The Science of Death
COMING BACK FROM THE BEYOND

Urban Parks

93 Spring Days

EXPLORER
Watch 'Faces of Death' Sunday, April 3, on the National Geographic Channel

APRIL 2016

NATIONAL GEOGRAPHIC

The Photo Ark

One man's quest to document the world's animals, one picture at a time

Ili Pika
(Ochotona iliensis)
Size: Body length, up to 20.5 cm (approx. 8 inches)
Weight: 217 - 250 g (7.7 - 8.8 oz)
Habitat: Sloping, high rock walls and cliff faces of the Borohoro mountain range
Surviving number: Unknown; populations declining

Photographed by Weidong Li

WILDLIFE AS CANON SEES IT

Pile high. The ili pika spends the summer constructing a huge pile of hay, which it will use as a food source to make it through the lean months of winter in its mountain home. This elusive loner's life centers on its den, from which it warily ventures to forage for nearby plants. Rarely seen by humans, its most recent confirmed sightings came after a disappearance of 20 years. Now, faced with climate change, overgrazing by livestock and deadly encounters with dogs, the ili pika may be on the verge of disappearing altogether.

As Canon sees it, images have the power to raise awareness of the threats facing endangered species and the natural environment, helping us make the world a better place.

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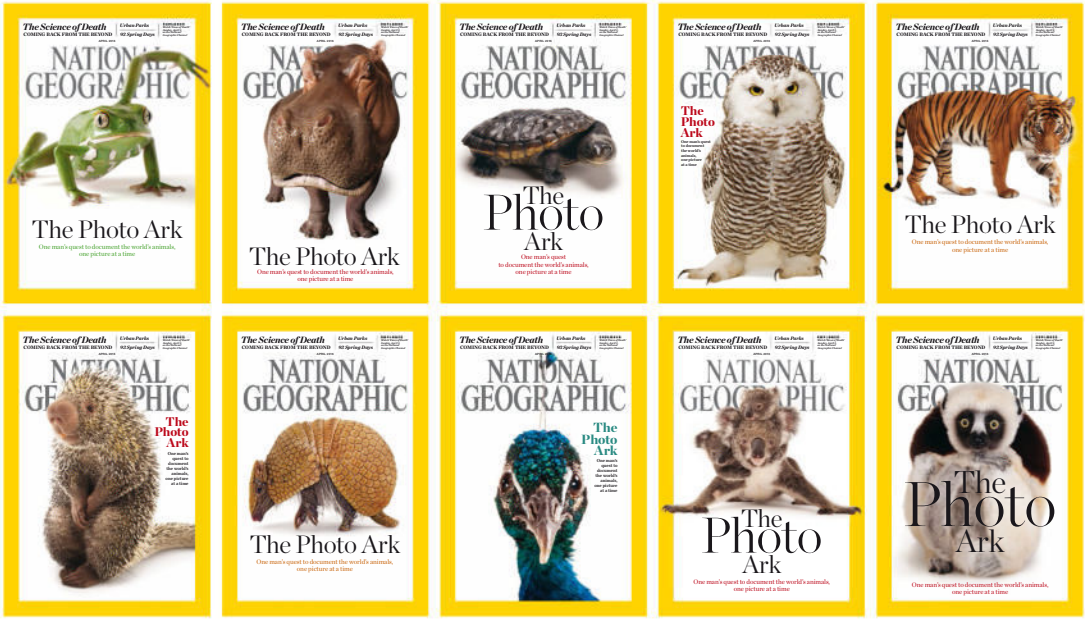
APRIL 2016 • VOL. 229 • NO. 4



With so many Photo Ark animals to choose from, we couldn't decide on one cover—so we made ten for this month's issue. If you didn't get the animal that you like best on your cover, call 1-800-777-2800 to purchase your favorite.
Top row, from left: waxy monkey tree frog, hippopotamus, Reimann's snake-necked turtle, snowy owl, Malayan tiger. Bottom row, from left: Brazilian porcupine, southern three-banded armadillo, Indian peafowl, mother and baby koalas, Coquerel's sifaka.

On the Cover Joel Sartore shot this month's cover images at (from left, by row) Rolling Hills Zoo, San Antonio Zoo, Zoo Atlanta, Raptor Recovery Nebraska, Omaha's Henry Doorly Zoo, Saint Louis Zoo, Lincoln Children's Zoo (two), Australia Zoo Wildlife Hospital, Houston Zoo.

Corrections and Clarifications Go to *ngm.com/more.*

Capturing Rare Species

And to think it all started with a naked mole rat.

The year was 2006, and National Geographic photographer Joel Sartore wanted to try making formal portraits of animals in captivity instead of his usual shots of them in the wild. For his first subject, he told a zookeeper, he just needed a creature that might sit still. The naked mole rat qualified.

From that modest beginning came Photo Ark, a joint project of Sartore and National Geographic. Within a 25-year span, Sartore aims to document as many of the species of animals now living in captivity as possible.

Why? Because by 2100, many of those species could be gone. Some of the animals he's photographed may have already become extinct: A fish called the chucky madtom hasn't been seen in the wild for more than a decade. Then there are others like the northern white rhino. Only three remain—destined for extinction.

Sartore travels the world from his home in Lincoln, Nebraska, to take these animals' portraits. His days on the road are often long—12 hours or more—and challenging. Animals can be uncooperative subjects, and the work far from glamorous. At the Plzeň Zoo in the Czech Republic, Sartore slept in a room above the rhino enclosure. The female rhino banged her horn on the bars all night (it sounded like "a machine gun"), and the odor of rhino urine was nearly overwhelming. But the price (free) was right.

The results are incomparable—so irresistible, in fact, that we couldn't pick a single photo for our cover. Instead we printed ten covers, each with a different photo; you can see them on the contents page. Sartore's soulful portraits have been projected in heroic scale on the facades of St. Peter's Basilica in Vatican City and the United Nations building in New York City. They'll soon be collected in a digital encyclopedia on *nationalgeographic.com,* as well as a gorgeous coffee-table book. They appear in a National Geographic book for kids of all ages (right) and regularly in this magazine.

Which brings us back to the naked mole rat, a decidedly appearance-challenged rodent pictured on page 75. Ultimately, Sartore says, "I want to get people to care, to fall in love, and to take action." That's a good description of the mission of Photo Ark—and of *National Geographic* as well. Thanks for reading.

Susan Goldberg, *Editor in Chief*

Joel Sartore's book *Photo Ark: A World Worth Saving* can be ordered at *shopng.com/photoark.*

What animal is most like you? Take the quiz at *natgeo.com/photo-ark-quiz,* and tell us about it. #PhotoArk

This baby chimpanzee was photographed at Tampa's Lowry Park Zoo.

PHOTO: JOEL SARTORE

NAT GEO WILD

natgeowild.com/YukonVet

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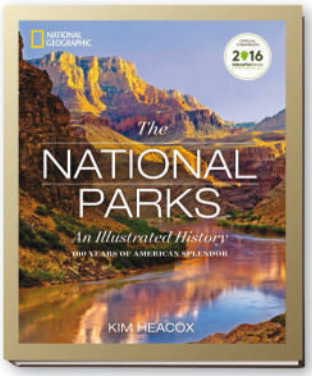
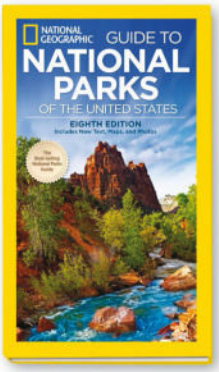
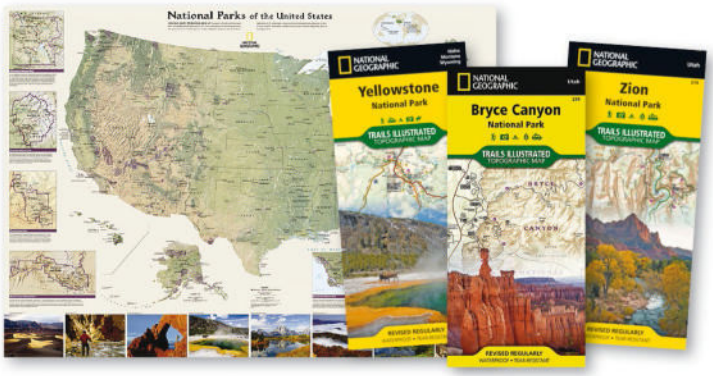
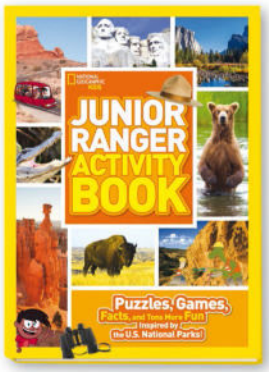
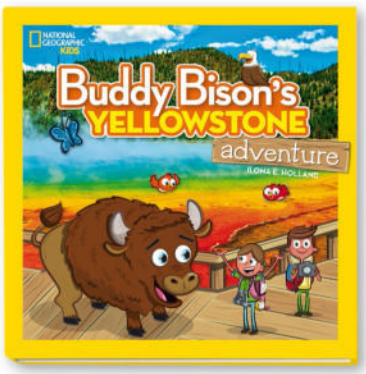






FOR KIDS!





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* For details and official rules visit: NationalParksSweeps.com

Why I Went Looking for Spiritual Answers

Morgan Freeman is an actor and director who has famously voiced the Almighty. Now he's asking big cosmological questions—How did we get here? What happens when we die?—for *The Story of God,* a new series on the National Geographic Channel. The quest for answers took Freeman, 78, to hallowed sites around the globe, from a Maya temple to the Vatican.

Did you come to this project with a curiosity about God and faith that you wanted to explore?
Well, I think I'm like most people who grow up with God. My grandmother was not religious, but she was a studious believer. She'd go to church because she was tired; she was a seamstress. You know how you say to children that God is love? Well, by the age of 13, I was beginning to question all that. The questioning is ongoing. This series was an opportunity to really delve into it, to go find some answers.

Some people picture God as you, after you played God in the movie *Bruce Almighty*. Who do you see?
Me? You know that George Burns also played God. [Laughs] I don't think there is an image of God. I like the idea of rays coming down from the clouds. I like the idea of seeing the Milky Way on a clear and starry night or under a full moon. That is the essence of existence. You're there totally with the great unknown. That's God.

How was it to visit these holy, heavily guarded places?
It wasn't bad, except maybe on one occasion at the Church of the Holy Sepulchre in Jerusalem. We got kicked out because I've got a big mouth—because I used an unallowable word, which we didn't realize was unallowable. We were in one of the tombs below where the Crucifixion of Jesus took place. I used the term "myth" in regard to what happened there, and we were asked to leave posthaste. Out. But we were allowed back in the next day.

PHOTO: MILLER MOBLEY

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VISIONS

Kenya
At a hotel in the suburbs of Nairobi, a Rothschild's giraffe named Lynne spots an offer she can't refuse: pellets of bran and molasses in the hand of Sala Carr-Hartley, age six. The 140-acre site is a sanctuary for the endangered subspecies.

PHOTO: ROBIN MOORE, NATIONAL GEOGRAPHIC CREATIVE

India
In the tall grass of West Bengal, a man in the vivid guise of a Hindu deity performs a Chhau dance—a martial mix of folk, tribal, and religious elements. These theatrical dances, staged at festivals in eastern India, reenact scenes from Sanskrit epics.

PHOTO: ARGHYA CHATTERJEE

United States
Moments after a recital, seven ballerinas relax backstage at the Mahaffey Theater in St. Petersburg, Florida. Most of the four- and five-year-old girls, who had just portrayed fairies onstage, were wearing makeup for the first time.

PHOTO: EVELYN REINSON

From Above

Assignment "Point downward" was the only rule we gave Your Shot members. See their work in each issue of the magazine and online every day.

EDITOR'S NOTE

'Taking the bird's-eye view—which is usually part of the story—and making it the *whole* story can refresh your work. There's power in seeing something in an entirely new way.'

Marie McGrory, *Your Shot photo editor*

Christian Åslund
Stockholm, Sweden

There aren't many tall buildings where Åslund grew up, so when he visited a friend's high-rise apartment in Hong Kong, the view downward inspired an idea. On the roof Åslund used a walkie-talkie to direct a friend lying on the street. They spent two days shooting similar images.

WHAT AGE SHOULD YOU START SAVING FOR RETIREMENT?

WHAT AGE DID YOU ACTUALLY START?

The difference between those two ages is what's known as the "Action Gap," and it has a bigger effect than you might think.

To better understand the impact, we performed a simple experiment. We asked a group of young people to use paint rollers to show us what age they think they should start saving. Then we asked a group of older people to indicate what age they actually *did* start. What we found was that there was often a years-long Action Gap between the two. But closing it up by even just a few years makes a huge difference in how much people can save over the long run. Which makes right now the perfect time to get better prepared for your retirement.

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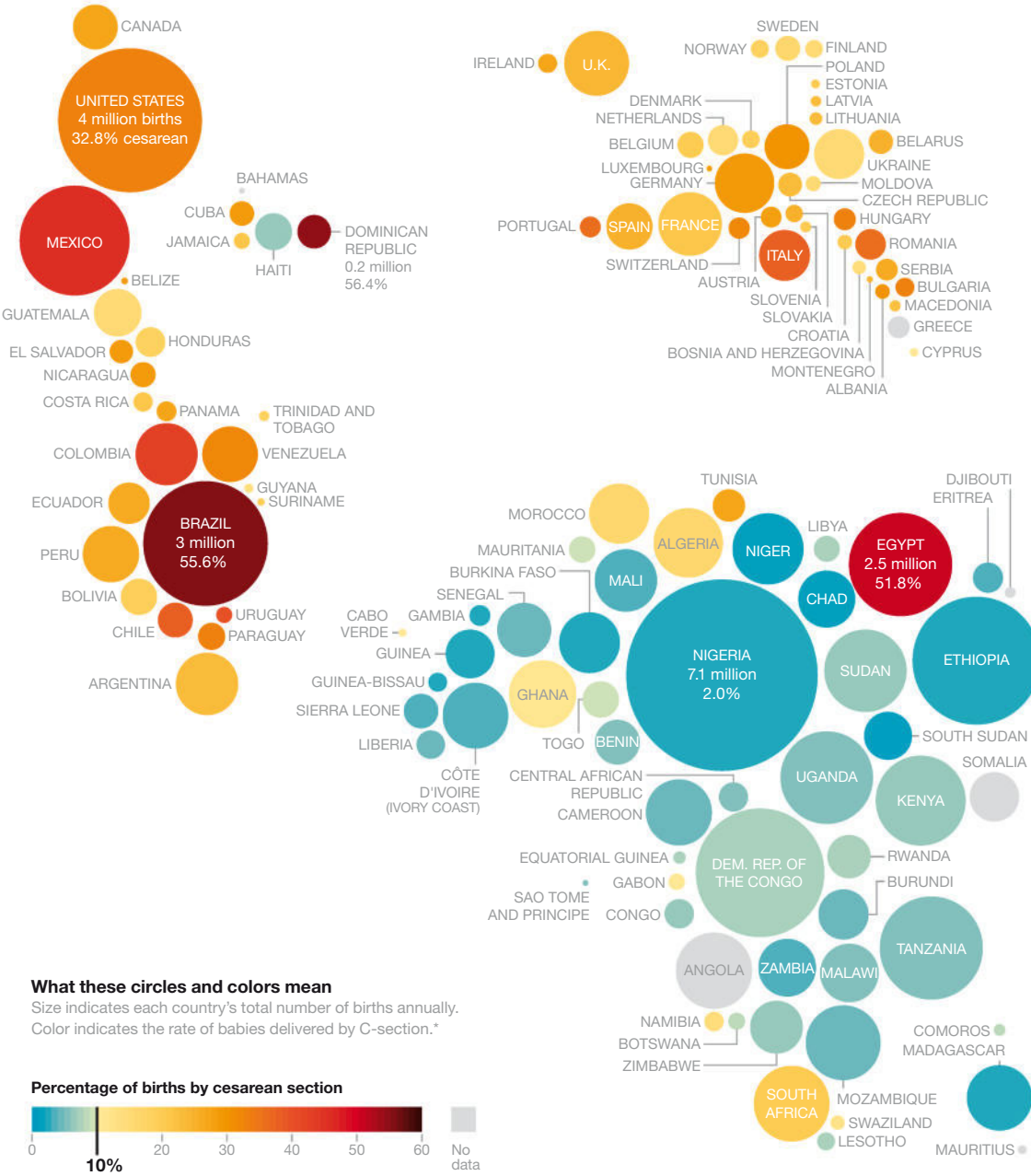


What these circles and colors mean

Size indicates each country's total number of births annually. Color indicates the rate of babies delivered by C-section.*

Percentage of births by cesarean section

0 | 10% | 20 | 30 | 40 | 50 | 60 | No data

The World Health Organization associates a C-section rate of 10% with preventing the deaths of mothers and newborns.

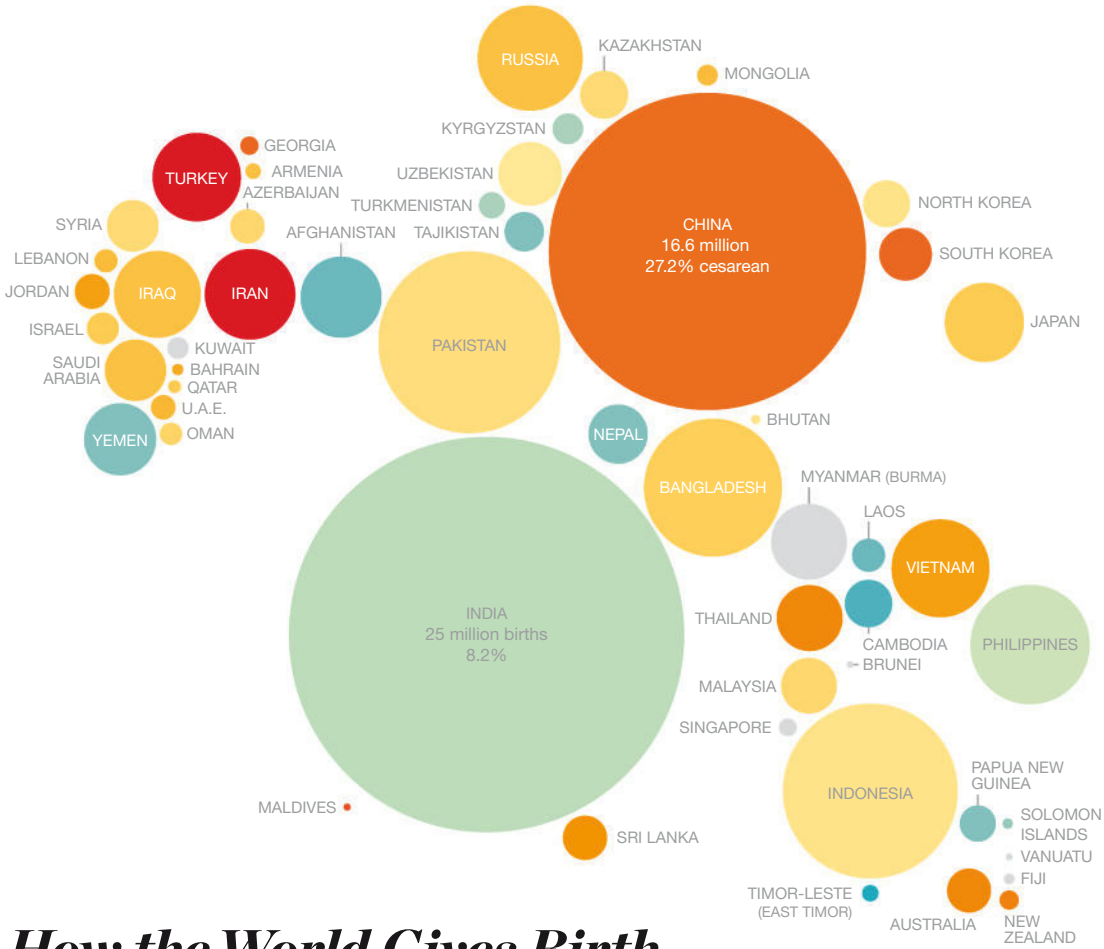
*Countries with more than 5,000 births a year shown

BRAZIL
The country with one of the highest C-section rates (55.6%) launched a public health campaign in 2015 to promote natural births.

FINLAND
The lowest rate among developed countries (14.7%) is likely a product of midwife-led deliveries and strict clinical protocols.

EGYPT
Its rate (51.8%) is growing fast, as more women ask for C-sections and doctors try to avoid medical and legal complications.

AFRICAN NATIONS
Less than 1.6% of babies in Niger, Chad, and Ethiopia are delivered via C-section, largely owing to a shortage of care facilities.



How the World Gives Birth

In 2014 nearly one in five pregnant women worldwide delivered babies by cesarean section. The original purpose of the procedure, in which the baby is removed through the uterus and abdomen, was to avoid life-threatening complications that can arise during vaginal births. Yet rates of C-sections in some countries are substantially higher than the 10 percent rate the World Health Organization associates with preventing the deaths of mothers and newborns.

Why do some countries see so many C-sections? WHO medical officer Ana Pilar Betrán says factors favoring the procedure include families' and doctors' expectations of achieving safer outcomes and avoiding long or painful labors. High rates, such as in Brazil, also can reflect a desire to time births more predictably, while low rates can indicate reduced access to medical care.

As doctors and expectant mothers reevaluate the benefits of delivering through the birth canal, C-section rates could decline, Betrán says. —*Daniel Stone*

MATTHEW TWOMBLY. SOURCE: WHO

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Please see Brief Summary of Prescribing Information on the next page.

SANOFI REGENERON

When **diet and the highest tolerated dose** of a statin are not enough, adding **PRALUENT** could make it **PLUNGE.**

PRALUENT is different than a statin, and is for adults with uncontrolled LDL (bad) cholesterol who have HeFH* or heart problems due to plaque in the arteries.

- In clinical studies of patients with HeFH* or heart problems due to plaque in the arteries who were not at their LDL cholesterol goal despite being on the highest tolerated dose of a statin, adding PRALUENT to a statin reduced high LDL cholesterol an additional **44%-58%**, on average
- So if diet, exercise, and statins haven't been enough to get your LDL cholesterol to where it needs to be, talk to your doctor about adding PRALUENT

*Heterozygous familial hypercholesterolemia.

What Is PRALUENT (alirocumab)?

PRALUENT is an injectable prescription medicine called a PCSK9 inhibitor. PRALUENT is used along with diet and maximally tolerated statin therapy in adults with heterozygous familial hypercholesterolemia (an inherited condition that causes high levels of LDL) or atherosclerotic heart problems, who need additional lowering of LDL cholesterol.

The effect of PRALUENT on heart problems such as heart attacks, stroke, or death is not known.

Safety and efficacy in children is unknown.

Important Safety Information for PRALUENT

Do not use PRALUENT if you are allergic to alirocumab or to any of the ingredients in PRALUENT.

Before starting PRALUENT, tell your healthcare provider about all your medical conditions, including allergies, and if you are pregnant or plan to become pregnant or if you are breastfeeding or plan to breastfeed.

Tell your healthcare provider or pharmacist about any prescription and over-the-counter medicines you are taking or plan to take, including natural or herbal remedies.

PRALUENT can cause serious side effects, including allergic reactions that can be severe and require treatment in a hospital. Call your healthcare provider or go to the nearest emergency room right away if you have any symptoms of an allergic reaction, including a severe rash, redness, severe itching, a swollen face, or trouble breathing.

The most common side effects of PRALUENT include: redness, itching, swelling, or pain/tenderness at the injection site; symptoms of the common cold; and flu or flu-like symptoms. Tell your healthcare provider if you have any side effect that bothers you or that does not go away.

Talk to your healthcare provider about the right way to prepare and give yourself a PRALUENT injection and follow the "Instructions for Use" that comes with PRALUENT.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

Praluent®
(alirocumab) Injection 75mg/mL 150mg/mL
THE FALL OF HIGH CHOLESTEROL

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(PRAHL-u-ent)
Injection, for Subcutaneous Injection

Rx Only

What is PRALUENT?
PRALUENT is an injectable prescription medicine called a PCSK9 inhibitor. PRALUENT is used along with diet and maximally tolerated statin therapy in adults with heterozygous familial hypercholesterolemia (an inherited condition that causes high levels of LDL) or atherosclerotic heart problems, who need additional lowering of LDL cholesterol.
The effect of PRALUENT on heart problems such as heart attacks, stroke, or death is not known.
It is not known if PRALUENT is safe and effective in children.

