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April 2024

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P3

ROBOT BIRDS TO THE RESCUE

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SARAH BUCKLEY

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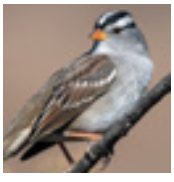

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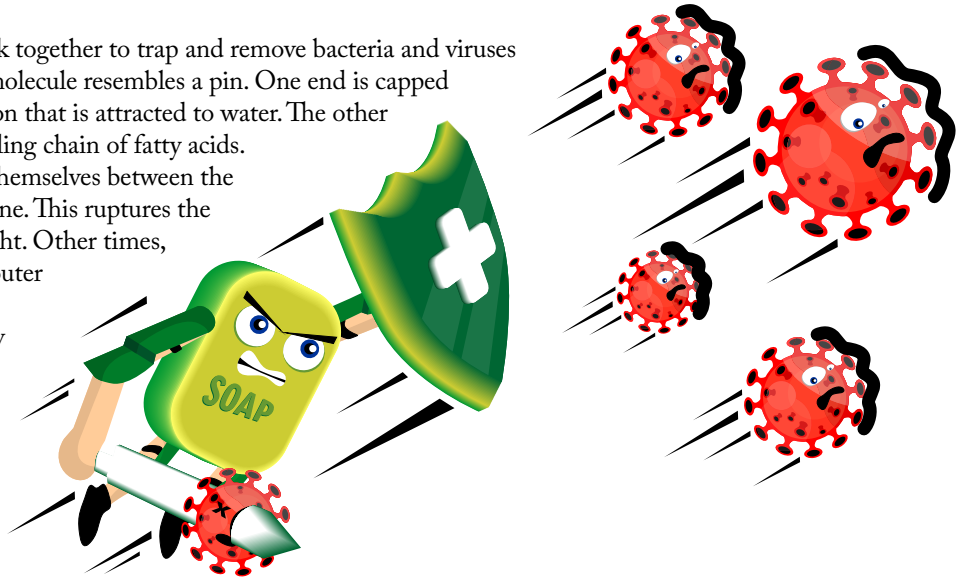
Q How does soap kill germs?

— *Faith Y.*

A Soap and water work together to trap and remove bacteria and viruses from a surface. A soap molecule resembles a pin. One end is capped with a hydrophilic salt ion that is attracted to water. The other end sports a water-repelling chain of fatty acids. Sometimes, the fatty acids can wedge themselves between the molecules of a microbe's outer membrane. This ruptures the membrane and kills the microbe outright. Other times, those fatty acid chains latch on to the outer membrane of a bacterium or virus. This dislodges the germ and traps it in a tiny bubble, with the salt ions sticking out. Rubbing your hands as you wash them helps to loosen any of these encased germs from your skin. The trapped microbes are then whisked down the drain when you rinse your hands.



Q How do atoms come together to form things?

— *Frankie G.*

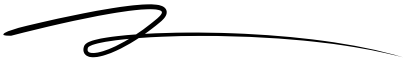
A Atoms can bond in several ways, thanks to how their electrons interact. The nucleus of every atom is surrounded by electrons. Ionic bonds form when one atom transfers an electron to another. This causes one atom to take on a positive charge. The other, a negative charge. The opposite charges causes the atoms to stick together. Table salt, baking soda and most minerals are formed with ionic bonds. A covalent bond forms when two atoms share electrons. Water and carbon dioxide molecules are held together by covalent bonds. These bonds are also found in more complex molecules such as caffeine and sugars. Metal atoms, such as gold and copper, readily swap electrons with their neighbors. These atoms hold together with a "sea" of freely flowing, shared electrons.

Q What does the core of the Earth have to do with compasses?

— *Regina D.*

A Earth's core is responsible for creating the planet's magnetic field, which is what makes compass needles point north. Here's how it works. Earth's solid inner core is surrounded by a liquid outer core. The superhot molten metal in Earth's outer core is constantly churning, much like a pot of boiling water on a stove. It's also continually swirled around by Earth's rotation. These motions generate electric currents within the liquid metal. Those currents power a magnetic field that wraps around the planet. This magnetic field exerts a force on all magnetized objects on Earth's surface, including steel compass needles. That force nudges compass needles to point north, toward one of the planet's magnetic poles.

Do you have a science question you want answered? Reach out to us on Instagram (@SN.explores), or email us at explores@sciencenews.org.



Sarah Zielinski
Editor, *Science News Explores*

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ASTA DESIGN/SHUTTERSTOCK

ANIMALS

Chinstrap penguins nap more than 10,000 times a day

These seconds-long sleeps add up to more than 11 hours of shut-eye

Nesting chinstrap penguins take nodding off to the extreme. These birds dip into slumber many thousands of times per day, sleeping only seconds at a time.

The penguins' breeding colonies are noisy and stressful. Threats from predatory birds and aggressive neighboring penguins never seem to let up. But their extremely disrupted sleep schedule may help these penguins protect their young while still getting plenty of Zzzz's.

Won Young Lee studies how animals' habitats affect their behavior. He works at the Korea Polar Research Institute in Incheon. Nearly a decade ago, he noticed something odd about the sleep behavior of chinstrap penguins (*Pygoscelis antarcticus*) nesting on Antarctica's King George Island.

Lee's team snooped on the daily slumbers of 14 nesting chinstrap penguins. The penguins had incredibly fractured rest. They took more than 600 "microsleeps" an hour, the team reports in *Science*. Each nap averaged only four seconds. At times, the penguins slept with half of their brain; the other half stayed awake. But all these oodles of snoozes added up. The more than 10,000 brief sleeps each day provided more than 11 hours of sleep for each brain half.

Getting enough sleep is crucial for healthy brains and bodies. The penguins' many micronaps appeared to give their brains at least partially restorative rest.

Sleep seems to vary widely from one species to another, Lee says. By studying how animals get that shut-eye, researchers can learn how sleep evolved to give their brains needed rest, he says. "I believe that there are still many things unrevealed about animal sleep."

— *Jake Buehler*

PAUL-ANTOINE LIBOUREL

This chinstrap penguin may be catching just a few seconds of shut-eye. While nesting, these penguins take "microsleeps" that last only four seconds on average.

PHYSICS

Nature may have sculpted sphinxes

Wind might naturally erode rock into ridges called yardangs

The Great Sphinx of Giza in Egypt might have been sculpted by desert winds long before humans carved into it.

Mysterious natural desert structures called yardangs look a lot like seated lions. Some researchers now think the ancient Egyptians might have carved the Great Sphinx out of one.

Built around 4,500 years ago, this massive statue sports the head of a person and body of a lion. A new study shows that this general shape forms under fairly simple natural conditions — no people needed. Scientists were able to shape their own sphinxlike mini-yardangs from clay globs immersed in flowing water.

Yardangs can evolve naturally in desert regions where winds wear exposed rock into long, streamlined ridges. But scientists aren't sure what triggers yardangs to form. Researchers at New York University reported their new findings in *Physical Review Fluids*.

Leif Ristroph was curious about how nature produces sphinxlike yardangs. This applied mathematician designs experiments that mimic the erosion of rock by natural forces, such as wind, water and ice. In nature, erosion can take thousands of years or more. To study it in the lab, Ristroph's team sped up the process to a few hours. They used a water tunnel to study how air or other fluids flow around stiff objects.

"[We can] put things like a piece of ice in there and look how it changes shape," Ristroph says. Or, "in this case, a chunk of mud."

In each of their hundred or so trials, the researchers started with a stiff clay paste. They sculpted it into a glob and then embedded it with bits of hard plastic. These bits represented harder parts of natural rock. Then the researchers plopped the globs into the water tunnel. Afterward, they watched a steady water current — meant to mimic wind — erode the clay away.

This setup repeatedly produced sphinxlike mini-yardangs.

Two conditions were key, the researchers found. First, they needed consistent, strong "wind" flow. And the starting blob had to contain a mix of both easily eroded and more-resistant bits. The starting shape of the glob and placement of the hard bits didn't matter much. The plastic bits just needed to be somewhere in the side facing the "wind."

Then, the researchers scanned their newly made mini-yardangs. They used those scans to 3-D print reusable plastic replicas. Then they coated the printed models with a thin layer of clay mixed with fluorescent dye.

In the water tunnel, the glowing clay allowed the researchers to trace how it eroded and see how currents flowed around the blob. A turbulent "mane" of eddies (swirling currents of water) formed behind the sphinx's head. These eddies carved out the yardang's sloping, catlike spine. The team is now working to model these patterns using math.

From these small-scale studies, it's not yet clear how wind could erode massive rocks into quirky yardangs. Ristroph hopes his team's mini-sphinxes will inspire others to investigate such questions.

— *Elise Cutts*

Glowing dye particles show how currents can erode lumps of clay into animal-like figures. Some researchers think winds could have similarly shaped the early form of the Great Sphinx of Giza in Egypt (inset).

GUNTHER FRAULOB/ISTOCK; APPLIED MATH LAB/NYU

HUMANS

Doctors plucked a live worm from a woman's brain

It's the first time this snake parasite has been found in a person

A woman in Australia was having mysterious symptoms.

First, it was weeks of belly pain and diarrhea. Then night sweats and a dry cough. Doctors found damaged spots on her lungs, liver and spleen. Maybe it was an infection? She got tested for bacteria. Fungi. A human parasite. Even autoimmune disease. All the tests came back negative.

After three weeks, a CT scan — a special type of X-ray — revealed a clue. Some of the spots in her lungs seemed to be moving.

Months later, the woman became forgetful and depressed. A brain scan showed a ghostly glow in her frontal lobe.

She had a tiny bit of tissue removed from her brain to check for disease. But during the procedure, her surgeon spotted something weird and stringy. The doctor plucked it out with forceps. It was pinkish-red, about half the length of a pencil — and wiggling.

"It was definitely one of those 'Wow!' moments," says Sanjaya Senanayake. He's an infectious disease doctor at the Australian National University and the Canberra Hospital. "A worm in the brain!"

It was a kind of roundworm usually found in snakes. This infection was the first ever seen in a human, Senanayake's team reported in *Emerging Infectious Diseases*.

