

A SCIENCE MAGAZINE TO KNOW MORE & BE MORE

NOV/DEC 2018

smore

Food of the Future

LAB-GROWN BURGERS

Bringing back
the seabirds
of Maine

Project Puffin

MAE JEMISON

An Astronaut's
World View



smore

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editor's note

Welcome to the 7th issue of Smore.

There are so many reasons to be excited about this issue, we are having a hard time picking a favorite. To start, we have Dr. Mae Jemison, the first African American woman to go into space, on our cover! Smore had the opportunity to speak with this remarkable astronaut, doctor, and dancer - and we are in awe. Not only can you read her story in this issue, but you can hear her talk about her childhood and life-shaping experiences in our interview. Look for the audio link in our upcoming newsletter.

This issue also has some more added fun, with activities like crossword puzzles, a craft, and DIY circuits. Look no further if you want to give a special handcrafted gift this holiday season.

We are also happy to introduce our Smore Reader Spotlight - a new way for you to get to know other Smore readers. Interested in being featured? Let us know!

This issue also brings you stories of some amazing researchers who work with animals and birds. Read about a team of biologists that spent three months living in a tent on a small island collecting important information to help protect the Atlantic Puffins. And if you have ever wondered about the dental hygiene of lions and tigers, you will love reading about what Dr. Tina Abbatangelo does for a living.

So, go ahead and take a look inside - and let us know what you think. We would love to hear from you at info@smoremagazine.com.

Happy Holidays!

Sarita



SCIENCE IN THE NEWS

By: Maria Ter-Mikaelian



TOP STORIES

#1

Scientists discover dinosaur with a face full of spikes

It lived 76 million years ago and probably used the spikes to defend itself against predators like the T. Rex.



Photo Credit: Andrey Atuchin

#2

Underground lake found on Mars

The lake, hidden under the ice on Mars' South Pole, is the perfect place to look for signs of life!



#3

United States sends a spacecraft to "touch" the Sun

It's the size of a small car, carries no people, and will take almost seven years to get there.



Parker Solar Probe

NEWS HIGHLIGHTS

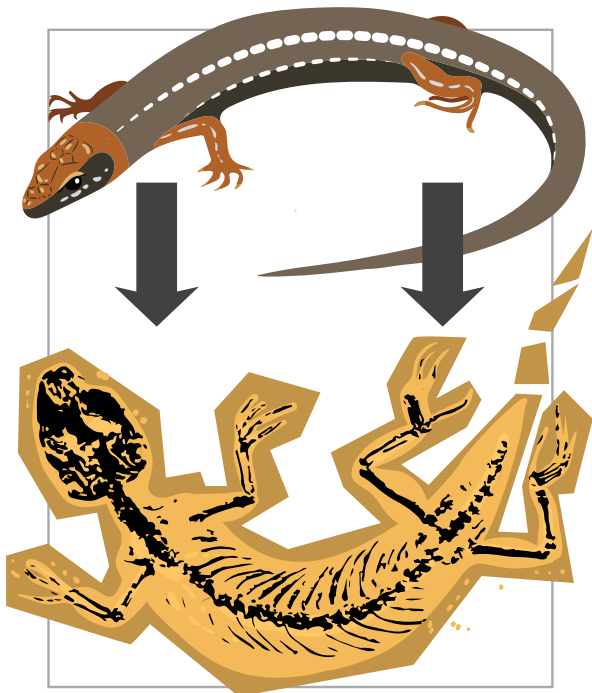
Evolution

Hurricanes Reveal Die-Hard Lizards

When scientists began measuring lizards on the islands of Turks and Caicos, they had no idea that two hurricanes would strike only a few days later. After the danger had passed, the scientists returned to make more measurements. Many lizards had been swept away in the hurricanes. The survivors had unusually wide feet, short back legs, and long front legs. These features may have helped the lizards grab onto rocks and trees and hold on tight. Lizards who can handle hurricanes survive to have their own kids – an example of what scientists call “survival of the fittest.”



Photo Credit: Colin Donihue



Paleontology

Scientists Learn to Bake Their Own Fossils

Finding new fossils can reveal exciting new information about creatures of the past. Scientists use the fossil record to figure out where ancient plants and animals lived and how they died. But the record we have is incomplete. Fossils need just the right conditions and thousands of years to form, so they can be very rare. Now, scientists have found a way to simulate the process of making fossils in just one day. By using a special high-pressure oven, they have experimented with feathers, leaves, and lizard skeletons!

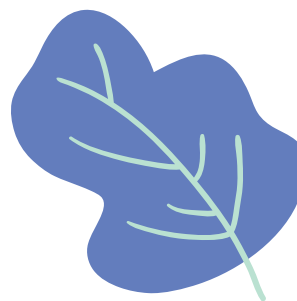
Technology

Electric Race Cars Get a Boost

Have you heard of Formula E? It's a car-racing championship for electric cars – no gas-powered cars allowed. Formula E cars race around winding courses at up to 140 miles (225 kilometers) an hour. They make almost no noise and produce no exhaust. But until this year, batteries for these races only lasted about 25 minutes. Drivers would have to switch to a second car in the middle of the race. But new Formula E cars will sport a new design and a larger battery. Not only will they make it through the whole race, but they will go even faster!



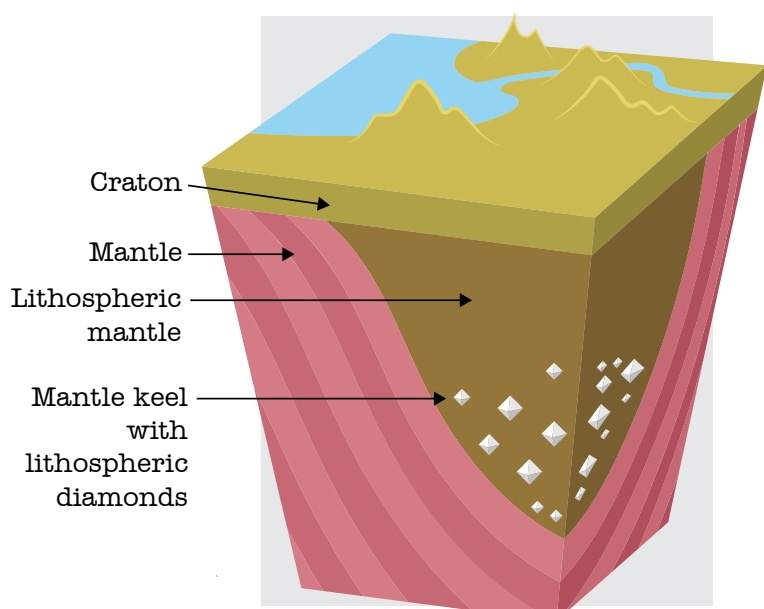
Photo credit: Matti Blume



Geology

Buried Treasure

A team of geologists just discovered buried treasure deep inside the Earth. By measuring how quickly sounds move through the ground, they figured out that there are probably tons of diamonds under our feet. A quadrillion tons, actually! Unfortunately, we will probably never get to see these pretty gemstones. The diamonds are buried over 100 miles underground. The high temperatures would be so extreme that – even we could drill that deep – our tools would probably melt.



Mathematics

College Teacher Uses Knitting to Teach Math

Do you like math? Many people think math is all about adding, subtracting, and fractions. Calculations are important, but math is also about learning to think in new ways. To help her students see math in a different light, one college teacher in Wisconsin teaches a math class with no pencils, calculators, or textbooks. Instead her students knit, draw, and play with beach balls. This may not sound much like math to you, but the activities help students to think about shapes and sizes the way professional mathematicians do.



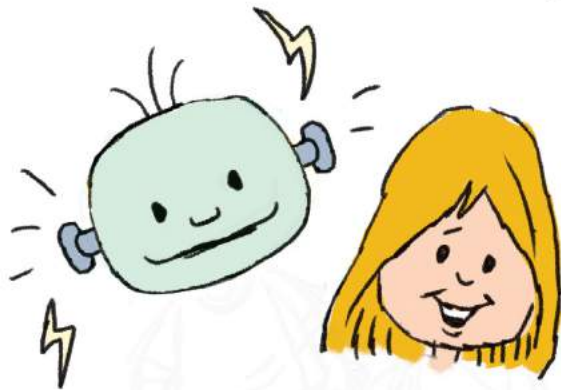
Archaeology

Rising Seas Reveal Ancient Footprints

As global temperatures increase, ice at the poles continues to melt and sea level slowly rises. Warmer temperatures are also changing the Earth's climate, making conditions for severe storms around the world more likely. But there is a small silver lining. As the seas rise and waves batter the shore, layers of the surface break away and sometimes reveal ancient footprints that were hidden for thousands of years. Recently, archaeologists in England found the footprints of a small family from 800,000 years ago. Scientists in Canada even found tracks left by some of the first humans who lived in North America.



SMORETOONS



by John Zakour & Mike Ferrin

Why so dim, Dimi?



I've read that talking to flowers makes them grow better.



But, I've talked and talked to the flower but it's still dying.

Hmmm, let me try something.



Have you tried watering it?

