

Chasing
Lightning

Olympic
London

Tibet's
"Gold"

NGM.COM AUGUST 2012

NATIONAL GEOGRAPHIC



In the Spirit *of* Crazy Horse

REBIRTH OF A **SIoux** NATION

THE DRIVE THRU LINE
THE 2nd ER VISIT
THE CARPOOL
THE ORTHODONTIST VISIT
THE VALET HANDOFF
THE DRIVE TO PRACTICE
THE DRIVE TO THE GAME
THE "WE'RE LATE, JUST CHANGE ON THE WAY" SPRINT
THE SUMMER-FRIDAY DAYTRIP
THE CUT-OUR-OWN-CHRISTMAS-TREE OUTING
THE BACHELOR-PARTY WEEKEND
THE SNOW DAY
THE CAMPING TRIP
THE DRIVE OVER INDEPENDENCE PASS
THE "WE DON'T NEED AIRLINES" SUMMER VACATION
THE 18-HOURS STRAIGHT-THROUGH ROAD TRIP
THE TWO-LANE HIGHWAY PASS
THE SCENIC OVERLOOK
THE "HEY, LOOK, THERE'S A MOOSE" DRIVE-BY
THE WHITE-WATER RAFTING ADVENTURE
THE COLLEGE-FOOTBALL TAILGATE
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THE RUN TO THE DOG PARK
THE ROAD TRIP

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Still deeply affected by the 1890 massacre, the Oglala Lakota find new hope in old ways.

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A cloud-to-ground strike flashes through a shaft of rain near Elephant Butte, New Mexico. Story on page 98.

CARSTEN PETER

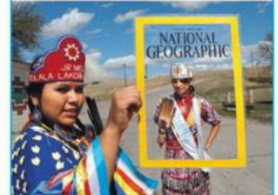


EXCLUSIVE ON THE IPAD



Lightning Video

A high-speed camera lets us show bolts in slo-mo.



Pine Ridge Audio and Video

Oglala Lakota speak of horses, poverty, and hope; strike a pose for our cover.

PHOTOS: CARSTEN PETER (TOP); AARON HUEY

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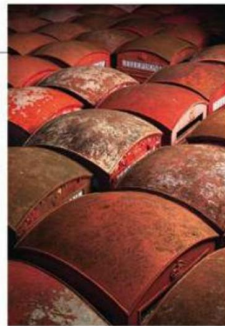
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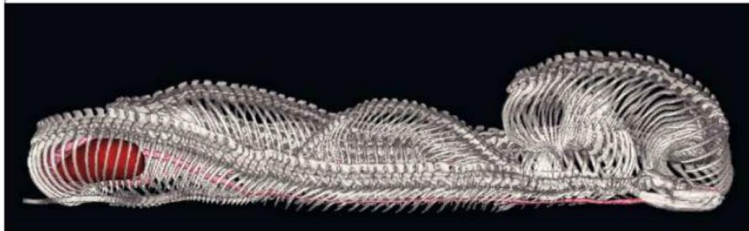
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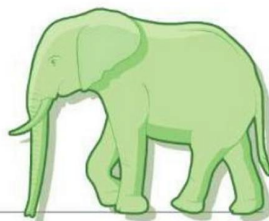


A Python's Growing Heart ▲

Mealtime makes the organ expand.

Supersize Me ▶

Scientists try to figure out how long it takes to evolve to elephantine size.



On the Cover

Horse races are part of the yearly Oglala Lakota commemoration of the 1876 victory over Lt. Col. George A. Custer, held near Manderson, South Dakota. Photo by Aaron Huey

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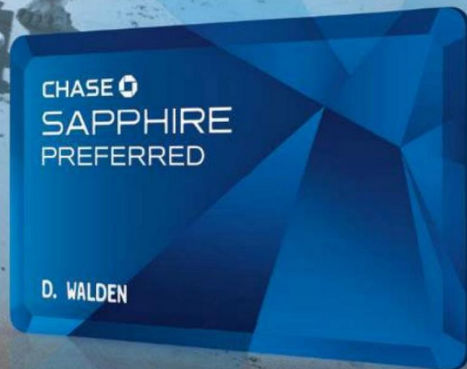
130 NG Connect
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2X POINTS ON TRAVEL

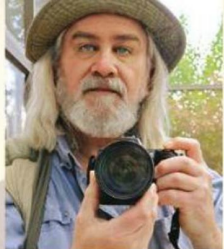
WHY NOT PRETEND THAT FOR JUST THIS WEEKEND
THERE'S NO SUCH THING AS WORK?



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Award-winning photographer Raymond Gehman's images have appeared in *National Geographic* and other publications. He lives in Waynesboro, Pennsylvania.

RAYMOND GEHMAN

My first national park memory dates back to when I was eight and my parents piled all of us kids into the car to spend the day on Skyline Drive in Shenandoah National Park. My dad took snapshots of the family posed in front of the overlooks. Fast-forward many years and I was working as a photojournalist for a large newspaper. One day, *National Geographic* called and offered me my first big assignment, documenting Yellowstone National Park through all four seasons. It was there that I discovered an affinity for photographing landscapes and wildlife.

I have shot nearly every national park in the country. This image from the Great Smoky Mountains National Park showcases Sugarland Mountain in spectacular autumn colors, viewed from the Chimney Tops Trail. The sun's backlighting brings a lively luminescence to the sea of trees. The national parks offer everyone a chance to experience America as it once was, a grand, mysterious, and challenging environment. When you climb to the top of a rocky peak, it allows you to connect with something much larger than yourself.

MY VIEW

Capturing Luminescence ^{IN}
Great Smoky Mountains
National Park

This is Raymond's view.
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Embracing the Spirit

On a windswept hill in South Dakota 25 years ago, in a small, traditional sweat lodge, I watched and photographed Robert Fast Horse and Ron Mousseau practicing a time-honored ritual in temperatures that would send most mortals fleeing. Seemingly oblivious to the scorching heat, they prayed and chanted as their Oglala Lakota forefathers had for generations. In embracing the ceremony known to them as *inipi*, or rite of purification, they were coping with the reality of living on the Pine Ridge Reservation, one of the poorest, most depressed regions of the United States.

They were coping as well with the scars left by one of the most brutal events in American history: the massacre at Wounded Knee, where Oglala men, women, and children were killed by members of the U.S. Seventh Cavalry Regiment on a winter day in 1890.

This month writer Alexandra Fuller and photographer Aaron Huey report that the spirit I witnessed in that sweat lodge is growing. The people of Pine Ridge still battle poverty, and—as Olowan Thunder Hawk Martinez, a 38-year-old activist, told Fuller—the weight of a tragic history continues to press down. But across the reservation there is a powerful resurgence of traditional values. It is nothing less than a spiritual rebirth, and with that comes hope. “When we honor our customs... we have everything we need to heal ourselves within ourselves,” Martinez said. I am certain she is right. I saw and felt the power of that rich culture myself, years ago, on that windswept hill in South Dakota.

They prayed
as their Oglala
Lakota fore-
fathers had.



Chief Oliver Red Cloud leads the parade at the annual Oglala Nation Pow Wow in Pine Ridge, South Dakota. The 94-year-old is a descendant of the famous Chief Red Cloud.

I DISCOVERED
SOUTH AMERICA'S
OLDEST INDIGENOUS TRIBES
AND ITS MOST
UNSPOILT BEACHES
MOUNTAIN BIKING
DOWN VOLCANOES
A LUXURY HOTEL
DEEP WITHIN THE
RAINFOREST
AND THE GALAPAGAN
FOUR EYED FISH IN
ECUADOR  **R** 



• SHINGLES VACCINE •

EXPLORE. EXERT. AS YOU GET OLDER, REALLY GREAT. BUT DON'T FORGET TO VACCINATE.

Now's the time to help prevent Shingles with ZOSTAVAX® (Zoster Vaccine Live).

ZOSTAVAX is a vaccine that helps prevent Shingles in adults 50 years of age or older. Shingles is caused by the same virus that causes chickenpox. The virus stays in your body and can resurface at any time as Shingles—a painful, blistering rash. And no matter how healthy you feel, your risk increases as you get older.



The sooner you get vaccinated with ZOSTAVAX, the better your chances of protecting yourself from Shingles. In fact, the ACIP* of the CDC (Centers for Disease Control and Prevention) recommends that appropriate adults 60 years of age and older get vaccinated to help prevent Shingles.

Talk to your health care professional to see if ZOSTAVAX is right for you.

ZOSTAVAX is given as a single shot. ZOSTAVAX cannot be used to treat Shingles, or the nerve pain that may follow Shingles, once you have it. For more information, visit ZOSTAVAX.com or call 1-877-9 SHINGLES.

ABOUT ZOSTAVAX

ZOSTAVAX is a vaccine that is used for adults 50 years of age or older to prevent Shingles (also known as zoster).

Important Safety Information


- ZOSTAVAX does not protect everyone, so some people who get the vaccine may still get Shingles.
- You should not get ZOSTAVAX if you are allergic to any of its ingredients, including gelatin or neomycin, have a weakened immune system, take high doses of steroids, or are pregnant or plan to become pregnant. You should not get ZOSTAVAX to prevent chickenpox.
- Talk to your health care professional if you plan to get ZOSTAVAX at the same time as PNEUMOVAX®23 (Pneumococcal Vaccine Polyvalent) because it may be better to get these vaccines at least 4 weeks apart.
- Possible side effects include redness, pain, itching, swelling, hard lump, warmth, or bruising at the injection site, as well as headache.
- ZOSTAVAX contains a weakened chickenpox virus. Tell your health care professional if you will be in close contact with newborn infants, someone who may be pregnant and has not had chickenpox or been vaccinated against chickenpox, or someone who has problems with their immune system. Your health care professional can tell you what situations you may need to avoid.

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.

Please read the Patient Information on the adjacent page for more detailed information.

*ACIP=Advisory Committee on Immunization Practices

Before you get Shingles, get vaccinated.

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VACC-1016603-0025 05/12

9989115

**Patient Information about
ZOSTAVAX® (pronounced “ZOS tah vax”)
Generic name: Zoster Vaccine Live**

You should read this summary of information about ZOSTAVAX before you are vaccinated. If you have any questions about ZOSTAVAX after reading this page, you should ask your health care provider. This information does not take the place of talking about ZOSTAVAX with your doctor, nurse, or other health care provider. Only your health care provider can decide if ZOSTAVAX is right for you.

What is ZOSTAVAX and how does it work?

ZOSTAVAX is a vaccine that is used for adults 50 years of age or older to prevent shingles (also known as zoster).

ZOSTAVAX contains a weakened chickenpox virus (varicella-zoster virus).

ZOSTAVAX works by helping your immune system protect you from getting shingles.

If you do get shingles even though you have been vaccinated, ZOSTAVAX may help prevent the nerve pain that can follow shingles in some people. ZOSTAVAX does not protect everyone, so some people who get the vaccine may still get shingles.

ZOSTAVAX cannot be used to treat shingles, or the nerve pain that may follow shingles, once you have it.

What do I need to know about shingles and the virus that causes it?

Shingles is caused by the same virus that causes chickenpox. Once you have had chickenpox, the virus can stay in your nervous system for many years. For reasons that are not fully understood, the virus may become active again and give you shingles. Age and problems with the immune system may increase your chances of getting shingles.

Shingles is a rash that is usually on one side of the body. The rash begins as a cluster of small red spots that often blister. The rash can be painful. Shingles rashes usually last up to 30 days and, for most people, the pain associated with the rash lessens as it heals.

Who should not get ZOSTAVAX?

You should not get ZOSTAVAX if you:

- are allergic to any of its ingredients.
- are allergic to gelatin or neomycin.
- have a weakened immune system (for example, an immune deficiency, leukemia, lymphoma, or HIV/AIDS).
- take high doses of steroids by injection or by mouth.
- are pregnant or plan to get pregnant.

You should not get ZOSTAVAX to prevent chickenpox.

Children should not get ZOSTAVAX.

How is ZOSTAVAX given?

ZOSTAVAX is given as a single dose by injection under the skin.

