



# ScienceWorld<sup>®</sup>

current science

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Superstorms  
on the Sun

### CHEMISTRY

Name That  
Element!

### BIOLOGY

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Albino Animals

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This treehouse  
was built  
about 45 feet  
off the ground.

#### CLOSER TO NATURE

A terrace below the  
main structure gives  
visitors an up-close  
view of birds.

#### HOME IN THE LEAVES

The structure  
is in a forest  
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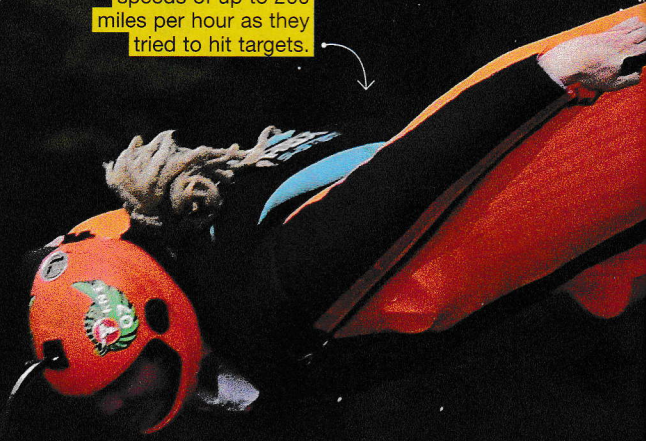
# SCIENCE NEWS

## PHYSICS: FORCES

# TARGET PRACTICE

### FALLING FAST

Contestants reached speeds of up to 200 miles per hour as they tried to hit targets.



This past fall, a group of elite skydivers jumped off a 1,460-meter (4,780-foot) cliff in Tianmen Mountain National Park in China. They flew using specialized *wingsuits*—garments that help skydivers glide long distances. These daredevils were competing in the 6th Carabao World Wingsuit Championship—a contest in which participants whiz through the air and try to hit as many polystyrene targets with their bodies as possible.

A wingsuit has flaps made from a specialized blend of materials that stretch between a wearer's arms and legs. These flaps catch air, which pushes against the suit as a skydiver falls. That creates *lift*—an upward force that helps wingsuit wearers stay aloft and maneuver through the air.

"If you were ever a kid who spread his arms and hoped to fly, this is the fulfillment of that dream," says Tim Sestak, a professor, wingsuit flyer, and engineer who studies wingsuit design at Embry-Riddle Aeronautical University in Prescott, Arizona.

—Spenser Mestel

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### IT'S A HIT

Crashing through the bull's-eye at the center of the target earns skydivers 50 points.

### IN FLIGHT

This wingsuit is specially designed to increase the body's surface area, creating resistance to the air to provide lift.

#### HELMET

Head protection and camera mount

#### WINGS

Provide lift by catching air as skydiver falls

#### PARACHUTE

Pulled at the end of a wingsuit flight for a safe landing

#### TAIL

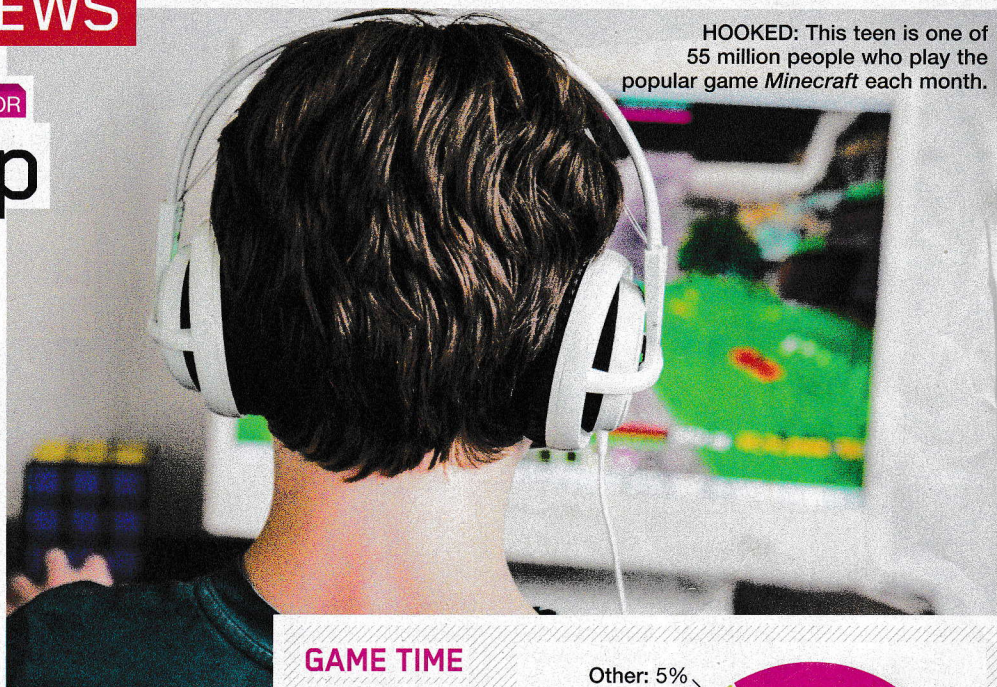
Provides extra control and helps regulate speed



## BIOLOGY: HUMAN BEHAVIOR

# Level Up

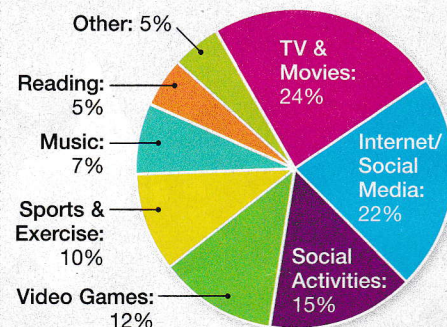
Would your school benefit from a club where kids can play video games? Matthew Barr, a lecturer at the University of Glasgow in Scotland, thinks so. Barr recently asked 16 college students to play 14 hours of video games over eight weeks to study how it affected their brains. He discovered that the activity helped strengthen *neurons*—specialized nerve cells—in the brain related to resourcefulness, adaptability, and communication. Even when students played single-player games, their social skills improved as long as they were talking to other players at the same time. “Playing video games is like exercising your brain,” says Barr. “The more you practice using the brain, the stronger it gets.” —Spenser Mestel



**HOOKED:** This teen is one of 55 million people who play the popular game *Minecraft* each month.

## GAME TIME

This graph shows the percentage of free time kids ages 13 and up in the U.S. spend on various activities. How does this breakdown compare to how you and your friends spend your time?



SOURCE: NIELSEN GAMES 360 REPORT (2017)



