIDS virus (HIV) is a retrovirus, i.e., a virus that modifies its host's

genome. However, it isn't safe to use a real retrovirus in animal research.

"Cats are one of the few animal species that are normally susceptible to such viruses [as FIV]," Dr. Robin Lovell-Badge of the Medical Research Council told Jha. "...Indeed they are subject to a pandemic, with symptoms as devastating to cats as they are to humans."

Likewise, scientists use the trait of "glowing" as a mock-up for the expression of an immunovirus. If a test animal can "resist" the glowing gene, scientists can begin to study how the resistance occurred.

"Understanding how to confer resistance is ... of equal importance to cat health and human health," said Badge.

CLASSROOM DISCUSSION

- Is a "glowing" gene modification a meaningful substitute for a retrovirus in research?
- What does a retrovirus really do?

How Green is Your Lab?

- ▶ Reusable, economical, long lasting
- ▶ Lead-free paint
- ▶ Manufactured from sand - a renewable resource
- ▶ Recyclable

KIMAX® beaker starter packs are designed to meet the needs of your eco-conscious school lab, where durability is essential and waste is not an option. KIMAX® beakers are designed to provide strength and reliability from top to bottom, and starter packs allow you to get a variety of sizes without ordering more than you need. Standard beaker packs consist of an assortment of popular size beakers (one each of 50, 100, 250, 600 and 1000mL). Heavy-duty beaker packs consist of one each of 250, 400, 600 and 1000mL.

Description	Cat. No.	Price
Beaker Starter Pack	S30731	35.50
Heavy-Duty Starter Pack	S30731A	51.50

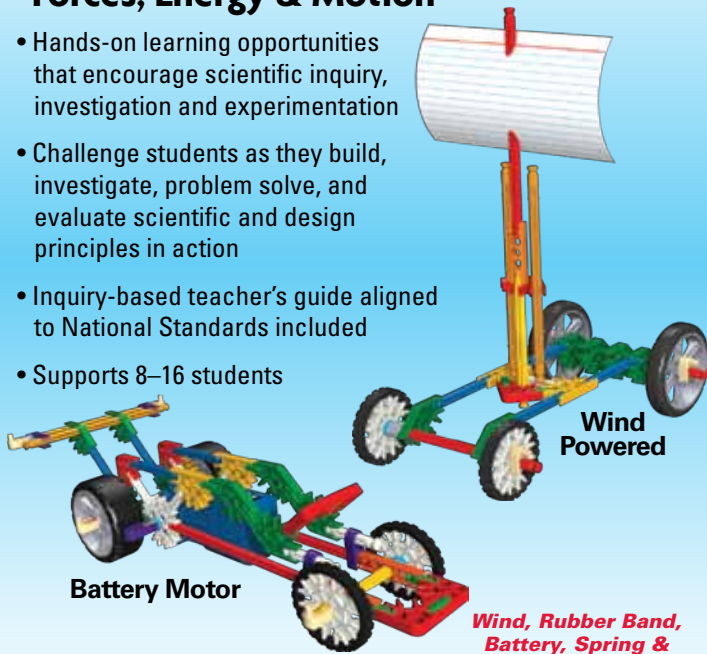
KIMBLE CHASE



AMERICA'S STEM BUILDING SOLUTION

Forces, Energy & Motion

- Hands-on learning opportunities that encourage scientific inquiry, investigation and experimentation
- Challenge students as they build, investigate, problem solve, and evaluate scientific and design principles in action
- Inquiry-based teacher's guide aligned to National Standards included
- Supports 8–16 students



Wind, Rubber Band, Battery, Spring & Flywheel Motor Powered Vehicles!

Description	Cat. No.	Price
Forces, Energy & Motion	S94282	137.50

Edvotek® MegaCycler™

Classroom PCR Amplified!

The all-new MegaCycler brings affordable PCR to the classroom without compromise.

- The 0.2 mL tube block holds up to 49 samples, stores 20 PCR protocols and comes pre-programmed with all Edvotek PCR protocols. These programs may be modified or deleted, plus there's extra memory slots for more!
- The vivid seven line LCD displays all program parameters simultaneously without any scrolling.
- A heated oil-free lid makes operation a snap.
- Proudly made in the USA and backed by a two-year warranty!

S05665 \$2850.00



GRID CELLS: YOUR BRAIN'S GPS

By Mary Rose Thomas-Glaser

Have you ever found yourself in an unfamiliar location yet strangely able to navigate? Or does reading a map make your head spin? In a groundbreaking study with epilepsy patients, neuroscientists may have found the explanation for these phenomena in "grid cells." Grid cells are specialized neurons found in the brains of humans, rats, bats and monkeys responsible for "dead reckoning," or our ability to navigate by instinct without landmarks.

ELECTRODES AND VIDEO GAMES

A team of researchers from Drexel University, University of Pennsylvania, UCLA and Thomas Jefferson University recorded the brain activity of fourteen epilepsy patients undergoing treatment with deeply implanted brain electrodes. Patients played a video game using a joystick to navigate a virtual bicycle to specific items and then recall locations when the objects were no longer visible.