What should I tell my health care provider before I get ZOSTAVAX?

You should tell your health care provider if you:

- have or have had any medical problems.
- take any medicines, including non-prescription medicines, and dietary supplements.
- have any allergies, including allergies to neomycin or gelatin.
- had an allergic reaction to another vaccine.
- are pregnant or plan to become pregnant.
- are breast-feeding.

Tell your health care provider if you expect to be in close contact (including household contact) with newborn infants, someone who may be pregnant and has not had chickenpox or been vaccinated against chickenpox, or someone who has problems with their immune system. Your health care provider can tell you what situations you may need to avoid.

Can I get ZOSTAVAX with other vaccines?

Talk to your health care provider if you plan to get ZOSTAVAX at the same time as the flu vaccine.

Talk to your health care provider if you plan to get ZOSTAVAX at the same time as PNEUMOVAX®23 (Pneumococcal Vaccine Polyvalent) because it may be better to get these vaccines at least 4 weeks apart.

What are the possible side effects of ZOSTAVAX?

The most common side effects that people in the clinical studies reported after receiving the vaccine include:

- redness, pain, itching, swelling, hard lump, warmth, or bruising where the shot was given.
- headache

The following additional side effects have been reported with ZOSTAVAX:

- allergic reactions, which may be serious and may include difficulty in breathing or swallowing. If you have an allergic reaction, call your doctor right away.
- chickenpox
- fever
- hives at the injection site
- joint pain
- muscle pain
- nausea
- rash
- rash at the injection site
- swollen glands near the injection site (that may last a few days to a few weeks)

Tell your health care provider if you have any new or unusual symptoms after you receive ZOSTAVAX. For a complete list of side effects, ask your health care provider.

Call 1-800-986-8999 to report any exposure to ZOSTAVAX during pregnancy.

What are the ingredients of ZOSTAVAX?

Active Ingredient: a weakened form of the varicella-zoster virus.

Inactive Ingredients: sucrose, hydrolyzed porcine gelatin, sodium chloride, monosodium L-glutamate, sodium phosphate dibasic, potassium phosphate monobasic, potassium chloride.

This page summarizes important information about ZOSTAVAX. If you would like more information, talk to your health care provider or visit the website at www.ZOSTAVAX.com or call 1-800-622-4477.

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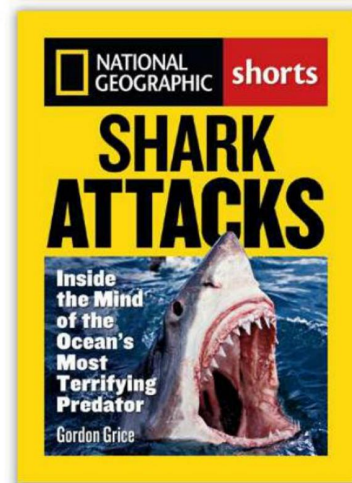
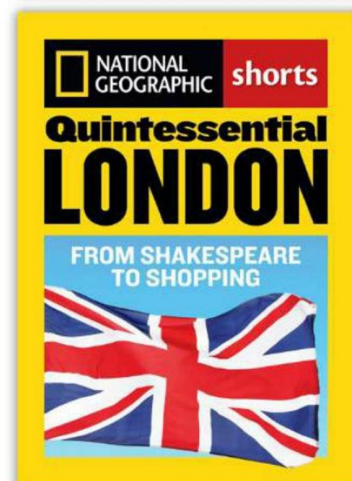
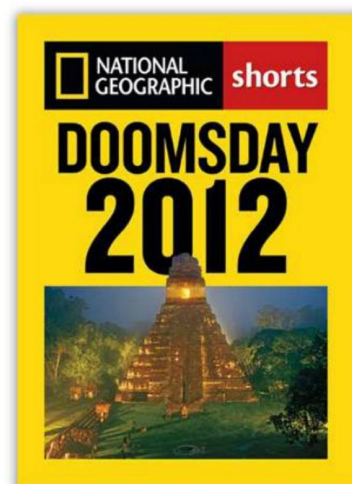
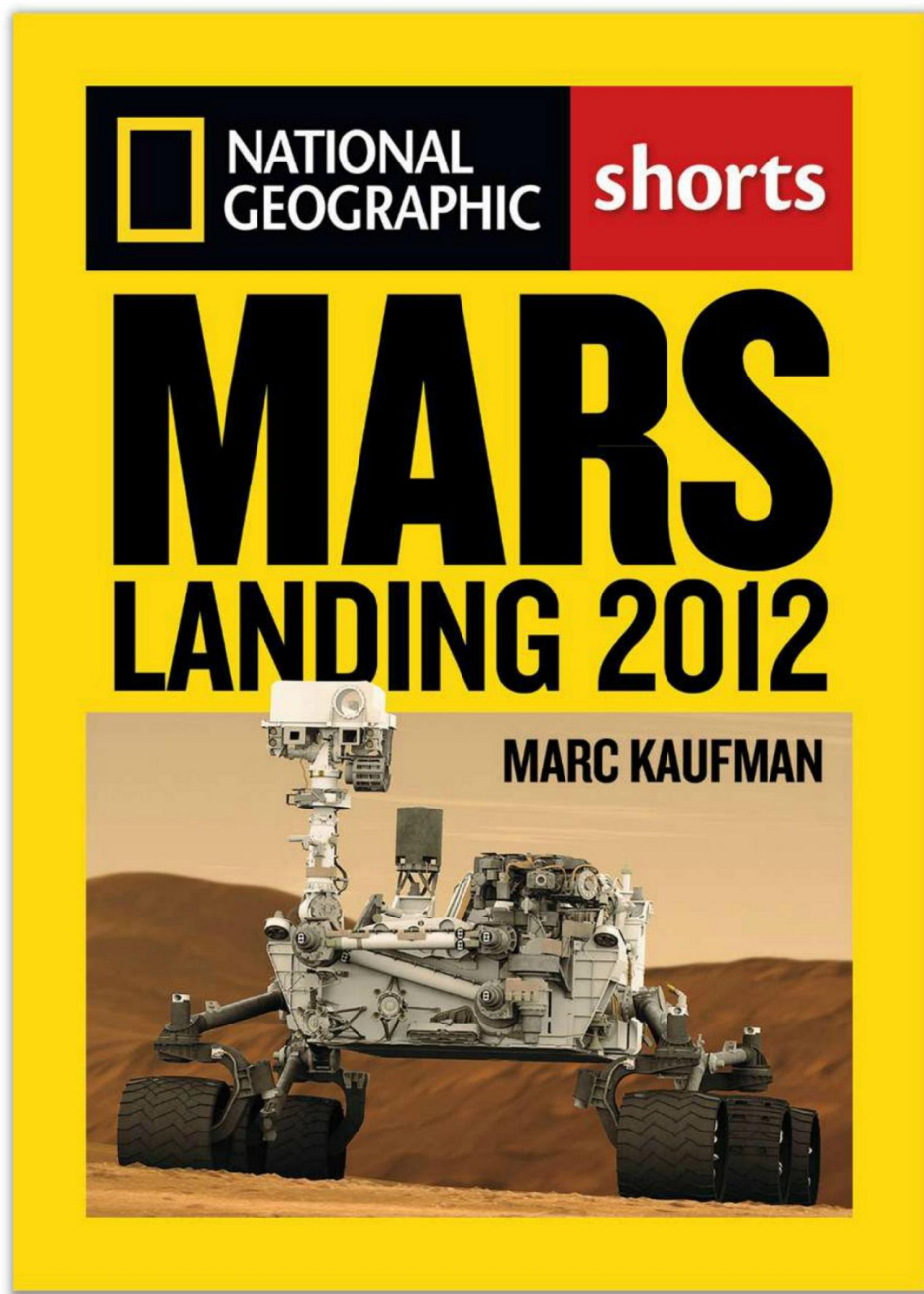
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Titanic

I would not fully agree with Robert Ballard and Eva Hart that the *Titanic* is a gravesite. By their definition, wouldn't all wrecks from the earliest points of history be considered

- gravesites? Is the *Titanic* more of a gravesite because of the modern tragedy of the event, the media coverage, the red-carpet list of passengers, the poor, and yes, the crew?

When does a wreck not become a gravesite? What about a wreck that contains gold, silver, or historical treasure? *Titanic* was a great loss indeed, but when you compare that sinking with the losses during World War I, there is no comparison.

THADDEUS B. KUBIS
Sheffield, Massachusetts

Since *Titanic's* discovery, she has been photographed, filmed, analyzed, and sadly, robbed. Let us now leave her and her dead in peace on the ocean floor and move on.

NICK HART
Beverley, England

I was intrigued by the photo on page 82, the group of workers at the Belfast shipyard. To the immediate left is a worker who appears to be a ghost. I can see right through

him to the rivets behind him. Intriguing, to say the least.

DAVID MECHAM
Seattle, Washington

According to Bill Sauder, the RMS Titanic, Inc.'s director of Titanic research, the ghostly appearance is most likely due to an attempt to improve the composition of the photo by removing the figure standing in a pit. The figure probably wouldn't have been visible in the newspapers of 1912,

which had very poor black-and-white contrast.

The article refers to *Titanic* as "the greatest ship that ever sailed." Maybe in 1912 it was the greatest ship, but there have been many great ships built in the past hundred years. The *Titanic* was a beautiful vessel, inside and out, but it did not even complete its first voyage. I think the author got a little carried away with the legend.

CHUCK JOHNSON
Irving, Texas

Page 95 reads: "No ship since the *Titanic* has been sunk by an iceberg in the North Atlantic." On January 30, 1959, the Danish ship *Hans Hedtoft* sank south of Greenland after striking an iceberg. It was well north of the route of the *Titanic* but still in the Atlantic.

NIELS MØLLER CHRISTENSEN
Viborg, Denmark

Hans Hedtoft's telegrapher sent an SOS that the ship had collided with an iceberg, but no visual confirmation was ever made.

FEEDBACK Some readers responded to the technical aspects of the *Titanic* story, others focused on emotion.

*"I've read the story twice."
"I was impressed by the minute-by-minute description of the sinking."
"The sonar mapping was particularly interesting."*

*"She has been photographed, filmed, analyzed, and sadly, robbed."
"A majestic gravesite for hundreds of souls."*

"Beware the technology that promises the unsinkable, the completely safe, and the totally reliable."



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Give An Inspiring Gift



Pat Minnick included National Geographic in her financial plans.

In 2007 Pat Minnick, a professional artist, decided to establish a charitable gift annuity to support National Geographic.

“I feel good knowing that National Geographic is doing so much to protect endangered wildlife,” says Pat. “The environmental problems we face are vast, but by joining with National Geographic and their history of remarkable accomplishments, I know we can pass on a more beautiful world.”

Pat now receives a guaranteed life income and is a direct part of the Society’s efforts to inspire people to care about the planet.

For more information about a charitable gift annuity or other ways to include National Geographic in your estate plans, please see below.

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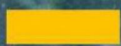
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VISIONS





United States

It's splashdown for Lulu, a Parson Russell terrier playing underwater fetch in a Phoenix, Arizona, pool. The clinching moment required familiarity with the photographer, about ten dive attempts, aquatic acuity, and perfect timing.

PHOTO: SETH CASTEEL, TANDEM STOCK

A vertical photograph of a lush rainforest. The scene is dominated by numerous tall, slender tree trunks that rise vertically from the forest floor. Sunlight filters through the dense canopy of green leaves, creating a soft, ethereal glow and visible rays of light. The ground is covered with fallen leaves and some low-lying green plants. The overall atmosphere is serene and natural.

India

Trees infused with sunlight dwarf an early morning visitor to the rain forest on Havelock Island. Rajan, an Asian elephant retired from logging, takes the stroll as part of his daily routine and occasionally swims in the Andaman Sea.

PHOTO: JODY MACDONALD

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China

On his way to second place in a bee-wearing contest in Hunan Province, a contestant disappears beneath a carpet of insects lured by a queen bee in a cage. A scale he was standing upon tallied his total take: about 50 pounds of bees.