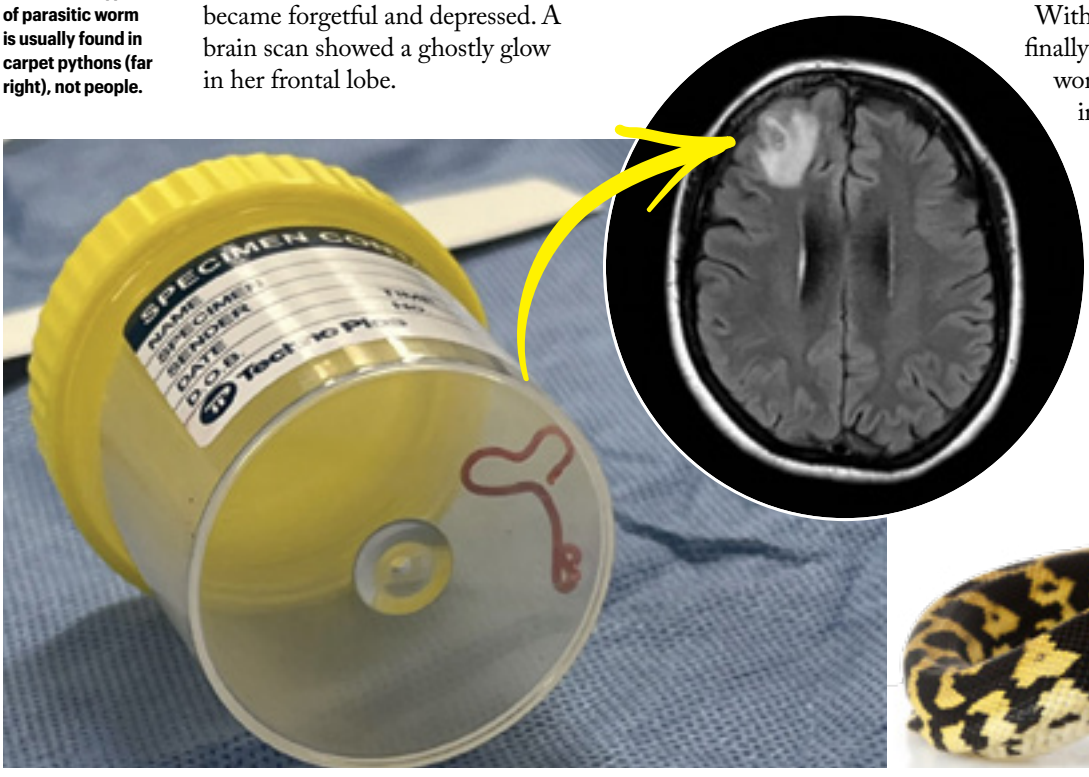
Adult worms tend to live inside carpet pythons (*Morelia spilota*). The snakes shed worm eggs in their feces.

The woman lived near a lake inhabited by carpet pythons. Doctors suspect she may have accidentally eaten worm eggs lurking on some wild edible plants. Parasites occasionally can jump from wild animals to people. As human and animal populations overlap, Senanayake says, "we're starting to see more and more of these spillover infections."

With a diagnosis, the doctors finally knew how to treat the woman. Her symptoms improved after taking parasite-killing drugs.

Some cat and dog parasites can infect people, too. So it's important to wash your hands after playing with animals.

— *Meghan Rosen*



A live, wriggling worm was pulled out of an Australian woman's brain (inset). This type of parasitic worm is usually found in carpet pythons (far right), not people.

CANBERRA HEALTH SERVICES; M.E. HOSSAIN *ET AL/EMERGING INFECTIOUS DISEASES* 2023; FIVESPOTS/SHUTTERSTOCK

Think you know what you're seeing? Find out on page **32**

GREENER than GRASS

Native plants save water while helping people and wildlife >>

SIMONE HOGAN/SHUTTERSTOCK

By **Alison Pearce Stevens**

Yards don't have to be big, flat expanses of grass, like the patch on the left. Native vegetation can be even more attractive and comes with environmental benefits.

When you walk through your neighborhood, what do you see? In many places in the United States, it will likely be a few trees and shrubs amid large areas of grassy lawns. These big green carpets might look pretty. But a plain expanse of grass is an ecological wasteland. It's filled with just one type of plant — grass. And this species doesn't support insects, birds or other wildlife the way a natural ecosystem would.

But increasingly, people are turning to alternatives — ones that better support nature and us.

Lawns as we know them started in Medieval England. At that time, most people had to grow their own food. A big expanse of grass served as a display of wealth; these people could afford to have land without crops. The grasses planted back then were native to England. They grew well with that nation's soils, ample rains and cool temperatures.

Those same grasses — and others — now cover lawns across the world, from Europe and the United States to Australia. Although they did well in England, they're not as well adapted to places with different climates and levels of soil nutrients.

It can take a lot of work to maintain these yards. People add fertilizers to keep their lawns lush and green. They water regularly, because these grass species can't handle hot summers or places with little rain. People may use chemicals to keep out unwanted plants (weeds) and pests.

All those activities use up or pollute much-needed fresh water. Both are problems, especially in the face of ongoing drought. Pesticides and fertilizers in runoff can also harm the ecosystems in streams.

That's why a growing number of people are rethinking lawns.

What does that mean? Allowing a greater variety of plants and animals to flourish in these spaces could save water, experts say. It could reduce chemical pollution. And yards planted with more diverse species could make for healthier ecosystems with more pollination and pest control.

In the end, such changes should benefit people and wildlife alike.

Embracing native plants

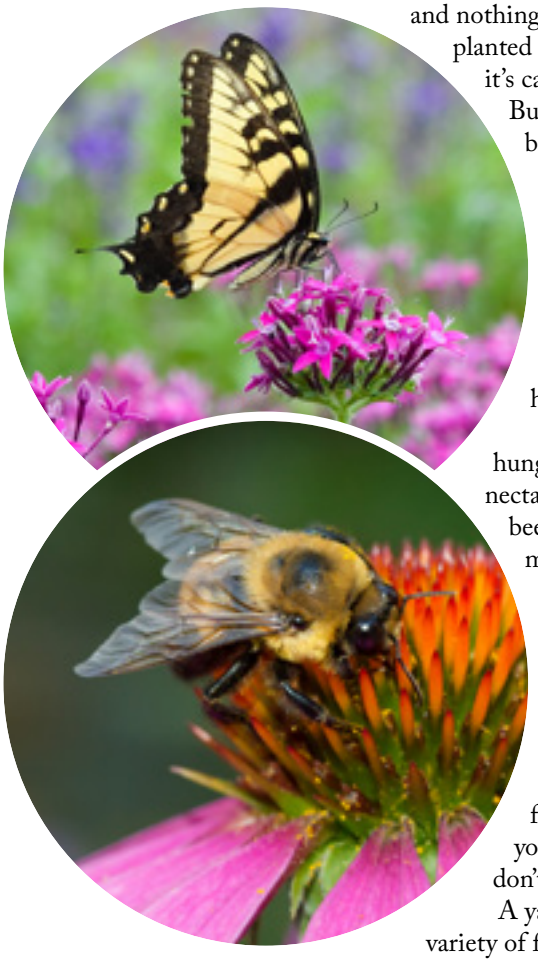
Lawns require a lot of water. On average each day across the United States, people use some 30 billion liters (8 billion gallons) of water on their yards. At the same time, much of this country has undergone years of drought. Water is often scarce. Both homeowners and researchers have been looking for alternatives to water-guzzling grasses.

Brooke Moffis is a graduate student at the University of Florida in Gainesville. She works with Basil Iannone in the school's ecology of residential landscapes lab. "One of the ultimate goals of some of Brooke's work stems from the need to conserve water," Iannone says. One way to do that is to fill a

Yards filled with drought-tolerant plants, such as this garden in California, need less water than a green lawn. Those plants can also provide more food for hungry insects.

SIMONE HOGAN/SHUTTERSTOCK

lawn with a variety of native plants. These are plants that are originally from and adapted to the region.



People often think of lawns as grass and nothing else. When a lawn is planted with just one species, it's called a monoculture. But "we don't need it to be a monoculture to serve the function of a lawn," Iannone says. Adding native plants, he says — including some that many people consider weeds — can make for a healthier outdoor space.

Imagine you're a hungry insect. If you eat nectar or pollen — as many bees, butterflies, beetles, moths, ants and other insects do — a grassy lawn isn't going to feed you. It would be like going to the grocery store and finding aisle after aisle of one kind of food. And it's a food you either can't eat or don't particularly like.

A yard brimming with a variety of flowering plants would instead seem like a welcome buffet. The different pollens and nectars in these many flowers would make sure you — and other nearby insects — had plenty to eat. That's the idea behind adding flowering plants, such as clover, purslane or pennywort, to existing lawns.

No such thing as a weed

Plants naturally live in diverse communities. It's not surprising, then, that various species will regularly pop up in grassy lawns. Landscapers refer to plants naturally showing up where people don't want them as weeds.

People often respond to such plants with a toxic chemical. But it's possible to grow lawns without relying on such treatments. Instead, invite in hardy plants that not only feed animals but also need less water.

There are other perks to embracing so-called weeds. "You're creating a healthier environment where people can walk without worrying," Iannone says. There's no need for those signs telling people to keep off the grass due to chemical treatments.

Iannone and Moffis decided to start changing how people think about weeds. They're studying the ecological benefits of lawns with flowers that most people would label as weeds. Their experimental plots include drought-tolerant grasses that can handle Florida's high temps. Also in the mix are tough, low-growing wildflowers native to the state. Those flowers can be mowed and walked on.

So far, the researchers have found that plots with flowers attracted a greater diversity of pollinators. Diverse lawns also covered the ground better than grass-only plots. That helps hold moisture, so that the plants there need less water to thrive.

Welcome pollinators!

Pollinators help many plants reproduce. One-third of our food crops, for instance, need help pollinating — everything from the tomatoes in ketchup to the alfalfa used to feed dairy cattle (so we can get ice cream). Plants need a variety of pollinators to make healthy seeds for the next generation. And some pollinators, such as butterflies, may travel long distances. They need to find food along the way.

