SCHOLASTIC

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PHYSICS

EXTREME SLEDDING

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BIOLOGY
Tracking Grizzlies

EARTH
Mind-blowing Rock Climbs

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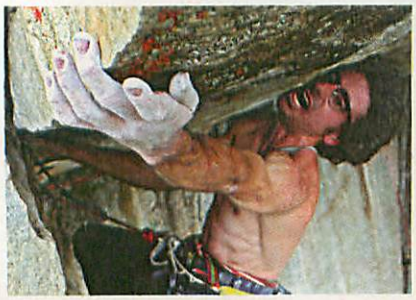
ScienceWorld
JANUARY 2, 2012 VOL. 68, NO. 7

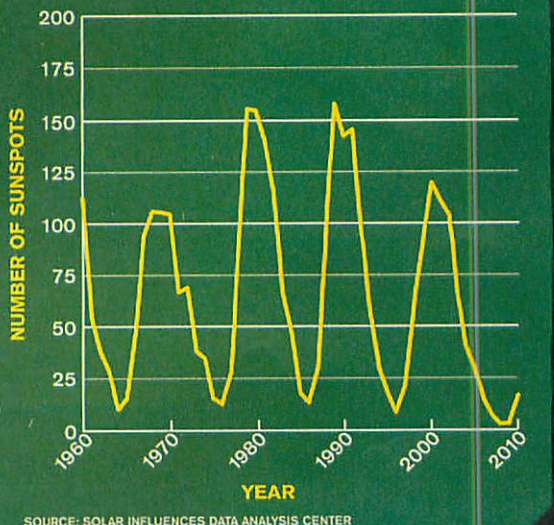
FEATURES



SCIENCE NEWS

THE SOLAR CYCLE

Every 11 years, the sun enters a period of high magnetic activity. This results in more sunspots. The next peak in the solar cycle is expected to occur in May 2013.



SOURCE: SOLAR INFLUENCES DATA ANALYSIS CENTER

STELLAR LIGHT SHOW

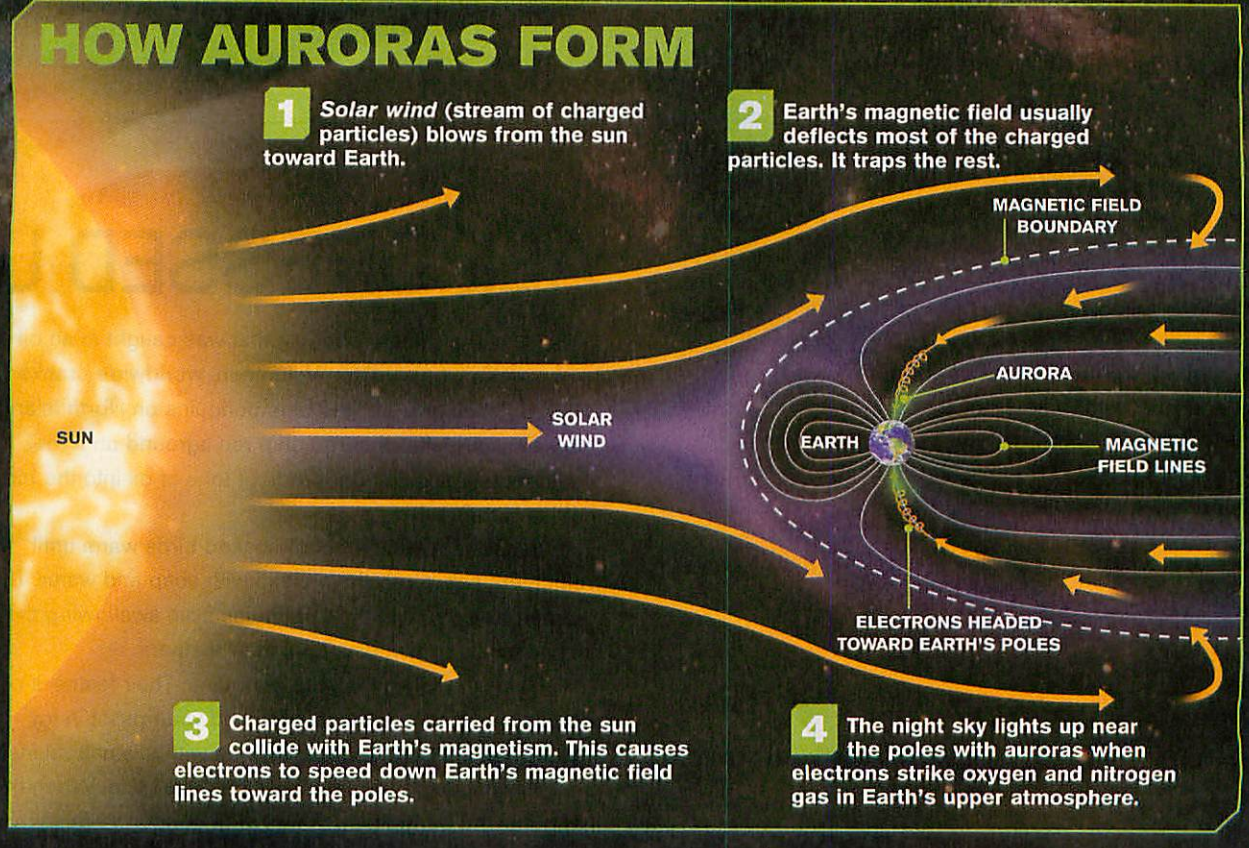
Astronauts on the International Space Station snapped this picture of the *aurora australis*, or southern lights, as they flew over New Zealand. *Auroras* are colored bands of lights in the sky that usually appear near Earth's poles (*see How Auroras Form, below*).

Although auroras occur all the time, exceptionally bright ones happen more often during stages of high activity in the sun's *solar cycle*. During these times, cooler areas on the sun with intense magnetism, called *sunspots*, are more abundant. Massive bursts of energy, such as *solar flares* and *coronal mass ejections*, also occur more frequently when the solar cycle peaks. "As a result, you see more auroras that are brighter because there's more energy involved," says William Pesnell, an astrophysicist at NASA.

Over the past year, increased solar activity has caused the *aurora borealis*, or northern lights, to be spotted as far south as Arkansas!