PHOTO: CHINAFOTOPRESS/
GETTY IMAGES



"When I learned my AFib puts me at 5 times greater risk of stroke, my first thought was about my family."

Patient portrayal

What is Pradaxa® (dabigatran etexilate mesylate) capsules?

PRADAXA is a prescription blood-thinning medicine used to reduce the risk of stroke and blood clots in people with atrial fibrillation not caused by a heart valve problem.

IMPORTANT SAFETY INFORMATION

PRADAXA can cause bleeding which can be serious and sometimes lead to death. Don't take PRADAXA if you currently have abnormal bleeding or if you have ever had an allergic reaction to it.

Your risk of bleeding with PRADAXA may be higher if you: are 75 years old or older, have kidney problems, have stomach or intestine bleeding that is recent or keeps coming back or you have a stomach ulcer, take other medicines that increase your risk of bleeding, like aspirin products, non-steroidal anti-inflammatory drugs (NSAIDs) and blood thinners, have kidney problems and take dronedarone (Multaq®) or ketoconazole tablets (Nizoral®).

Call your doctor or seek immediate medical care if you have any of the following signs or symptoms of bleeding: any unexpected, severe, or uncontrollable bleeding; or bleeding that lasts a long time, unusual or unexpected bruising, coughing up or vomiting blood; or vomit that looks like coffee grounds, pink or brown urine;





If you have an irregular heartbeat called atrial fibrillation, or AFib, not caused by a heart valve problem, **PRADAXA** can reduce your risk of stroke.

- In a clinical trial, PRADAXA **reduced stroke risk 35% more** than warfarin.

Risk reduction was greatest when compared to patients on warfarin whose blood tests showed lower levels of control.

- **Unlike warfarin:**
No regular blood tests.
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Ask your doctor about

Pradaxa[®]
dabigatran etexilate
CAPSULES 150 mg

red or black stools (looks like tar), unexpected pain, swelling, or joint pain, headaches and feeling dizzy or weak.

It is important to tell your doctor about all medicines, vitamins and supplements you take. Some of your other medicines may affect the way PRADAXA works.

Take PRADAXA exactly as prescribed by your doctor. Don't stop taking PRADAXA without talking to your doctor as your risk of stroke may increase.

Tell your doctor if you are planning to have **any** surgery, or medical or dental procedure, because you may have to stop taking PRADAXA for a short time.

PRADAXA can cause indigestion, stomach upset or burning, and stomach pain.

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.

Please see more detailed Medication Guide on next page.

Pradaxa[®]
dabigatran etexilate
CAPSULES 150 mg

For more information or help paying for your medication, call 1-877-PRADAXA or visit pradaxa.com.



MEDICATION GUIDE
PRADAXA (pra dax' a)
(dabigatran etexilate mesylate)
capsules

Read this Medication Guide before you start taking PRADAXA and each time you get a refill. There may be new information. This Medication Guide does not take the place of talking with your doctor about your medical condition or your treatment.

What is the most important information I should know about PRADAXA?

- PRADAXA can cause bleeding which can be serious, and sometimes lead to death. This is because PRADAXA is a blood thinner medicine that lowers the chance of blood clots forming in your body.
- **You may have a higher risk of bleeding if you take PRADAXA and:**
 - are over 75 years old
 - have kidney problems
 - have stomach or intestine bleeding that is recent or keeps coming back, or you have a stomach ulcer
 - take other medicines that increase your risk of bleeding, including:
 - aspirin or aspirin containing products
 - long-term (chronic) use of non-steroidal anti-inflammatory drugs (NSAIDs)
 - warfarin sodium (Coumadin®, Jantoven®)
 - a medicine that contains heparin
 - clopidogrel (Plavix®)
 - prasugrel (Effient®)
 - have certain kidney problems and also take the medicines dronedarone (Multaq®) or ketoconazole tablets (Nizoral®).

Tell your doctor if you take any of these medicines. Ask your doctor or pharmacist if you are not sure if your medicine is one listed above.

- PRADAXA can increase your risk of bleeding because it lessens the ability of your blood to clot. While you take PRADAXA:
 - you may bruise more easily
 - it may take longer for any bleeding to stop.

Call your doctor or get medical help right away if you have any of these signs or symptoms of bleeding:

- unexpected bleeding or bleeding that lasts a long time, such as:
 - unusual bleeding from the gums
 - nose bleeds that happen often
 - menstrual bleeding or vaginal bleeding that is heavier than normal
- bleeding that is severe or you cannot control
- pink or brown urine
- red or black stools (looks like tar)

- bruises that happen without a known cause or get larger
- cough up blood or blood clots
- vomit blood or your vomit looks like “coffee grounds”
- unexpected pain, swelling, or joint pain
- headaches, feeling dizzy or weak

Take PRADAXA exactly as prescribed. Do not stop taking PRADAXA without first talking to the doctor who prescribes it for you. Stopping PRADAXA may increase your risk of a stroke.

PRADAXA may need to be stopped, if possible, for one or more days before any surgery, or medical or dental procedure. If you need to stop taking PRADAXA for **any reason**, talk to the doctor who prescribed PRADAXA for you to find out when you should stop taking it. Your doctor will tell you when to start taking PRADAXA again after your surgery or procedure.

See “What are the possible side effects of PRADAXA?” for more information about side effects.

What is PRADAXA?

PRADAXA is a prescription medicine used to reduce the risk of stroke and blood clots in people who have a medical condition called atrial fibrillation. With atrial fibrillation, part of the heart does not beat the way it should. This can lead to blood clots forming and increase your risk of a stroke. PRADAXA is a blood thinner medicine that lowers the chance of blood clots forming in your body.

It is not known if PRADAXA is safe and works in children.

Who should not take PRADAXA?

Do not take PRADAXA if you:

- currently have certain types of abnormal bleeding. Talk to your doctor, before taking PRADAXA if you currently have unusual bleeding.
- have had a serious allergic reaction to PRADAXA. Ask your doctor if you are not sure.

What should I tell my doctor before taking PRADAXA?

Before you take PRADAXA, tell your doctor if you:

- have kidney problems
- have ever had bleeding problems
- have ever had stomach ulcers
- have any other medical condition

- are pregnant or plan to become pregnant. It is not known if PRADAXA will harm your unborn baby.
- are breastfeeding or plan to breastfeed. It is not known if PRADAXA passes into your breast milk.

Tell all of your doctors and dentists that you are taking PRADAXA. They should talk to the doctor who prescribed PRADAXA for you, before you have **any** surgery, or medical or dental procedure.

Tell your doctor about all the medicines you take, including prescription and non-prescription medicines, vitamins, and herbal supplements. Some of your other medicines may affect the way PRADAXA works. Certain medicines may increase your risk of bleeding. See **“What is the most important information I should know about PRADAXA?”**

Especially tell your doctor if you take:

- rifampin (Rifater, Rifamate, Rimactane, Rifadin)

Know the medicines you take. Keep a list of them and show it to your doctor and pharmacist when you get a new medicine.

How should I take PRADAXA?

- **Take PRADAXA exactly as prescribed by your doctor.**
- Do not take PRADAXA more often than your doctor tells you to.
- You can take PRADAXA with or without food.
- **PRADAXA comes in a bottle or in a blister package.**
- **Only open 1 bottle of PRADAXA at a time. Finish your opened bottle of PRADAXA before opening a new bottle.**
- **After opening a bottle of PRADAXA, use within 4 months. See “How should I store PRADAXA?”**
- **When it is time for you to take a dose of PRADAXA, only remove your prescribed dose of PRADAXA from your open bottle or blister package.**
- **Tightly close your bottle of PRADAXA right away after you take your dose.**
- Swallow PRADAXA capsules whole. Do not break, chew, or empty the pellets from the capsule.
- If you miss a dose of PRADAXA, take it as soon as you remember. If your next dose is less than 6 hours away, skip the missed dose. Do not take two doses of PRADAXA at the same time.
- Your doctor will decide how long you should take PRADAXA. **Do not stop taking PRADAXA without first talking with your doctor. Stopping PRADAXA may increase your risk of stroke.**

- Do not run out of PRADAXA. Refill your prescription before you run out. If you plan to have surgery, or a medical or a dental procedure, tell your doctor and dentist that you are taking PRADAXA. You may have to stop taking PRADAXA for a short time. See “What is the most important information I should know about PRADAXA?”
- If you take too much PRADAXA, go to the nearest hospital emergency room or call your doctor.
- Call your healthcare provider right away if you fall or injure yourself, especially if you hit your head. Your healthcare provider may need to check you.

What are the possible side effects of PRADAXA?

PRADAXA can cause serious side effects.

- See “What is the most important information I should know about PRADAXA?”
- Allergic Reactions. In some people, PRADAXA can cause symptoms of an allergic reaction, including hives, rash, and itching. Tell your doctor or get medical help right away if you get any of the following symptoms of a serious allergic reaction with PRADAXA:
 - chest pain or chest tightness
 - swelling of your face or tongue
 - trouble breathing or wheezing
 - feeling dizzy or faint

Common side effects of PRADAXA include:

- indigestion, upset stomach, or burning
- stomach pain

Tell your doctor 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 PRADAXA. For more information, ask your doctor or pharmacist.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

How should I store PRADAXA?

- Store PRADAXA at room temperature between 59°F to 86°F (15°C to 30°C). After opening the bottle, use PRADAXA within 4 months. Safely throw away any unused PRADAXA after 4 months.
- **Keep PRADAXA in the original bottle or blister package to keep it dry (protect the capsules from moisture). Do not put PRADAXA in pill boxes or pill organizers.**
- **Tightly close your bottle of PRADAXA right away after you take your dose.**

Keep PRADAXA and all medicines out of the reach of children.

General information about PRADAXA

Medicines are sometimes prescribed for purposes other than those listed in a Medication Guide. Do not use PRADAXA for a condition for which it was not prescribed. Do not give your PRADAXA to other people, even if they have the same symptoms. It may harm them.

This Medication Guide summarizes the most important information about PRADAXA. If you would like more information, talk with your doctor. You can ask your pharmacist or doctor for information about PRADAXA that is written for health professionals.

For more information, go to www.PRADAXA.com or call 1-800-542-6257 or (TTY) 1-800-459-9906.

What are the ingredients in PRADAXA?

Active ingredient: dabigatran etexilate mesylate

Inactive ingredients: acacia, dimethicone, hypromellose, hydroxypropyl cellulose, talc, and tartaric acid. The capsule shell is composed of carrageenan, FD&C Blue No. 2 (150 mg strength only), FD&C Yellow No. 6, hypromellose, potassium chloride, titanium dioxide, and black edible ink.

This Medication Guide has been approved by the U.S. Food and Drug Administration.