**IT'S MELTING!**  
This thin, stretchy sheet of electronics dissolves in the presence of vinegar.

## CHEMISTRY: MATERIALS

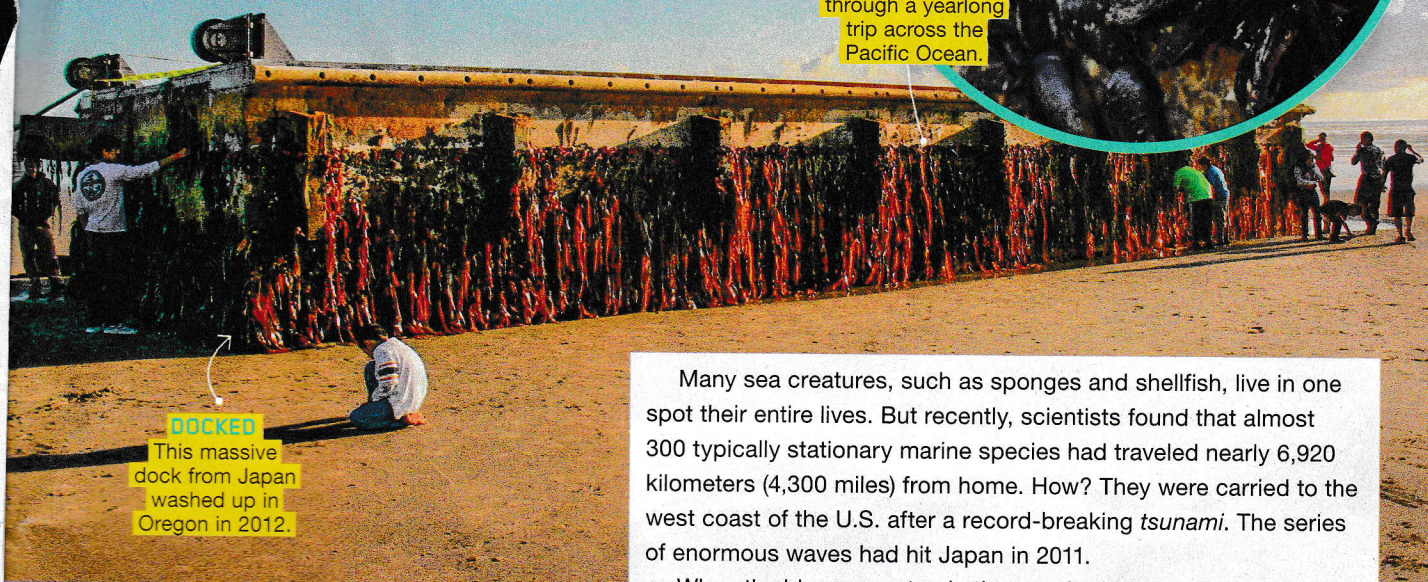
# Dissolvable Electronics

Each year, people in the U.S. throw out 10 million tons of broken or outdated computers, phones, and other devices. To prevent this e-waste from piling up in landfills, it's essential to find alternatives to throwing it away, says Ting Lei, a chemical engineer at Stanford University in California. Lei recently helped develop a new plastic *polymer*—a large molecule made up of repeating units. The chemical bonds between some of the polymer's atoms break down in the presence of acids, such as vinegar. The polymer could be used to make dissolvable electronic components that are better for the environment.

—Hailee Romain



# HITCHING A RIDE



**DOCKED**  
This massive dock from Japan washed up in Oregon in 2012.

**SURVIVORS**

These clingy crustaceans got through a yearlong trip across the Pacific Ocean.

Many sea creatures, such as sponges and shellfish, live in one spot their entire lives. But recently, scientists found that almost 300 typically stationary marine species had traveled nearly 6,920 kilometers (4,300 miles) from home. How? They were carried to the west coast of the U.S. after a record-breaking *tsunami*. The series of enormous waves had hit Japan in 2011.

When the big waves struck, they washed boats, docks, and buoys into the ocean. Ocean currents then carried the animals living on those objects to North America and Hawaii. A lot of the floating debris was made out of artificial materials, like fiberglass and plastic, that don't *biodegrade*, or break down naturally. That allowed the trash—and the hitchhikers attached to it—to make the trip.

The ocean-drifting critters could cause trouble if they thrive in their new home. "The introduction of nonnative predators and competitors can replace or displace native species," says James Carlton, a marine scientist at Williams College in Massachusetts.

—Eamon Murphy



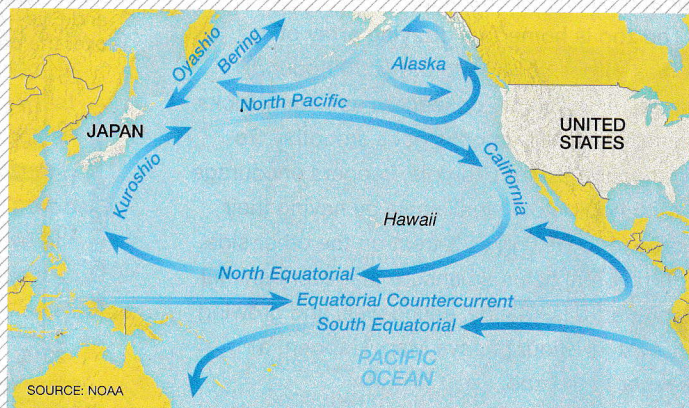
**STARRY STOWAWAYS:**  
These starfish held on to debris to survive the trip from Japan to North America.

**CRAFTY CRAB:** This small crab is native to Japan but is now thriving in North America.



## RIDING THE CURRENTS

About 300 species were discovered to have hitched a ride from Japan to North America on debris carried by ocean *gyres*—circular ocean currents—following a 2011 tsunami.





**MONKEY BUSINESS:**  
This cute squirrel monkey gets a hand during the annual weigh-in.



## BIOLOGY: HUMAN-ANIMAL INTERACTION

# ZOO WEIGH-IN

Weighing and measuring 20,000 animals is no easy task. Just ask the zookeepers at the London Zoo in England, who recently conducted their annual animal checkup.

The zoo is home to a dizzying array of species—from 1,000 kilogram (2,200 pound) giraffes to tiny ants. Zookeepers use many tricks to ensure that the process goes smoothly. To weigh penguins, for example, keepers encourage them to hop onto a small scale by having their favorite food waiting as a treat on the other side.

"[The data] helps us ensure that every animal we look after is healthy, eating well, and growing at the rate it should," says Mark Habben, a manager at the zoo.

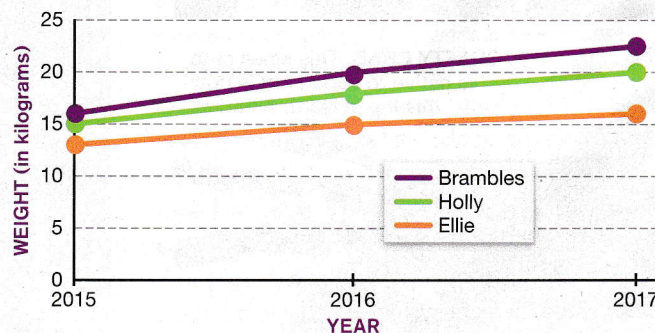
—Cici Zhang



**TRICKING WITH TREATS:**  
A zookeeper offers Ellie the pygmy goat a snack.

## GROWING GOATS

Three of the London Zoo's lovable pygmy goats—Brambles, Holly, and Ellie—have been growing! How have their weights changed over the past three years?



SOURCE: LONDON ZOO



# NUMBERS IN THE NEWS

**3.95 billion**

Age of ancient

rocks inside of which scientists discovered carbon atoms believed to be left over from the first organisms on Earth.

**3 million**

Number of U.S. citizens in Puerto Rico left without power after Hurricane Maria hit the island in September.

**4,100**

Length in miles of a new high-speed fiber-optic cable that Microsoft and Facebook recently laid across the Atlantic Ocean floor.



**74**

Percent of New York City subway commuters who were late to work at least once this past summer because of problems with the aging infrastructure.

**5**

Number of new species of peacock spiders, known for their vibrant colors, discovered by scientists in Australia last September.



**ON DISPLAY:**  
The chandelier was unveiled at a museum of design in London.

## BIOLOGY: ADAPTATIONS

# Living Lamp

This chandelier does more than just light up a room—it also purifies the air. The eco-friendly lamp is made up of 70 glass “leaves” filled with water and *algae*. These tiny, plantlike creatures use light from the chandelier’s LED lights and carbon dioxide from the air to create their own food. This process, called *photosynthesis*, releases oxygen as a by-product. The lamp helps produce clean, fresh air indoors just as trees and plants do in nature.