—Karina Hamalainen

HOW AURORAS FORM



TOP: AP PHOTO IMAGES/NASA; DIAGRAM: SW INFOGRAPHIC

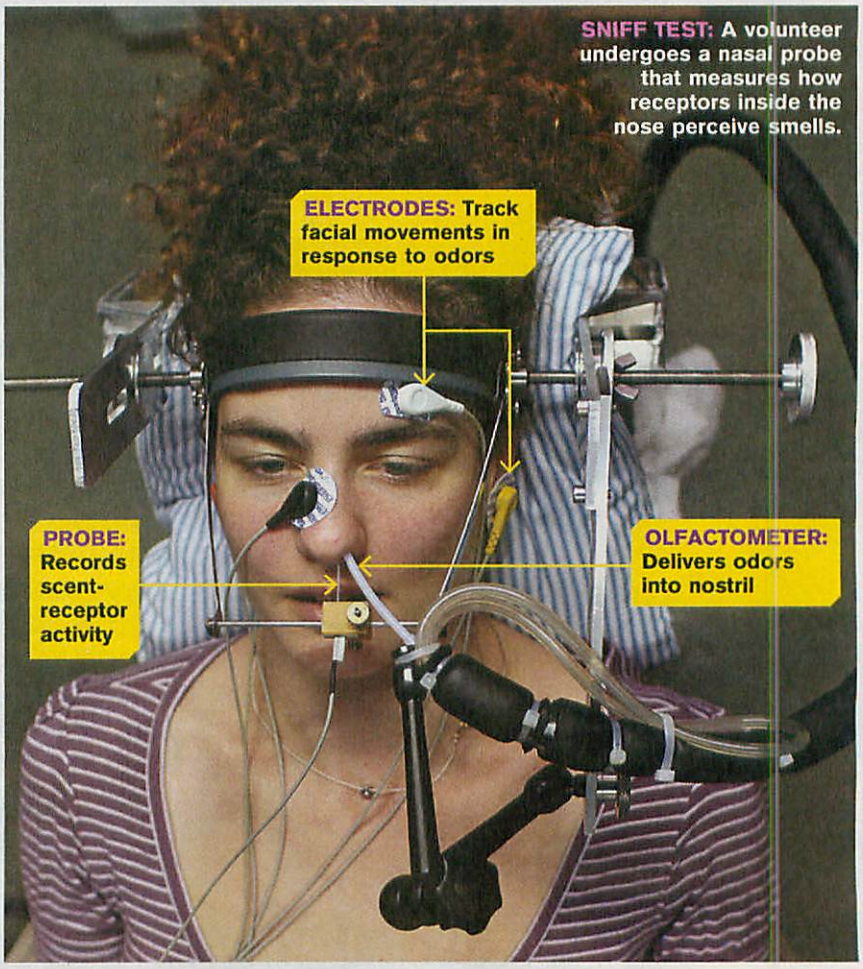
BIOLOGY: SENSES

DECODING SMELL

PEW, something stinks! A new study shows that scent receptors in the nose are tuned to detect whether odors are awful or pleasant.

Scientists made the discovery by inserting probes into people's nostrils. They then gave the volunteers whiffs of different scents. The probes measured the reactions of scent-sensing *neurons* in the nose. These nerve cells are located on a postage-stamp-size membrane, called the *olfactory epithelium*, that lines the nasal cavity.

"Different odors evoked different patterns of activity across the olfactory epithelium," says Hadas Lapid, a neurobiologist at the Weizmann Institute of Science in Israel. Her team found that scent receptors are organized in distinct patches dedicated to detecting good or bad smells. *–Cody Crane*



SNIFF TEST: A volunteer undergoes a nasal probe that measures how receptors inside the nose perceive smells.

FASHION STATEMENT? Penguins wear sweaters to keep warm after an oil spill.

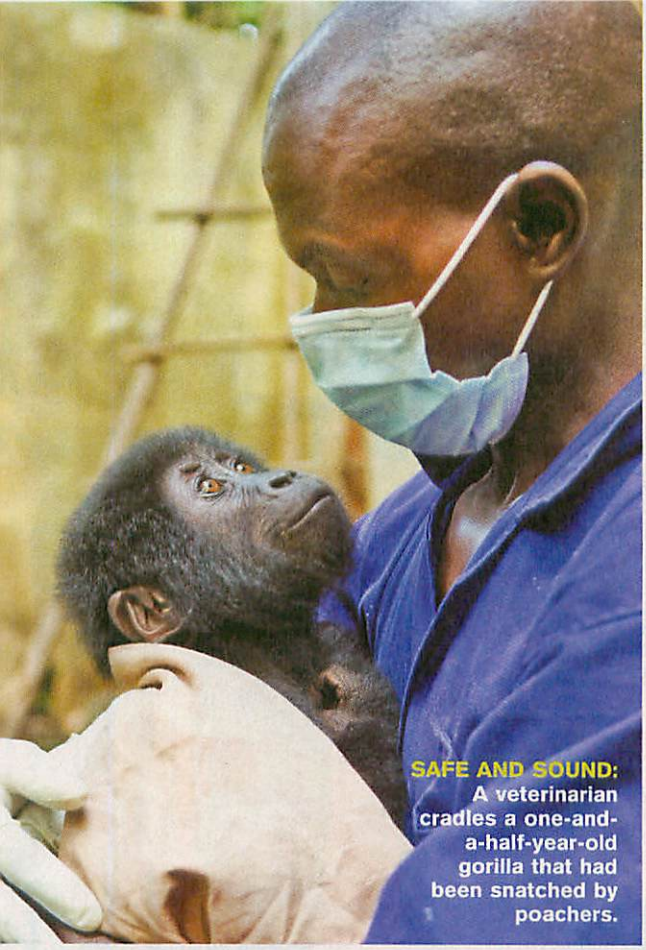
EARTH: ENVIRONMENTAL PROTECTION

ALL DRESSED UP

Want to help a penguin that was caught in an oil spill? Knit it a sweater. Volunteers worldwide cranked out sweaters for little blue penguins on North Island, New Zealand, after a cargo ship ran aground on a reef. The damaged ship spilled hundreds of tons of oil into the birds' habitat last October.

The knitwear keeps the oil-soaked birds warm until volunteers can scrub them clean with soap and water. The garments also prevent the penguins from swallowing the toxic oil when they *preen*, or groom their feathers.

Oil is extremely harmful to penguins. Their feathers contain natural oils that keep them warm and waterproof in icy waters. The oil from a spill interferes with this natural insulation, allowing water to penetrate the birds' skin. When this happens, the penguins can freeze to death. *–Susan Gaidos*



SAFE AND SOUND: A veterinarian cradles a one-and-a-half-year-old gorilla that had been snatched by poachers.

BIOLOGY: ENDANGERED SPECIES

GORILLA RESCUE

Park rangers in the Democratic Republic of the Congo in Africa recently took part in an undercover operation to rescue a baby eastern lowland gorilla from poachers. The illegal hunters were trying to sell the *endangered* animal for $40,000.

Shamavu, named after one of the rangers who saved him, was the fourth baby gorilla rescued this year. Although scared, he was in good health. "He was one of the lucky ones, because he was rescued," says Jan Ramer, a veterinarian who examined Shamavu.

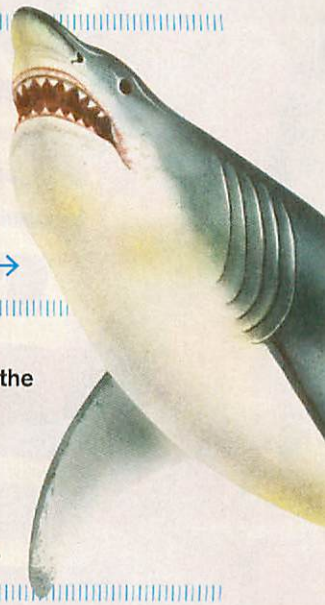
The infant ape now lives with 11 other rescued gorillas in a forest enclosure at the Gorilla Rehabilitation and Conservation Education center in the Democratic Republic of the Congo. Eventually, they'll be released into a partly free-range environment. —*Charlye Dehart*

BABY GORILLA: ©LUANNE CADD; NUMBERS IN THE NEWS: ISTOCKPHOTO.COM (3)

NUMBERS IN THE NEWS

PLAY A GAME: scholastic.com/scienceworld

$200,000,000
will be spent by a company to build a "ghost town" in New Mexico. The fake city will be used to test new technologies, like driverless vehicles.



750,000
square miles—more than 2.5 times the size of Texas—is the area of a new shark sanctuary located in the Pacific Ocean.

35,800 feet is the depth of the Pacific's Mariana Trench. A deep-sea probe there recently spotted a giant single-celled amoeba the size of a person's fist.