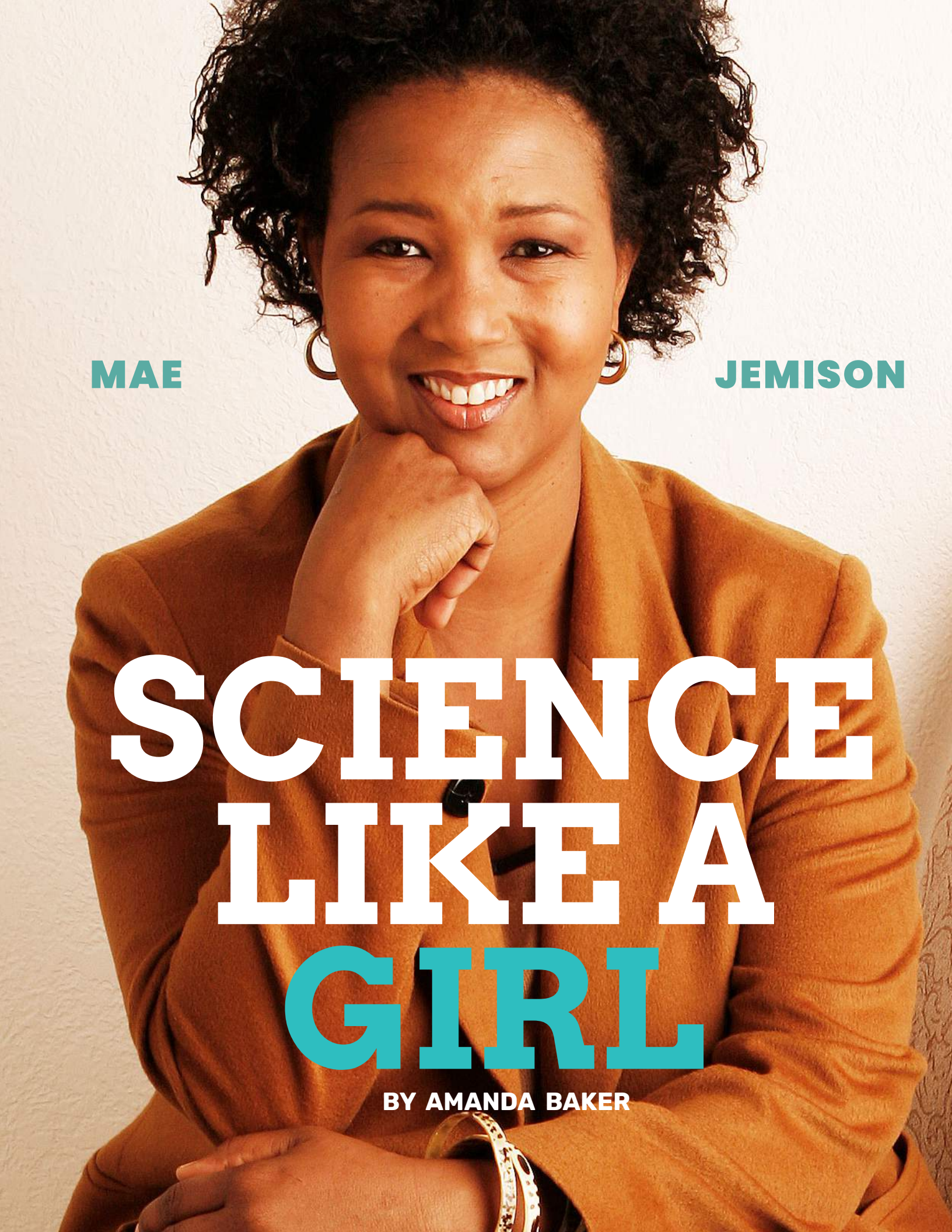
Oh, I thought talking would be enough.



OMG it's true! Actions are more important than words.

It's always nice when I actually get through to her.



A portrait of Mae Jemison, a Black woman with short, curly dark hair, smiling warmly at the camera. She is wearing a mustard-colored blazer over a dark top, large hoop earrings, and a wide, ornate bracelet on her left wrist. Her right hand is resting under her chin. The background is a plain, light-colored wall.

MAE

JEMISON

SCIENCE LIKE A GIRL

BY AMANDA BAKER

It's easy to imagine an elementary school Mae Jemison – future doctor and astronaut – picking out astronomy books at the library. It takes a little more effort to picture young Mae's mother handing her novels and reminding her daughter that she can't just read about one thing all the time. And few familiar with Mae's accomplishments have likely taken the time to picture Mae's parents standing firm that – regardless of her creative excuses – Mae would do just as many dishes as anyone else. But Mae believes that being encouraged to look at the world from as many perspectives as possible, and being taught to focus and do the hard work as it needed to be done, shaped her life as much as any journey into space.

Mae wasn't just encouraged to read about different subjects, but to explore a wide range of activities. She danced and painted and learned about science all at once, taking advantage of the unique opportunity childhood provides to test the waters and find what you love. "Every little kid comes out excited about the world around them. They want to dance, they want to draw, they want to color, they want to know why bugs do what they do, they want to learn about the stars," Mae said. "It's usually adults telling them they can't think about the world that way."

Every little kid comes out excited about the world around them.

She felt lucky to have parents who didn't acknowledge the supposed boundaries between interests, joking that "I chose my parents well." It wasn't because the world around her wasn't trying to set invisible boundaries. "The cues could have been there," she said, "if you listened to them." Rather than being held to some specific standard for kindergarten success, she feels lucky to have been given the chance to explore.

But getting to explore what the universe had to offer didn't mean a free-



for-all without rules. "If I hadn't been told no as a kid sometimes – been told to sit down and focus – that ability to be with myself would have never happened," Mae said. Some people seem to think that if you like a subject or hobby, it should be fun all the time. But anything from dance to science to music involves grunt work. You can't perform a surgery if all the materials haven't been read, the rooms cleaned, and the instruments prepared. You can't perform a flawless dance without practicing and falling over and over. Mae wishes that the stories we tell about science – whether in books or movies – spent more time exploring the hard work and didn't seem to suggest that discoveries come clearly and all at once.

I



Mae Jemison is Bayer Science Literacy Ambassador and works with them to highlight the importance of science literacy for all students.

If I hadn't been told no as a kid sometimes – been told to sit down and focus – that ability to be with myself would have never happened.

Mae said that learning to settle in and do work she didn't like, learning to keep working at things she found hard, and pushing herself to a higher standard on work she found easy has served her in everything from dance to school to preparing for her journey in the shuttle. Again she pointed

to her parents as her models for that persistence, with her mother working as a school teacher and sewing their clothes while her father worked two jobs.

The foundation she formed in her mother's name – The Dorothy Jemison Foundation for Excellence – acknowledges the standard her mother set about keeping personal excellence personal. Not everyone can be number one, but that doesn't mean that every person can't still achieve excellence. And just because you are number one in a certain group doesn't mean you have reached your personal highest standard.

When Mae talks about her desire to go into space, she also describes it as a personal one. "I always assumed I wanted to go into space," Mae said. She pointed to the many questions she has been asked over the years about who or what inspired her. "People want a narrative where you have to see something you like in order to want to do it," Mae said. "What about Neil Armstrong? What about Yuri Gagarin? They didn't have to see anybody to want to do it. Why do I?" She believes that whether there had never been a single person in space or if there had been thousands, she still would have wanted to make the trip.

N

Not everyone can be number one, but that doesn't mean that every person can't still achieve excellence.

And making the trip in the shuttle – just a short period in her very full life – reinforced her feeling that she was “not just part of the Earth, but part of the greater universe.” That sense of connection has carried through much of the work Mae has done in the decades since.

She believes anyone's experience of space would be unique. She also believes that the knowledge and social experiences a person has shapes the questions they ask – in research or in life.

That is why Mae believes that taking on the next big challenges will mean bringing together as many perspectives as possible. Her work leading the 100 Year Starship Foundation embraces the challenge of preparing humans to travel beyond our solar system.

Such a task will take great leaps not just in technology, but also in biology, psychology, and energy. It will also mean reconnecting the public with space. Even though the GPS in our phones means we are all walking around with space receivers in our hands, the perspective that we all share this planet has faded.

Mae hopes to help people recognize that we are all earthlings, because that is the only way we will be able to take on challenges on our planet and beyond.



The Earth We Share is an International Science Camp (TEWS) organized by the Jemison Foundation and includes teachers and students from around the world.



**SMORE
SMARTS**

A grocer received 30 red apples and 30 golden apples from his wholesaler. The recommended prices were one dollar for 2 red apples and one dollar for 3 golden apples. To avoid confusion, he decided to sell a mix of 5 apples for two dollars. He thought there is no difference between selling 5 apples for two dollars and selling 3 for one dollar and 2 for one dollar. Curiously enough, he sold all the fruits and earned 24 dollars—one dollar less than expected! Can you explain why?

SEABIRD STEWARDS: BRINGING BACK THE SEABIRDS OF MAINE

By Emilie Seavey



F

From far away, Eastern Egg Rock – a small island about six miles off the coast of Maine – isn't much to look at. The island is the length of about two football fields, has no trees, is covered in low and

scrubby vegetation, and is surrounded by a rocky shoreline. Getting a boat close to the island, let alone finding a beach on which to sunbathe, would be hard.

