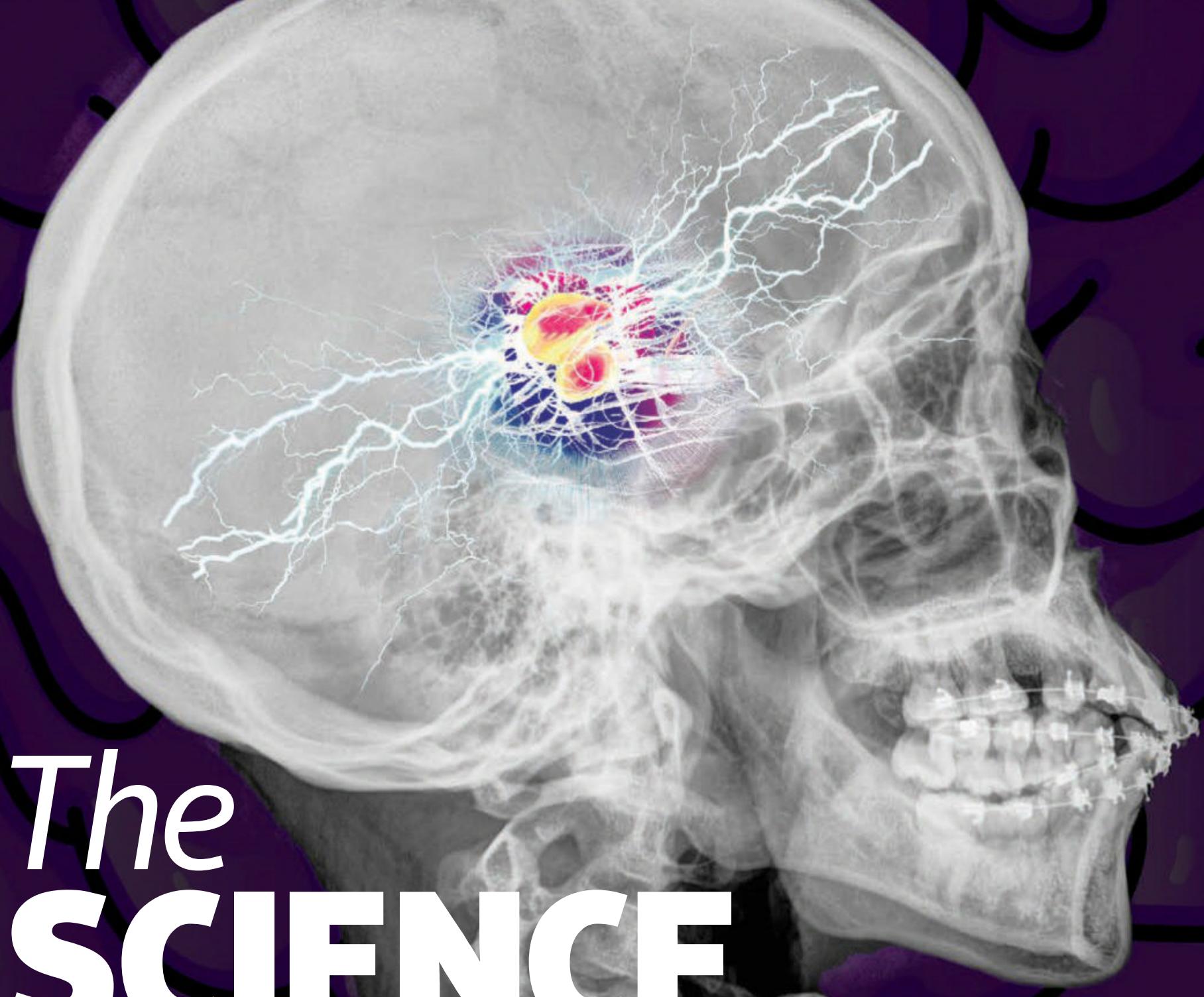


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Science and Exploration for Inquisitive Minds



The
SCIENCE
of **FEAR**



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No Fear

A woman who's not afraid of anything...or is she?

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WHATSI TAMATOA

HEIGHT 5'7"
AGE 14
WEIGHT Much more than a stranger would guess
BORN Samoa
INTERESTS Bioengineering, tinkering, meditation
ONCE SAID "We found a way to harness the magnets and induction nanos in O's space suit."

OCTOBER 2021

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Pg 36 (The Gothic) - text © 2021 by Cathleen Davies

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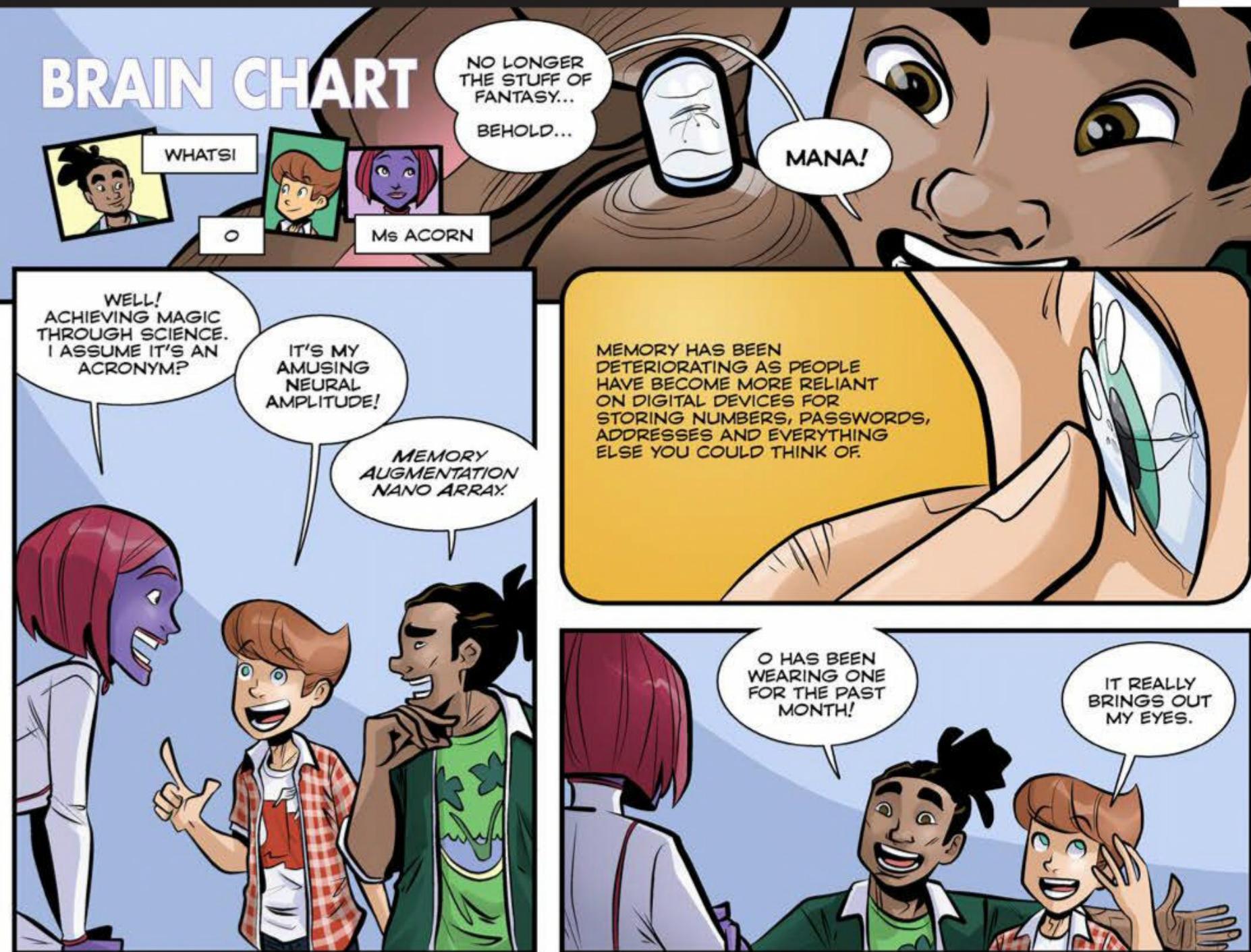
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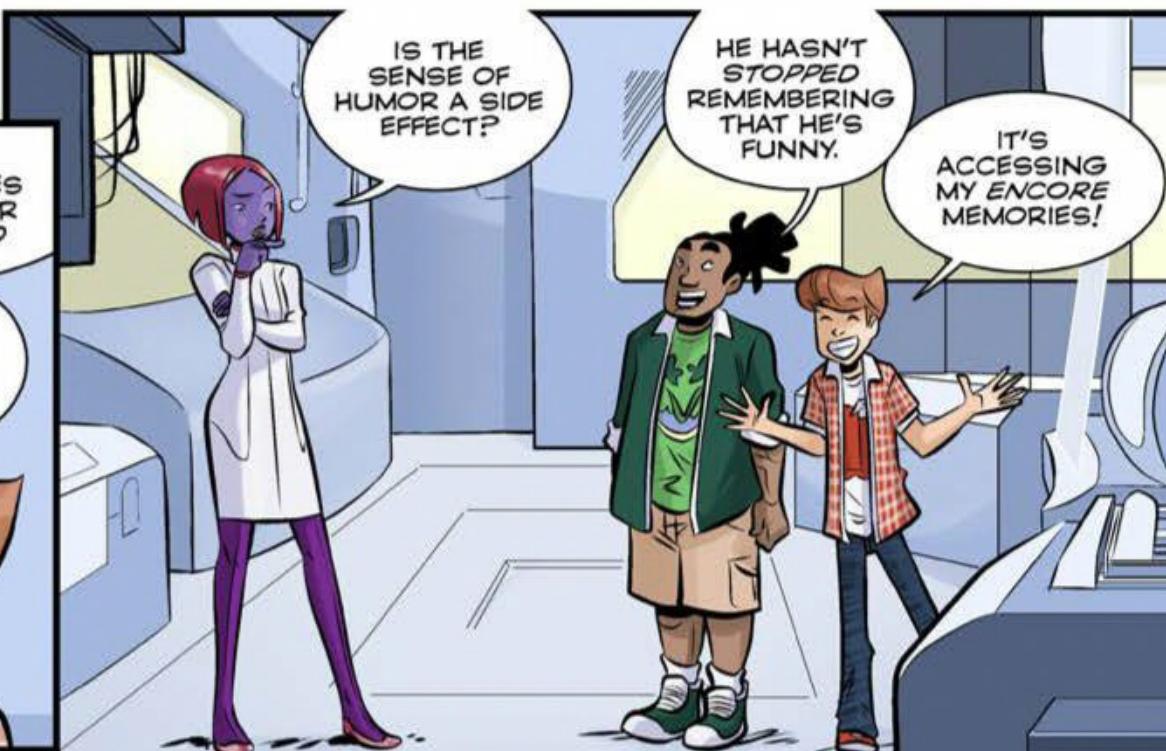
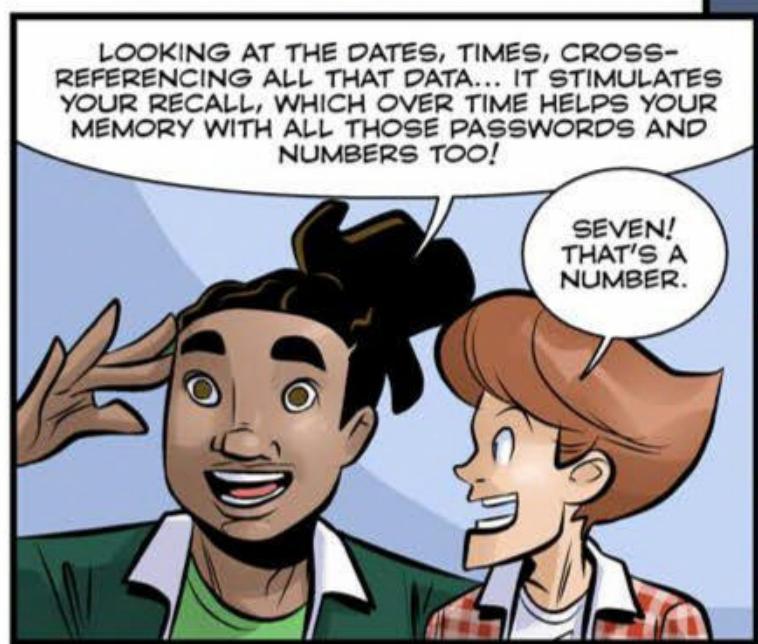




BRAIN CHART



IT HAS MONITORED TEMPERATURE, CORTISOL, DOPAMINE, SMELLS, TASTES, CERTAIN STRONG EMOTIONS... AND TRACKED HIM VIA GPS!





**LETTER
of the
MONTH**

So...Many...Questions...

I just got subscribed to your magazine, and I love it. I have many questions that I hope you could answer. Just to get started, I love playing a coding game that's called "Scratch." I'm wondering how the computer responds to my codes. I know that it uses 1's and 0's, but what do they mean? Also, how does me pressing my computer keys make letters on the computer appear? How does me pressing a button on my Bluetooth headphones pause my music that's on my tablet? How does my Google Home understand, "Okay, Google?" How does clicking a tab bring me over to that tab? I know that it's wiring, but how does that work? Also, why does one of your cartoon characters have purple skin?

—PETRA / age 10 / Illinois

P.S. Did you do an article on the coronavirus yet? If not, please make one.

P.P.S. Did you do an article on climate change and how it's killing adorable polar bears?

You are asking ALL the good questions! I'll answer one, and I hope you'll keep exploring the others. I have purple skin because purple is one of my favorite colors, and I can program myself to be any color I want—with 1's and 0's, just like your computer at home!

—MS. ACORN

Xceling at Ideas

My name is Hanne, and I'm going to tell you right away that it's pronounced Han-nah, not Han or Hane. I've had people call me Han-aye too. Anyways, I love *Muse!* I really like guessing the fake article. Even if I don't always get it right...I'm a ten-year-old girl that really likes gymnastics. I'm a level Xcel gold at my gym. (If you're familiar with gymnastics you'll know that there's a different kind of leveling called JO.) I was wondering, maybe you could do a magazine article on gymnastics, like muscle memory, flexibility, and strength. You could also talk about famous gymnasts. Who doesn't want to read about Simone Biles and her impossible flips?

—HANNE R.



I love watching gymnastics, although I'm not so good at them myself.

Maybe someday

I'll get my mom to update my limbs to be extra-stretchy...

—WHATSI





From Aardvark to Zebra

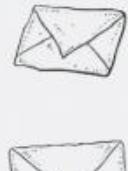
I am a normal person, and I LOVE ANIMALS! I'll tell you why and how. One day I was reading my animal encyclopedia, and I thought to myself, "Wow! These animals are pretty cool!" and I've always loved animals ever since. I want to be a wildlife filmmaker when I grow up. O, you are my favorite person from Parallel U, because you have the best sense of humor. Do you think you could tell me some of your best jokes? (NOT CHEESY!!) Animals are some of the things that make me happy, including *Muse*. Every time we get a magazine, we literally fight over who gets to be the first one to read it! I hope the mail isn't copyrighted, because in the March 2020 magazine someone submitted a letter that said they didn't have any armies. Well, me too. If you don't publish this, I will be heartbroken, and you will have to feel the guilt. HA! Outsmarted ya!

—EZRA C. / Maryland

Where the Stars Compete

Witness the dominance of the Athletic Galaxy, where all sports are welcome! We don't discriminate and under no circumstances will this be thrown into the FMP. We will not accept defeat. If you do put this in the FMP, "athletic" will be the last description of your life. For I am the Emperor of the Athletic Galaxy. But you can aid my heroism by simply including this in your magazine. I think it would be cool to educate people on the benefit of athletics in younger children's communities and how it can benefit kids in the future when they can get a basic understanding and some knowledge of what sport they would like to participate in. Especially when those younger children can't afford athletics or are living in poverty, it's important that we acknowledge these families and give them privileges so they can have a better life. Remember your warning! This message is sincere, but my army is prepared to invade the *Muse* headquarters and attack if it's not published. Your cooperation will be greatly appreciated.