London artist and engineer Julian Melchiorri designed the chandelier, named *Exhale*. He says that it shows how *biotechnology*—technology that uses biological processes for industrial purposes—can improve our quality of life.

—Hailee Romain



### GLASS LEAF

Water and algae circulate inside each of these hollow glass leaves.



**MONKEY BUSINESS:**  
This cute squirrel monkey  
gets a hand during the  
annual weigh-in.



**BIOLOGY: HUMAN-ANIMAL INTERACTION**

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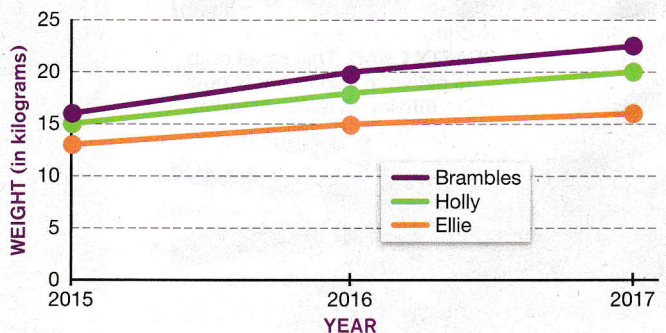
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**GLASS LEAF** Water and algae circulate inside each of these hollow glass leaves.





# TRICKED-OUT TREEHOUSES



## TREEHOTEL

You can book a stay at the metal and Plexiglas Beach Rock treehouse in Japan.

## How builders design incredible hideouts above the forest floor

**ESSENTIAL QUESTION:** How might building a treehouse differ from constructing a regular home?

These aren't your typical backyard treehouses. Some nature lovers have constructed amazing tree hideouts so they can experience life in the forest in comfort. That's what the Gardner family did.

When the family moved to their new home on a dairy farm in Waxhaw, North Carolina, their daughter Anna had one request: to have a treehouse. "It was my idea, because I never had a backyard playset like other kids in my old neighborhood," says Anna, who is now 14 years old.

One day, Anna's dad, Alan, and mom, Gwen, saw *Treehouse Masters* on the cable network Animal Planet. The series, now in its ninth season, follows Nelson Treehouse and Supply, which designs and builds extreme treehouses. Anna's dad contacted the company, based in Washington State, to create a treehouse big enough for his whole family. Its construction was featured in one of the show's episodes.

The Gardner treehouse (see *Treehouse Features*, p. 10) sits about 3.5 meters (11 feet) off the ground nestled between tree trunks. It has a main room with a small kitchen and dining area, a lounge, and an outdoor balcony. Anna has a secret loft in the ceiling where she hangs out with friends. There's also a bed suspended above the floor by ropes and surrounded by windows for spectacular views of the forest.

"People love treehouses," says Daryl McDonald, a project manager who has designed and constructed many treehouses for Nelson Treehouse and Supply. "They're a way to get closer to nature." And since nature is an integral part of the structure's design, building a house perched on tree branches requires a lot of specialized engineering expertise.

*Continued on page 10 →*







#### BIRD HOUSE

Nelson Treehouse designed this structure in Washington State with big windows ideal for bird watching.



#### HANGING OUT

The Free Spirit Sphere is suspended by cables from trees in Canada.



#### OWL NEST LIBRARY

Nelson Treehouse created this owl-themed treehouse library for a school in North Carolina.



## TREEHOUSE FEATURES

Find out more about how the Gardners' treehouse was designed and constructed.

### SIDING

Rot-resistant red cedar shingles help to waterproof the treehouse and protect it from the elements.

### ROOF

Moisture can accumulate in wooden roofs, so metal roofing is used instead. It protects against rot.

### UTILITIES

Water pipes and electrical lines let Anna and her family spend time at the house in comfort. Some treehouses have solar panels that provide electricity.

### PLATFORM

The treehouse sits on a platform that acts as its foundation.

### OUTHOUSE

A composting toilet uses bacteria to break down waste into harmless by-products.

### TREEHOUSE ATTACHMENT BOLTS (TABS)

These bolts anchor the platform to surrounding trees to support the load of the treehouse.

## CONSTRUCTION SITE

To start designing a treehouse, McDonald first visits a client's property. He walks around looking for trees with trunks that are at least 31 to 46 centimeters (12 to 18 inches) wide, so they're strong enough to support a treehouse. The trees also need to be 2 to 4 m (6 to 12 ft) apart. That's so the building's *vertical load* is distributed as evenly as possible between the trees. A vertical load equals the mass of a structure multiplied by the downward force of *gravity* (see *Standing Tall*, right).

"Most traditional homes have a cement foundation to support the structure above," says McDonald. "But the trees act to support the load of a treehouse."

It's also important that only healthy, strong trees are chosen to support a treehouse.

McDonald says that he looks for any sign of fungal growth on a tree. If he spots any mushrooms growing on a trunk, he knows there's likely moisture and decay within the wood. The trees need deep roots, as well. Trees like willows and cottonwoods, with shallow root systems, could easily topple over from the treehouse's load. Oaks, poplars, maples, firs, and eastern hemlocks are some of the best to build in. The Gardners' treehouse, for example, was built among a group of trees that included oaks and poplars.

## TREETOP BLUEPRINT

Once a site has been selected, McDonald sketches out a rough drawing of what a client's treehouse might look like. He considers the best locations for windows and outdoor balconies so owners can have the most spectacular views





**TREETOP BUILDERS:**  
The Nelson crew  
builds a platform for a  
treehouse in Oregon.

on their underside to support the weight of the limb,” says McDonald.

Once the platform is complete, workers truck in walls and other parts built off-site. The crew installs the pieces and covers the structure’s exterior in western red cedar siding. This wood is naturally resistant to rot thanks to chemicals called *tannins*. Electrical lines, plumbing, and connections for heat and air-conditioning can be run into the treehouse. The Gardners even had an outhouse with a toilet installed.

It takes the crew about three weeks to complete construction—and that’s when the real fun begins. “My favorite thing to do is to have my friends over to the treehouse,” says Anna. “We have a great time spending the night and having a sleepover.” ❁ —Andrew Klein

## CORE QUESTION

What design criteria and constraints must builders consider when constructing a treehouse?

The Gardners’ treehouse is positioned so the family can look out over their farm and stables, where they keep horses, goats, and donkeys.

In addition to using hand-drawn illustrations, the Nelson team uses *drones* to help plan designs. These small robotic aircraft fly around the trees taking hundreds of digital photos. Computer software converts the images into a virtual 3-D model. Designers use the model to make precise measurements of the trees. “That allows us to accurately design and construct a lot of the structure off-site,” explains McDonald.

After enough information about the Gardners’ site was collected, the team drafted a blueprint of the treehouse back at their Washington headquarters. Then it was time to build.