Who should not use PRALUENT?
Do not use PRALUENT if you are allergic to alirocumab or to any of the ingredients in PRALUENT. See the end of this Summary of Information for a complete list of ingredients in PRALUENT.

What should I tell my healthcare provider before using PRALUENT?
Before you start using PRALUENT, tell your healthcare provider about all your medical conditions, including allergies, and if you:
- are pregnant or plan to become pregnant. It is not known if PRALUENT will harm your unborn baby. Tell your healthcare provider if you become pregnant while taking PRALUENT.
- are breastfeeding or plan to breastfeed. You and your healthcare provider should decide if you will take PRALUENT or breastfeed. You should not do both without talking to your healthcare provider first.

Tell your healthcare provider or pharmacist about any prescription and over-the-counter medicines you are taking or plan to take, including natural or herbal remedies.

How should I use PRALUENT?
- **See the detailed ″Instructions for Use″ that comes with Praluent about the right way to prepare and give your PRALUENT injections.**
- Use PRALUENT exactly as your healthcare provider tells you to use it.
- PRALUENT comes as a single-dose (1 time) pre-filled pen (autoinjector), or as a single-dose pre-filled syringe. Your healthcare provider will prescribe the type and dose that is best for you.
- If your healthcare provider decides that you or a caregiver can give the injections of PRALUENT, you or your caregiver should receive training on the right way to prepare and administer PRALUENT. **Do not** try to inject PRALUENT until you have been shown the right way by your healthcare provider or nurse.
- PRALUENT is given as an injection under the skin (subcutaneously) 1 time every 2 weeks.
- **Do not** inject PRALUENT together with other injectable medicines at the same injection site.
- Always check the label of your pen or syringe to make sure you have the correct medicine and the correct dose of PRALUENT before each injection.
- If you forget to use PRALUENT or are not able to take the dose at your regular time, inject your missed dose as soon as you remember, within 7 days of your missed dose. Then, take your next dose 2 weeks from the day you missed your dose. This will put you back on your original schedule. If the missed dose is not given within 7 days, wait until your next scheduled dose to re-start PRALUENT. This will keep you on your original schedule. If you are not sure when to re-start PRALUENT, ask your healthcare provider or pharmacist.
- If you use more PRALUENT than you should, talk to your healthcare provider or pharmacist.
- **Do not** stop using PRALUENT without talking with your healthcare provider. If you stop using PRALUENT, your cholesterol levels can increase.

What are the possible side effects of PRALUENT?
PRALUENT can cause serious side effects, including:
- **allergic reactions**. PRALUENT may cause allergic reactions that can be severe and require treatment in a hospital. Call your healthcare provider or go to the nearest hospital emergency room right away if you have any symptoms of an allergic reaction including a severe rash, redness, severe itching, a swollen face, or trouble breathing.

The most common side effects of PRALUENT include: redness, itching, swelling, or pain/tenderness at the injection site, symptoms of the common cold, and flu or flu-like symptoms.
Tell your healthcare provider if you have any side effect that bothers you or that does not go away.
These are not all of the possible side effects of PRALUENT. Ask your healthcare provider or pharmacist for more information.
Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

General information about the safe and effective use of PRALUENT.
Medicines are sometimes prescribed for purposes other than those listed in a Patient Information leaflet. **Do not** use PRALUENT for a condition for which it was not prescribed. **Do not** give PRALUENT to other people, even if they have the same symptoms that you have. It may harm them.
This is a summary of the most important information about PRALUENT. If you would like more information, talk with your healthcare provider.You can ask your pharmacist or healthcare provider for information about PRALUENT that is written for health professionals. For more information about PRALUENT, go to www.PRALUENT.com or call 1-844-PRALUENT (1-844-772-5836).

What are the ingredients in PRALUENT?

- Active ingredient: alirocumab
- Inactive ingredients: histidine, polysorbate 20, sucrose, and water for injection.

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Revised: October 2015

ALI-PPI-NG-OCT15

A Plant That Preys

The secret life of plants can be deadly—and more efficient than is immediately apparent. As University of Bristol biologist Ulrike Bauer and her colleagues recently found, a curvaceous, nectar-producing tropical pitcher plant known as *Nepenthes* (left) makes a good living working only part-time.

How does it do it? By exploiting weather fluctuations. The dry pitcher rim provides a safe foothold for ants seeking nectar (below). When the scout returns to its colony and shares the sweet news, ants stream to the source. But the tropical climate ensures that *Nepenthes'*s surface will soon become wet and slick—an inescapable death trap.

Danger messages don't reach the colony immediately, so the plant can enjoy a long buffet before the ant march ends. But there's a catch: The strategy works only for plants with a taste for social insects, like ants. *—Lindsay N. Smith*

PHOTOS: CHRISTIAN ZIEGLER

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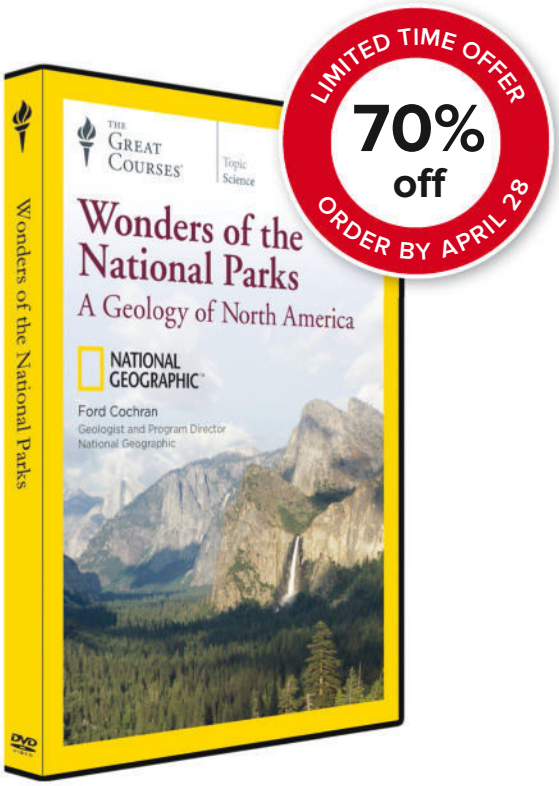

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5. The Hawaiian Islands and Maui's Haleakala
6. Mount Saint Helens, Lassen Volcanic, Rainier
7. Crater Lake, Olympic, North Cascades
8. Volcanoes of Alaska: Katmai and Lake Clark
9. Alaska's Glacier Bay and Kenai Fjords
10. Yosemite: Nature's Cathedral
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21. National Marine Sanctuaries and Monuments
22. Acadia's Highlands and Islands
23. The Dakota Badlands
24. The Grand Canyon's 2-Billion-Year Staircase
25. Carving the Grand Canyon
26. Petrified Forest and Other Fossil Parks
27. Bryce Canyon, Canyonlands, Arches
28. Zion, Gunnison's Black Canyon, Capitol Reef
29. Mesa Verde and Ancient Settlements
30. The Colorado Rocky Mountains
31. Montana's Glacier and the Canadian Rockies
32. Big Bend on the Rio Grande and Saguaro
33. Mammoth Cave, Wind Cave, Carlsbad Caverns
34. The Everglades and the Congaree Bottomland
35. Voyageurs, Isle Royale, the Canadian Shield
36. Assembling North America, Park by Park

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Declaring Their Own Kingdoms

A king without a kingdom is not without options. For centuries, wannabe rulers intent on independence, political subversion, religious freedom, or just a laugh have laid dubious claim to territories. Some call these domains "micronations."

Where have self-appointed rulers planted flags? On islands: Off Denmark's coast is the Kingdom of Elleore, which bans *Robinson Crusoe* as slander against island life. In deserts: Nevada's Republic of Molossia sells bonds to fund its war—with East Germany. And in the ocean: The ruler of the Principality of Sealand, a WWII-era British Navy sea fort, says he once foiled a hostage-taking coup.

By international law, those aspiring to nationhood must have a government, a permanent population, defined territory, and a capacity for foreign relations; some tiny nations also have flags, constitutions, and currencies. What most don't have is recognition. They exist, as their founders do, on the fringes. —*Nina Strochlic*

A. ELLEORE
For one festive week a year, 271 Elleorians flock to their island kingdom. It was founded in 1944 by a group of schoolteachers now known as the "Immortals."

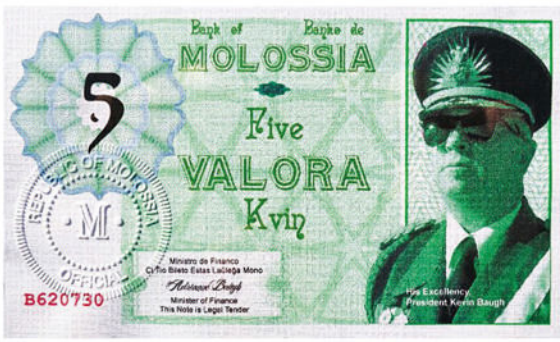
B. SAUGEAIS
According to lore, this republic struck out from France in 1947 when a restaurateur jokingly asked a local official to show his entry permit before dining.

C. MOLOSSIA
President Kevin Baugh's War Department scrapped plans for an army and air force but does have a five-raft navy that "stands ready"—in the Nevada desert.

D. SEBORGA
Residents of this medieval principality believe independence was granted in A.D. 954. Italy isn't convinced, but Seborga operates consulates in 19 countries.

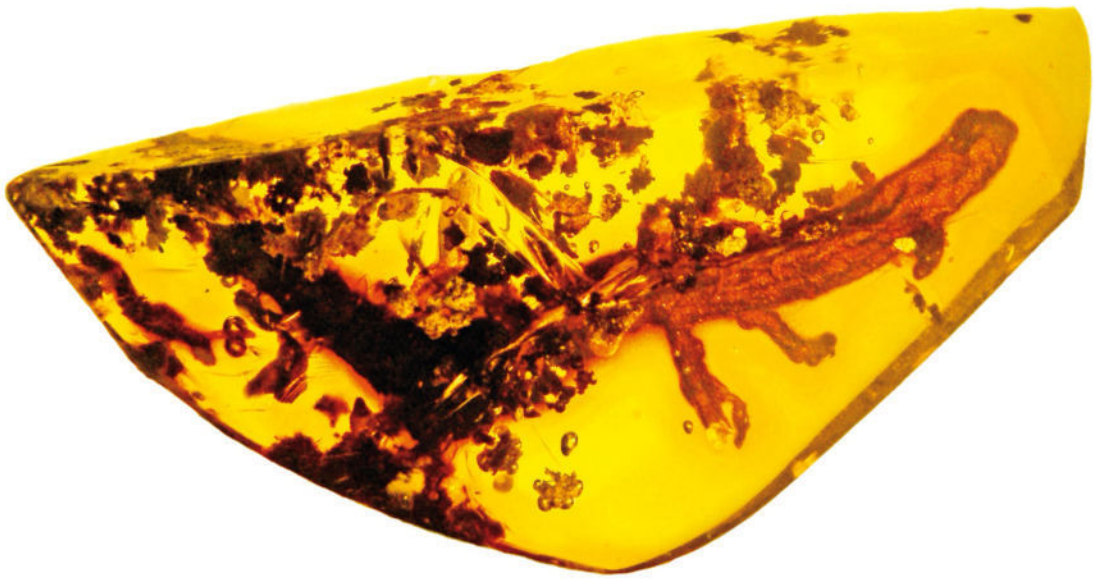
E. ATLANTIUM
None of its 3,000 citizens actually reside in the 200-acre Australian realm, but Emperor George II rents out the whole thing—pyramid included—on Airbnb.

C



E

PHOTOS: LÉO DELAFONTAINE (A, B, C, D); REPUBLIC OF MOLOSSIA (CURRENCY); EMPIRE OF ATLANTIUM (STAMPS)



A Victim Trapped in Amber

More than 20 million years ago a salamander hatchling less than three-quarters of an inch long met a traumatic end. A hungry predator—perhaps a spider or bird or snake—ripped off its left front leg, leaving the stub of a bone jutting from its side. The salamander managed to escape but then must have fallen into a pool of tree resin, which preserved the tiny amphibian as it hardened into amber.

George Poinar, Jr., a biologist at Oregon State University who specializes in amber, believes he collected this specimen in the Dominican Republic years ago without realizing that it was unique. When he examined it recently, he was astounded to see the salamander—the first such creature ever found in amber and the only one, extinct or living, known to come from the Caribbean.

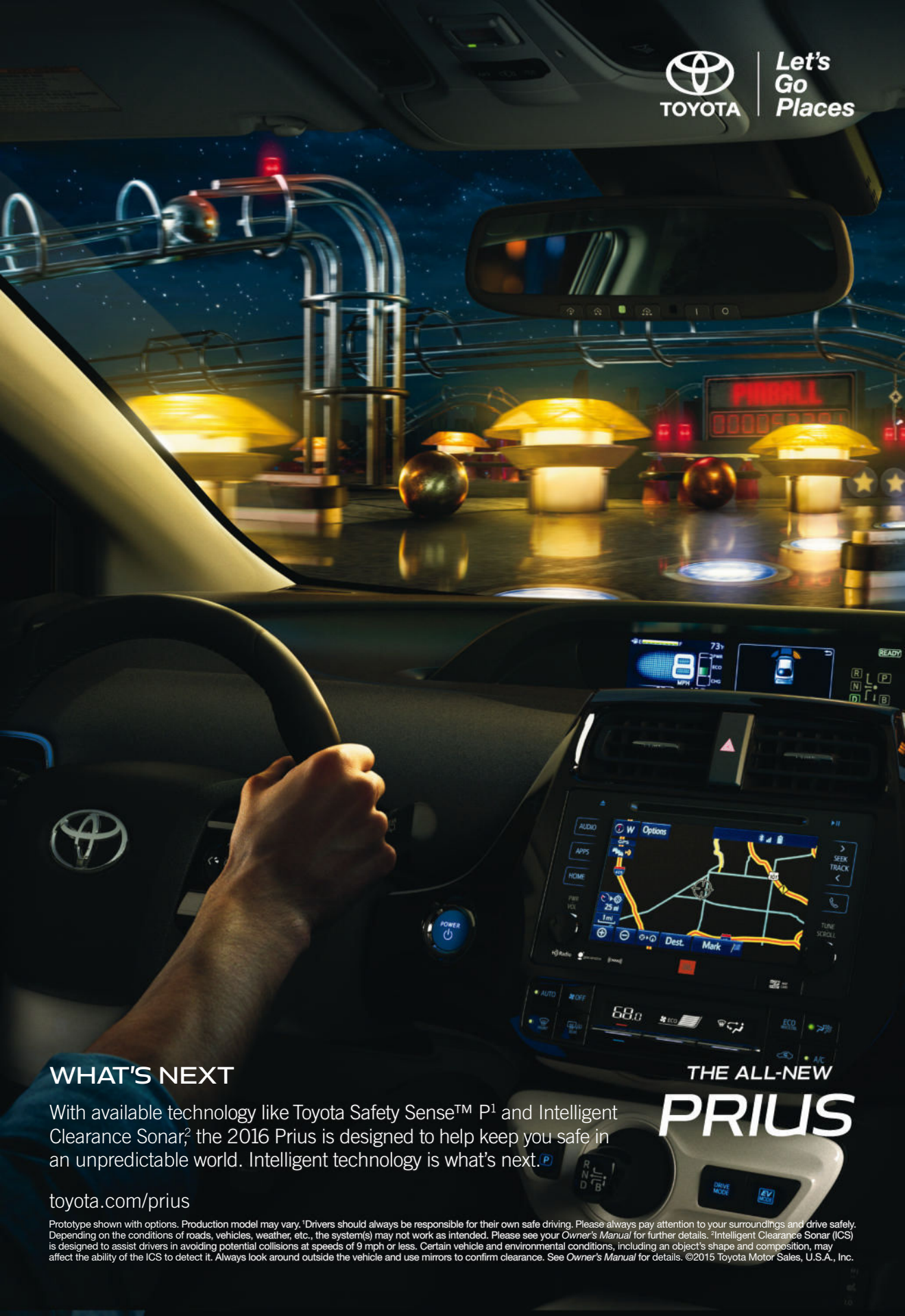
It has since been identified as a new genus, based on visible physical features such as the large webbed front and back feet. "This shows," says Poinar, "that just because we haven't found something in a particular area doesn't mean it didn't exist there millions of years ago." *—A. R. Williams*

3,800-YEAR-OLD OFFERING FROM PERU

A trio of painted, unfired-clay figurines has come to light at the coastal site of Vichama in what is now Peru. The three may represent powerful people in an offshoot of the ancient Caral culture. The largest, almost nine inches tall, may portray a priestess. A male with long, blond hair and another female could be political leaders. All were found facing each other in two nested baskets.

The figurines were likely deposited as ritual offerings before the construction of a building. Archaeologists believe the female figures attest to the power women wielded as their city struggled to survive a long drought. *—ARW*

PHOTOS: GEORGE POINAR JR. (TOP); CARAL ARCHAEOLOGICAL ZONE, MINISTRY OF CULTURE, PERU



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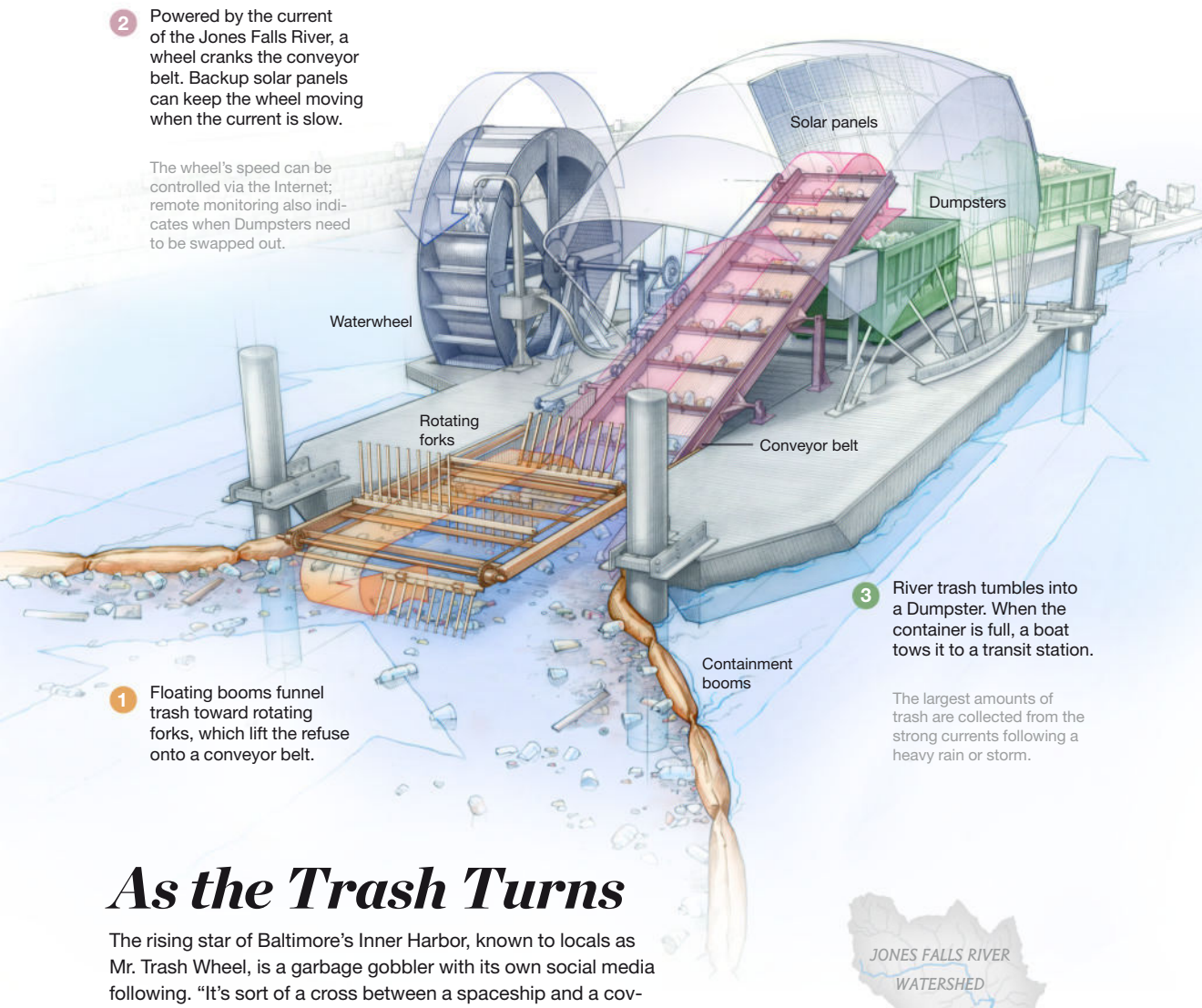

As the Trash Turns

The rising star of Baltimore's Inner Harbor, known to locals as Mr. Trash Wheel, is a garbage gobbler with its own social media following. "It's sort of a cross between a spaceship and a covered wagon," says its creator, John Kellett, the former museum director who sketched the contraption's design on a napkin.

Built with $720,000 in public and private funds, the voracious device filled 12 Dumpsters with trash in the 48 hours after a particularly heavy storm last year. Since its debut in 2014, it has pulled in some 354 tons of trash. The Waterfront Partnership of Baltimore owns the wheel and makes a detailed tally of its intake—which as of last December included 176,589 chip bags and nearly seven million cigarette butts.

Dozens of countries have asked for help in creating their own wheels, says Kellett. Among them: India, for its garbage-laden Ganges River, and Brazil, which will host Olympic events this year in Rio de Janeiro's trashy Guanabara Bay. —*Eve Conant*

The Jones Falls River watershed covers 58 square miles. Its currents carry the majority of the trash found in the Baltimore Harbor.

JASON TREAT, NGM STAFF. NGM MAPS. ART: BRUCE MORSER
SOURCES: JOHN KELLETT, CLEARWATER MILLS; WATERFRONT PARTNERSHIP OF BALTIMORE

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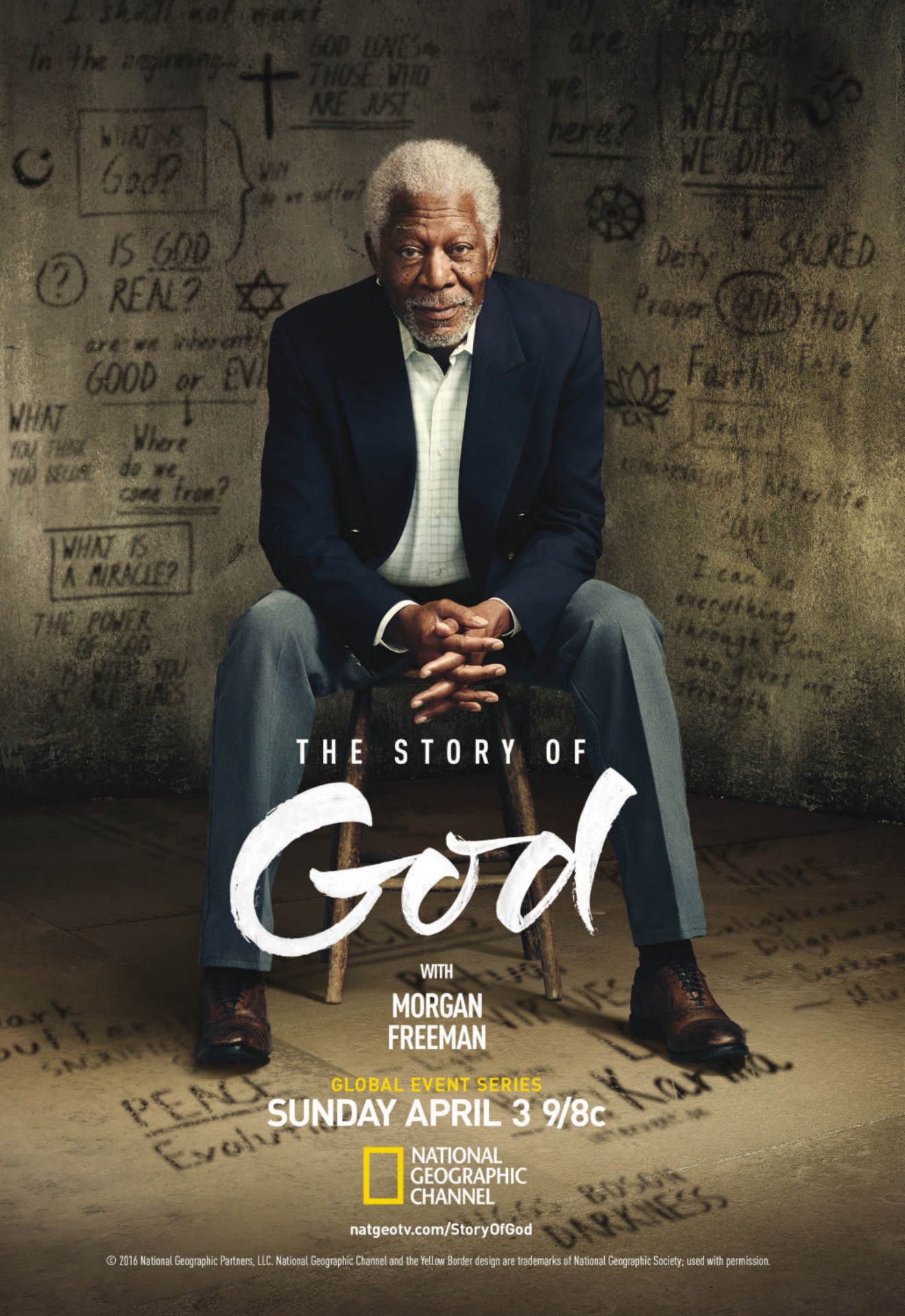

A Settlement has been Proposed in a Class Action Lawsuit that Alleges Safety Defects in

Taurus Pistols

PLEASE READ
Important Information
Concerning Your Options

Para una notificación en Español, visitar www.TaurusCarterSettlement.com

WHAT'S THIS ABOUT?