Out of the corner of your eye you spot a black-and-white blur. Something about the shape and size of a small football zooms past you. The blur lands in the water. When you focus your binoculars on a colorful bill, you realize that you have spotted an Atlantic Puffin!

Atlantic Puffins were once killed on many islands off of Maine during the 1800s. Fishermen and hunters sold puffin meat

for food and fishing bait. When puffin chicks were brought back to this island by biologists in the 1970s, the scientists realized that the birds would need to be protected from human activity and predators if they were going to survive for future generations.

Birds like puffins depend on Egg Rock as a summer home for raising their chicks, and it takes the hard work of young seabird stewards to keep the birds safe.



A DAY IN THE LIFE OF A SEABIRD BIOLOGIST

Imagine living in a tent for three months on an island without internet or running water – that means no showers or flushing toilets! You are living amongst thousands of birds. They are sitting on nests, soaring through the air with fish in their bills, or hopping along rocks and wiggling into rocky burrows. That is what life was like for four biologists – Laura, Coco,

Audrey, and Kay – who called Eastern Egg Rock home this summer.

A normal day on the island started early. The seabird biologists scattered across the colony to sit in observation blinds and watch for Atlantic Puffins with metal bands on their legs. These bands were placed on puffins when they were small, fluffy chicks and

don't harm the birds at all. Once biologists spotted a metal band, they read it with their spotting scope and recorded the information. Entering this data in the computer lets scientists see who else had spotted that puffin and where it traveled over time. This important tool helps ornithologists make decisions about how to protect birds like the Atlantic Puffin.



Banding the Puffling –

Biologist Audrey Holstead uses pliers to put a metal band on a recently-hatched puffin, called a puffling for short. Seabird biologists are specially trained to handle and band birds as safely as possible. Image credit: Kay Garlick-Ott



Weighing the Puffling-

Biologist Coco Faber carefully puts the puffling in a cloth bag in order to record its weight with a scale. Biologists will weigh pufflings several times through the nesting season to track how well they are being fed by their parents. Image credit: Kay Garlick-Ott

Data Collection – Biologist Laura Brazier collects data for a recently-banded puffin. Recording data – such as weight, bill measurements, wingspan, and band number – is an important tool that helps seabird biologists to track specific puffins over time. Image credit: Kay Garlick-Ott



Seabird Selfie – The Eastern Egg Rock field crew poses with their newly-banded puffin chick. From left to right: Lyanne Pierina Ampuerto Merino, Kay Garlick-Ott, Laura Brazier, Audrey Holstead, and Coco Faber. Image credit: Lyanne Pierina Ampuerto Merino





FUN FACTS ABOUT PUFFINS

- **Atlantic Puffins** are known as the “clowns of the sea,” because of their big, brightly-colored bills.
- During the summer months, puffins make their nests in burrows underground, where they will raise one chick per year.
- During the rest of the year, puffins fly and swim off to the sea, eating and sleeping on the open ocean.
- Puffins can dive up to 200 feet underwater to hunt for fish, their favorite food.
- Puffins can fly through the air at 55 miles per hour (88 kilometers per hour) by beating their wings 300 times per minute!
- Young puffins, commonly called “pufflings,” will stay in the burrow for only six weeks. Then they make their way to the ocean with out their parents. They will spend three to five years on the water before returning to the island to have their own chicks.

What can I do to help birds in my neighborhood?

Many people who work as seabird biologists have gone to college, which might be a little far in the future for some readers of Smore Magazine. But there are some things that you and your family can do to help the birds in your own backyard:

- Plant bird-friendly native plants. Find out more at: <https://www.audubon.org/news/10-plants-bird-friendly-yard>
- Volunteer with your local Audubon Society chapter. Find out more at: <https://www.audubon.org/about/chapters>
- Become a citizen scientist! Find out more at: <http://www.birds.cornell.edu/>

Glossary

Citizen Scientist – Someone who volunteers their time toward scientific research, like bird counts or invasive species removal.

A citizen scientist does not have to be a scientist by training; they just need to be someone who cares about the cause!

Binoculars – A piece of equipment that uses two separate lenses to view far-away objects. Some people like to call them “bigger-makers.”

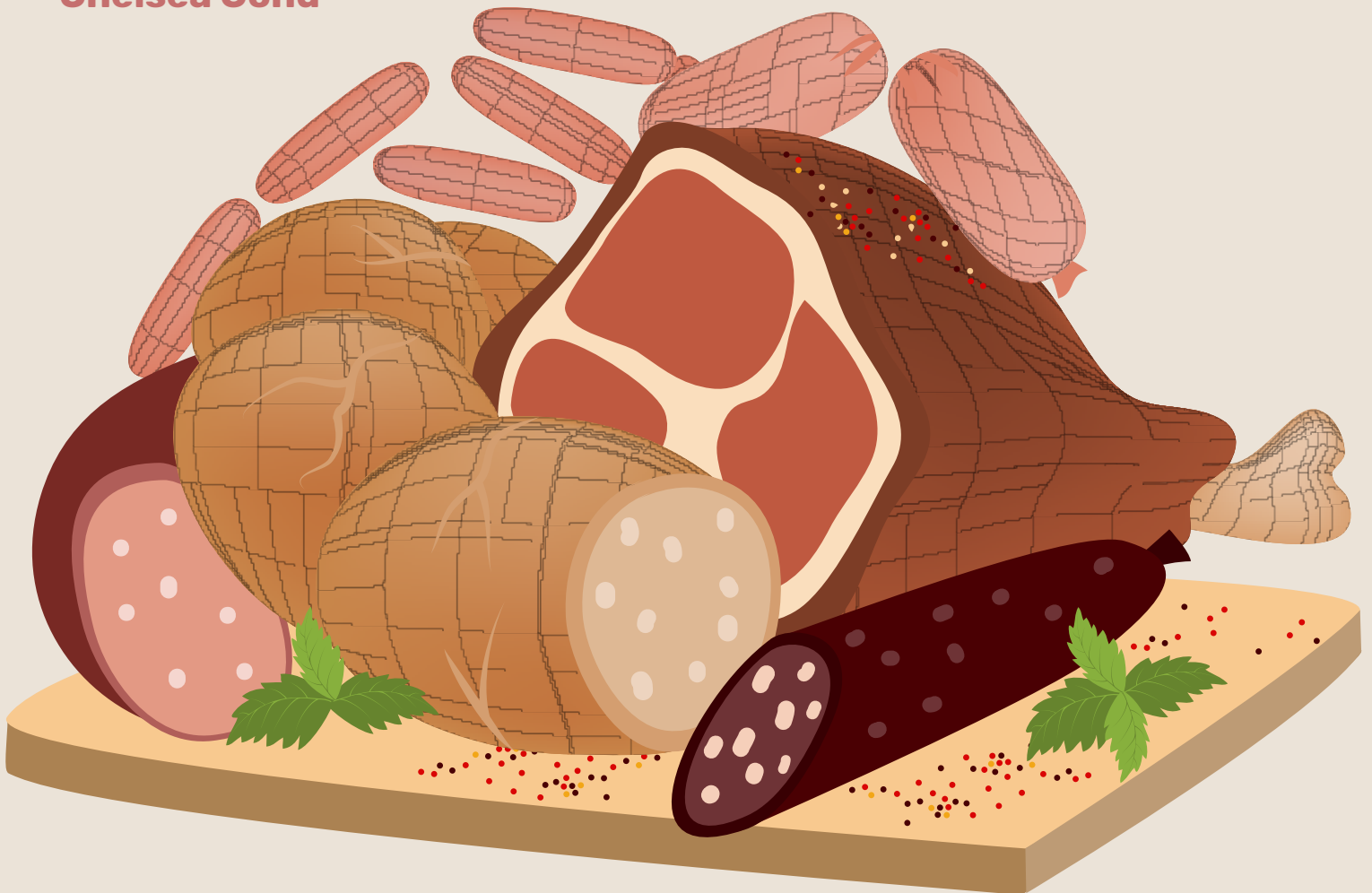
Biologist – A scientist who studies and works with living things. There are lots of different kinds of biologists, and they can study everything from marine mammals in Antarctica to insect colonies in the tropics to bird behavior in cities.

Spotting Scope – A small telescope that can be used to magnify objects from far away. Seabird biologists use spotting scopes to read the metal bands on birds like puffins.

Into the Future

How and Why are Scientists Growing Meat?

Chelsea Gohd



The world's first lab-grown beef burger was made in Dr. Mark Post's Laboratory in 2013. Credit: David Parry / Reuters



Lab-grown meat, which is also called cultured meat or cell-based meat, starts with just a few cells.

Fake Meat?

For many years, both vegetarians and non-vegetarians have enjoyed “fake meat.” These meat substitutes use everything from soy beans to wheat gluten to create a “meaty” taste. While these meat alternatives have gotten tastier over the years, lab-grown meat might be the future of meat for everyone.

Lab-grown meat, which is also called cultured meat or cell-based meat, starts with just a few cells. The cells are taken from an animal like a chicken or cow and multiplied into edible meat. So even though a few tiny cells from your burger once came from a cow, just about all of the meat would be grown in a lab. It's real meat! it just doesn't come directly from an animal.