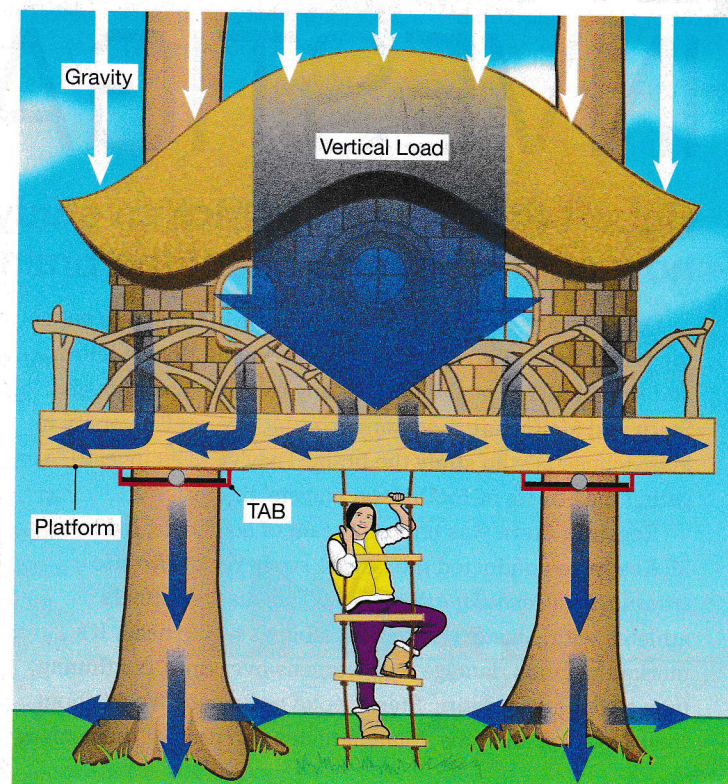
## BRANCHING OUT

The first step in constructing the Gardners’ treehouse was to make its *platform*—the flat ground floor that’s connected to the trees. Solid steel bolts, called *treehouse attachment bolts* (TABs), anchor the platform to the trees. McDonald explains that TABs are the treehouse’s backbone. They also stabilize the structure so it’s not damaged by rough weather.

Each TAB is inserted into holes drilled deep into a tree trunk and can support up to 4,500 kilograms (10,000 pounds). Mature trees grow only from the tops of their trunks. Since TABs are placed at lower or middle regions of trunks, the treehouse remains level over time. McDonald explains that the TABs don’t harm a tree. Instead, a trunk eventually grows strong fibers under where the TAB is inserted. That helps to further support the load of the treehouse. “The tree treats a TAB like a branch. Branches naturally have a stronger, tighter grain

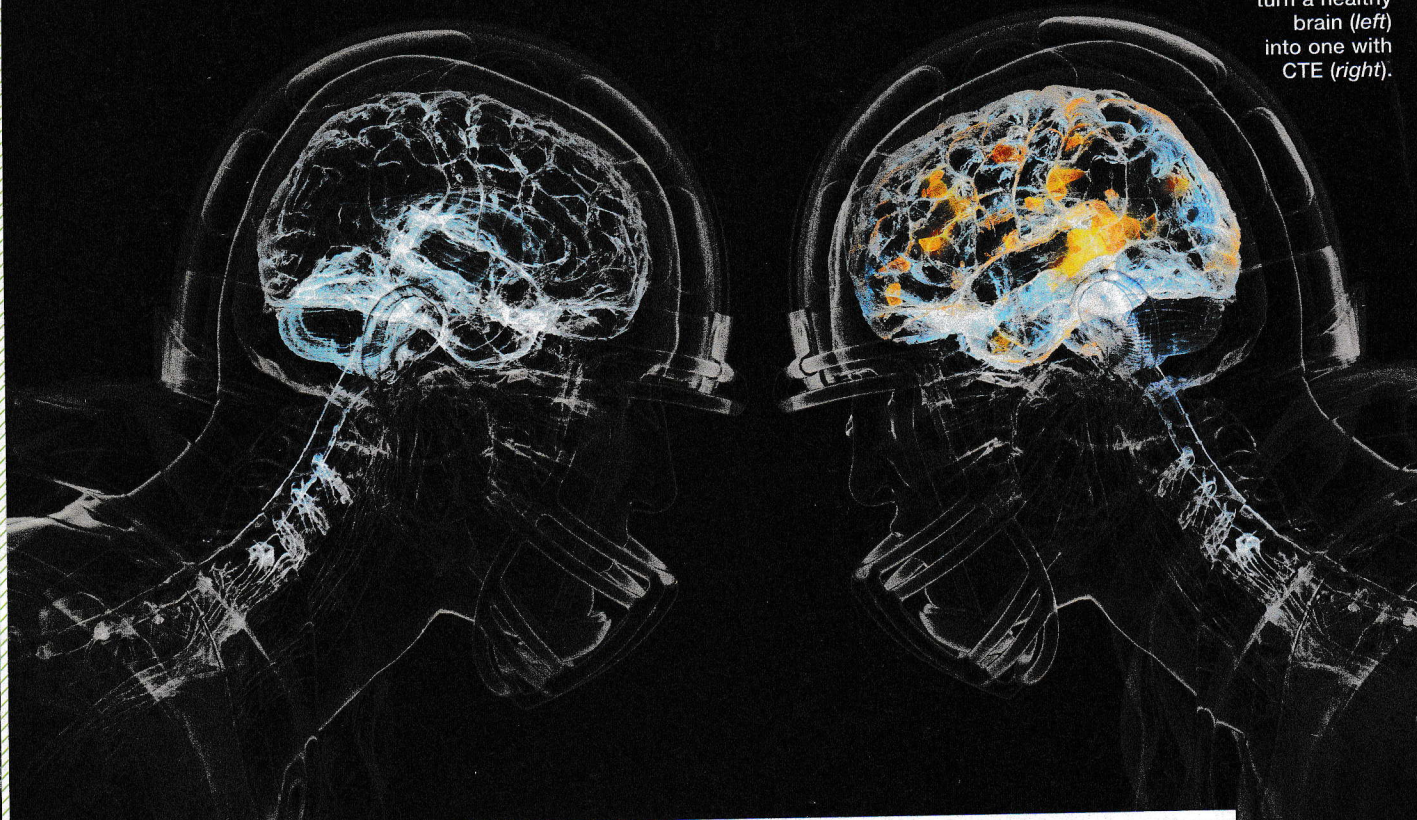
## STANDING TALL

The arrows in this diagram show how a treehouse’s *vertical load*—a structure’s mass multiplied by the downward force of gravity—is distributed so the building doesn’t collapse. The load is spread out across the treehouse’s platform, into the attachment bolts and the trees they’re attached to, and then the ground.





HEAD TO HEAD:  
Hard hits can  
turn a healthy  
brain (left)  
into one with  
CTE (right).



# BRAIN TRAUMA INVESTIGATOR

**Robert Stern** and Ann McKee study how contact sports affect the brain

On February 4, millions of Americans will tune in to watch the Super Bowl. Two of those viewers will be Robert Stern and Ann McKee. They're not just any football fans, though. Stern and McKee are *neuroscientists* at Boston University in Massachusetts who study the brain. They've been investigating the effects of football on players' brains.

Recently, Stern was part of a team of scientists, led by McKee, who conducted the largest study yet of *chronic traumatic encephalopathy* (CTE). This disease affects athletes with a history of repeated blows to the head. It's marked by brain damage that worsens over time, continuing long after players retire. Stern spoke to *Science World* about their research and how young athletes can protect themselves.



BRAIN TEAM:  
Stern (left)  
and McKee



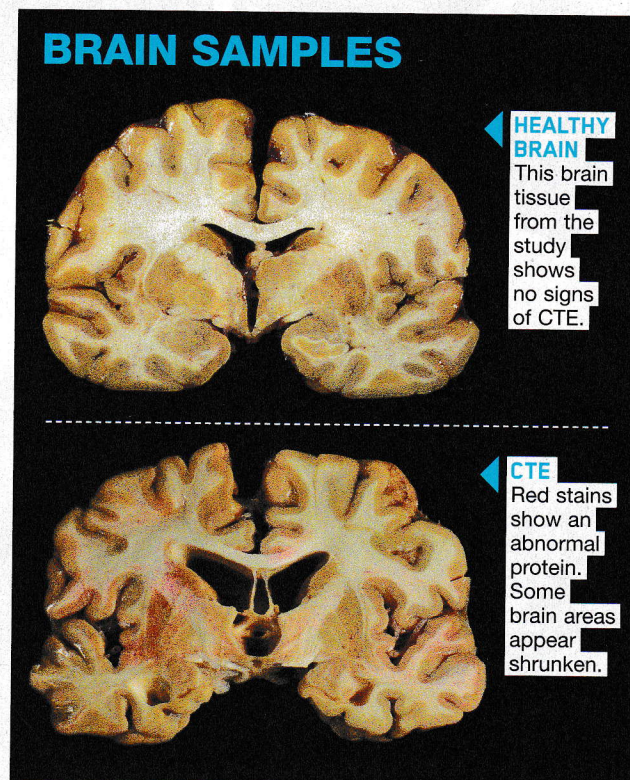
### How did you become interested in CTE?