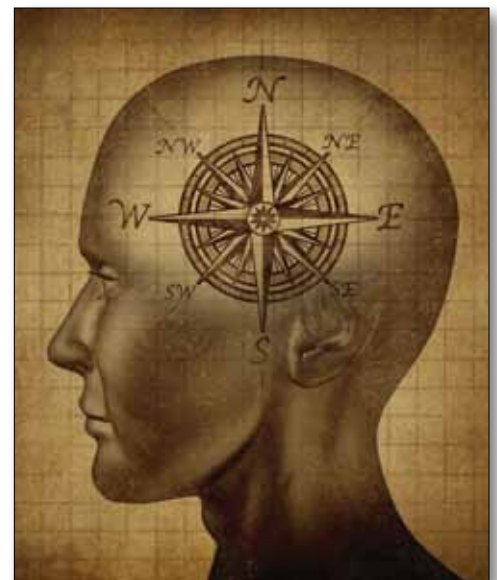
During the game, scientists monitored brain activity and observed when grid cells fired based on the where the patient was on their game grid. Researcher Joshua Jacobs from Drexel University concluded that grid cells are key to path integration navigation, the ability to unconsciously track your travel from point to point. According to Jacobs, "Without grid cells, it is likely that humans would frequently get

lost or have to navigate based only on landmarks. Grid cells are thus critical for maintaining a sense of location in an environment."

Fellow researcher Dr. Michael Kahana from the University of Pennsylvania continued, "The present finding of grid cells in the human brain...provides compelling evidence for a common mapping and navigational system preserved across humans and lower animals." He added how well grid cells function could explain variations in the sense of direction between individuals.

ALZHEIMER'S CONNECTION?

This was the first study involving humans to verify the existence of grid cells in the entorhinal cortex, a part of the brain critical to memory. This is also the first area of the brain to be affected by Alzheimer's disease and may explain why people with the disease frequently become disoriented. Grid cells may prove to be key to improving brain function and memory for Alzheimer's patients.

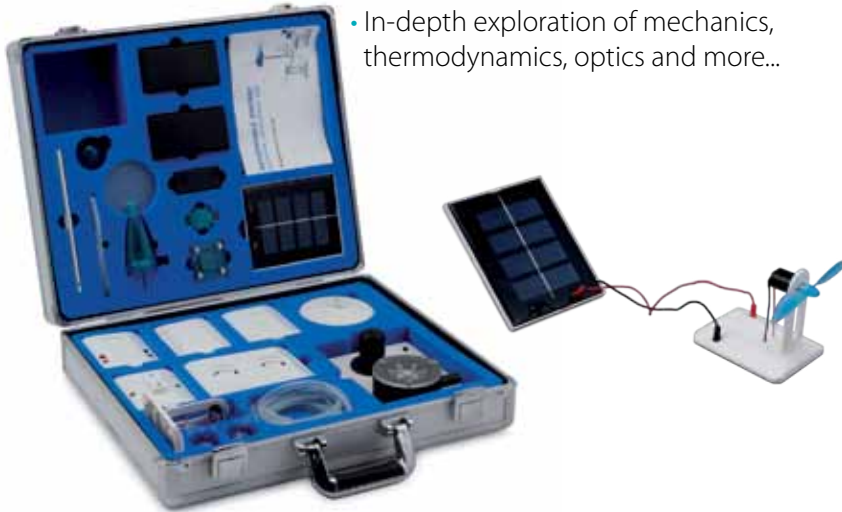


CLASSROOM DISCUSSION

- What would be a real-life scenario in which you could observe the navigational power of grid cells?
- What experiment could you create to test the ability of grid cells in lower animals, such as rats?

PHYSICS

- Innovative kits
- In-depth exploration of mechanics, thermodynamics, optics and more...



ANATOMICAL MODELS

- Anatomically correct
- Durable
- User-friendly



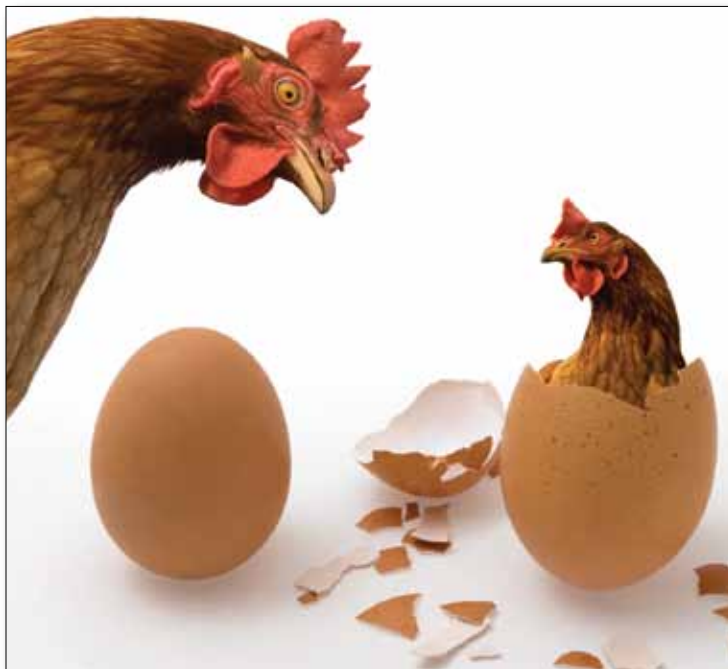
Description	Cat. No.	Price
Anatomy of Cranial Cavity Head Neck and Thorax	S05992	\$217.00
Alternative Energy Source System	S05627	\$460.00



For further information visit www.fisheredu.com/altay

CRACKING THE CHICKEN OR EGG MYSTERY

By Samba Lampich



Which came first — the chicken or the egg? Chickens come from eggs and eggs come from chickens, but which one was the first in existence? Science finally has an answer: the egg.

JUST THE FACTS, YOLKS

Mitchell Moffit of *AsapSCIENCE* explains that chickens, as we know them today, evolved from chicken-like birds that would not be familiar to us. They were genetically close to chickens but not chickens. Moffit calls these proto-chicken. The proto-chicken laid eggs and proto-roosters fertilized them. The zygote produced, the first cell of a baby zygote, contained a mutation that created the first true chicken. That means two non-chickens created a chicken egg from which the chicken hatched. The only place where the DNA mutation is found is in the zygote cell, which is in the chicken's egg. Therefore, the egg came first.