Companies working on lab-grown meat hope that, one day, animals will not have to be used for meat. This is exciting for both animal lovers and animal rights activists. It would mean that animals wouldn't have to be killed for meat. But many others, including scientists, think that lab-grown meat could be an ideal option for environmental reasons. While many people around the world love the taste of meat and rely on its nutrients, raising and maintaining livestock uses an enormous amount of resources like water.

Scientists at NASA even think that growing meat in a lab could be important for future long-term space missions, because astronauts will need a source of food for an extended period of time.

Livestock raised for meat also damage the environment and contribute heavily to climate change. Part of this problem stems from cow farts (yes, really). Cow farts contain methane — a gas that has the ability to warm the planet. The fact that cows fart isn't the problem, it's just the truly huge number of cows being raised for meat that

creates an issue. In addition to cow farts, the animal farming process produces huge amounts of other gases like carbon dioxide, which contribute to climate change.

Cow farts contain methane — a gas that has the ability to warm the planet.

How to Grow Meat

You probably can't grow meat in your kitchen, but scientists around the world are figuring out the best ways to grow meat in a lab. How do you actually grow meat?

You start out with a few cells from a real animal like a cow or chicken. These can be stem cells, or even cells that make up animal muscle or fat. Scientists are using many different types of cells to grow meat. Once they have the cells, they put them in a special mixture of nutrients like those that would be found in the animal's body.

This special mixture allows the cells to multiply, so a few fat cells will become fat, a few muscle cells will become muscle, and stem cells can become different types of cells. This all takes place in a tank where scientists can control the temperature, oxygen levels, and other conditions.

Amazingly, scientists have successfully created lab-grown meat. But they're still facing challenges. The meat cells need structure and something to grow on, or else you'd wind up with just be a messy pile of cells (not very tasty). And while scientists might be able to grow a small amount of meat in a lab, there are billions of people on our planet. It will be difficult to make a meat-growing process that can produce large amounts.

Growing meat as nutritious as "real" meat also presents a challenge. Even if the meat is made up of real muscle cells, it needs specific proteins, vitamins, and sugars. This will be especially necessary and important to solve if lab-grown meat is to one day replace traditional meat.

Scientists have successfully created lab-grown meat



This meatball was grown in a lab by Memphis Meats.
Credit: Memphis Meats

We're not there yet, but scientists are working hard to make real meat that's tasty, nutritious, and doesn't depend on animal farming.

GLOSSARY

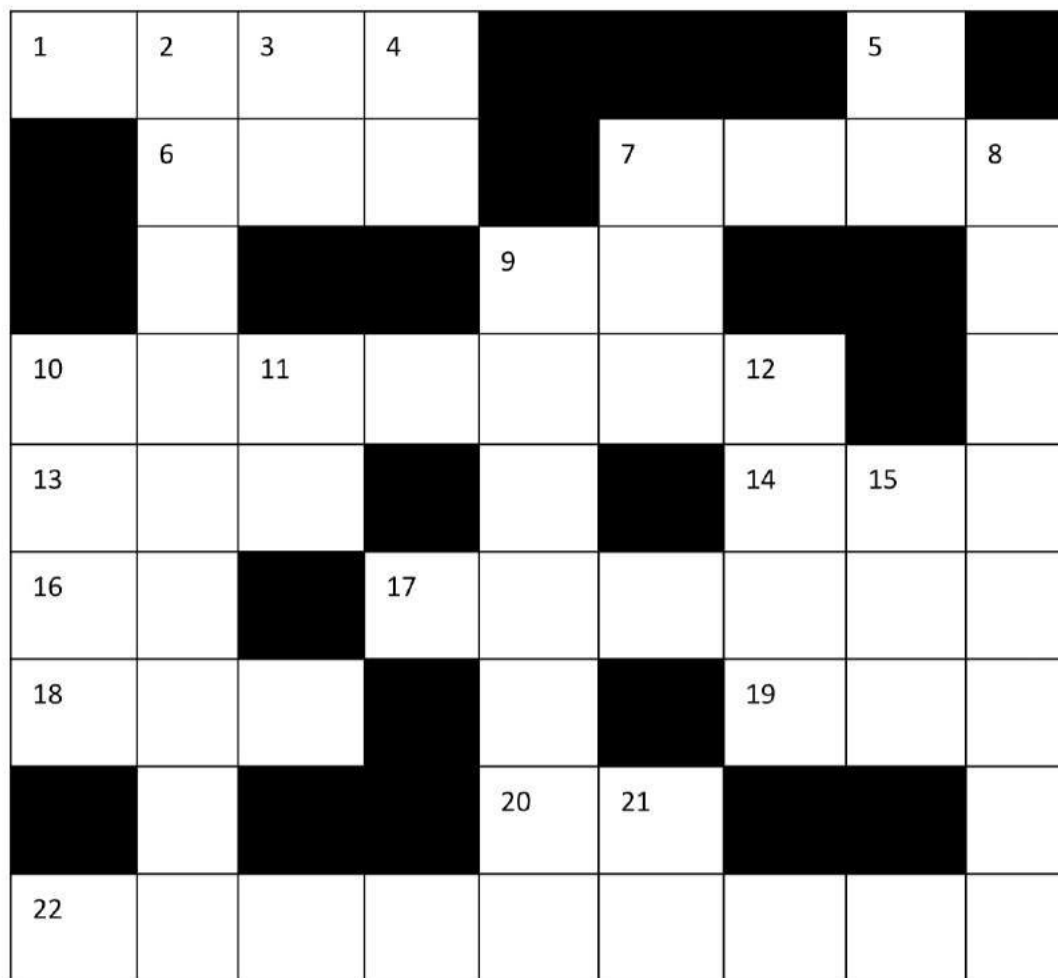
Climate Change – Changing global climate patterns caused mostly by human activity that generates gases like carbon dioxide.

Cells – The smallest unit of biological life. Cells form tissues, tissues form organs, and so on.

Stem Cells – Cells that are able to develop into different types of specialized cells.

Cultured – When cells or microbes are grown in an artificial way.

Carbon Dioxide – A gas produced by breathing and burning carbon and organic material.



Across

1. Evidence-based truth
6. That's where you experiment
7. A scientist's results
9. ___ situ (inside tissue)
10. Place to publish scientific articles
13. Energy currency in body
14. The A in STEAM education
16. Reactive Nitrogen (Abbreviation)
17. Element with symbol Ag
18. A very long period of time
19. Mathematician and computer whiz
____ Lovelace
20. ___ factor, present in blood
22. Rock scientist

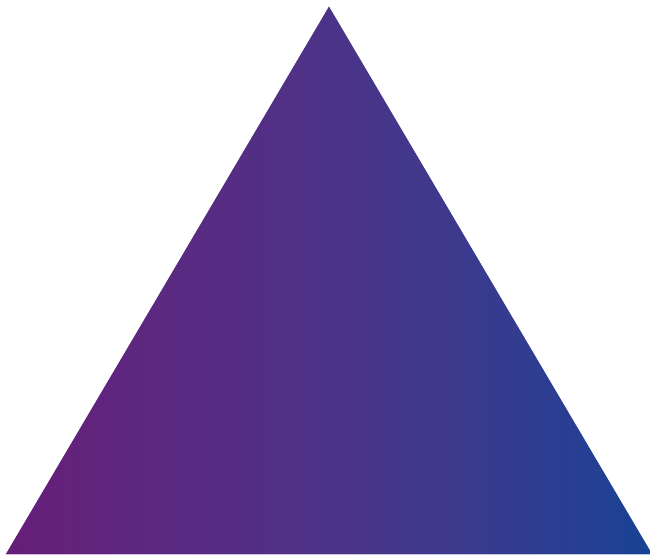
Down

2. Different forms of an element
3. Calcium (symbol)
4. Tuberculosis (Abbreviation)
5. ____ Scan
7. Genetic information carrier
8. Summary of research
9. Inside a test tube or a lab
10. ____ Goodall
11. Get ___ and do an experiment
12. Volcano liquid
15. ____ Blood Cells
21. Mercury (symbol)



SCIENCE DIVA ALLIE WEBER

By Amanda Baker



Allie E. Weber is a maker, builder, and inventor. She has an online following for her channel “Tech-nic-Allie Speaking.” She is a winner and ambassador for the Global Spark Lab Invent-It Challenge, one of Teen Vogue’s “21 Under 21,” and The Mars Generation’s “24 Under 24.” And now this 13-year-old Robot Maker Girl will be coming to your screen as part of the new Mythbusters Jr.

1. Lots of kids are intimidated by the idea of trying to invent something. What goes through your mind when you decide to take on a new design?

I think that the main thing that keeps people from innovating is high expectations. They think, like I used to, that you need a huge problem to solve like world hunger or global warming. It’s just not the case. All you really need is an issue that bothers you and something to solve it. The portable card table I created didn’t solve a huge problem, but it still improved long road trips.



2. How many tries does it take to come up with a new prototype? How do you decide what to test and what to change?

It really depends on the problem you’re trying to solve. Some prototypes have taken several months and others I have finished in a couple of days. You also want to test everything. If it fails, find the cause and fix it. If it works, try to find ways to improve it. Whatever the case, make sure the final prototype is something you are truly proud of.