—BLAKE S. / age 12 / Wisconsin



Fantasy Friendship

This is Lucretia (but you can just call me Luca) writing to you from Portland, ME! I really hope this gets into one of your issues! Do you like art, reading, and writing? I do! I have been doing this thing for over month now, so I wanted to tell you about it (by the way, it was inspired from one of your issues): I have made up 5 characters who are best friends. Their names are Zelda (the smart one), Ben (the dancer), Emily (the fashionista), Brent (the prankster), and Tessa (the athlete). I am writing a story about them on a quest where they will have to use each of their special talents to succeed and get their Mysterious Prize. Maybe you can give me an idea for the title! I will try and send it to you later, but it might be a while. Thanks for reading this!

—LUCA M. / age 10 / Maine



Hmm, what would my special talent be to get a Mysterious Prize? Time travel just seems so obvious...

—CATE



Probably snoring the loudest, Cate.

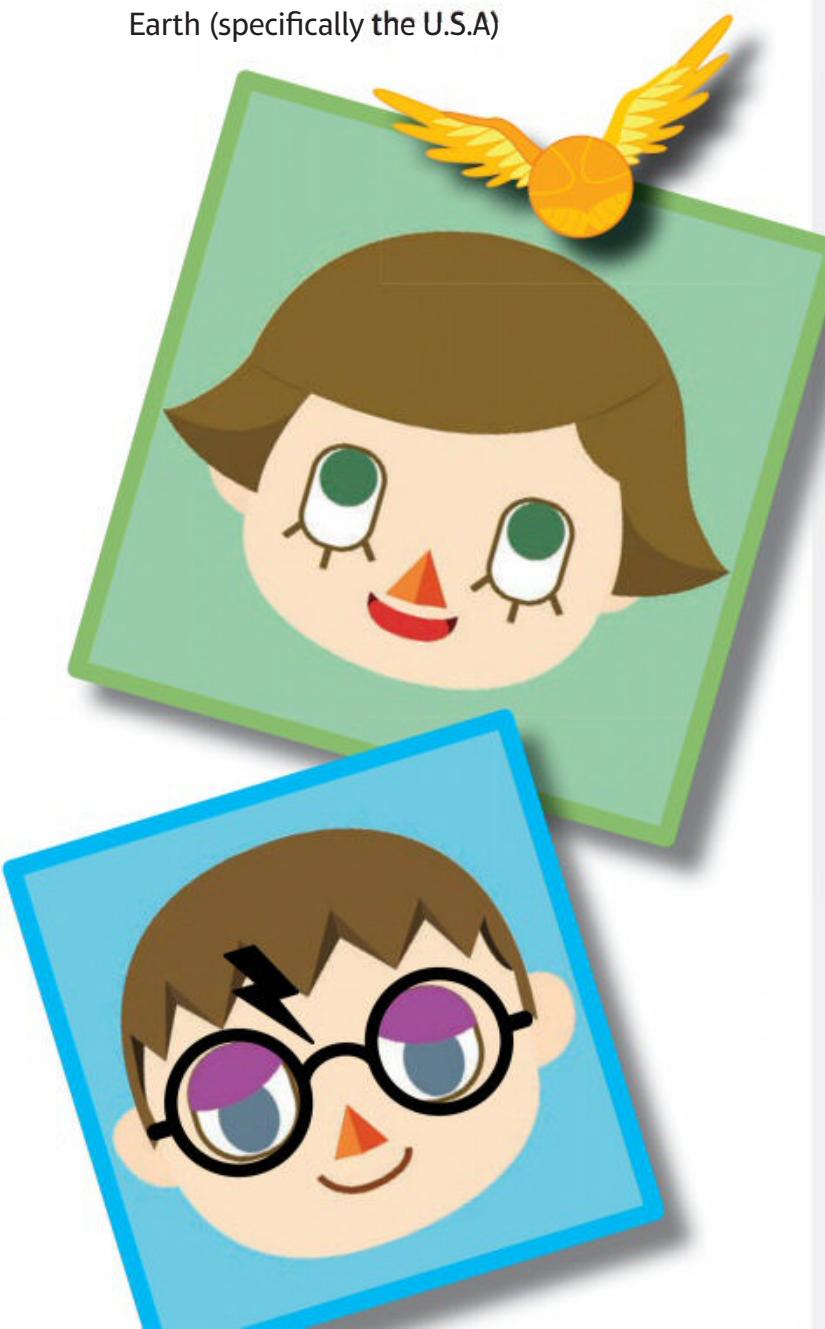
—O

Far Away Flavortown

I am from a very strange and mysterious planet called Earth.

I have been reading *Muse* since January 2020 (eek, so long ago!), and now I love it! My favorite might be the “Far Away Worlds” issue (March 2021), but I can’t decide, there are so many good ones out there! I love Harry Potter, *Hamilton*, Guy Fieri, animals, *The Simpsons*, and *Animal Crossing*. I am officially weird. I know so many people have asked this, but could you PLEASE do an issue on Harry Potter? Also, could you make a sequel to the Frog-Sleep fiction piece you did, also in the March 2021 issue? It’s so good! As a closing note, if you throw this in the Horrific Pit of Sad Fans’ Mail, I will send my army of dementors, demigods, dogs with fish breath (you do not want that to happen, trust me), *Animal Crossing* villagers, Javelina pigs (also known as Peccaries), stuffed animals, Hufflepuffs (they can be scary if they want to), AND you would be forced to play Guy’s Grocery Games for the rest of your life. Cue the evil laughter.

—**GIGI F.** / age 9 1/2 / a mysterious planet called Earth (specifically the U.S.A)



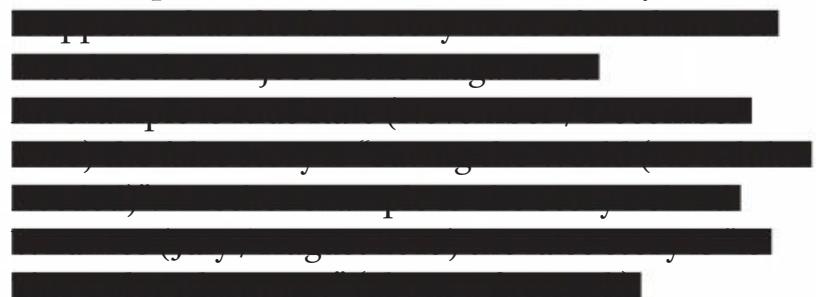
Dorky and Delighting In It

I have only been reading *Muse* for the last few months but I love it so much! The fiction stories are so much fun and I always love reading them. What I would like to say is that I absolutely love *Dork Diaries* and am the queen of all other dorks out there! My followers enjoy jumping on trampolines while eating blackberries and sipping on root beer, just like me! We also are obsessed with *Hamilton* and know practically everything about it. You can visit my amazing land by singing a verse from *Hamilton* and then opening a root beer bottle. I am writing on behalf of my citizens: we have agreed that if you do not publish this, we will send our military regiment with trampolines, blackberry launchers, root beer squirt guns, and *Hamilton* music blasters to *Muse* HQ. Do not ask how we will use these weapons, but we will divide and conquer. Please continue writing amazing articles and stories and thanks for reading!

—**NIALA** / age 11 / Virginia

You Can't Handle the Truth

My brother and I love reading *Muse*, especially figuring out the false story in “Muse News”. Out of 18 magazines we have received, 15 of them repeat a similar pattern to determine which story is false.



Our question to you is whether this pattern has been done on purpose to make it easier to detect the false story, or is it just a coincidence?

Thank you for putting together such a great magazine.

—**KINDAH AND IYAD** / age 11 and age 13

Ssh! You've cracked our code...but we can't let them all know.

—**MS. ACORN**



Something to say?

Send letters to *Muse Mail*,
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or email them to
muse@cricketmedia.com.



text © 2021 by Elizabeth Preston

>> CLIMATE CHANGE

Chilly with a Chance of ZZZZZAP!

Global warming is making the whole planet toastier. It can also affect the weather in weird ways. In the Arctic, climate change seems to be causing more lightning.

Researchers looked at data from

a worldwide network of sensors that pick up lightning strikes. Between 2010 and 2020, they looked at lightning during June, July, and August—the stormy months for the northern half of the world. Then they compared lightning in the Arctic to everywhere else on Earth.

The Arctic is the cold region at

the top of the planet. Global warming is heating up the Arctic even more quickly than other parts of the world. And the scientists saw that as the Arctic has warmed over the past decade, lightning has heated up too. There's about three times as much lightning in the Arctic now as there was in 2010.

» One of these stories is FALSE. Can you spot which one? The answer is on page 46.



» ARCHAEOLOGY

Sit. Lie Down. Stay for 2,000 Years

ABOUT TEN YEARS AGO,

researchers found a huge collection of ancient animal bones buried in Egypt. Now they've dug up the remains of 585 animals from the site and studied them closely. They've cracked the case: this site was

most likely a pet cemetery.

People buried these animals almost 2,000 years ago. Most of the remains researchers found belonged to cats. There were also some dogs and monkeys.

Many of the animals wore fancy collars. And there were

other signs that these were beloved pets. Some animals' skeletons showed they were old when they died, or had diseases or injuries that would have made it hard to survive on their own. That means humans were probably taking care of them.

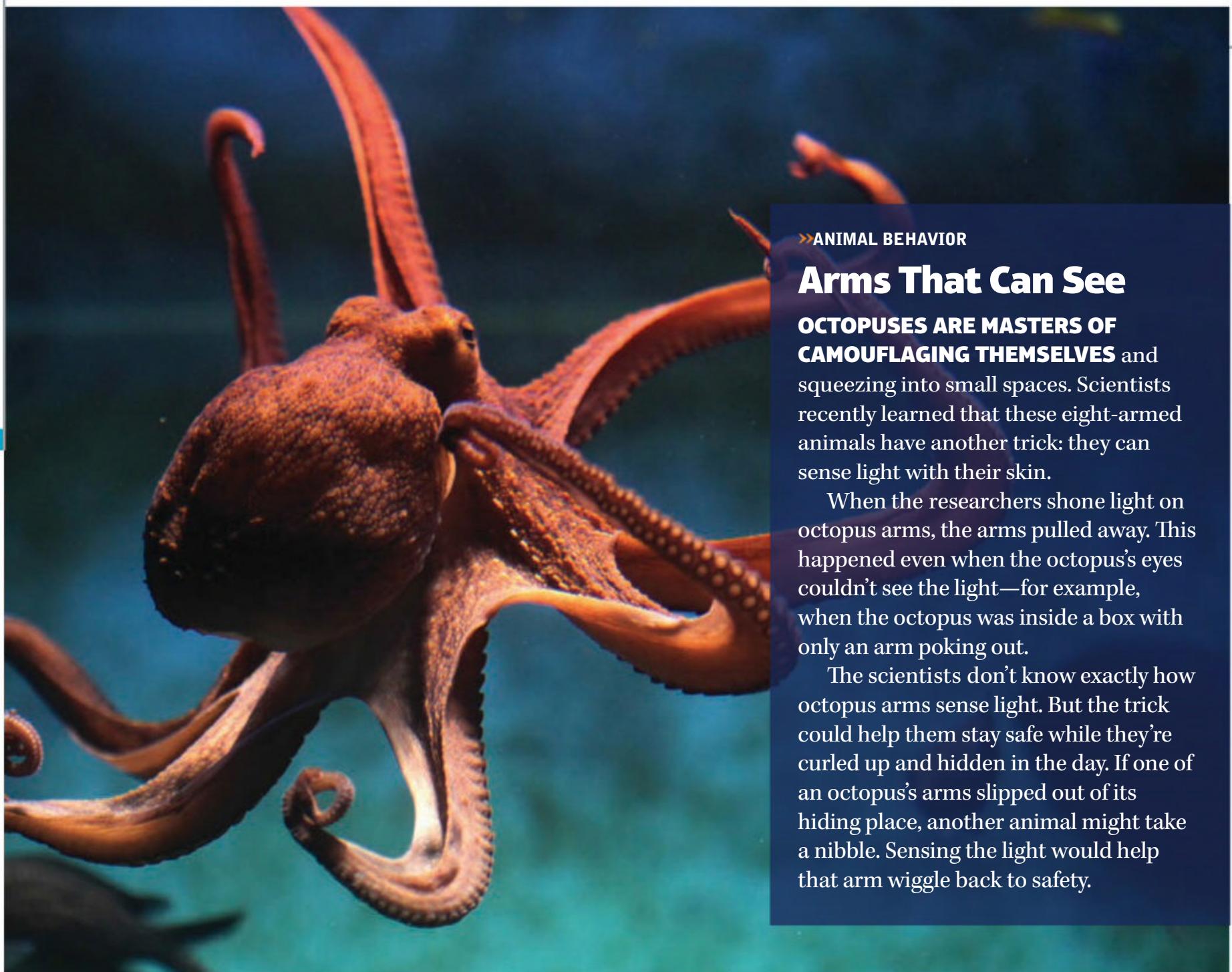
» TECH DESK

A Telescope with a Bug's Eye

MOST SPACE TELESCOPES USE

HUGE LENSES to peer deep into the sky. But a telescope called Dragonfly has eyes like a fly, instead. It's made of 48 small lenses, in two clumps. All of these lenses point to the same place in the sky. This has helped researchers discover distant galaxies that are extremely faint. Now Dragonfly is getting ready for an upgrade. Scientists are going to add 120 more lenses, making it the most powerful bug's eye around.





>>ANIMAL BEHAVIOR

Arms That Can See

OCTOPUSES ARE MASTERS OF CAMOUFLAGING THEMSELVES and squeezing into small spaces. Scientists recently learned that these eight-armed animals have another trick: they can sense light with their skin.

When the researchers shone light on octopus arms, the arms pulled away. This happened even when the octopus's eyes couldn't see the light—for example, when the octopus was inside a box with only an arm poking out.

The scientists don't know exactly how octopus arms sense light. But the trick could help them stay safe while they're curled up and hidden in the day. If one of an octopus's arms slipped out of its hiding place, another animal might take a nibble. Sensing the light would help that arm wiggle back to safety.

>>BOO!

Who's More Scared?