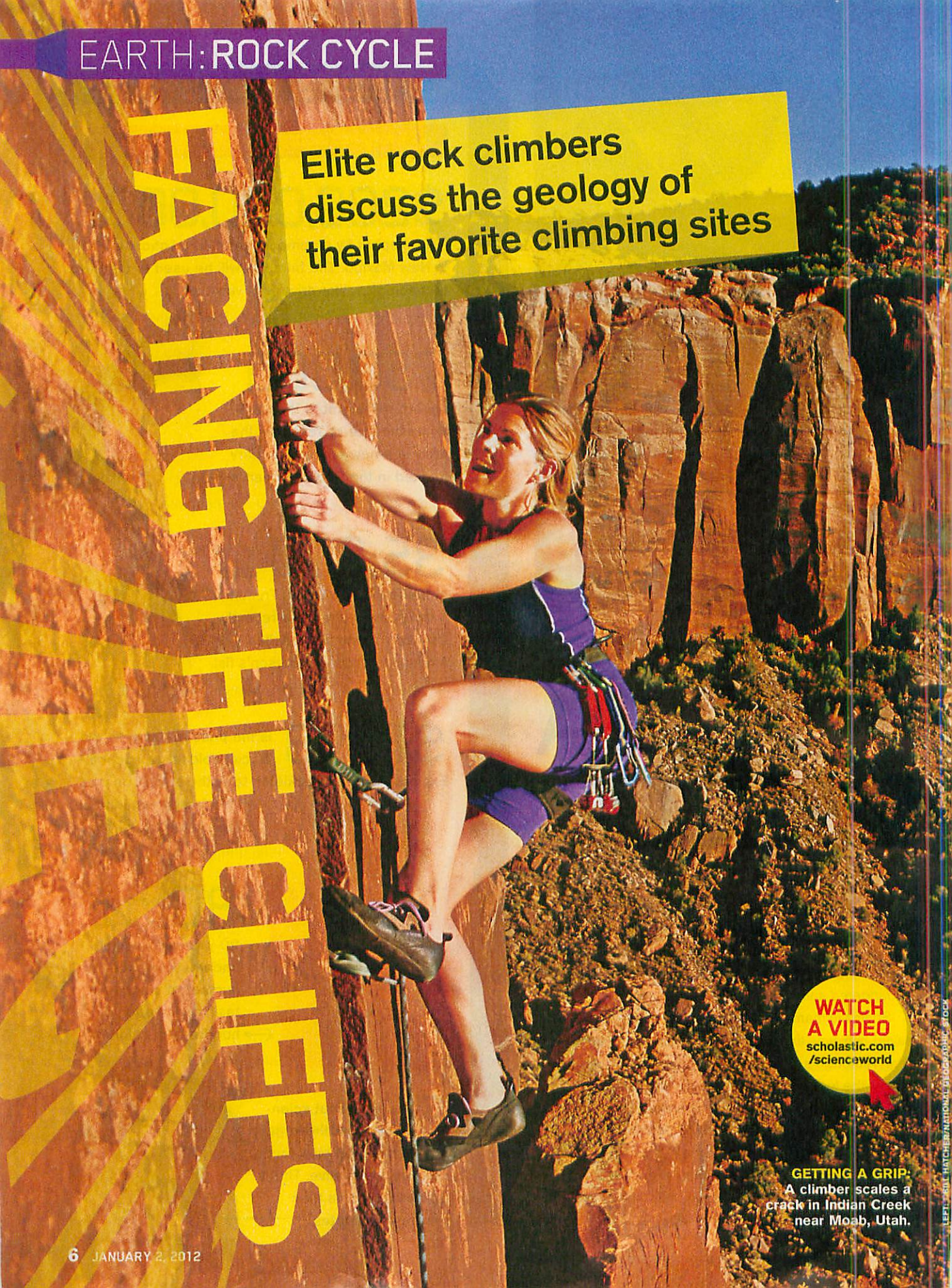
$1,993 is the price a 104-year-old biscuit sold for at auction. Explorer Ernest Shackleton took the biscuit on one of his famed expeditions to the Antarctic.

80 percent of 11- to 20-year-olds usually underestimate the number of calories in fast foods—often by hundreds of calories.

9 tons is what scientists think the largest *T. rex* specimen ever found weighed when alive. That's 30 percent more than previous estimates.

FACING THE CLIFFS

Elite rock climbers discuss the geology of their favorite climbing sites



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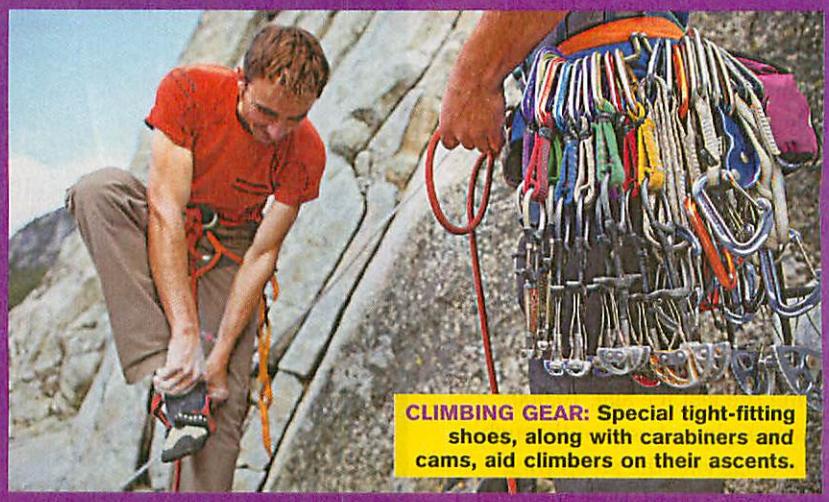
GETTING A GRIP: A climber scales a crack in Indian Creek near Moab, Utah.

Kate Rutherford clings to the steep rock face beside Yosemite Falls in California's Yosemite National Park. She has jammed her hand into a crack in the rock as she looks for the next hold on her route up the cliff. Her toes are perched on small ridges in the rock no wider than a pencil. Grip by careful grip, Rutherford makes her way up the cliff. Along the way, she clips her rope to metal hooks called *carabiners* and removable supports called *cams*. Sometimes, when she can't find a crack for cams, she uses bolts that previous climbers drilled into the route. The rope will prevent her from falling all the way down.

Professional rock climbers like Rutherford travel the world performing gravity-defying climbs. As they tackle new routes, they get to know the rocks. "You really get up close and personal with all different kinds of rock. There's so much geology going on in our lives as climbers," says Rutherford. Each climb is a new adventure, no matter if you're an expert climber or a novice. Across the United States, mountainsides, cliffs, and boulders created by a variety of geological forces provide unique challenges for climbers.