Green spaces, including lawns, can provide important dining rooms for pollinators and other urban wildlife, notes Sheryl Hosler. She's a graduate student in urban ecology at the University of Illinois Chicago. "For a long time, cities were treated as biological deserts," she says. "But there are lots of things living in the city besides people." Hosler wanted to know how our yards affect which insects stop by, specifically bees.

To find out, she went door to door in Chicago neighborhoods. At each home she asked people to let her study their backyards. She recorded the types of plants in backyards and tallied their flowers, both individual blooms and the number of flowering species. She recorded plant heights and flower colors. And she recorded bees — honeybees, bumblebees and a wide variety of native bees.

In a final step, she measured how effectively those bees were pollinating plants. To do this, she placed pots with cucumber plants in each yard she studied. "Cucumber plants literally cannot make seeds without the help of insect pollinators," Hosler says. When more pollinators move pollen from a male flower to a female one, the resulting cucumber develops more seeds.

"The higher the diversity [of bees], the higher the number of seeds," she says. That suggests those bees are "doing a good job moving pollen between the flowers."

ORHAN CAM, PAUL REEVES PHOTOGRAPHY/SHUTTERSTOCK

Green spaces, including yards and gardens, can provide important dining rooms for pollinators and other urban wildlife, notes Sheryl Hosler. Diverse plantings can provide a buffet for insects, such as the eastern tiger swallowtail (top) and brown-belted bumble bee (bottom).

Yards with diverse bee communities also had a variety of flowers in their lawns and gardens. It's "like a buffet," she notes. "Every bee might have different preferences. The more diverse the flowering plants in your yard are, the more likely you are to have a diverse bee community."

Pest control

Yards with many plant species offer benefits beyond pollination. A diverse ecosystem invites in many types of birds, mammals and other animals. That includes insects that prey on pest species. Ladybugs and lacewings, for example, eat aphids, which can damage a wide variety of plants. And chinch bugs cause huge amounts of damage to people's grass. But if there's a nearby garden that supports big-eyed bugs, those predators will keep the chinch bugs under control. Now people won't have to spray chemicals to get rid of them.

Incorporating shrubs and trees into yards also aids pest control. "If you're making this nice habitat for birds, then [those birds are] going to also help out by doing what a lot of these songbirds do best — which is eating just a ton of insects," says ecologist Megan Garfinkel. She, too, works at the University of Illinois Chicago. The key is to plant species that supply fruit and nuts for the birds to eat when insects aren't available.

Ecosystems provide other important services, too, she points out. Trees provide shade and store carbon. And people seldom think about the oxygen released by plants. But it's there in every breath we take.

Green spaces even support recreation, such as bird watching and hiking. When there's wildlife, the area around us becomes more engaging and even relaxing. It's kind of like going to a national park, but on a small scale close to home.

In urban areas, Garfinkel says, "there are all these types of benefits that wildlife can provide to us." But at the same time, she adds, we need to support them.

In cities, the spaces available to wildlife have been "really altered by a lot of the things that we're doing," she says — such as constructing buildings, roads and sidewalks. Most wildlife can't live in large paved areas. But changing how we care for our lawns can help wildlife make use of more urban areas.

Feed native species

Many plants bought from garden centers evolved on other continents. They may look pretty, but they may not provide much food for the wildlife native to where you live. They also may not make much nectar or pollen. And their leaves may not nourish the larvae of native pollinators, such as caterpillars.

Of course, many people "don't want their plants to look chewed on," says Sarah Buckley. She is a specialist in sustainable landscapes at the Nebraska Statewide Arboretum in Lincoln. But "caterpillars have to eat something if you want to have butterflies." She points out that "if nothing's eating your garden, then it's not habitat."

Lawns won't change overnight. Still, ecologists hope we'll soon start to see a shift. You can help. Talk with the adults in your life and suggest some changes. Ask if you can turn some grassy corner of the yard into a garden. We need to think of yards as more than just places to grow grass.

"If we could get people to start seeing the beauty in these sort of wilder-looking yards," Garfinkel says, "that would be a really great first step."

Some yards mix native plants (left) with grassy lawns, like this one. Native gardens can support insects, such as the green lacewing (above), that provide natural pest control. Green lacewing larvae are just one example of the many insects that chow down on lawn and garden pests.

SARAH BUCKLEY/NEBRASKA STATEWIDE ARBORETUM; PAVEL ABRAMOV/ISTOCK/GETTY IMAGES PLUS

Kathleen Murray won the World's Ugliest Lawn contest in 2023 for her yard in Tasmania, Australia. The divots in the lawn were created by native marsupials called bandicoots. The contest honors lawns that exemplify water conservation. The prize: a T-shirt that says "Proud owner of The World's Ugliest Lawn."

How to make a yard friendly for wildlife (and people)

1. **Do less.** Mow less often. And don't rake up all the leaves. This provides homes and nutrients for insects overwintering in those leaves, notes Garfinkel.
2. **Cut back on watering and fertilizing yards.** This will release less pollution into streams when it rains.
3. **Watch the weather and turn the sprinkler on only when the lawn needs it.** For a landscape to be sustainable, it has to use resources wisely, notes Buckley. She also recommends planting species that require less water.
4. **Cut back on weed killers and pesticides.** Those chemicals don't just stamp out wildlife. They can be harmful to people and pets. Spraying a lawn to get rid of weeds can put children at risk for cancer, asthma and cognitive harm, according to the American Academy of Pediatrics.
5. **Plant more native species.** Since they're adapted to your local climate and soils, they should need little help to thrive. They're also "ready to provide habitat for the animals and insects that are already there," Buckley points out.

Basil Iannone and Brooke Moffis created experimental lawn plots. Some had only grass. Others, like the one above, contained a mix of grass and wildflowers.

SANDRA B. WILSON

This urban gardener is mimicking nature to create healthier plants

Kwesi Joseph has ideas about how rocks and plants might team up against climate change

Kwesi Joseph's passion for soil health started while trying to fix his backyard garden. He turned to a local community garden for help. That's where he learned about natural farming. This type of growing doesn't rely on harsh chemicals to help plants thrive. Instead, gardeners use processes already found in nature. Adding eggshells and compost can boost nutrients in the soil, for instance. Integrated pest management attracts insects and birds that eat common garden pests. "It's like having a military in your backyard," says Joseph. "But it's one designed by nature."

Gardening also inspired Joseph to experiment. He wondered if crushed rocks could provide plants with essential nutrients. A former high school earth science teacher, Joseph already knew a lot about rocks. "When I learned what [these] micronutrients were, my geology background kicked in," says Joseph, now an urban garden specialist with the Cornell Cooperative Extension in New York City.

Working with a scientist from Cornell University, Joseph started conducting trials with basalt "rock dust." Basalt is a type of rock that contains micronutrients. These micronutrients can capture carbon dioxide from the atmosphere and trap it in solid minerals. Joseph thought that gardeners might be able to use this widely available rock to grow healthier plants while also helping with greenhouse emissions.

Joseph also helps community and school gardens in New York City troubleshoot any problems they may have while growing plants. In this interview, he shares his experiences and advice with *Science News Explores*. (This interview has been edited for content and readability.) — *Aaron Tremper*

Q How did you get to where you are today?

A I got into gardening as a way to reduce stress. After trying it out — and not knowing what I was doing — I threw myself into learning more about gardening. I realized that there wasn't an equilibrium in the backyard. So I wanted to make it a safe place for insects. Instead of using pesticides, I grew a wide variety of flowers that attracted the real killers. And they reduced the pest pressure in the garden. I'm slaughtering the pests just by growing flowers. That was interesting to me. Just looking at nature and trying to mimic it.

Kwesi Joseph studied geology in college. His studies inspired him to test how crushed basalt could help grow healthier plants. Though his first tests didn't pan out, he's hoping for better results this year.

R.J. ANDERSON/CORNELL COOPERATIVE EXTENSION

Joseph started gardening to relax. Now he is an urban garden specialist, and he often meets people at community gardens who also hope to use plants to help themselves unwind, he says.

Q How do you get your best ideas?

A I was one of those kids who broke apart toys to see how they operated and couldn't put them back together. But with gardening, you get to deconstruct things. That's the beauty of gardening. It's trial and error.

Q What would you say was one of your biggest failures and how did you get past that?

A My biggest failure was the rock dust trial. I didn't come from the plant science side of things. I didn't realize that I needed to be there frequently to collect this data, collect the samples and mail them out. When I do the rock dust trial this year, I will have a lab technician or a field technician working for me to collect the data.

Q What piece of advice do you wish you'd been given when you were younger?

A There's nothing wrong with failure. The more you fail, the more you learn. And to just see it as a giant experiment. It doesn't say anything about you if you fail. That's just the process that everyone goes through as a scientist. You will fail. You have to fail to be successful.

ROBOT BIRDS TO THE RESCUE

CLICKMANIS/SHUTTERSTOCK; RALPH SIMON

By **Aaron Tremper**

Meet the bots inspired by the wildlife they're designed to benefit >>

Two zebra finches sit on a wooden perch. The small songbirds with orange cheeks and black-and-white striped throats normally live in Australia's dry grasslands. But this pair is getting a tutoring session at Leiden University in the Netherlands. They listen intently to an intricate melody formed of trills and chirps from their feathered instructor. This singing teacher isn't a bird. Meet RoboFinch.

RoboFinch is a robotic singing coach for birds. Researchers designed RoboFinch to study what young songbirds need to see and hear to better learn their tunes. Such robots could one day help rare birds survive. RoboFinch is one of several new robots that mimic wildlife to help solve problems.

People have been mimicking birds in design for hundreds of years. Famed artist-scientist Leonardo Da Vinci noted as early as the 1480s that birds could inspire flying machines. Today, birds inspire robots that make humans' lives and work easier.

And now researchers are creating robots that look, sound or act like birds to study and protect the birds themselves. They are discovering how birds learn their distinctive melodies, protecting birds from airplane collisions and working to help future scientists protect the habitats in which birds live.