I've studied *neurodegenerative diseases* like Alzheimer's for decades. These are diseases that gradually attack the nervous system, including the brain. About 10 years ago, I was giving a talk on brain disease and an audience member told me they knew someone who wanted to meet me. It turned out to be Chris Nowinski, a retired WWE wrestler. Nowinski suspected that repeated hits he took in the ring had impaired his brain function. He'd started a foundation to study the long-term effects of *concussions*—brain injuries caused by blows to the head. After speaking with him, I wanted to study CTE.

### What did your recent study on CTE reveal?

Our team examined 111 brains from deceased former National Football League (NFL) players. We discovered that 110 of them had CTE. We also looked at 53 brains from college football players who gave up the sport after they graduated—48 of them had CTE. And we checked 14 brains from people who played football only through high school—three of those had CTE.

The brains in the study were mainly donated by family members who were concerned about whether football had affected their



loved ones' brains, so they may not reflect all football players. But our results do show that CTE is associated with playing tackle football early in life, not just at the professional level.

### Why did the study look only at the brains of deceased players?

You can't accurately diagnose CTE during life. CTE leads to problems while people are alive, like changes in mood and problems with thinking. So you can make a well-educated guess that they're suffering from CTE based on symptoms, but until you examine the brain tissue, you can't know for sure. To diagnose CTE, we look for the buildup of an abnormal *protein*—a large biological molecule—in specific parts of the brain.

In severe cases, areas of the brain are destroyed.

### What else have you learned about brain trauma in young players?

I recently conducted a study of the risks of

contact sports to younger athletes' brains. I found that children who start playing tackle football before the age of 12 are three times more likely to have behavioral and mood problems than those who start playing after that age.

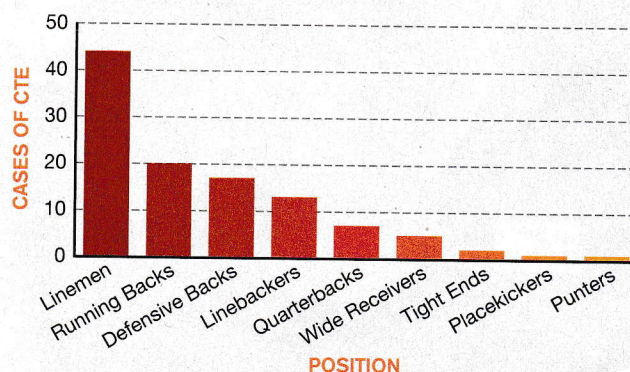
### What should young athletes who are concerned about your findings do?

Don't let worry about a brain disease prevent you from being an athlete. Keep being active and involved in sports. But talk to your parents about alternatives to playing tackle football until you are older. Young people need to protect the most important organ in their body from being hit potentially hundreds of times per season. Some of the NFL's most successful players didn't play tackle football until high school. ✂

—Jeanette Ferrara

## ACROSS THE FIELD

This graph shows the number of NFL players' brains with CTE in the Boston University study, sorted by position. Is this data sufficient to predict which positions are most likely to develop the disease? Why or why not?



SOURCES: THE NEW YORK TIMES; JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, MEZ ET AL., JULY 2017.

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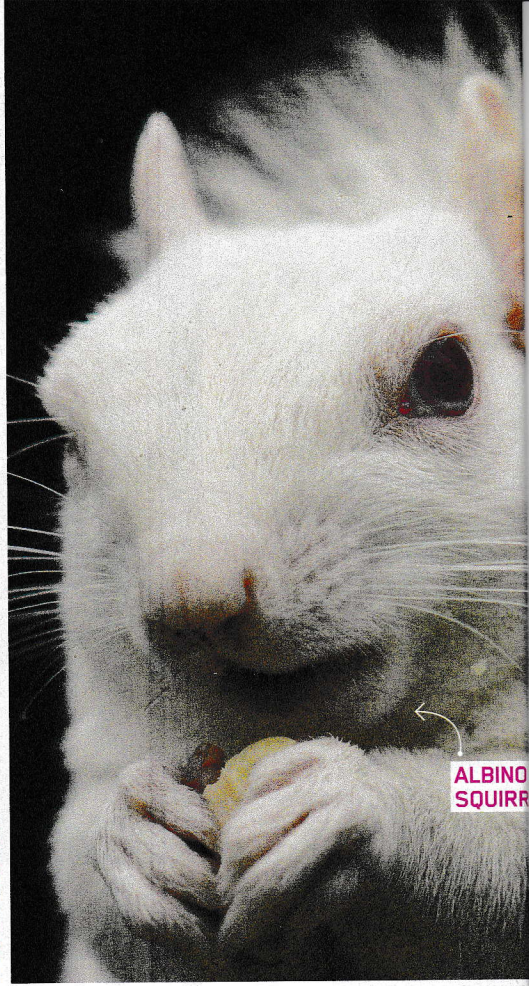




ALBINO  
KANGAROO



ALBINO  
SQUIRREL



ALBINO  
IGUANA



ALBINO OWL





# CREATURES WITHOUT COLOR

*Life is full of challenges for animals born lacking hue*

**ESSENTIAL QUESTION:** Why is coloring important to an animal's survival in the wild?

**T**his past spring, the Borneo Orangutan Survival Foundation mounted a special rescue mission. The foundation's conservationists saved a young orangutan being kept in a cramped cage in a village on the Southeast Asian island of Borneo. Orangutans are endangered, so the group aims to protect as many as they can. But this one was even more special than usual. That's because instead of having an orangutan's typical reddish fur, she was completely white. The ape's rescuers named her Alba, Latin for "white." She's the only known *albino* orangutan in the world.

*Albinism* is an inherited condition in which the body can't properly produce colored chemical compounds called *pigments*. As a result, the skin, hair, fur, feathers, or scales of albino animals are mostly colorless. Without their typical coloration, these animals don't usually fare well in the wild.

## A RARE TRAIT

Albinism has been documented in at least 300 animal species in North America and in a wide range of species around the globe. But it tends to be rare—only one out of many thousands of individuals might have this trait. Albinism occurs in people as well. About one in 20,000 people

worldwide have albinism, though certain populations have higher or lower rates.

Part of the reason for albinism's rarity has to do with the genetics of this trait. Units of hereditary material, called *genes*, control the production of pigments. Pigment genes have different versions, called *alleles*. People and most animals inherit one allele from each parent. Alleles associated with albinism are *recessive*, which means that an organism will show the trait only if it inherits two albinism alleles.

Many people—about 1 in 70—and many animals carry one allele for albinism and one for

*Continued on the next page →*



**MEET ALBA:** This albino orangutan will be kept safe on a special reserve.

JOEL SARTORE/NATIONAL GEOGRAPHIC CREATIVE (KANGAROO); PETER TRIMMING/FLOKOR (CC BY 2.0) (SQUIRREL); STEVE COOPER/SCIENCE SOURCE (IGUANA); PHOTOBACROFT IMAGES/REDOX (OWL); BOS FOUNDATION/INDRAYANA (ORANGUTAN)

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1



2



3



4

## PALE PARADE

1

albino bison

2

albino porcupine

3

albino sea turtle

4

albino lemur

5

albino rat snake

typical-looking carriers can have offspring with albinism (see *Passing On Genes*, right).