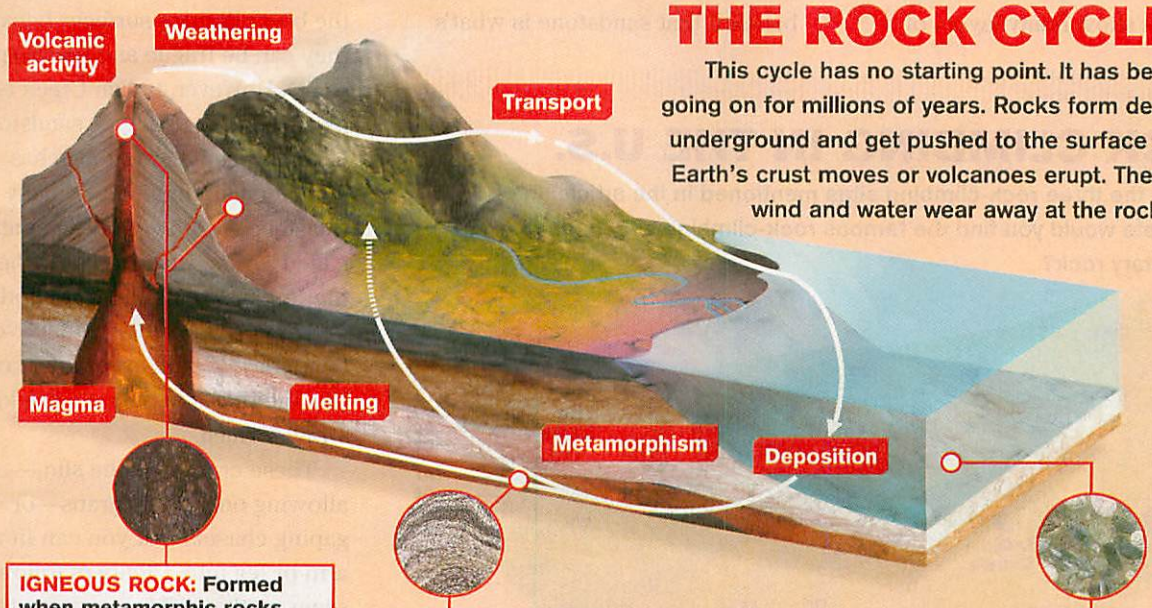
CLIMBING GEAR: Special tight-fitting shoes, along with carabiners and cams, aid climbers on their ascents.

SHEER FACES

"Granite, and all of the rocks in the granitic family, are definitely the most sought-after types of stone to climb," says Sarah Garlick, a geologist and rock climber who wrote a guide to the geology of world-famous rock-climbing sites. Yosemite, located in the Sierra Nevada mountain range, is among climbers' top

THE ROCK CYCLE

This cycle has no starting point. It has been going on for millions of years. Rocks form deep underground and get pushed to the surface as Earth's crust moves or volcanoes erupt. There, wind and water wear away at the rocks.



IGNEOUS ROCK: Formed when metamorphic rocks melt to form *magma* (melted rock), which then cools underground or erupts and cools on Earth's surface.

METAMORPHIC ROCK: Formed when heat and pressure change sedimentary, igneous, or other metamorphic rocks.

SEDIMENTARY ROCK: Formed when layers of sediment are squeezed and cemented together.

TOP: JIMMY CHIN/NATIONAL GEOGRAPHIC STOCK; DIAGRAM: SW INFOGRAPHIC

destinations (*see Climbing Records, right*). Its granite is an *igneous rock* that was originally formed when magma deep within a volcano slowly cooled 100 million years ago (*see The Rock Cycle, p. 7*).

Over the years, the Sierra Nevada mountain range rose, and *weathering* due to wind, rain, snow, and ice wore down the softer surrounding rocks. *Erosion* carried the rock particles down rivers. "During the last ice age, 10,000 years ago, glaciers swept through the area, carving the steep rock faces of El Capitan, Half Dome, and the other famous rock faces within Yosemite," says Garlick.

OVERNIGHT STAY: For long ascents, climbers sleep on the wall in hanging tents called portaledges.

LAYERED ROCKS

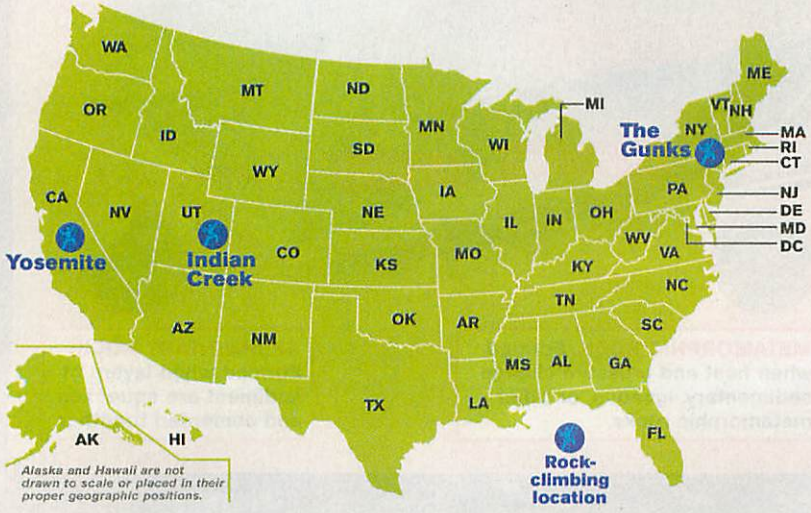
While Yosemite's granite is perfectly suited for epic cliff-face climbs, the *sandstone* across Utah offers climbers its own unique challenges. Sandstone is a type of *sedimentary rock* that forms when particles from other rocks are compressed and cemented together over millions of years. In Utah, the rocks show many layers of sandstone that tell the history of the area. For example, 200 million years ago, the Wingate sandstone that makes up the cliffs of Indian Creek near Moab, Utah, was originally a desert covered with dunes, much like the Sahara Desert. Just beneath that sandstone is what's called the Chinle Formation, which is mainly made up of river-bottom sediments. From studying the area's layers, geologists can tell that Utah has undergone vast changes throughout time.

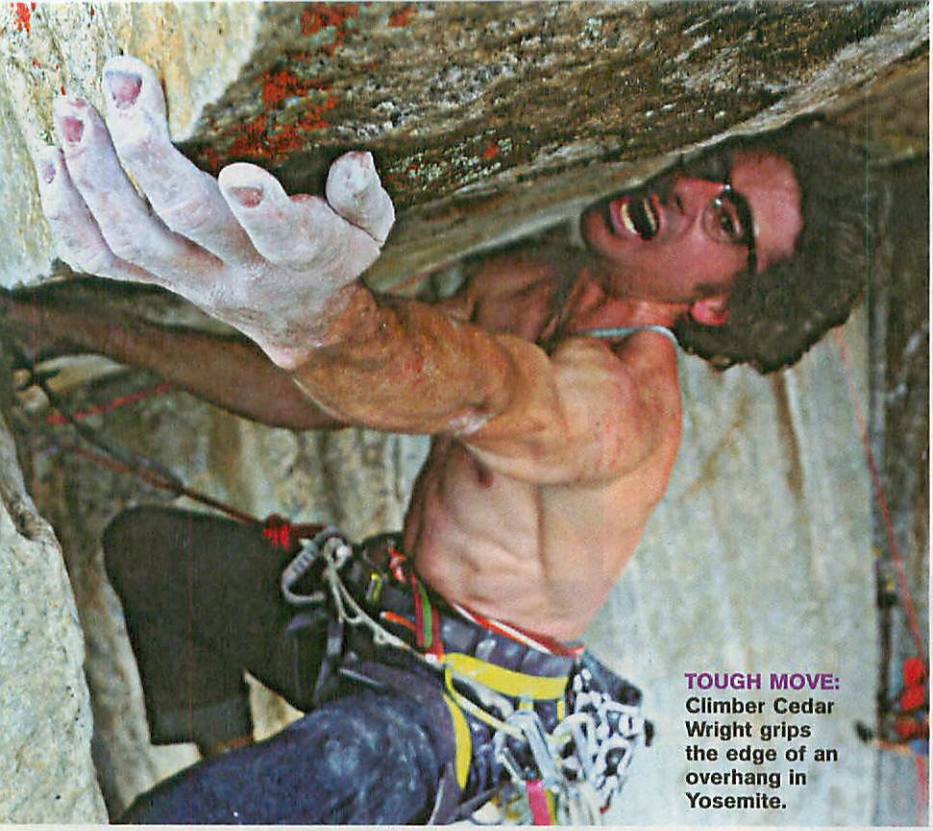
Some sandstones don't make the best climbing surfaces because they can be fragile and break apart easily. However, Indian Creek is an exception. The Wingate sandstone is smooth and hard. It also has many cracks running vertically up the steep rock face. These cracks, called *joints*, were created when the Rocky Mountains were uplifted. Pressure caused the rock above to bend, or *fold*, and eventually cracks like the ridges in a bendy drinking straw formed.