A class action settlement of a lawsuit alleging safety defects in certain Taurus pistols has been proposed. The lawsuit claims "Class Pistols" may unintentionally fire with the safety in the "on" or "safe" position, and may unintentionally fire when dropped or bumped. Taurus denies all allegations of wrongdoing and liability.

WHO'S INCLUDED?

You may be a Class Member if you are a resident or entity of the U.S., Puerto Rico, U.S. Virgin Islands, or Guam and own at least one "Class Pistol" (these include PT, Millennium, and 24/7 models; see the website for a complete listing) on July 30, 2015. The settlement doesn't include Taurus G2 model pistols.

WHAT ARE THE SETTLEMENT BENEFITS?

Taurus will provide a free, transferable lifetime enhanced warranty benefit.

Taurus will pay shipping and inspection costs and repair or replace the pistol, with no requirement that the owner prove the alleged safety defects. No repair is currently available, so pistols returned under this option will be replaced with a comparable Taurus G2 (or similar) model pistol at this time. You can receive a replacement only if applicable law permits the shipping of a replacement pistol to your state (visit the website for details). If Taurus develops a repair, it can repair rather than replace Class Pistols. Taurus will also provide safety training videos to all Settlement Class Members.

Settlement Class Members who want a cash payment may return their Class Pistol to Taurus (with shipping paid by Taurus).

They will receive up to $200 per pistol, depending on the total number returned. Total cash payments will not exceed $30 million. If the Court approves the settlement and there are no appeals, the claims period for cash payments will run from approximately August 22, 2016 until December 20, 2016.

WHAT ARE YOUR OTHER OPTIONS?

You can opt-out or **object** to the settlement, but must do so by May 18, 2016. If you do not opt-out, you release Taurus from liability for alleged design or manufacturing defects that may result in an unintended discharge. If you opt-out, you will not get a benefit from this settlement.

The Court will hold a continued Final Approval hearing on July 18, 2016, to consider whether to approve the settlement.

This is a Supplemental Summary authorized by the Court. For detailed information, visit the website, call 1-844-528-0180, or write to Taurus Class Action, c/o Heffler Claims Group, P.O. Box 230, Philadelphia, PA 19107-0230.

www.TaurusCarterSettlement.com

China to Laos

Two muddy wheels in the path of a future train

KYLE HEMES *Environmental scientist*

When Kyle Hemes began his 620-mile bike ride across parts of Laos and China, he wanted to physically feel the friction of the terrain. In northern Laos it's this terrain—steep, forested, and largely impassable—that historically has separated upland people from lowland state institutions.

Soon that may change. China—continuing its campaign of railroad diplomacy with its neighbors—plans to build a high-speed rail line connecting Vientiane, Laos, to Kunming, China. Hemes, a National Geographic young explorer, wanted to bike the route to understand how 21st-century infrastructure may affect isolated groups like the Hmong, Hani, and Khmu, who all live in the Laotian highlands.

Bikes could cover ground impassable for trucks. "It was the terrain, not the distance, that challenged us," says Hemes.

The strenuous trip, nine weeks from beginning to end, brought moments of cultural fascination, rumbling uncertainty (where to get the next meal?), and bike-seat discomfort. Village elders and their families showed great hospitality to Hemes and his traveling companions. In Laos, Hemes saw friction between cultures embodied in a 15-year-old boy. The teen carried a cell phone and told Hemes he aspired to be a teacher. But his family needed him to farm. Full of ambition, the boy was clearly torn between conflicting responsibilities. *—Daniel Stone*

India

How genetically modified crops grow

ANDREW FLACHS *Anthropologist*

Flachs describes his research:

As a specialist in the anthropology of agriculture, I'm familiar with the claim that genetically modified crops pose a threat to biodiversity. My question was whether the threat might come less from GM seeds than from the way GM plants often are farmed: as a single cash crop that's undiversified, leaving farms open to waves of disease and loss.

There's no place this would be more on display than India, an immense country with both the largest population of small farmers and the world's largest cotton output. Supported by a National Geographic grant, I surveyed GM cotton farmers in India's Telangana state.

Farmers who grew genetically modified cotton with a built-in pesticide, also known as Bt cotton, showed me they didn't just grow cotton. In parts of their fields where cotton wouldn't grow, they grew other useful plants—an average of 16, some of them fruits and vegetables.

For these farmers, the usual fears about

PHOTO: WILL STAUFFER-NORRIS. NGM MAPS

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monocropping didn't seem to materialize. However, this crop variety did seem to open vulnerabilities elsewhere. GM cotton is still susceptible to some pests. They can be managed by spraying—which has consequences for food crops nearby.

Peru

A loyal frog changes its stripes—and spots

KYLE SUMMERS *Biologist*

Two traits make *Ranitomeya imitator* "really neat," says Kyle Summers, a biologist at East Carolina University and a National Geographic grantee. "This is the only frog that's known to be monogamous." And, he says, "it's a mimic."

Summers studies the poisonous frog in the rain forests of Peru, where it has evolved to match the coloration of other toxic frogs. That way, predators have to recognize only one kind of frog as too dangerous to eat. Summers and his colleagues have found four types of the mimic poison frogs: spotted, striped, banded, and orange-headed. They "look quite different from each other," he says, "but similar to the species they co-occur with."

Research also has confirmed that the frogs are monogamous, Summers says. Lifelong bonded pairs work together to feed their tadpoles in the tiny pools of water that collect on the leaves of tropical plants.

To study the frogs, the scientists catch them in plastic cups. They weigh them, measure them, and take a small toe clip for genetic analysis. Then they let the frogs go. "We put a little bit of Neosporin on the toe," says Summers, "to keep it from getting infected."

Is the poison an issue for researchers? "We handle the frogs with rubber gloves," he says, "but that's mostly for the frogs."

As distasteful as the mimic poison frog may be to predators, it isn't particularly toxic to humans. *—Rachel Hartigan Shea*

The frog on the left *(R. imitator)* has evolved to resemble the frog on the right *(R. fantastica).* The mimicry isn't exact—just close enough to warn predators away from both toxic species.

United States

Using music as an antidote to cancer

MARY ELIZABETH WILLIAMS *Author*

Williams reports: I met Jedd Wolchok at Memorial Sloan Kettering Cancer Center during the melanoma clinical trial that saved my life. Although I've known him for four years, I've never seen him like this before: his white lab coat replaced by black-tie attire, his stethoscope traded in for a tuba.

My doctor, an award-winning oncologist, is in a high school auditorium in New York City's Brooklyn borough today not to treat cancer but to make music. He's part of the Brooklyn Wind Symphony, a volunteer group for dedicated—but not necessarily professional—musicians who practice and perform together.

"The day job can be stressful and emotionally challenging," Wolchok says. Making music with this group is "an opportunity to restore, prevents burnout and compassion fatigue, and enhances the ability to focus on creative solutions." It's beautiful to experience the kind of art that can guide innovation—and the kind of innovation that can save lives, like mine.

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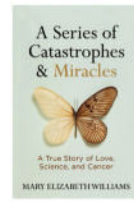

Williams's new memoir explores her journey through a revolutionary clinical trial.

PHOTO: JASON L. BROWN. NGM MAPS

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CONSERVATION STATUS
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OTHER FACTS
The larger Pacific striped octopus is known as a harlequin for the patterns and colors seen on the female (at left) and her male partner.

Mating Beak to Beak

In most octopus species it's customary after sex for the female to make a meal—of her partner. To avoid being eaten, the male typically "jumps on top of the female, they mate in a position where he's as far from her mouth as possible, and when they're done, the male runs away," says marine biologist Richard Ross of the California Academy of Sciences. That mating behavior was such accepted science that in 1982, when Panamanian marine biologist Arcadio Rodaniche reported finding an octopus that mated beak to beak and cohabited between sex acts, his research was dismissed or ignored.

Some three decades later Ross and Roy Caldwell of the University of California, Berkeley, have bred and studied that elusive cephalopod, the larger Pacific striped octopus (LPSO). They've confirmed what Rodaniche found—and more. LPSO mates will share dens and meals, whereas most octopuses are loners (if not cannibals). LPSOs mate as often as daily, and females lay eggs over months; in most other species, females die after raising one brood. And though most octopuses couple warily, at arm's length, LPSOs mate with the beaks on their undersides pressed together, as if kissing (above).

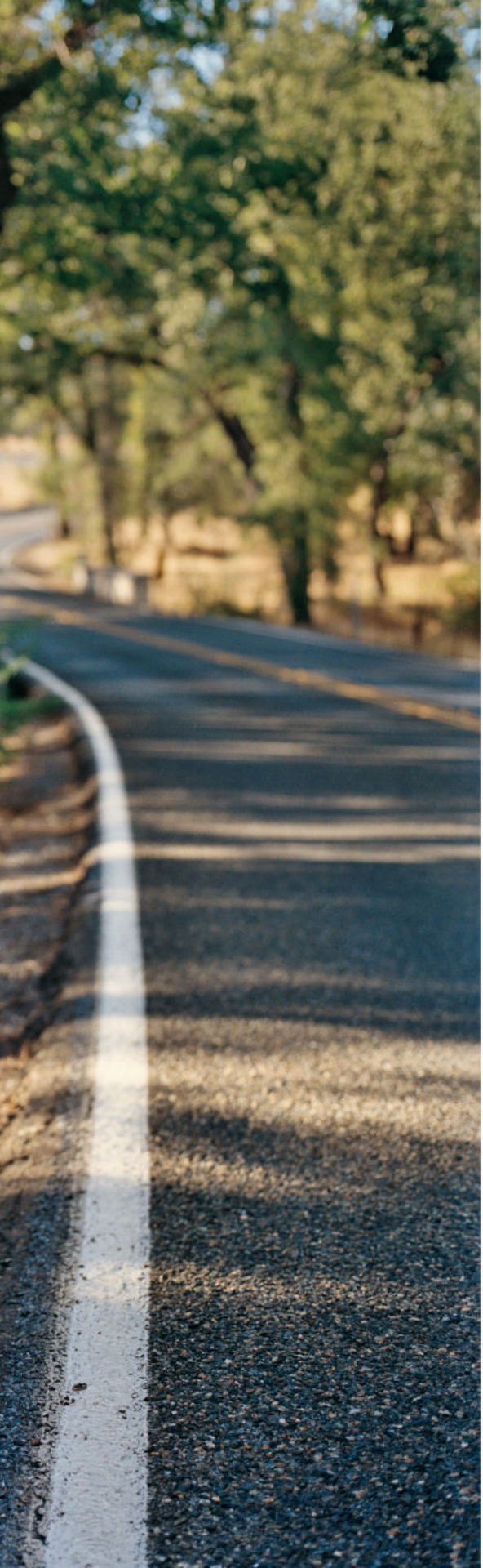
With all those revelations from just one species, imagine what's still to be discovered. More than 300 octopus species are believed to inhabit Earth's oceans, and many have never been studied. *—Patricia Edmonds*

PHOTO: ROY L. CALDWELL

The Crossing

After toddler Gardell Martin fell into an icy stream in March 2015, he was dead for more than an hour and a half. Three and a half days later he left a hospital alive and well. His story is one of many prompting scientists to question the very meaning of death.

Linda Chamberlain, co-founder of the Arizona-based cryonics company Alcor, hugs the container where the body of her husband, Fred, is frozen in the hope that someday he can be thawed and revived. She plans to join him in cryo limbo when her time comes. Fred's last words, she says, were "Gee, I hope this works."



"My baby, my boy, has left such an impact," says Deanna Santana of her son Scott, who died at 17 in a car crash and whose organs and tissues were transplanted into 76 people. Rod Gramson (at center), who received the heart, met Deanna and her husband, Rich, near the road in Placerville, California, where Scott died.

By Robin Marantz Henig
Photographs by Lynn Johnson

At first it seemed like nothing more than the worst headache she'd ever had.

So Karla Pérez—22 years old, the mother of three-year-old Genesis, and five months pregnant—went into her mother's room to lie down, hoping it would pass. But the pain got worse, and as she vomited off the side of the bed, she told her younger brother to call 911.

It was not quite midnight on Sunday, February 8, 2015. The ambulance raced Pérez from her home in Waterloo, Nebraska, to Methodist Women's Hospital in Omaha. She began to lose consciousness in the emergency room, and doctors put a tube down her throat to keep oxygen flowing to her fetus. They ordered a CT scan, and there it was: a massive brain bleed creating severe pressure in her skull.

She had suffered a stroke, but amazingly her fetus was doing fine, the heartbeat strong and steady as if nothing were wrong. Neurologists did another CT scan at about two in the morning, and their worst fears were confirmed: Pérez's brain had become so swollen that the whole brain stem had pushed out through a small opening at the base of her skull.

"When they saw that," says Tifany Somer-Shely, the obstetrician who'd cared for Pérez through her pregnancy with Genesis and with this baby too, "they knew for sure that it wasn't going to end well."

Pérez had landed at the ragged border between life and death, with a brain that had ceased functioning and would never recover—in other words, it was dead—and a body that could be sustained mechanically, in this case for one reason only: to nurture her 22-week-old fetus until he was big enough to manage on his own. This borderland is becoming increasingly populated, as scientists explore how our existence is not a toggle—"on" for alive, "off" for dead—but a dimmer switch that can move through various shades between white and black. In the gray zone, death isn't necessarily permanent, life can be hard to define, and some people cross over that great divide and return—sometimes describing in precise detail what they saw on the other side.

Death is "a process, not a moment," writes critical-care physician Sam Parnia in his book *Erasing Death*. It's a whole-body stroke, in which the heart stops beating but the organs don't die immediately. In fact, he writes, they might hang on intact for quite a while, which means that "for a significant period of time after death, death is in fact fully reversible."

How can death, the very essence of forever, be reversible? What is the nature of consciousness during that transition through the gray zone? A growing number of scientists are wrestling with such vexing questions.

In Seattle biologist Mark Roth experiments with putting animals into a chemically induced suspended animation, mixing up solutions to lower heartbeat and metabolism to

near-hibernation levels. His goal is to make human patients who are having heart attacks "a little bit immortal" until they can get past the medical crisis that brought them to the brink of death.

In Baltimore and Pittsburgh trauma teams led by surgeon Sam Tisherman are conducting clinical trials in which gunshot and stabbing victims have their body temperature lowered in order to slow bleeding long enough for surgeons to close up their wounds. The medical teams are using supercooling to do what Roth wants to do with chemicals—kill their patients, temporarily, in order to save their lives.

In Arizona cryonics experts maintain more than 130 dead clients in a frozen state that's another kind of limbo. Their hope is that sometime in the distant future, maybe centuries from now, these clients will be thawed and revived, technology having advanced to the point where they can be cured of whatever killed them.

In India neuroscientist Richard Davidson studies Buddhist monks in a state called *thukdam,* in which biological signs of life have ceased yet the body appears fresh and intact for a week or more. Davidson's goal is to see if he can detect any brain activity in these monks, hoping to learn what, if anything, happens to the mind after circulation stops.

And in New York, Parnia spreads the gospel of sustained resuscitation. He says CPR works better than people realize and that under proper conditions—when the body temperature is lowered, chest compression is regulated for depth and tempo, and oxygen is reintroduced slowly to avoid injuring tissue—some patients can be brought back from the dead after hours without a heartbeat, often with no long-term consequences. Now he's investigating one of the most mysterious aspects of crossing over: why so many people in cardiac arrest report out-of-body or near-death experiences, and what those sensations might reveal about the nature of this limbo zone and about death itself.

OXYGEN PLAYS A PARADOXICAL ROLE along the life-death border, according to Roth, of Seattle's Fred Hutchinson Cancer Research Center. Ever since oxygen was discovered in the early 1770s, "scientists have recognized it as essential to life," he says. What the 18th-century scientists didn't know is that oxygen is essential to life in a surprisingly nonbinary way. "Yes, if you take away oxygen, you can kill the animal," Roth says. "But if you further reduce the oxygen, the animal is alive again, but it's suspended."

He has shown that this works in soil nematodes, which are alive in air with as little as 0.5 percent oxygen and are dead if you reduce the oxygen to 0.1 percent. But if you then proceed quickly to a much lower level of oxygen—0.001 percent or even less—the worms enter a state of suspension where they need significantly less oxygen to survive. It's their way of preserving themselves during extreme deprivation, a bit like animals hibernating in winter. These oxygen-starved, suspended organisms appear to be dead but not permanently so, like a gas cooktop with only the pilot light on.

Roth is trying to get to this pilot-light state by infusing experimental animals with an "elemental reducing agent," such as iodide, that greatly decreases their oxygen needs. Soon he'll try it in humans too. The goal is to minimize the damage that can occur from treatments after heart attacks. If iodide slows oxygen metabolism, the thinking is, it might help avoid the blowout injury that sometimes comes with treatments like balloon angioplasty. At this lower setting the damaged heart can just sip the oxygen coming in through the repaired vessel, rather than get flooded by it.

Life and death are all about motion, according to Roth: In biology the less something moves, the longer it tends to live. Seeds and spores can have life spans of hundreds of thousands of years—in other words, they're practically immortal. Roth imagines a day when using

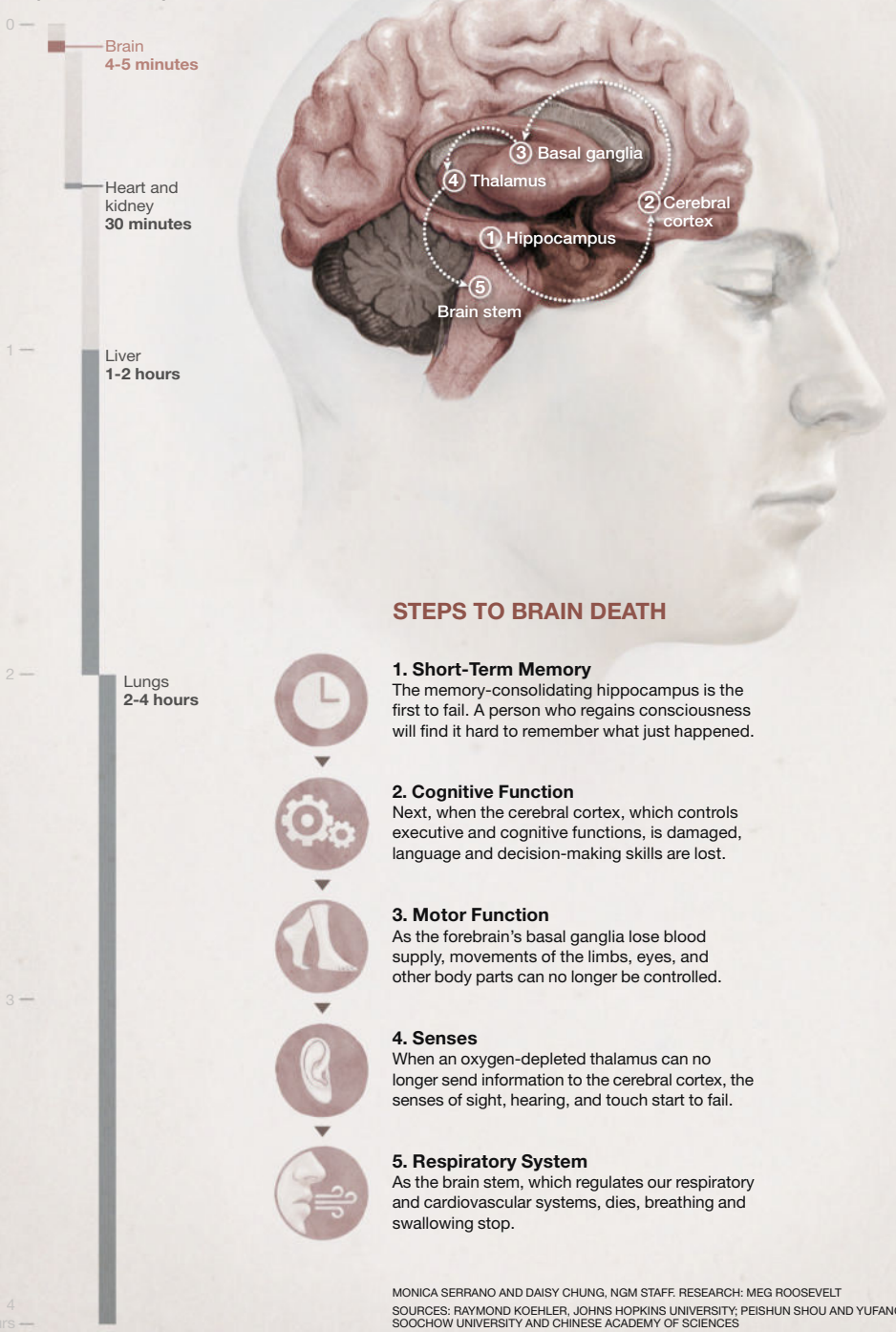
EXPLORER

Tune in Sunday, April 3, to National Geographic Channel's Explorer series episode *Faces of Death.*

Countdown to Irreversibility

The brain has higher energy needs than other organs, so it is the first to lose function—and suffer irreversible injury—when a person goes into cardiac arrest and blood stops circulating. Different regions of the brain have varying levels of susceptibility, beginning with one of the most fragile, the hippocampus.

TIME BEFORE PERMANENT DAMAGE OCCURS IN A BODY AT NORMAL TEMPERATURE



STEPS TO BRAIN DEATH

1. Short-Term Memory
The memory-consolidating hippocampus is the first to fail. A person who regains consciousness will find it hard to remember what just happened.

2. Cognitive Function
Next, when the cerebral cortex, which controls executive and cognitive functions, is damaged, language and decision-making skills are lost.

3. Motor Function
As the forebrain's basal ganglia lose blood supply, movements of the limbs, eyes, and other body parts can no longer be controlled.

4. Senses
When an oxygen-depleted thalamus can no longer send information to the cerebral cortex, the senses of sight, hearing, and touch start to fail.

5. Respiratory System
As the brain stem, which regulates our respiratory and cardiovascular systems, dies, breathing and swallowing stop.

MONICA SERRANO AND DAISY CHUNG, NGM STAFF. RESEARCH: MEG ROOSEVELT

SOURCES: RAYMOND KOEHLER, JOHNS HOPKINS UNIVERSITY; PEISHUN SHOU AND YUFANG SHI, SOOCHOW UNIVERSITY AND CHINESE ACADEMY OF SCIENCES

an agent such as iodide, a technique that will soon be studied in early clinical trials in Australia, can give people that immortality "for a moment"—the moment they most need it, when their heart is in serious trouble.