This process did not happen overnight — it evolved over a long time. The mutation was gradual so there was no single instance in which a proto-chicken laid an egg containing a chicken. A similar example would be the domestication of dogs; there was no single instance in which a wolf, the ancestor of dogs, gave birth to a dog. Dogs were wolves that evolved to become what they are today.

But answering the chicken and the egg question doesn't mean the debate is over. Some scientists in the chicken-came-first camp argue that if the proto-chicken laid a proto-chicken egg that contained a chicken and this chicken then laid a chicken egg, the chicken came first.

Moffit summarizes that regardless of whether it was a proto-chicken egg or a chicken egg, the first true chicken came from an egg.

CLASSROOM DISCUSSION

- Why are chicken eggs different colors?
- Is there any nutritional difference between white and brown eggs?

SUGAR SHOTS 'WON'T HURT A BIT'

By Christina Phillis

Kings College London/YouTube

According to Mary Poppins, "A spoonful of sugar helps the medicine go down," but she probably never imagined that a shot could be made out of sugar. This may become a reality thanks to researchers at King's College London who have developed a shot-delivering system that uses a patch of microneedles instead of a syringe to administer injections.

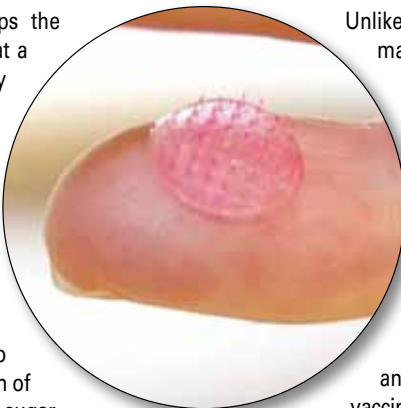
A NEW DELIVERY SYSTEM

The microneedle array, which consists of a tiny disk with several microneedles made of sugar, was created using a silicone mould developed by the U.S. company TheraJect. To create the microneedles, the team developed a dried version of a live, modified, adenovirus-based candidate HIV vaccine in sugar.

After applying the new system to mice, researchers found that the dried live vaccine kept at room temperature was able to stay equally stable and effective as a traditional needle injecting the same dose of liquid vaccine that had been preserved at -80°C.

Imaging enabled the researchers to see how the vaccine dissolved in the body's system. Their findings are the first evidence to suggest that a sub-set of specialized dendritic cells in the skin are responsible for picking up the vaccine and activating the immune system.

This is not the first time sugar microneedles have been developed. Last year, Fuji Film introduced a similar microneedle array consisting of a sheet with 100 to 2,000µm projections that are injected into the skin to deliver drugs into the body.



Unlike the Fuji Film microneedles, the latest shot delivery system is made entirely of sugar.

GLOBAL HEALTH IMPLICATIONS

Besides being significantly less painful, this new system can hold vaccines at room temperature and are just as effective as needle-based solutions. In addition, they're inexpensive to produce and reduce the risk of transmitting blood-borne disease from contaminated needles and syringes.

Sugar microneedles would make a significant difference in the ease and cost of delivering life-saving vaccines for HIV and Malaria to developing countries. Currently, transporting live vaccines in a continuously cold environment (around 2° to 8°C or below) is impossible in certain areas of the world. When a live vaccine is not kept cold, it can become unsafe to use and lose effectiveness.

"This new technique represents a huge leap forward in overcoming the challenges of delivering a vaccination program for diseases such as HIV and Malaria. But these findings may also have wider implications for other infectious disease vaccination programs, for example infant vaccinations, or even other inflammatory and autoimmune conditions such as diabetes," said Linda Klavinskis, PhD, Peter Gorer Department of Immunobiology, King's College London.

CLASSROOM DISCUSSION

- What effect does painless vaccination administration have on the world?
- What are the potential drawbacks of using a needle-less vaccination?

Student-friendly Spectrophotometer makes learning a breeze

The Thermo Scientific™ SPECTRONIC™ 200 Visible Spectrophotometer brings new possibilities to student education:

- Trusted live display supports current experiments
- Full spectrum scan mode finds peaks in seconds
- Removable sample compartment for easy clean-up
- Measure in square or test tube cuvettes

Take a closer look and watch our video on YouTube under SPECTRONIC 200 spectrophotometer.

Request a free trial unit for your classroom at tinyurl.com/s200Fisher

Thermo
SCIENTIFIC

Part of Thermo Fisher Scientific



RARE CORPSE FLOWER BLOOMS

By Celeste Beley



Corpse Flower (*Amorphophallus titanum* or *Titan arum*) bloomed at Phipps Conservatory in Pittsburgh.

A SMELLY AND RARE TREASURE

The *Titan arum* only grows in the wild in the rainforests of Sumatra, India, but is cultivated by private collectors and botanical gardens all over the world. Odoardo Beccari scientifically identified the flower in 1878. The first non-native flowering was documented in London in 1889 at the Royal Botanic Gardens, but more than 100 flowerings have been documented since that time.

The flower typically takes seven to ten years to bloom for the first time but subsequent blooms may take a few as three years. In rare cases, the flower may bloom twice in the same year.

The flower blooms for only about 48 hours, peaking at night, and can heat up to nearly 100 degrees. The flower can stay open for 24 to 48 hours before it begins to wilt and collapses into itself.

Besides its unique aroma, the Corpse Flower is also known for having the largest unbranched inflorescence in the world as it's able to reach ten feet in height. The flower consists of a hollow spadix, wrapped by a spathe, and looks like a large petal.

It smells like rotting meat, dirty diapers or garbage. Would you wait in line for hours to see and smell a flower that doesn't smell as sweet? Thousands of people did just that in late August when the rare

WHY DOES IT STINK?