3. Even though hospitals already have spirometer, you designed a version with blow darts. What inspired you to come up with the idea? Do you think a grown-up could have come up with a similar design?

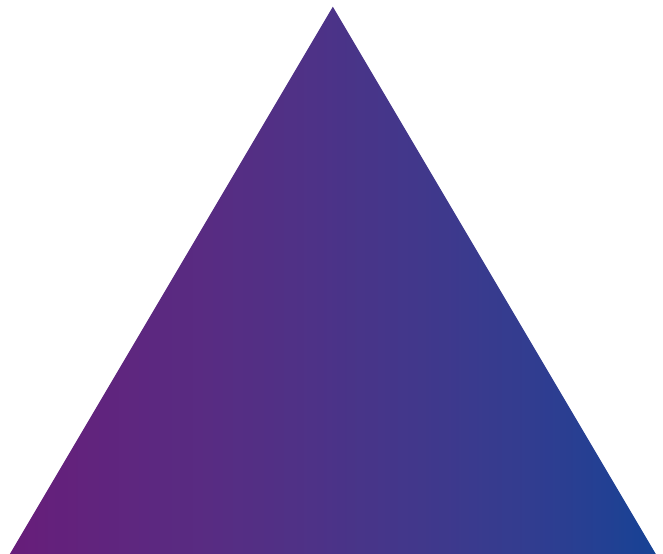
One year I got a toy blow dart gun for Christmas. I really enjoyed it and noticed that my lungs started feeling stronger. My mom suggested that it might be good therapy. That's when I remembered how extraordinarily boring my grandfather thought respiratory therapy was. Why not combine the two? Although innovators are working on improving children's medical equipment, almost all of them are adults. Sometimes it takes a kid to design for a kid.

4. You love movies and building, and you just got to be a part of the new Mythbusters Jr series with Adam Savage. What were some of the most memorable moments?

I love working with everyone on set. Every day is a new adventure, but my favorite was "Chicken Bowling." We had bowling balls and rubber chickens, so why not? Fishing for goldfish with spider webs was also really cool. Other people might say "crushing cars" or "blowing stuff up" – which is still extremely phenomenal – but I see that in action movies a lot. When was the last time you saw someone go chicken bowling?

5. You have your own YouTube channel for sharing your designs. What makes sharing your work online different than sharing them in person?

It is both easier and harder. Making a video takes a lot of time and effort, but you can edit it and take time to think through what you're going to say. You also need to address it to a wider audience. When talking in person you have less time to think about what you're going to say, but you can scope out who you are talking to and personalize the message a bit more. Both methods have their pros and cons, and I like both.



6. You love a lot of kid stuff, and that might make people assume you are limited to typical kid skills. How did you learn to solder, program, and design in 3D? How do adults react when they find out what you can do?

Whenever I need to learn a new skill for one of my innovations, I look to YouTube or other sources online. And if that doesn't work, I reach out to one of my mentors or STEAM friends on social media for help. Adults are usually surprised – and maybe a little intimidated – to find out about my skills. But I almost always find a way to relate my project to something similar they might be doing, and that helps a lot.

7. Are there any inventions you have had to abandon or set aside? How did you decide when it was time to move on?

You know those two poles with a rope between that restaurants or amusement park rides use to keep people from cutting? They're called stanchions. I came up with the idea to make mini-velcro ones that kids can use to make backyard mazes. It was expensive, boring, and just didn't make sense to play with.



- 1.** Favorite fictional character: Dr. Ian Malcolm (*Jurassic Park*) and Indiana Jones (*Indiana Jones*)
- 2.** If you could own any movie prop: The triceratops from the first *Jurassic Park*
- 3.** If you could be an extra in any movie scene: Ewok on Endor in *Return of the Jedi*

DIY TECH

Light-Up Shadow Box



By Randy Sarafan

A light-up shadow box frame is a great way to learn how use LED strips, even if you've never worked with electronics before. It also makes a nice personalized holiday gift for family or friends. The best part is that this project is super customizable and gives you the chance to really let your creativity shine bright!

Materials:

(x1) Shadow box frame

(x1) Adhesive-back white LED strip

(x1) 8 x AA battery holder (with switch and plug)

(x8) AA batteries

(x1) Sheet of white parchment paper

(x1) Glue stick

(x1) Assorted crafts supplies*

(x1) DC power adaptor (optional)

Black construction paper (optional)

STEP 1

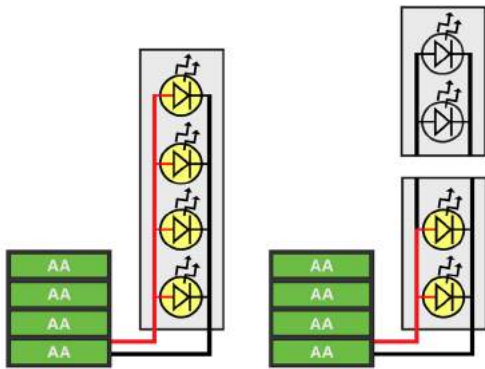
Remove the back panel from the frame and take it apart. Set aside the cardboard photo mat that was inside the frame.



STEP 2



Starting from the edge of the roll, measure out enough of the LED strip to wrap once around the inside of the frame. Cut the LED strip along the nearest line on the LED strip marked with a scissor icon.



The reason that you can cut the LED strip and it will still work is that it is wired in parallel. This means that instead of electricity passing through each LED one after another, they are wired side-by-side and electricity passes through all of them at once. Even if a few are removed from the circuit, electricity will continue to flow through the ones that remain.

STEP 3

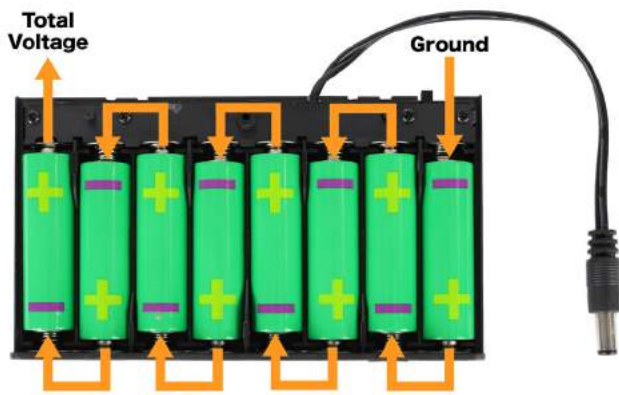
Peel the cover off of the back of the LED strip, and stick it around the inside of the shadow box frame about halfway between the front and back of the frame.



STEP 4

Insert the batteries into the battery holder. If your battery holder has a cover, put it back on once the batteries are in.





The batteries might appear to be smushed into this box randomly, but they are actually wired in series. This means that the batteries are connected electrically front to back. Connecting batteries in series is special, because the voltage of each battery gets added together to create a new total voltage.

For instance, every AA battery can provide 1-1/2 volts. When you connect four AA batteries in series, they all add together to become 6V.

Can you calculate how many volts our battery pack with 8 AA batteries generate?

$$1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} = 6$$



STEP 5

Plug the battery holder into the power socket on the LED strip.



Does your LED strip have wires on the end instead of a power socket? If so, you need to get a DC power adapter jack.

First, insert the black wire into the socket marked with a minus sign and tighten the socket's set screw with a screwdriver.

Next, insert the red (or sometimes white) wire into the socket marked with a plus sign and tighten its set screw with a screwdriver.

You are now ready to connect together the battery pack and LED strip.



STEP 6



Turn on the switch on the battery holder and make sure that the LEDs light up. If they don't, double check that you inserted the batteries correctly. Once you are sure it is working, turn the LEDs off and set the frame aside.

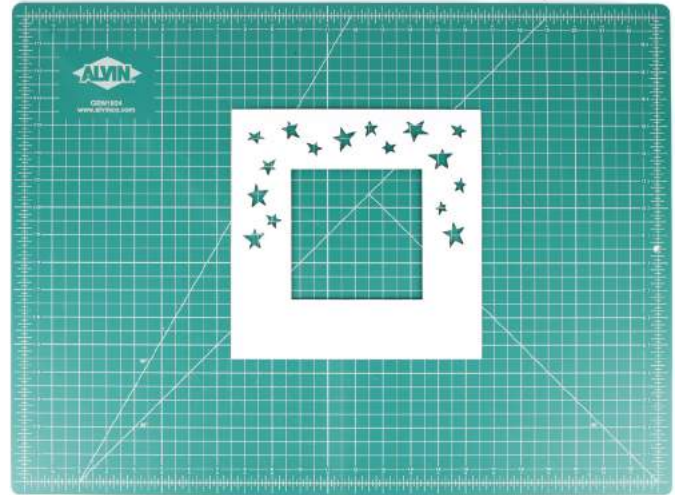
STEP 7

Now is time to get crafty! Gather the cardboard photo mat you removed from the frame earlier, cut a piece of parchment paper to the same size as your photo mat, and grab your craft supplies.



STEP 8

The background of your picture will be the cardboard photo mat. The LED light will shine through wherever there is a hole in the cardboard. You can leave it as it is, or carefully cut additional shapes into it. I decided to cut stars into mine.