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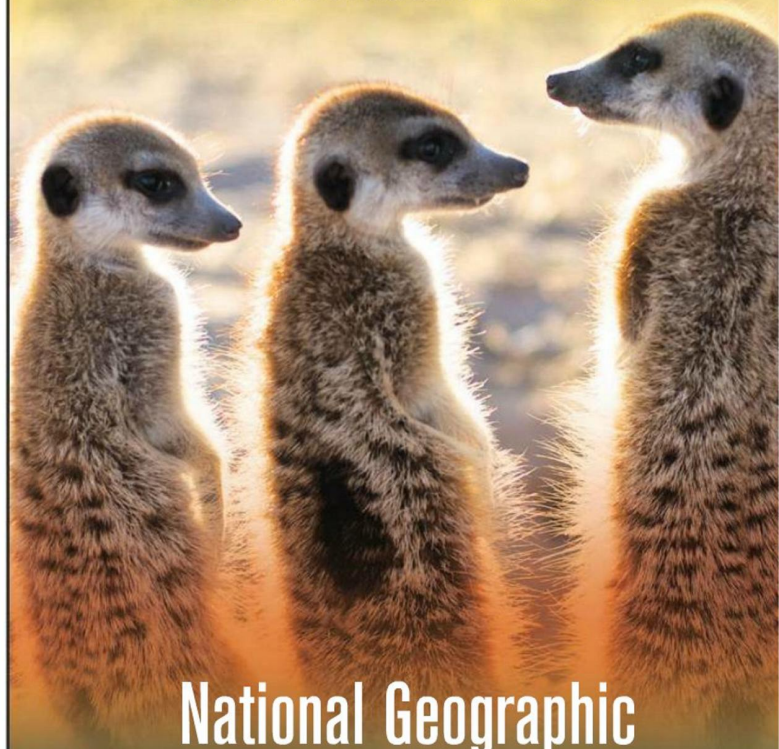
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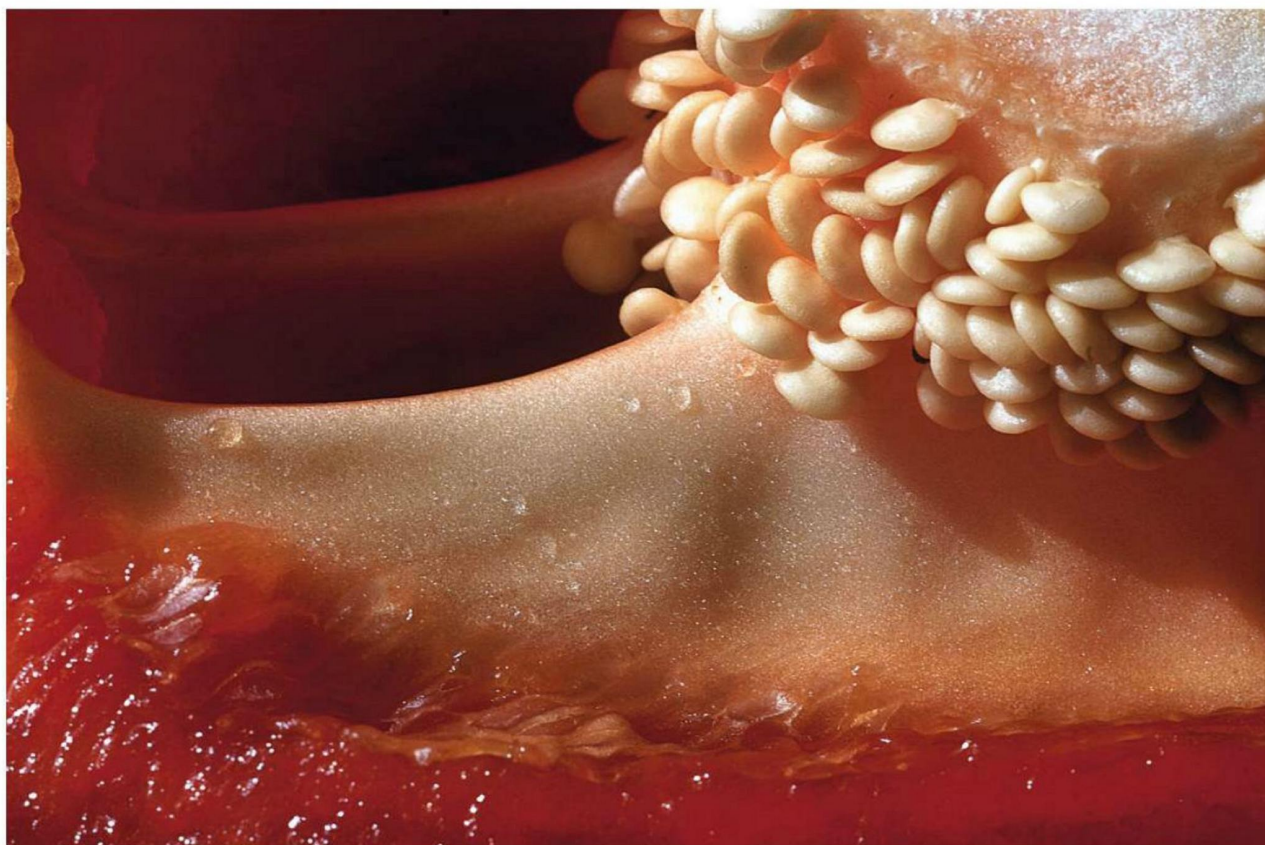
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EDITORS' CHOICE **Wiesława Dąbrowska** Gdansk, Poland

To explore close-up photography, Dąbrowska, an art restorer, turned to small objects at home, like flowers, fruits, and vegetables. Here the inside of a red pepper reminded her of a woman's neck, adorned with a ruff collar and red dress.



READERS' CHOICE

Marie-Pier Couture

Quebec City, Canada

During a break from her job working with aerial photographs of cities, mining facilities, and forests around Canada, Couture, 30, visited one of her favorite animals at the zoo in St.-Félicien. She watched this polar bear drift lazily up and down in the water several times.



NOW

Remaking a British Icon

For decades the red telephone booth has been a much loved symbol of Britishness. The most popular model, the K6, was designed in 1935 by architect Sir Giles Gilbert Scott to commemorate King George V's silver jubilee and became an instant classic. Nearly 70,000 were installed throughout the U.K. Now, though, the glass-and-cast-iron kiosks are mainly gathering dust, thanks to mobile phones. Thousands have been removed, sold overseas as curios, and used as everything from movie props to outdoor showers.

Others are being "adopted" under a British Telecommunications program in which communities buy a decommissioned kiosk for one pound (about \$1.60). Westbury-sub-Mendip in Somerset, for instance, now claims one of the world's smallest libraries, a refurbished booth with 150 books and DVDs. Villagers in Settle, North Yorkshire, made theirs an art gallery—former Queen guitarist Brian May exhibited there—for a touch of "bohemian rhapsody" on the green. —Roff Smith

In a storage lot in England, decommissioned K6 telephone booths await refurbishment.

NOW



Sri Lanka tops the list of nations with fisheries targeting mobula rays (seen here at a bustling Negombo market) and mantas. India, Peru, Indonesia, and China round out the top five.



Manta and mobula ray numbers are falling as they're hunted for Asian remedies.

RAYS IN DANGER | In the ocean, manta and mobula rays move with exceptional grace, gliding and twirling with mouths agape to feed near the surface. Now an appetite for their gill rakers—filaments that filter out plankton, krill, and other food—has put their populations at risk, says a new study. Demand in China for dried gill rakers as purported medicine for chicken pox and other ailments means a large manta can fetch several hundred dollars, versus \$20 to \$40 for its meat alone. Last year around 100,000 of the rays landed in global fish markets, the study estimates, boding ill for nearly a dozen mobulid species—many listed by the IUCN as vulnerable or near threatened.

“As quickly as rays started appearing in markets, we fear they could disappear from the sea just as quickly,” says Shawn Heinrichs, lead author of the report released by conservation groups WildAid and Shark Savers. Mobulid catches rose sharply about a decade ago. Despite increased fishing efforts, fewer and smaller rays are being caught, indicating populations in peril, says Heinrichs. On the flip side, the sublime creatures have proved a lucrative tourist draw—a ray of hope for the slow-to-reproduce sea dwellers. —Luna Shyr



Go green without going slow.

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Das Auto.

NEXT

CITY SOLUTIONS

City of Lights

Charting New York City's energy consumption block by block makes for powerful knowledge, according to researchers at Columbia University. By pointing out areas of intensive use, the mapmakers hope to help city officials, power companies, and landlords lower NYC's carbon footprint.

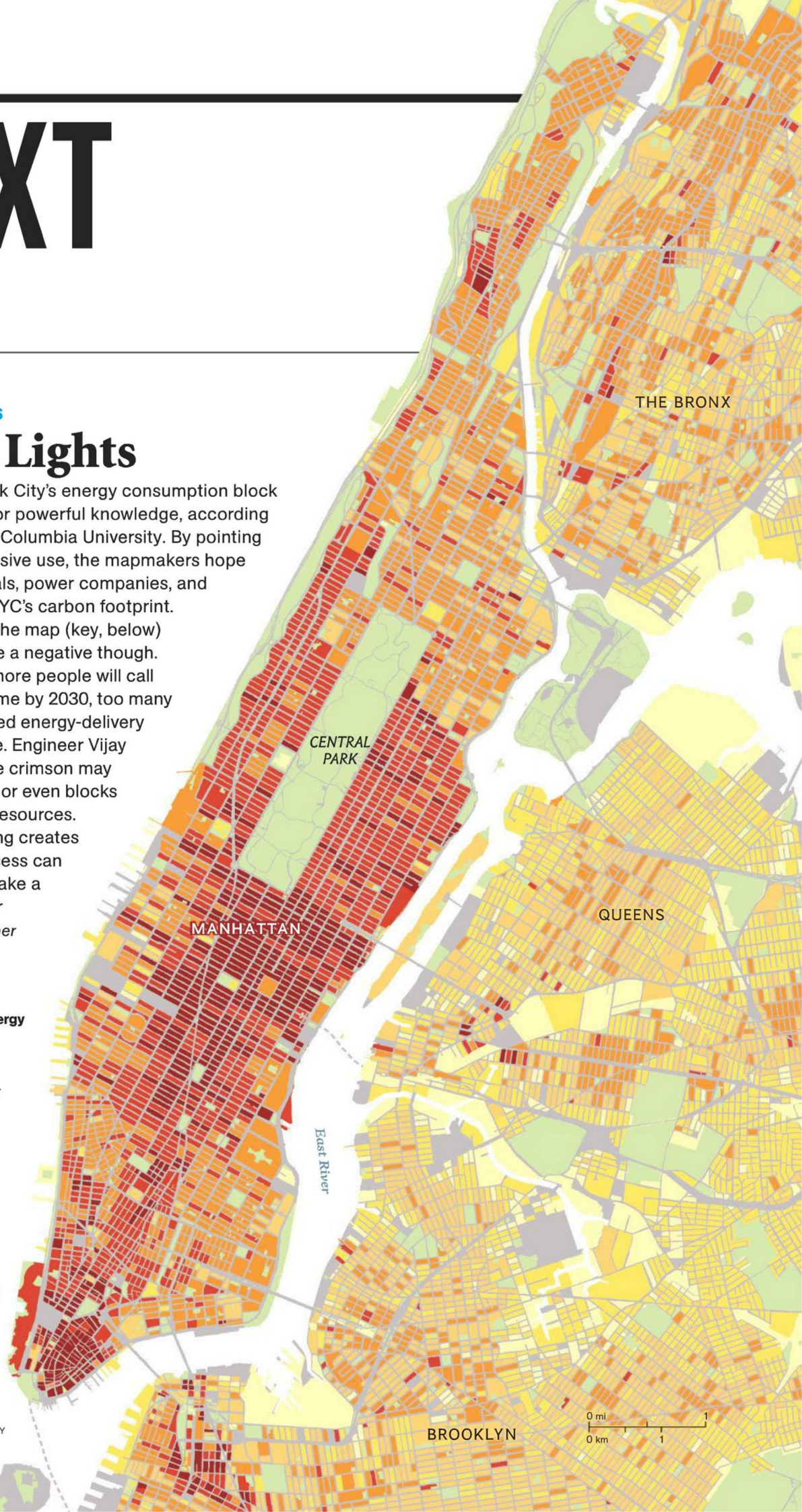
Seeing red on the map (key, below) doesn't have to be a negative though. Almost a million more people will call New York City home by 2030, too many for the town's dated energy-delivery systems to handle. Engineer Vijay Modi says that the crimson may point to buildings or even blocks that could share resources. Powering a building creates heat, and that excess can be siphoned to make a neighbor's shower hot. —Bruce Falconer

Estimated annual energy consumption, 2009
(kWh per square meter of block area)

- 2,500 and greater
- 1,250-2,499
- 600-1,249
- 300-599
- 100-299
- 1-99
- No data
- Open space

A 100-watt lightbulb turned on for ten hours uses one kilowatt-hour (kWh) of energy.

JEROME N. COOKSON,
NGM STAFF
SOURCES:
COLUMBIA ENGINEERING
AND EARTH INSTITUTE;
NYC DEPARTMENT
OF INFORMATION TECHNOLOGY
AND TELECOMMUNICATIONS



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The most common side effect of insulin is low blood sugar. Some people may experience symptoms such as shaking, sweating, fast heartbeat, and blurred vision, while some experience no symptoms at all. That's why it's important to check your blood sugar often. Talk to your doctor about whether insulin is right for you.