Chorus lessons

Young male zebra finches learn to communicate by listening to adults. In the lab, researchers have found that these songbirds can learn from audio recordings. But zebra finches learn better when they listen to live male finches, notes Ralph Simon. He studies bioacoustics — how animals make and use sounds — at the Nuremberg Zoo in Germany. Simon is part of the team that built RoboFinch.

His group wanted to know how being around adult males helped young finches learn. Was it the social interaction? Or did they watch their elders' beak and head movements?

To find out, the researchers built six bird robots. They also recorded high-speed video of adult males to analyze how their beaks move when they sing. The researchers then programmed their robots to mimic those beak movements. "A lot of people thought we would never [make] a robot that moves its beak so fast," Simon recalls. Finally, the researchers painted their RoboFinches the same hues as the real birds.

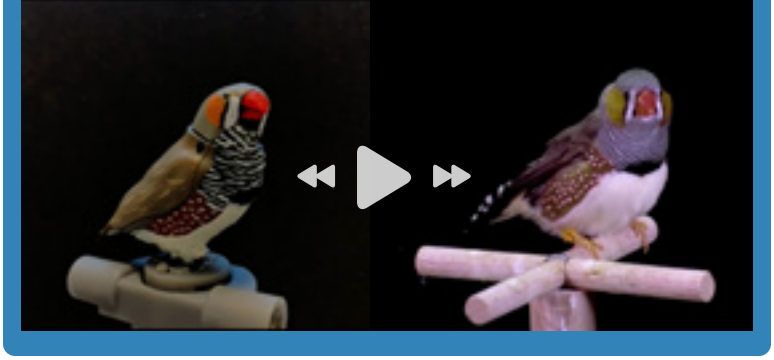
Then it was time for chorus practice.

In one experiment, the team divided 45 young finches into four groups. Some only heard recordings of finch songs played by a speaker. Others listened to the recordings while accompanied by female birds, which do not sing. This was to study whether song learning depended on social interactions. RoboFinches taught the two other groups of chicks. Birdsongs played from a speaker behind the robots. And the robots' beaks moved either in or out of sync with the songs. That allowed the team to investigate whether beak or head movements aid song learning.

Not all finches learned their tutors' tunes. But birds housed with RoboFinches eventually spent most of their time near the robot and its speaker. "Almost immediately, they became interested in [RoboFinch]," says Simon. "And then when it sang, they approached it within a few minutes."

The researchers tallied up the amount of time finches spent near the sound source, either a RoboFinch with a speaker or just a speaker. During

Listen to the finches practice their chorus!



RALPH SIMON

PLANE AND FALCON: MURATART, HARRY COLLINS PHOTOGRAPHY/SHUTTERSTOCK; ROBOT: UNIVERSITY OF GRONINGEN/MARINA PAPADOPOULOU

Birds can pose a big hazard for airplanes, so airports are keen to find ways to keep the birds away. The RobotFalcon (top inset) resembles a peregrine falcon (bottom inset), a speedy predator that many birds fear. In tests, RobotFalcon outperformed other methods for shooing away birds.

the first week, finches living with a RoboFinch whose song was in sync with its beak motions spent 27 percent of their time perching near the robot. Those caged with a robot playing songs out of sync were less keen. They only spent 5 percent of their time near the setup during the first week. Finches that heard only the audio without RoboFinch or female birds spent even less time around the sound source.

Young finches partnered with RoboFinches sang less while the songs played. This was especially true when the robots' beaks moved in sync with the songs. Those paired with a female also sang less while hearing the recordings.

The young finches seemed to pay close attention to the robots' movements during training sessions, the researchers say. When a RoboFinch started singing, the birds often stopped what they were doing to approach it. Scientists have observed similar behaviors in wild finches learning from live tutors.

The team shared its findings in *Methods in Ecology and Evolution*. The group also shared instructions on how to make RoboFinch. Simon hopes researchers will adapt this approach to building robots of other species, too.

Such robots might one day help orphaned birds, says Heather Williams. A behavioral ecologist, she studies bird songs at Williams College in Williamstown, Mass. She was not involved in the study. Chicks become strongly attached to whoever feeds or interacts with them, Williams says. Future bird-bots could one day help critically endangered birds reared in captivity. Orphaned chicks could attach to robots who could act as choral mentors.

Singing robo-birds could also be placed in the wild to teach endangered birds how to sing. If there aren't enough role models in the wild, scientists worry, young birds may not learn their characteristic calls. This may already be happening with some species, such as regent honeyeaters. Without instruction, such avians risk "losing the species' song," Williams concludes.

Air-traffic control

In some locales, feathered friends can pose a danger to people. Consider when birds collide with airplanes. Between 1990 and 2022, more than 260,000 collisions between civilian planes and birds were reported in the United States.

To help clear the air, engineers in the Netherlands at the University of Groningen have built a flying robot. The researchers designed their robot to look like a peregrine falcon — a bird that hunts a broad range of bird species all over the world. With its lifelike wings and tail, the robot sports the same gray feathers and speckled underside as its real-life counterpart. Fashioned from fiberglass and rigid plastic, this faux bird of prey is called RobotFalcon.

Bird species around airports should view the bot as a threat, says Groningen biologist Charlotte Hemelrijk. She's one of the robot's designers. RobotFalcon runs on two propellers that are attached to the fronts of its wings. Video relayed from a camera on its head allows drone pilots to steer the high-flying device.

Hemelrijk's team tested how well RobotFalcon scared away birds commonly found at airports. These included starlings, gulls, lapwings and corvids, such as crows and jackdaws. The researchers compared RobotFalcon's performance with how well a regular drone fared at shooing away such birds.

RobotFalcon won out. It cleared all 54 targeted flocks within five minutes of being deployed. Half of the time, RobotFalcon cleared the fields in just over 60 seconds. Birds also fled sooner when RobotFalcon came at them from above, like a real falcon predator would.

The regular drone cleared about 80 percent of its fields within five minutes. Half of the 56 flocks it targeted were cleared within two minutes — twice

as long as it took RobotFalcon. The drone also proved less effective at keeping birds airborne. Birds chased by the regular drone were more likely to land back in the field than the ones that encountered RobotFalcon.

RobotFalcon also outperformed other methods used to shoo birds, such as small explosives or recordings of the same species' distress calls. These are sometimes used at Leeuwarden Air Base in the Netherlands. The robot encouraged most birds to stay away longer than these other tactics.

Hemelrijk's team shared its findings in the *Journal of the Royal Society Interface*.

Many birds have a deep fear of predators etched into their brain, says Paolo Segre. He studies biomechanics at the University of Wisconsin-Green Bay. But we don't have a good understanding of how birds decide what poses a threat, he says. "Something about RobotFalcon makes birds think that it is a real falcon," he notes, "and more of a threat than other human-made objects."

Currently, airports use a range of drastic tactics to evict occupying birds. They might shine blinding lights at them, shoot them or release live falcons to hunt them down. In contrast, Hemelrijk notes, RobotFalcon "is an animal-friendly method."

A perching spy

High-flying drones can help researchers map and study animals across wide areas. These machines can count breeding colonies of water birds, find rare rainforest monkeys and even collect whale snot! But hard-to-reach places — such as under a forest canopy — can challenge drones, notes Peter Zheng. This roboticist led a team at Imperial College London in England that designed a robot to fill that niche.

Drones waste a lot of battery power staying in the air. By perching, a new type of drone can collect data for longer periods than regular drones. And, adds Zheng, "the longer you can stay in one place, the better." So his team's new robot changes shape to switch between flying and perching.

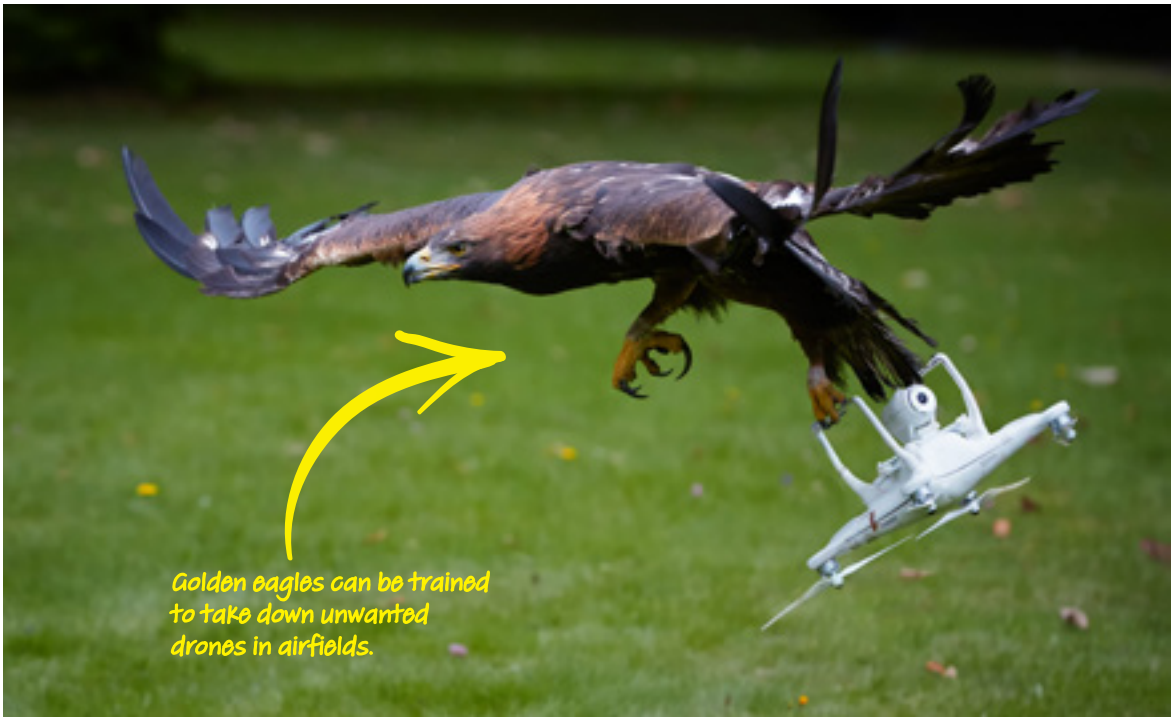
Four propellers allow the robot to navigate to a high spot. As the robot prepares to land, a motor pulls on a series of strings. They trigger an arm at the robot's front to curl around a branch. Once the drone has latched on, the motor shuts off. The clasping arm now holds the bot securely in place.