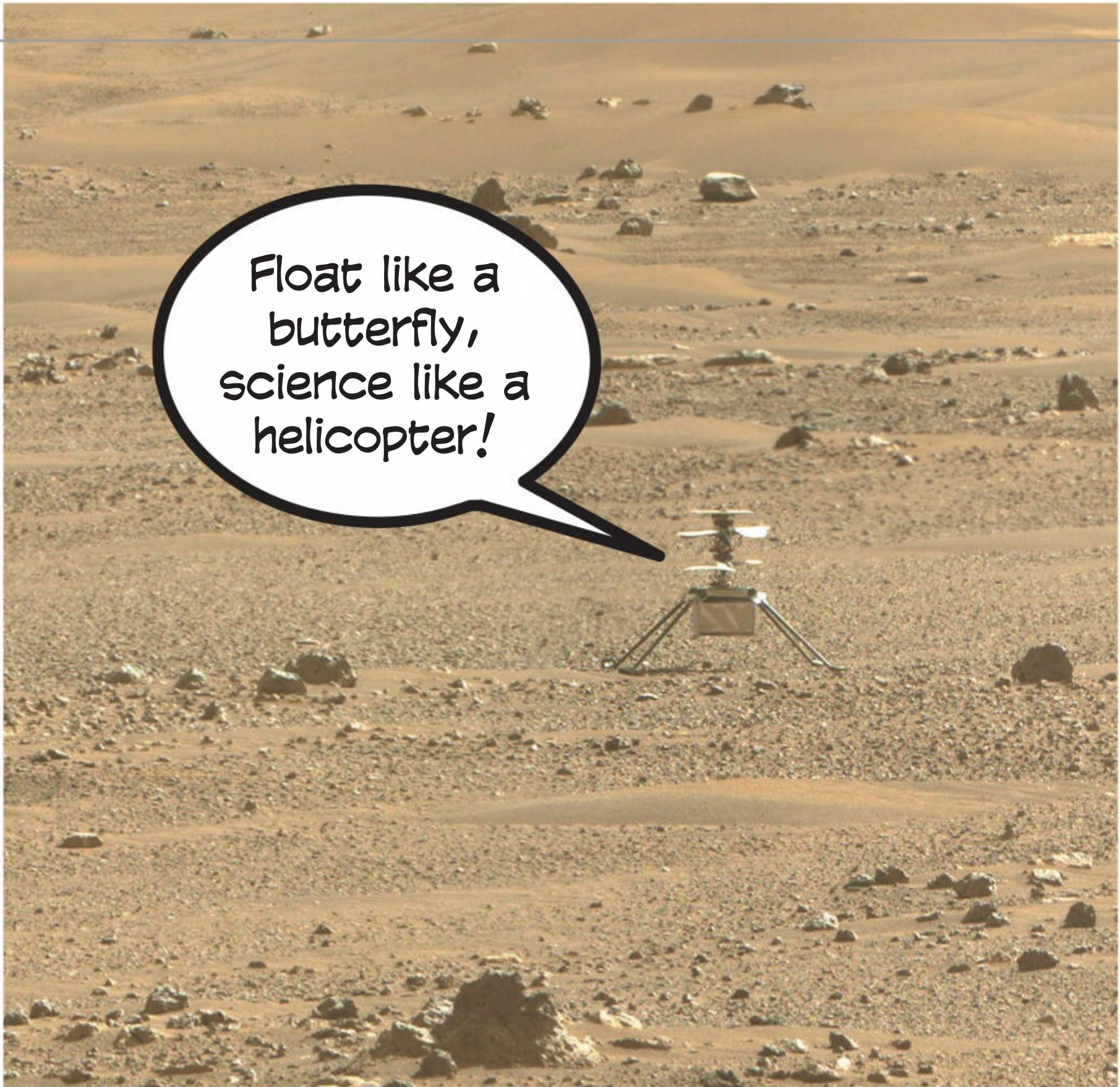
HAS ANYONE EVER TOLD YOU THAT BUGS ARE MORE SCARED OF YOU THAN YOU ARE OF THEM?

It makes sense. To a bug, you're a dangerous giant with squishy shoes. But a tiny centipede or spider (probably) can't hurt you.

But can bugs even get scared? Neuroscientists wanted to learn more. They put electrodes onto the heads of human volunteers, then measured the subjects' brain activity while they watched spiders in cages. The researchers also put tiny electrodes into the brains of the spiders. (They needed a large spider for their equipment to work, so they used a huge tarantula called the Goliath birdeater.) Then the researchers stomped around nearby while the electrodes measured the spiders' brain activity.

The measurements revealed roughly how much fear the humans and spiders felt, compared to when they were resting. The spider brains showed fear when humans were nearby. But the brains of humans watching spiders showed even more fear.





»UP IN SPACE

Where No Helicopter Has Gone Before

IN FEBRUARY, A ROVER CALLED PERSEVERANCE LANDED ON MARS.

It carried a passenger on its belly: a little helicopter named Ingenuity.

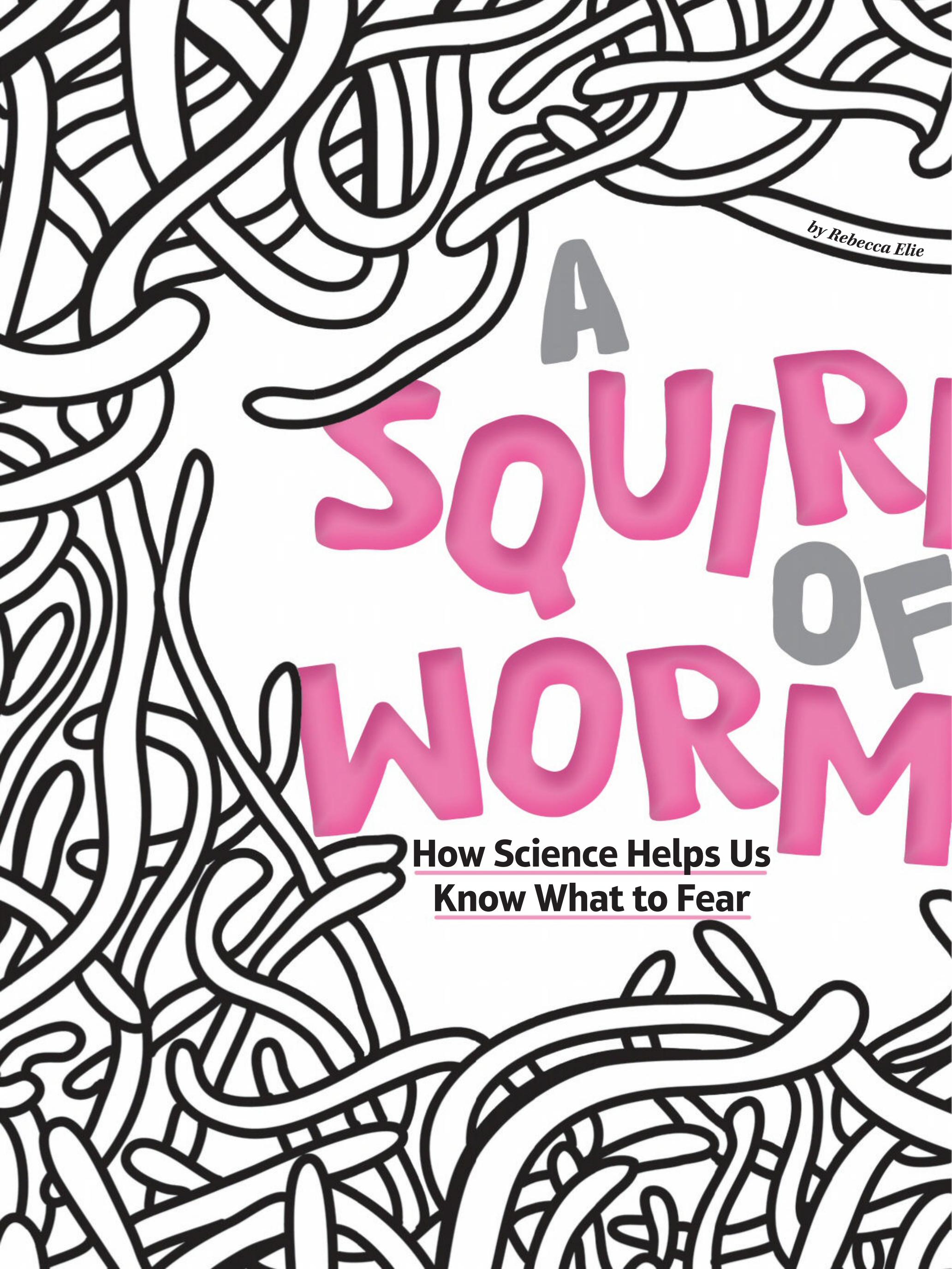
No helicopter or plane had ever flown on Mars before. The air there is very thin—just 1 percent of the thickness of Earth's atmosphere. That makes it hard for an aircraft to take off. Engineers handled this by making the Ingenuity helicopter as light as possible. It weighs just 4 pounds

(less than 2 kilograms) and is 19 inches (about half a meter) tall.

In short test flights, Ingenuity showed that it could fly on the red planet. It was only supposed to do experimental flights for a month, then go into retirement. But since the helicopter worked so well, NASA scientists decided to let it keep working and do some real exploring, just like its rover buddy.

That's the news!
Go to page 46 to see if you spotted the false story.





by Rebecca Elie

A SQUIRREL OF WORM

How Science Helps Us
Know What to Fear



Tapeworms are nasty little beasts. What if they came out of nowhere? For thousands of years, people had no idea where maggots and parasites came from. Curious people saw maggots wiggling on raw or rotten meat left out in the air—but how had they gotten there? Without microscopes or powerful magnifying glasses, there was no way to see the tiny eggs that flies laid in meat, which developed into maggots; or the even tinier eggs of parasites. Instead, teachers like Aristotle theorized that maggots, tapeworms, and other organisms were able to form from air or lifeless matter like dust and dirt. This idea is called “spontaneous generation,” or biogenesis.



WHAT IS AVAXHOME?

AVAXHOME-

the biggest Internet portal,
providing you various content:
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fresh magazines, hot games,
recent software, latest music releases.

Unlimited satisfaction one low price
Cheap constant access to piping hot media
Protect your downloadings from Big brother
Safer, than torrent-trackers

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But without knowledge of how these wriggling critters appeared, people naturally feared the parasites that made them sick and uncomfortable. The only treatments available were nasty drinks of bitter herbs that caused vomiting or pooping. Maggots eat dead, rotten meat, so they were despised as harbingers of death. There seemed to be almost no way to prevent the creatures from appearing.

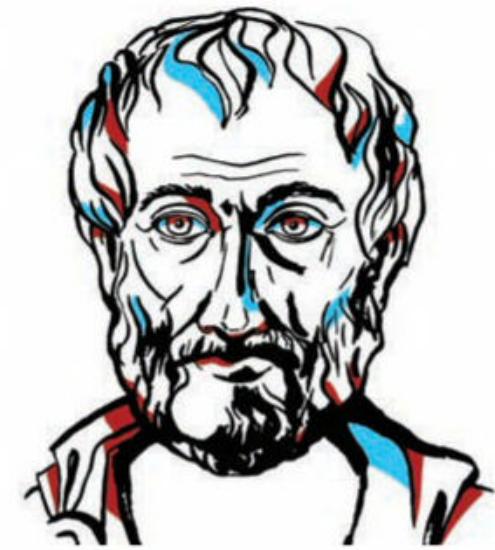
How to Make Mice

Researchers, such as the 17th century Dutch chemist and doctor Jan Baptist van Helmont, had performed experiments on spontaneous generation. But these experiments were not done in controlled environments. Van Helmont conducted a series of experiments with mice. He placed a dirty, smelly shirt in the opening of a vessel containing wheat (a mouse's favorite food in the 17th century), reasoning that since mice are dirty creatures they have to come from dirt. After about three weeks, he discovered that mice had appeared in the vessel! Satisfied, van Helmont wrote, "the reaction of the leaven [in other words, the dirt] in the shirt with fumes from the wheat will, after approximately twenty-one days, transform the wheat into mice."

Although many naturalists believed Aristotle and van Helmont's theories (some even believed that clams



spontaneously generated from sand, and crocodiles appeared from mud), the scientific community was beginning to loudly questioned the theory by the end of the 1700s. One experimenter, Francesco Redi, discovered in 1668 that maggots did not appear on raw meat exposed to air but covered with thin cloth. But some researchers still held on to the theory and wouldn't let it go. Louis Pasteur, a French scientist in the 1800s, didn't buy it. He performed controlled experiments to dispel people's beliefs (and fears) about spontaneous generation once and for all.



The Greek philosopher Aristotle (384–322 BCE) was so influential that his theories were still considered law in the 1800s.

Not So Spontaneous

Pasteur pointed out that van Helmont's experiment didn't actually work. Van Helmont's research was done in a way that simply allowed mice in by crawling through the open mouth of the vessel to eat the wheat inside. Pasteur had been experimenting with fermentation for several years. He'd discovered that grapes fermented due to natural yeasts on their skins. Sterilized grapes didn't ferment. If even tiny microorganisms needed a catalyst for them to appear, then more complicated animals like parasites or van Helmont's mice couldn't form from just air.



One of Pasteur's most famous accomplishments was vaccinating a 9-year-old boy against rabies in 1885. It was the first-ever rabies vaccine.



Tapeworms eggs are tiny, about 40 micrometers long. But the adult worms can be whole feet long.



Pasteur devised an experiment in 1859 that he hypothesized would answer his questions. He sterilized broth in a flask by boiling it, making sure no bacteria or animals were living in it. The flask had a long neck that bent downward, like a swan's neck. This shape allowed air to enter, but not particles like dirt or dust. After several days, the broth was growth-free. No maggots, worms, or other critters appeared. But when the flask was shifted so the neck faced upward, allowing particles to enter, the broth turned opaque. Mold and bacteria grew. Pasteur's experiment showed that what grew in the flasks had to come from outside the broth. If nothing was alive in a sterile environment, nothing grew. Dead things couldn't produce living things. There were no zombie germs or worms springing from

dead meat. Pasteur had overturned both the scientific theory and the public fear of spontaneous generation.

Germ Theories

Worms and parasites weren't the only thing Pasteur knew had to come from somewhere. His work with fermentation also proved that beverages like milk or wine were spoiled by colonies of

bacteria growing in the liquid—it was those bacteria that made people sick when they drank the spoiled liquid. Those bacteria were spread through poor hygiene and exposure to the air, just like in the flask experiment. Today, we no longer have to be afraid of pests appearing from nowhere. We know there's a good reason to not leave meat out on the counter, but it's not because the meat itself is creating maggots—it's because bacteria or pests might contaminate the food. We know to wash our hands to prevent the spread of disease. Pasteurization is used today to kill germs in things like milk (and notice whose name is included in the word)! And we know for sure that those dirty shirts under your bed aren't going to grow a swarm of mice overnight.

Rebecca Elie is a Michigan writer.



The Mystery of the Reappearing Anthrax

Louis Pasteur began studying anthrax in 1877. Sheep were dying of the disease in fields, and then buried where they'd died. Even if shepherds avoided these fields for years, when they returned their flocks would catch the disease and die. Some had the superstitious belief that the fields were cursed.

Pasteur found earthworms in the affected fields. The anthrax bacteria were carried to the surface by the worms, where they rubbed off on the grass the sheep ate and infected them. To prevent the spread of disease, Pasteur recommended shepherds burn the deceased sheep or bury them where no animals would eat.

In 1881, Pasteur created an anthrax vaccine and tested it on cows and sheep. After two inoculations, the unvaccinated and vaccinated animals were given a shot of the virulent anthrax on May 31st. On June 2nd, all the vaccinated animals were well. The others were already dead, or sick and dying. Pasteur's vaccine worked: now he had both a way to prevent the disease altogether.



FREEZE, FIGHT, FLY

by S. Cary

You're in the woods, on a camping trip with your family. After hiking and exploring all day, you're bedded down for the night... except you have to use the latrine.

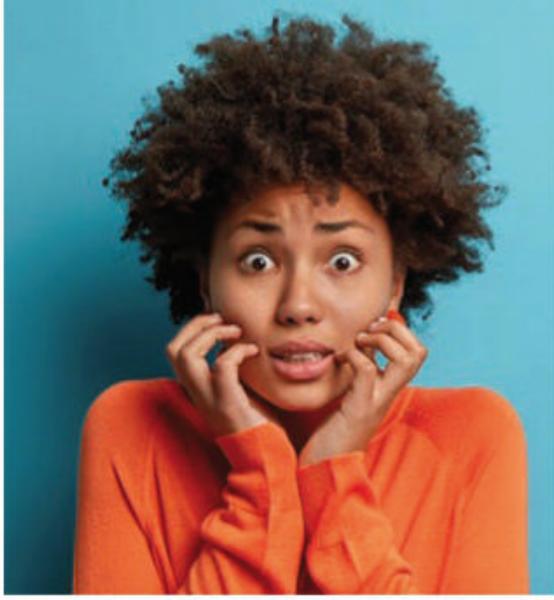
You creep out of the tent, careful not to wake your siblings, and head down the path. It's very dark outside, with only a little moonlight shining through the leaves. Your flashlight bobs in your hand, its beam bouncing off tree trunks and rocks.