Like other flowering plants, the *Titan arum* relies on pollinators to reproduce but instead of attracting bees, their putrid sulfur-ridden smell draws flies and beetles. When these insects land on the flowers, they navigate into the tight spaces of the flower as they try to find the source of the smell and a place to lay their eggs. They become covered in pollen and pollinate the flower as they move around.

A SMELLING EVENT

During the Phipps Conservatory blooming, curators extended hours so more visitors could see and smell the rare flower. Affectionately nicknamed "Romero" after local filmmaker George A. Romero. In conjunction with extended hours, Phipps hosted viewings of "Night of the Living Dead" and provided specialty drinks to spectators.

CLASSROOM DISCUSSION

- Would you wait in line to see and smell a Corpse Flower? Why or why not?
- Research and discuss other rare flowers. How do their blooming cycles compare to the Corpse Flower?



Meet Your New Lab Partner

OHAUS Starter Series

- Complete line of electrochemistry/ water quality test meters
- Accurately measure pH, Conductivity, Salinity, TDS, DO and ORP
- Durable OHAUS design, classroom practical features & simple operation

**OHAUS
accuracy &
precision now
available in
electrochemistry
meters!**



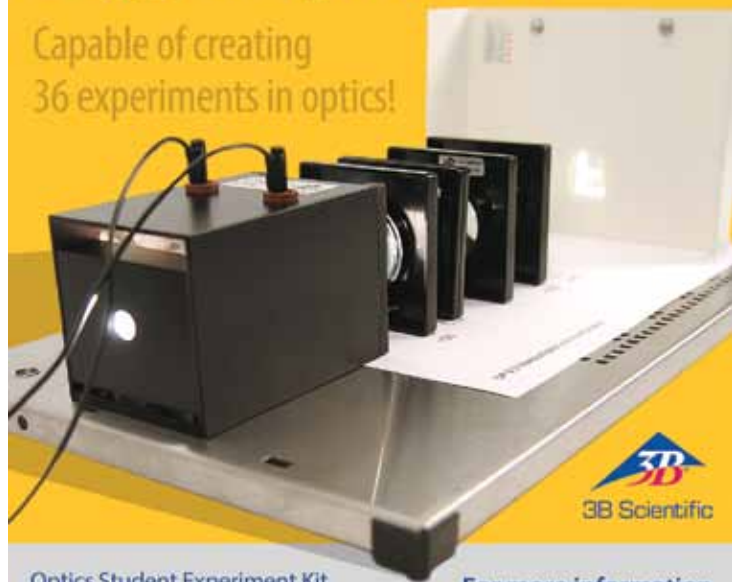
Visit www.fisheredu.com/Ohaus for more information and a complete listing of available products or contact your local Fisher Education Sales Representative.

Ingeniously Practical

1-800-955-1177
www.fisheredu.com/Ohaus

Bring science to life with this versatile and rugged optics kit!

Capable of creating 36 experiments in optics!



Optics Student Experiment Kit

S06619

532.00

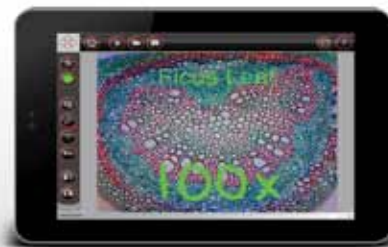
For more information visit fishersci.com



EduCam™ by Ken-A-Vision™

"A brilliant top new teaching app"

- FunEducationalApps.com



EduCam is the first app designed for use with document cameras and digital microscopes. Stream live images from any Ken-A-Vision digital product to a classroom set of tablets. Students can view, capture, annotate and share their work for instant assessment.



ken-a-vision™

Description	Cat. No.	Price
Digital CamScope 2	59029BMP1	489.00

Works with ALL past and present Ken-A-Vision digital products
Current models have been optimized for EduCam

ANY TWO PAGES ON THE WEB ARE CONNECTED BY 19 CLICKS OR FEWER

By Samba Lampich



There is no doubt that the Internet has transformed the world and how we interact. From shopping to entertainment to socializing, our daily lives revolve around being connected online. It is estimated that there about 14 billion pages on the Web. There is no way a single human could visit every page in a lifetime.

According to Albert-László Barabási, a networking theorist in the UK and a member of The Royal Society, any two web pages are no more than 19 clicks apart.

Barabási findings occurred in 1999 and were published in the February in Philosophical Transactions of the Royal Society. Barabási claimed then that no matter how large the web became, two pages would still be connected by 19 or fewer clicks.

According to Barabási the Web is actually arranged "in an interconnected hierarchy of organizational themes, including region, country, and subject area." Web pages about science web sites have similar organizational themes as do pages about real estate.

IT'S A SMALL WORLD AFTER ALL

While it seems unlikely that you could go from your bank's web page to a page dedicated solely to cute puppies in 19 or fewer clicks, Barabasi says it's possible because of a few highly connected sites. Sites like Reddit (aggregators), Facebook and Twitter (social networking), Google and Yahoo! (search engines), and Wikipedia and the Internet Movie Database (indexes) enable most of the Web's circuitry. They act like hubs for sites to connect to one another and keep the web small. This interconnectedness doesn't change with scale; so if the Web gets bigger, two pages will still remain separated by 19 or fewer clicks.

And thanks to the explosion of social networking our connections online have grown tighter. Most social network users have only four degrees of separation from one another.

A POTENTIAL DANGER

There is a downside to having just a few highly connected hubs. If these sites are compromised, it would lead to the "disintegration of the network," Barabási said. Important connections would be lost and this would leave vast sections of the Web inaccessible.