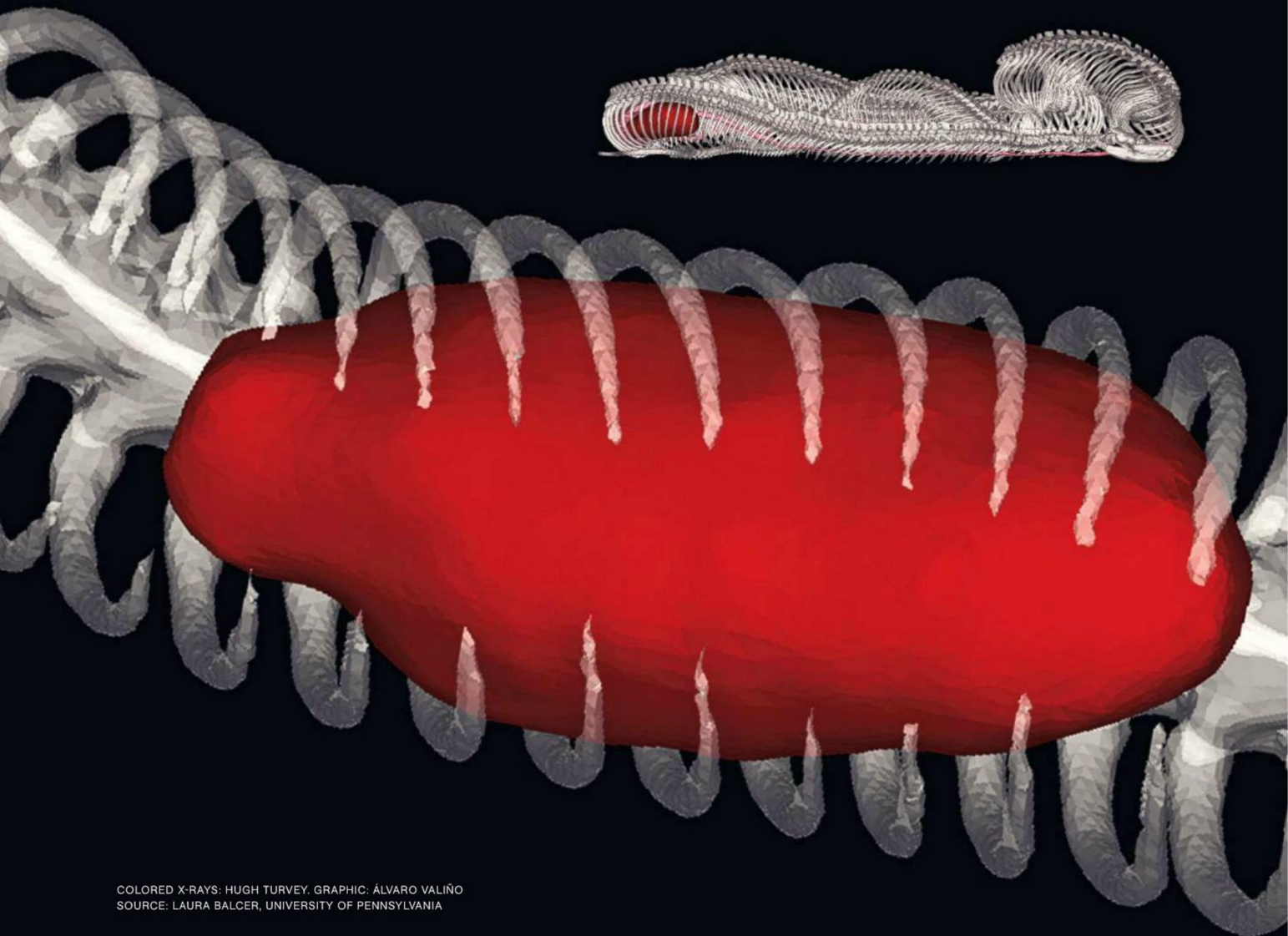
**Learn more at [UnderstandBloodSugarControl.com](https://www.UnderstandBloodSugarControl.com)
or call 1.866.923.0210.**



Gross Anatomy Biologist Leslie Leinwand found Burmese pythons to be bighearted, at least when they eat. In fact, with the exception of the brain (likely constrained by the skull), all of the snake's organs studied grew between 30 and 100 percent after a meal. Portion size matters. Leinwand says, "The organs will just keep getting bigger and bigger as the meal does." And when the pythons do feast—it may be months or even a year between meals—reaction time is relatively fast. Organs start to grow at 12 hours and reach maximum size by 76 hours, shrinking back to normal in ten days, digestion done. The suite of enlarged organs, anchored by the heart, accommodates a metabolic rate 40 times normal. "It's like a thoroughbred running the Kentucky Derby, except for days on end," says Leinwand.

The python is building new tissue, not swelling up—a feat that Leinwand thinks might translate to treating heart disease in humans. Her team hopes the three-lipid combo that triggers the cardiac cell growth may combat heart atrophy in cancer patients and astronauts. Or, conversely, that disease-enlarged hearts might mimic the python ticker's regression phase and go down a size. —*Johnna Rizzo*

X-rays of a Burmese python (below) expose the 40 percent increase of its heart after a meal, which can equal 75 percent of its body mass.



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Built-in alarm

LCD complications

Electro-luminescence
backlight



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The watch's extraordinary dial seamlessly blends an analog watch face with a stylish digital display. Three super-bright luminous hands keep time along the inner dial, while a trio of circular LCD windows track the hour, minutes and seconds. An eye-catching digital semi-circle animates in time with the second hand and shows the day of the week. The watch also features a rotating bezel, stopwatch and alarm functions and green, electro-luminescence backlight. The **Compendium Hybrid** secures with a rugged stainless steel band and is water-resistant to 3 ATMs.

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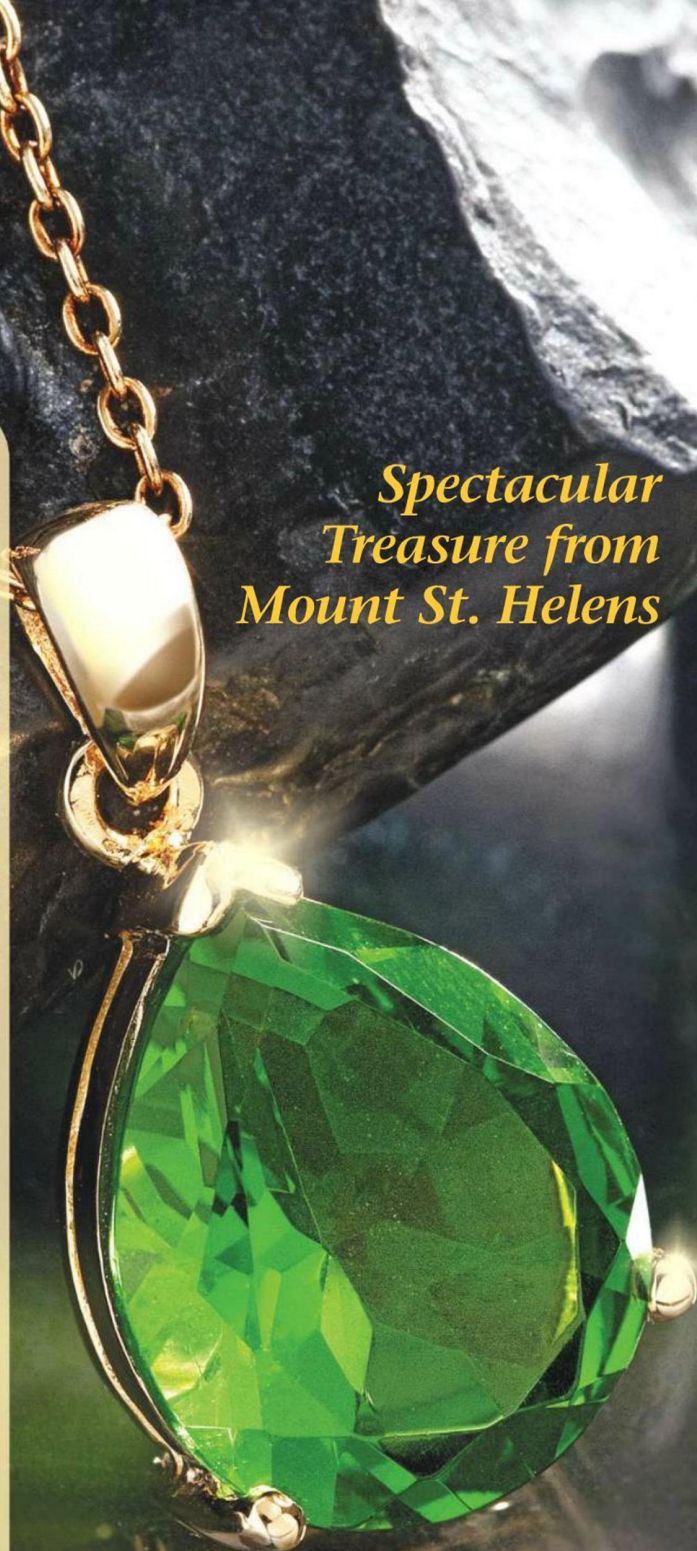
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Sizing Up Seventy million years ago the largest known mammal weighed only six pounds. From then, some animals grew steadily. But slowly. Large-scale changes in body size actually took millions of generations.

So say scientists led by Alistair Evans of Australia's Monash University, who studied fossil records of 28 groups of mammals, including elephants, primates, and whales. The team is the first to get hard numbers on just how long

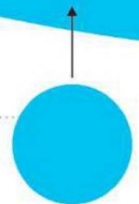
it takes to get a lot bigger. After all, gaining girth isn't just about adding muscle and bone. It's also about reengineering hearts and eyes—even metabolism and diet. And limbs need to carry more weight, which may explain another revelation: Whales can grow twice as fast, likely because water helps support newly added mass. Evans adds that evolving larger takes ten times as long as evolving smaller, reaffirming just how much sheer size is to be prized. —Gretchen Parker

IT TAKES A MINIMUM OF

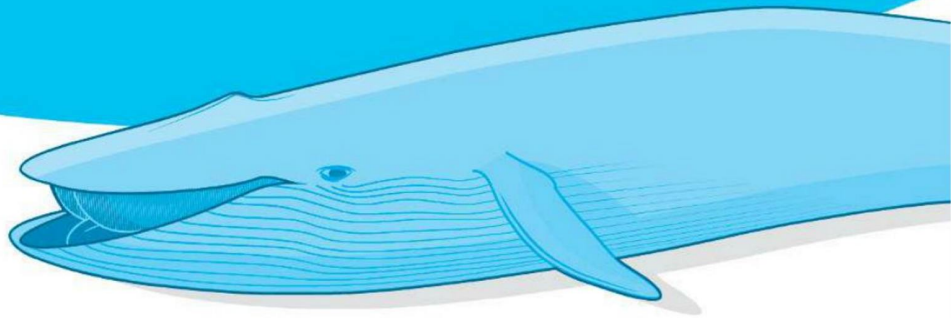
3 MILLION GENERATIONS

for a dolphin-size aquatic mammal to increase to the size of a blue whale.

ONE MILLION GENERATIONS



1,000 times (x) change in size



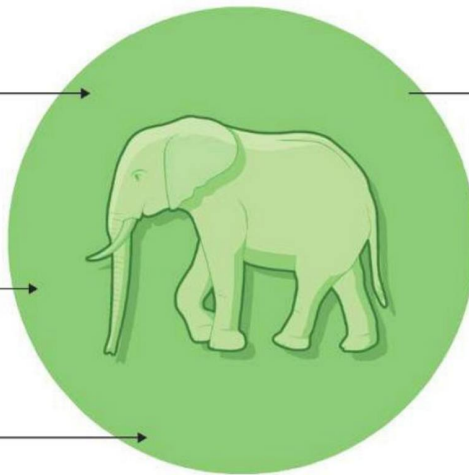
1.6 MILLION GENERATIONS

for a sheep-size land mammal to increase to the size of an elephant

ONE MILLION GENERATIONS



100x



+100

BUT IT TAKES ONLY A MINIMUM OF

0.1 MILLION GENERATIONS

for an elephant-size land mammal to decrease to the size of a sheep.