## TROUBLE IN THE WILD

Some evidence suggests that animals born with albinism don't fare well in the wild. One reason is that a stark-white animal stands out in its natural habitat, unlike an ordinary-colored companion that blends in with its surroundings. That makes it easy for predators to spot and catch an albino animal. Some studies, for example, have found that owls are more likely to pounce on albino mice than brown ones.

Lack of color brings other problems too. Albino birds often have trouble finding a

mate and are sometimes even attacked by members of their own flock. The birds may not recognize an individual lacking the usual markings as the same species.

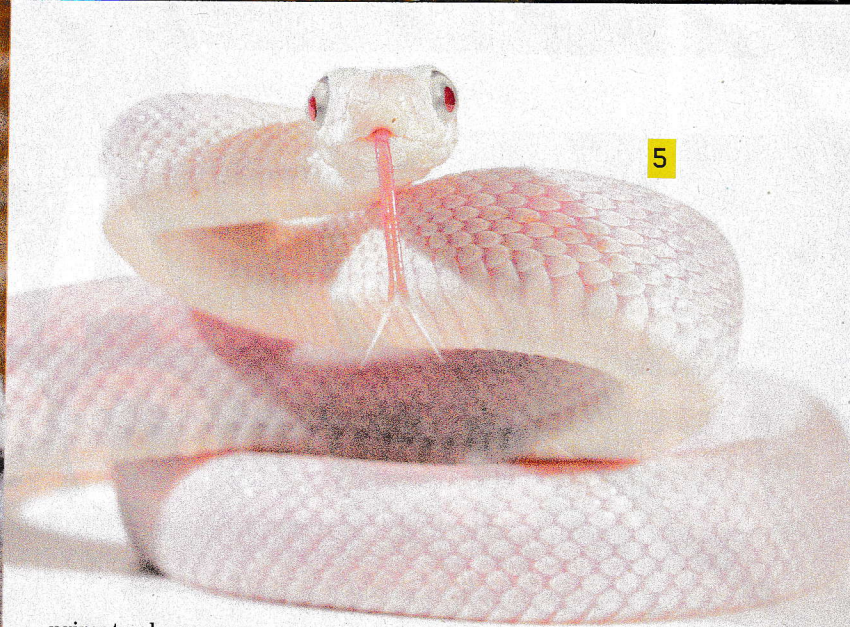
The sun is another potential danger for albino animals. The pigment *melanin*—which creates tan, brown, or black coloration in many animals—can be important for protection from the sun's damaging *ultra-violet* (UV) rays. In people, exposure to the sun signals the body to pump up production of this pigment. That causes skin to tan, which provides some defense against burns. Animals and people with albinism, though, don't produce this pigment. That makes them especially susceptible to sunburns and possibly deadly skin cancers.

Albino crocodiles, snakes, and lizards face special difficulties. Reptiles are *cold-blooded*—they rely on external heat to regulate their body temperatures and often bask in the sun to warm themselves up. Albino reptiles can't keep warm the typical way without the risk of sunburn. They tend to do better in captivity, where caretakers can provide artificial heat sources like special heated stones to keep them warm.

## THE EYES HAVE IT

Just because an animal's coloring is pale doesn't mean it has inherited albinism. "There are many naturally white animals, such as polar





5

bears, that aren't albinos," says Murray Brilliant, a geneticist at the Marshfield Clinic Research Institute in Wisconsin. One big clue that an animal isn't albino is dark-colored eyes. True albino animals don't produce dark eye pigments.

An ongoing study of squirrels across the U.S. is showing how the occurrence of white fur compares with that of true albinism. Of the squirrels reported to have white fur, the survey found that about 80 percent have dark eyes. Only about 20 percent have red or pink eyes that show they're truly albino. "That pink color comes from blood vessels in the back of the eye," says Brilliant. The same is true for albino rabbits and mice.

Other species with albinism, including people and orangutans like Alba, don't have pink eyes—although camera flashes can sometimes make it look that way in photos. Since humans and other

primates have more types of eye pigments than other animals, individuals with albinism tend to have eyes that appear very light blue.

Eye pigments and the molecules involved in making pigments are important for healthy eye development. Without them, animals with albinism can have serious vision problems, which can make spotting prey or predators difficult.

People with albinism often have vision problems too. In his research, Brilliant has identified alleles associated with albinism in people. "Now we're working on understanding how the genes function and developing therapies to enhance vision in people with albinism," he says.

Poor vision is just one of the problems that would put Alba, the albino orangutan, at risk in the wild. To keep her safe, conservationists plan to set up a spacious reserve for her to live in with three orangutan friends—a fitting home for a truly unique animal. ❀

—Jennifer Barone

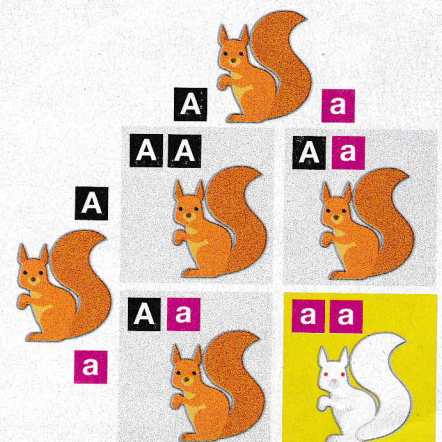
## CORE QUESTION

Create a Punnett square that shows the offspring of a parent with albinism and a parent carrying one allele for albinism.

## PASSING ON GENES

A chart called a *Punnett square* can determine the chances of offspring having a particular trait. In the chart, *dominant* alleles are shown with a capital letter. Traits from dominant alleles show up in offspring even if the offspring inherit only one copy. Recessive alleles (such as those associated with albinism) are shown with a lowercase letter. To create a Punnett square:

- 1 Put one parent's alleles for a trait across the top and the other's along the left side.
- 2 Fill in the inside squares by combining the letters from the top and left of each.
- 3 The inside squares show the possible allele pairs of offspring and therefore their chances of inheriting a trait. What percentage of offspring from these parents would display albinism?







# SOLAR EXPLOSION!

*The sun just released its strongest energy burst in a decade*

**ESSENTIAL QUESTION:** How does the sun affect people on Earth?

**O**n September 6, 2017, the sun unleashed several massive bursts of energy. One of the blasts was the largest solar flare in 12 years. Energy from the explosion bombarded Earth, interfering with radio signals and GPS.

The sun follows an 11-year cycle, during which its activity rises and falls. Currently, our star should be entering a quiet phase, not flaring up. Scientists are keeping a close eye on the unusual *space weather* caused by changing conditions on the sun. It could have a big effect on our planet.

## FIRESTORM

Before its recent eruptions, the sun showed signs that something big was

coming. Cooler areas, called *sunspots*, formed on its surface.

Sunspots are created by the sun's extremely strong *magnetic field*. The spots usually come in pairs. They tend to form at places where the sun's constantly changing magnetic field creates north and south poles. The field is like a rubber band that twists and stretches out from the sun's surface until it suddenly snaps. That releases an explosion of energy as a solar flare.

The September eruption disrupted radio communications on Earth for about an hour. Flares can also affect power grids. Some interact with Earth's magnetic field to create bands of light known as *auroras* in the skies near the poles.