The researchers were inspired by tree-dwelling animals, such as sloths and squirrels, that use their arms in unique ways to grasp trees and stay up high. But the robot, nicknamed "The Sloth," also mimics what birds do when they perch. Steel spines line the robot's grasping arms. Like bird talons, these spikes latch onto tree bark. Zheng's group shared its design in *Scientific Reports*.

While the drone perches — prolonging its battery life — equipment on board could snoop on wildlife or its habitat. Microphones might record bird songs or monkey calls. Cameras could snap pictures while online sensors monitor humidity and temperature. What makes this new forest spy special, Zheng says, "is that it can stay on trees for a very long time."

At first glance, "The Sloth" doesn't look like a bird. But this flying drone has steel "claws" that mimic the talons that birds use to perch on branches. Such a robot could help researchers monitor hard-to-reach spots in rainforests.

PETER ZHENG



Some research has suggested that consumer drones can stress birds. Raptors such as hawks and owls may even attack drones to defend their territories and young.

MARTIN MECNAROWSKI/SHUTTERSTOCK; THE EXPERIMENT PUBLISHING

Are there risks to deploying bird robots?

Recruiting robots as conservation aids is still fairly new. Since the first of these eco-bots took off in 2011, the devices have come a long way, Segre notes. Many small ones are "widely available, easy to fly and highly customizable."

Still, scientists aren't sure how drones and other robotic tech might affect bird behavior.

Some studies suggest that birds aren't bothered by drones. But others have found that consumer drones can cause stress. Raptors, such as eagles and owls, may even attack drones to protect their territories. Researchers have also observed that shorebirds (such as American oystercatchers and the endangered piping plover) may try to chase drones away from their nests. This leaves their young vulnerable to predators.

But finding ways to study birds safely with robots could offer benefits. One BirdLife International report found that four in 10 bird species worldwide are in decline. North America, alone, has lost nearly 3 billion individual birds since 1970, according to a study in *Science*. And researchers are looking for any tools that could help address declining numbers of birds worldwide.

Today's robots probably can't collect all the detailed data on animal behavior that ecologists want, Zheng notes. The devices would likely spook the creatures they are supposed to spy on if they got too close, for example. And in general, robotics tends to focus on cutting-edge technologies. These may not be practical in the wild.

Still, whether it's singing finches or perching drones, a new wave of tech is taking cues from nature. These devices can tap into the unique abilities of birds and other tree-dwelling critters to help both humans and wildlife. Borrowing tricks from animals could make robots more useful, too. "Nature and animals are excellent at adapting to their environment," Zheng says. For roboticists, "there are many lessons to be learned from nature through biomimicry."

READ MORE

Find More Birds: 111 Surprising Ways to Spot Birds Wherever You Are
—by Heather Wolf

Birds are everywhere, and this book will help you find them. It suggests unexpected places to search and what to watch for.

ANIMALS

How do migratory birds navigate?

Use real-world data to investigate birds' sense of direction

By Science Buddies

Each winter, Gambel's white-crowned sparrows migrate from Canada and Alaska to California and Mexico — but how? Do the birds simply follow an instinct to fly south? Or can they navigate to their intended destination no matter where they start? And do young birds making their first trip navigate the same way as older, more experienced birds? In this experiment, we investigate by analyzing tracking data on 15 young and 15 adult sparrows. These birds were taken from Washington state and released in New Jersey.

OBJECTIVE

Determine if white-crowned sparrows can find their way to their wintering grounds from more than 3,500 kilometers (2,200 miles) away.

EXPERIMENTAL PROCEDURE

1. Open the dataset at https://bit.ly/SNEmigrate, which shows each bird's ID number, age and location at different dates and times — starting when it was released.

2. Using Google Earth, mark each location visited by each bird. Label each spot with the bird's ID and the date/time it was there.

3. Using Google Earth's path tool, connect all the marked locations for each bird, tracing its total flight path.

4. Use the path tool to create three imaginary lines starting from New Jersey, which show which way the birds would travel if they were headed: (a) back to Washington, (b) directly south or (c) toward California or Mexico.

5. How many birds traveled in the direction of each imaginary line? Does it seem that the birds simply follow an instinct to travel south, or can they navigate to their migration destination even after being displaced? Are the answers different for young and adult birds?

Find the full activity, including how to analyze your data, at snexplores.org/birdmigration. This activity is brought to you in partnership with Science Buddies.

SCIENCE BUDDIES

Some birds migrate in flocks. But Gambel's white-crowned sparrows (pictured) travel thousands of kilometers (miles) solo between their breeding and wintering grounds each year.

CRAIG CHADDOCK/SHUTTERSTOCK

Written by Maria Temming
Illustrated by JoAnna Wendel

Secrets of the Octopus Garden

This is the Octopus Garden, the largest known group of octopuses in the world. Nestled on a rocky seafloor hill off the coast of California, it lies about 3.2 kilometers (2 miles) below the ocean's surface. Here, thousands of pearl octopuses, each about the size of a grapefruit, gather to mate and nest.

Since it was discovered in 2018, scientists have wondered why pearl octopuses chose this spot for their nursery.

"It's just kind of this magical place in the dark, cold waters of the deep sea," says James Barry. He's a marine biologist at the Monterey Bay Aquarium Research Institute in California. To find out what draws octopuses here, Barry and his team drove a remote-controlled robot down to the Octopus Garden 14 times over three years. It turns out, octopuses nest near cracks and crevices where warm water seeps out of the seafloor.

Eggs in the Octopus Garden's hotspots hatched in less than two years.

In colder waters nearby, eggs would probably take at least five years to hatch.

Hatching faster leaves less time for octopus eggs to get injured, sick or eaten by shrimp, snails or other predators. That probably boosts baby octopuses' odds of survival.

Mama octopuses usually die after their eggs hatch. So after hatching, the babies don't stick around. "They swim off into the dark," Barry says. Where they go remains a mystery.

ENVIRONMENT

Nanoparticles from tree waste could prevent fogged lenses

Coating glass keeps water droplets from clouding the view

Cold weather can be extra annoying for people who wear eyeglasses. Walk indoors from the cold, and your lenses get fogged up. The same thing happens when the warm air from a car's heater hits a cold windshield. A new coating could prevent that fog. Its key ingredient: tiny particles made from tree waste.

When you enter a house from the frosty outdoors, the warm air around you cools. This causes some of the water vapor in the air to condense into droplets. If you have glasses, nearby water droplets will latch onto the lenses and fog them up, explains Alexander Henn. He developed the new coating at Aalto University in Espoo, Finland.

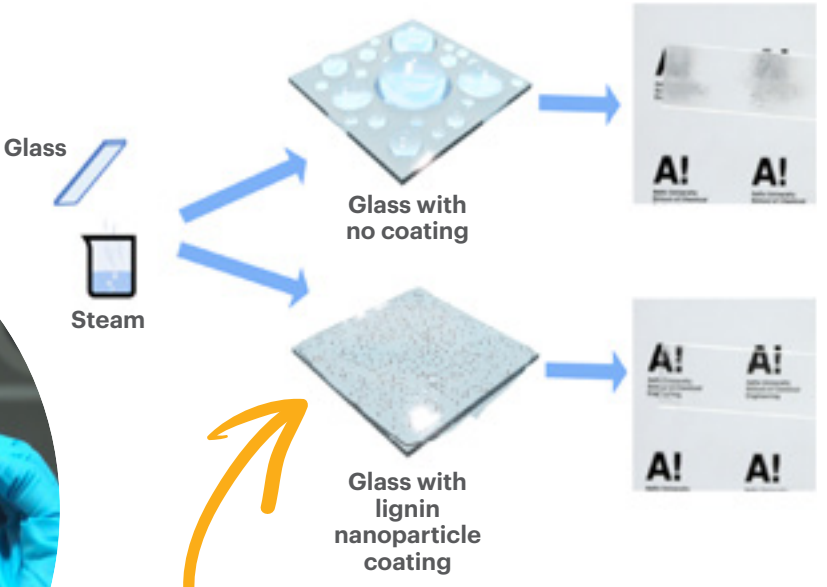
The shape of the water drops on your lenses is what makes it hard to see, says Monika Österberg. A chemist, she also works at Aalto University. Droplets scatter light in all directions, she says. Look through them and you can't focus on anything. But if you were to look through a thin film of water, all would be clear.

Österberg and Henn tackled the fog challenge using a renewable waste product: lignin. It's a polymer — a big molecule made from smaller building blocks. Woody plants contain lots of lignin. That's what keeps them stiff and strong.

"Here in Finland, we have a lot of trees," Österberg says. "You can build with the wood. Or you can make pulp that you can use to make paper or, now, textiles," she says. But most of those processes don't use a tree's lignin. It ends up as a waste product.

When warm air hits cool glass, water droplets make a "fog" that's hard to see through.

CHRISTINA LANDINO/SHUTTERSTOCK



When steam hits an uncoated glass surface, water droplets condense, making it hard to see through (top). Coating that glass with lignin nanoparticles makes the droplets spread into a thin layer of water that doesn't obscure vision (bottom).

ALEXANDER HENN/AALTO UNIVERSITY

Alexander Henn (above) shows the difference between a typical lens (left) and a coated lens (right) when his glasses are exposed to steam.

WASTE NOT

Waste lignin is a brown powder that looks a bit like cocoa. It can be burned as a fuel. But there are more valuable and environmentally friendly ways to use it, Henn says.

Scientists are exploring new ways to turn this waste into a resource.

There are two main approaches, says Bin Yang. Though not part of the new work, this chemical engineer and microbiologist is familiar with such tactics. At Washington State University in Richland, he works on tech to develop energy from renewable resources.

The first approach is to make new chemicals and fuels with lignin, Yang explains. The second is to make new materials, such as nanoparticles. Nano bits are so small that they're measured in billionths of a meter.