These cracks can be slim—allowing only finger grabs—or gaping chasms that you can fit an arm or leg into. Climbers follow a seam up the cliff face using a technique called *jamming*. "It's a really unique style, where you're climbing strictly in the spaces in between the rocks," says professional climber Cedar Wright. "There's really only

ROCK CLIMBING IN THE U.S.

Here are the three rock-climbing sites mentioned in the article. In which state would you find the famous rock-climbing site made of sedimentary rock?





TOUGH MOVE: Climber Cedar Wright grips the edge of an overhang in Yosemite.

one Indian Creek, so people come from all over the world to experience that style of climbing."

SLANTED FORMATIONS

Just outside New Paltz, New York, is another climbing attraction, called the Shawangunk Ridge, or the Gunks for short. The ridge has horizontal cracks, rather than the vertical cracks of Indian Creek. Initially, the rock here was sedimentary: a river-lain *conglomerate*. But over time, the sedimentary rock was squeezed, heated, and transformed into a *metamorphic rock* called quartzite. Not only did the squeezing compress it into a new type of rock, but it also caused the area to buckle. "The layers have been tilted backward, so it has a nice angle for climbers," says Garlick. "And the rock is smooth and hard, rather than crumbly sandstone."

The Gunks also draw climbers who specialize in a technique called *bouldering*. Giant boulders that are 3 to 6 meters (10 to 20 feet) tall dot a nearby valley. Since the heights aren't as extreme as the ones climbers face when they scale rock walls, ropes and harnesses are unnecessary when climbing boulders. Garlick is intrigued by the Gunks' boulders, "because, as a big cliff goes through the weathering and erosion process, it produces [the] boulders that we climb," she says. "Then those eventually will erode away into particles that may become a future sandstone."

WHAT DO YOU THINK?

If you were to try rock climbing, which location would you want to visit? Why?

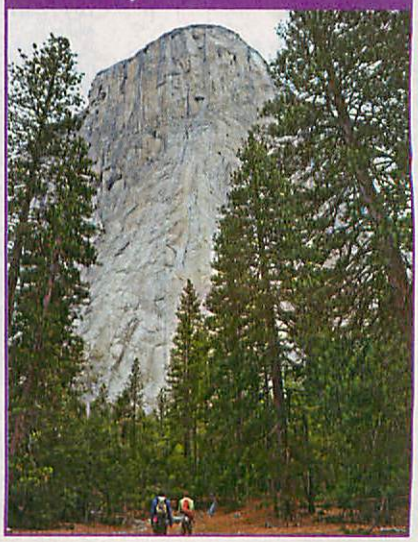
No matter where you are in the U.S. or around the world, you can probably find rocks relatively nearby that climbers have scaled. "It's a good sport, and we learn a lot about geology through our love for the rocks," says Wright. "Rocks really punctuate the landscape. They're beautiful, and for some people they beg to be climbed."

—Karina Hamalainen

CLIMBING RECORDS

Yosemite's El Capitan is one of the most famous formations climbers visit. This vertical granite rock face is shaped like the prow of a boat. Its tip rises 890 meters (2,920 feet) from the base to its summit. The first climbing route established on El Capitan, called "the Nose," goes up the front edge. In 1958, a team led by rock-climbing legend Warren Harding took 18 months to drill bolts and hammer big nails called *pitons* into the rock to which they attached ropes. All told, it took them 47 days of actual climbing to make it to the top of the Nose.

Nowadays, experienced climbers take several days to make the ascent, relying on tents called *portaledges* that hang from the wall. But the route has been scaled even faster: In late 2010, daredevil *free solo* climbers Dean Potter and Sean Leary scaled the Nose in two hours, 36 minutes, and 45 seconds. They accomplished such a speedy ascent by leaving most of their heavy climbing gear behind.



Guardians of the GRIZZLY

A scientist teams up with native Canadians to protect grizzly bears

SCHOLASTIC and AMERICAN MUSEUM of NATURAL HISTORY present SCIENCE EXPLORATIONS

When Chris Filardi was growing up in New York City, he loved exploring the American Museum of Natural History. Gazing at the grizzly-bear exhibit, he imagined wild places.

Today, Filardi is a biologist at the museum's Center for Biodiversity and Conservation. He travels to the wild places he used to dream about to study grizzly bears. Filardi partners with the Heiltsuk, people native to the coastal rainforests of British Columbia in Canada. Over thousands of years of living in grizzly habitat, the Heiltsuk have developed a deep understanding of the bears. Now, cutting-edge science combined with the Heiltsuk people's ancient knowledge may protect grizzlies.

TRAP FUR, NOT BEARS

Grizzly bears and the Heiltsuk have lived side by side for about 10,000 years. The grizzly—a massive type of brown bear—once roamed from northern Canada to the Great Plains. Over the past century, clashes with humans have reduced the number of grizzly bears, especially in the United States.

The Heiltsuk must know more about the bears to protect them. To gather this *data*, they could have used darts to sedate the bears and then outfitted them with radio collars that could track their whereabouts. "But the thought of bears with collars is too much for the Heiltsuk," says Filardi. So they came up with a plan that would not disturb the grizzlies. They set up snares to collect the bears' fur instead of the bears themselves.

To snag the hair, the Heiltsuk search for bear trails in the forest. It's easy to find these paths: Grizzlies leave behind fish skeletons and scat as they roam. Researchers encircle trees along the trail with a string of barbed wire and spray a scent mixture of moss, salmon oil, and berries there to attract the bears. When a bear brushes against the wire to check out the yummy scent, it leaves evidence behind—tufts of tangled hair.

CHRIS FILARDI

DECODING THE DATA

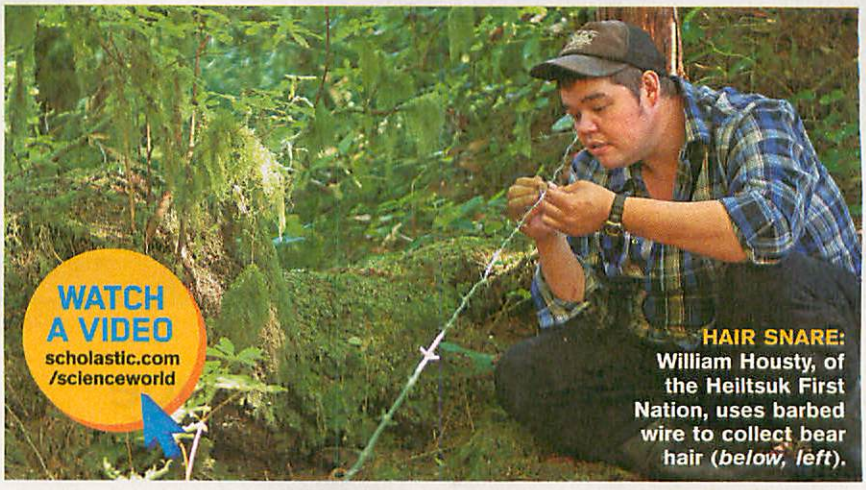
The Heiltsuk collect the hair and send it to a laboratory that extracts *DNA* from the samples. Filardi then analyzes this hereditary material. Since each bear's genetic code is unique, Filardi can tell how many individual grizzlies there are. He can also determine how bears in the area are related to each other, their gender, and even what they've been eating. This information is vital to assessing the health of the region's bear population.