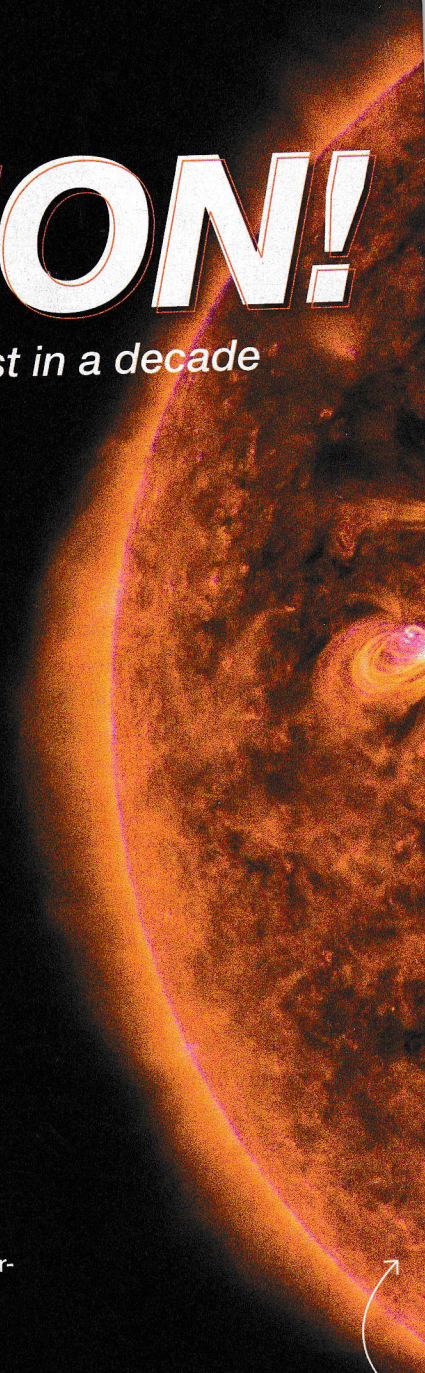
## FUTURE FORECAST

Solar-flare events are helping scientists learn about the sun and how it affects Earth. "Improved understanding will lead to better forecasts of space weather and the potential implications to our high-tech era," says Shawn Dahl, a forecaster at the Space Weather Prediction Center in Boulder, Colorado. That includes threats from dangerous solar radiation to future astronauts traveling to Mars and disruptions to navigation systems that self-driving cars rely on. 🌞 —Rene Ebersole



### LIGHT SHOW

Auroras usually occur near Earth's poles. But when the sun is more active, auroras can be seen at lower latitudes.



### PLASMA

Currents of hot *plasma*—gas made up of charged particles—circulate inside the sun. This motion drives sunspot and solar-flare activity, which rises and falls in an 11-year-cycle.





## CORE QUESTION

Use evidence from the text to explain how energy from a solar flare could disrupt your daily life.

### SUNSPOT

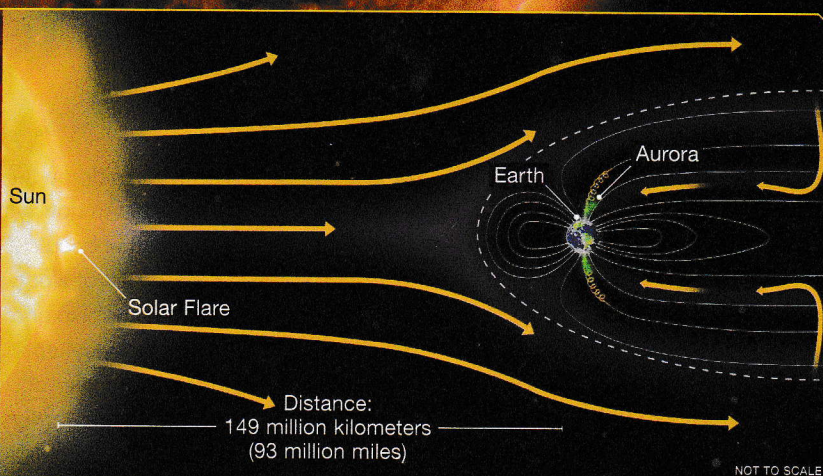
Sunspots form in regions where the sun's magnetic field is very strong, seen as bright areas here. They are about  $2,000^{\circ}\text{C}$  ( $3,600^{\circ}\text{F}$ ) cooler than the rest of the sun's surface.

### MONSTER FLARE

The enormous explosion seen here happened when a buildup of magnetic energy was suddenly released on September 6, 2017.

## HOW AURORAS FORM

Solar activity can blast charged particles toward Earth. Particles that get trapped inside Earth's magnetic field interact with atoms in the atmosphere, creating glowing auroras.



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# Name That Element!

Which element keeps roads free of snow, helps you digest food, and sheds light on Mars' past? Use these five clues and the periodic table on page 22 to find out.

—Jacqueline Adams and Cici Zhang

## ANATOMY OF AN ELEMENT

|        |                |
|--------|----------------|
| X      | Atomic Number  |
| ??     | Element Symbol |
| NAME   | Element Name   |
| X.XXXX | Atomic Mass    |

**ATOMIC NUMBER** equals the number of *protons* (positively charged particles) in an atom's *nucleus*, or center. Each element consists of atoms that all have the same number of protons, and so each has a unique atomic number. In a neutral atom, the number of protons and the number of *electrons* (negatively charged particles) are equal.

**ATOMIC MASS** is the average mass of the naturally occurring *isotopes* of an element. Isotopes are atoms of an element with the same number of protons but with different numbers of neutrons.



### GETTING TOGETHER

By itself, the mystery element is a smelly, greenish-yellow poisonous gas. Luckily, it's rarely found alone in nature. That's because its *atoms*—the smallest unit of an element—are unstable. They quickly chemically combine with other elements to form *compounds*.

The most common of these compounds is found in large quantities in the ocean. **Figured it out already?**

**Score 100 points. Otherwise, read clue #2.**



### ANTI-FREEZE

When water cools to below 0°C (32°F)—its *freezing point*—it hardens into ice. This physical change often creates slippery streets on winter days. Road crews come to the rescue by scattering a compound made of calcium (Ca) and the mystery element onto roadways. This chemical dissolves in water, lowering the solution's freezing point. That helps keep the liquid from freezing. **Got the answer? Score 80 points. If not, try clue #3.**



## A photograph of the Mars rover Spirit on the Martian surface. A yellow arrow points to the rover's mast, which houses the camera system.



# 4

Combine hydrogen (H) and the mystery element, and you'll get an acid that is so *corrosive* it can eat rust off the surface

of steel. Believe it or not, your stomach lining produces the same acid. It activates *enzymes*—proteins that speed up chemical reactions—that your body uses to digest food. Why doesn't the acid eat holes in your stomach? Your stomach lining protects itself by producing other chemicals that act as *antacids*, or acid-fighting agents. **Solved the mystery? Score 40 points. Not yet? Check out clue #5.**

## 5

When the mystery element combines with calcium (Ca) and oxygen (O)—two other *nonmetals*—it becomes a powerful *disinfectant*. It's used in household cleaners and swimming pools to kill bacteria. The same compound is a strong *oxidizer*, meaning it causes other chemicals to lose negatively charged *electrons*. When it is added to laundry, it oxidizes stains. That breaks them down, keeping white clothes bright. Hint: This element has 17 electrons.

**Cracked the case? Score 20 points. Then turn the page.**



## WHAT'S THE ELEMENT?



**ATOMIC STRUCTURE**

Pool floats, sneakers, and backpacks often contain the mystery element, which is found in some plastics.

Pool floats, sneakers, and backpacks often contain the mystery element, which is found in some plastics.