Henn and Österberg had been working with lignin nanoparticles before they ever thought about fog. To make them, the scientists dissolved lignin powder in a liquid made of organic molecules (ones with a carbon backbone). When the researchers poured that liquid into water, the lignin bunched up. It formed tiny clusters dispersed in the water. Each one was about 100 nanometers in size. Those tiny bits were hydrophilic, which means they loved water, Henn says.

A CLEAR SOLUTION

Henn realized that coating glass with water-loving lignin bits would change how its surface interacts with water. The nanoparticles want to grab onto the water. That would make it spread out across the glass surface. If that water spreads out enough, the droplets would form a continuous thin layer. Now wet, the lenses might not be foggy.

There was just one problem. "You can see lignin particles," Henn says. So putting lignin bits on glass would make it look a bit dirty.

This motivated Henn to make smaller lignin particles. He swapped a group of atoms on the lignin polymers for one that interacts differently with water. This made the polymers bunch up extra tightly. They formed particles smaller than 50 nanometers across — tiny enough to escape notice.

The team coated glass with a single layer of this lignin liquid. The coating kept the glass from fogging up in steam and during temperature changes. The group shared its finding in *Chemical Engineering Journal*.

The coating isn't costly and it should be possible to scale up production, the researchers say. And the coating could do more than make life less annoying for glasses wearers — it could make life safer, too. Many people whose work calls for eye protection don't wear safety glasses because clearing foggy lenses slows down the work, says Henn. Lignin could offer a clear — and sustainable — solution.

— *Kendra Redmond*

TECHNOLOGY

Could we build a mecha?

These giant robots might be better suited for construction work than fighting crime

Optimus Prime from *The Transformers* rearranges his body parts to become a semi trailer truck. In the *Gundam* series, pilots battle in space using massive mobile suits. Power Rangers fuse smaller machines together to fight crime as a humanoid robot, Megazord.

Called mechas, these larger-than-life robots have what it takes to save the day. But would these giants hold up in real life?

Well, if you travel to Yokohama, Japan, you can find a real-life Gundam. Sort of. Standing at 18 meters (59 feet) tall, this huge robot can't fly in space or wield laser beam sabers. But it can bend down on one knee and move its fingers. It currently holds the Guinness World Record for the largest mobile humanoid robot.

Certain giant robots are more realistic than others, says Sangbae Kim. He's the director of the Biomimetics Robotics Laboratory at the Massachusetts Institute of Technology in Cambridge. Engineering a Transformer that morphs in mere seconds would be trickier than crafting a Gundam mobile suit that keeps its shape, he says.

There aren't too many technological barriers to making a rearranging robot, agrees Robert Siddall. At the University of Surrey in England, this engineer studies how animal movements can help people build better robots. Matching the speed of a Transformer rearranging itself mid-jump, though, would require extreme accelerators on all of its interchanging parts.

MECHA MADE

Roboticists have already built simple mechas. The Japanese company Suidobashi Heavy Industry unveiled its rideable mecha, Kuratas, in 2012. This 4-meter (13-foot) tall robot sports four wheels and a pair of massive arms. And in 2017, Amazon founder Jeff Bezos rode in the Method-2, a 4.1-meter (13.5-foot) tall walking mecha built by South Korean roboticists from Hankook Mirae Technology.

But unlike their film counterparts, these smaller mechas move very slowly, says Siddall. "They don't move in that dynamic way that you sort of hope to see in the movies."

Part of this has to do with the square-cube law. As an object gets taller, its surface area increases by the square of its height. Its volume, in turn, increases by the cube of its height. By doubling the height of an object, its strength quadruples while its weight increases eightfold.

This law applies to animals as well, says Siddall. Large animals, though, evolved ways to help carry their weight. Sauropod dinosaurs such as *Brachiosaurus* and *Diplodocus* had hardened tendons in their long necks to help hold up their heads, studies suggest. Elephants have foot pads to help distribute their weight and allow them to run.

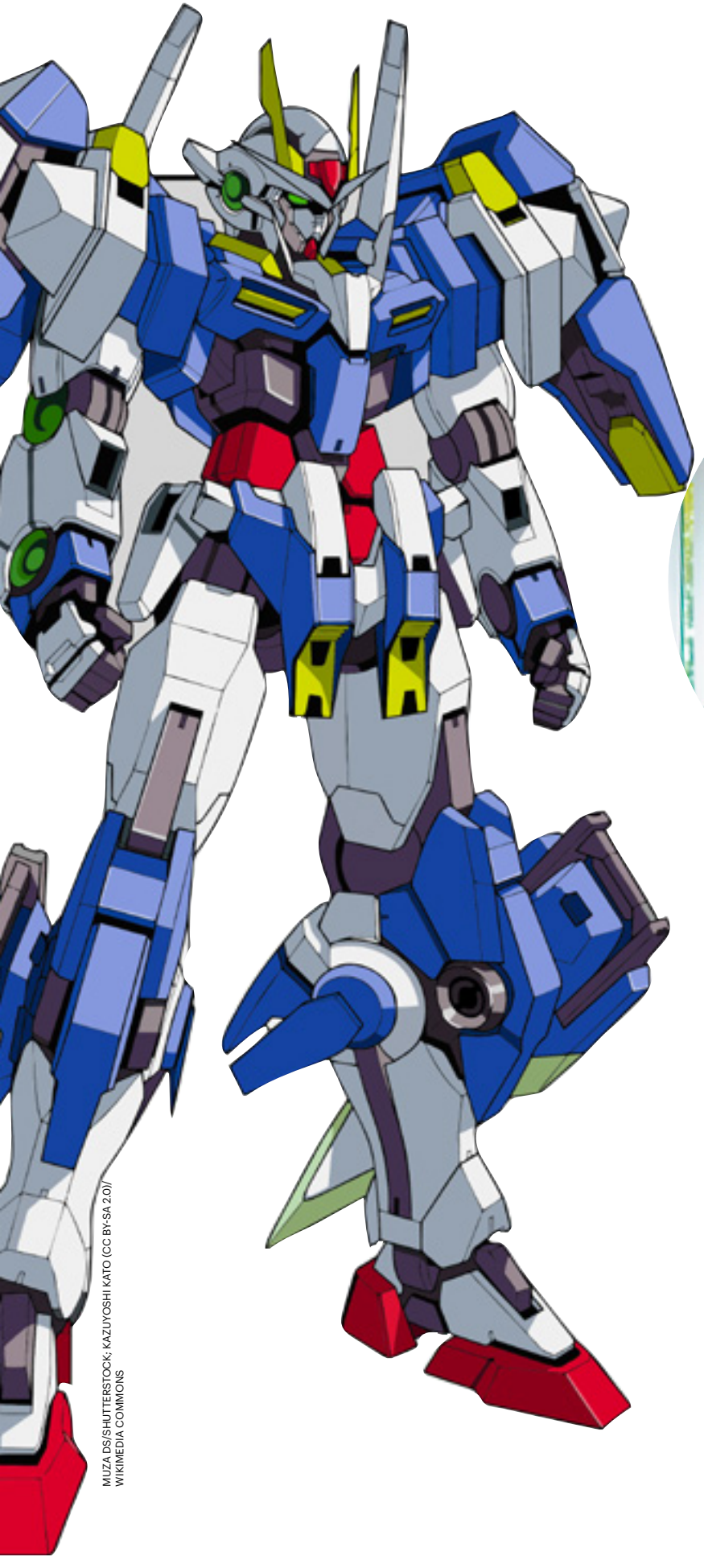
Adding squishy and pliable footpads might help divert energy, says Siddall. Reinforcing the robot's body with rubber could also add extra shock absorption. This rubber would serve a similar purpose as bone does in our bodies. Though only as strong as fiberglass, human bone is more flexible than steel. This springiness helps diffuse the force of high-impact movements like sprinting and jumping.

Running might still be too much for a mecha, though. When a person runs, each heel produces a force three to four times their body weight. For a 77-kilogram (170-pound) person, that's nearly 318 kilograms (700 pounds) of pressure traveling up from the foot. The Yokohama Gundam weighs 25 tons, or roughly the same as five male African elephants. "A walking robot as big as a Gundam is doable," says Kim. But a real-life mecha could easily break from the impact of a quick run or accidental fall.

Swapping steel for titanium could lighten a mecha's frame. Titanium weighs nearly half as much as steel but is just as strong. It's often combined with other metals when building high-speed aircraft and spacecraft. Titanium could also be reinforced with carbon fiber, says Kim. Made of tiny carbon filaments, this material is also lightweight and strong.

In the movies, mecha are the perfect fighting machines. These robots rely on their bulk to squash crime and muscle through dangerous situations. A real mecha would probably

Thanks to Earth's gravity, giant piloted robots like this Gundam from the *Mobile Suit Gundam* series would probably struggle with all but the most basic tasks.



MUZA DS/SHUTTERSTOCK; KAZUYOSHI KATO (CC BY-SA 2.0)/ WIKIMEDIA COMMONS

The Kuratas can be operated by a pilot in the cockpit and remotely. This 4-meter (13-foot) tall machine holds the record for the largest mecha robot controlled by a smartphone.

be more sluggish and uncoordinated than its brawny counterparts. What job would a real-life robot have?

"The closest thing I can think of is a glorified excavator," says Kim. Excavators clear heavy debris and dig trenches using a mechanical arm. These heavy construction vehicles often rely on other specialized machines such as dump trucks and bulldozers to finish a job. A single mecha could do the work of several machines while also being easier to control.

Such giant workers could help with mining or offshore construction. They might even assemble structures in near-Earth orbit, says Siddall. Future humans might rely on mechas for building space stations or space habitats. These large-scale settlements would need to be kilometers (miles) wide to sustain artificial gravity. Siddall says, "At that point, you'd probably ... want to use bigger and bigger robots."

— *Aaron Tremper*

ENVIRONMENT

What is an endangered species?

Identifying species in danger of disappearing is the first step to conserving them

From the tiniest mushroom to the mightiest whale, endangered species have one thing in common. They're in danger of disappearing. Whether it's a cactus or a coral, these species face threats in their environment. Such threats can include habitat loss, disease and climate change. And with small or dwindling numbers or range, these species could soon be completely gone.