SUCH AN APPROACH would not have helped Pérez, whose heart never stopped beating. The day after her devastating CT scan, her obstetrician, Somer-Shely, tried to explain to Pérez's stunned and frightened parents, Berta and Modesto Jimenez, that their beautiful daughter—the lively young woman with sparkly eyes who adored her little girl, had a passel of friends, and loved to dance—was brain-dead.

There was a language barrier. The Jimenezes' first language is Spanish, and everything the doctor said had to be filtered through a translator. But the real barrier wasn't language. It was the concept of brain death itself. The term dates to the late 1960s, when two medical developments coincided: high-tech, life-sustaining machinery, which blurred the border between life and death, and organ transplantation, which made clarifying that border especially urgent. No longer could death be defined in the traditional way, as cessation of breath and heartbeat, since ventilators could provide both indefinitely. Is a patient on a ventilator dead or alive? If you remove the ventilator, when can you ethically retrieve the organs to transplant into someone else? If a transplanted heart starts beating again in a new chest, was the heart donor really dead in the first place?

To address such thorny questions, a Harvard panel met in 1968 to define death in two ways: the traditional way, by cardiopulmonary criteria, and a new way, by neurological ones. The neurological criteria, which are now used to determine "brain death," involved three cardinal benchmarks: coma or unresponsiveness, apnea or the inability to breathe without a ventilator, and the absence of brain-stem reflexes, measured by bedside exams such as flushing the ears with cold water to see if the eyes move, poking the nail bed to see if the face grimaces, or swabbing the throat and suctioning the bronchia to try to stimulate a cough.

It's all quite straightforward, yet also counterintuitive. "Brain-dead patients do not appear dead," wrote James Bernat, a neurologist at Dartmouth's medical school in New Hampshire, in the *American Journal of Bioethics* in 2014. "It is contrary to experience to call a patient dead who continues to have heartbeat, circulation, and visceral organ functioning." His article, meant to clarify and defend the concept of brain death, appeared just as two controversial patients were making headlines: Jahi McMath, a California teenager whose parents refused to accept the diagnosis after the girl experienced a catastrophic loss of oxygen during a tonsillectomy, and Marlise Muñoz, a brain-dead pregnant woman whose case differed from Pérez's in a significant way. Muñoz's family didn't want anything done to sustain her body, but hospital staff overruled them, because they thought Texas law required them to keep the fetus alive. (A judge eventually ruled against the hospital.)

Two days after Pérez's stroke the Jimenez family, along with the father of the unborn baby boy, found themselves in a crowded conference room at Methodist Hospital, still reeling from the tragic twists of Pérez's pregnancy. There to meet with them were 26 hospital staff members, including neurologists, palliative-care specialists, nurses, chaplains, ethicists, and social workers. The parents listened intently as the translator explained that the doctors' tests had revealed their daughter's lack of brain function. They heard the team offer "somatic support" to Pérez until the fetus was at least 24 weeks old, which is when he would have a fifty-fifty chance of surviving outside the womb. If they were lucky, the doctors said, they could keep Pérez's body functioning even longer, improving the baby's survival odds with each passing week.

Modesto Jimenez might have been thinking of the conversation he'd had the night before with Somer-Shely—the only physician in the hospital who'd known Pérez as a living, breathing, laughing, loving person—when he'd

"If I had listened to the doctors, I'd be visiting my daughter in the cemetery," says Nailah Winkfield, whose daughter Jahi McMath was declared brain-dead in 2013, when she was 13. Winkfield insists that her daughter is not dead.

taken her aside and asked, *"¿Será mi hija nunca despertar?"*

"No," she'd said. "Your daughter probably will never wake up." It was one of the hardest things she'd ever had to say.

"In my clinical mind I knew that brain death is death," she says. "Clinically speaking, she was dead at that point." But seeing her patient lying there in the intensive care unit, Somer-Shely found that stark fact almost as difficult to believe as the family did. Pérez looked like someone who'd just come out of surgery: Her skin was warm, her chest was rising and falling, and in her belly a fetus was still moving about, apparently healthy.

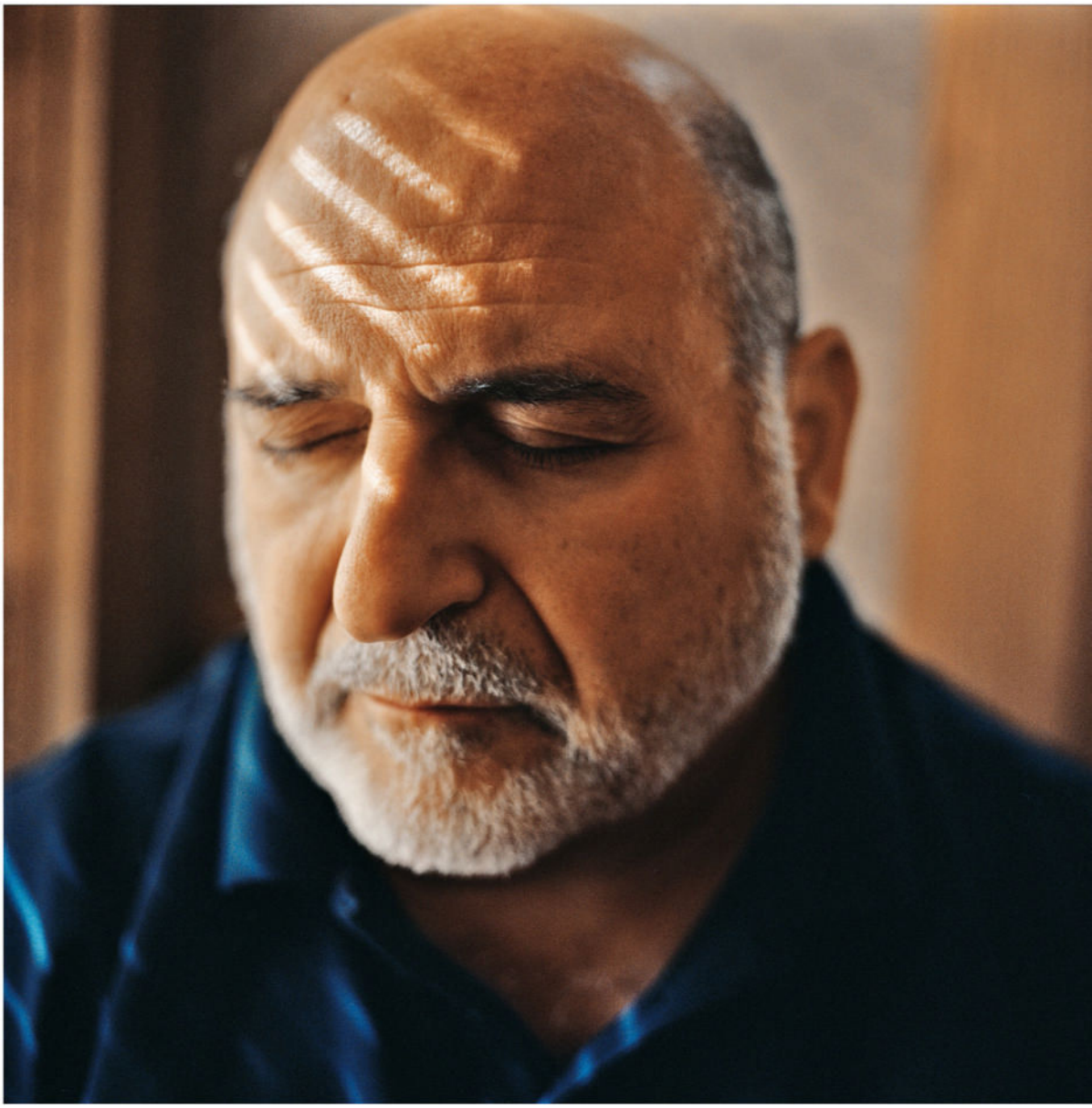
In the crowded conference room the Jimenezes nodded gravely, telling the medical team that they understood their daughter was brain-dead and would never wake up. But, they added, they would keep praying for *un milagro*—a miracle—just in case.

IF A MIRACLE is defined as bringing someone back from the dead, sometimes that does happen in medicine.

The Martin family believe they witnessed a miracle after their youngest son, Gardell, died last winter when he fell into an icy stream. He and his mother, father, and six older siblings live on a big rural property in central Pennsylvania that the kids love to explore. On a warm day in March 2015 two of the boys took Gardell, not quite two years old, out to play. The toddler lost his footing and fell into a stream about a hundred yards from his home. His brothers noticed that he was gone and were frantic when they couldn't find him. By the time emergency rescuers got to Gardell—who'd been pulled out of the water by a neighbor—the boy's heart had stopped beating for at least 35 minutes. The EMTs began chest compression, but they couldn't get his heart to start up again. They continued CPR as they sped the ten miles to Evangelical Community, the closest hospital. He had no heartbeat, and his body temperature was 77 degrees Fahrenheit, more than 20 degrees below normal. *(Continued on page 48)*

A “spiritual cowboy” told her not to be afraid.

Ashlee Barnett was a college student when she had a serious car crash on a remote Texas highway. Her pelvis was shattered, her spleen had ruptured, and she was bleeding profusely. At the scene, she says, she moved between two worlds: chaos and pain on one side, as paramedics wielded the jaws of life; and one with white light, no pain, and no fear. Several years later she developed cancer, but her near-death experience made her confident that she would live. She has three children and counsels trauma survivors.



As he climbed the stairs to check on his family, his legs began to disappear.

At a family picnic at upstate New York's Sleepy Hollow Lake, Tony Cicoria, an orthopedic surgeon, had just tried to call his mother on the phone. An approaching storm sent a lightning bolt through the phone into his head, stopping his heart. Cicoria says he felt himself leave his body, moving through walls toward a blue-white light, eager to be one with God. He emerged from his near-death experience with a sudden passion for classical piano, creating melodies that seemed to download, unbidden, into his brain. He came to believe he'd been spared so that he could channel "the music from heaven."

She saw her grieving stepfather buy a candy bar.

A head-on collision landed Tricia Barker, then a college student, in an Austin, Texas, hospital, bleeding profusely, her spine broken. She says she felt herself separate from her body during surgery, hovering near the ceiling as she watched her monitor flatline. Moving through the hospital corridor, she says, she saw her stepfather, struggling with grief, buy a candy bar from a vending machine; it was this detail, a stress-induced indulgence he'd told no one about, that made Barker believe her movements really happened. Now a creative writing professor, she says she's still guided by the spirits that accompanied her on the other side.

They prepped Gardell for a helicopter ride to Geisinger Medical Center, 18 miles away in Danville. Still no heartbeat.

"He had no signs of life whatsoever," recalls Richard Lambert, director of pediatric sedation service and a member of the pediatric critical-care team that awaited the helicopter. "He looked like a child who was ... Well, he was dusky, dark colored. His lips were blue ..." Lambert's voice trails off as he remembers that dreadful moment. He knew that children who drown in ice water sometimes recover, but he'd never known of one who'd been dead for as long as Gardell had. Even worse, the boy had a shockingly low blood pH, a sign of imminent organ failure.

An emergency room resident turned to Lambert and his colleague Frank Maffei, director of pediatric critical care for Geisinger's Janet Weis Children's Hospital: Maybe it was time to stop trying to revive the boy? Lambert and Maffei both wanted to keep going. All the elements were as favorable as they could be in a brink-of-death story. The water was cold, the child was young, and resuscitation efforts had been started within minutes of the drowning and had continued nonstop ever since. Let's try just a little longer, they told the team.

So they continued. Another 10 minutes, another 20 minutes, another 25. By this time Gardell had been without pulse or breath for more than an hour and a half. He was "a flaccid, cold corpse showing no signs of life," as Lambert describes him. But team members kept pumping, pressing, monitoring. The ones doing chest compression rotated on and off every two minutes—it's exhausting to keep doing it right, even on a tiny chest—and others inserted catheters into his femoral vein, jugular vein, stomach, and bladder, infusing warm fluids to gradually increase his body temperature. None of it seemed to be making any difference.

Rather than call off the resuscitation entirely, Lambert and Maffei decided to bring Gardell into surgery for a cardiopulmonary bypass—the most aggressive form of active rewarming, a last-ditch effort to get his heart beating. After they scrubbed up, they checked for a pulse one more time.

Incredibly, there it was: a heartbeat, faint at first, but steady, without the rhythm abnormalities that sometimes appear after a prolonged cardiac arrest. And just three and a half days later Gardell left the hospital with his prayerful family, a little wobbly on his feet but otherwise perfectly fine.

GARDELL IS TOO YOUNG to tell us what it was like during the 101 minutes he was dead. But sometimes people who've been rescued, thanks to persistent, high-quality resuscitation, come back with stories that are quite clear—and eerily similar. These survivors can be thought of as having crossed over to the other side and returned with stories that offer some insight into how it feels to die. Their tales from the gray zone have been the subject of some scientific scrutiny, most recently in a study called AWARE (AWAreness during REsuscitation), led by Sam Parnia. Beginning in 2008, Parnia, director of resuscitation research at Stony Brook University, and his colleagues looked at 2,060 cases of cardiac arrest at 15 American, British, and Austrian hospitals. Among them were 330 survivors, 140 of whom were interviewed. Fifty-five of the 140 patients said that during the time when they were being resuscitated, they perceived some kind of awareness.

Though most couldn't quite recall details, others mentioned sensations similar to those found in best-selling books such as *Heaven Is for Real:* time either speeding up or slowing down (27 people), peacefulness (22), separating from their bodies (13), joy (9), or seeing a bright light or golden flash (7). Some (the exact number wasn't specified) said they remembered bad sensations: fear, drowning or being dragged through deep water, or in one case, seeing "men in coffins being buried upright." The study, Parnia and his co-authors wrote in the medical journal *Resuscitation,* provides "further understanding of the broad mental experience that likely accompanies death after circulatory standstill." They wrote that the next step would be to study whether and how

these episodes—which most investigators call near-death experiences (NDEs), though Parnia prefers "actual death experiences"—affect survivors after recovery, either with positive influences or negative ones, such as cognitive problems and post-traumatic stress. What the AWARE team didn't explore was a common aftereffect of NDEs: a renewed sense of purpose and meaning to one's life. That's the feeling you often hear about from survivors—especially those who go on to write books about it. Mary Neal, an orthopedic surgeon from Wyoming, mentioned that effect to a large audience at a 2013 New York Academy of Sciences panel discussion called Rethinking Mortality. Neal, author of *To Heaven and Back,* described drowning while kayaking in Chile 14 years earlier. She said she could feel her spirit peeling away from her body and rising out of the river, as her knees bent backward, breaking her bones. She remembered walking down an "incredibly beautiful pathway toward this great domed structure that I knew was the point of no return—and I could hardly wait." She described thinking how strange the whole experience was, wondering how long she'd been underwater (later she learned it had been at least 30 minutes), finding comfort in the knowledge that her husband and children would be fine without her. Then she felt her body come out of the boat and could see the first responders doing CPR. She heard one of them calling to her, "Come back, come back!"—which she said she found "really very irritating."

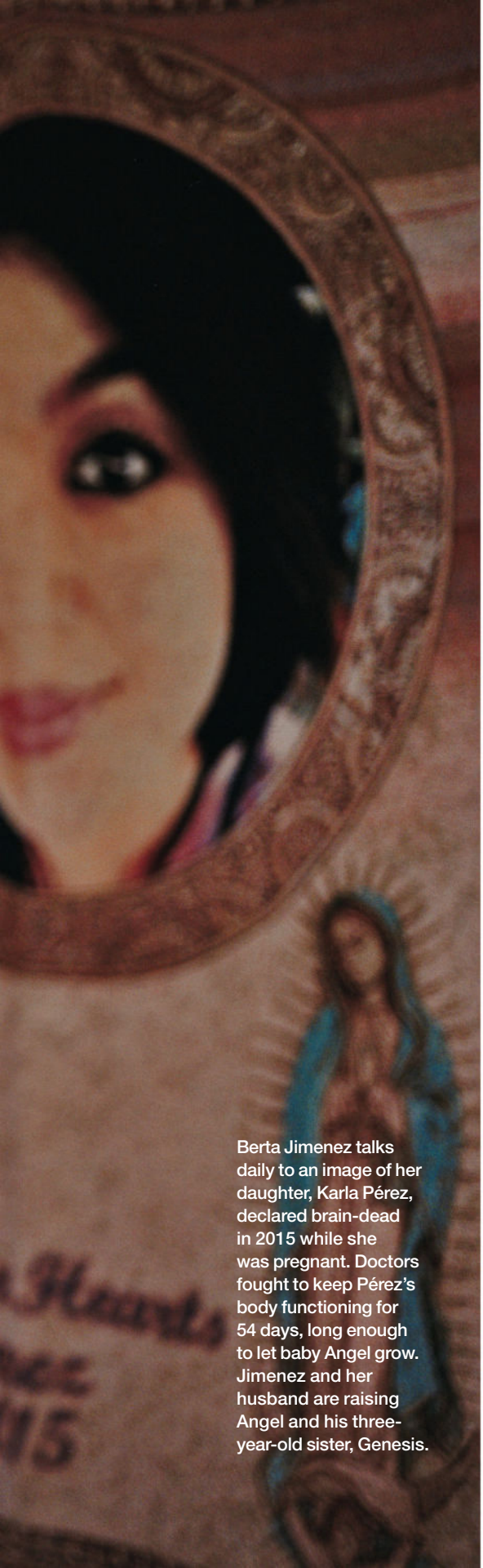
Kevin Nelson, a neurologist at the University of Kentucky, was on Neal's panel, and he was skeptical—not of her memory, which he acknowledged was intense and valid, but of its explanation. "These are not return-from-death experiences," he said, also contradicting Parnia's view of what had happened. "During these experiences the brain is very much alive and very much active." He said that what Neal went through could have been a phenomenon called REM intrusion, when the same brain activity that characterizes dreaming somehow gets turned on during other, nonsleep events, such as a sudden loss of oxygen. To him, near-death and out-of-body experiences are the result not of dying but of hypoxia—a loss of consciousness, not of life itself.

Patients can be brought back from the dead after hours without a heartbeat, often with no long-term consequences.

Other studies point to different physiological explanations for NDEs. At the University of Michigan a team led by neuroscientist Jimo Borjigin measured brain waves in nine rats after cardiac arrest. In all of them high-frequency gamma waves (the ones associated with meditation) became more intense after the heart stopped—more coherent and organized, in fact, than they are during ordinary wakefulness. Maybe this is what NDEs are, the investigators wrote, a "heightened conscious processing" that occurs during the limbo period before death becomes permanent.

More questions about the gray zone arise from the phenomenon of thukdam, a rare occurrence in which a monk dies but there is seemingly no physical decomposition for a week or more. Richard Davidson of the University of Wisconsin, who has spent years studying the neuroscience of meditation, has long been intrigued by this—is the person conscious or not? dead or not?—especially after he saw a monk in thukdam at the Deer Park monastery in Wisconsin in the summer of 2015.

"If I had just casually walked into the room, I would have thought he was sitting in deep meditation," Davidson says, his voice on the phone



Berta Jimenez talks daily to an image of her daughter, Karla Pérez, declared brain-dead in 2015 while she was pregnant. Doctors fought to keep Pérez's body functioning for 54 days, long enough to let baby Angel grow. Jimenez and her husband are raising Angel and his three-year-old sister, Genesis.

still a little awestruck. "His skin looked totally fresh and viable, no decomposition whatsoever." The sense of the dead man's presence, even at close range, helped inspire Davidson to study thukdam scientifically. He has assembled some basic medical equipment, such as EEGs and stethoscopes, at two field stations in India and has trained an on-site team of 12 Tibetan physicians to test these monks—preferably beginning while they're still alive—to see whether any brain activity continues after their death.

"It's likely that in many of these practitioners, they enter a state of meditation before they die, and there is some kind of maintenance of that state afterward," Davidson says. "Just how that occurs, and what the explanation might be, eludes our conventional understanding." His research, though grounded in Western science, aims for a different kind of understanding, a more nuanced one that might clarify what happens not only to monks in thukdam but also to anyone traveling across the border between life and death.

DISINTEGRATION USUALLY PROCEEDS swiftly after a person dies. When the brain stops functioning, it loses all ability to keep the other systems in balance. So to allow Karla Pérez to continue nurturing her fetus after her brain stopped working, a team of more than a hundred doctors, nurses, and other hospital workers had to fill in as ad hoc orchestrators. They took readings continuously, around the clock, of Pérez's blood pressure, kidney function, and electrolytes, all the while adjusting what was going into her tubes and IV lines.

But even as the team members performed the functions of Pérez's ruined brain, they still had trouble thinking of her as dead. To a person, they treated her as though she were in a deep coma, greeting her by name when they came into the room and saying goodbye when they left.

To some extent these gestures toward Pérez's personhood were made out of respect for the family, a courtesy to avoid seeming to treat her as an inert baby vessel. But in a way, the gestures went beyond courtesy. They reflected how the

people attending to Pérez actually felt.

Todd Lovgren, co-leader of the medical team, knows the anguish of losing a daughter—he lost one too, the oldest of his five children, who would have been 12 years old had she lived. "It would have offended me not to treat Karla like a person," he told me. "I saw a young woman with painted fingernails, her mom doing her hair, with warm hands and warm toes...Whether her brain was still functional or not, I don't think her humanity was gone."

Speaking as a parent rather than a clinician, Lovgren says he thought something of Pérez's essence was still there in the bed—even though he knew, by the time of her second CT scan, that not only was her brain not functioning but large portions of it were dying off and peeling away. (Despite this, he hadn't tested for the last of the three criteria of brain death, apnea, fearing that removing Pérez from the ventilator for even a few minutes might harm the fetus.)

On February 18, ten days after Pérez's stroke, it became clear that her blood wasn't clotting normally—an indication that dead brain tissue was getting into her bloodstream, one more sign to Lovgren that "she was never going to recover." By this time the fetus was 24 weeks old, so the team transferred Pérez from the main campus back to Methodist Women's, the maternity hospital. They managed to correct the clotting problem for the moment. But they were ready to do a C-section as soon as it became clear that it was time to let go, when even the semblance of a living person that their skills and instruments had patched together was beginning to fall apart.

TO SAM PARNIA, death is potentially reversible. Cells inside our bodies don't usually die when we die, he says; some cells and organs can remain viable for hours, maybe even days. The timing of the declaration of death is sometimes a matter of personal attitude, he says. When he was in training, he notes, people would stop CPR after just five to ten minutes, assuming that any longer would mean irreparable brain damage.

But resuscitation scientists have learned ways to keep the brain and other organs from dying even after the heart stops. They know that lowering body temperature helps—which happened naturally with Gardell Martin, and which happens deliberately in some ERs that routinely chill patients before doing CPR. They know that persistence helps too, especially in hospitals that use machines to regulate chest compressions or that someday might use drugs such as iodide.

Parnia compares resuscitation science to aeronautics. It never seemed possible for people to fly, yet in 1903 the Wright brothers flew. How incredible, he says, that it took only 66 years from that first, 12-second flight to a moon landing. He thinks such advances can happen in resuscitation science too. When it comes to reversing death, Parnia believes we're still in the Kitty Hawk era.

Yet doctors are already able to snatch life from death in stunning, inspiring ways. In Nebraska that happened on April 4, 2015, the day before Easter, when a baby boy named Angel Pérez was born by C-section at Methodist Women's Hospital just before noon. Angel is alive today because doctors were able to keep his brain-dead mother's body functioning for 54 days, long enough to let him grow into a small yet otherwise perfectly normal newborn, two pounds, 12.6 ounces, miraculous in his ordinariness. A baby who turned out to be the milagro his grandparents had been praying for. □

At the start of this project photographer **Lynn Johnson** connected with a friend whose mother, Phyllis, was dying. Find the family's powerful story at *ngm.com/more.*

What meaning do you hope readers find in their story? The intention of the project was to ask, How do you want to die? Because we're all going to do it. This is how one woman and her family moved through that time. And they did so with a lot of tenderness and love, with an effort to help her be pain free and fear free.

Where Death Doesn't Mean Goodbye...

In a remote corner of Indonesia, the departed—and their corpses—remain a part of the family.