DID YOU KNOW

- 100 hours of video are uploaded to YouTube every minute
- 294 billion emails are sent every day
- 250 million photos are uploaded to Facebook every day
- 1 out of every 11 people on the planet are on Facebook
- 32.7 percent of the world's population uses the Internet

Source: YouTube, Digital Buzz, Bixa Media

SELF-HEALING CONCRETE

By Samba Lampich



Any mention of a modern, bustling city conjures up images of soaring skyscrapers and miles of highways do not gleam highways, tunnels and bridges all constructed from concrete. As sturdy as it is, concrete is no match for nature — it decays and crumbles rapidly if left to the elements. As a result, concrete structures require expensive and frequent maintenance.

BACTERIA TO THE RESCUE

In an effort to save money, cut CO₂ emissions and increase the life of these concrete structures, researchers from Newcastle University in the UK use bacteria to produce a special glue to knit together cracks in existing concrete structures.

When a crack forms in a concrete structure, water seeps in and, with the changes in temperature, the water turns to ice and expands, widening the crack. The water can also carry chemicals like sulfates and carbon dioxide that damage the concrete, making it brittle and prone to crumbling.

A team of students from Newcastle University created bacteria and programmed the genetically modified microbe to only start germinating when triggered by the specific pH of concrete. The researchers also built in a self-destruct gene to ensure bacteria are unable to survive in the environment if they fail to germinate. Once the cells have germinated, they swarm down the fine cracks in the concrete and know they have reached the bottom when they start clumping.

This clumping activates the cells to differentiate into three types: cells that produce calcium carbonate, cells that become filamentous to act as reinforcing fibers and cells that produce a Levans glue which acts as a binding agent. The calcium carbonate and bacterial glue combine with the filamentous cells, ultimately hardening to the same strength of the surrounding concrete to form what the researchers have dubbed “BacillaFilla,” which knits the concrete structure together again.

SCRATCHING THE SURFACE

Another solution to protect concrete is to start on the surface and ensure that cracks never get worse. Chan-Moon Chung, a professor of polymer chemistry at Yonsei University in South Korea, leads a team that is producing on a new coating that contains polymer microcapsules filled with a solution that, when exposed to light, turns into a water-resistant solid. In their research, the scientists used coated and uncoated concrete samples. Both were scratched with razors to create cracks and exposed to sunlight for several hours then examined under an electron microscope. The coated sample showed healing in the damaged area where the microcapsules had released their solution but the uncoated samples did not self-heal. The coated samples were also less vulnerable to water and chloride penetration.

Chung says the next step is to find the optimal composition for the coating and extend its stability.

CLASSROOM DISCUSSION

- If you could, what other materials would you give the ability to ‘self heal’ and why?
- What other environmental factors damage infrastructure?

FISHER SCIENTIFIC Hotplates and Hotplate/Stirrers

Heat from 150° to 590°C (302° to 1094°F); reach maximum temperature in minutes.

- **HOT TOP indicator light alerts when top plate is too hot to touch**
- Reflective white ceramic top plate resists alkalis and acids, cleans easily; drip edge guards against spills
- Durable die-cast aluminum base

Hotplate/Stirrers

- Variable analog speed control from 100 to 1200rpm — stir up to 0.52 gal. (2L) water
- Instant-on at 100rpm ensures smooth, safe low-speed operation
- Come with support rod mount and PTFE-coated stir bar



Cat. No.	Price
S50466CSH	\$470.00
S50462CH	\$330.00
S504631H	\$338.00



SPER SCIENTIFIC

Environmental Measurement Instruments

Water Quality Meter

Using optional probes, this versatile meter reads pH, mV, conductivity, TDS, DO temperature and ORP.



Description	Cat. No.	Price
Water Quality Meter	S98764	168.00
Water Quality Meter pH Kit	S96343	320.00



www.fisheredu.com/sper

THE THANKSGIVING DAY COMET

By Robert Marshall, Educator, Carnegie Science Center

NASA: principle investigator



Comet ISON photographed by the Hubble Space Telescope earlier this year.

Amateur astronomers around the world are already using telescopes to take pictures of what will become visible to the unaided eyes of North Americans on Thanksgiving Day. Comet ISON could possibly be as luminous as the planet Venus upon closest solar approach. And if it survives its orbit of the sun, ISON could very well be the brightest comet in decades, giving early morning observers in the Northern Hemisphere a spectacular celestial light

show throughout December. But many scientists are skeptical, calling it too early to make a prediction about what we should expect to see.

A CLOSE BRUSH WITH THE SUN

Comets are dynamically unpredictable, especially those about which we have limited information like ISON, which is believed to have never traveled to the inner solar system before. First identified by the International Scientific Optical Network (ISON) in September 2012, Comet ISON has already made history as the earliest sungrazing comet to ever be discovered. Sungrazers are classified as comets that pass less than a few solar radii to our sun, sublimating their ice materials directly into gas quickly due to such close proximity to solar wind and radiation. The sun's gravity will bring ISON within 2.7 solar radii or nearly one million miles at perihelion (closest approach), an area where the last 30 years of solar spacecraft observations show most comets break up and do not survive.

Given these odds, why are astronomers so excited? Still fresh in the minds of people in the Southern Hemisphere is the tail of sungrazing comet Lovejoy that stretched halfway across the sky back in December of 2011. Lovejoy's nucleus was an estimated two or maybe as much as five

times smaller than ISON's giving hope that ISON will survive its journey all the way around the sun.

KEEPING OUR EYES ON THE SKIES

In order to understand more about ISON, scientists need more data. Over a dozen NASA mission spacecrafts around the solar system will devote time to photographing ISON as it continues its slingshot. However, many of these missions were not designed to image comets, adding to the mystery of ISON's visibility after Thanksgiving. Therefore, amateurs who have already spotted ISON are a terrific resource for scientists.

You too can help astronomers by joining the amateur campaign to track Comet ISON: <http://www.isoncampaing.org/>

CLASSROOM DISCUSSION

- What are the two different types of tails comets can have and what do they look like? Can they be visible at the same time?
- Besides Hubble Space Telescope, what other spacecraft will be used to image Comet ISON?