Just as you're coming back from the latrine, there's a crash in the woods to your left. *What was that?!* A strange hiss cuts through the still night air. Your heart starts to pound. You start breathing faster. Goosebumps ripple out on your arms. Your eyes open wide.

Your body is doing some strange things! Why? Because you're scared—maybe even terrified. It's not you being a scaredy-cat: you can't help it. Your body's reactions to fear are some of the most deeply instinctive reactions we have, passed down to us by millions of

years of evolution to keep us safe from predators. You can see the same behaviors in many other animals, from your pet cat when she's afraid of the neighbor's dog, to the sparrow escaping a hawk in your yard. Like yours, their bodies prepare them at a moment's notice to protect themselves.





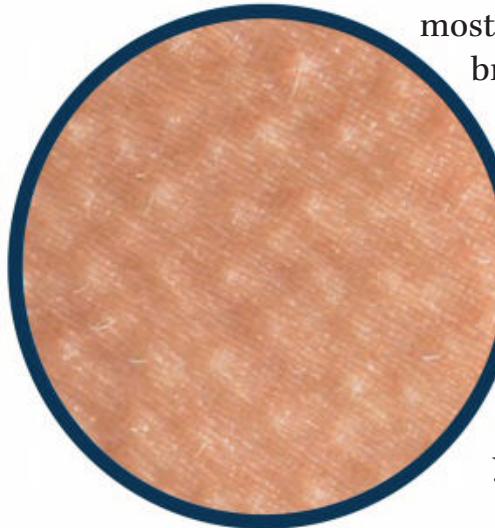
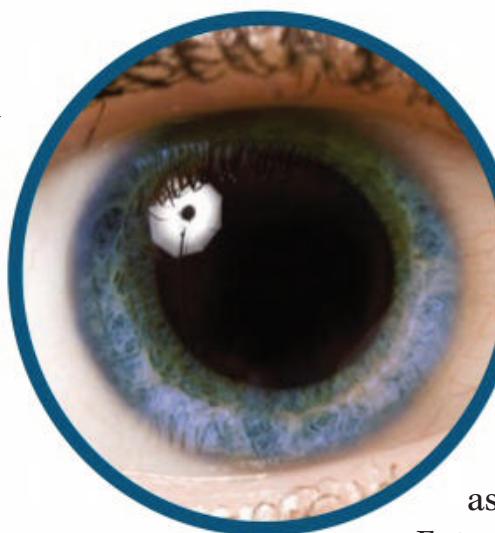
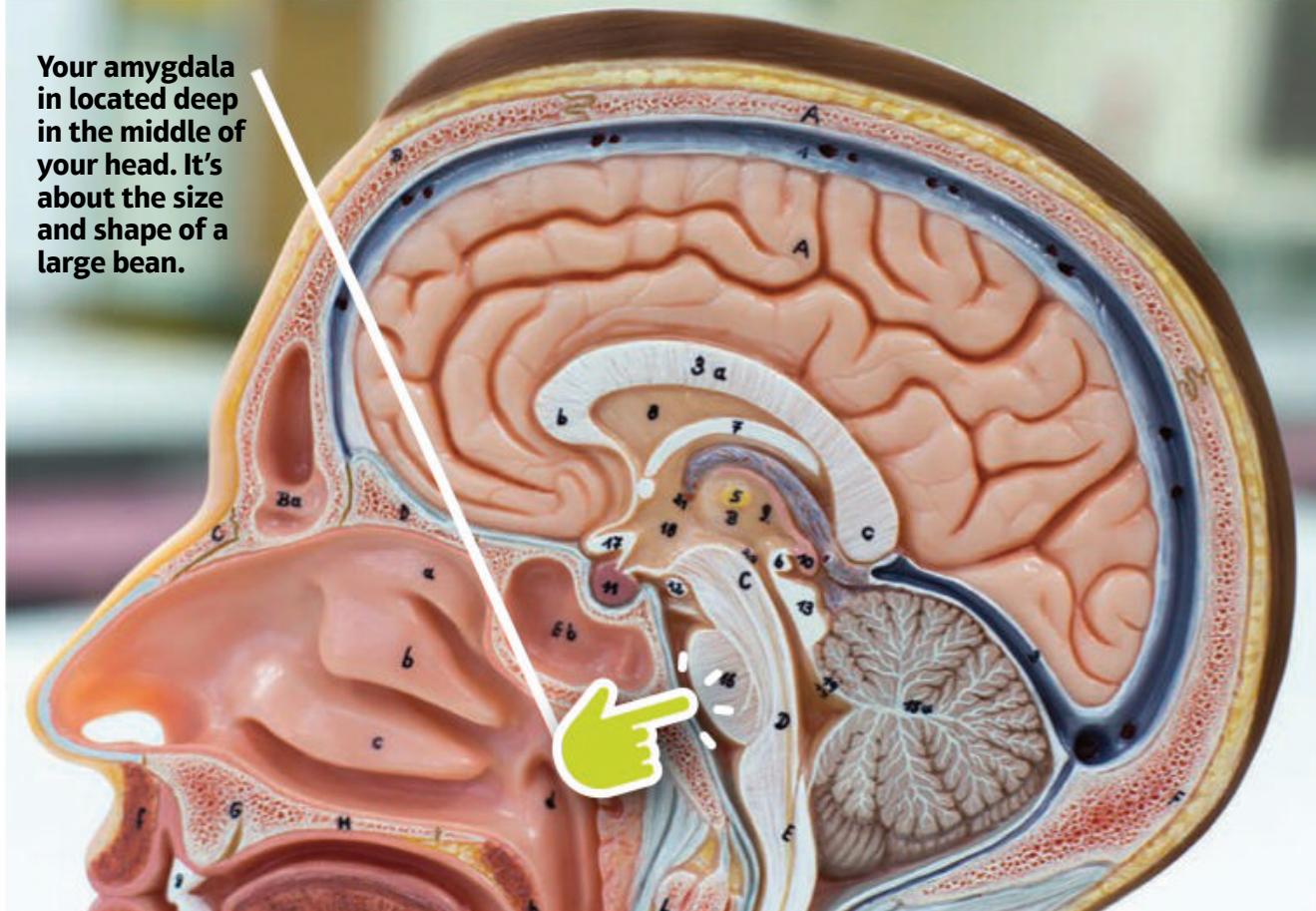
FREEZE

You're standing perfectly still on the forest path. The thought "I should stand still" didn't cross your mind, so why was this your first instinct? Most predators have excellent vision when it comes to seeing movement—they can spot small animals flitting by in the underbrush. But they are not so good at noticing things that stand still. Freezing in place means that a larger predator might not even notice you and simply pass you by. Prey animals like rabbits, deer, and mice rely primarily on the freeze instinct for protection. They usually freeze for as long as they can, then flee if the other animal gets too close.

FIGHT

While you're frozen (desperately hoping your older brother is playing the worst prank ever), your body is getting ready to fight. A section of your brain called the amygdala kicks into gear, releasing a flood of hormones like adrenaline and cortisol. Adrenaline courses through your bloodstream, making your heart beat faster. The increased heartbeat pushes more blood to your muscles, making them strong and tense—ready to hit back if something comes at you. The cortisol flooding your body raises your blood sugar to give you an extra burst of energy. Goosebumps make your hair stand up, so you maybe look bigger and more intimidating. (It works for cats and dogs!) Your eyes open wide and your pupils get bigger so more light can enter your eyes, helping you see better—especially in the dark.

Goosebumps
fluff up hair o
look bigger—
it's why cats
and dogs get
suddenly
fluffier wh
they're scared!



Your amygdala is located deep in the middle of your head. It's about the size and shape of a large bean.

Your pupils dilate so that more light can enter your eye, helping you see better when there's not much light around. It's the same reason your pupils get bigger when you enter a dark room.

FLEE

If fighting doesn't seem like a good idea, you're ready to run from danger. That extra blood your heart is pumping into your muscles also helps your legs move strongly and quickly. You start breathing fast and hard as adrenaline makes your airways expand and your lungs kick into high gear, trying to get as much oxygen as possible into your bloodstream. Extra oxygen enables your body to work faster—and most importantly, move faster. Blood flow to your brain increases as well, helping you to think quickly; you need to be able to spot potential escape routes. Even you were thinking about a snack just moments ago, your hunger pangs disappear when you're scared. Your body doesn't want you distracted if Sasquatch is waiting for you in the bushes. Your excretory system—the parts of you that tell you when you need to pee—turns off. Even your saliva dries up, so you don't need to swallow. The noise gets closer. You swing your flashlight round to where it's coming from and see...a possum, trundling across the forest path. When it spots you, it freezes. Its hair puffs up and its sides heave noticeably as it starts to breathe faster.

You take a few deep, calming breaths to bring your heart rate back to normal. "Nothing to be scared of here," you tell your new forest friend. Then you hurry back to the safety of the tent and your brother's snores.



CAPTCHA GOT YOUR TONGUE?

You arrive at a favorite website and enter your username and password. But that's not enough to get you in. You also have to decipher a wiggly word or two and type in what you think the letters are. What's that all about?

This extra step is designed to guard against automated computer programs, or bots. If they snuck into these sites they might buy up the best seats for a rock concert, for example, or farm for resources in an online multiplayer game so quickly that no human could keep up. The idea behind the little puzzle is that, even though computers can

do all sorts of amazing things, some tasks that are easy for people are still remarkably hard for computers. For example, computers have trouble reading distorted text or identifying pictures.

This kind of security puzzle is known as a CAPTCHA. The word was coined by Luis von Ahn, Manuel Blum, Nicholas Hopper, and John Langford of Carnegie Mellon University. It stands for "Completely Automated Public Turing Test to Tell Computers and Humans Apart."

A Turing test, named for computer pioneer Alan Turing,

Alan Turing was a mathematician and computer scientist. He's often considered the "father of artificial intelligence."

is one in which a person asks questions of two hidden participants. One of them is a human, and the other is a computer. The interrogator's job is to figure out from the answers which one is which.

The Carnegie Mellon scientists invented CAPTCHAs to solve a practical problem. Companies such as Google allow people to sign up for free email accounts. However, advertisers who want to send out mass mailings (spam) can use bots to create hundreds of accounts automatically in a short time. They can then use those accounts to send out spam.

Coming up with the right puzzle to stop a bot can be tricky. Sometimes the words are so distorted that even you, the human, can't tell what all the letters are. And what about computer users who can't see? At the same time, computer programs are getting better and better at deciphering images. So CAPTCHAs that once worked to keep bots out may no longer be effective.

In a neat twist, the Carnegie Mellon group is now also using one type of CAPTCHA in a crowdsourced project to help digitize books. The distorted words are real examples from the pages of books that have just been scanned. Your answers help clean up the text so that other people can read it easily—no puzzling required.

You can find out more about CAPTCHAs at captcha.net.

The Fright Stuff

THERE'S NO NEED
TO FEAR FEAR: IT'S
A GOOD THING, FOR
ANIMALS AND FOR
THE ENVIRONMENT.

by Jude Isabella



A door is open. The bandit leaves the dead squirrel he's been gnawing and trundles across the threshold. He pauses, cocks his head, and scratches his side. No sound comes from inside the house, and he continues down a hallway, toward the smell of food.

The scent of an unprotected loaf of rye bread catches his nose. *Yum.*

Crumbs scatter across the shiny wood table. When most of the bread is gone, it's time for dessert. He reaches into a wooden bowl, picks up a foil-wrapped chocolate, unwraps it, and pops the candy into his mouth. When he hears a gasp, his head swivels toward the sound. He stares, his eyes—surrounded by a black mask—unblinking.

Human and raccoon gaze at each other. The raccoon climbs down from the table and scoots past the two-legged intruder, his behind wiggling as he scampers back down the hallway and out the door.

This raccoon has little fear of humans. In fact, like most raccoons in cities and other places without serious predators, he's taking advantage of living fear-free. He forages day and night for bird eggs, small animals, or a loaf of rye bread held captive in a plastic bag.

For many raccoons, fearless is the new normal. Is that a good thing or a bad thing? Well, it depends.





Stressed sparrows spent more time on their nests than searching for food. Fear comes naturally to these birds—they're afraid of raptor silhouettes even if they've never seen them before.



Fearless and Fertile

Michael Clinchy is an ecologist at the University of Victoria in Canada. He has spent years figuring out what happens when an animal learns appropriate fear of predators—and what happens when an animal loses it.

Clinchy and Liana Zanette, an ecologist at the University of Western Ontario in Canada, studied fear in song sparrows. They set up an experiment on Canada's west coast, on islands that are part of the Gulf Islands National Park Preserve. They wanted to test whether birds without predators, but with a fear of predators, had fewer chicks. From March to July 2010, Zanette, Clinchy, and their colleagues studied 225 song sparrow nests.

Song sparrows nest on the ground, so the scientists protected the nests with electric fences to stop predators like raccoons from eating eggs or nestlings. They also draped netting over the nests to protect them from bigger flying predators, such as hawks. They set up speakers around the forest. Some sparrows regularly heard the sounds of predators (raccoons, hawks, owls, crows), while others heard non-predators (seals, geese, hummingbirds, loons).

"We showed for the first time in any wildlife, in any bird or mammal, that the fear itself can actually cause the prey to have fewer

offspring," Clinchy says. "They are more stressed when there are more predators around."

The scared birds spent more time sitting on their eggs and less time foraging for food. They were so stressed that they had 40 percent fewer chicks than the birds that heard non-predator calls. Fear, then, is bad for fertility.

Clinchy is now investigating raccoons on the same islands. The ring-tailed marauders have no serious predators and are fearless, foraging for crabs and fish on the beach at all hours of the day and night. Do these relaxed, well-fed islanders have more young (called kits) than fearful raccoons living in places with top predators, like wolves and cougars? Clinchy thinks so.

Learning to Be Afraid

Scientists have tried all sorts of experiments to figure out how much of fear is "innate"—something an animal is born with—and how much is learned. For example, nesting songbirds are scared of silhouettes of hawks, even if they've never experienced a hawk predator. And crawling insects instinctively avoid the light, where they're more likely to be seen and eaten.

John Laundré, assistant director of the James San Jacinto Mountains Natural Reserve at the University

of California, Riverside, studies the connection between prey and predators. "In adults of all vertebrates (animals with a backbone), there's a lot more learning than we expect," Laundré says, in spite of the examples above. "A lot of fear comes from experience."

That masked kitchen raider, the city raccoon, has learned that humans are no threat. We're a source of food, lots of food—even chocolate. But being fearless has a cost too. Animals that haven't learned which animals can kill them are more likely to die.

"You live or die, and if you make the wrong choice, you're dead; you don't have any more kids," Clinchy says. That's what happened to two species of flightless birds, the dodo and the giant moa.

Dodos lived on Mauritius, an island off the east coast of Africa. Giant moas lived in New Zealand. Like many birds





The flightless dodos went extinct in the 17th century. Sailors hunted them for meat, introduced predators to their islands, and accidentally destroyed their habitat before they had time to adapt.

that settle on islands, each species lost the ability to fly as it evolved. It made sense, says Mike Dickison, who's an ornithologist and curator of natural history at Whanganui Regional Museum in New Zealand. Flight takes a lot of energy and is only necessary if an animal has a predator that lives on the ground.

That doesn't mean flightless birds have no predators. Penguins, for example, fear predators in the sea, not on land. Giant moas probably feared giant eagles. If dodos had a predator, it too was likely a flying bird. Then a ground predator—humans—showed up on Mauritius and New Zealand. The birds had to learn to be afraid or die.