BY AMANDA BENNETT PHOTOGRAPHS BY BRIAN LEHMANN

Friends and family inspect the body of Debora Maupa', who died in 2009 at age 73. A well-preserved body, mummified with a solution of formaldehyde and water, is thought to bring good fortune. Preceding page: A family member adjusts glasses worn by Tappang Rara, who died in 2006 at age 65.

Near Rantepao, Sulawesi, cousins and sisters surround three-year-old Syahrini Tania Tiranda, who died the day before. They touch her and talk to her. To them she is *to makula'*—a sick person.

One night, a little before seven, Elisabeth Rante pulls a golden curtain back from the doorway. Together we slip inside. She speaks to her husband. "Papa...Papa," she whispers. "We have a guest from far away." Behind us, second eldest son Jamie enters the room with a tray and walks up quietly. "Here is your rice, Papa. Here is your fish. Here are the chilies," he says.

As we back silently out of the room, Elisabeth says softly, "Wake up, Papa. It's time for your dinner." I turn back for a moment as eldest son Yokke explains: "She's taking your picture, Papa."

A touching family scene. Nothing that couldn't happen anywhere on Earth. Except for one thing. Elisabeth's husband, a former clerk in the city marriage bureau, has been dead for nearly two weeks. Here, in the handsome, melon-colored concrete house of a respected and prosperous family, Petrus Sampe lies motionless on a wooden twin bed, a red patterned blanket tucked under his chin.

For several more days in this house on the fringe of the town of Rantepao, in the remote highlands of the Indonesian island of Sulawesi, Petrus will lie in this bed. His wife and children will speak to him as they bring him food four times a day—breakfast, lunch, dinner, and mid-afternoon tea. "We do this because we love him and respect him so much," Yokke says. Elisabeth adds, "Before, we used to eat together. He's still at home—we should feed him." Formalin (formaldehyde plus water) treatments shortly after death mean the body will not putrefy, but in time it will mummify. The room's scent is nothing more than the usual hint of sandalwood in a Torajan house. On the wall a picture of Jesus Christ leading a lamb looks down.

Four days later, after musical tributes, a Christian religious service, and a pork, vegetable, and rice dinner for more than a hundred, family members lift Petrus from the bed into a coffin. Videographers record the event. Eight or more children—relatives and friends from the neighborhood—push each other out of the way to get a better view. Afterward Petrus will remain at home, in his coffin, until his funeral in December, four months from now. His wife will live in the house with him until then; some families follow the old custom of never leaving a dead person alone. Until the funeral, Elisabeth and her children will call him *to makula'*—a sick person. "We believe that even though the father is to makula', his soul is still in the house," Yokke says.

For Torajans, the death of the body isn't the abrupt, final, severing event of the West. Instead, death is just one step in a long, gradually

Risma Paembonan takes dinner to her mother-in-law, Maria Salempang, who died two weeks earlier, at 84. Time at home with parents can be highly prized. "I'm not sad, because she's still with us," says another Torajan woman of her 73-year-old mother, who has lain dead in the house for more than a year.

unfolding process. Late loved ones are tended at home for weeks, months, or even years after death. Funerals are often delayed as long as necessary to gather far-flung relatives. The grandest funeral ceremonies are week-long events drawing Torajans home in a vast reverse diaspora from wherever in the world they may be. When a brigade of a hundred or more motorcycles and cars rips through town accompanying a corpse home from far away, traffic stops in a manner that not even an ambulance or a police officer can command. Here, death trumps life.

Torajans do not reject medical treatments for life-threatening conditions. Nor do they escape grief when loved ones die. But far from pushing death away, almost everyone here holds death at the center of life. Torajans believe that people aren't really dead when they die and that a profound human connection lasts well past death. Death for many Torajans is not a brick wall but a gauze veil. It is not a severing but just another kind of connection. Often in Toraja the deep link with a loved one doesn't end at the grave. Periodically some northern Torajans bring their relatives out of their tombs to give them fresh clothing and burial shrouds.

No one knows exactly when Torajan death practices began. The Torajan language was

Toraja Heartland

Nearly half a million Torajans live in the highlands of the Indonesian island of Sulawesi. The vast majority, at least 90 percent, are Christians, but they remain influenced by their traditional religion, Aluk To Dolo, or Way of the Ancestors.

written down only in the early 20th century, so most of the old traditions are still oral. Only recently, through carbon dating of wooden coffin fragments, have archaeologists concluded that there are Torajan death practices that date back at least as far as the ninth century A.D. The first Dutch ships arrived in what is now Indonesia in the late 16th century, searching for nutmeg and cloves. Just over 300 years later they reached Toraja, a cultural region that today encompasses the districts of Toraja Utara and Tana Toraja. Thanks to Dutch missionaries, it's a Christian enclave, made up mostly of Protestants but also Roman Catholics, in a majority-Muslim country. Christianity has tried more or less successfully to partner with traditional practices: Nearly every step of a Torajan death is greeted with prayers, readings from Matthew or John, and a recitation of the Lord's Prayer.

Toraja is dotted with villages perched high on the side of cliffs or nestled deep in the valleys below. Rantepao, a dusty town of 26,000, is reached mainly via an eight-hour trip from Sulawesi's largest city, Makassar, on 200 miles of corkscrewing, cliff-hugging road. The villages in turn are connected only by winding, one-lane dirt paths carrying two-lane traffic that dodges dogs and toddlers along routes pocked with head-banging, watermelon-size ruts.

I made the rough trek here after years spent writing and speaking about an American way of death that glorifies medicine and drugs but fears death, which it considers a failure of technology or will. That leaves most Americans dying in institutions, when the majority say they would prefer to die in peace at home. After my husband, Terence, died, I began seeking alternatives. I have come here to explore a culture that is even more extreme, but in the opposite direction.

There are obvious limits to my search. Feeding the dead, letting bodies hang around, and opening coffins aren't practices the rest of us will likely adopt anytime soon. Even so, I can't help wondering if the more gradual rhythm and pacing of Torajan death practices don't hew more closely to the actual racking and shuddering experience of human grief than do our own more buttoned-up rituals.

Seeing, talking to, and feeling the presence of a dead loved one are commonplace in the West, write Colin Murray Parkes and Holly G. Prigerson in *Bereavement: Studies of Grief in Adult Life*. "I talk to him and quite expect him to answer me," they quote one widow as saying. Grief itself, they say, doesn't follow a clean trajectory but rather erupts and calms in cycles over many years—just as Torajan death practices do. But the Western habit of sweeping the dead out of sight within days or even hours of death would seem far too abrupt to a Torajan. "My mother died suddenly, so we aren't ready yet to let her go," says Yohana Palangda, as she begins to weep. "I can't accept burying her too quickly." Her mother has continued to receive guests in

an upstairs room for more than a year. Because Yohana's mother was the village chief—a position Yohana now has—villagers continue to come to seek blessings for important events, or even permission to marry.

Michaela Budiman, an anthropologist at Charles University, in Prague, Czech Republic, writes that if the deceased in Toraja were buried immediately, it would be "as if a hawk careened suddenly upon its prey, snatching it in its talons and vanishing forever in the split of a second."

So what is the difference between Yohana's reluctance to let her mother go and our own? Or between Elisabeth's conversation with her dead husband and the ones Western widows secretly hold with theirs? Or Elisabeth's family's feeding ritual compared with novelist Joan Didion's reluctance to part with her dead husband's shoes, lest he need them when he returns? The best thing to resolve grief is time. What if we, like the Torajans, gave ourselves more time to unspool it at its own rate?

A FEW DAYS AFTER my visit to the deceased Petrus Sampe and his wife, another man's funeral is in full swing at the other end of town. I climb a shaded bamboo structure the family has built for out-of-town guests. I curl up on a rug next to a young teen, the granddaughter of the deceased. Dinda applies eyeliner. She fiddles with her smartphone. Everyone likes funerals, especially for the chance to meet faraway relatives, she says, as three younger cousins romp nearby, including around their grandfather's coffin.

Hundreds of men, women, and children wander below or sit chatting in the shade of ancestral homes—called *tongkonan*—distinctive stilted structures that carpet the region, their giant curved roofs seeming to float like huge red boats on seas of palm, coffee trees, and bougainvillea.

The spaces between the tongkonan are cluttered with squealing pigs bound to bamboo poles, soon to become lunch. Women in slim black-and-white sheath dresses sell cigarettes. A motorcycle vendor hawks Mylar balloons. Sleek, fat water buffalo are everywhere, lounging under trees, standing alongside the road, or being walked in circles by young men who tend them as affectionately as they would pets. A master of ceremonies high in a tower above the crowd addresses a magnificent animal, its huge, gracefully curved horns as wide as a man is tall.

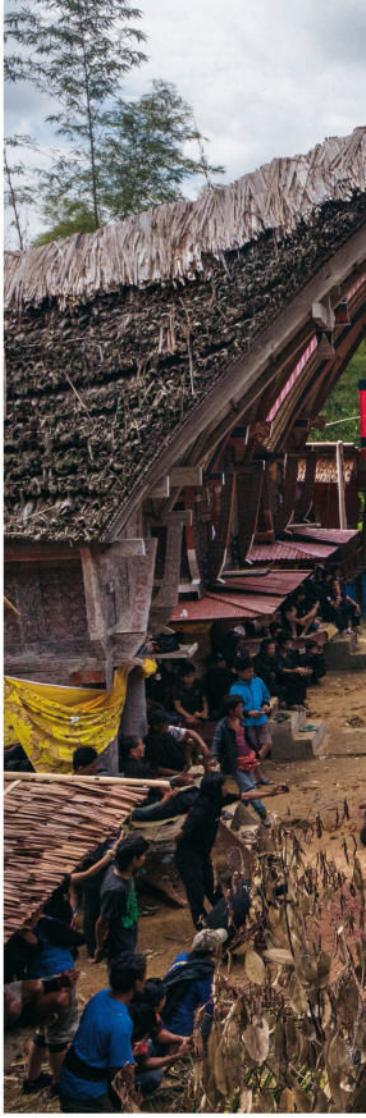
"You are the most important buffalo here," he says. "You will go with this man to the next world and make him rich."

A grand Torajan funeral is measured in the number and quality of buffalo, which serve as a form of currency. Everything about the funeral is hierarchical, cementing the status of the dead person's family, the people who attend, and many who don't. Today is near the end of more than a week of meals, receptions, meetings, prayers, entertainment, and carefully choreographed rituals separating the dead gradually from life. The body moves from the home into the family's ancestral building, then into a nearby rice barn, then to the funeral tower overlooking the ceremonial plain.

Funerals glue Torajans tightly, one family to the next, one village to the next. Funerals consume savings as people outdo each other in gifts of animals, creating multigenerational obligations and conspicuous consumption. Your cousin donates a buffalo? You must give a bigger one. You can't repay a past gift? Then your son or daughter must. If they can't, the burden will fall to your grandchildren. This dark side of funeral obligations can be clearly heard in the cries of the emcee announcing the gifts. "Whose pig is this?" he intones over a loudspeaker. "Whose buffalo is this?" In a metal-roofed shelter below, government officials tally the quality and size of each gift for tax purposes. At the ceremony's end the neat ledger will be presented to the family, which will be expected to reciprocate when some member of a giver's family dies.

Torajan funerals are also great fun. A funeral is a wedding, a bar mitzvah, and a family reunion all in one, easily outstripping the conviviality of Irish wakes. Lavish funerals are a chance to meet and mingle, to eat and drink well, to enjoy games and entertainment—even to network for jobs or eye prospective mates. There

Family members prop up the body of Pangkung Rante Rante, thought to have died at the age of 115, to honor him. This rare practice, called *dipatadongkon,* is performed only by upper-class families.



are water buffalo fights. ("No gambling," the emcee announces. "The family is Christian, and the police are here. The family does not support gambling.") As a cry goes up summoning the strongest to move the coffin to the tower, at least 50 young men seize the bamboo poles. They chant their way around the field, pumping the coffin up and down as the lyrics grow bawdy: something about body parts, and size, and sexual prowess. A water fight breaks out, with the bearers drenching each other, and the guests, with water from plastic cups.

"You can make an excuse for a wedding, but you have to come to a funeral," says Daniel Rantetasak, 52, who sits one bright afternoon in the VIP section at the funeral of Lassi Allo To'dang, Dinda's grandfather. Daniel figures he has attended more than 300 funerals in his lifetime. He says that at a funeral like this a minimum of 24 buffalo should be sacrificed. Sometimes the number may exceed a hundred. At an average of 20 million rupiah per buffalo ($1,425)—prices can go much higher for the most prized, mottled ones—an elite funeral can top $400,000 in buffalo costs alone, paid for by socially compulsory donations and by the many family members who send money home from abroad. Food and drink for hundreds of guests and temporary bamboo housing for visitors add to the costs. People devote resources to funerals even while struggling to pay $10,000 for university expenses. One woman remembers her grandmother saying funds were too scarce to pay for college. A few weeks later her grandmother spent thousands on pigs for a relative's ceremony. "I was a victim of tradition," the woman says. It is commonly said that in Toraja, one lives to die.

Yet some Western tourists who come to Toraja seeking the exotic pageantry of funerals find that the human connections, unflinching contact with death, and sheer fun help shift their thinking about their own culture's habits. "When someone dies in Spain, it's the worst thing that can happen in a family," says Antonio Mouchet, an IT consultant touring from Madrid. "We Western people…don't think of the end. Here, they have been preparing for years."

I avert my eyes at the buffalo sacrifice—55 will be killed in total. It feels brutal to Western sensibilities. Torajans look on unfazed; their concern is more for the group than the individual, says Stanislaus Sandarupa, a Torajan and a linguistic anthropologist at Hasanuddin University, in Makassar. The buffalo's obligation, he says, is to provide meat to ensure human existence. People, in turn, must care for the species and make sure it endures.

WHILE THE FUNERAL is unfolding in town, another set of ceremonies is taking place in the countryside. August is a month not only for funerals but also for *ma'nene'*—the "second funerals" held by families every few years when they return to ancestral tombs to tidy up, bring

Water buffalo in Toraja are raised to be sacrificed. Until then, boys (and sometimes girls) care for them with affection and pride, as they would a fine stallion or an expensive car. At the funeral the animals are killed by a machete chop to the jugular. The more buffalo sacrificed, the greater the prestige.

the dead snacks and cigarettes, and take long-buried bodies out for a turn in the sun and put fresh clothing on them. Daniel Seba Sambara presides over a gathering that includes his wife, a daughter and granddaughter, son, son-in-law, and many others congregated around a grand family crypt on a breezy spot overlooking a valley. Daniel wears new trousers and looks slightly surprised, as if peering out from behind new wire-rimmed glasses. He died in 2012 after 20 years with diabetes. This is the first time his family has seen him since he was interred. This week, for the ceremony of ma'nene', he was hauled out along with a dozen or so much longer dead relatives, his companions in the crypt.

Relaxed and fit, Pieter, Daniel's son, followed his father in the construction business in Papua Province, more than a thousand miles away. Pieter's orange polo shirt is fashionable. His English is excellent. His daughter, Monna, a civil engineer, passes around cell phone pictures of her choir camp in Cincinnati. Pieter and his family are thoroughly modern Torajans.

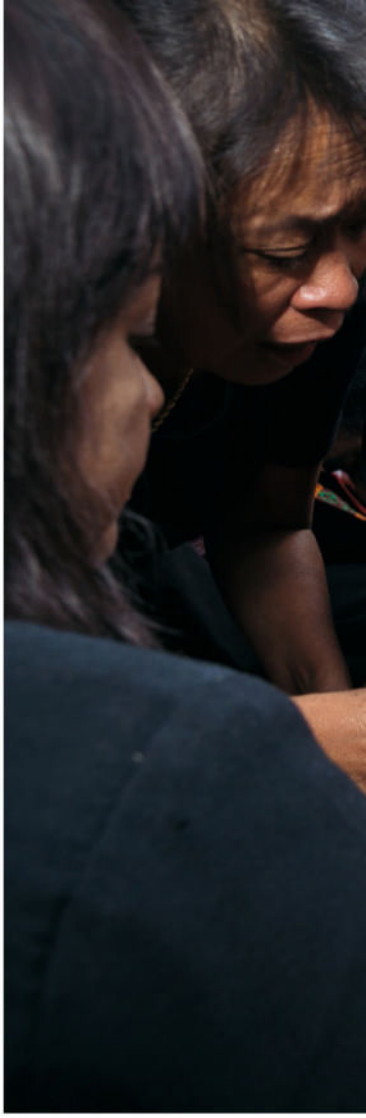
So how does he feel seeing his three-years-dead father lashed to a stucco pillar, with relatives posed at his side? Proud. And excited. His father's body is relatively intact and recognizable, unlike those of other relatives lying nearby,

which look more like Halloween skeletons. His skin is smooth. His fingernails and beard have grown since they saw him last, relatives exclaim. Daniel was nicknamed Ne' Boss—Grandpa Boss—years ago, a commentary on his rags-to-riches success. The body's state is a sign to Pieter that he too will prosper. "Not everybody is like this. It will bring his children and grandchildren success," he says, gleefully.

I approached this moment with trepidation. After all, we Westerners cringe at the sight of a corpse. Confronted with several, I find myself curiously calm and interested. Everyone is festive, wearing bright colors and appearing decidedly happy. The smell is musty, like a bunch of blankets put away wet and stored for several years. The sight is definitely odd but surprisingly not unpleasant or gruesome. "The way they handle the bodies, it's not scary at all," says Ki Tan, an Indonesian who grew up in the Netherlands, as he watches a family interact with a group of long-dead loved ones, including a year-old child, dead for 38 years. Nearby, a 21-year-old backpacker from Berlin grows reflective. "I feel very lucky to have seen this," says Maria Hart, recalling sadly that she was so upset by her own grandfather's death that she refused to attend his funeral. "On a personal level, I take some comfort in the tradition," says Kathleen Adams, an anthropologist at Loyola University Chicago who has lived among Torajans and their dead.

THE IMPORTANT THING, Torajans say, is that they are not just individuals. The death of one person is only the dropping of a single stitch in an intricate financial, social, and emotional canvas winding backward through ancestors and forward through children. How did Torajans come to believe this? I wonder. Go ask Kambuno, the people say. He's the man who knows the answers.

Watch a *ma'nene'* ceremony, or "second funeral," and listen to Torajans talk about their relationship with the dead. You can find the video at *ngm.com/more.*



In search of Kambuno, we wind northward from the small town of Pangala, skirting rice fields and passing through village after village. Shopkeepers, motorbike riders, and passersby direct us. Everyone knows where Kambuno lives. Two schoolgirls in white shirts, navy skirts, and black ties hop in the car to point the way. When the road peters out, we continue on foot up a steep, rocky course.

We find Petrus Kambuno, wiry, goateed, almost toothless, cutting grass by the side of the road. "You are lucky you found me," he says. "There is no one left but me who knows these stories." He claims to be 90 years old. He spins a Genesis-like creation tale, with Toraja at its center. "Here God created man in heaven, and woman from the Earth," he says. Looking out over lime green terraced rice fields framed

Tini Patiung breaks down moments before a group of men carry her mother to her grave. Ester Patiung died ten months earlier, at age 62; her body was kept in the family home as decisions were made about her funeral ceremony.

against an aquamarine sky, it's easy to believe that God chose this to be his Eden.

Kambuno continues: God gave the gifts of bamboo and bananas from the Earth and betel and lime from the heavens. "He commanded us to use these things that give people pleasure to ease our grief, to make ourselves feel happy if we are sad when someone dies."

I realize I'm asking the wrong question. Torajans, it appears, are probably more deeply connected than we are to the way people everywhere feel death: the desire to stay connected to loved ones in both body and spirit; to believe that people don't ever really die permanently; and to have, and to become, an ancestor. So the question isn't why do Torajans do what they do, but why do we do what we do? How did we distance ourselves so much from death, which is, after all, just a part of life? How did we lose the sense of being connected to each other, to our place in society, in the universe?

Kambuno gestures at his family crypt, which he says holds more than ten relatives. "My father is in here," he says. "But I am here, so he is not really dead. My mother is in here, but I have daughters, so she is not really dead. My daughters have been exchanged for my mother. I have been exchanged for my father." □

Cristina Banne, who died in 2011, is held up by her son Bartolomeus Bunga' as grandson Jerry Putra Bunga' gives a thumbs-up. With more than half of Torajans living elsewhere, funerals bring families back together.

AFRICAN WHITE-BELLIED TREE PANGOLIN A baby hitches a ride on its mother at Pangolin Conservation, a nonprofit organization in St. Augustine, Florida. The mammals are illegally killed for bush meat and their scales, which are claimed to have medical value.

EVERY LAST ONE

On a deeply personal mission, Joel Sartore is photographing as many animals as he can—before some disappear.

FIRST ROW Eastern subterranean termite, sand cat, Roanoke logperch, pink-sided tree frog, greenbottle blue tarantula, Eurasian red squirrel, Nicobar pigeon, green tree python **SECOND ROW** Philippine crocodile, Gulf fritillary butterfly, orangutan, red-fan parrot, bilby, Grevy's zebra, Diana monkey, yellowtail clown fish **THIRD ROW** Curl-crested aracari, giant stag beetle, ring-tailed lemur, black-and-rufous elephant shrew, shortfin lionfish, desert millipede, Chinese flying frog, Yangtze giant softshell turtle **FOURTH ROW** Scorpion, four-toed hedgehog, giant panda, straw-necked ibis, Schmidt's red-tailed monkey, Taiwan giant grass mantis, Florida regal doris, American flamingo **FIFTH ROW** Mandrill, racquet-tailed roller, Asian garden dormouse, rhinoceros snake, Australian finches, Amazonian horned frog, North American porcupine, flower beetle **SIXTH ROW** Chinstrap penguin, fire shrimp, lion-tailed macaque, red-knobbed imperial pigeon, panther chameleon, white-throated wood rat, common desert centipede, American oystercatcher **SEVENTH ROW** Blue-spotted emperor butterfly, pygmy slow loris, Panamanian golden frog, blue-spotted tree monitor, *Nassarius* snail, hyacinth macaw, dama gazelle, titan triggerfish **EIGHTH ROW** Himalayan wolf, metallic sweat bee, bat star, Guianan cock of the rock. Photographs taken at the locations listed on page 85.

By Rachel Hartigan Shea
Photographs by Joel Sartore

NAKED MOLE RAT
This species of rodent, the first animal to be photographed for Photo Ark, thrives in large underground colonies in arid parts of East Africa.
Lincoln Children's Zoo, Nebraska

For years National Geographic photographer Joel Sartore worked far away from home—documenting the astonishing wildlife of Bolivia's Madidi National Park or scrambling up the three tallest peaks in Great Britain or getting too close to grizzly bears in Alaska. His wife, Kathy, stayed in Lincoln, Nebraska, and took care of the kids. "He never wanted to change diapers or be a stay-at-home dad," she says.

But in 2005, on the day before Thanksgiving, Kathy was diagnosed with breast cancer. The cancer sentenced her to seven months of chemotherapy, six weeks of radiation treatments, and two operations. So Joel Sartore had no choice: With three kids ages 12, 9, and 2, he couldn't travel for the stories that were the mainstay of his career. Of that time, he says now, "I had a year at home to think." He thought about John James Audubon, the ornithologist. "He painted several birds that are extinct now," says Sartore, who has prints of Audubon's Carolina parakeet and ivory-billed woodpecker in his home. "He could see the end for some animals, even in the 1800s." He thought of George Catlin, who painted American Indian tribes "knowing that their ways of life were going to be seriously altered" by westward expansion. He thought of Edward Curtis, who "photographed and recorded, on early movie footage and sound," threatened native cultures.

"And then I thought about myself," he says. "I'd done almost 20 years of photographing in the wild, and I wasn't moving the needle very much in terms of getting people to care."

He had taken pictures that showed in one frame why a species was struggling—an Alabama beach mouse, for instance, in front of a coastal development that threatened its habitat—but he wondered whether a simpler approach would be more effective. Portraits could capture an animal's form, features, and in many cases its penetrating gaze. Could they also be used to capture public attention?

ON A SUMMER DAY IN 2006 Sartore called up his friend John Chapo, president and CEO of the Lincoln Children's Zoo, and asked if he could take portraits of some of the zoo's animals. Even with Kathy's illness, he could work a little close

to home—and the zoo was one mile away. Chapo told Sartore to come on down. "I was mostly humoring him," Chapo says.