MOBILE DEMO UNITS

Sell-contained units can come equipped with its own water supply, waste container, sink, hand pump, rods, crossbars and mirror/marker boards.

MOBILE STORAGE UNITS

Locking units provide a safe, mobile, and convenient resource to store lap tops, microscopes, balances, and supplies for classrooms.



LAB & STORAGE FURNITURE

flexible solutions

Add Swift's X-Factor to your **STEM** Classroom!

Discover how Swift Microscopes and the new Moticam X may be used in your STEM classroom.

*What's next on your list?
Way to engage whole class + Technology equipment*

Swift is excited to introduce our new WiFi camera, the Moticam X! With the combination of a Swift microscope and Moticam X imagine the possibilities that can happen in your STEM classroom! Teachers can broadcast from their own microscope to student tablets, smartphones or laptops wirelessly.



Description	Cat. No.	Price
Swift M3602C-4	S19617H	499.00
Moticam X	S02359G	449.00



Science:

- Cell Biology and structure comparisons
- Data Collection

Technology:

With included Motic imaging software, you can capture still images and video clips which can be used for further data manipulation, assessment and evaluation.

Engineering:

- Quality control
- Check for corrosion, damage, erosion

Math:

- Time Lapse Study
- Sequencing

MICROSCOPES & DIGITAL IMAGING PRODUCTS

EXCEPTIONAL OPTICS n DURABLE CONSTRUCTION n INNOVATIVE DESIGNS



CORAL FIGHTS BACK AGAINST WARMING SEAS

By Cory Bickel



Coral reefs house millions of species of marine life and are important to the health of ocean ecosystems. But corals are very sensitive to changes in their environment and can't move to new homes when theirs go bad. Rising ocean temperatures resulting from global warming have been causing corals to die off all over the world, leaving scientists worried for the future of the planet's reefs and oceans.

But some corals are proving to be tougher than expected, and scientists are hurrying to find out why. Corals in tide pools in American Samoa show differences in their ability to survive high temperatures depending on which pool they live in. One tell-tale sign of an unhappy coral is called bleaching, in which

corals lose color as they lose the symbiotic algae that normally live within them. Scientists noticed that corals in some pools showed a lot of bleaching at high temperatures, while others in pools just down the beach looked healthy at the same water temperatures.

PREPPING FOR STRESS

They realized that the healthy corals were exposed to high temperatures for short periods of time more often than those in neighboring pools, and that this was somehow priming the corals to withstand high-temperatures. To understand how this was happening, scientists compared the genes expressed in corals from both types of pools. They found that the corals from high temperature pools expressed 60 different genes at higher levels than regular corals even when they weren't stressed by heat, and that these gene products kept the corals prepared to remain unstressed by high temperatures. They included heat shock proteins, which help other proteins keep their shape and function, antioxidant enzymes and proteins that can prevent cell death. So the coral from high-temperature pools already had the necessary safeguards in place for preventing damage from heat, and could thrive in the same conditions that hurt or even killed other corals.

This discovery provides a way to rescue corals on a large scale, by turning on this safety system before corals are stressed. Alternatively, scientists could identify corals that are already prepared to face environmental stresses and focus conservation efforts on these groups that stand the best chance.

CLASSROOM DISCUSSION

- What other challenges are coral reefs facing besides rising temperatures?
- What are things you can do at home to help protect ocean life?



Double-Safe™ Enviro-Safe® For All Mankind – For Better Lab Results!

PFA coated glass for ultra safety!
PFA safety coating assures thermometer liquid and glass will remain contained if the thermometer is broken

Enviro-Safe®; the only 'Green' certified, lab grade thermometers on the planet!

- Certified* biodegradable, 100% nontoxic liquid in lead-free glass
- Tested and calibrated in our triple accredited/registered ISO 17025:2005 facility
- Made in the USA

Fun Facts about Temperature
The Celsius scale was invented by Swedish Astronomer Anders Celsius in 1742.

Visit www.fisheredu.com Key word: **Double-Safe**

*All H-B Double-Safe™ thermometers have been certified to meet or exceed independent EnviroKleen standards for product and packaging.




H-B Instrument
A Division of Bel-Art Products

STEP INTO

THE FUTURE CLASSROOM

Robotics is the fastest growing industry and most advanced technology used in education and research. The NAO humanoid robot is the ideal platform for teaching or researching in Science and Technology.

By using our NAO robotics platform, instructors and researchers stay current with major technical and commercial breakthroughs in programming and applied research.