Nightlights for Lions

Richard Turere grew up in a village at the edge of Kenya's Nairobi National Park. Back in 2009, when he was nine years old, his job was to bring the cattle in at night and lock them into a stable called a *boma* (a typical job for a Maasai boy). Each month, however, lions killed some of the family's cows, sheep, and goats. Then in 2011, at age 11, he decided to do something about it. Lions avoid homes where someone is up and walking around with a flashlight. Richard thought he could replicate the effect without staying up all night clutching a bobbing flashlight in his hands. He tried a couple of different methods, including kerosene lamps and scarecrows, but neither worked. Then he scavenged LEO lights from broken flashlights and wired the bulbs to an old car battery. The lights automatically flashed out toward the darkness, giving the impression that someone was walking around with a flashlight. It worked. No more lions bothered the Turere household. When the neighbors noticed the Turere's livestock were no longer being eaten, other villagers installed the same system in their bomas. From there the idea spread to other herding communities.

The Kenya Wildlife Service estimates that only about 2,000 lions are left in the country, which loses about 100 lions a year. By keeping humans and cats out of conflict, Richard's affordable invention saves humans, livestock, and the endangered lions.

"A bird being chased and attacked by humans that gets away can learn fear—but they have to get away, and they never do," Dickison says.

"If there's enough time, evolution can select for the birds more scared of humans. But they need a few generations for that to work."

Dodos and giant moas weren't stupid; they just ran out of time. Dodos went extinct by the end of the 1600s and giant moas by the end of the 1400s. For them, a little fear would have been a good thing.

The Landscape of Fear

Fear is a part of life. Even a predator becomes prey at some point: when it's young, old, or sick, for example. Or it might be vulnerable during the day but not at night.

In the sea, penguins have to contend with orcas, leopard seals, and sharks. From the air, birds called skúas prey on chicks. Yet penguins fearlessly approach humans on Antarctica, since they have no natural ground predators.





Lions prefer to avoid hunting on the night of the full moon—but they are very hungry the night after.

There may be some fears that young animals learn almost immediately because in the past their ancestors had to avoid specific dangers or predators. Human babies, for example, begin to fear heights early in their development. And primates (monkeys and apes, including us) seem primed to be scared of slithery animals with forked tongues—like venomous snakes.

When researchers showed snake pictures to lab-raised monkeys that had never seen a snake in real life, the monkeys noticed those pictures much more quickly than they noticed images of flowers. While primates might not be born with the fear, they seem predisposed to learn it.

“Growing up is a weeding-out process,” Laundré says. If animals see their siblings get killed, or if they are almost killed themselves, “they quickly learn their landscape of fear.”

Laundré studies fear landscapes through the eyes of a prey species. Every day, a prey species has to face the threat of becoming another animal’s dinner. But risk varies over the course of a day, or month, or season. Animals adjust their behavior

The Maasai people sometimes come into conflict with lions, hunting cats that kill cows from their herds. Lions have learned to fear people in part because of this.



to deal with this risk: for example, an animal might change how it uses its habitat based on whether its main threat is a flying predator, a nocturnal predator, or even a mechanical predator limited to roads. Humans evolved in Africa before spreading around the world. This means our landscape of fear included big cats. Today that legacy can still be seen in cultures around the world, even in places where no lions, tigers, or leopards live.

Craig Packer has studied lions in Kenya, Tanzania, and South Africa for 36 years. He thinks the scary stories humans have created about the full moon might be tied to our past experiences with big cats.

Humans see poorly in the dark; big cats see well in the dark. It’s under cover of darkness when lions are more likely to attack a human. “During daytime, lions seem lazy, and they’re also timid around people. But once it gets dark they’re like a different

species,” Packer says. “They’re more alert and bold around people. Darkness is their kingdom; it’s when they are at their full powers because they have such good night vision.”

Having evolved with big cats in our environment, humans fear darkness instinctively, Packer says. This was especially the case once most societies stopped living as hunter-gatherers and put down roots, planted crops, and moved indoors. A full moon in a clear sky—when it’s bright enough to read a book—keeps the big cats away. In an environment with lions, the night of the full moon is the safest of the whole lunar cycle. Yet when Packer researched lion attacks on humans, he found that attacks peak about three or four days after a full moon. It seems that after about a week of bright night skies—the three or four days before and after a full moon—cats are hungry.

“It’s like the full moon is the perfect dividing line in the lunar cycle,” Packer says. The creepy feelings we get from a full moon may not be about the full moon itself; rather, the moon is a signal that dangerous nights are ahead. Lions, meanwhile, have learned to fear people—such as the Maasai, livestock herders who live in Kenya and Tanzania. The Maasai will defend their cattle against feline raiders with clubs and spears.

So what to do about uninvited guests like urban raccoons, whose landscape of fear only includes busy streets with lots of cars?

Fear 2.0

Researcher Suzanne MacDonald at York University in Toronto, Canada, studies urban raccoons. She found that in Toronto, raccoons live within territories of about three city blocks. Their boundaries are roads with

lots of traffic. Toronto-area raccoons are so bold that they break into the raccoon enclosure at the Toronto Zoo to chow down with their captive cousins. The zoo traps the gatecrashers, vaccinates and neuters them, then returns them to the same area where they were trapped.

“We have so many on site, this is to help control numbers,” says Maria Franke, mammal curator at the zoo. “If we were to remove them, another raccoon would just take over their territory.”

Barking dogs make raccoons nervous, since dogs are one of their natural predators in the wild. But in cities, dogs are kept on leashes and in yards, so they can’t hunt. Raccoons quickly learn to avoid places where dogs live or gather—raccoons might not live in a yard with a dog, but they will happily live next door. Plus, some people find raccoons cute and encourage contact by feeding them.

But ultimately, animals like raccoons that don’t have predators or a fear of them can be bad for the environment. Clinchy and one of his students, Justin Suraci, have shown what happens when fearless, predator-free raccoons move

into a new environment. “They eat everything in sight,” Suraci says.

In his research on a Gulf Island, Suraci observed raccoons foraging day and night on the beach. In fact, they’re eating so many red rock crabs, clingfish, polychaete worms, and other intertidal species that they’re putting the island’s biodiversity at risk. This worries Parks Canada, the group that looks after the Gulf Islands National Park Preserve. In other national parks, wolves and cougars are present and feasting on raccoons galore. This in turn protects other creatures.

Suraci played recorded sounds of predators, like cougars and dogs, and non-predators, like seals. The only sound that scared the raccoons was barking dogs. “If you let loose a cougar on some of these islands to reduce the raccoon population, it would explode” from overeating the fearless animals, Clinchy says.

Since releasing a cougar isn’t an option, Clinchy says the best way to manage raccoons is probably re-instilling a sense of predator fear. That’s easier said than done. In the meantime, Parks Canada is keeping a close watch on raccoons at another national park, Gwaii Haanas. This is a remote island chain where raccoons are an introduced species, without predators, and they feast on seabird eggs and nestlings. Officials are also watching the Gulf Islands raccoons closely.

As for urban raccoons, maybe humans should be less friendly with masked raiders. Fear, after all, can be good for everyone.

Jude Isabella is a science journalist and author living in Canada.



TERRIFYING TERMINOLOGY

Everyone is afraid of something, and usually they should be. Things like tornados, speeding traffic, or wild animals are dangerous. They should be treated with caution. However, fears of some objects or situations—being afraid of water, or dogs, or heights—are called phobias. They’re considered irrational fears because the fear is caused by something that’s not necessarily dangerous. Some phobias are the result of bad experiences or arise when people anticipate something bad happening. Sometimes there’s no particular reason for them. Whatever the cause, though, phobias cause real fear for the people who have them, even if they don’t seem so scary to other people.

Phobia comes from the Ancient Greek word for fear, *phobos*. Most scientific terms for phobias also come from Ancient Greek. Here’s a list of some common and not-so-common phobias. Can you figure out what fear each terrifying term is referring to?

2. Astrapophobia



3. Logophobia



13. Selenophobia



10. Ophidiophobia



12. Photophobia

OH, JUST SOME RANDOM ANCIENT GREEK WORDS:

arakhne: a spider

astrape: lightning

dendros: a tree

haphe: touch

homikhle: fog or mist

iatros: a doctor

katoptron: a mirror

logos: a word

musos: uncleanliness

ophis: a snake

ornis: a bird

phos: light

Selene: a moon goddess

thalassa: the sea



ANSWERS: 1. spiders, 2. thunderstorms, 3. mirrors, 4. trees, 5. being touched, 6. fog, 7. doctors, 8. talking, 9. germs or dirt, 10. snakes, 11. birds, 12. light, 13. the Moon, 14. the sea



By Abha and Deepa Jain

FRIGHTENED OF FOIL

ARE YOU THE KIND WHO STICKS TO THE SAME OLD TYPE OF CHIPS WHILE YOUR FRIENDS ARE BUSY TRYING OUT THE LATEST PINEAPPLE-AND-CINNAMON-AND-BARBECUE FLAVOR? You aren't alone. Many people dislike new things. For some, this isn't because they are extremely fond of their old possessions or typical favorites. They have neophobia: they're frightened of trying out anything that is novel. That includes new types of food, sports, or clothes. In Greek, *neo* means new, and *phobia*, fear. Some people who dislike new things are just reluctant to change their routine. But those with neophobia become so worried that they go to great lengths to avoid new foods, objects, or situations. For such people, neophobia is a serious medical problem.

NEOPHOBIA DOESN'T JUST AFFECT HUMANS, EITHER.
Many animals seem to shy away from novelty as well.

They are particularly cautious about things they think they can eat. An unfamiliar food may taste bad, or worse, be poisonous. So being wary of new foods, like unknown beetles, is a good strategy...sometimes. That's because in other cases, the food may be extra-nutritious. Avoiding that yellow-and-pink beetle may mean losing out on a yummy and nutrient-rich grub snack.

TO EAT NEW FOODS OR NOT TO EAT, THAT IS THE QUESTION. Animals tackle this dilemma in different ways. One group of animals, called generalists, consumes a wide range of foods. Some generalists, like raccoons, eat practically anything they can get their paws on. For others, though, only certain types of food will do. Koalas, for example, eat the leaves of (and only of) the eucalyptus tree. These animals, called specialists, have a much more restricted diet than generalists.

WHICH WOULD YOU PREDICT TO BE MORE NEOPHOBIC, SPECIALISTS OR GENERALISTS? Test your hypothesis with the following experiment, in which you provide your neighborhood critters with a new object, a shiny ball of foil. For them, the ball is a new object that they may want to explore to see if they can eat it.

EQUIPMENT

- » unused aluminum foil
- » food-grade activated charcoal
- » vegetable oil
- » white paper
- » 9"x12" rectangular piece of cardboard
- » packing tape or glue
- » 1" masking tape
- » camping stakes or garden staples

1. Paste the white paper on the cardboard. Crumple the foil into a fist-sized ball. Attach it to the center of the paper with packing tape or glue (like in figure 1).
2. In a bowl, add the charcoal and vegetable oil in equal amounts. Mix well to make a paint (as we did in figure 2).



FIGURE 1

3. Stick masking tape along the sides of the white paper to form a border. Paint the tape with the charcoal-oil mixture—try to not leave any gaps. When an animal or a bird steps on the painted tape, the soles of their feet pick up the paint and leave footprints behind when they walk on the white paper. This allows you to track visitors you don't see (as in figure 3).



FIGURE 2

4. Check the forecast to confirm there'll be mostly dry weather for the next week. If it rains, the paper and cardboard will get soggy. Carry the setup outside to a spot your neighborhood critters congregate: under a feeder, by a birdbath, or somewhere else you've seen animal activity.

CRITTER/ TRACK	GENERALIST/ SPECIALIST		CRITTER/ TRACK	GENERALIST/ SPECIALIST	
CAT 	SPECIALIST		OPOSSUM 	GENERALIST	
DOG 	GENERALIST		MOOSE 	SPECIALIST	
FOX 	GENERALIST		DEER 	SPECIALIST	
RACCOON 	GENERALIST		BEAVER 	SPECIALIST	

CRITTER/ TRACK	GENERALIST/ SPECIALIST		CRITTER/ TRACK	GENERALIST/ SPECIALIST	
OTTER	SPECIALIST		CROW	GENERALIST	
RAT	GENERALIST		BALD EAGLE	GENERALIST	
SQUIRREL	GENERALIST		TURKEY	GENERALIST	
FROG	GENERALIST		ROOSTER/HEN	GENERALIST	

5. Drive camping stakes or garden staples through the cardboard's corners to pin it to the ground.

6. Check daily for black paint tracks on the white paper around the foil. Replace the white paper and tape as necessary. Use the track guide to identify some tracks. Watch your setup to see if you catch any activity, and record your first findings on the chart.

Abha and Deepa Jain are a twin writing team. They are *probably* not afraid of foil.

Some questions to chew on:

- » What creatures visited? Why do you think any specialist species came? Think about the track patterns: did the critters walk straight to the foil or circle it? What does this suggest about how they viewed it?
- » Assume some animals felt nervous when they saw the shiny foil. Can you rank the visitors from less to more neophobic by how many tracks around the foil you find? Do you think you *can* measure actual fear?
- » Some critters' visits may not be recorded. Can you think of any you might not see?
- » This setup only considers animals that can see the foil. What about animals that hear better than they see? Can you come up with a way to correct this problem?



FIGURE 3

TRACK NUMBER	NUMBER OF FOOTPRINTS	TRACK PATTERNS	POSSIBLE SPECIES	GENERALIST OR SPECIALIST
(EXAMPLE)	10	WALKED STRAIGHT TO THE FOIL	SQUIRREL	GENERALIST
1				
2				
3				

Q:

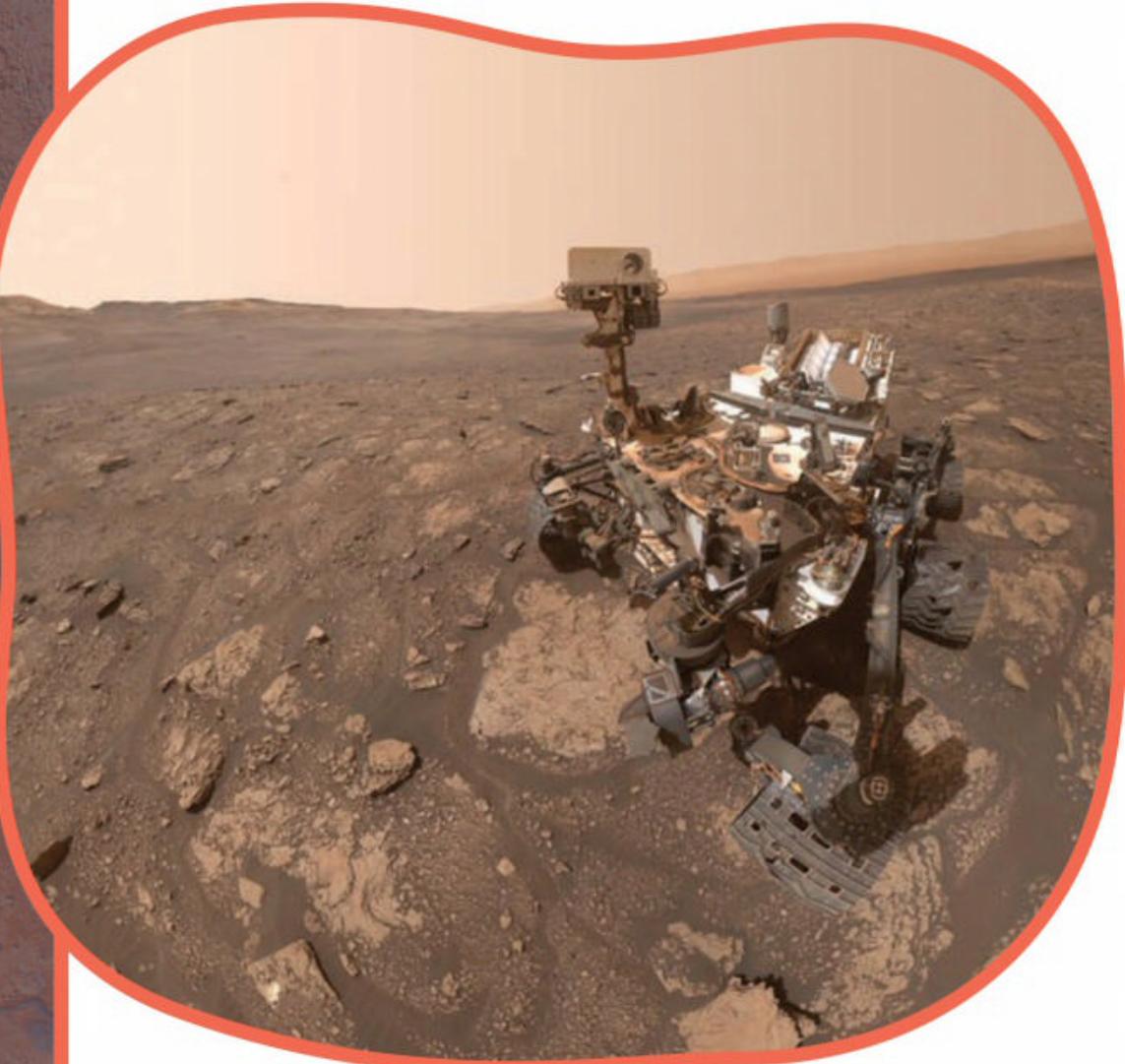
Was there life on Mars ever? And if scientists found a way to live on a different planet, would they tell people they could live there and make it a new Earth?