5 MILLION GENERATIONS

for a rabbit-size mammal

ONE MILLION GENERATIONS



1,000x

24 MILLION GENERATIONS

for a mouse-size mammal

ONE MILLION GENERATIONS

100,000x

ET CETERA

Prostate cancer is discovered in a **2,200-YEAR-OLD MUMMY** in his 50s—the second oldest known case and further evidence for a genetic link for the disease. ■ **CHICKPEAS AND FAVA BEANS** from Syria are among the 25,000 samples recently added to the Arctic seed vault. ■ **MADAGASCAR** was first settled 1,200 years ago by 30 women from Indonesia, say researchers from Massey University. ■ The French government ordered a phaseout of **"MADEMOISELLE"** to identify unmarried women on official forms.

IN THE SHADOW OF WOUNDED KNEE



After 150 years of broken promises, the Oglala Lakota people of the Pine Ridge Reservation in South Dakota are nurturing their tribal customs, language, and beliefs. A rare, intimate portrait shows their resilience in the face of hardship.

Riders take a break during a day of activities to mark the 1876 defeat of Lt. Col. George Armstrong Custer.







Stanley Good Voice Elk, a *heyoka*, burns sage to ritually purify his surroundings. In Oglala spirituality, *heyokas* are recipients of sacred visions who employ clownish speech and behavior to provoke spiritual awareness and “keep balance,” says Good Voice Elk. Through his mask, he channels the power of an inherited spirit, which transforms him into Spider Respects Nothing.



Three-year-old C. J. Shot bathes among dishes. The Oglala concept of *tiospaye*—the unity of the extended family—means that homes are often overcrowded, especially with the severe housing shortage on the



reservation. In 2008, when this photograph was made, 22 people lived in the three-bedroom house. "These houses aren't who we are," says Oglala activist Alex White Plume.



BY ALEXANDRA FULLER

PHOTOGRAPHS BY
AARON HUEY

ALMOST EVERY HISTORICAL atrocity has a geographically symbolic core, a place whose name conjures up the trauma of a whole people: Auschwitz, Robben Island, Nanjing. For the Oglala Lakota of the Pine Ridge Indian Reservation that place is a site near Wounded Knee Creek, 16 miles northeast of the town of Pine Ridge.

From a distance the hill is unremarkable, another picturesque tree-spotted mound in the creased prairie. But here at the mass grave of all those who were killed on a winter morning more than a century ago, it's easy to believe that certain energies—acts of tremendous violence and of transcendent love—hang in the air forever and possess a forever half-life.

Alex White Plume, a 60-year-old Oglala Lakota activist, lives with his family and extended family on a 2,000-acre ranch near Wounded Knee Creek. White Plume's land is lovely beyond any singing, rolling out from sage-covered knolls to creeks bruised with late summer lushness. From certain aspects, you can see the Badlands, all sun-bleached spires and scoured pinnacles. And looking another way, you can see the horizon-crowning darkness of the Black Hills of South Dakota.

One hot and humid day in early August,





Oglala youths hold an upside-down flag—an international symbol of distress and an act of defiance toward the U.S. government—at a rally to commemorate a 1975 shoot-out between American Indian Movement (AIM) activists and FBI agents. Two agents and one AIM member died; AIM’s Leonard Peltier was jailed for life.

THE OGLALA SIOUX TRIBE OF PINE RIDGE CALL THEMSELVES THE OGLALA LAKOTA. (THEIR FLAG IS OPPOSITE, TOP.) THEY ARE ONE OF SEVERAL GROUPS THAT MAKE UP THE SIOUX NATION. “SIOUX” COMES FROM THE NAME USED FOR THEM BY THEIR ALGONQUIAN-SPEAKING ENEMIES AND ADAPTED BY FRENCH TRADERS.

I drove out to interview White Plume in a screened outdoor kitchen he had just built for his wife. Hemp plants sprouted thickly all over their garden. “Go ahead and smoke as much as you like,” White Plume offered. “I always tell people that: Smoke as much as you want, but you won’t get very high.” The plants are remnants from a plantation of industrial hemp—

\$9,728*

Annual per capita income,
PINE RIDGE
RESERVATION (RES.)
\$27,334 UNITED STATES

48.3%

Poverty rate,
PINE RIDGE RES.
13.8% UNITED STATES

low-tetrahydrocannabinol (THC) *Cannabis sativa*—cultivated by the White Plume family in 2000.

During World War II cultivation of hemp was encouraged in the United States, its fiber used for rope, canvas, and uniforms. But in 1970 low-THC industrial hemp

was outlawed under the Controlled Substances Act. In 1998 the Oglala Sioux Tribe passed an ordinance allowing the cultivation of low-THC hemp, a crop well suited to places, like the “rez,” with a short growing season, arid soil, and weather fluctuations.

“The people of Pine Ridge have sovereign status as an independent nation,” White Plume said. “I take that to mean I am free to make a living from this land.” So in spite of reportedly stern warnings from Robert Ecoffey, the superintendent for the Bureau of Indian Affairs (BIA) on Pine Ridge, who pointed out that Oglala Sioux sovereignty is limited and does not include the right to violate federal laws, the White Plumes planted an acre and a half of industrial hemp using seeds collected from plants growing wild on the rez. A few days before the crop was due to be harvested, in late August 2000, agents from the Drug Enforcement Administration, the FBI, the BIA, and the U.S. Marshals Service swarmed the place in helicopters and SUVs and shut down the hemp operation. The crop went feral. “It was an experiment in capitalism and

a test of our sovereignty, but it seems the U.S. government doesn’t want to admit that we should have either,” White Plume said. Then he laughed in the way of a man who knows that he cannot be defeated by ordinary disappointments.

After that we spoke of the treaties made and broken between the U.S. and the Sioux, and that led naturally to a conversation about the Black Hills, which the Oglala consider their *axis mundi*, the center of their spiritual world. The 1868 Fort Laramie Treaty guaranteed the Sioux possession of the hills, but after gold was discovered there in 1874, prospectors swarmed in, and the U.S. government quickly seized the land. The Sioux refused to accept the legitimacy of the seizure and fought the takeover for more than a century. On June 30, 1980, in *United States v. Sioux Nation of Indians*, the U.S. Supreme Court upheld an award of \$17.5 million for the value of the land in 1877, along with 103 years’ worth of interest, together totaling \$106 million. But the Sioux rejected the payment, insisting that the Black Hills would never be for sale.

And then White Plume asked me to consider the seemingly calculated insult of Mount Rushmore. “The leaders of the people who have broken every treaty with my people have their faces carved into our most holy place. What is the equivalent? Do you have an equivalent?” I could offer none. Then White Plume, who punctuates his oddly unexcited view of history’s injustices not only with laughter but also with pauses long enough to roll a cigarette, looked up and asked if I had extra time on my hands and extra fuel in my car.

I SAID I HAD BOTH, and we drove out onto his cathedral land. Sitting by a cottonwood-lined creek, in a dark pool of shade, we spoke of the ways in which lives are lost on the rez and about the suicide, earlier that summer, of a 15-year-old Oglala Lakota girl. Partly because time is not linear for the Oglala Lakota but rather is expressed in circular endlessness and beginnings, and partly because many can recite the members of their family trees, branch after branch, twig after twig, vines and incidental outgrowths

Alexandra Fuller wrote in June 2010 about reconciliation in South Africa. Aaron Huey spent seven years documenting life on Pine Ridge Reservation.

WHEN I WAS A BOY THE SIOUX OWNED THE WORLD.

The sun rose and set in their lands.

They sent 10,000 horsemen to battle.

Where are the warriors to-day? Who slew them?

Where are our lands? Who owns them?



Sitting Bull, circa 1831–1890

included, it does not seem to me too big a historical step to go from the bodies piled in the snow at Wounded Knee in 1890 to the body of Dusti Rose Jumping Eagle lying in shiny mannequin perfection in an open coffin in a tepee in Billy Mills Hall in the town of Pine Ridge in early July 2011, a scarf draped over her neck to conceal the manner of her suicide.

“The whole Sioux Nation was wounded at that last terrible massacre, and we’ve been suffering ever since. It’s true we have our own ways of healing ourselves from the genocidal wound, but there is just so much historical trauma, so much pain, so much death,” White Plume said, and he would know. There is a flat plateau in the center of his ranch, he told me, where some of the historic Ghost Dances that precipitated the Wounded Knee massacre are supposed to have taken place. Participants in these ritualized spiritual ceremonies danced themselves into an altered state and claimed to have communed easily with their dead, become mentally untethered from the Earth, and touched the morning star. Then there is the unavoidable fact that three of his relatives were killed on that winter day.

In 1890 a bad drought brought more than the usual deprivation to the reduced reservations of the Great Plains. (The Great Sioux Reservation had been chopped up into six smaller reservations.) At the same time, agents of the BIA got jumpy about an upswing in the number of Ghost

Dances being performed by the Sioux, who were gathering with increasing desperation and frequency on the open prairie, petitioning for advice and guidance from their ancestors and spirits.

On December 15, 1890, U.S. Indian policemen arrested Sitting Bull in an effort to quell the “messiah craze” of the native ceremonies. The arrest turned unintentionally violent in ways that retrospectively seem inevitable. Sitting Bull was killed, along with seven of his supporters and six of the policemen. Fearing a backlash, another leader, Big Foot, fled south with his band under cover of night to seek asylum with Red Cloud on the Pine Ridge Reservation.

Nearly two weeks later, on the morning of December 28, 1890, a nervy U.S. Seventh Cavalry unit found Big Foot’s band at Porcupine Creek and escorted them to Wounded Knee Creek. The following morning the cavalry attempted to disarm the Indians. What happened next on that frozen-prairie morning isn’t entirely clear. It is said that a medicine man, Yellow Bird, began to perform a dance, throwing handfuls of dirt in the air. A scuffle ensued, a gun was discharged, the Army opened fire, and by the time the smoke cleared, Big Foot and at least 145 members of his band had been killed (the Oglala argue many more), including 84 men and boys, 44 women, and 18 children. A reported 25 U.S. soldiers also died, some possibly as a (Continued on page 48)



Bareback riders Carey Rouillard (left) and Travis New Holy stop for a neighborly chat in Evergreen. Oglala have a traditional reverence for the horse, which they call *sunka wakan*, or sacred dog. Evergreen, one resident says, is “a good community. Everybody gets along. Neighbors help out neighbors.”



THE LOST LAND

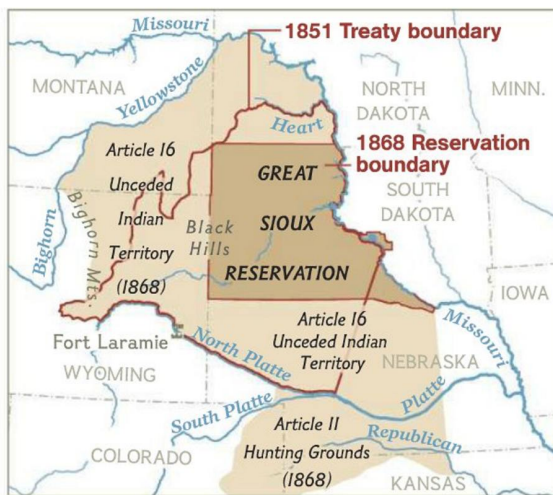
Around 1700, Sioux tribes on the prairies of western Minnesota hunted buffalo on foot. By the mid-1700s various tribes had gained access to horses, and by the turn of the 19th century the Oglala Sioux and other Plains Indians had developed a way of life that depended on mounted buffalo hunting. After gold was found in California in 1849 and in the Black Hills in 1874, prospectors, merchants, and settlers streamed into Sioux territory. The culture clash led to a series of broken treaties and unfavorable legislation, which confined the tribes to an ever shrinking area (maps, right). Meanwhile, the newcomers had all but exterminated the buffalo. In 1980 the Supreme Court ordered the U.S. government to pay for its appropriation of the Black Hills. With interest, the amount is now more than a billion dollars, but the Sioux won't touch it. They want their land back.