MOTIVATE STUDENTS

IMPROVE LEARNING
EFFECTIVENESS

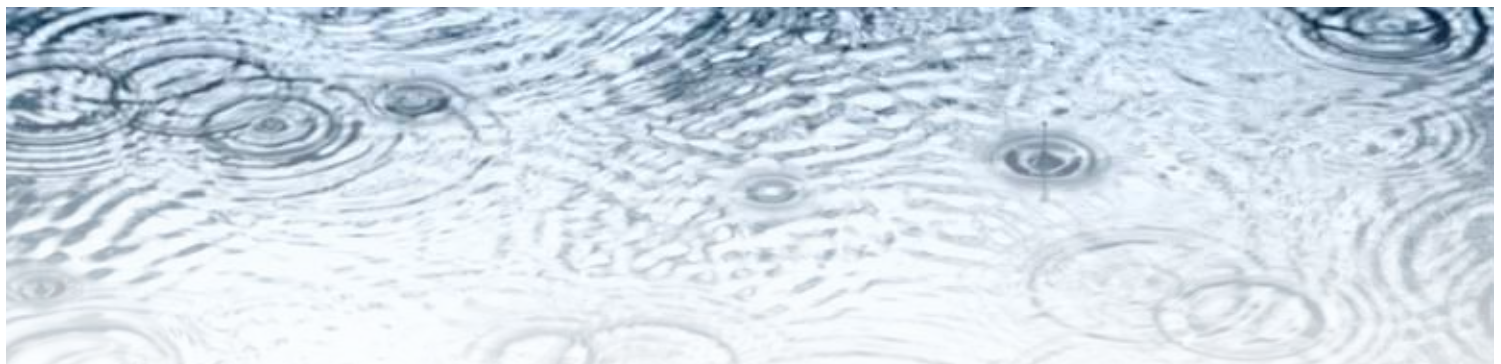
TEACH A JOB-
CREATING FIELD



ALDEBARAN
Robotics

SCENT OF A STORM

By Christa Cuccia



Have you ever been outside after it rains and been overwhelmed by the powerful scent in the air? Many people find the after-rain smell pleasing but can't quite explain why. What causes the smell? Where does it come from? Is it the same everywhere? In 1964, a pair of Australian scientists began their research into the smell of rain. They even gave this smell a name: Petrichor, the scent of rain falling on dry earth.

JUST ADD WATER

The main cause of the distinctive rain smell is a blend of oils that plants secrete during dry periods or spells. The oils build up in rocks and soil and during a rainstorm they are released into the air. Once airborne, the oils combine with other compounds to produce the distinctive scent.

Geosmin, a chemical produced by soil-dwelling bacteria known as actinomycetes, is a common substance usually found in moist forested areas. This compound

is secreted when bacteria produces spores and is released into the air. Large supplies of spores are produced during droughts and when, it rains for the first time after a dry spell, the smell of Geosmin is very strong and pronounced. In addition, research shows that the human nose is extremely sensitive to Geosmin. It can be detected at very low concentrations (as low as five parts per trillion).

Ozone or O₃ is also another cause of the smell of rain. A lightning bolt's electrical charge can split oxygen and nitrogen molecules and usually they recombine into nitric oxide, which interacts with chemicals to produce the sharp-smelling Ozone. In fact, Ozone can be smelled before a storm because it can be carried over long distances from high altitudes.

CLASSROOM DISCUSSION

- How did smell help early man survive?
- Why is losing the ability to smell devastating?



NEW Fisherbrand™ Traceable™ Waterproof/Steam-proof Timer

Flat profile design—affixes to anywhere in the classroom

Affix timer anywhere using removable suction cup

- 1 Channel
- Timing capacity: 99 minutes, 59 seconds
- Resolution: 1 second
- Accuracy 0.01%
- Features: countdown/up, memory, stopwatch mode
- Automatic Bounceback™ Memory for repetitive timing
- Supplied: stand, removable suction-cup, battery, Traceable Certificate



Traceable to NIST for accuracy

To assure accuracy an individually serial-numbered Traceable® Certificate is provided from an ISO 17025 calibration laboratory accredited by A2LA. It indicates traceability to standards provided by NIST (National Institute of Standards and Technology).

Description	Cat. No.	Price
Fisherbrand Traceable Waterproof/Steam-proof Timer	S04782	22.00



Fisher Science Education

For customer service, call 1-800-955-1177.
To fax an order, use 1-800-955-0740.
To order online: www.fisheredu.com



WHERE'S THE LAB-GROWN BEEF?

By Brian Marks

In a demonstration of one possible view of the future of food, a hamburger made from cow shoulder muscle grown in a laboratory was fried, served and eaten. Taste testers reported that it was dry and lacking in flavor. But the focus of the test was meant to make a case that lab-grown meat deserves additional financing and research. The lab-grown burger contained breadcrumbs, salt and a naturally occurring red color compound found in muscle tissue called myoglobin.

Stem cells, which can turn into tissue-specific cells, were multiplied in a nutrient solution and put into small Petri dishes. After three weeks, there were more than a million stem cells, which are put into smaller dishes where they coalesce into small strips of muscle. These strips are collected into small pellets, which are frozen. When ready, they are defrosted and compacted into a patty just before being cooked.

CURRENT MEAT PRODUCTION

Because we don't have the resources to maintain more animals, it's important to research and develop alternative food sources beyond increasing livestock yield. Scientists estimate that 70 percent of agricultural land and eight percent of the global water supply is already devoted to livestock production. An obvious advantage of lab-grown meat includes reduction in the use of water. Also, livestock produce anywhere

from 18 to 50 percent of all greenhouse gas emissions, while emissions from lab-grown meat are minimal.

SAFETY

Also, our current factory farming methods bring about many opportunities to create widespread disease and bacterial contamination. More animals mean more risk to our population, so the reduction in the number of farmed animals reduces the chance of spreading infections. Scientists point out that cultured meat could still get infected with bacteria during processing. So for now, lab-grown meats still require the use of antibiotics.

NUTRITION

Currently, lab-grown meat lacks essential nutrients. It consists only of muscle fibers and contain no fat, blood, blood vessels or connective tissues. So the range of nutrients in cultured beef is different than in conventional meat. In the future, scientists believe lab-grown meat could be better for us because we would gain greater control over what the meat consists of — for example, its fat content. Once all of these other components are included in lab-grown meat, the nutrients should at the very least be equivalent.



A burger patty made from Cultured Beef

CLASSROOM DISCUSSION

- Would you eat lab-grown meat? Why or why not?
- What would be the benefits of lab-grown meat compared to traditional meat?

David Parry / PA Wire

PYREX® VISTA™ Glassware Balancing Functionality and Economy

PYREX Vista glassware is a cost-effective option for the laboratory, enabling you to stretch your budget dollar farther. The PYREX Vista glassware line offers a full range of products from beakers to pipets and is easily recognized by its blue graduations and novel marking spot. To get the functionality, economy, and quality you require, PYREX Vista is the clear choice.