—Julian H., age 11

A: Chris McKay, a planetary scientist at NASA Ames Research Center, has been wondering about

these two questions ever since he learned that Mars wasn't always the frozen wasteland it is today. Billions of years ago, "Mars had rivers and lakes and oceans," McKay says. To keep all that liquid water from freezing, Mars must have also been a lot warmer, with a thick atmosphere trapping the sun's heat. In short, McKay says, ancient Mars "was very much like Earth." So could life have evolved there too?

McKay thinks it probably did, since life (at least in its Earthling form) is known to thrive wherever there is liquid water. But he still doesn't know for sure. NASA's Curiosity rover is on the surface of the red planet right now, looking for signs of ancient (likely microbial) Martians. So far, it has found one good sign: organic molecules, or chemicals that contain carbon. You can't have



life without organic molecules, McKay explains. But you can have organic molecules without life, as often happens on meteorites. Curiosity can't tell the difference between organics created by past Martians and organics brought to Mars by meteorites crashing onto the planet. To figure it out, scientists will have to do more tests.

But for the sake of your second question, let's say scientists do discover that there was once life on Mars, and that it died when the planet lost its atmosphere and froze. For McKay, the next step is obvious: we should try to bring it back.

The process of turning another planet into a world that could support life is called "terraforming," and it would actually be pretty easy to do on Mars, McKay says. All you'd have to do is warm it up by pumping greenhouse gases into the atmosphere—just like we're doing on Earth. "On Earth, we

would call it pollution. On Mars, it's called medicine," McKay says. Within 100 years or so, Mars would be warm enough to support the kind of life it used to have. If any Martian microbes are still frozen on its surface, they might even start growing again, McKay says.

But don't start packing your bags for Earth 2 quite yet. For one, the restored Martian atmosphere wouldn't have enough oxygen for humans to breathe. Anyway, "making homes for humans is not really what terraforming Mars is about," McKay says. If there are native Martians, "then in my view they own the planet. If we terraform it, we should terraform it for them."

—Lizzie

Have any questions?

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**GIVING
HAPPY
FATHER'S
DAY**



**THE
FATHER'S
DAY**



How Hypnosis Can Help Beat Needle Phobia

by Alison Jarman

When Dr. Allan Cyna meets a child who is afraid of needles, he doesn't talk about pain or sharp things. Instead, he might talk about ice cream.

He might ask them to imagine walking to an ice cream parlor and choosing their favorite flavor. Then he'll ask if they've taken a bite and if it tastes as good as last time. When they can almost feel the ice cream dripping down their chin, he will ask if it's OK to take their arm and put in an IV, an intravenous needle that leaves behind a small plastic tube for giving medicine. The patient typically doesn't care. All they can think of is the sweet taste of chocolate chip or cookies n' cream.

This state of mind is actually a form of hypnosis. It isn't mind control, like you see in the movies. Hypnosis is more like being invited to be super focused on one thing while another part of your mind is free to accept suggestions—like the idea that you can cope with this needle better than you think. People can also learn to hypnotize themselves, which can be a powerful skill.

Turning the spotlight on hypnosis

Dr. Cyna is an anesthesiologist, a doctor who keeps people asleep and safe during surgery, at the Women's and Children's Hospital in Adelaide, Australia. He compares hypnosis to going into a dark room and switching on a flashlight. "What you're conscious of is where the light is shining," he says. During hypnosis, positive thought can act as that shining light. As you become more immersed in positive thoughts, the rest of the room—or the doctor putting in the IV—fades from your awareness.

Hypnosis usually starts with a phase known as "induction," an invitation to a deeper state of suggestibility. Though not everyone can be hypnotized, kids are often champions at it; especially between age four and ten, when imagination and play are top priority. Have you ever been reading or playing a game you were so into that you didn't notice your parents calling your name? That ability to be totally absorbed makes it more likely you can be hypnotized.

Dr. Cyna is one of a growing number of doctors who use hypnosis to help patients cope with medical procedures. About one in four adults fear needles, and for some, their fear is so intense that they avoid going to the doctor at all. This is a major problem when they need life-saving treatments.

David (not his real name) is a teenager who had a blood clot in his brain. He needed an injection every week to help



the clot dissolve. For a long time, David was so needle-phobic he had to be sedated in the hospital for a procedure that took two minutes and normally could be done at home. Then his doctor got him in touch with Dr. Amanda Stock, a pediatric emergency physician at the Royal Children's Hospital in Melbourne, Australia. She has a passion for hypnosis. "He wanted to be able to conquer the needle phobia," said Dr. Stock.

Needle phobia: is it in the blood?

Needle phobia is a little different from other phobias. When most people meet animals they're afraid of, like spiders or snakes, or frightening situations like heights or tight spaces, their fight-or-flight response takes over. Their heart rate



You might have seen hypnosis in movies—a hypnotist moves their hands mysteriously, or swings a gold watch in front of someone's eyes. The hypnotized person moves slowly, like they're in a trance. But that's just in the movies. Real hypnosis is much less dramatic.





Patients being hypnotized usually sit or lie down somewhere quiet and calm. Their doctor might gently hold their hand for them to focus on.

and blood pressure increase to generate the energy for a quick escape. Many needle phobics get that first increase—but then their heart rate and blood pressure fall, leading to fainting, sweating, or nausea.

Needle phobia sometimes runs in families. The phobia can be inherited, but it can also be learned as you grow up, maybe by watching your parents react to needles. The good news is that being calm is also teachable. Children who have calm parents with them during medical procedures are less likely to feel pain or distress.

Driven to distraction

The language a doctor or nurse uses with needle-fearers can have a big effect. Using words like “safe” and “comfortable” coach a patient’s brain to expect good feelings. Sticking to positive language is important: telling someone “this is going to hurt” really increases the chances that it will! But it’s also important not to lie and say there will be no pain—that’s why doctors often tell patients they’re going to feel a “pinch.”

Distractions like reading a favorite book or watching a YouTube video give people something to focus on other than the needle. Physical distraction also helps to reduce the pain of injections. You know how a nurse sometimes rubs your arm just before you get a shot? That’s a way of tricking the brain by firing up nerves that respond to dull pressure rather than sharp pain and drowning out the “ouch” signal.

Hypnosis takes distraction to a whole other level. In needle-fearers, it can distract them from the anxiety and fear that have become linked in their mind to needles. This makes it easier to have injection without feeling as bothered by it. Brain scans show that the anterior cingulate cortex (which curves like a cupped hand around the deeper parts of the brain) lights up under hypnosis. This area of the brain has a role in toning down the negative feelings that can come with pain.

Learning self-hypnosis

Though it is often easier for a doctor to guide their patients through induction and hypnosis in hospital, people can learn to do it for themselves at home. One technique Dr. Cyna teaches is called “switch-wire imagery.” He asks his patients to imagine different-colored wires running throughout their body—say, a blue one going to their leg and a red one to their arm. Just like the electricity wires in their house, each one has a button which they can turn on and off. When they turn off the red switch, he tells them, the arm won’t work. This means they can’t move their arm or feel the pain of a firm pinch.

After practicing at home, they come back to the hospital for their procedure. First, Dr. Cyna will lead them through the induction phase by taking them through an imaginary journey to get ice cream or to play their favorite sport. Then he will ask them to “switch off” their arm, and they’re able to have an IV without feeling bothered by it.

Remember David? He really loved riding his motocross bike. Dr. Stock saw a photo of him in his protective gear and asked him to tell her about it. As he did, Dr. Stock knew she had found her way in. She did a hypnotic induction by getting him to describe every step in putting on the gear that would keep him safe. When the gear was “on,” he felt safe and protected. Three sessions (and a lot of practice) later, he walked into the hospital, “geared up,” and was ready for his injection.

Hypnosis isn’t a magic cure for needle phobia. But training your brain to be less bothered by needles means you can “get mastery over your body,” as Dr. Cyna says. If you feel your heart racing when you have an injection or your next shots, try distracting it with thoughts of ice cream or video games. It might take some practice, but it could turn out to be a life-changing superpower.

Alison Jarman is an anesthesiologist in Melbourne, Australia, who loves finding better ways to get her patients through their procedures. She has an eight-year-old daughter who has learned to be OK with needles, and a dog who has not.

CHILLS & G

You shudder and shiver, and a wave of goosebumps breaks out over your arms. But what are goosebumps?

And why do you get them?

People have been pondering this for generations. But it wasn't until 2020 that scientists got closer to figuring this out. (Hint, it's linked to why some people go bald while others don't.)

Fluffing Up

It's easy to understand why other animals get goosebumps. Say you're a fox and it's cold out. Goosebumps push your red fur up and bingo, there you go, extra insulation from the elements.

How? Goosebumps happen when small muscles at the base of hair follicles contract (this reflex is called "horripilation"). This happens in automatic response to the elements and to emotions. The hair rises, which expands the layer of insulating air between the animal's body and the environment. The thicker the coat, the more air and heat gets retained. That's how the thick coat of the fox can keep him cozy even in snow and freezing wind.

But we don't have a thick, fluffy coat. And we don't just get goosebumps from the cold—we also get them when we're scared. Why?

Say you're a porcupine out in the woods, just minding your own business. All of sudden you hear a twig snap. That sound could be a predator ready to gobble you up. What do you do? Get those sharp quills to stand at

attention! Your increase in size (and pokiness) may scare the predator away. The same reflex that gives you goosebumps allows a porcupine to protect herself from predators.

That all makes sense for a fox or a porcupine, but what about humans? We don't have thick fur or sharp quills. Why would our bodies still get goosebumps?

For years, goosebumps were considered a vestigial trait. Vestigial is a term for the leftover traits and organs we have that evolved for specific purposes in our ancient ancestors (the same ancient furry mammals that foxes and porcupines are related to), but seem to be mostly useless now. Humans also get goosebumps in situations that seem to have nothing to do with cold weather or fear. They're linked to powerful emotions like love or excitement.



Goosebumps fluff this fox's fur to trap extra air between the strands. The air acts as insulation between the cold air and the fox's skin.



Porcupines' quills are modified hairs evolved to be extra thick and sharp. That means goosebumps lift this porky's quills up just like the hair on your arms, ready to scare off predators.

THRILLS

Ever wonder why you get goosebumps?

Getting Hairy

In an article published on July 15, 2020 in *Cell* magazine, biologists from Harvard University and National Taiwan University revealed that they had discovered a new function for goosebumps. In their experiment, they took skin samples from mice and explored what role goosebumps might play in generating hair growth.

After conducting a variety of experiments on the mice's skin, they discovered that goosebumps seem to trigger new hair growth. The same sympathetic nerve reflex that causes goosebumps also sends messages to hair follicles. It contracts the muscle, which causes goosebumps and activates the hair follicle stem cells. Overtime, this leads to new hair growth. When the scientists examined the skin under an electron microscope they found that the sympathetic nerve fibers actually wrapped around the hair follicle cells. It almost looked like a ribbon wrapped on a ponytail.

Interestingly, people with baldness are often lacking the muscle cells that sit at the base of each strand of hair. This new finding might help scientists learn how to reverse hair loss and better understand how wounds heal on skin. Figuring out how to trigger

hair growth with stem cells might be able to help better understand how cells heal overtime.

What's This Feeling?

Some people get goosebumps and feel cold or shivery when they experience very strong emotion, not just when it's cold out. Most people call this "getting the chills." Goosebumps are controlled by the sympathetic nerve system, which regulates the body's unconscious actions, like breathing or blinking. When we feel strong emotion or a change in environment, the sympathetic nervous system can kick into gear. Major experiences and even movies or music may make you break out in goosebumps, too. In 2017, a researcher at the University of Southern California named Matthew Sachs ran a study that found links between people who get the chills in response to music and a structural difference in their brains. People who get goosebumps more often tend to have a stronger connection between the parts of their brains that process audio and the parts that process emotion. Why that makes them break out in goosebumps, though, is still being investigated.

Someone Walking on My Grave

But what about when you get the chills right out of nowhere? It's not

cold. You're not watching a scary movie or riding a rollercoaster or even listening to emotional music. There is an old wives' tale, worthy of Halloween, that explains this phenomenon. When you get chills out of nowhere that supposedly means that someone out there is walking on your grave!

What really causes random goosebumps that seem to just come out of nowhere? This experience may be a muscle spasm due to something called the myoclonus—a short, sharp twitching of the muscles. It's not the same thing as getting goosebumps, but it feels similar—you just suddenly have a full shudder go through your whole system.. This twitching can occur while you are awake, and during sleep transitions (it's the reason you might feel like you're falling just as you're drifting off to sleep, Another example of myoclonus is hiccups.

So, whether you call them cold creeps, the heebie-jeebies, or horripilation, now you know there's much more to goosebumps than just having your skin look like freshly de-feathered poultry.

Jessica Renslow loves getting goosebumps on rollercoaster rides and while listening to music. She stays clear of horror films due to her overactive imagination.



Your goosebumps may stimulate the hairs on your body, making them grow (just a little bit!) over time.

GOING GOTHIC

HOW TO TELL THE GOTH-TEST STORY EVER

WHAT DO DRACULA, FRANKENSTEIN, AND YOUR SISTER'S LACE-UP COMBAT BOOTS ALL HAVE IN COMMON? If your answer was "they're super cool," you'd be right! But if your answer was "they're all part of the gothic tradition," you'd be even righter.

Being gothic wasn't always about loud songs and weird makeup. Long before Siouxsie and the Banshees, some writers in the 18th and 19th century decided they were bored with books about ordinary people and their everyday dramas. All those stories had been done to death! Instead, they wanted to be scared out of their wits. They wanted horror, gore, romance, and the macabre, fancy black velvet and creepy old castles. And so the gothic genre was born.

There are many different things that make the gothic what it is. Knowing just a few will turn you from an amateur storyteller to a sinister, gothic expert. The next time you're at a sleepover and you're all telling scary stories, you'll know how to curdle their blood.



STEP ONE: PATHETIC FALLACY

"Today was a great day. The sun was shining, the birds were singing, and I played at the park with all my friends."
"Today was a miserable day! It rained constantly and I was so sad! I can't wait for it to be over so I can go to bed!"

Do you see that? That's what good writers call a "pathetic fallacy." It's where the weather in a story reflects the feelings of the characters. Since gothic stories like to focus on all things frightening, the weather usually reflects that. Whether it's the icy, cold Arctic or a gloomy thunderstorm, you know that something bad is about to happen when you read about those black clouds overhead.

CHOOSE YOUR WEATHER!