0 mi 100
0 km 100

PRESENT BOUNDARIES AND DRAINAGE SHOWN

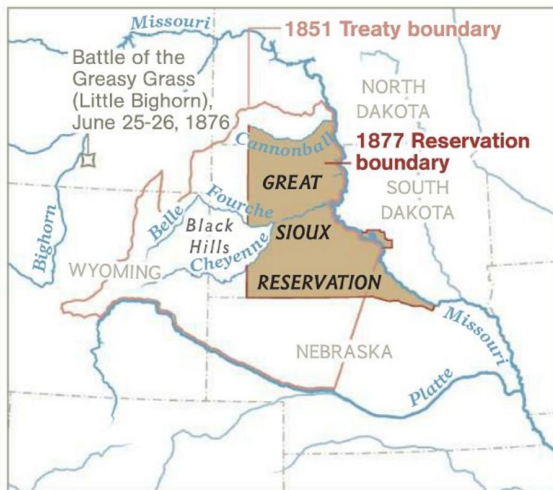
MARTIN GAMACHE, NGM STAFF

SOURCES: DAVID BARTECCHI, VILLAGE EARTH; BUREAU OF INDIAN AFFAIRS; U.S. CENSUS BUREAU; RICHMOND CLOW, UNIVERSITY OF MONTANA; RAYMOND J. DEMALLIE, INDIANA UNIVERSITY; U.S. DEPT. OF THE INTERIOR; LIBRARY OF CONGRESS; MARGARET PEARCE, UNIVERSITY OF KANSAS



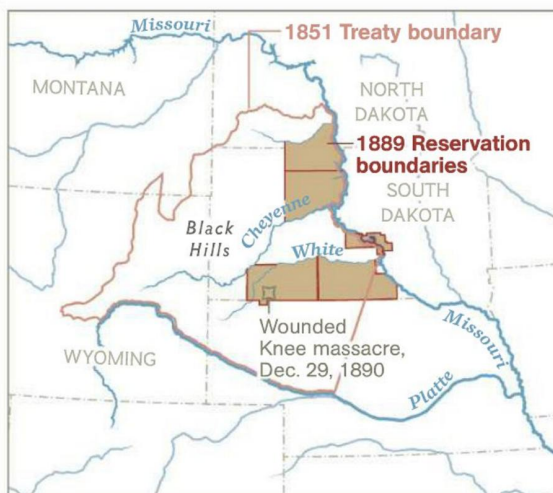
1851-1868

Treaties with the United States first established the Sioux Nation's boundaries and then set up a reservation. An 1868 treaty allowed hunting in unceded territory as long as buffalo herds roamed there.



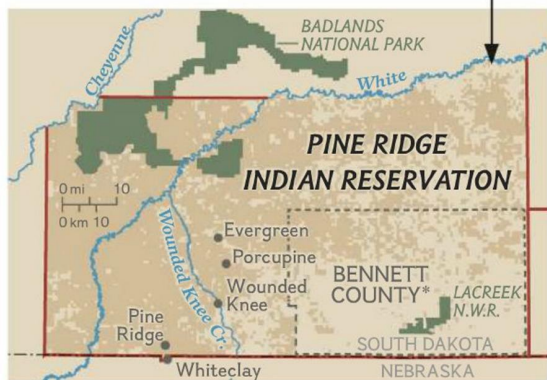
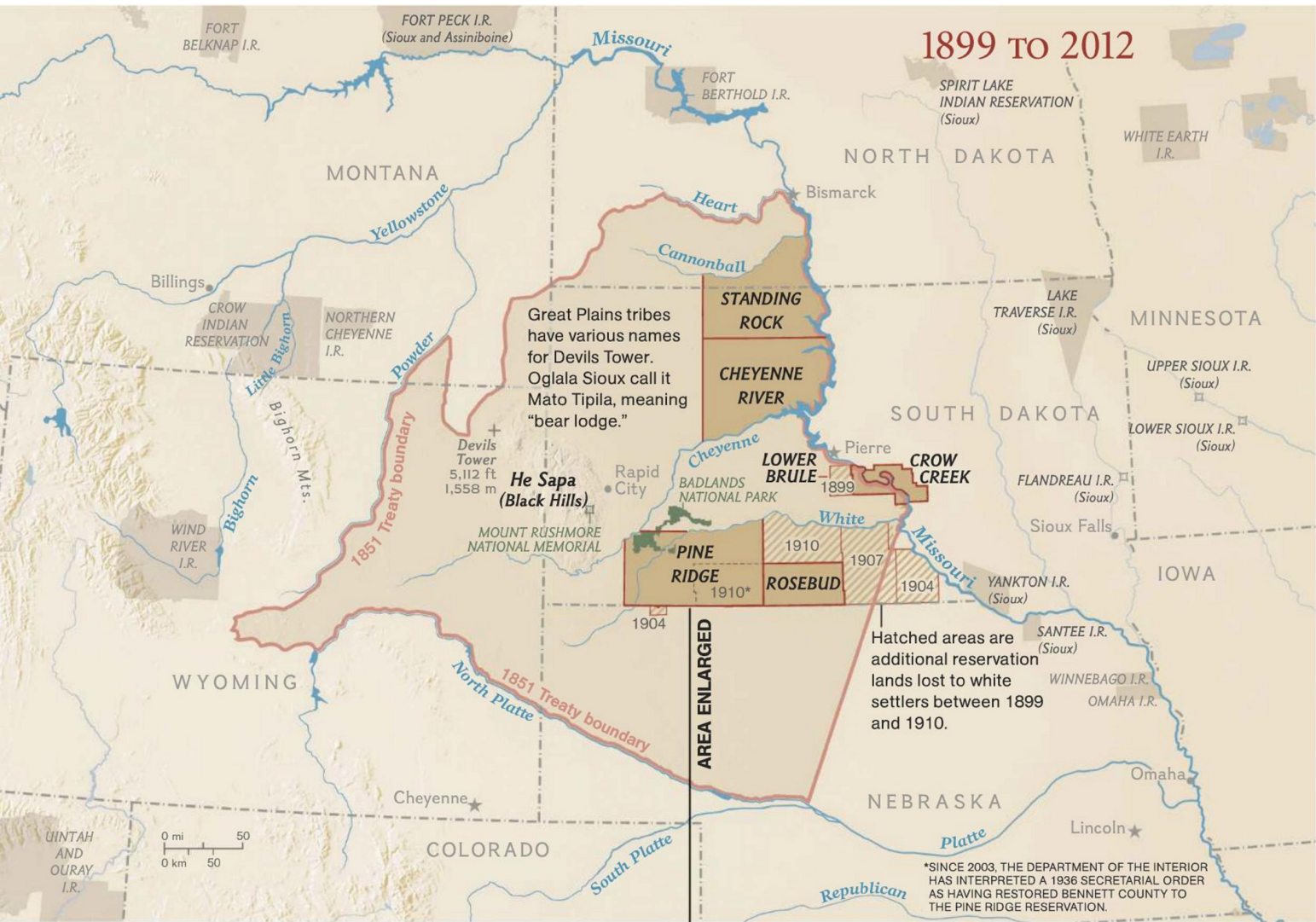
1876-1877

The U.S. Army fought the Sioux who remained outside the reservation. Colonel Custer's troops were annihilated at Little Bighorn. The government then seized the Black Hills and other Sioux land.



1889

As North and South Dakota moved toward statehood, the 21-million-acre reservation was cut by half and the remaining land divided into six smaller reservations. Some of that reservation land was later opened to settlers.



Today

On Pine Ridge and five other reservations (above), the Sioux own five million acres of their original treaty land. Through the Bureau of Indian Affairs, tribes can arrange leases of reservation land, used mainly for grazing. Some leases go to Indians, others to outsiders. Because of the way land was originally allotted, the Sioux have been left with the least productive tracts.



Teenagers disregard the threat of a summer storm in the town of Wounded Knee. On December 29, 1890, at least 146 Indians were killed by the U.S. Army near here. For the Sioux and other Native Americans, Wounded Knee remains a potent symbol—geographically and politically—of historic injustice.





A passenger barely has room for the journey home as a car is loaded with used clothing donated by a Colorado-based Native American charity. Contrary to popular myth, Native Americans do not automatically



receive a monthly federal check and are not exempt from taxes. The Oglala Lakota and other Sioux tribes have refused a monetary settlement for the U.S.'s illegal seizure of the Black Hills, their spiritual home.

(Continued from page 39) result of friendly fire.

Testifying to the commissioner of Indian Affairs in February 1891, the Oglala leader American Horse said of that day, “There was a woman with an infant in her arms who was killed as she almost touched the flag of truce... Right near the flag of truce a mother was shot down with her infant; the child not knowing that its mother was

dead was still nursing, and that was especially a very sad sight... Of course it would have been all right if only the men were killed; we would feel almost grateful for it. But the fact of the killing of the women, and more especially the killing of the young boys and girls who

66.6

Life expectancy,
PINE RIDGE RES.
(Shannon County)
76.5 UNITED STATES

18.4

Infant mortality per 1,000
births, PINE RIDGE RES.
(Shannon County)
6.8 UNITED STATES

are to go to make up the future strength of the Indian people, is the saddest part of the whole affair and we feel it very sorely.”

“THEY TRIED EXTERMINATION, they tried assimilation, they broke every single treaty they ever made with us,” White Plume said. “They took away our horses. They outlawed our language. Our ceremonies were forbidden.” White Plume is insistent about the depth and breadth of the policies and laws by which the U.S. government sought to quash Native Americans, but his delivery is uncomplainingly matter-of-fact. “Our holy leaders had to go underground for nearly a century.” It wasn’t until Congress passed the American Indian Religious Freedom Act, in 1978, that any interference in native spiritual practices was made a crime. “And yet our ceremonies survived, our language survived,” White Plume said.

Buried deep within the pages of the 2010 Defense appropriations bill, signed by President Barack Obama in December 2009, is an official apology “to all Native Peoples for the many instances of violence, maltreatment, and neglect inflicted on Native Peoples by citizens of the United States.” The resolution commends those states “that have begun reconciliation

efforts with recognized Indian tribes,” but there is no mention of reparations, nor of honoring long-broken treaties.

White Plume lit one of his rolled-up cigarettes and squinted at me through a ribbon of smoke. “Do you know what saved me from becoming a cold-blooded murderer? My language saved me. There is no way for me to be hateful in my language. It’s such a beautiful, gentle language. It’s so peaceful.” Then White Plume started to speak in Lakota, and there was no denying the words came softly.

Above us, in an otherwise empty sky, two small clouds touched each other and melted into nothing. White Plume got up and walked toward the creek, and then I heard him exclaim in surprise—“Aha!”—as if greeting someone revered, and deeply known. He had found the cottonwood tree for his Sun Dance ceremony. Although most Pine Ridge traditions are off-limits to outsiders, I gathered that the following would occur: The tree would be brought down by White Plume and some of the men in his family and carried to the Sun Dance grounds with the kind of reverence due a holy being. There it would be fixed with prayer ties—bundles of tobacco and other offerings wrapped with cloth of various colors—and set in a hole in the ground, where it would remain until the following year.

In 1974 White Plume joined the Army and was deployed to Germany. (Native Americans are disproportionately represented in the armed forces.) “The year I left to join the Army, there were only three Sun Dances on the whole reservation,” he said. “Now there are scores.” White Plume still holds his own family and extended family’s Sun Dances in the traditional way. “It’s just us,” he said, in a way that sounded less exclusive than it looks in print. “It’s so beautiful, so spiritual.”

The vigorous resurgence of Sun Dance ceremonies owes much to the passage of the 1978 act but also to the widespread Indian activism that began earnestly in the early 1970s. Now every year during the summer there are more than 50 separate Sun Dances across Pine Ridge, up from the few held in secret decades ago. At each

WE PREFERRED HUNTING
to a life of idleness on the reservation,
where we were driven against our will...
We preferred our own way of living...
All we wanted was peace
and to be left alone.