Governments and organizations use different terms and criteria to describe species' risk of going extinct. The International Union for Conservation of Nature (IUCN) is a global organization that gathers information about the world's species. The organization ranks species based on their population health. A species in peril, considered Threatened, can be labeled as **Vulnerable**, **Endangered** or **Critically Endangered**. Meanwhile, the U.S. government has its own terms: **threatened** and **endangered**.

"But the goal is the same — identify the species at highest need of our help," says Jennifer Luedtke Swandby. Luedtke Swandby is a conservationist who helps the IUCN keep track of the world's amphibians. She also works in Washington, D.C., for Re:wild. This organization is working to protect the diversity of life on Earth.

More than 40,000 species fall into the IUCN's Threatened categories. These categories are like a warning system for extinction risk. Imagine a Vulnerable species, such as the giant panda, carrying a yellow caution sign. But a species that is Critically Endangered — such as the Sumatran rhino — has a flashing red siren.

The United States has its own process for identifying plants and animals in peril. A law called the Endangered Species Act (ESA) guides the process. The U.S. Endangered Species List has just two categories. Species it lists as endangered are considered currently at risk of extinction. Threatened species are those that could become endangered in the future.

"Once a species is listed [by the ESA], that gets legal protection," explains Brenna Forester. She's a biologist with the U.S. Fish and Wildlife Service in Fort Collins, Colo. That's one of the agencies that collects information about species' health, habitat and threats. That information is used to decide whether a species should be listed and protected.

If a plant or animal makes it onto the Endangered Species List, it becomes illegal to harass, kill or catch them. Then the next step begins: developing a plan to help them recover. We "figure out what needs to happen to stop the threats," Forester says. That plan could involve restoring habitats or removing invasive predators. It can even mean breeding the species in captivity to boost its numbers.

Figuring out species' extinction risk is just the first step to conserving the planet's biodiversity. "Whether it's to inform a school project or the creation of a national park, we want this information to be widely used," Luedtke Swandby says. "The reason we're doing this is so that people can do something about it."

— *Jaime Chambers*

CREATIVEANGELA/SHUTTERSTOCK

U.S. ENDANGERED SPECIES ACT SUCCESS STORIES

The ESA currently protects more than **2,300 species**. This includes more than 900 plants and at least 160 marine species. So far, the Act has kept **99 percent** of listed species from extinction.

ISLAND NIGHT LIZARD
(Xantusia riversiana)

STATUS: delisted due to recovery

The eyelid-less lizard, which is native to California, was delisted in 2014 — 30 years after a recovery plan had been implemented.

GOLDEN PAINTBRUSH
(Castilleja levisecta)

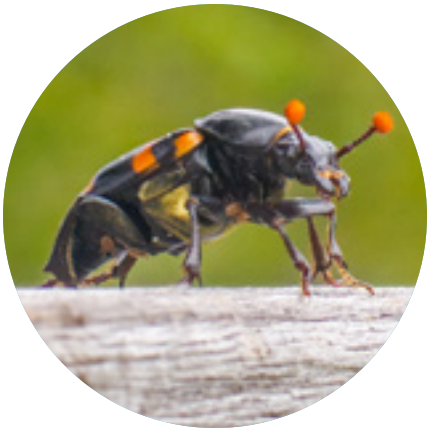
STATUS: delisted due to recovery

This once-endangered flower once again grows in the wilds of Washington and Oregon thanks to habitat restoration efforts.

HUMPBACK WHALE
(Megaptera novaeangliae)

STATUS: endangered (but not everywhere)

One of the first animals added to the U.S. Endangered Species List, the humpback whale has recovered such that 9 out of 14 populations are no longer considered in danger.



AMERICAN BURYING BEETLE
(Nicrophorus americanus)

STATUS: threatened

The largest of U.S. carrion beetles, this eater of dead animals moved up from endangered in 2020 due to improving population numbers.

GRIZZLY BEAR
(Ursus arctos horribilis)

STATUS: threatened

These bears have been making a comeback in the northern Rocky Mountains due to protections that prevent them from being killed.

OREGON CHUB
(Oregonichthys crameri)

STATUS: delisted due to recovery

Tiny Oregon chub again swim through Northwest bogs and ponds, thanks to protections offered by the ESA.

EARTH

Climate change may worsen ocean noise

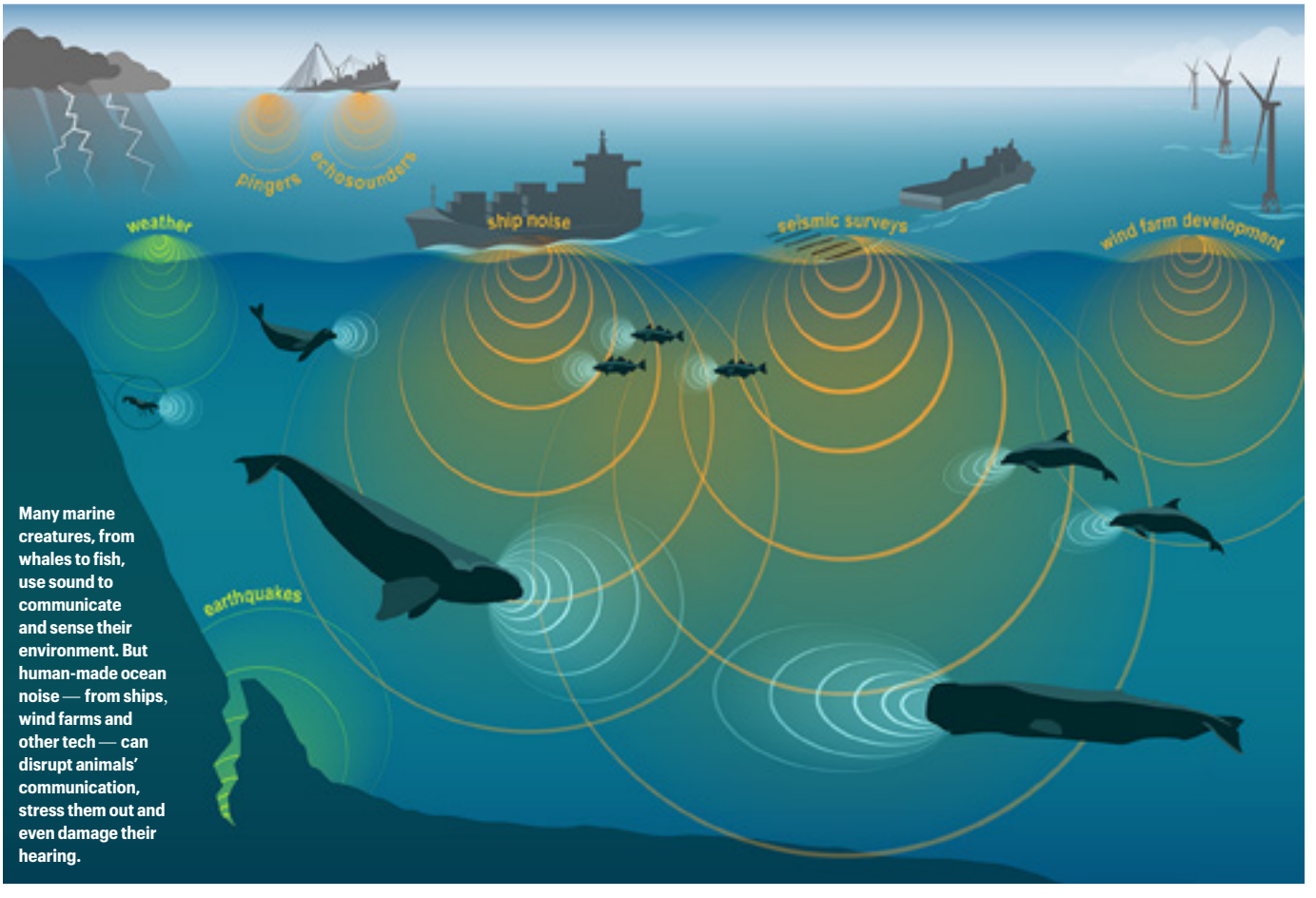
Sound traveling faster and farther may harm marine animals

From the rumble of boats to the din of oil drilling, sounds from human activity cascade across the oceans. This noise can bother ocean creatures. And climate change may make some spots even louder.

Researchers have expected the oceans to get noisier because of increasing human activity. "The more goods you buy, the more shipping you have, so the more noise you have," says Luca Possenti. He studies sound in the ocean at the Royal Netherlands Institute for Sea Research in Texel. But Possenti and his colleagues realized that climate change might also influence how sound travels through the water.

Human-caused climate change is altering ocean temperatures, salt levels and acidity. So Possenti's team used computers to model how those factors influence noise levels across the world's oceans. The team compared models of the world now to models of the world in about 75 years if climate change continues. They found that changing ocean temperatures and salt levels could affect how well different layers of the ocean mix. And that, in turn, had a big impact on how well sound traveled.

In the North Atlantic, the researchers saw a boost in sound levels in the upper 125 meters (410 feet) of the ocean. This was caused mostly by ice melting off of Greenland, forming a chilly layer of water near the ocean's surface. Sound traveling through water tends to bend toward the coldest area, Possenti says. As a result, sound waves tended to get stuck



Many marine creatures, from whales to fish, use sound to communicate and sense their environment. But human-made ocean noise — from ships, wind farms and other tech — can disrupt animals' communication, stress them out and even damage their hearing.

NOAA FISHERIES

in the chilly top layer — spreading farther out across the water, instead of traveling deeper. That increased the noisiness at this depth in the North Atlantic. The models suggested that, in the future, a single ship could sound about five times louder underwater because of this, Possenti says.