Clues from the hair have revealed that about 100 bears enter the area every fall. Some come from as far as 50 kilometers (31 miles) away. The attraction: Huge numbers of salmon swim upstream from the Pacific Ocean to the region's Koeye River each fall to spawn. Grizzlies catch the fish and feast on them.

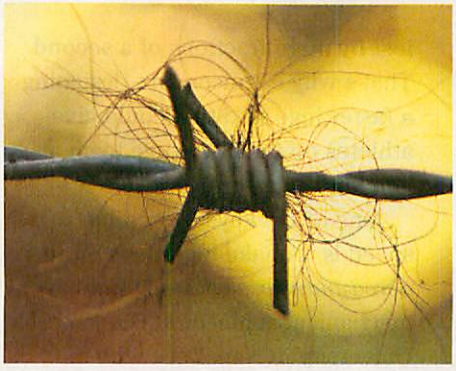
Unfortunately, results from the partnership also show that the grizzly population there is in decline. According to Filardi, it is important to continue monitoring bears in British Columbia's coastal rainforests and to make management decisions that will protect the animals.

After 20 years of working with the museum, the Heiltsuk now run the grizzly project. They design research studies to investigate their own questions. "Anyone who sees and hears thoughtfully can have a huge impact," says Filardi. When it comes to the call of the grizzly, the Heiltsuk know how to listen.

—Judith Jango-Cohen

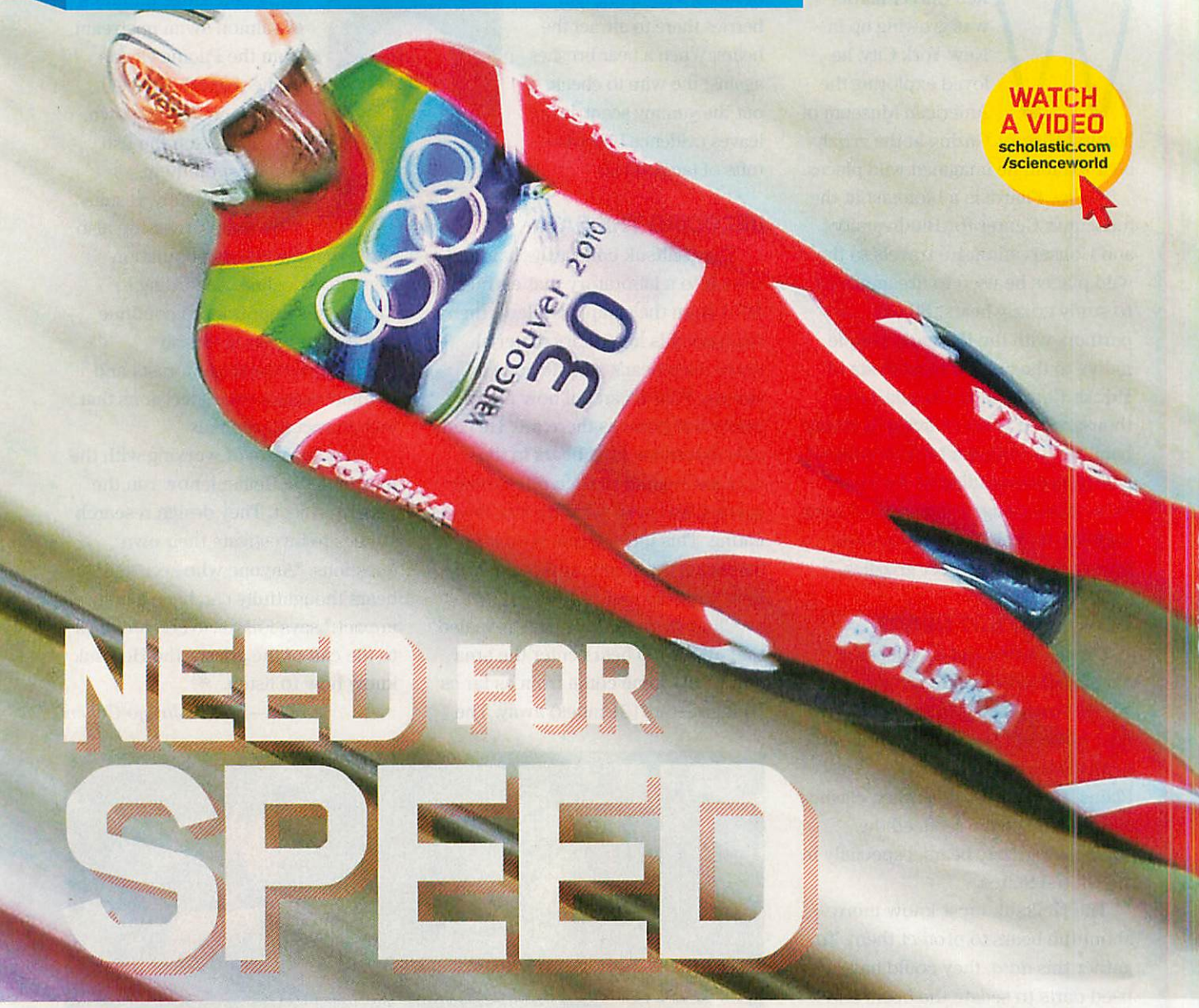


HAIR SNARE: William Housty, of the Heiltsuk First Nation, uses barbed wire to collect bear hair (*below, left*).



HEILTSUK LANDS

LEFT: ©REX FEATURES VIA AP IMAGES; FILARDI: ©AMERICAN MUSEUM OF NATURAL HISTORY; BOTTOM: MARK GODFREY© THE NATURE CONSERVANCY (2); MAP: JIM MCMAHON



NEED FOR SPEED

A faster sled could give luge athletes a competitive boost

WHOOSH! A luge slider lying on a sled streaks down a twisting and turning icy track so fast he looks like a blur. Lugers reach speeds of more than 140 kilometers (90 miles) per hour, making their sport one of the fastest in the Winter Olympics. Races are won or lost by mere fractions of a second. That's why engineers are designing a faster luge sled that could give athletes on the USA Luge team a winning edge.

One of the keys to gaining speed is to make luge sleds more *aerodynamic*, says Doug Bohl, a mechanical engineer at Clarkson University in New York who is working with the luge team. This will allow air to flow around the sled more easily instead of creating *drag*, or air resistance, that slows a sled down.

Bohl got involved in the project after his 13-year-old son, Bailey, participated in the USA Luge slider search, which scouts and trains future luge athletes. The program lets kids try out a luge sled outfitted for the street, with wheels instead of steel runners (*see Luge Sled Design, right*). Those who do well, like Bailey, get the chance

COOL SPORT: Luge is considered to be the fastest sport on ice.

SPEED TEST: A luge sled and mannequin rider are placed in a wind tunnel at Clarkson University.