When he arrived, Sartore requested two things from Chapo and curator Randy Scheer: a white background and an animal that would sit still. "What about a naked mole rat?" said Scheer. He put the bald, bucktoothed rodent on a cutting board from the zoo kitchen, and Sartore started taking pictures.

It might seem odd that such a humble creature could inspire what has become Sartore's lifework: photographing the world's captive species and making people care about their fate. But launching a planetwide mission with a tiny rodent fits perfectly with Sartore's philosophy. "I get most excited when I do little critters like this," he says, "because nobody's ever going to give them the time of day."

THERE ARE ESTIMATED TO BE BETWEEN two million and eight million species of animals on the planet. Many of them (forecasts range from 1,600 species to three million) could go extinct by the end of this century, as a result of habitat loss, climate change, and the wildlife trade. "People think we're going to lose animals in their grandchildren's time," says Jenny Gray, CEO of Zoos Victoria in Australia. "We're losing them now. And those animals are gone forever."

Zoos are the last hope for many animals on the verge of vanishing—but zoos shelter only a fraction of the world's species. Even so, Sartore estimates that it will take 25 years or more to photograph most of the species in captivity.

During the past decade he's photographed more than 5,600 animals for the passion project he calls Photo Ark. He's taken pictures of small ones: a green-and-black poison dart frog, an El Segundo flower-loving fly. Large ones: a polar bear, a woodland caribou. Marine animals: a foxface rabbitfish, a Hawaiian bobtail squid. Birds: an Edwards's *(Continued on page 84)*

NATIONAL GEOGRAPHIC
PHOTO ARK
JOEL SARTORE

Photo Ark is a joint project of National Geographic and Joel Sartore. Learn more at *natgeophotoark.org*.

FENNEC FOX
The smallest foxes in the world have enormous ears to cool them down as they traverse sand dunes in the Sahara, where they are common. Their cuteness makes them attractive to the wild-pet trade.
Saint Louis Zoo

RED-RUFFED LEMUR

Nearly half of all primate species are in danger of extinction, and the five here are among the world's most endangered. Around 70 Cat Ba langurs are believed to exist worldwide; the population of red-ruffed lemurs is similarly diminished. The brown-headed spider monkey is rapidly losing its South American

SUMATRAN ORANGUTAN

CAT BA LANGUR

habitat. But life's pleasures remain: The Sumatran orangutan rests on a comfortable perch, and the Delacour's langur relishes a bit of banana. Clockwise from top left: Miller Park Zoo; Endangered Primate Rescue Center, Vietnam (two); Summit Municipal Park, Panama; Rolling Hills Zoo, Kansas

BROWN-HEADED SPIDER MONKEY

DELACOUR'S LANGUR

NORTHERN WHITE RHINOCEROS
This female named Nabiré was one of the last of her subspecies. She died last summer, a week after this photograph was taken. A few months later another northern white rhino died, leaving only three.
Dvůr Králové Zoo, Czech Republic

SNOWY OWL
Snowy owls live in the upper latitudes of North America, Europe, and Asia, but this one ended up in Nebraska and was starving when it was rescued by Raptor Recovery.
Raptor Recovery Nebraska

BRAZILIAN PORCUPINE
Also known as the prehensile-tailed porcupine, the largely nocturnal species spends some 85 percent of its time in trees. Sartore's camera caught it at rest but alert.
Saint Louis Zoo

MALAYAN TAPIR
The baby shown here was just six days old when it was photographed. The coats of young tapirs are spotted to blend in with the dappled light of the tropical forest floor.
Minnesota Zoo

After a photo shoot at the Columbus Zoo in Ohio, a clouded leopard cub climbs on Sartore's head. The leopards, which live in Asian tropical forests, are illegally hunted for their spotted pelts. Grahm S. Jones, Columbus Zoo and Aquarium

pheasant, a Montserrat oriole. And on and on and on. Sartore says he won't stop until he dies or his knees give out.

Sandra Sneckenberger, a biologist with the U.S. Fish and Wildlife Service, has seen firsthand how Sartore's photos can move others. A few years ago the population of Florida grasshopper sparrows—a bird Sneckenberger concedes looks "drab brown" from a distance—had plummeted to about 150 pairs at only two locations. After Sartore's image of the bird raised awareness of its plight, federal funding to help the agency conserve it soared from $20,000 to more than a million dollars.

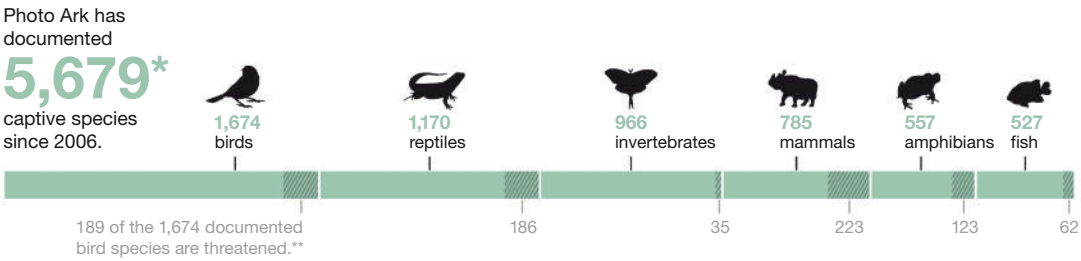
Sartore has taken portraits of animals that may be saved—but also of animals that are doomed. Last summer, at the Dvůr Králové Zoo in the Czech Republic, he photographed a northern white rhino, one of only five left in the world. The 31-year-old female lay down to sleep at the end of the shoot. A week later it died of a ruptured cyst. In fall 2015 another northern white rhino died; one male and two females remain. "Do I think that the rhinos going away is sad?" Sartore says. "It's not just sad. It's epic."

Most of the animals in Photo Ark, which is supported by the National Geographic Society, have never been photographed so distinctively before, with their markings, their fur, and their feathers so clearly on display. If they disappear, this will be the way to remember them. Sartore's goal "isn't just to have a giant obituary of what we've squandered," he says. "The goal is to see these animals as they actually looked in life."

Now millions of people have seen the animals that Sartore has photographed. People have met their gazes on Instagram, in this magazine, in documentaries, and projected on the sides of some of the world's great monuments: the Empire State Building, the United Nations headquarters, and, most recently, St. Peter's Basilica.

THERE ARE AS MANY WAYS to photograph an animal as there are animals, but Sartore operates within some basic parameters. All the portraits are taken with a black or white background. "It's a great equalizer," he says. "The polar bear is no more important than a mouse, and a tiger and a tiger beetle are exactly the same."

Large animals are photographed in their enclosures, where Sartore either hangs a giant black curtain to serve as backdrop or paints a



*AS OF JANUARY 2016. **SPECIES LISTED BY IUCN AS VULNERABLE, ENDANGERED, CRITICALLY ENDANGERED, OR EXTINCT IN THE WILD

MATTHEW TWOMBLY. SOURCE: JOEL SARTORE

wall. At the Houston Zoo he draped 18 feet of black cloth at one end of a giraffe's stall. The giraffe didn't even notice, says Peter Riger, vice president of conservation at the zoo. "It just knew it was coming in to get lunch."

Small animals are placed in a soft-sided box, with Sartore poking his lens through a slit in the side. "Some of them fall asleep or eat in there," he says. "A lot of them don't like it at all." He keeps the sessions short, a few minutes at most.

Sartore doesn't wrangle the animals himself; he leaves that to the zookeepers. If at any point "the animal shows signs of stress, the shoot is over," he says. "The safety and comfort of the animals come first." None has been injured.

Sartore, however, has not been so lucky. "A crane tried to blind me one time," he says. "That was terrifying." A mandrill, a burly type of primate, punched him in the face. A white-crowned hornbill—"the nastiest, most badass bird I've had to do"—struck him with its beak and drew blood. "But aren't I asking for it, in a way?" he says.

JOEL AND KATHY SARTORE sit side by side at their kitchen table in Lincoln with the lights dimmed. His arm rests on her shoulders. He had returned from Madagascar the night before (he began traveling again in 2007) and wanted her to help him select photos of rare lemurs and pochards, a kind of duck, to post on Instagram. "The thing that draws people is the human element," says Kathy, who often serves as his photo editor.

Sartore grew up not too far from Lincoln, in Ralston, Nebraska. His parents loved nature. His father took him mushroom gathering in the spring, fishing in the summer, and hunting in the fall. His mother, who died last summer, gave him a Time-Life book about birds when he was around eight years old that may have changed his life. Toward the back, in a section on extinction, was a picture of Martha, the world's last passenger pigeon. He remembers returning to that page over and over: "I was amazed that you could go from billions to none."

Joel and Kathy met as University of Nebraska students at a spot called the Zoo Bar. "Our dates," Kathy recalls, "were fishing and frog-gigging," which involves spearing frogs for their legs. The activity can be justified, Sartore hastens to explain: "They were bullfrogs; they're an invasive species here in Lincoln."

Kathy's cancer came back in 2012; she had a double mastectomy. That same year, their son Cole, who was 18, was diagnosed with lymphoma. Both recovered, but the illnesses have left their mark. "We don't get uptight about too much anymore," Sartore says.

Photo Ark has changed him as well. "It has made me very aware of my own mortality," he says. "I can see how long it's going to take." If he can't finish the job—he still has thousands of species to photograph—Cole will take over. "I want the pictures to go to work," Sartore says, "long after I'm dead." ▯

To document the world's creatures, photographer Joel Sartore must abide the unruly, distract the curious, and clean up unexpected messes. Watch video of the animal antics at *ngm.com/more.*

Animals on pages 72 and 73 photographed at Audubon Butterfly Garden and Insectarium, Louisiana; Budapest Zoo and Botanical Garden, Hungary; Chattanooga Zoo; Cincinnati Zoo and Botanical Garden; Columbus Zoo and Aquarium, Ohio; Conservation Fisheries, Inc., Tennessee; Dallas World Aquarium; Dallas Zoo; Dreamworld, Australia; Fort Worth Zoo; Gladys Porter Zoo, Texas; Great Plains Zoo, South Dakota; Houston Zoo; Lee G. Simmons Conservation Park and Wildlife Safari, Nebraska; Lincoln Children's Zoo, Nebraska; Miller Park Zoo, Illinois; Nebraska Aquatic Supply; Newport Aquarium, Kentucky; Omaha's Henry Doorly Zoo and Aquarium; Padmaja Naidu Himalayan Zoological Park, India; Philadelphia Zoo; Phoenix Zoo; Plzeň Zoo and Botanical Garden, Czech Republic; Pontificia Universidad Católica del Ecuador; Pure Aquariums, Nebraska; Riverbanks Zoo and Garden, South Carolina; Riverside Discovery Center, Nebraska; Saint Louis Zoo; Sedge Island Natural Resource Education Center, New Jersey; Sedgwick County Zoo, Kansas; Shark Reef Aquarium at Mandalay Bay, Nevada; Suzhou Zoo, China; University of Utah; Zoo Atlanta

Bringing nature closer to home

URBAN

Swimmers bob down the Eisbach ("ice brook" in German), a short, man-made river in Munich's English Garden. The park is named for an informal landscape style popular in the 18th century, when it was first laid out.

PARKS


단원드
오지연치과
남산

Cheonggyecheon meanders through Seoul, South Korea. Once the city's lifeblood, the stream was covered for years. Now it's a place that embraces community and the soothing nature of water.

By Ken Otterbourg
Photographs by Simon Roberts

There is magic here, the delight in being not quite lost and not quite found.

I am off trail, following an unnamed stream in northeast Ohio, scrambling over downed trees through a ravine of crumbling shale, the water milky with silt as it cascades over tiny falls. The sun dances with the stream and the hardwoods. When I take off my boots and splash in the small pools, I feel the cool of the mud between my toes. In the distance, just over the rise, the sound of the city comes and goes. Civilization is so close and seems so far, and in that toggle is the wonder of an urban park.

The place is an offshoot of Cuyahoga Valley National Park, which stretches like a skinny inkblot between the gridded sprawl of Cleveland and Akron. The park's centerpiece is the resilient Cuyahoga River, once a punch line about environmental ruin after an oil-slicked pile of debris on the water caught fire. The park came five years later, in 1974, first mostly in name, and then slowly assembled from land across the compact valley.

The grandeur is varied and comes in small doses. Sandstone cliffs are hidden in the woods. A former auto repair yard is now a marsh created by beavers damming an old canal. And on the site of an arena that was once home to the Cleveland Cavaliers basketball team, there is a broad field that's ideal for watching hawks. The built and natural worlds are in proximity, layered and competing for attention from the bikers and hikers and joggers making their ways up and down the old canal towpath.

This is the urban park of today. Unlike the neatly drawn public spaces of an earlier age, these parks are reclaimed from the discarded parcels of our cities: Stranded patches of woods, abandoned military bases and airports, storm-water systems, rail lines and bridges, places where scraps of land are pieced together like quilts or strung together like beads.

The experimentation is global. Rail parks, many inspired by the success of New York City's High Line, are now beguiling fixtures in Sydney, Helsinki, and other cities. Singapore is building an artificial rain forest inside Changi Airport. At the edge of Mexico City, an immense park

The sweeping views of San Francisco Bay from the Golden Gate National Recreation Area draw visitors such as Ben Fernyhough, who came from Oregon on a skateboarding trip.

is planned on what remains of Lake Texcoco.

I am captivated by the breadth of innovation and energized by the passion people bring to these spaces. As I explored them, what became clear is that urban parks aren't a substitute for the enormous and often remote parks that protect our most majestic forests and mountains and canyons. They serve a different purpose; the truth is, we need both.

ON A HOT AND HAZY AFTERNOON, I set off to walk the four-mile length of Cheonggyecheon, the lovely ribbon of water that unfurls with quiet assertiveness through the heart of Seoul.

In the city's preindustrial years, the stream was where lovers courted and women gathered to do wash. But Seoul's boom after the Korean War brought shantytowns and pollution, and the stream became an eyesore. In 1958 a road was built over it. An elevated highway, finished in 1976, completed the entombment.

There Cheonggyecheon might have stayed, if not for serendipity and politics. Throughout the 1990s, a small group that included academics and engineers sought to uncover the waterway. They figured out how to manage the stream's hydrology and mitigate the traffic snarl that might ensue when the highway and the road below, which carried more than 170,000 vehicles a day, were removed. "I didn't think the money was the problem," said Noh Soo-hong, a professor of environmental engineering at Yonsei University and one of the project's first supporters. "I thought it was the will."

The missing component was a leader with clout. That person arrived in the form of Lee Myung-bak, a former construction executive whose company had been the principal contractor in building the highway. He made the stream's restoration a key issue in his successful campaign for mayor of Seoul in 2002. (Five years later, he was elected president of South Korea.) "It was a very dangerous idea," said Hwang Kee-yeon, a transportation engineer who helped develop the master plan. "Lee Myung-bak decided, 'I built it. It's time for me to demolish it.'"

Work on the $372 million project, a reclamation job of mammoth proportions, began in 2003. First the elevated highway was torn down. Then the surface road was ripped up, again exposing the stream. Like many restorations, this one is not entirely faithful to the past. The stream was intermittent, barely trickling in the dry months and surging during the summer monsoon. Thanks to pumping stations that deliver more than 30 million gallons a day from the Han River, the stream now babbles reliably.

"People criticize this as a man-made river or fish tank," Lee In-keun, a wiry and animated man, told me as we strolled the upper portion of Cheonggyecheon. The paths by the stream were crowded with people enjoying the water and pointing with delight at carp idling in the deeper pools. Research shows it provides a cooling effect during Seoul's steamy summers. Lee oversaw the restoration project and agrees that Cheonggyecheon is artificial. But that distinction doesn't matter to him; he finds the presence of nature as vital as in a truly natural setting. "It's a jewel of the city. You can hear the water flow in the central area of ten million people. It's unbelievable. We made that intentional."

Cheonggyecheon begins in the financial district, within a canyon of office buildings. The stream flows east, the banks widen, the concrete gives way to thatches of reeds and glades of trees. It moves past glitzy shopping areas and tired-looking wholesale districts and gigantic apartment complexes that rise up like fortresses. At one point a pair of concrete abutments appears in the stream. Part of the old highway, they are reminders of the past and the impermanence of our engineering. Many Seoul residents find it hard to remember a time when the stream was covered, when herons didn't wade gingerly in the water hunting for fish, when it wasn't an inviting place.

I was near the end of Cheonggyecheon when I heard the singer. I followed her voice to a small stage under a bridge where a band was playing a Korean "trot" song, the honky-tonk sound mixing with haunting lyrics.

1660

ST. JAMES'S PARK
LONDON, ENGLAND

British soldiers march in the annual summer parade that marks the queen's official birthday. The route runs through the park, which is adjacent to Buckingham Palace. Once a swamp, then the site of a hospital for patients with leprosy, the land became royal property in 1532, when Henry VIII acquired it as a preserve for deer hunting. When Charles II became king, he opened the grounds to Londoners, creating one of the earliest public parks.

When I released my hold on my mother's hand and turned back,

Even an owl cried. So did I.

I sat on a stool at the edge of a gathering of retirees and listened, and eventually a woman with a sweet smile and a firm insistence asked me to dance. We shuffled to the music, holding hands, joined like the city and the park that runs through it.

"THIS IS WHERE IT ALL BEGAN," said Amy Meyer, as we pulled into the driveway of Fort Miley, part of the Golden Gate National Recreation Area at the northwestern edge of San Francisco. A coyote stood in the middle of the road and stared at us, in no apparent hurry to move. Though the National Park Service has maintained a presence in cities for years (it oversees the National Mall in Washington, D.C., for example), the creation of Golden Gate is considered a turning point in the urban parks movement.

Meyer is now 82, and by turns gracious and feisty. In 1969 she was a stay-at-home mother when she heard about plans to build an archives center at Fort Miley, a largely empty coastal defense site a few blocks from her house. She began organizing to save the space as open land and eventually joined forces with activists on the other side of the Golden Gate Bridge who were alarmed that suburban sprawl might destroy the austere beauty of the Marin Headlands.

Golden Gate, along with Gateway National Recreation Area in New York and New Jersey, was established in 1972. These new parks signaled a move by the Park Service to look beyond its wilderness parks to more accessible places closer to America's cities. As Walter Hickel, secretary of the interior and former governor of Alaska, said at the time, "We have got to bring

1792

ENGLISH GARDEN
MUNICH, GERMANY

Summer attracts sunbathers, clothed and otherwise, to the grassy banks of the Schwabinger Bach. The meadows in this park, one of Europe's largest, have been popular with nudists since the 1970s. Among its features are a Chinese pagoda, a Japanese teahouse, and two beer gardens with seats for 9,500. The park's designer opted for a natural appearance rather than the more formal layout typical of parks at the time.

1858

**CENTRAL PARK
NEW YORK,
NEW YORK**

The city's storied heart is perhaps the world's best known urban park, a lush expanse framed—and increasingly shaded—by the skyscrapers of Manhattan. More than 42 million people visit each year. Despite those crowds, the park still provides pockets of tranquillity. Birders like Jeffrey Ward (right) gather on weekend mornings in the Ramble, a wild woodland that's a popular stopover in spring and fall for migrating birds.

the natural world back to the people, rather than have them live in an environment where everything is paved over with concrete."

The people are definitely at Golden Gate, one of the most visited places in the national park system, drawing around 15 million visitors each year. It spans both sides of the entrance to San Francisco Bay, with miles of coastline, towering bluffs, redwoods, and remnants of former military installations. And there is an island, Alcatraz, where 4,000 tourists a day disembark from ferries to tour the former federal prison and ponder life behind bars.

The park can be nearly a circus, with locals on their morning strolls skirting past tourists, weekend Frisbee games and parties on the fields, and dogs on and off leash seemingly everywhere. Many visitors have no idea they're in a national park. That's understandable. There are no grand entrances. Adding to the confusion, San Francisco has its own Golden Gate Park, which abuts the national park near the ocean.

All this creates a daunting range of constituents, from hang gliders and politicians to surfers and commuters, and the battles over how best to manage the resources can be intense.

"We're in a democracy, and democracies are messy," Golden Gate Superintendent Chris Lehnertz said. A dog-management plan, for example, has been in the works for more than a dozen years.

Lehnertz also is working with area governments on a strategy for assisting the homeless, an issue at many urban parks. "I see a homeless person who spends the night here as a visitor," she said, "just like I see somebody who walks their dog on a beautifully groomed trail."

One morning I drove about five miles south of San Francisco out to Milagra Ridge, a tiny outpost of the park with a commanding view of

1926

PARK GÜELL
BARCELONA, SPAIN

Designed by Antoni Gaudí as an exclusive neighborhood for Barcelona's wealthy, the site failed as a real estate venture. The city bought the development and opened it to the public. Along the popular Dragon Stairway are mosaic sculptures, including a colorful salamander that has become the park's unofficial mascot. Above the columns a large plaza offers sweeping views of the city and the Mediterranean Sea.

1955

SILESIA PARK
CHORZÓW, POLAND

Wrested out of a wasteland of slag heaps, bootleg mines, and garbage dumps, this postindustrial landscape was transformed into a verdant area that includes a zoo and a dinosaur valley. Much of the work was done by volunteers coordinated by the Communist Party. In southern Poland's urban core, the park is an inviting place for young people such as Maja Peryga (right), who visited the rose garden to photograph a friend.

the Pacific Ocean. The stuccoed developments of suburban Pacifica press in on the ridge and its rolling carpet of scrub and coastal prairie. At the height of the Cold War this was a missile base, with barbed wire and guard dogs. The ridge eventually made its way into the fold of Golden Gate. Jutting up above a sea of housing, it's become a serene and defiant island, a refuge for threatened species such as the California red-legged frog.

Last year, in anticipation of its 100th anniversary, the National Park Service released its "Urban Agenda," which is a continuation, although with more urgency, of earlier calls to action begun in the 1970s. What the report makes clear is that it is good business and—with America's demographics changing rapidly—good politics to make the agency more relevant to an increasingly urban and diverse America.

One place where this new order is playing out is Indiana Dunes National Lakeshore, which nestles up to the steel mills along Lake Michigan in northwest Indiana and stretches into the largely hidden beachfront of Gary, one of America's poorest cities. "Big parks deliver the wealthy, white, rich people," said Paul Labovitz, the park's superintendent. But the future of the Park Service means cultivating new visitors, and that's easier for the urban parks. Because they are newer, Labovitz said, they have fewer traditions to get in the way of experimentation.

THE ICONIC URBAN PARKS with their straight borders and square shoulders aren't going away. They are treasured in cities around the world. But the orderly layout they require is harder to find in places that are already built-up. So our newer urban parks, in the United States and beyond, reflect the challenges of acquiring and developing land. There's now more review from

1996

THE PRESIDIO
SAN FRANCISCO,
CALIFORNIA

Sunset and low tide lure walkers to Marshall's Beach. Strategically located at the entrance to San Francisco Bay, the park was a military outpost for 218 years, used first by Spain, then Mexico, and finally the United States. Unlike other parks in the national system, it receives no federal money. Most revenue comes from renting out former military buildings, many of which are classified as historic structures.

2005

CHEONGGYECHEON
SEOUL, SOUTH KOREA

Commuters listen to a band on a pedestrian bridge spanning the park. The stream, although important to the city's culture and development, was intermittent, dwindling to a rivulet at times. To ensure a constant flow, more than 30 million gallons of water is pumped in daily from the nearby Han River. Most residents view that artificiality as an acceptable trade-off for the serenity the park brings to the city.

the public as well as more oversight by regulators, said Adrian Benepe, the director of city park development for the Trust for Public Land and former New York City parks commissioner. Compounding the problem is the hunt for money to transform the bits and pieces of postindustrial landscape into parklands. "There is a struggle because the cities are also paying for health care and education," Benepe said. "Often the parks are the last priority." What's emerging, he said, is a model more reliant on working with the private sector, both for building parks and for operating them. In Tulsa, Oklahoma, for example, a foundation created from oil and banking wealth has donated $200 million toward a $350 million community park on the Arkansas River. In Newark, New Jersey, Benepe's group worked with government and business leaders to bring a park to once contaminated property along the Passaic River.

Perhaps the world's most ambitious urban park run with this entrepreneurial mind-set is the Presidio, the former Army base that is part of Golden Gate Recreation Area but operates separately. Situated at the entrance to San Francisco Bay, the Presidio was first claimed by Spain, then Mexico, and finally, in 1846, by the United States. Peace did what wars could not, and in 1989 the Presidio was deemed unnecessary to the national defense, and the base—1,491 acres of barracks, buildings, valleys, and breathtaking vistas—was closed.