- ⚡ Frozen and snowy
- ⚡ Dark and gloomy
- ⚡ Stormy, with thunderbolts and lightning
- ⚡ Hot and oppressive
- ⚡ Calm and quiet
- ⚡ Windy and cloudy

Happy you've got the mood right? Good! Now let's whip up a storm!

STEP TWO: MONSTER MAYHEM

Arguably the biggest part of all these gothic tales is the supernatural. That's right, baby: we're talking ghosts and

ghouls, vampires and werewolves, stitched-up dead bodies and maniac scientists. It wouldn't be a gothic story if there wasn't something hiding in the shadows to give you the heebie-jeebies. What better tool to use than some creepy non-humans that go bump in the night?

CHOOSE YOUR FIGHTER!

- 💀 The Vampire
- 💀 The Monster
- 💀 The Ghost
- 💀 The Mad Scientist
- 💀 The Zombie
- 💀 The Bogeyman

If you don't like any of these, make up your own! Get yourself a mutant dragon with chainsaws for arms, or an evil fortune teller than can shoot laser beams from her eyes. It might seem crazy, but as long as it's scary you can make it work.

STEP THREE: THE SETTING

So, we've got our spooky weather. We have our nightmare-inducing monster. What's next? Well, a ghost in middle of a sunny park picnic isn't all that freaky. What we need is a place—



the creepier the better—and the gothic has a lot of great examples.

CHOOSE YOUR SETTING!

- Rundown old castle
- Experimental laboratory
- Cabin in a creepy forest
- Abandoned mansion
- Ghost town with creaking, unused swing sets
- Empty, old hospital
- Mossy graveyard
- Quiet church
- Underground cellar

The possibilities here are quite literally endless. All you need to do is sit back and think: “Where would I *not* like to be by myself at midnight, when there was a creepy monster on the loose?” You know a place? That’s your setting. So let’s go!

STEP FOUR: THE DRAMA

Now, don’t get me wrong—Edgar Allan Poe would be my bestie, and I’d hang out with Charlotte Brontë every day if it were possible. But they’d just be too much sometimes, because gothic writers (every one, no exceptions) were complete DRAMA QUEENS. Agony! Despair! Torment! Fury! Their stories piled on the emotion. With all this in

mind, I think you might be ready to tell your own tale. Here’s a little template...but feel free to go off-script, and get ready to scare yourself silly.

THE STORY

It was a [your weather] night. All around me was misery. My steed, valiant and strong, galloped bravely towards my destination, but internally my heart was filled with dread. Just as I thought I might never find it, I saw in the distance: [your place]. Wasting little time, I continued in its direction, unsure of what might await me. Of course I had heard the rumors. The townsfolk always talked in whispers about [your monster], but I didn’t believe a word of it. I had faith in science and logic, after all. I continued on my way.

So what happens next? Will it be a bloodbath? Will our hero escape? Will the monster prevail? Will they end up best friends and leave the normal, boring world behind? Well, that’s up to you. After all, you’re the storyteller. The world is your oyster. Just make sure you make it horrible.

Cathleen Davies (a.k.a. Dr. Speuks) is a writer from East Yorkshire, England. She’s published a number of stories and poems, most of them evil and nasty. She lives in many places and has a black-and-white cat waiting for her in most of them.



By Tracy Vonder Brink

MARGE KERR

SOCIOLOGIST

Fear is sociologist Margee Kerr's job. As a scientist who studies people and social relationships, she's worked in and designed haunted houses and wrote a book about scary experiences, all with the goal of understanding fear.



HOW DID YOU BECOME INTERESTED IN FEAR?

As a sociologist, I've always been interested in understanding how people and groups relate to each other. I was curious about how people decided who was "in" and who was "out." Through my years of research and education I learned fear is often behind acts of hate and discrimination, and that people sometimes fear those who are different, leading to racism, homophobia, sexism, and intolerance in general. My goal became to understand fear from every angle, from what we fear, to how our body responds under stress, to how and why we would want to be afraid.

YOU WATCHED PEOPLE GO THROUGH A HAUNTED HOUSE AND THEN DID BRAIN SCANS ON SOME. WHAT DID YOU LEARN?

We learned that contrary to what many people might think, getting scared can actually IMPROVE mood! Participants in our study reported significantly higher mood after going through the haunted house. They also reported feeling less stressed, anxious, or tired. And the scarier the better—those who rated the experience as more intense, thrilling, and scary also reported higher mood.

WHAT DO YOU THINK CAUSED THE HIGHER MOOD AFTER BEING SCARED?

We found that higher mood was related to changes in how participants' brains were processing information.



Namely, higher mood ratings were related to decreased activity in their brain. We think this might be similar to what people experience after running for long distances—basically doing something scary can take people "out of their head." When you're on a rollercoaster or in a haunted house you're not thinking about your bills, your classes, your relationships, or your future. It's like pressing the "mute" button on our inner dialogue, and that can feel like a nice break to a lot of people.

WHY CAN IT BE FUN TO BE AFRAID?

Thrilling and scary activities activate our fight-or-flight response (or acute stress response). Our sympathetic nervous system increases activity in our body by triggering a cascade of neurotransmitters and hormones like dopamine, serotonin, and adrenaline that change how we think and feel, usually giving us the feeling of having a lot of energy and being excited. But it's up to us—and the context that we're in—to interpret this response as enjoyable, leaving us feeling like a superhero and not actually like our life is in danger.

ARE THERE OTHER REASONS IT'S FUN, BEYOND WHAT HAPPENS IN THE NERVOUS SYSTEM?

Yes! Doing scary things can also be a way to increase our self-esteem. As our research shows, when people make it through a safe yet scary activity, it results in learning more about yourself, which in turn can increase self-confidence. Even though the threat is not real, the feeling of pushing yourself and making it through is a reward in itself. There is also the very important social component of fear enjoyment. Haunted houses and amusement parks are linked to friends and family. We're taking on these challenges together and in doing so creating stronger



bonds, stronger memories and feelings of closeness. If you watch people coming out of a haunted house, you'll see lots of hugs and high fives.

WHAT'S THE DIFFERENCE BETWEEN A "GOOD SCARE" AND A "BAD SCARE"?

There's no one rule to distinguish between a good or bad scare, it depends on the person and the specific situation. In general, however, "good" scares, or what I call "fun-scary" are scares that you choose to engage with and are, ironically, safe. Scares where you have no sense of control can lead to trauma. When you knowingly choose to do something frightening, you're in control, and this can make all the difference. These kinds of scares include scary movies, haunted houses, thrill rides, and scary stories. The key is that you are choosing to engage, can leave at any time, and there's no real risk of harm.

WHY DO THINGS SUCH AS CLOWNS, BATS, SKELETONS, AND GHOSTS FRIGHTEN US?

Much of what we find scary is based on our culture and traditions. Today, the reason we find some creatures and characters scary, like clowns and bats, is because we've learned that they are supposed to be scary from TV shows and movies. Other popular monsters get their reputation because they're linked to things that we find scary, for example, skeletons and ghosts remind us of death.

WHAT ABOUT PEOPLE WHO CAN'T STAND SPIDERS OR SNAKES?

Some people have very real, intense fear of spiders and snakes. Research suggests that we've evolved to be very good at identifying characteristics that we associate with threat—things that move quickly, things that are very small or very big, things that are sharp. In fact, our brain activates more quickly to some "scary" images. This is likely to our benefit, to help us identify and respond to things that could hurt us.



YOU DID A BUNCH OF SCARY THINGS FOR YOUR BOOK, SUCH AS GOING ON A GHOST HUNT AND HANGING FROM A TALL TOWER ON ROPES. ARE YOU REALLY BRAVE?

To me, one of the bravest things in the world is being able to acknowledge and feel your feelings—especially fear. For many people, confronting the reality that they fear something and actually letting themselves feel it, and then digging further to find out where it might be coming from and how it's impacting their life, is the scariest thing in the world. It was for me, and through doing a lot of different types of scary activities, I was better able to know myself. I learned to trust myself in a whole new way, and that makes me feel brave.

IF I GET SCARED, DOES THAT MEAN I'M WEAK, OR THAT I NEED TO TOUGHEN UP?

Absolutely not! While what we fear changes from place to place and person to person, the threat response, that automatic response that gets our heart rate going and makes us want to fight or flee, is universal. Every living animal has a threat response and it's responsible for keeping us all alive. Feeling afraid is healthy and normal. People who are better able to know when they're afraid, and even talk about it, are better able to manage their fears and overcome them—quite the opposite of weak!



WHAT ADVICE WOULD YOU GIVE SOMEONE WHO DOESN'T LIKE TO BE SPOOKED?

The first thing I would say is that “it’s OK!” Just like people have different tastes in music and food, some people simply do not like that feeling of growing anticipation, the feeling of tightness in their chest, or the increase in their heartrate—and that is completely fine. What’s important is that we keep trying new things and continue to learn about ourselves and the world.

WHAT DO YOU HOPE COMES OUT OF STUDYING AND UNDERSTANDING FEAR?

If we understand our fears, from the things that scare us to how our body responds in times of stress, then we can make sure our threat response is working for us instead of standing in our way. We can make sure this incredible automatic, highly evolved response is doing what it was designed to do: keep us safe. I’m also hoping that if we understand our fears, we won’t be so afraid to get to know each other, and will be encouraged to investigate places that are different, and to treat everyone with respect and dignity.

Tracy Vonder Brink is a science writer from Ohio. She loves scary movies but won't step foot in a haunted house.

WANT TO BUILD YOUR OWN HAUNTED HOUSE? AN EXPERT SHARES HER ADVICE!

When Margee Kerr designs a haunted house, she starts by thinking about all the different ways she can startle people—and the story behind the scares. “A well laid-out series of startles can leave people feeling both terrified and thrilled, but they have to make sense within the context of a strong story,” she says. “Think about it: a zombie rounding a corner and walking up to you would certainly make you stop in your tracks—but it appearing suddenly in a haze of smoke, lights strobing, and a clamor of growls will have you running in the other direction.” She adds, “Definitely don’t forget about the effects! Lots of different lights, sounds, fog, tactile surfaces, and smells go a long way in bringing a narrative to life. It’s fun to create the stories and the characters, but the startle effects are what get our blood pumping and take the screams of fear to screams of laughter.”



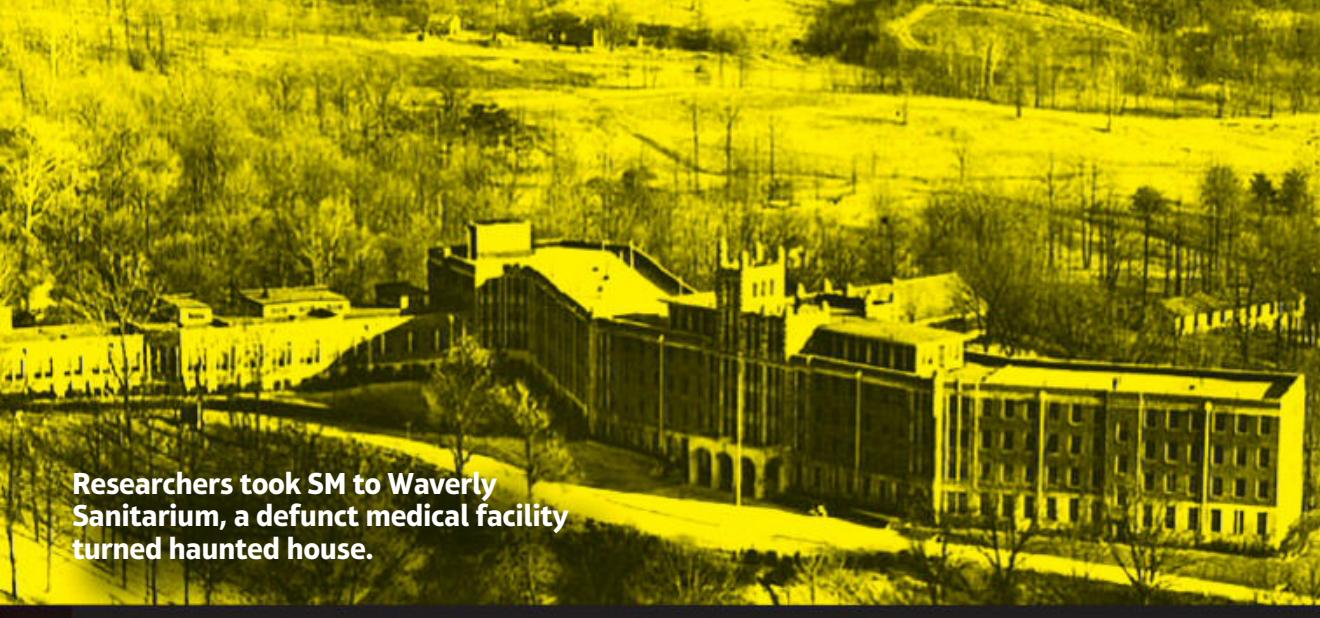
by Kathryn Hulick

Can a rare brain disease erase fear?

hideous monster leaped out of the darkness. Everyone walking through the haunted house screamed. Well, not everyone. One woman smiled and laughed. "This way guys, follow me!" she shouted excitedly, leading the way down a dark hallway and around a corner into the next room. At one point, she poked the mask of a man dressed up as a murderer.

The woman, called SM to protect her identity, seemed to have no fear.





Researchers took SM to Waverly Sanitarium, a defunct medical facility turned haunted house.

A rare disease

SM has an extremely rare genetic condition called Urbach-Wiethe disease. Only a few hundred cases of the disease have ever been identified in the entire world. The disease causes skin problems and a hoarse voice. Over time, it may also cut off blood flow to parts of the brain. Often, the disease destroys part or all of the amygdala; a set of two small, almond-shaped clusters of cells that sit near the brain stem, one on each side of the brain. By the time SM was an adult, both sides of her amygdala had almost entirely stopped working.

In the past, researchers had removed the amygdala from monkeys or rats. These animals tended to act less fearful in the face of danger. Rats, for example, would walk right up to cats. These animals also had poor social skills, trouble finding the right food to eat, and more.

It was clear that the amygdala played an important role in fear as well as in other emotions. SM's disease offered a rare opportunity to study the fear responses of a person without a functioning amygdala. Researchers at the University of Iowa thought SM might not respond to scary situations in a typical way. So in 2010, they set out to test her sense of fear.

Snakes, spiders, and scary movies

With SM's permission, the research team put her into several situations where most people would feel very afraid. They observed her behavior and asked her how she felt. During the trip to that haunted house—an annual one held every Halloween at the Waverly Hills Sanatorium in Louisville, Kentucky—SM acted excited and curious. She never looked nervous or frightened and reported that she never felt afraid, either.