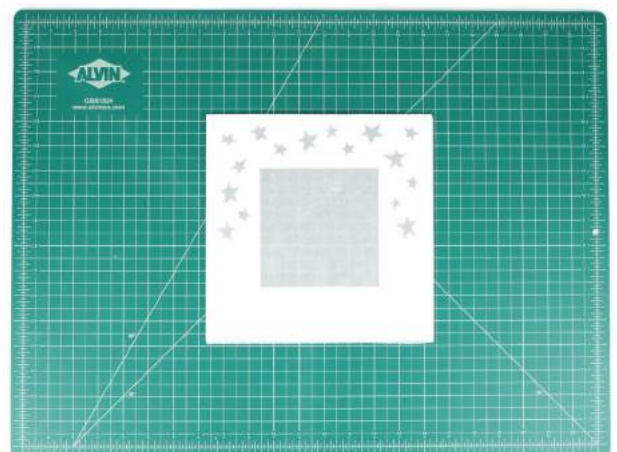


The frame can be a little challenging to cut, so you may need to ask an adult for help here.

STEP 9

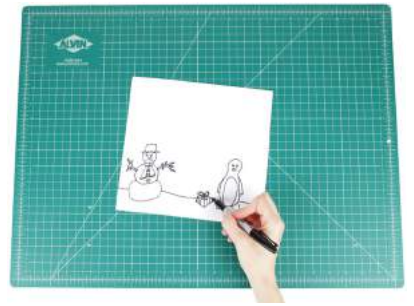
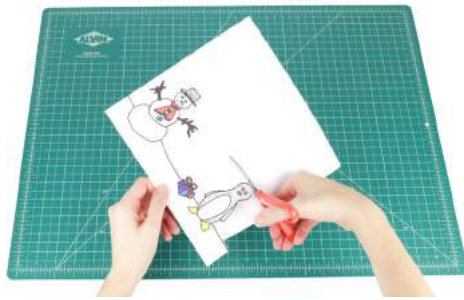


In the picture's middle part we will use parchment paper. This will be our light diffuser and help make the picture glow. Simply stick it to the front of the photo mat using a glue stick.



STEP 10

The front of the image is your chance to get really creative and personalize your display. Almost anything goes here. You can use paper cutouts, markers, paint, or other craft supplies. Just be careful not to cover too much of the surface, or it might block the light that shines through the mat.



STEP 11

Gently insert the completed photo mat into the shadow box frame and place it in front of the LED strip. If the LED strip is now blocking it from being inserted, trim the picture a little smaller so that it fits.



STEP 12

Once the image is inserted in the frame, use some tape to hold it in place.



STEP 13 (OPTIONAL)

While it is not necessary, it helps to cover the back with a piece of black paper to prevent light from shining out the back of the frame.



If you find that your batteries keep dying, you can replace your battery pack with a 12V power supply. This allows you to power the LED strip using a wall socket. If you are not sure the voltage of your power supply, ask for help from a grown-up. They can help you find where it is listed on its product label.



STEP 14

Now that you are done, power up the LEDs by turning on the switch and enjoy your creation!

Going Further!

If you are interested in going further with this project, here are some ideas:

- Try experimenting with different color LED strips. Other common colors are red, green, and blue.
- Set your mat back slightly from the front of the frame and make a light up diorama with small toys.
- Replace the parchment paper with other kinds of paper and see how it changes the light.



FREAKY EATERS OF THE DEEP

By Madeleine McLaughlin



You're seated at a table for lunch. Your hands are neatly folded in front of you. All around, your lunch-mates devour scraps off the floor. They will be eating with their feet, their spines, and even their anus. Is this a dream? Where are you?

You're with the echinoderms (EE – KY – NO – DERMS): sea stars, feather stars, sea urchins, sea cucumbers, sea lilies, and sand dollars. And this lunch is taking place at the bottom of the ocean.

While you're enjoying a soup in a recyclable container with a biodegradable straw, these animals snack on kelp, krill, algae, plankton, and each other.

The most human-like eater of the bunch is the feather

star, which drifts throughout the meal and directs particles towards its mouth with its arms. It might amuse you as you sit, sipping on your soup, to see them float past your face. Meanwhile the sea lily, like most of the other echinoderms, sucks up bits up with its feet from the ocean floor to deposit into its food groove.

The sand dollar moves food along its spine towards its mouth. The sea urchin, with five bony plates forming a beak, scrapes its food off the sea floor and directs it with its tube feet. Tube feet are a special development of the echinoderms – no other creature has them. Try pulling an echinoderm off a rock as you sip and you will be surprised at the strength of these tiny animals.



Credit Lakshmi Sawitri

But it's the sea cucumber that might set your head spinning. It eats with its anus. Because it has no blood, the sea cucumber uses its anus to suck in water and distribute nutrients throughout its body. Riding in along with the water are bits of food, which is absorbed into its inner organs.





The sea star (which used to be called a star fish), climbs up the legs of the table. You may be sorry

it does: sea stars are carnivorous and snack on urchins and even other sea stars. The way it does it might be a little hard to watch. The sea star's stomach comes right out of its body, surrounds its prey, and digests it. Its stomach fluids dissolve the prey's body until it's like a

soup – a bit like the one you are sipping. Its stomach then recedes back into the creature. You probably don't know anyone else who eats like that.

Such a lunch at the bottom of the ocean would be very interesting, and maybe a touch worrying. But these brainless animals can teach us a lot about the different ways life forms in nature and survives for millions of years. Your lunch may seem a little less appetizing, but you'll be sure to remember your meal with the freaky eaters of the deep.



SCIENTIST OF THE SEA

Chantal Conand is a French marine biologist. Born in 1943, she graduated with a PhD in 1988. She became the chief scientist of the marine ecology laboratory in Reunion in 1993. Her main interest was in sea cucumbers, but she is an expert in all echinoderms of the Indo-Pacific. She also studied crown-of-thorn sea stars, which feed on stony coral polyps. Now retired, she has written thirty books or book chapters and has published one hundred peer-reviewed articles and reports.

Chantal Conand lives in Reunion.

GLOSSARY

Echinoderm – the largest family of salt water animals

Recycle – process again for reuse

Biodegradable – capable of breaking down by natural means

Kelp – seaweed

Krill – small, shrimp-like marine animal

Algae – types water plants

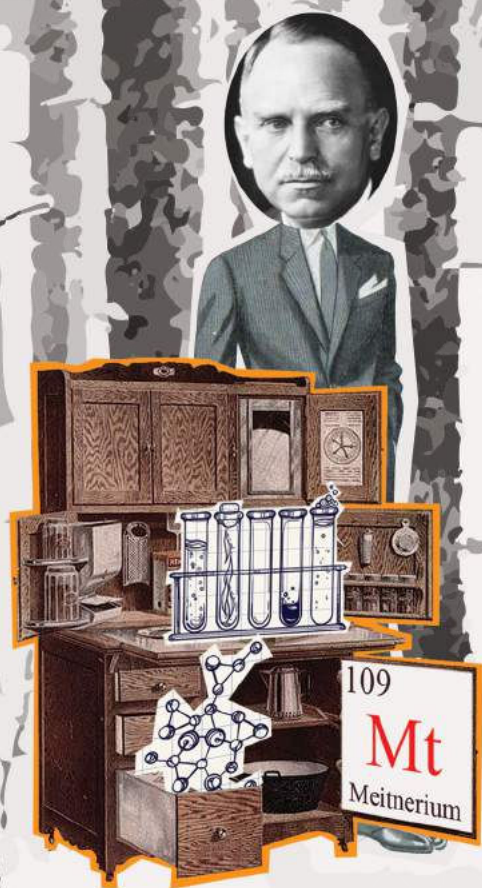
Plankton – tiny animal and vegetable organisms floating in water

Marine biologist – a person who studies life in the sea

Polyp – the living animals that form coral

Ecology – the science of natural life

Blast from the Past





LISE MEITNER

By Charlie Evans

Although her life was filled with obstacles, Lise Meitner didn't let anything stop her from exploring the world and achieving her dreams.

While other people were busy with Christmas celebrations, one woman went for a walk in a Swedish forest. She had a lot on her mind. She had been getting strange letters from her friends who were researching atoms. The results they were getting from their experiments were confusing. So, as her feet crunched through the snow and the cold air hit her face, she tried to work it out. She sat down and started adding things up using Einstein's famous equation: $E = mc^2$.

**SHE WAS A
CURIOUS GIRL,
INTERESTED
PARTICULARLY IN
MATHEMATICS,
BUT AT
FOURTEEN
YEARS OLD SHE
WAS NO LONGER
ALLOWED TO GO
TO SCHOOL.**

This was the moment that Lise Meitner worked out what was going on! It was the result of years of work involving lots of universities and people in different countries. But after fleeing from the Nazis, being denied an education, and working late nights, it was Lise Meitner who cracked it using determination and mathematics.

Lise was born on November 7, 1878, in Vienna, Austria. She was a curious girl, interested particularly in mathematics, but at fourteen years old she was no longer allowed

to go to school. Lise was bored. She loved reading and playing the piano but wanted to learn more. How could she uncover the secrets of the universe from her house?