In 1994 it was transferred to the Park Service. Unlike other national parks, the Presidio has its own board of directors and now raises all its own revenue, mainly by leasing out the former military housing as well as the hospital and administrative buildings to residential and commercial tenants. The private businesses employ about 4,000 people, and more than 3,500 live on

the rehabbed base. A house in one of the swankier neighborhoods, where the Army brass once lived, rents for $12,000 a month. The proceeds are plowed back into restoration, renovation, and maintenance. The cypress trees, planted more than a century ago, are dying and need to be replaced. Re-creating a wetland, part of a broad plan to restore biodiversity, would require tearing down less historic, but affordable, apartments, underscoring the constant soul-searching and rebalancing of competing missions.

"The overlay of values and land is more complex here than at any other place," said Michael Boland, one of the Presidio's top officials. The park's assets, which brought in $100 million last year, are far from typical, but that obscures the larger point about urban parks, their fuzzy boundaries, and the compromises that they end up forging. "I think the future looks a lot more like this than it does like wilderness areas."

WILDERNESS CAN SEEM like both a bright line and an increasingly subjective description of an environment that has all but disappeared. With urban parks it isn't about absolutes but often just about the joy of being outdoors. I was reminded of that when I visited Tempelhof, an airport turned park near the heart of Berlin. It was a weeknight, and in the hour before sunset people were pouring into the park. They rode bicycles on the mile-long runways and jogged around the meadows. Young men parasailed with skateboards, and mothers kicked soccer balls with their children. And because this is Germany, there was beer.

Tempelhof Airport closed in 2008. When it reopened as a park two years later, there was uncertainty about whether it would be embraced by Berliners. Then, as now, the park had few amenities; it was as if the airfield had just closed for a day so the tarmac could be repaved. But the authenticity—that it had been largely unaltered—proved key to the park's appeal. Residents liked its openness and nearly unobstructed sunsets. They delighted in entering property that had once been off-limits. But most of all, they reveled in the sense of freedom found in Tempelhof's 1.2 square miles. When city planners unveiled a proposal to build housing and office space on a fifth of the land, a backlash led to a referendum in 2014 that blocked most future development there.

"You can feel the sky. You can breathe," said Diego Cárdenas, one of the leaders of the referendum movement, as we sat on the grass at Tempelhof. "If you start developing one part, where will it end?"

Tempelhof's future still involves housing, although perhaps not in the way either side envisioned. Part of the terminal building, with its three-quarter-mile-long curved roof, is providing temporary shelter for some of the thousands of refugees who have poured into Germany.

With the clarity of hindsight, officials say the development plan was not well explained and they didn't realize how people would respond once they were inside the park. Berliners have a history, they noted, of claiming unused open land as their own. At Tempelhof that happened on a colossal scale.

"They wanted to seize it," said Ursula Renker, a planner with Berlin's city government. "For most people, the airport was part of their history. There was a special fascination because it was so fenced in. You had to walk in through a gate."

THE GATES ARE STILL THERE, and you can see people break into a smile as they pass through them. It is anticipatory pleasure, based on familiarity. Urban parks may not make our bucket lists, but they deserve a place on what I would call our coffee-cup lists.

And so it is with my favorite urban park, a wetland near my home. It's nothing flashy, just a few acres of low ground that were spared development. I go there often. I like to get there in the early morning, walk among the cattails, and watch the two worlds—one of pavement and the other of the swamp—come to life. As the sun rises, catching the tops of the trees, the traffic grows along the four-lane roads that flank the park. Eventually, the noise becomes constant enough that it fades into the background. Then, if I listen carefully, I can hear the birds sing. □

2010

SHERBOURNE COMMON
TORONTO, ONTARIO

A wedding party poses for photographs at the zinc-clad Pavilion. The park offers green space on the densely developed Lake Ontario waterfront and a skating rink that doubles as a splash pad. In the Pavilion's basement an ultraviolet system treats storm water and then sends it flowing through dramatic sculptures into the lake. The park's design has won praise for its clean look—and some criticism for its perceived sterility.

Snow softens a gorge in northern Armenia that people call Jardi Dzor, “massacre canyon,” where Turkish forces are said to have shot some 4,000 Armenians in 1920.

OUT OF EDEN WALK · PART FIVE

GHOST LANDS

A century-old slaughter still haunts Turkey and Armenia.

The sturdy friendship between the Armenian Christian family of Nuran Taş (second from left) and the family of Nizamettin Çim, a Kurdish Muslim (center rear), whose grandfather helped shelter the Taşes from intolerance, offers a

counterpoint to a history of ethnic tension in eastern Turkey, where the Armenian population was mostly killed or expelled during World War I. The Armenian and Turkish governments have yet to kindle such trust and amity.

By Paul Salopek • Photographs by John Stanmeyer

One million Armenians—some say more, some say less—were killed a century ago in the Ottoman Empire, the predecessor of modern Turkey.

A stone cenotaph in Yerevan, the capital of Armenia, commemorates this tragic event: the Medz Yeghern, or "great catastrophe," of the Armenian people. Each spring—on April 24, when the pogroms started—many thousands of pilgrims climb an urban hill to this shrine. They file past an eternal flame, the symbol of undying memory, to lay a small mountain of cut flowers. Just 60 miles to the northwest, and a few hundred yards across the Turkish border, lie the ruins of an older and perhaps more fitting monument to the bitterness of the Armenian experience: Ani.

What is Ani? Ani was the medieval capital of a powerful, ethnically Armenian kingdom centered in eastern Anatolia—the sprawling Asiatic peninsula that today makes up most of Turkey—and straddling the northern branches of the Silk Road. It was a rich metropolis that hummed with 100,000 souls. Its bazaars overflowed with furs, with spices, with precious metals. A high wall of pale stone protected it. Renowned as the "city of 1,001 churches," Ani rivaled the glory of Constantinople. It represented the flowering of Armenian culture. Today it crumbles atop a remote, sun-hammered plateau—a scattering of broken cathedrals and empty streets amid yellow grasses, a desolate and windblown ruin. I have walked to it. I am walking across the world. I am retracing, on foot, the pathways of the first ancestors who abandoned Africa to wander the world. I have seen no place on my journey more beautiful or sadder than Ani.

"They don't even mention the Armenians," marvels Murat Yazar, my Kurdish walking guide.

And it is true: On the Turkish government placards erected for tourists, the builders of Ani go unnamed. This is intentional. There are no Armenians left in Ani. Not even in official histories. So just as Tsitsernakaberd hill in Yerevan calls to remember, Ani is a monument to forgetting.

Last year the Armenian Apostolic Church, one of the world's oldest Christian communities, made saints of all the victims of the genocide of Armenians under the Ottoman Empire, the sprawling and multiethnic state that gave rise to modern Turkey. A veiled woman attends the canonization ceremony in Ejmiatsin, Armenia.

ONE OF THE OLDEST and most intractable political disputes in the world—a toxic standoff that has locked Armenia and Turkey in acrimony, in enmity, in nationalist extremism for generations—can be reduced to the endless parsing of three syllables: genocide. This word is freighted with alternative meanings, with shadings, with controversy. It is codified by the United Nations as one of the worst of crimes: the attempt to obliterate entire peoples or ethnic, racial, or religious groups. And yet when does it apply? How many must be slaughtered? How to weigh action versus intent? By what ghastly accounting?

The Armenian version of events: The year is 1915. World War I is nine months old. Europe is herding its young into the fires. The vast and multicultural Ottoman Empire—the world's most powerful Muslim polity—has allied itself with Germany. A large Christian Armenian minority, once so peaceful and trusted as to be labeled by the sultans as the *millet-i sadıka,* or loyal nation, is wrongfully accused of rebellion, of siding with the Russian enemy. Some Ottoman leaders decide to resolve this "Armenian problem" through extermination and deportation. Soldiers and local Kurdish militias shoot Armenian men. There are mass rapes of women. Armenian villages and city neighborhoods are looted, appropriated. The dead clog the rivers and wells. Cities stink of rot. The survivors—ragged columns of women

and children—straggle at bayonet point into the waterless deserts of neighboring Syria. (Today just three million Armenians live in Armenia; eight to ten million are scattered in diaspora.) The Armenian population in the Ottoman Empire drops from about two million to fewer than 500,000. Most historians call this subtraction the modern world's first true genocide.

"I am confident that the whole history of the human race contains no such horrible episode as this," wrote Henry Morgenthau, Sr., the U.S. ambassador to Constantinople at the time. "The great massacres and persecutions of the past seem almost insignificant when compared with the sufferings of the Armenian race in 1915."

Turkish authorities categorically deny this account. Their version of the "so-called genocide" goes like this: It is a time of supreme madness in history, a time of civil war. Armenians suffer, it is true. But so do many other groups trapped inside the Ottoman Empire as it splinters during the Great War: ethnic Greeks, Syriac Christians, Yazidis, Jews—even the Turks themselves. Blood flows in all directions. There is no systematic extermination plan. And the Armenian death tolls are exaggerated, fewer than 600,000. Moreover, many Armenians are in fact traitors: Thousands join the armed ranks of invading coreligionists, the imperial Russian Army.

Challenging this official view still carries risks in Turkey. Though prosecutions have eased, Turkish judges deem the term "genocide" provocative, incendiary, insulting to the nation. When speaking of the Armenian calamity, even such luminaries as Orhan Pamuk, the Turkish novelist and Nobel Prize winner, have faced charges of denigrating Turkishness or the Turkish state.

"It is our hope and belief," then Prime Minister Recep Tayyip Erdoğan declared in a carefully worded speech in 2014, "that the peoples of an ancient and unique geography, who share similar customs and manners, will be able to talk to each other about the past with maturity and to remember together their losses in a decent manner."

What is the special power of this word "genocide"?

The Armenian diaspora has spent decades funding lobbying campaigns to urge the governments of the world to deploy this term when describing what occurred under the Ottomans.

A toxic standoff that has locked Armenia and Turkey in nationalist extremism for generations can be reduced to the endless parsing of three syllables: genocide.

In Diyarbakır, a Kurdish city in eastern Turkey, I am conducting an interview at a newly reopened Armenian church—a small, fragile gesture of Turkish-Armenian conciliation—when a man strides up to me.

"Do you recognize the genocide?" he demands. He is Armenian. He is agitated. He peers into my eyes.

I am startled. I'm working, I tell him.

"I don't care," he says. "Do you or don't you recognize the genocide?"

I put down my pen. He repeats his question, over and over. He is telling me: I am not a ghost.

THE QUESTION OF MEMORY: Never forget. But of course we do. Eventually we always forget.

"People have been making war for thousands of years," observed the Polish journalist and writer Ryszard Kapuściński, "but each time it is as if it is the first war ever waged, as if everyone has started from scratch."

Empires and Exile

Caught between the collapsing Russian and Ottoman Empires, the region then known as the Armenian highlands—now eastern Anatolia—lost nearly all its Armenians within a decade of the start of World War I. Historians estimate that 500,000 to 1.5 million of them were killed or displaced in what Armenians call a genocide, a claim rejected by Turkey.

Paul Salopek's 21,000-mile trek traverses areas where long-ago events are a source of present-day tensions.

Paul Salopek's walking route*
Political boundaries, 1915
Armenian population of at least 12 percent, circa 1915**

RUSSIA
Caspian Sea
CAUCASUS MOUNTAINS
GEORGIA
RUSSIAN EMPIRE
Black Sea
Tbilisi
Nov. 11, 2015
LESSER CAUCASUS
Akhaltsikhe
Samsun
Merzifon
Giresun
Trabzon
Jardi Dzor
Gyumri
Ani
ARMENIA
Yerevan
AZERBAIJAN
1994 cease-fire line
Oltu
Bagaran
Ejmiatsin (Echmiatsin)
Erzurum
Ağrı
Mt. Ararat (Ağrı Dağı) 16,854 ft 5,137 m
AZERB.
NAGORNO-KARABAKH
Yozgat
Sivas
Erzincan
ANATOLIA
TURKEY
Kangal
Patnos
Taşkale
Kayseri
Muş
Lake Van
Van
Çalışırlar
Bitlis
Cüngüş
Diyarbakır
Batman
Adıyaman
Siverek
Oct. 6, 2014
Euphrates
Pozantı
Adana
Mersin
OTTOMAN EMPIRE
PERSIA
Mosul
Tigris
HATAY
Aleppo
Musa Dağ 4,446 ft 1,355 m
SYRIA
IRAQ
Kirkuk
Travel by boat
Medit. Sea
Homs
IRAN
LEBANON

Turning Point
Turks and Armenians lived together mainly peaceably for centuries. But in 1914 Turk nationalists sided with Germany and began to fear Armenian collusion with the Russian Empire.

Frozen Conflict
Ethnic Armenians have controlled Nagorno-Karabakh since a 1994 cease-fire between Azerbaijani and Armenian forces. Azerbaijan still claims the disputed region.

0 mi 100
0 km 100

*TO REPORT THIS STORY, SALOPEK MADE A SIDE TRIP TO ARMENIA AND NAGORNO-KARABAKH.
**OUTLINE FOLLOWS ADMINISTRATIVE BOUNDARIES WITHIN THE OTTOMAN AND RUSSIAN EMPIRES.

LAUREN C. TIERNEY, NGM STAFF. SOURCES: OTTOMAN EMPIRE 1914 CENSUS FIGURES (BY RELIGION); RUSSIAN EMPIRE 1897 CENSUS FIGURES (BY LANGUAGE)

On April 24, 2015, the hundredth anniversary of the beginning of a mass slaughter that many historians label the first genocide of the modern era, crowds join a torchlight procession through the Armenian capital of Yerevan to

honor the dead. During the annual commemoration, part somber memorial and part nationalist rally, the grieving can turn overtly political—participants sometimes burn Turkish flags.

Nektar Alatuzyan, 102, was a year old when the massacres and deportations of Armenians began in Turkey. Her family, rescued from a coastal mountain in southern Turkey by a French warship, escaped to Egypt; in 1947 she, her husband,

and their children settled in Armenia. The last eyewitnesses of what Armenians call Medz Yeghern—the "great catastrophe"—are deemed living treasures in Armenia. A dwindling few remain to tell their families' stories.

In a town outside of Yerevan a shrunken old man slumps on a couch. His name is Khosrov Frangyan. He is bundled against the nonexistent cold—in blankets, in a pile jacket, in a knit cap, with socks pulled over his gnarled hands—because his heart and veins are antique. He is 105 years old. He is one of the last living survivors of the Armenian massacres. These frail elders, now mostly gone, are cherished as national heroes in Armenia. Because they are the last palpable links to the crime of 1915. Because they are a breathing rebuke to denial. They have repeated their stories so many times that their delivery seems dry, remote, rote—worn as smooth as well-rubbed coins.

"I was five when the Turks came," Frangyan rasps. "They chased us up the mountain."

He recounts his story in shards. It is a fabled incident from the genocide. Some 4,700 residents of six Armenian villages in what is now southern Turkey fled up a coastal mountain called Musa Dağ. They rolled rocks down on their Turkish pursuers. They held out for more than 40 days. The desperate survivors waved a handmade banner at ships steaming past along the Mediterranean shore. "CHRISTIANS IN DISTRESS—RESCUE." By some miracle French warships saved them and carried them off to Egypt, to exile.

Frangyan's brown eyes are watery and red rimmed. He does not dwell, as some Armenian witnesses do, on the horrors, on the summary executions of parents in front yards, on mass rapes, on decapitations. No. His voice rises as he recalls instead the fruits of his lost village: "The gardens! My grandfather had figs—each tree was 50 meters high! I want to eat those bananas now! I want to keep the memory of those bananas!" Frangyan's middle-aged daughter shakes her head. She apologizes. The old man gets confused, she says. But he is not confused. I have been to his homeland in Hatay Province, Turkey. I have stood near his old village amid orchards lush with tangerines and lemons. It is indeed a subtropical paradise. And I have peered from a hilltop overlooking the same blue sea where the warships dropped anchor. His chance salvation reminded me, unreassuringly, of the conclusion to that novel of human evil *Lord of the Flies:* How adults finally splashed ashore on a remote island of innocent, castaway children—children who had devolved, unsupervised, into murderers—to save the day.

When does a genocide officially end? At which point is the act of mass annihilation complete—finished, documented, resolved?

A century ago the French Navy rescued Frangyan and his family. But who will save the French sailors from human darkness? And who will rescue the rest of us?

I WALK OUT OF AFRICA. I follow the footsteps of our Stone Age ancestors. Wherever these pioneers appeared, other resident hominins disappeared. They vanished.

In eastern Turkey I walk by derelict Armenian farmhouses. Trees sprout from their rubble, their roofless rooms. I walk past old Armenian churches converted to mosques. I sit in the mottled shade of walnut orchards planted by the long-ago victims of death marches.

"We fought the Armenians, and many died," says Saleh Emre, the gruff, white-haired mayor of the Kurdish village of Taşkale. He suddenly softens. "I think this was wrong. They belonged here."

Mount Ararat, a powerful symbol of Armenian identity, looms over children at play in eastern Turkey. Redrawn borders after World War I left it inside Turkey, to the dismay of Armenians. Today Ararat is a fixture of Yerevan's southern skyline—seemingly so close, yet locked beyond a border shut by controversy, pain, and history.

Muslim Kurds occupy a strange place in the violent history of eastern Turkey. From a frontier gendarmerie who did the Ottomans' dirty work a century ago, they have become a besieged ethnic minority, demanding more political rights in modern Turkey. Victimhood now binds many Kurds to their long-departed Armenian neighbors.

Emre says his family acquired the land for his village from Armenians. It came very cheap. He lets this fact sink in. He ticks off the names of nearby towns that once were majority Armenian: Van, Patnos, Ağrı. Few or no Armenians live in them now.

When does a genocide officially end? At which point is the act of mass annihilation complete—finished, documented, resolved? Surely not when the gunfire stops. (This is far too soon.) Is it when the individual dead disappear from the chain of human memory? Or when the last emptied village acquires a new population, a new language, a new name? Or is it sealed, at long last, with the onset of regret?

My guide, Murat Yazar, and I inch northward. We trek across yellowing steppes where wolves run before us, pausing to gaze back over their shoulders in silence, then trot on. We pass Mount Ararat. The 16,854-foot peak shines to the east, smeared white with snow. The Bible links the mountain to Noah's high-altitude anchorage. The beautiful volcano is sacred to the Armenians. (A popular misconception

The archways of the crumbling Surp (Saint) Garabed Church in Çüngüş, eastern Turkey, hint at the former heights of Armenian culture here. Many old churches have fallen to ruins or been converted into mosques in the former Armenian

heartland. But grassroots attempts at reconciliation, often led by Turkey's minority Kurds, have also helped rebuild one of the largest Armenian churches in the Middle East, in the city of Diyarbakır.

Arif Oruç (far right) and his Armenian family, who are Muslim, live a prosperous life near Batman, Turkey. A century ago thousands of Armenians converted to Islam to save their lives—or became Muslims as orphaned children adopted by

Turkish and Kurdish families. As the debate over what to call the massacres of Armenians becomes a topic of more broad-minded discussion in Turkey, descendants of “hidden Armenians” are grappling with their past for the first time.

has it that Armenian Apostolic priests even wear caps shaped like Ararat's cone.) In August 1834 the Russian meteorologist Kozma Spassky-Avtonomov climbed to the mountain's icy summit. Ararat towers so high that he thought he might see stars twinkling during the daytime. His expedition was the perfect Anatolian quest: He was trying to discern what is always there yet invisible. This is a landscape haunted by absences.

"CHOSEN TRAUMA" IS HOW the political psychologist Vamık Volkan describes an ideology—a worldview—by which grief becomes a core of identity. It applies to entire nations as well as individuals. Chosen trauma unifies societies brutalized by mass violence. But it also can stoke an inward-looking nationalism.

I slog across the Lesser Caucasus Mountains from Turkey into the republic of Georgia. I throw stones to knock frozen apples from bare trees. Pausing in Tbilisi, I ride a night train to Yerevan. It is April 24, the hundredth anniversary of the Armenian genocide.

Billboards festoon the Armenian capital. One shows weapons—a scimitar, a rifle, a hatchet, a noose—arrayed to spell out "1915." Another bluntly pairs an Ottoman fez and "Turkish" handlebar mustache with Adolf Hitler's brush mustache and comb-over. The least combative symbol of mourning is the most poignant: forget-me-not flowers. Millions of violet petals brighten Yerevan's parks and medians. The corollas are reproduced on banners, on stickers, on lapel pins: a blossom of genocide. "I remember and demand"—this is the slogan of the commemoration.

But demand what?

This is the key question that Armenians are asking themselves. Is the past a guide? Or is it a trap?

Apostolic Bishop Mikael Ajapahian, of the Armenian city of Gyumri: "In Armenia there is no enmity toward Turkey. We hold nothing against ordinary Turks. But Turkey must do everything—everything—to heal the wounds."

Elvira Meliksetyan, women's rights activist: "We don't know what we want. If everything reminds us of our past burdens, then we lose the future, no? We have no strategy. All this victimization makes us beggars."

Ruben Vardanyan, billionaire philanthropist: "A hundred years later we are the winners. We survived. We are strong. So saying thank you, giving back something to the people who saved us, including Turks, is the next step. A hundred years ago some of their grandparents saved our grandparents. We need to connect those stories." (Vardanyan has funded an award, the Aurora Prize, to honor unsung heroes who rescue others from genocide.)

'If everything reminds us of our past burdens, then we lose the future, no? All this victimization makes us beggars.' Elvira Meliksetyan, women's rights activist

There is a torchlight march. There are photo exhibits. There is a concert by an Armenian-diaspora rock band from Los Angeles. ("This is not a rock-and-roll concert! To our murderers, this is revenge!") The Tsitsernakaberd with its eternal flame—the hilltop monument to the dead—is crowded with diplomats, academics, activists, ordinary people. At a genocide-prevention conference, an American historian dryly lays out the case for Turkish reparations. It is "not an absurd or immaterial proposition," he suggests, for Turkey to cede the six traditionally Armenian provinces of the Ottomans

to Armenia. (Germany has paid more than $70 billion in compensation to the victims of Nazi atrocities.)

The most wrenching story I hear on my Armenia side trip comes from a young man with eyes like open manholes.

"I was just a baby, maybe one year old. I was dying in the hospital. I had pneumonia—I think it was pneumonia. The doctors could do nothing. A Turkish woman in the maternity ward noticed my mother crying. She asked my mother if she could hold me. She unbuttoned her dress. She took me by my ankles and lowered me down the front of her body. It was like she was giving birth to me all over again. She did this seven times. She said prayers. She shouted, 'Let this child live!'"

And?

"I got better." He shrugs. "The Turk saved my life."

Ara Kemalyan, an ethnic Armenian soldier, tells me that story inside a frontline trench about 150 miles southeast of Yerevan. There are *pocks* of distant gunfire. A dusty white sun. Rusty cans hang on barbed wire—a primitive alarm system against infiltrators. For more than 20 of his 38 years Kemalyan, a fighter from the breakaway region of Nagorno-Karabakh, has been squared off against soldiers—his former friends and neighbors—from the central government of Azerbaijan, a secular Muslim state. Up to 30,000 people, mostly civilians on both sides, have died in the violence over Nagorno-Karabakh since the late 1980s, and hundreds of thousands have been displaced. This poisonous little war, paralyzing the Caucasus, has virtually nothing to do with the older violence under the Ottomans. Yet Kemalyan still dubs the woman in the hospital, the Azerbaijani midwife who saved him with magic, an enemy "Turk." The specters of 1915 have occupied his heart.

BEFORE WALKING OUT of these ghost lands, I revisit Ani. The medieval ruin in Turkey. The monument to denial. This time I see it from the Armenian side of the frontier.

The closed Armenia-Turkey border is one of the strangest boundaries in the world. Turkey shut its land crossings in 1993 out of sympathy with Azerbaijan in the Nagorno-Karabakh war. The Armenian side also remains sealed, owing in part to pressure from the diaspora against normalizing relations with Turkey. The result: Roads traversing a storied intersection of the globe—a fulcrum point between Asia and Europe—go nowhere. A train station on the Armenian side has not seen a locomotive pass in 22 years. A sleepy clerk sweeps the station office once a day while the rails silently rot. (A ghost airline does fly direct between Armenia and Turkey; it operates from a nondescript office in Yerevan.) As a result, the economies of both countries suffer. People on both sides of the line are cut off, isolated, poorer.