1. How many elements within the periodic table are classified as nonmetals?

- (A) 10                      (C) 21  
 (B) 15                      (D) 28

**2.** Two or more different atoms that are chemically combined form a \_\_\_\_\_.

- (A) mixture      (C) metal  
 (B) compound    (D) molecule

**3.** What is the atomic number of silicon (Si)?

- (A) 14                      (C) 34  
 (B) 16                      (D) 50

**4.** Which of the following elements is found in the same group on the periodic table as hydrogen (H)?

- (A) aluminum (Al)  
 (B) calcium (Ca)  
 (C) magnesium (Mg)  
 (D) sodium (Na)

**5.** Which of these elements is found in its natural state as a gas?

- (A) argon (Ar)  
 (B) boron (B)  
 (C) phosphorus (P)  
 (D) potassium (K)

The periodic table is a systematic way to organize Earth's *elements*—substances that each consist of only one kind of atom. Today, there are 118 known chemical elements.

Elements on the periodic table are arranged by their atomic numbers in ascending order. Hydrogen (H), for example, has an atomic number of 1 and is the lightest known natural element.

Scientists have created elements with atomic numbers greater than 92, but they don't exist naturally.

**22** JANUARY 15, 2018



**ONE-EYED?**

Snails have a pair of tentacles with eyes at the end. It's unclear if this snail lost one or if the tentacle is retracted.

**SHELL SHIELD**

A snail is born with a shell that acts as an exoskeleton to protect against predators.

**AFRICAN LAND SNAIL**

**SLIMED!**

Snails secrete mucus to keep from drying out and to help them slide over surfaces.

# Monster Snails

**T**hey're huge and slimy, and they've been spotted slinking across parts of southern Florida. Meet the giant African land snail, a dangerous *invasive species* spreading in Florida. Each of the animals can grow bigger than a person's hand—up to 20 centimeters (8 inches) long and 10 cm (4 in.) wide. And they carry another unwelcome guest—a parasite that can cause a life-threatening infection in humans.

Scientists believe people first brought the snails, which are originally from East Africa, to the U.S. as pets. Some of the animals

escaped or were released into the wild, where they thrived. The snails breed quickly. That's because they can switch genders, allowing them to mate with any other giant African land snail. And each snail can lay up to 1,200 eggs a year. The creatures aren't picky eaters, either—they can feed on plants not found in their natural habitat.

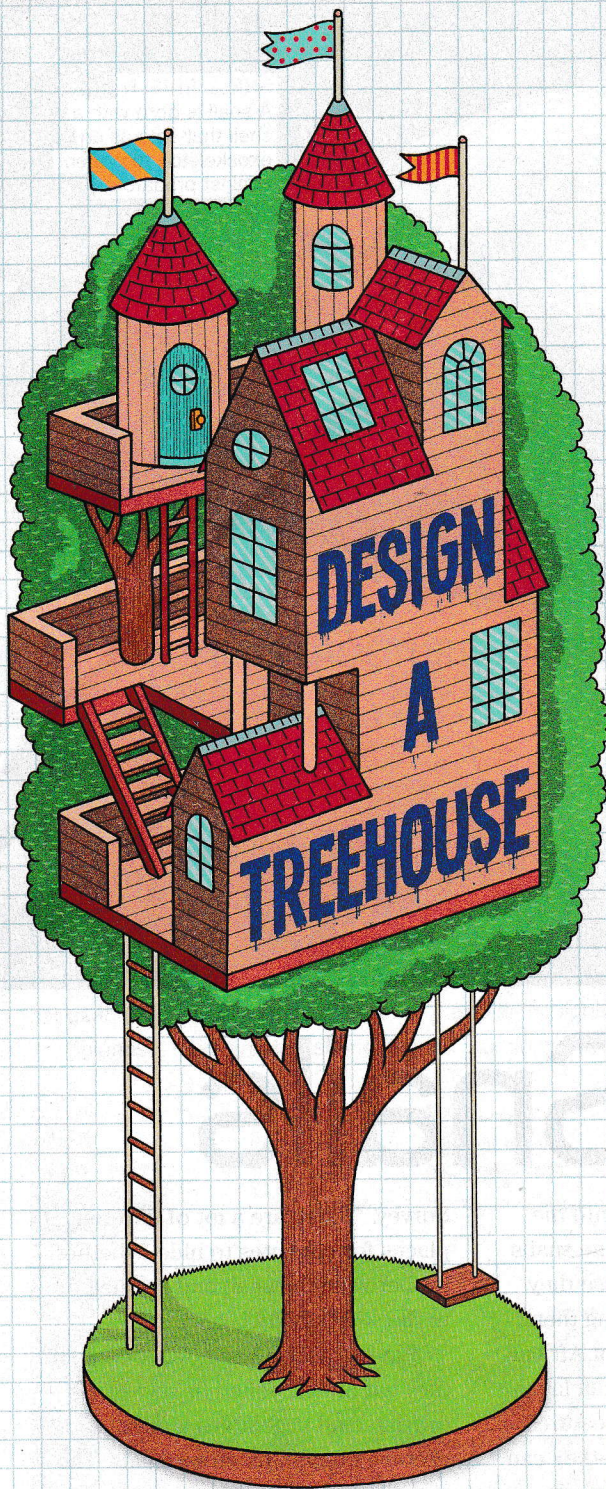
Testing of the snails in and around Miami, Florida, found that many carried a parasite called rat lungworm—a tiny worm-like animal. "Snails are good hosts for the parasites," says Deborah Iwanowicz, a biologist at the U.S. Geological

Survey. "There are a lot of different places for parasites to hide, whether it's between the snail and its shell or in the snail's body."

Rat lungworm can infect people if they eat undercooked or raw snails or fruits and vegetables that have become contaminated by snails. The parasite can cause *meningitis*, an infection that leads to a dangerous inflammation of the membranes around the brain and spinal cord. Florida is hunting down the invaders and using pesticides to prevent the snails—and the disease they carry—from expanding further.

—Kathryn Free





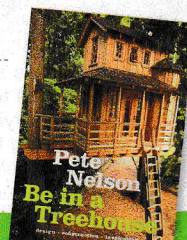
In "Tricked-Out Treehouses" (p. 8), you read about a company that designs treehouses. Use these steps and what you learned in the article to make a blueprint for your own treehouse.

**1 STATE YOUR OBJECTIVE** How do you want your treehouse to look, and what features should it have? Where would it be located? How many people could it hold? Write a detailed description of the treehouse. Include information about the criteria and constraints you'd need to consider for your design to be successful.

**2 BRAINSTORM SOLUTIONS** Think about how you could turn your idea from step 1 into a reality. Come up with several different ideas for your treehouse. Write out step-by-step plans, draw diagrams, or make models for each design.

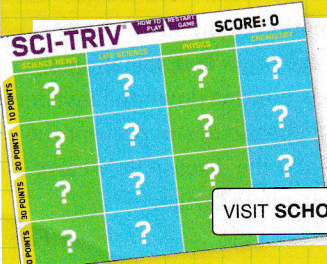
**3 PLAN AND IMPROVE IT** Pick your best idea from step 2. Create a blueprint. This type of technical drawing is drawn to scale and contains measurements and symbols to indicate design features, such as a toilet. Discuss your plans as a class and offer suggestions to improve each other's treehouse design.

**4 OPTIMIZE YOUR DESIGN** Based on the feedback you received in step 3, make adjustments to your design. Keep modifying your plans until you're satisfied. Then enter your design in our contest (right).



**ENTER TO WIN!** Include illustrations or photos of a model treehouse. Submit a 1-page description of its design features. Select entries will be judged by Nelson Treehouse and Supply. Two winners will each receive a Nelson Treehouse prize package. Go to [scholastic.com/scienceworld](http://scholastic.com/scienceworld) for more details about how to enter.

**ANALYZE IT** How might a treehouse be utilized to help people in ways other than for recreation?



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