She wanted to be a scientist, and she knew that to do that she needed to study at the University of Vienna. It is hard to imagine a time when school was so different from how it is for most of us today. But in Austria at this time, it was against the law for women to study. Lise wasn't allowed to go to school! But did this stop her? Not at all.

She was interested in a phenomenon that had just been discovered – radioactivity.



Her father was supportive of her dreams, but recommended that she train to be a teacher instead in the hopes that it would give her a way to get into a university one day. Her father was right. "When she qualified, the University of Vienna had luckily just

started taking applications from women. In February 1906, Lise graduated with a Ph.D. in physics and started staying up late into the night to continue her studies even further. She was interested in a phenomenon that had just been discovered – radioactivity.

She moved to Berlin where she met chemist Otto Hahn. A couple of years later, the science duo moved to the new Kaiser Wilhelm Institute for Chemistry. Once again, Lise hit a barrier. Her only option to study at the cutting-edge research institute was by setting up some equipment in a cupboard. Women were not allowed in the laboratories. If that wasn't bad enough, they didn't even pay her for the first year!

The idea of the atom experiments was to take neutrons (tiny particles in the middle of an atom) and blast them at the nucleus (the centre) of another atom. In theory, the smaller neutron being blasted at the bigger nuclei would cause the neutron to stick to the nuclei and make them heavier. But every time they did the experiments, the atom being blasted with neutrons appeared to be lighter. This didn't make

sense, so scientists set about trying to work out why.

Then disaster struck. The Nazis had taken over Germany and had started persecuting Jews – and Lise was of Jewish descent. She stayed for as long as she could, knowing there was little of her vital research she would be able to take with her. Finally, Otto Hahn told her it would be best for everyone if she stopped coming into work. She was hurt and felt let down by her old friend, but he was right that her life was in danger.



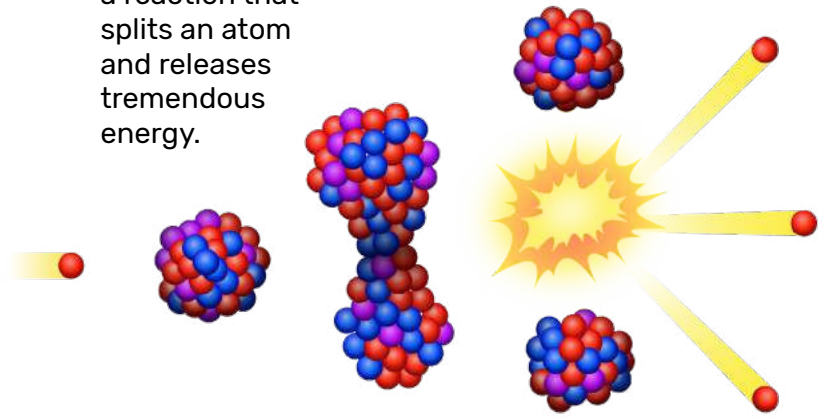
Lise Meitner and Otto Hahn

M

MEITNER CALLED THIS NUCLEAR FISSION, AND SHE CALCULATED THAT IT COULD MAKE MASSIVE AMOUNTS OF ENERGY. NUCLEAR POWER WAS BORN!

Lise crossed the border in secret on the night of July 13, 1938 with hardly any possessions, arriving in Sweden with just some basics and a diamond ring from Otto to bribe border guards. And it was here, when she took her walk in the woods, that she realized that the neutrons were not sticking to the nucleus – they were being smashed into two lighter pieces! Meitner called this nuclear fission, and she calculated that it could make massive amounts of energy. Nuclear power was born!

Nuclear fission is a reaction that splits an atom and releases tremendous energy.



Lise Meitner never returned to Germany and died aged 89. She had published 129 scientific papers. Though she didn't share the Nobel Prize in Chemistry for nuclear fission (she should have, but it was given exclusively to Otto Hahn instead), she received many awards and honors. After her death, an element was named after her: Meitnerium!

So the next time you're in math, remember Lise Meitner – the fierce little girl who fought so hard to study and went on to change the world.

Glossary

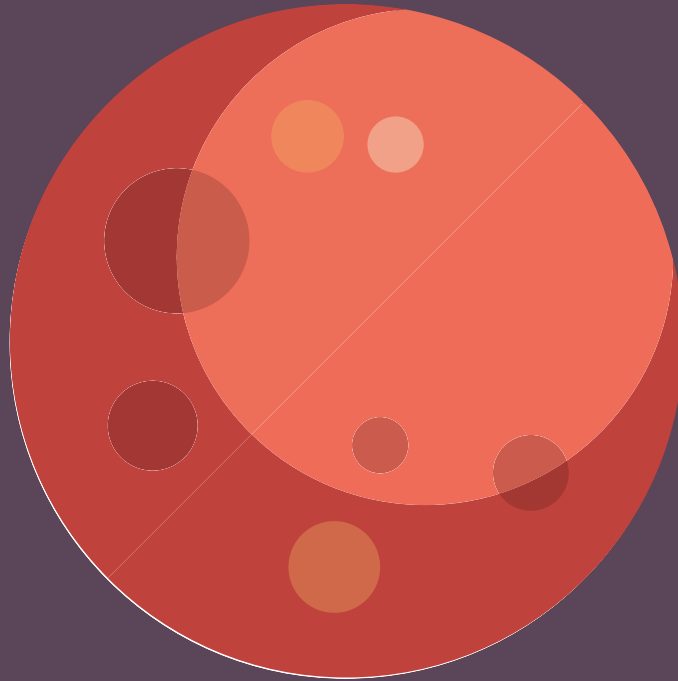
Atom – the smallest particles that make up everything in the universe

Neutron – a particle in the center of the nucleus of an atom that does not have an electric charge

Radioactivity – energy or particles by the breaking apart of atoms of certain elements

Space and Tech

WE FOUND WATER ON



MARS!

By Lia N. Rovira

I

If you listen carefully, you can hear the sound of space nerds everywhere jumping up and down and shrieking with excitement. They know that scientists just announced new evidence for a giant lake on Mars!

Planetary scientists have known for some time that water flowed on Mars in the past, back when it had warmer temperatures and a thicker atmosphere. Right now Martian temperatures can reach -68 Celsius (-90 Fahrenheit), and any liquid water would have to be full of salt. Past searches have not found any bodies of water that were permanent or of this scale. But now, thanks to the Italian Space Agency's use of the radar instrument, MARSIS, we have better evidence than ever that a giant, underground lake exists on Mars today!

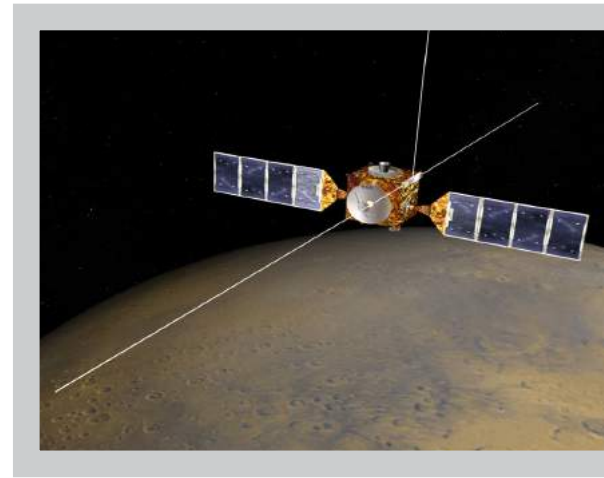


Illustration of European Space Agency's Mars Express showing its MARSIS antenna.
Credit: NASA/JPL/Corby Waste

"MARSIS was born to make this kind of discovery, and now it has," said Roberto Orosei, a leading scientist on the investigation. The project uses radar technology to image below the surface of Mars, much like how we detect planes here on Earth. By sending out radio waves and measuring how they bounce back, scientists are able to form interpretations of what they cannot see. By

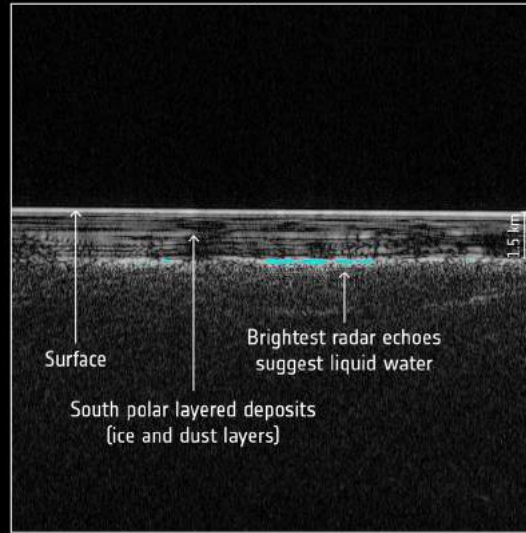
observing the materials the waves bounced off of and those they passed through scientists were able to dig through about three years' of data from Mars' south pole. The area is covered mostly in a thick layer of water ice, but the waves did something strange about two kilometers (one mile) below the surface. They formed a big, bright reflection on a surface - the interface between liquid water and ice.