Cat. No.	PYREX® VISTA™ Glass Product Description	Qty./Pack	Qty./Cs.	Price
S76100A	Griffin Beaker, 10mL	12	24	\$51.85
S76100B	Griffin Beaker, 20mL	12	24	\$46.05
S76100C	Griffin Beaker, 30mL	12	24	\$46.00
S76100D	Griffin Beaker, 50mL	12	24	\$44.60
S76100E	Griffin Beaker, 100mL	12	24	\$47.10
S76100F	Griffin Beaker, 150mL	12	24	\$44.60
S76100G	Griffin Beaker, 250mL	12	24	\$40.60
S76100H	Griffin Beaker, 400mL	12	24	\$48.25
S76100J	Griffin Beaker, 600mL	6	12	\$30.35
S76100K	Griffin Beaker, 1000mL	6	12	\$57.75

CORNING

Keep it Colder...Longer with Magic Touch 2™ Icewares



- Compatible with ultra-low temperature materials including dry ice, salt slurries, dry ice solvent slurries, or liquid nitrogen
- Superior insulation with superb durability and chemical resistance
- Wide effective temperature range -196°C to 100°C

Available in:

Ebony Black, True Blue, Emerald Green



2.5L and 4.0L Buckets.
1.0L, 4.0L, and 9.0L Pans.

Description	Cat. No.	Price
Blue, 2.5L Ice Bucket w/Lid	S04556	95.00
Black, 2.5L Ice Bucket w/Lid	S04558	95.00
Green, 2.5L Ice Bucket w/Lid	S04560	95.00
Blue, 4.0L Ice Bucket w/Lid	S04557	105.00
Black, 4.0L Ice Bucket w/Lid	S04559	105.00
Green, 4.0L Ice Bucket w/Lid	S04561	105.00

Magic Touch 2™ Ice Pans (1L, 4L, 9L)
also available, visit www.fisheredu.com

Fisher Scientific Education

For customer service, call 1-800-955-1177.
To fax an order, use 1-800-955-0740.
To order online: www.fisheredu.com

scienceware
BET-BART PRODUCTS

Fingerprint Analysis

This kit provides students the opportunity to learn the techniques available for dusting and developing latent fingerprints from various surfaces. Students compare the prints to standards developed by the FBI and help in identifying the would be suspect. Each of the groups prepare evidence for another group to analyze and with the aid of the Modus Operandi sheets, the group identifies the fingerprints of the suspects.

Target Grades: 6-11



Description	Cat. No.	Price
Analysis of Fingerprints Kit	S25716	118.00
Other Kemtec Kits		
Blood Typing via Saliva	S25080	143.00
Analysis of Drugs & Poisons Kit	S25702	173.00
Characteristics of Matter	S06736	129.00



FREE balance with \$500 purchase of Kemtec kits!
Find out more at www.fisheredu.com/freebalance.

kemtec™
excite. encourage. inspire.

The INCREDIBLE STEM-Credibles

Passionate, dedicated educators by day; science-powered superheroes whenever they're needed.

This special group of educators know that STEM is much greater than the sum of its parts: Science, Technology, Engineering and Mathematics. Known as the STEM-Credibles, their mission is to help students make meaningful connections between real-world situations and what they learn in their classrooms. When they work together using an interdisciplinary approach to teaching STEM, their superpowers emerge.

STELLA



STELLA is the leader of the STEM-Credibles. She recognized the superpowers of the others and is in charge of summoning the right superhero(es) for the situation.

- Full name is STELLA T. Fisher. She aspires to attend M.I.T.
- Committed to **Science, Technology, Engineering, Life-Long Learning and Achievement**
- Her best friend is Buster

Cosmic Ray



Cosmic Ray — the “big picture” guy in the group — has telescopic vision that lets him see the most distant objects in the universe.

- Full name is Ray Shi Shen, Astronomy professor
- Descendent of Master Shi Shen, an ancient Chinese astronomer
- Volunteers at the local science center

DNA Man



DNA Man is twisted, but in a good way. From amino acids to zoology, Dan is the man for everything life science.

- Real name is Dan D. Helix; teaches Biology
- Enjoys fishing and participating in Civil War Reenactments
- Has three pet turtles

Tess Lah



Tess Lah has a magnetic personality. She's the STEM-Credible to call when the way things work needs to be clarified.

- Physics teacher
- Theme park and roller coaster enthusiast
- Plays pool and laser tag competitively

Ava Gadro



Ava Gadro gets chemistry. If someone needs help concocting the right (and safe!) solution or assistance managing chemical inventories, Ava comes to the rescue.

- Full name is Ava Gadrollino; teaches Chemistry
- National Whac-A-Mole Champion
- Born on October 23rd

Forrest D. Fender



Forrest D. Fender talks to plants — and the plants talk back! Whenever nature has a problem, he's there to solve it.

- Earth Science teacher and football coach
- Competed on a reality TV show
- Enjoys online shopping

Buster



Buster has a nose for news. He'll be there anytime there's a scientific discovery, new product or a special deal on science education products.

- Finds deals, science news and hot new products for teachers
- Frisbee Champion
- Was rescued from New Orleans

These superheroes are teaching students to become the innovators and critical thinkers of tomorrow — the next generation of STEM-Credibles.

© 2013 Thermo Fisher Scientific Inc. All rights reserved.
Trademarks used are owned as indicated at www.fishersci.com/trademarks.

In the United States:

For customer service, call 1-800-955-1177
To fax an order, use 1-800-955-0740
To order online: www.fisheredu.com

13_1328 JJ/JJ Litho in USA 10/13 BN1021132



Fisher Science Education

Part of Thermo Fisher Scientific