On another occasion, the researchers took her to an exotic pet store, because SM had often said she hated snakes and spiders. Was she afraid of them? She didn't act like it. At the store, she held a snake for several minutes. "She rubbed its leathery scales, touched its flicking tongue, and closely watched its movements as it slithered through her hands," wrote the researchers. She told them, "This is



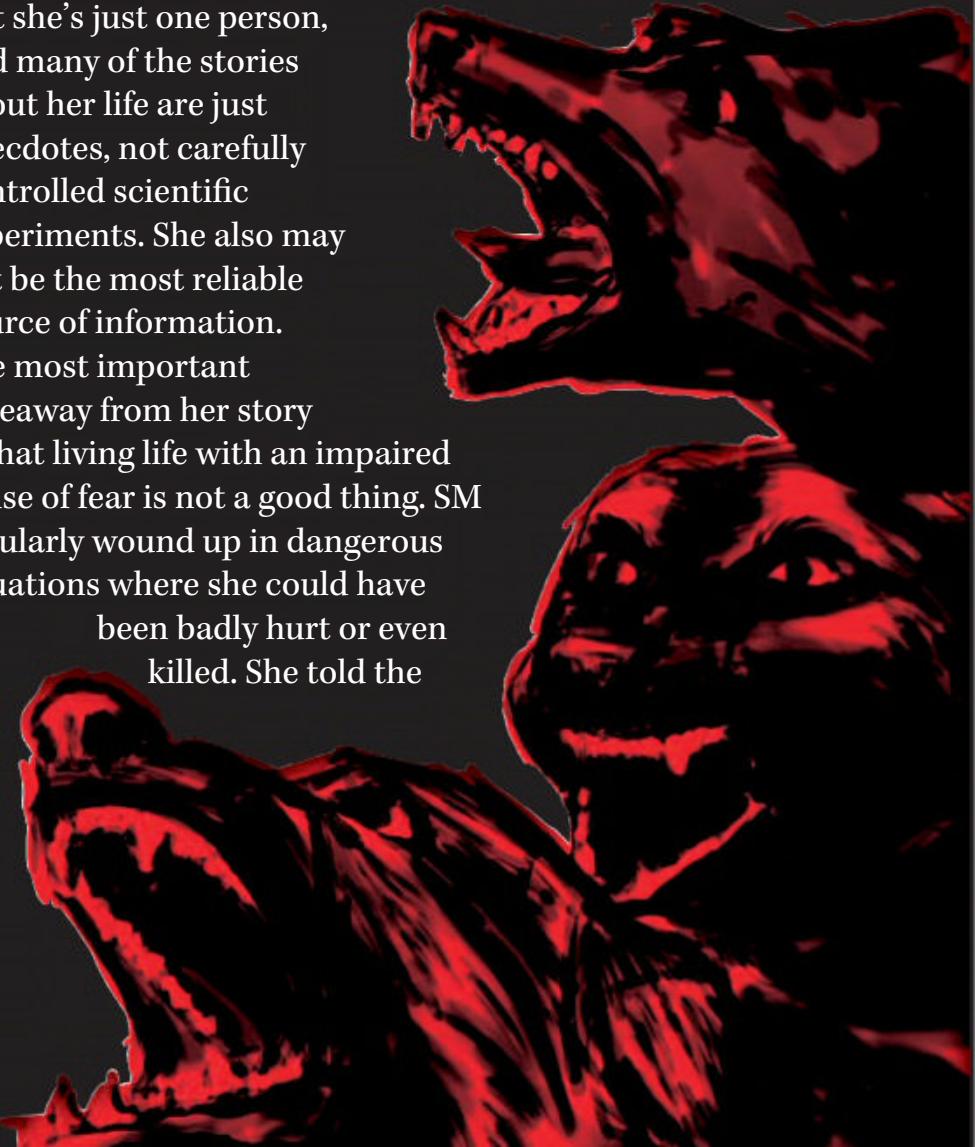
Researchers showed SM clips of scary movies and other movie clips to test her emotions. She felt happy and sad—but not afraid.

so cool!" Afterwards, she kept asking to touch other snakes in the store, even ones that an employee told her were not safe to touch. She also tried to touch a tarantula. The researchers asked her why she wanted to touch animals she claimed to dislike and knew were dangerous. She said she was very curious.

The researchers also showed her short clips from ten different horror movies, including *The Shining*, *Blair Witch Project*, and *Halloween*. They mixed in movie clips that make most people feel anger, sadness, disgust, surprise, or happiness. SM reported feeling these emotions at appropriate times, but never any fear. SM got normal scores on tests of her memory, language, and IQ.

When the researchers talked to SM about her childhood, she recalled instances of being scared. She used to be afraid of the dark. She also remembered a time when a large dog growled and snarled at her. "I hollered for my mom. I can remember my gut tightening up. I was afraid to move... That's the only time I really felt scared. Like gut-wrenching scared," she told the researchers. Her disease had begun damaging her brain when she was around 10 years old. It seemed that over time, the damage to SM's amygdala had erased her ability to feel afraid.

SM's case is fascinating. But she's just one person, and many of the stories about her life are just anecdotes, not carefully controlled scientific experiments. She also may not be the most reliable source of information. The most important takeaway from her story is that living life with an impaired sense of fear is not a good thing. SM regularly wound up in dangerous situations where she could have been badly hurt or even killed. She told the

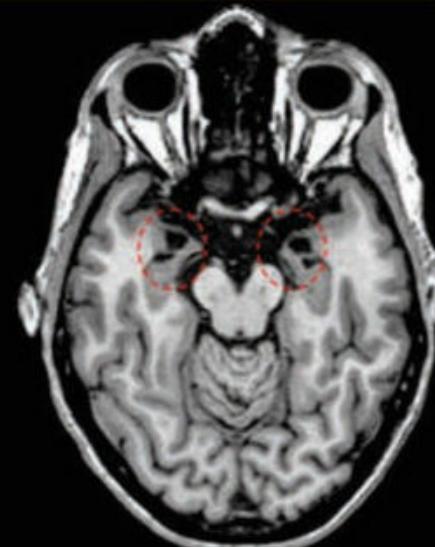
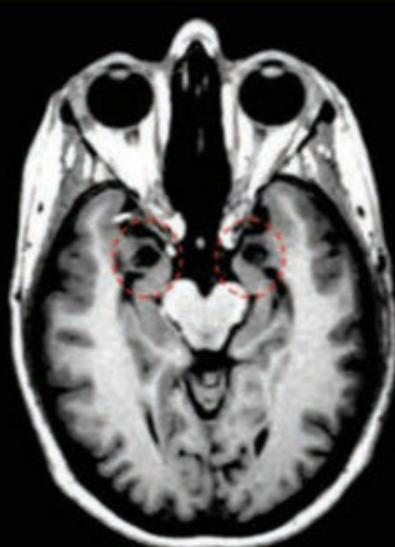
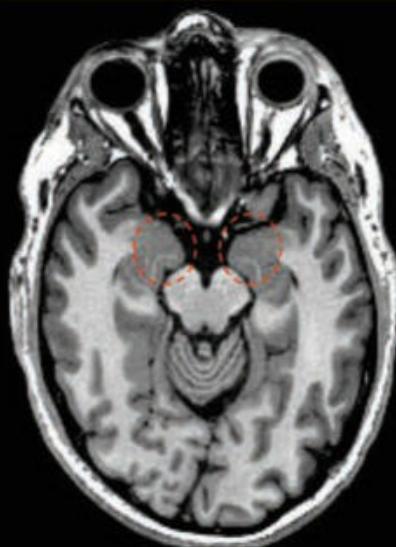


Comparison

SM

AM

BG



Researchers compared the amygdalas (circled in red) of several people with Urbach-Wiethe disease, including SM, to an “average” brain (on the far left). The test subjects had visible black spots where their amygdalas had been damaged.

researchers that she had walked outside in the middle of a terrible thunderstorm to help a friend. Another time, a man in a park threatened her. She walked through the same park again the next day. Fear could have helped her avoid these types of situations.

The many sides of fear

Fear is not a simple emotion. And the brain is a very complex organ. “There is no doubt the amygdala is involved in fear,” says Beatrice de Gelder. She’s a neuroscientist at Maastricht University in the Netherlands who has worked with multiple people who have Urbach-Wiethe disease. Many of them, like SM, have an impaired sense of fear likely due to a damaged amygdala. However, the amygdala is not the only part of the brain responsible for fear. The brain is a network, with many interconnections among its parts. “If you knock out the amygdala,” says de Gelder, “fear would not disappear.”

In fact, SM could still feel afraid. The researchers that worked with her realized that the haunted house, snakes, and scary movies were all threats that came from the outside world, mostly through SM’s eyes and ears. She might respond to internal threats, such as feeling great pain or being unable to breathe, very differently. For example, SM had once gone through a painful medical procedure. She reported feeling anxiety and dread about having to do it again.

The researchers wanted to test this type of fear. Of course they wouldn’t actually put SM in danger. But they knew of one safe, painless way to threaten the body. If a person takes one breath of a mixture of air that contains a much higher percentage of carbon dioxide gas than normal, the body feels like it is suffocating (even though it is not). This causes some people to have a panic attack, a sudden feeling of intense fear or anxiety that often involves a racing heart, trembling or shaking, sweating, and difficulty breathing. What would happen to SM?

The researchers gave her and two other volunteers with amygdala damage the gas mixture. A few seconds after breathing it in, SM started gasping and tried to rip off

her mask. The experimenter immediately took it off. “The skin on her face was flushed, her nostrils were flared, and her eyes were opened wide,” wrote the researchers. SM had a panic attack. So did the other two volunteers. In a control group of adults without brain damage, only three out of 12 panicked in response to breathing the gas mixture. A damaged amygdala seemed to make panicking more likely in this situation.

The adaptable brain

The amygdala isn’t the only brain region responsible for fear. Similarly, fear isn’t the only thing the amygdala handles. Hans Markowitsch is a retired neuroscientist who studied the brain for decades at the University of Bielefeld in Germany. The purpose of the amygdala, he says, is to give emotional meaning to new information coming in from the outside world. The amygdala also helps store and retrieve memories related to strong emotions. “The amygdala not only processes negative emotions, but also positive emotion,” he says. That includes happiness and joy. Amygdala damage can make it more difficult to process all emotions. In 2003, Markowitsch helped lead a research study involving 10 people with Urbach-Wiehe disease. He found that they had great trouble remembering emotionally charged pictures.

One of the amazing things about the human brain, though, is its remarkable ability to adapt. When one part of the brain is damaged, other parts may be able to take over its role. Markowitsch is currently working with an 18-year-old boy with Urbach-Wiehe disease. So far, his amygdala has not been too badly damaged. Markowitsch told him and his parents that he should practice identifying the emotions in faces regularly. That way, his brain may be able to adapt so that he doesn’t lose his ability to recognize and respond to fear and danger.

The next time you visit a haunted house, remember that fear is an essential emotion. It may not feel good to get scared. But fear helps keep you safe.

Kathryn Hulick is brave enough to explore all kinds of science (even the gross stuff) in her writing.



>> NEW CONTEST

Haunted With You

You might know a haunted house—the one in town that's covered in fluttering bats and glowing jack-o'-lanterns for Halloween. But what would a haunted house look like if it was designed just for you? Would there be room where your cousin tells you a scary story about Grandma's house? Or one where your neighbor's weird cat just stares at you? Or...are YOU the haunter? Send us a haunted house of personal poltergeists, and we'll pick our favorites to scare us silly.

CONTEST RULES

1. Your contest entry must be your very own original work. Ideas and words should not be copied.
2. Be sure to include your name, age, and full address on your entry.
3. Only one entry per person, please.
4. If you want your work returned, enclose a self-addressed, stamped envelope.
5. All entries must be signed by a parent or legal guardian, saying that this is your own work and no help was given and granting permission to publish. For detailed information about our compliance with the Children's Online Privacy Protection Act, visit the policy page at cricketmedia.com/privacy.
6. Your entry must be received by October 31, 2021. We will publish winning entries in the February 2022 issue of *Muse*.
7. Send entries to Muse Contest, 1 East Erie Street, Suite 525, PMB4136, Chicago, IL 60611 or via email to muse@cricketmedia.com. If entering a digital photo or scan, please send at 300 dpi.



—ELLIOTT K. / age 11 / New York

>> ANNOUNCING

CONTEST WINNERS!

In April, we asked you to send us your most comedic comic strips, inspired by Pranav S.'s idea. Laugh away your fears with these horribly hilarious comic strips!



—VIV T. / age 12 / Louisiana

>> ANSWERS

PAGES 6-9: MUSE NEWS

The false story is "Who's More Scared?"

PAGE 24: TERRIFYING TERMINOLOGY

- | | |
|------------------|------------------|
| 1. spiders | 7. doctors |
| 2. thunderstorms | 8. talking |
| 3. mirrors | 9. germs or dirt |
| 4. trees | 10. snakes |
| 5. being touched | 11. birds |
| 6. fog | 12. light |
| | 13. the Moon |
| | 14. the sea |



>> RUNNERS-UP

Honorable Mention

This month's runners-up are Arya K., age 11, Montana; Candace V., age 10, Maryland; Caroline C., age 9, New York; Claire S., Washington; Cole S., Oregon;

Jazlyn T., Tennessee; Moriah M., age 12, Minnesota; Neil M., age 10, Pennsylvania; Norah R., age 11, Georgia; Risa B., age 13, Washington; William B., age 10, Minnesota; and William M., age 13.

BY KATHRYN HULICK



WILL SUPERINTELLIGENT COMPUTERS TAKE OVER THE WORLD?

“WHAT CAN I HELP YOU WITH?” says a voice from an iPhone. It’s Siri, and she’s ready to follow your voice commands to search the Internet, text someone, or play a song. Siri is an example of artificial intelligence (AI), or a computer program that can think. The way Siri thinks is very different from how a person thinks. She doesn’t have a brain. Instead, she relies on code in a computer program to understand speech and answer questions. And some questions are still too difficult for her to answer. However, AI programs like Siri are getting smarter and smarter every year. In 2011, an AI named Watson defeated two human champions on the quiz show *Jeopardy!* Computer programs can also drive cars, perform science experiments, and produce their own artwork.

Someday, artificial intelligence will most likely surpass human intelligence. Once this happens, computers will think, plan, and act at a level that human beings can’t comprehend. In his book *Superintelligence*, Nick Bostrom writes, “As the fate of the gorillas now depends more on us humans than on the gorillas themselves, so the fate of our species would depend on the actions of the machine superintelligence.”

If a superintelligence wanted to rule the world, Bostrom

In the future, will computers be smart enough to make us do their homework?

argues, it would easily do so. It could also wipe out all humans. Or just ignore us. Whatever it did, we likely wouldn’t have much control. He’s not the only one worrying. In 2015, a group of prominent scientists, including Stephen Hawking, wrote an open letter that asks anyone researching AI to proceed carefully. AI has the potential to benefit society greatly, but “our AI systems must do what we want them to do,” they write.

What do you think? If people create a superintelligent AI, will we be able to control it? What will happen to us if a superintelligent AI starts making decisions on its own?

Learn more about AI in **Kathryn Hulick’s** new book, **Welcome to the Future: Robot Friends, Fusion Energy, Pet Dinosaurs, and More!** (Quarto, October 2021).

WHAT KIND OF MONSTER ARE YOU?

You wake up, stretch, and...

- a. Wipe the slobber off your cheeks.
- b. Feed your hair its favorite breakfast.
- c. Brush your fangs. Got to keep them pearly white for maximum scariness!



A full moon is rising outside. It's going to be a beautiful night. You...

- a. Let out an eerie call to gather your many siblings. It's more fun to hunt in a big pack.
- b. Tend to your statue garden with your two sisters. A small group is best.
- c. Waft around your castle in a gust of mist...alone, always alone.

Time to get dressed. You wear...

- a. Not much—it tends to get shredded. Remember: always make sure that you're wearing pants.
- b. A loose, comfy chiton. You can never improve on the classics!
- c. Crisp white shirts and tailored suits...maybe with a velvet cape if it's cold.



Success! The children are terrified. You get home after a long night of scaring and...

- a. Curl up in your favorite smelly spot.
- b. Add the stone hamster to a lovely spot in the garden.
- c. Take a leisurely flight through the night on your bat wings.



At last: how do you plan to scare the children of the town?

- a. Howl below their window at midnight so they can't sleep.
- b. Turn their hamsters to stone.
- c. Loom out of the shadows when they go to the bathroom.



Answers:

Mostly a: Werewolf
Mostly b: Medusa
Mostly c: Vampire

Oh dear—the townspeople are coming to confront you! You...

- a. Flee to the hills to hide in the old caverns.
- b. Turn them to stone with one cold glare.
- c. Barricade yourself in your lavish basement.



Cricket

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— LIA, 15 years old



I want to give my teacher, Joe,
700 stars!

— KAI, 7 years old



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**“Your body’s reactions
to fear are some of the most
deeply instinctive reactions
we have, passed down to us by
millions of years of evolution.”**