Mars south polar region



Radar image of subsurface



Water detected under the south pole of Mars.
Credit: ESA/
NASA/JPL/ASI/
Univ. Rome

The scientists wanted to check into other possibilities, like whether the layer could be frozen carbon dioxide. But liquid water was the case that made the most sense. The lake stretches across about 20 kilometers (12 miles). It is unclear whether it is a separate layer of water or liquid mixed with sediment. But that would still be one of the most exciting sludges humans have ever found in space.

If there is water on Mars, that points to the huge - and even cooler possibility - of some form of alien life. Liquid water is critical for life as we know it. That is why searches for life and searches for water on other planets go hand in hand. Even this lake environment would be extremely harsh, bitterly cold, and filled with salts. The chemicals in the lake could pose another problem. These salts are not the same

as what you find in your salt shaker. These perchlorates are toxic to humans and more intense than bleach, and the Martian soil is full of them. So, if you ever do get the chance to visit an underground lake on Mars, be sure not to lick it!

Some especially tough and tiny creatures called extremophiles can technically live in these kinds of environments. They can go decades without water, survive in a vacuum, and even feed off of perchlorates. There is a chance that the water may be warmer and less salty than scientists think, but it would still be cutting it close even for extremophiles.

As hard as it may be to send a mission to Mars to look for life deep below the surface, knowing where to start the search is an amazing achievement in itself. And difficult is not the same as impossible.

Glossary:

extremophiles: microorganisms that thrive in conditions of extreme temperature or acidity

perchlorates: chemical compounds with extreme levels of salt

radar technology: uses radio waves to determine the distance, size, or speed of objects

radio waves: electromagnetic waves used for long-distance communication

sediment: matter that settles to the bottom of a liquid

never Be limited

BY OTHER PEOPLE'S

• limited imagination •

Dr. Mae Jemison



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WATCH ME WORK

Dr. Tina Brandon Abbatangelo

How a toothache
inspired me to
become a dentist,
and more



Dr. Tina Brandon Abbatangelo teaches students and treats patients at the School of Dental Medicine at the University of Nevada, Las Vegas. She is an author and a state-of-Nevada pageant winner. She also volunteers with the Peter Emily International Veterinary Dental Foundation, which provides dental care to exotic animals such as lions, tigers, and bears – Oh my!

M

My career path began when I had to visit the dentist as a child. The pain in my mouth was so bad that I had to be excused from school. I needed a root canal, and I was in the chair for quite a while.

But what I remember most was the dentist. He was very sweet and kept telling me how brave I was, and that everything would be fine.

Moment by moment, I felt the pain going away. I felt safe and comforted, and I have not forgotten that feeling. I wanted to help others the way he helped me. Then a trip to my dog's veterinarian inspired me and I began fixing teeth for monkeys, bears, tigers, and other exotic animals.



Three of us performing root canals on three different teeth all on one tiger. We have to work quickly, efficiently, and in sync to complete the treatment and limit the amount of time the animal is sedated.

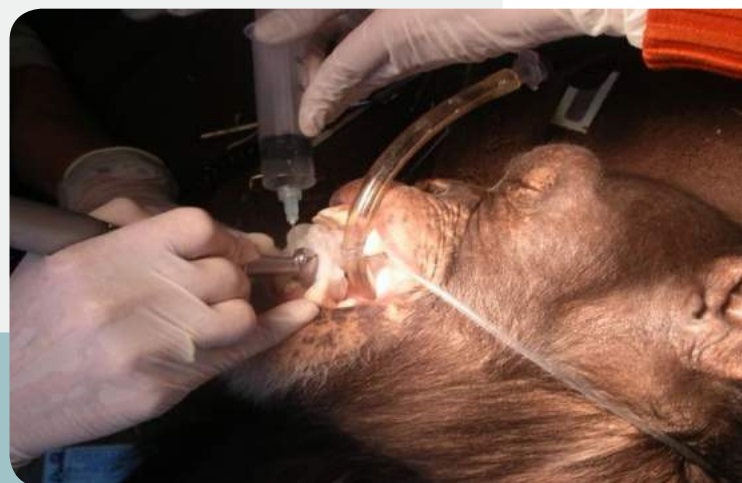


We restored a tiger's tooth with a composite restoration after completing a root canal.



We treated Miss Montana the bear's broken tooth so she can eat her favorite foods without pain again.

Representing my home state as Ms. Nevada during the 2018 Ms. America pageant. My fellow representatives are among the most passionate and determined women I have ever met. Part of my duties as Ms. Nevada included talking to people and inspiring them. My favorite topic is encouraging others to have empathy and respect for animals.



Restoring Chuckles the chimpanzee's smile.

mind muddlers

1. Seasons on other planets can be longer or shorter than ours. How long is a single summer on Uranus?

- a. 1 year
- b. 21 years
- c. 42 years
- d. 63 years

2. What do camels store in their humps?

- a. Food
- b. Water
- c. Fat
- d. Nothing - it's empty

3. Which food has more genes than humans?

- a. Potatoes
- b. Strawberries
- c. Pineapples
- d. Tomatoes

4. Which of these animals can run faster than a human?

- a. Hippopotamus
- b. Salamander
- c. Turtle
- d. Elephant

5. Autophobia is the fear of what?

- a. Cars
- b. Robots
- c. Music
- d. Being by yourself

6. Sphenopalatine ganglioneuralgia is just the fancy scientific term for what?

- a. Brain freeze
- b. Goosebumps
- c. Paper cut
- d. Short-term memory loss

7. Which of these animals sleeps the most during a single day?

- a. Sloth
- b. Crocodile
- c. Koala (note: 22 hours of sleep a day!)
- d. Cat

8. What did scientists manage to turn into diamonds by using a pressure experiment?

- a. Glass
- b. Cheese
- c. Plastic
- d. Peanut butter

9. Which of the planets in our solar system is the only one to spin clockwise?

- a. Venus
- b. Mars
- c. Saturn
- d. Neptune

10. If you could dig a tunnel from one side of the Earth to the other, how long would it take you to travel through the tunnel if you jumped in and fell out the other side?

- a. 32 minutes
- b. 42 minutes
- c. 52 minutes
- d. 62 minutes

ANSWERS : 1-C, 2-C, 3-D, 4-A, 5-D, 6-A, 7-C, 8-D, 9-A, 10-B

READER SPOTLIGHT “Summer Radecky”



Tell us about yourself

My name is Summer, I am nine years old, and I was born in the summertime! I'm in 4th grade and my teacher knows how much I love STEM!

What do you like to do for fun?

I love playing kickball and soccer and playing the piano. I also love to draw and love math in school. I love working with computers, astronomy, and learning about cool stuff - like DNA, viruses, and animals!

What do you think you will grow up to be?

A veterinarian! I love helping animals!

What world problem would you like to help solve?

I would like to fix the pollution in our environment.

What would you do with a million dollars?

I would start an animal rescue and use the money for food, supplies, and health care for the stray animals.

If you could meet one celebrity, who would it be?

Selena Gomez, because she adopted stray puppies and she is an awesome singer and actor.

What advice would you give to grown-ups?

Grown-ups, you need to get involved in saving the environment because you don't have enough time to wait for kids to grow old enough to have the power to make the changes!

Share your favorite joke.

How do you keep a dog from barking in the back seat? Put him in the front! Ha!

SMORE SMARTS

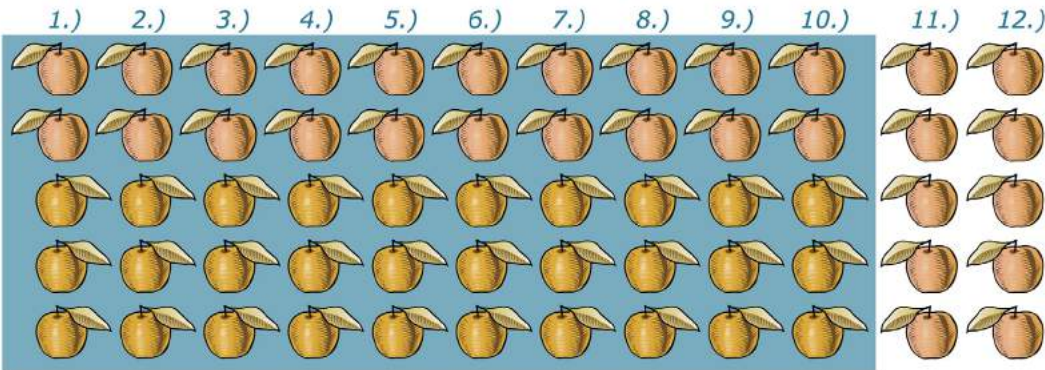
CROSSWORD ANSWER

1F	2A	3C	4T				5C	
	6L	A	B		7D	A	T	8A
	L			9I	N			B
10J	O	11U	R	N	A	12L		S
13A	T	P		V		14A	15R	T
16N	R		17S	I	L	V	E	R
18E	O	N		T		19A	D	A
	P			20R	21H			C
22G	E	O	L	O	G	I	S	T

PUZZLE ANSWER

Red & Golden Apples

As you can see from the image, the red and golden apples together make ten bunches of five apples you can reasonably sell for two dollars. The last two bunches are made only with red apples that cost effectively much more than two dollars the price at which they have been sold! Therefore the loss of one dollar depends on the price difference of these last ten red apples.



FROM SMALL IDEAS TO BIG INNOVATIONS

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