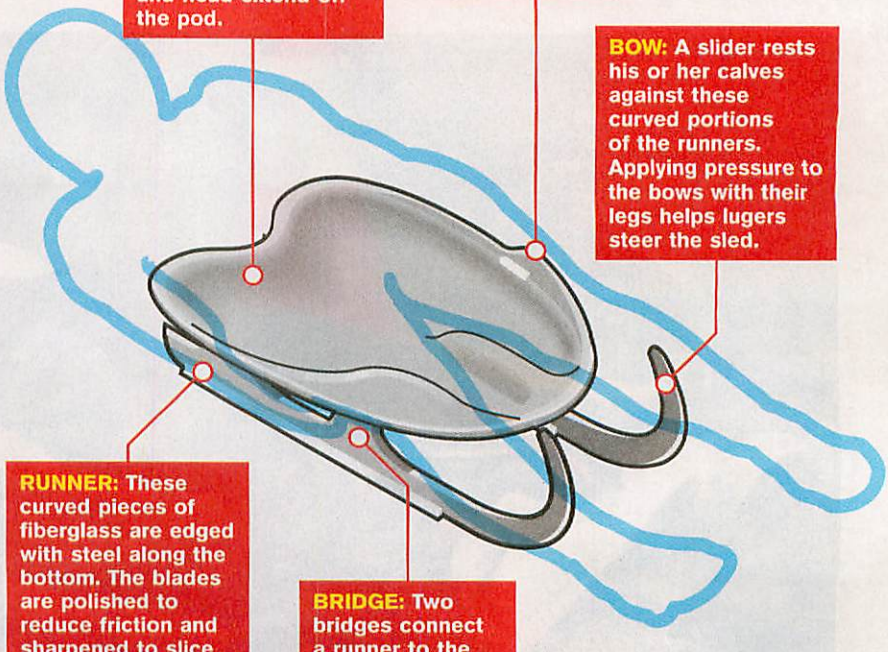
to practice and compete on the ice-covered track in Lake Placid, New York. There, Bohl met USA Luge coaches and offered to lend his science know-how to help create an improved sled for the 2014 Winter Olympics in Sochi, Russia.

EXTREME SLIDING

Luge tracks like the one in Lake Placid are on average 1.5 km (0.9 mi) long—a distance sliders cover in less than a minute. The tracks follow the natural descent of the mountains on which they are built,

LUGE SLED DESIGN

Lugers rocket down a nearly milelong track in less than a minute on a small, fiberglass sled. The sleds are custom-built to fit a slider's proportions. Take a look at the parts of this important piece of luge equipment.



TOP: COURTESY OF CHRISTOPHER LENNEY, CLARKSON UNIVERSITY; DIAGRAM: BRICE HALL/REUTERS

so each is different. Lugers must navigate a course's hairpin turns and *S*-shaped curves, while traveling at breakneck speeds. "It can be a little scary," says Bailey. "But once you get used to it, it's a lot of fun."

To gain speed, sliders launch themselves down the track with as much force as possible. A luger generates *momentum* (object's mass times its speed) by grasping handles on either side of the track, rocking forward and backward, and then giving a powerful push. The slider accelerates even more at the start by paddling against the ice with spiked gloves.

As the course slopes, lugers lie back and point their toes as the downward force of *gravity* takes over, rocketing them down the track. Along with their flat aerodynamic position, sliders wear sleek, skin-tight speed suits and helmets with visors that extend past the luger's chin to minimize air pockets. "You can't see much, so you have to rely on knowing the track," says Bailey.

A slider steers through twists and turns by pushing against a sled's runner with one calf while pressing down with his or her opposite shoulder. This causes the sled to pivot. *Centripetal force* pushes lugers outward from their curved path, so the sides of the track are banked to keep the sliders from flying off. They must control how far they ride up the wall, because the farther up they travel, the more time they add to their run.

WHAT DO YOU THINK?

The design of the luge track at the 2010 Winter Olympics allowed athletes to go too fast. As a result, a slider crashed and died. Should there be a limit to how fast lugers can go?

BUILDING A BETTER SLED

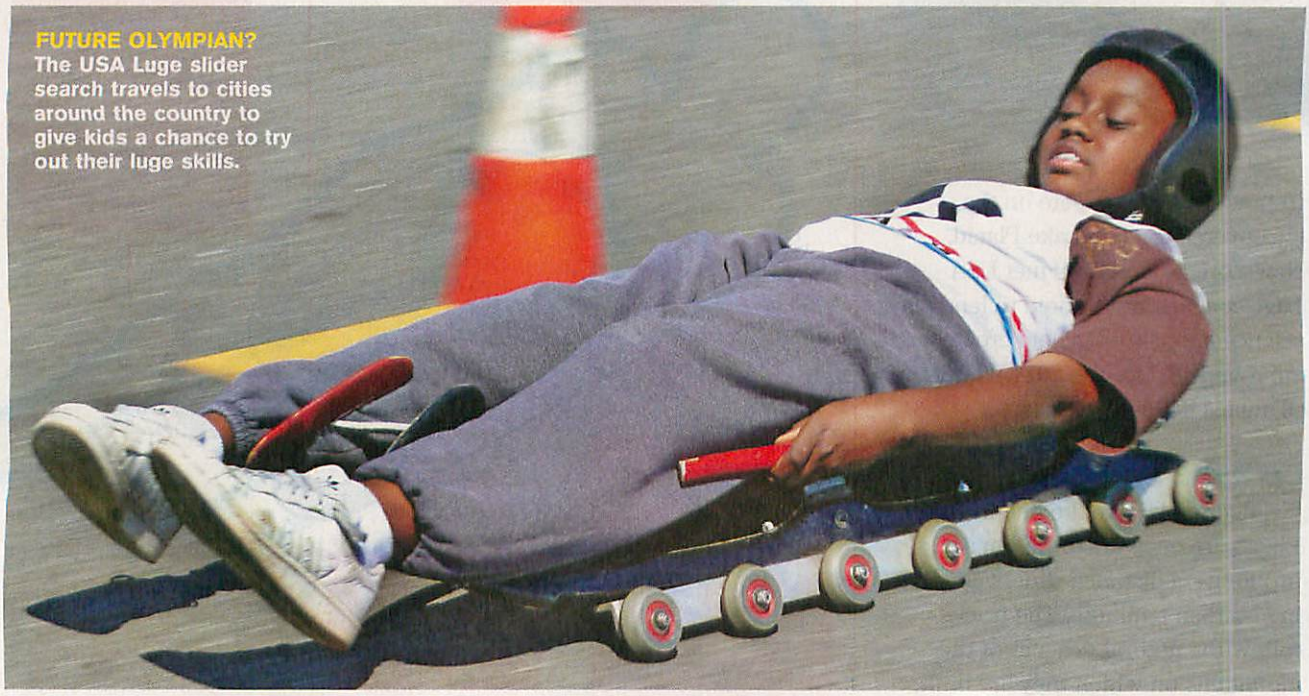
Skill is the main factor that determines whether a luger will be the fastest across the finish line. But "everything counts in our sport," says Gordy Sheer, an Olympic silver medalist and marketing director for the USA Luge team. "Shaving off even 100th of a second is a big deal."

That's where the changes Bohl is making to luge sleds come into play. Ideas for a speedier sled include altering the sled's width or the shape of its fiberglass shell. The new sled designs—along with a life-size slider mannequin—get tested in a wind tunnel. "When air flows around a body, it can make a wake in the back, where the air is turbulent and choppy," says Bohl. "In a gliding sport like luge, that slows you down."

Bohl also uses computer models of sleds to compute drag. One program allows him to simulate a sled going down the track at Lake Placid. He can alter drag, sled and rider weights, and friction against the ice to see how these factors affect race times.

Working closely with the USA Luge team, Bohl makes sure sleds are not only speedy but also easy for riders to handle. "The coaches and athletes know a lot more about driving and the feel of a sled," says Bohl. "I try to bring science to what was before more of an art." Their teamwork might just propel a slider on the USA Luge team to the winner's podium in 2014.