The Russian Army guards the Armenian side of the border with Turkey as part of a mutual-defense pact. This is how Moscow maintains influence in the strategic region. The sight is surreal: Strands of Armenian barbed wire, Russian watchtowers, and checkpoints face open fields in Turkey, which demilitarized its side of the border many years ago. Russian and Armenian troops face off against Turkish shepherds. The shepherds wave.

"I always keep my kitchen fire lit," says Vahandukht Vardanyan, a rosy-cheeked Armenian woman whose farmhouse sits across the barbed wire from Ani. "I want to show the Turks that we're still here."

I climb an overlook by her home where Armenian pilgrims disembark from buses. These tourists come to gaze longingly across a fence at their ancient capital in Anatolia. I look too. I see exactly where I stood months earlier in Turkey. A ghost of my earlier self roams those ruins. Nothing separates any of us except an immense gulf of loneliness. □


MATTHIEU CHAZAL

Follow National Geographic Fellow **Paul Salopek** on his seven-year walk around the world at *national geographic.com/edenwalk,* where he posts personal dispatches and photographs from his journey.

Pastoralists in southeastern Turkey push sheep into pastures that have known the calls of Kurdish, Armenian, Arab, and Turkish shepherds. The Ottoman Empire, a patchwork of ethnicities and once a great cultural entrepôt, combusted

during World War I in the flames of ultranationalism. Today tens of thousands of Armenians live openly in Turkey—a tiny number compared with the three million in Armenia and the estimated eight to ten million in the global diaspora.

Picnicking at night beneath apricot trees—and a giant cross shining defiantly into Turkey—villagers in the border town of Bagaran, Armenia, belt out songs of memory, cultural endurance, and survival. The bitter dispute between Armenia and

Turkey dating back four generations has paralyzed economic, diplomatic, and political progress in the region. The ancient crossroads between Turkey's eastern highlands and the Caucasus remains in the thrall of ghosts.

93 Days of Spring

Story and Photographs by
JIM BRANDENBURG

There's no place like home. In life and in photography, a closer look at the familiar can often reveal truth and beauty. This series of 93 days of spring in my home state of Minnesota is no exception.

Shooting locally may seem counterintuitive to some. Cameras seek the exotic, and for good reason—novelty is inspiring. As a *National Geographic* photographer for more than three decades, I've made millions of images in far-flung places—majestic African landscapes, remote groups of indigenous people, lively street scenes in Paris.

But sometimes the most revealing photographs are of the places we know best. When you shoot an area you know in your bones, as I do the North Woods and prairies of Minnesota, it touches on something primal. Familiarity and intimate knowledge of the subject come to light and manifest themselves in the frame.

I was born in the southwestern part of the state—a

DAY 84 | SWALLOWTAIL BUTTERFLY ON BIRCH TREE

flat, featureless landscape dominated by corn and soybean fields. It's not exactly a location brimming with compelling imagery. But learning to make photographs on the prairie may have been a blessing for me: I was weaned on looking carefully. The visual language I employ today—my photographic voice—was born in this minimal landscape of "fly-over country."

Like the two other season-specific series I've produced, this one has been a near-transcendental experience for me. Each image I make feels like a prayer flag I've hung out to the universe—a celebration of nature's wonder. I hope some of that is revealed here.

I'm drawn to limitations. So when I started this series, I thought I'd shoot it the same way as an earlier one: by restricting myself to one image a day, simply and minimally. I would shoot like a Japanese Zen master calligrapher who observes a sheet of paper, then makes one simple gesture. And I'd make each image at exactly noon. As photographers know, noon light is the worst light of the day—a time to put away the camera and take a nap.

But after two weeks my self-imposed limit began to feel artificial, even cruel. I was missing precious light and moments. So I decided to shoot in a more joyous way, driven by aesthetics rather than the clock.

Most of these photographs were intuitive and unplanned. Sometimes I'd see a subject and say, This orchid isn't quite in full bloom, I'll come back later. But spontaneity was the standard.

This project began on the 2014 vernal equinox and ended on the day before summer solstice. Minnesota weather can vary greatly in spring. When the season begins, there's deep snow in the north and temperatures are as low as -30°F. Then it climbs, often to uncomfortable heights. Record highs and lows have ranged a full 140 degrees.

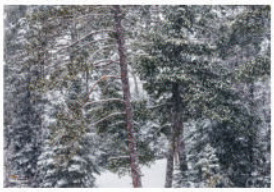
I took these photos in the state's four main ecological zones: tallgrass aspen parkland, prairie grassland, deciduous forest, and coniferous forest. Many of the images have a strong narrative. For instance, I'd been watching an eagle nest for five years but had never photographed it. Then on day 50, on my way to finally shoot it, I saw an eagle floating in a pond nearby. It had been hit by a car. My heart broke as I watched it

hang its head and die in the water. The next shot (day 51) shows the eagle's mate waiting in vain near their nest. It waited for days.

Other frames record happier experiences. Days 91 and 93 were made at Touch the Sky Prairie—a thousand-acre preserve I established in 2002. It's one of the few large unplowed pieces of land in the region. I was born on a farm just a mile away, and I made some of my very first photographs there when I was 14. I've come full circle. I've come home again.

NGM MAPS. SOURCE: MINNESOTA DEPARTMENT OF NATURAL RESOURCES

DAY 1 | MINK TRACKS, REFLECTED SUN



DAY 2 | SNOWFALL ON PINES AND SPRUCE

DAY 3 | LYNX TRACKS

DAY 4 | RED SQUIRREL

DAY 5 |

DAY 7 | ICE PATTERNS

DAY 8 | BLACK-CAPPED CHICKADEE

DAY 9 | CANADA ON THE HORIZON

DAY 10 | KAWISHIWI FALLS

DAY 11 |

DAY 13 | GOLDFINCHES AND PINE SISKIN (CENTER)

DAY 14 |

DAY 18 |

DAY 22 |

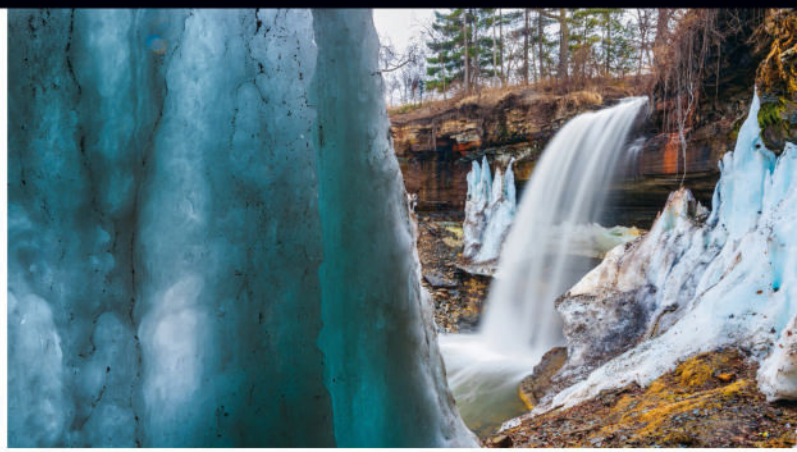
DAY 26 |

WHITE PINE

DAY 6 | DEAD TREE TRUNKS

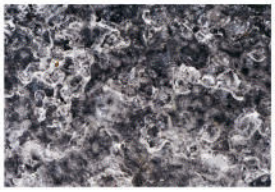
SHADOWS ON SNOW

DAY 12 | BLACK SPRUCE



DAY 31 | THAWING WATERFALLS

SNOWDRIFTS



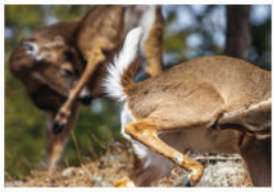
DAY 15 | ICE PATTERNS CLOSE-UP

DAY 16 | GRASS AND SNOW

DAY 17 | BALD EAGLE

THAWING CREEK

DAY 19 | RAINDROPS ON RED PINE NEEDLES



DAY 20 | WHITE-TAILED DEER

DAY 21 | THAWING LAKE

| WHITE PINES AND CLOUDY SKY

DAY 23 | JUDD LAKE, CLIFF WITH LICHEN

DAY 24 | RED PINE GROVE

DAY 25 | THIN ICE, SNOWBANK LAKE

| OTTER CATCHING FISH

DAY 27 | FROZEN WATERFALL

DAY 28 | PURPLE FINCH

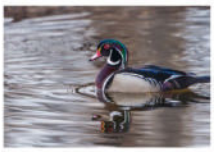
DAY 29 | GOLDFINCH

Sometimes the most revealing photographs are of the places you know in your bones—as I do the North Woods and prairies of Minnesota.

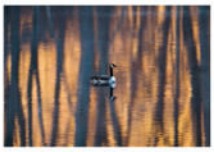
PHOTOS FOR DAYS 5, 9, 22, 64, AND 90 ARE INFRARED.

DAY 44 | WILLOW BRANCHES LEAFING OUT

DAY 30 | ICE RIDGES ON LAKE SUPERIOR

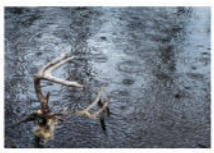


DAY 34 | MALE WOOD DUCK



DAY 38 | CANADA GOOSE

DAY 46 | TANGLED BRANCHES



DAY 52 | GARTER SNAKE ON DEER SKULL

DAY 53 | WILD TURKEYS

DAY 54 | WILLOW TREE

DAY 55 | CEDAR WAXWING

DAY 56 | TREES IN QUAKING BOG

DAY 60 | SUN AND SKY REFLECTED

DAY 61 | LAKE SUPERIOR, ROCKY BEACH

DAY 62 | WHITE PINE

DAY 63 | DEER SKELETON

DAY 64 | JUDD LAKE

DAY 42 | WHITE PELICANS PREENING

DAY 32 | PASQUEFLOWERS

DAY 33 | TRUMPETER SWANS

DAY 36 | WOOD DUCKS IN RAIN

DAY 37 | RED-WINGED BLACKBIRD, CATTAILS

I made all the images in this series in the state's four main ecological zones: tallgrass aspen parkland, prairie grassland, deciduous forest, and coniferous forest. I began on the vernal equinox and ended on the day before the summer solstice.

DAY 39 | GREAT EGRET

DAY 40 | DRIED GRASSES BLOWING IN WIND

DAY 41 | DUCKS IN SPRING SNOW

DAY 43 | GREAT EGRET

DAY 45 | YELLOW-RUMPED WARBLER

DAY 47 | DUTCHMAN'S-BREECHES

DAY 48 | CANADA GEESE

DAY 49 | PRAIRIE FIRE

DAY 50 | BALD EAGLE TAKING LAST BREATH

DAY 51 | BALD EAGLE WAITING FOR MATE

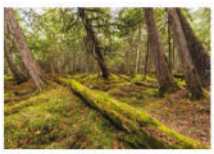
DAY 57 | SPRING FLOODING

DAY 58 | LAKE SUPERIOR

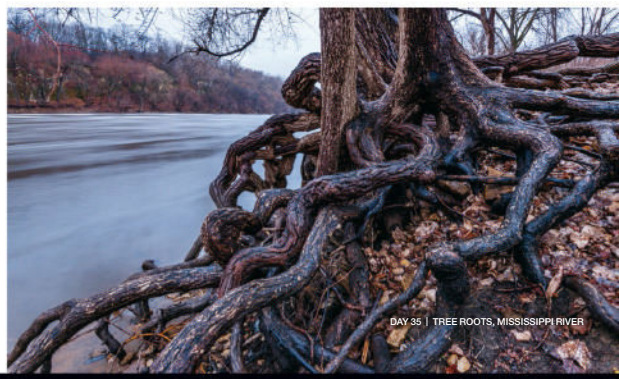
DAY 59 | DISCOVERY LAKE

DAY 65 | REFLECTION IN WATERFALL

DAY 66 | HANGING BIRCH BARK



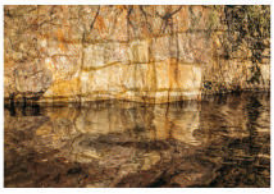
DAY 68 | WHITE CEDAR



DAY 35 | TREE ROOTS, MISSISSIPPI RIVER

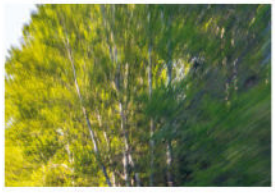
Each image I make feels like a prayer flag I've hung out to the universe—a celebration of nature's wonder. I hope some of that is revealed here.

Jim Brandenburg's new book on spring in Minnesota, *The Awakening*, will be published this year.



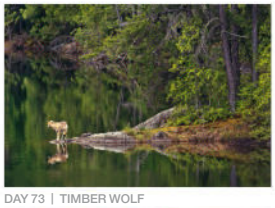
DAY 69 | CLIFF REFLECTED IN LAKE

DAY 70 | MARSH MARIGOLDS



DAY 71 | BIRCH TREES

DAY 72 | COMMON MERGANSER

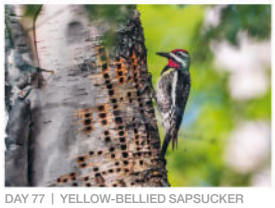


DAY 73 | TIMBER WOLF

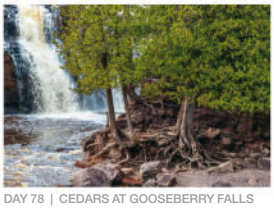
DAY 74 | COMMON LOON

DAY 75 | CLOUDY SKY, SECTION 12 LAKE

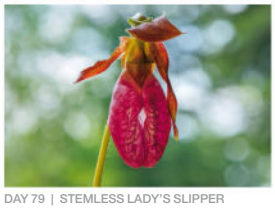
DAY 76 | COLUMBINE



DAY 77 | YELLOW-BELLIED SAPSUCKER

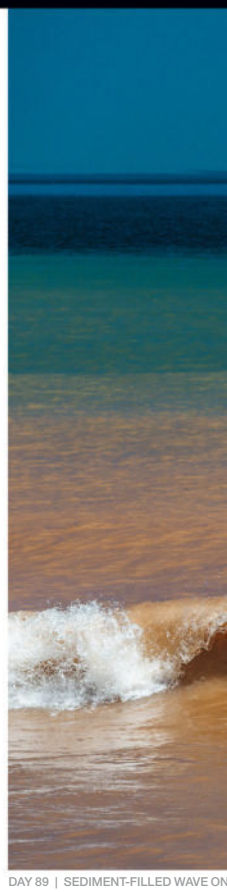


DAY 78 | CEDARS AT GOOSEBERRY FALLS

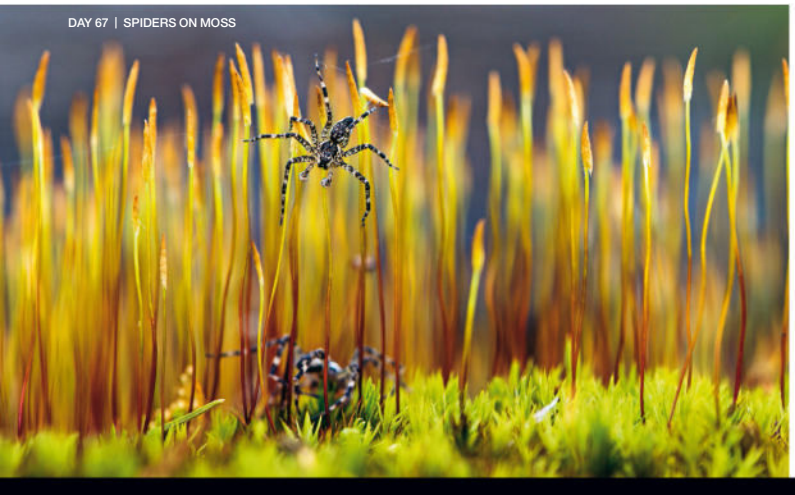


DAY 79 | STEMLESS LADY'S SLIPPER

DAY 80 | BLACKBURNIAN WARBLER

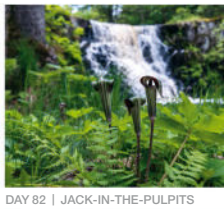


DAY 89 | SEDIMENT-FILLED WAVE ON

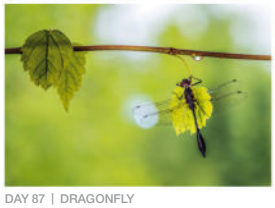


DAY 67 | SPIDERS ON MOSS

DAY 81 | WOLF SPIDERS, LICHEN



DAY 82 | JACK-IN-THE-PULPITS

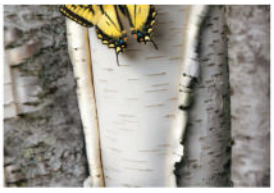


DAY 87 | DRAGONFLY

DAY 88 | HEAVY RAIN ON ROOKIE PO

I LAKE SUPERIOR

DAY 83 | RAM'S-HEAD LADY'S SLIPPERS



DAY 84 | SWALLOWTAIL BUTTERFLY

DAY 85 | LEOPARD FROG, REINDEER MOSS

DAY 86 | BLACK SPRUCE

ND

DAY 90 | BISON, BLUE MOUNDS STATE PARK

DAY 91 | TOUCH THE SKY PRAIRIE

DAY 92 | BLUE MOUNDS STATE PARK

DAY 93 | SUNSET, TOUCH THE SKY PRAIRIE

In the Loupe

With Bill Bonner, National Geographic Archivist

Frontier Memories

It is 1890. The town of Mason, Texas—once a frontier outpost contested by settlers and Native American tribes—has become a thriving ranch community. This day, clearly, was one to preserve for posterity.

Although the photographer of this particular shot is unknown, its collector is famed. Noah Hamilton Rose (1874-1952) was a chronicler of the Old West. He collected thousands of images, from scofflaws and brigands to the townsfolk of Mason and other frontier hamlets on the cusp of the 20th century.

On this particular day, the people of Mason gathered to pose, their faces peering up at a distant lens. Perhaps it was a big news day: After all, perched atop the building housing the *Mason News* (inset) is a brave soul, waving a newspaper. He tips his hat, in honor of events now long forgotten. *—Eve Conant*

PHOTO: NOAH HAMILTON ROSE, NATIONAL GEOGRAPHIC CREATIVE

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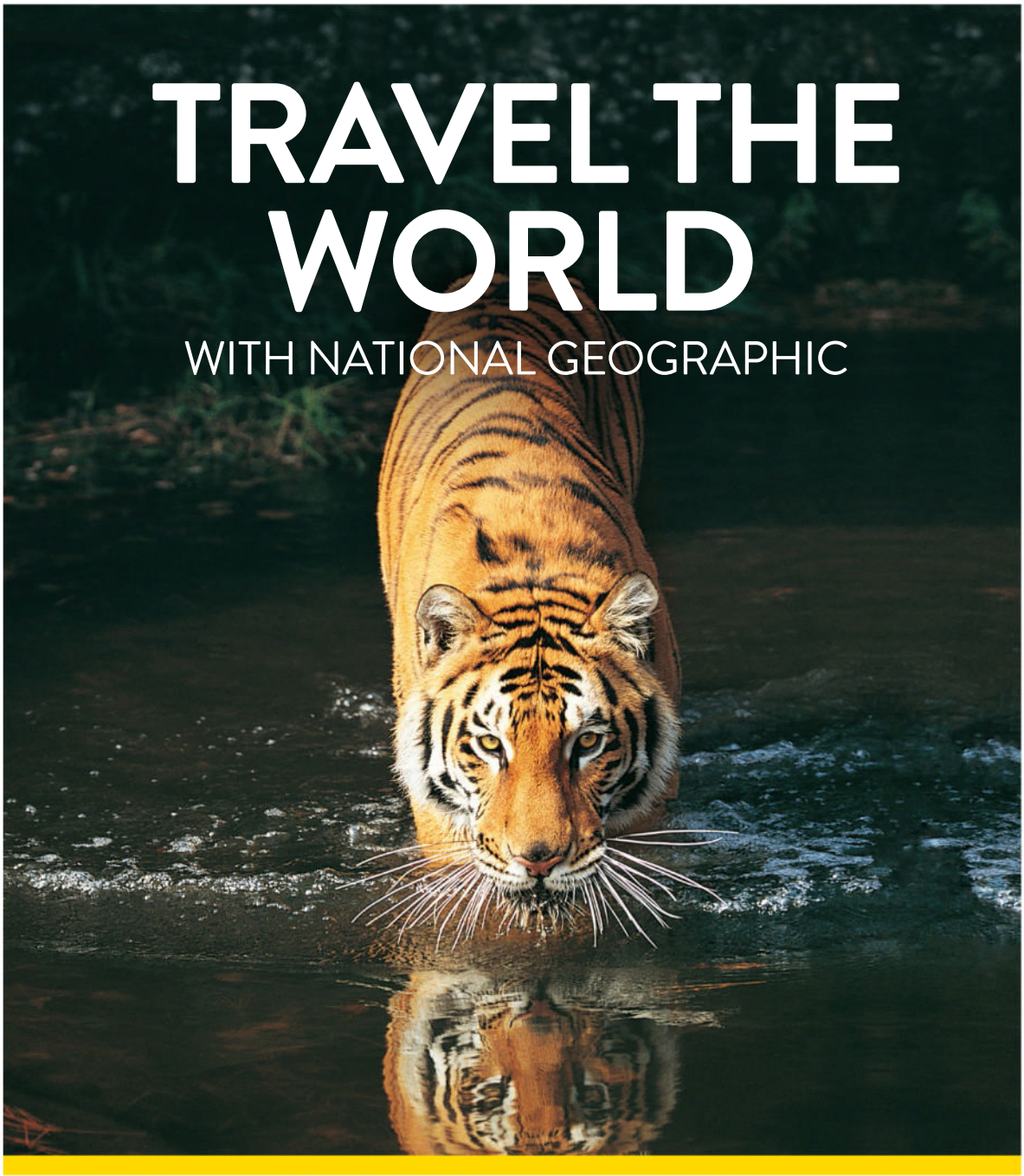
NATIONAL GEOGRAPHIC (ISSN 0027-9358) PUBLISHED MONTHLY BY NATIONAL GEOGRAPHIC PARTNERS, LLC, 1145 17TH ST. NW, WASHINGTON, DC 20036. ONE YEAR MEMBERSHIP: $39.00 U.S. DELIVERY, $44.00 TO CANADA, $51.00 TO INTERNATIONAL ADDRESSES. SINGLE ISSUE: $7.00 U.S. DELIVERY, $10.00 CANADA, $15.00 INTERNATIONAL. (ALL PRICES IN U.S. FUNDS; INCLUDES SHIPPING AND HANDLING.) PERIODICALS POSTAGE PAID AT WASHINGTON, DC, AND ADDITIONAL MAILING OFFICES. POSTMASTER: SEND ADDRESS CHANGES TO NATIONAL GEOGRAPHIC, P.O. BOX 62130, TAMPA, FL 33662. IN CANADA, AGREEMENT NUMBER 40063649, RETURN UNDELIVERABLE ADDRESSES TO NATIONAL GEOGRAPHIC, P.O. BOX 4412, STN. A, TORONTO, ONTARIO M5W 3W2. UNITED KINGDOM NEWSSTAND PRICE £5.99. REPR. EN FRANCE: EMD FRANCE SA, BP 1029, 59011 LILLE CEDEX; TEL. 320.300.302; CPPAP 0715U89037; DIRECTEUR PUBLICATION: D. TASSINARI DIR. RESP. ITALY; RAPP IMD SRL, VIA G. DA VELATE 11, 20162 MILANO; AUT. TRIB. MI 258 26/5/84 POSTE ITALIANE SPA; SPED. ABB. POST. DL 353/2003 (CONV L.27/02/2004 N.46) ART 1 C. 1 DCB MILANO STAMPA QUAD/GRAPHICS, MARTINSBURG, WV 25401. MEMBERS: IF THE POSTAL SERVICE ALERTS US THAT YOUR MAGAZINE IS UNDELIVERABLE, WE HAVE NO FURTHER OBLIGATION UNLESS WE RECEIVE A CORRECTED ADDRESS WITHIN TWO YEARS.



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