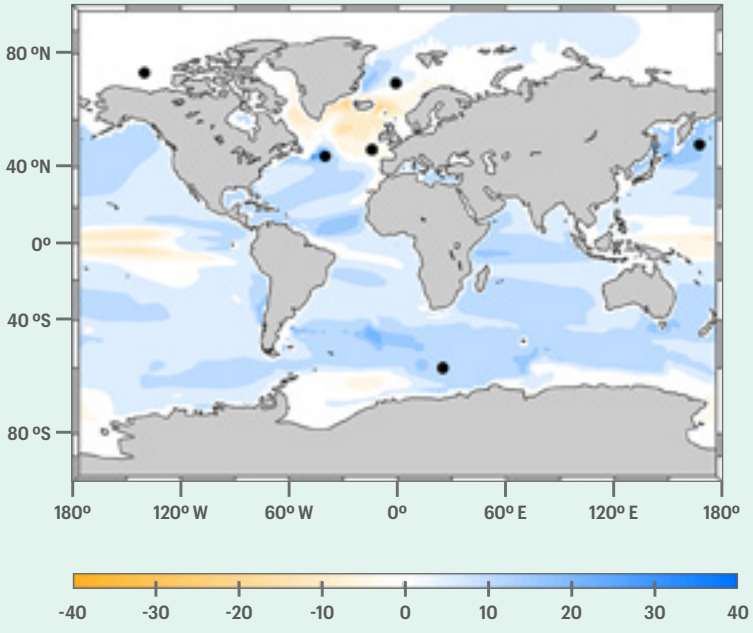
The researchers shared their findings in *PeerJ*.

This bump in loudness is important because of all the ship traffic between Europe and North America, he says. The noise from that activity could make this area of the ocean even louder. That may stress animals, many of which communicate, hunt or navigate with sound. Marine mammals seem to avoid harbors because of the noise, Possenti says. "But if everywhere is going to get louder, we don't know what is going to happen."

— *Carolyn Wilke*

TURNING UP THE VOLUME

Sound could travel differently through the ocean in the future thanks to changes in wind speed and water temperature, salt levels and acidity. Researchers modeled the speed of sound 125 meters (410 feet) below the ocean's surface around the world. They did this first for the years 2018 to 2022. Then they modeled how fast sound would travel at that depth in the years 2094 to 2098 if the world experiences moderate warming. This heat map shows the difference in sound speed between those two time periods. In their model, the researchers placed sound sources (black dots) at several spots near the coasts of continents.



DATA DIVE

1. What are some areas where sound may travel more slowly in the ocean in the future?

2. What are some areas where sound may travel more quickly?

3. How much more quickly will sound travel in the North Atlantic, between Europe and the United States?

4. How might this picture change if the researchers placed the sound sources elsewhere in their computer model?

5. Why would it be harmful for animals that communicate or navigate with sound to live in louder environments?

ANSWER

Jupiter's newfound, super speedy jet stream

The source of the air current's energy remains a mystery

New beauty shots of Jupiter reveal a fast, narrow air current, or jet stream, looping around its equator.

Researchers have known Jupiter had other jet streams since 1979. Those winds whip through a part of the planet's atmosphere known as the troposphere. The newly spotted feature lies 20 to 40 kilometers (12 to 25 miles) higher up, in the gas giant's stratosphere.

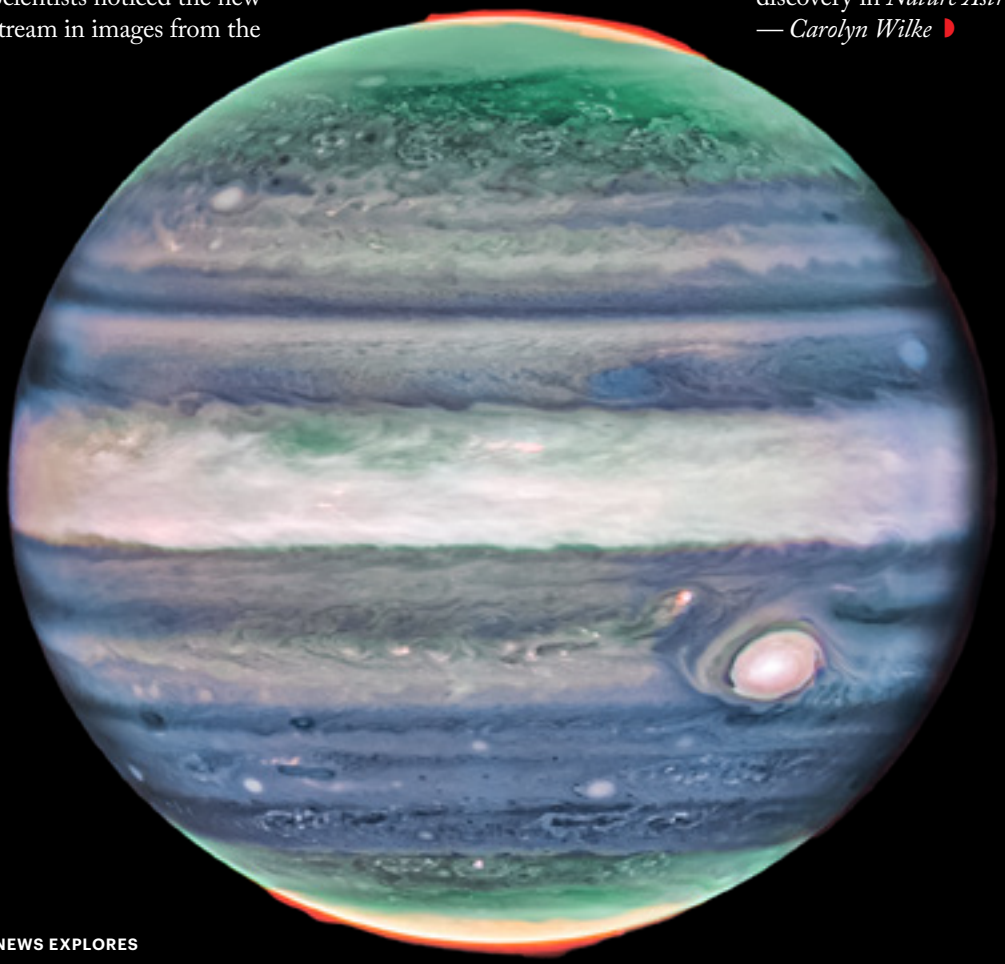
Scientists noticed the new jet stream in images from the James Webb Space Telescope. The researchers compared two snapshots of Jupiter taken 10 hours apart. Those images showed spots and streaks in Jupiter's atmosphere. Based on how those spots and streaks shifted between the shots, the team could clock the jet stream's speed.

This air current flies at about 500 kilometers (300 miles) per hour. That's roughly twice as fast as the jet streams lower in Jupiter's atmosphere.

"We were not expecting to find these strange motions," says Ricardo Hueso. An astrophysicist, he works at the University of the Basque Country in Bilbao, Spain. None of the theories about the planet's atmosphere predict a change in winds at this altitude, so it's not clear yet what causes the speedy jet.

Hueso's group reported the new discovery in *Nature Astronomy*.

— *Carolyn Wilke*

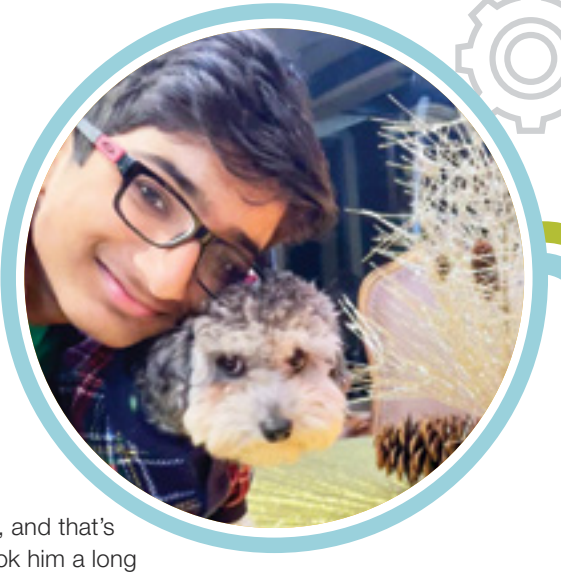


This false-color image of Jupiter was taken by NASA's James Webb Space Telescope. A thick band of clouds circles the planet's equator. Some of the bright white spots in this area are storms. Auroras (red) can be seen over the poles.

NASA, ESA, CSA, STScI, R. HUESO/UNIV. OF THE BASQUE COUNTRY, I. DE PATER/UCB, T. FOUCHET/OBSERVATORY OF PARIS, L. FLETCHER/UNIV. OF LEICESTER, M. WONG/UCB, J. DEPASQUALE/STSCI

INSIDE THE MIND OF A YOUNG SCIENTIST

A Thermo Fisher Scientific Junior Innovators Challenge finalist answers four questions about his science



Science competitions can be fun and rewarding. But what goes on in the mind of one of these young scientists? **Maan Mamta-Sanjay Patel**, a finalist at the 2023 Thermo Fisher Scientific Junior Innovators Challenge, shares some of his experience.

Q What inspired your project?
A "I was on a ski trip with my brother and my dad, and that's when my dad had an accident," Maan says. "It took him a long time to recover, and I had known that the helmet on his head had saved his life." Maan designed a bike helmet for his project.

Q What was your favorite part of this project?
A "My favorite would be getting to research Voronoi patterns, because they're very fascinating." Maan says. These patterns can be found on turtle shells and a giraffe's coat.

Q Most important resources?
A "My starting article, the thing that sparked my thought, was an article in *Science News*," Maan says. "It was talking about how sea urchin skeletons had an 82 percent match with a randomly generated Voronoi pattern."

Q If you did this project over again, what would you change?
A "I might test more shapes, because this time I tested patterns of the same shape," Maan says. "I could randomly generate Voronoi patterns and test those, and it would be interesting to see how those would differ."

Thermo Fisher Scientific Junior Innovators Challenge finalist

Maan Mamta-Sanjay Patel

Maan, 14, took inspiration from turtle shells to design better bike helmets. The scales on turtle shells are arranged in mathematical patterns called Voronoi patterns. Maan designed and built clay test helmets with these patterns and found they did not break as easily as other test helmets when dropped. This finding could lead to safety gear that better protects bikers in accidents, which injure more than 130,000 cyclists and kill 1,000 others per year. Maan is a seventh grader at McCullough Junior High School in The Woodlands, Texas.

EXPLORE
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What are three reasons lightning bugs glow?
Why are giraffe tongues blue?
Why do we knead bread?