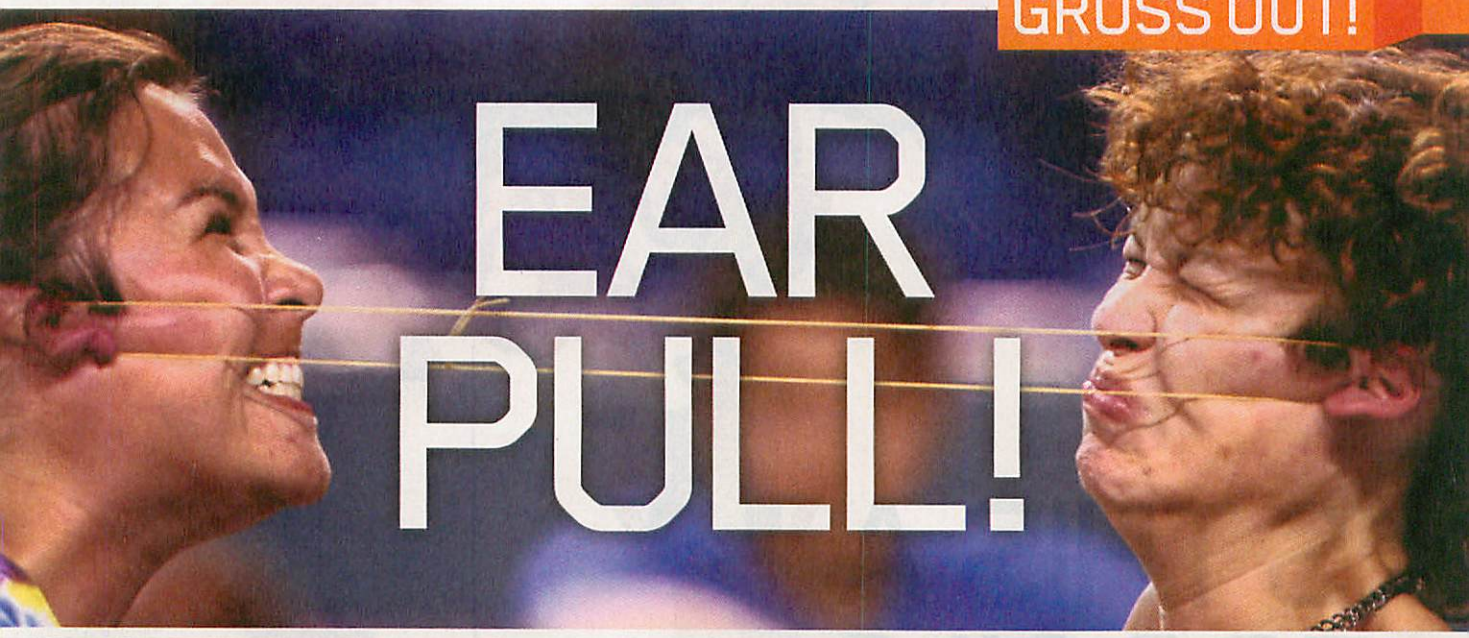
—Cody Crane

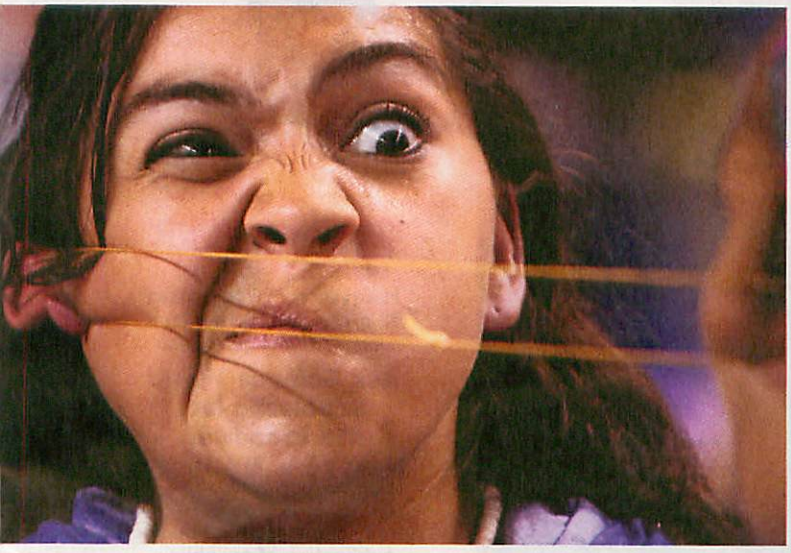


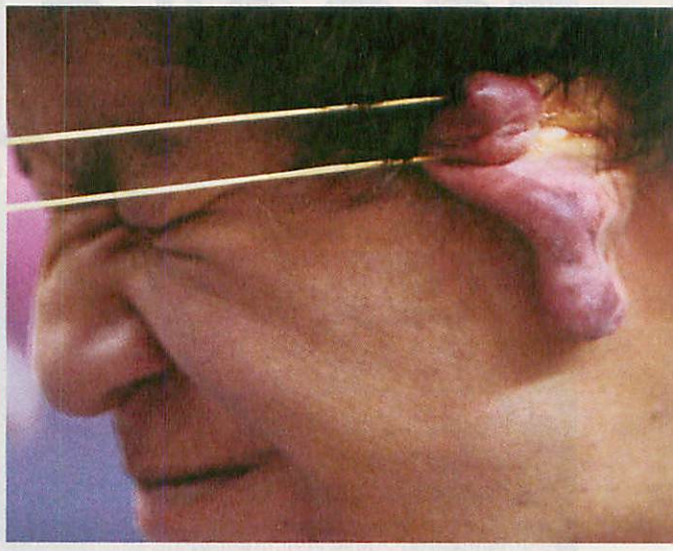
FUTURE OLYMPIAN? The USA Luge slider search travels to cities around the country to give kids a chance to try out their luge skills.

COURTESY USA LUGE

EAR PULL!







These competitors are getting an earful at the annual World Eskimo-Indian Olympics in Fairbanks, Alaska! That's because they are taking part in the ear-pull contest.

For this event, competitors sit on the floor facing each other with string looped around an ear. The string connects one contestant's ear to that of his or her opponent. At the start signal, the competitors lean away from each other, starting a tug-of-war of ears. A person wins once the string slips off the opponent's ear.

The game is intended to test competitors' stamina and tolerance of pain—characteristics necessary to survive the harsh environment near the Arctic Circle, where many Eskimos live. But playing such games with the ears can have serious consequences.

Dr. Christopher Linstrom, an ear, nose, and throat specialist in New York, says that the *auricle* (external ear) is designed to direct sound into the ear, not to be pulled.

"It would have developed into a tougher appendage if it were meant to be pulled," says Linstrom. "It's unlikely that an auricle would be torn away in a tug-of-war game, [but] auricular injury is a very serious problem."

Hemorrhage (loss of blood from a ruptured blood vessel) under the skin of the auricle could lead to death of the underlying *cartilage* framework. Such damage to this flexible connective tissue can lead to a severely deformed auricle—a condition called "cauliflower ear." Other injuries include abrasions or partial tearing.

"The auricle enjoys its best health when left alone to perform its normal function: to hear," says Linstrom. — *Sara Goudarzi*

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"How do chameleons change color?"
—Kevin, Maryland

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Chameleons have special cells in their skin called *chromatophores*. These cells are shaped like starfish, and inside each one are brightly colored *pigments*. The pigments move in and out of the "arms" of the chromatophores to hide or reveal colored layers below.

Chameleons can't change the pattern of the chromatophores on their skin. "It's a popular misconception that chameleons can match whatever background they are placed on," says Devi Meian Stuart-Fox, who studies lizards at the University of Melbourne in Australia. Chameleons change color by thinking about it, she says, so "when they are asleep, they are essentially colorless."

SEND US YOUR QUESTIONS!

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