Crazy Horse, ca 1842–1877

ceremony scores of invited participants dance, meditate, pray, are purified in sweat lodges, and fast for days at a time. Men who are deemed spiritually equipped to withstand this symbolic act of communal self-sacrifice are pierced with bone pegs at the end of ropes tied to the branches of ritually harvested cottonwood trees. They then jerk themselves free, tearing their skin in the process. A mantle of ancient-feeling, sacred humidity settles over the rez.

IT SAYS A LOT of what you need to know about Alex White Plume that an imperfect yet contagiously optimistic 38-year-old woman named Olowan Thunder Hawk Martinez considers him a mentor. At one time or another, Martinez has been almost everything you might despair of in a person, but she is also an irrepressible spirit and a courageously outspoken, self-appointed youth leader. “You want me to be that drunk Indian woman in the corner?” Like her mentor, Martinez has an unsettling habit of laughing when she is most serious. She laughed now. “I’ve been there, done that. I snapped out of it.”

On the night she heard of Jumping Eagle’s suicide, Martinez said, she could feel the victim’s pain—as if the body of the dying girl had briefly broken its bounds and inhabited her own. “I know why a lot of young girls try to kill themselves on the rez,” Martinez said. “We’re all in

constant danger of losing ourselves, losing our identities. It’s a daily struggle for each and every one of us to be fully Lakota. And sometimes we lose the struggle, and then the men take out their feeling of worthlessness on the women, the women take out their feelings of worthlessness on themselves, and everyone takes out their feelings of worthlessness on the children.”

In Martinez’s case, an uncle had molested her when she was six and again when she was ten. “Afterward he used words—he told me I was useless. I remember feeling such a deep pain that nothing and nobody could reach inside to take it away.” Soon after the second defilement Martinez found herself standing alone in the kitchen of her mother’s house. “Just like today, it was hot outside and building up for rain,” Martinez said. “I remember looking down at the kitchen counter and seeing a knife. And suddenly that knife seemed like the only way to cut out every pain inside me. So I picked it up and started to saw through the skin on my wrist.”

As Martinez was telling this story at her kitchen table, there was a rumble out of the sky, as thunderclouds massed—Wakinyan, the Oglala Lakota call them, Thunder Beings. “The sixth time I was trying to cut, the floor beneath me rumbled,” Martinez said. “Wakinyan were speaking to me. They were telling me I had to live. I dropped the knife.”

For a moment we sat in the sultry, fly-buzzing

In 1868 men came out and brought papers.
We could not read them, and they did not tell us truly
what was in them... When I reached Washington
THE GREAT FATHER EXPLAINED TO ME
...that the interpreters had deceived me.
All I want is right and justice.



Red Cloud, ca 1822–1909

silence. She lit a twist of sage, and we took turns wafting the cleansing smoke around our hair. A small commotion erupted outside. Although money is always tight, and Martinez has three children of her own (who are 19, 11, and 5), there is often a posse of unrelated or half-related youngsters hanging around, participants in Martinez's somewhat haphazard youth-leadership endeavor. Today was no exception. Several boys, ranging in age from 14 on up, were running in circles around her humid, overgrown garden, shooting at each other good-naturedly with pellet guns. One of them had been shot in the rear and was wailing. Martinez laughed and got to her feet. "Oh my warrior youth," she said. "Let's find out who did what to who."

IT IS PERHAPS ONLY NATURAL that Martinez, who grew up on the rez in the 1970s and early '80s, has radical tendencies. "Those were crazy times," Martinez told me. Unseen people walked at night, heavily armed; houses in the more remote towns were frequently shot at after dark; there were scores of killings. "You can dance words around it, but what was happening back then felt a lot like a war to the people who were in it," she said. In February 1973, 200 members of the American Indian Movement (AIM), a pro-native group that included Martinez's young parents, occupied the site of the Wounded Knee massacre to protest broken treaties and corrupt tribal

governance. In response the tribal government formed its own private militia—Guardians of the Oglala Nation, they called themselves (GOONs for short)—and along with dozens of National Guard troops and FBI agents, faced down the activists. By the time the siege was over, 71 days later, 130,000 rounds had been fired, and authorities had made more than 1,200 arrests.

Martinez and I were talking about this one late afternoon at the Wounded Knee Cemetery, not far from her house. "I am a direct result of that revolution," she said. We had spread out in the shade of a tree that also sheltered her father's grave. Angelo "Angel" Martinez had died in a car crash in 1974, when Martinez was a baby. It is a measure of the esteem he was held in by AIM members that his funeral included an elaborate procession from the village of Porcupine and burial in this highly significant cemetery. "Right here at Wounded Knee," Martinez said, digging her finger into the ground. "This is where the idea of me happened."

Looking at it head-on, the 1973 siege did not achieve its goals. Broken treaties between the U.S. and the Oglala Sioux remained broken, the tribal government remained as corrupt as ever, and those rebellious days had a long and violent afterlife. Between March 1, 1973, and March 1, 1976, the murder rate on the Pine Ridge Reservation was more than 17 times the national average. But the AIM activists had

made two things abidingly and indelibly clear. The U.S. government could never again dismiss Indian people as a bothersome obstacle to an otherwise perfectly executed manifest destiny, and being native, resisting colonization and assimilation was something to which people could proudly dedicate their lives.

ONE AFTERNOON a few weeks later Martinez and I drove two hours northwest to deliver a birthday cake to a niece by marriage, who had recently been raped on the rez and had fled to a women's shelter in Rapid City, South Dakota. On the way Martinez pointed out several unmarked state police cars. When I asked her how she could tell, Martinez said, "I can spot a pig a mile off. It's the way I was raised by my mother."

It's true that Victoria Thunder Hawk had presciently prepared her child for jail, because whatever else was up for grabs in Martinez's future, incarceration was inevitable. "I grew up on marijuana money," Martinez said. "It's how my mother took care of us and funded her work in the resistance. So she always used to tell us, 'Just remember, when they come for you, keep your head up and mouth shut.'" Martinez said the whole rez community seemed to come through their doors to buy marijuana when she was a kid, "teachers, cops, neighbors. I thought everyone smoked." But Thunder Hawk never got rich on the trade, sharing her profits liberally with the community. Also, she viewed marijuana as a medicine that would allow her people to heal from oppression and to tap into a creative, contemplative frame of mind. By the time Martinez was 30, she had been involved in selling drugs for most of her living memory. "It was just a matter of time," Martinez said. "You know? You get selfish, you get careless, you get caught."

By now we had delivered the birthday cake and were driving through Rapid City's downtown, with its once-we-were-cowboys-and-Indians public art. But as Martinez kept insisting, the past wasn't neatly done and dusted, as the bronze statues of cowboys would suggest. It was here and now. A day earlier, on August 2,

a 22-year-old Indian man originally from the reservation, Daniel Tiger, had shot and killed a police officer in an altercation at a bus stop in the city. Tiger too had been shot and died of his wounds, another officer had died, and another was recovering in a hospital. "White people always say there's nothing racist about it," Martinez said. "But that's because they're not native. Maybe it's time we made the boundaries around the rez impenetrable. Keep the Indians in, keep the crackers out. Then we can just get on with it. No more cowboys and Indians."

Martinez pointed to a stark, square building to her right. "Pennington County Jail," she said. "That's where I spent my 11 and a half months in hell." She looked over at me. "They got me for conspiring to distribute. But I didn't snitch on anyone. I did my time. Head up, mouth shut, just like my mother told me."

Martinez said the worst part of her died in that jail. "The greedy, selfish Martinez died in those walls. She's buried there." She reached over, patted my arm, and laughed. "Don't you think that's a good place to bury a colonized Indian ass? In a white man's jail." Encouraged to participate in sobriety classes, Martinez was unequivocally clearheaded for the first time in decades. "Then when I was having revelations, when I was feeling the spirits, I knew I wasn't hallucinating. I started to trust my visions." Sitting in a windowless cell, Martinez said, she saw her future. "I could see dozens of tepees set up in a meadow and young warriors everywhere, flags and braids and camouflage flying. I was in the middle of them, and my children were with me." Martinez shut her eyes, and for a moment all the hurt and the fight went out of her face.

IN THE EARLY SPRING of 2011 Olowan Thunder Hawk Martinez briefly caught the edge of the vision she had had in jail. For a few weeks in that unkind South Dakota season, she borrowed

121.3

Liver disease deaths per 100,000, PINE RIDGE RES. (Shannon County)
9.7 UNITED STATES

37.2

Suicides per 100,000, PINE RIDGE RES. (Shannon County)
10.9 UNITED STATES

a tepee and set it up on land she had inherited from her mother, who had died while Martinez was incarcerated. Martinez was not permitted to attend her mother's funeral. "She died with an outstanding warrant for her arrest hanging over her head, for the same thing that landed my ass in jail," Martinez said.

By conventional Western mores, Martinez's vision would seem unambitious to the point of meaninglessness. Still, her mother would have approved of Martinez's setup on her land. And it's something Alex White Plume would respect too. "Everything in the U.S. is designed around money," he had said to me. "So how do we live in that mode—with the white man's houses, the white man's pickup, the white man's currency—and still keep our traditional Lakota culture?"

In the tepee Martinez heated baked beans over an open fire surrounded by her two young daughters, her son, and half a dozen coming and going Oglala Lakota youth. As in her vision, the youngsters were dressed in camouflage, many of them wore their hair in long braids, ribbons were flying. For a few sacred weeks Martinez wasn't in mold-infested, government-issued housing. She was off the grid. (She can rarely afford her electricity and water bills when she isn't.) She woke up early and walked out of her tepee and directly into the grace of the morning star, to which she gave her Lakota thanks.

And outside the tepee, against the restless Great Plains sky, bleak with heavy spring snow clouds, Martinez raised an American flag, union down. According to the Flag Code of the United States of America, the flag should never be displayed union down, except as a signal of dire distress or in instances of extreme danger to life or property. "That's almost right," Martinez said. "We're in dire distress, but we don't need anyone to come and save the Indian. When we honor our customs, and when we perform ceremonies, and when we listen to our ancestors, then we have everything we need to heal ourselves within ourselves." Martinez thought for a moment, and then she added, "Write this: When the lights go out for good, my people will still be here. We have our ancient ways. We will remain." □





A candlelight vigil is held to honor 15-year-old suicide victim Dusti Rose Jumping Eagle. The suicide rate for the Oglala on the reservation is more than three times as high as for the U.S. population as a whole. “No matter how young, they know about suicide on the reservation,” says Eileen Janis, a suicide prevention leader.



Possessing alcohol or being under its influence is illegal on the Pine Ridge Reservation. But in Whiteclay, Nebraska (population around a dozen), on the reservation boundary, four liquor stores sell some four



million cans of potent malt liquor annually. Alcoholism afflicts eight out of ten Oglala families. The tribe has filed suit against beer distributors for knowingly making alcohol so readily available.





A young man suffering from the effects of a neurological disease and alcoholism sleeps in the living room of his home, six miles from the nearest town. Since the photograph was made, in May 2011, the house has been condemned, and he and the other occupants have moved elsewhere.



Lenny Jumping Eagle rides in a celebration of the defeat of Colonel Custer in the Battle of the Greasy Grass (the Battle of the Little Bighorn), June 25-26, 1876. Every year dozens of long-distance rides or horse races on and beyond the reservation commemorate great leaders, sacred lands, and historic events.



Out of the Indian
approach to existence
THERE CAME A
GREAT FREEDOM,
an intense and absorbing
love for nature...enriching
faith in a Supreme Power;
and principles of truth,
honesty, generosity, equity,
and brotherhood as a guide
to mundane relations.



Luther Standing Bear, ca 1868–1939

With the reverence afforded a sacred being, Oglala men fell a specially chosen cottonwood tree and carry it to the center of a Sun Dance circle. Erected in the earth, the tree will become the focus of a days-long spiritual ceremony. Sun Dances and other traditional ceremonies have undergone a resurgence since the 1970s.

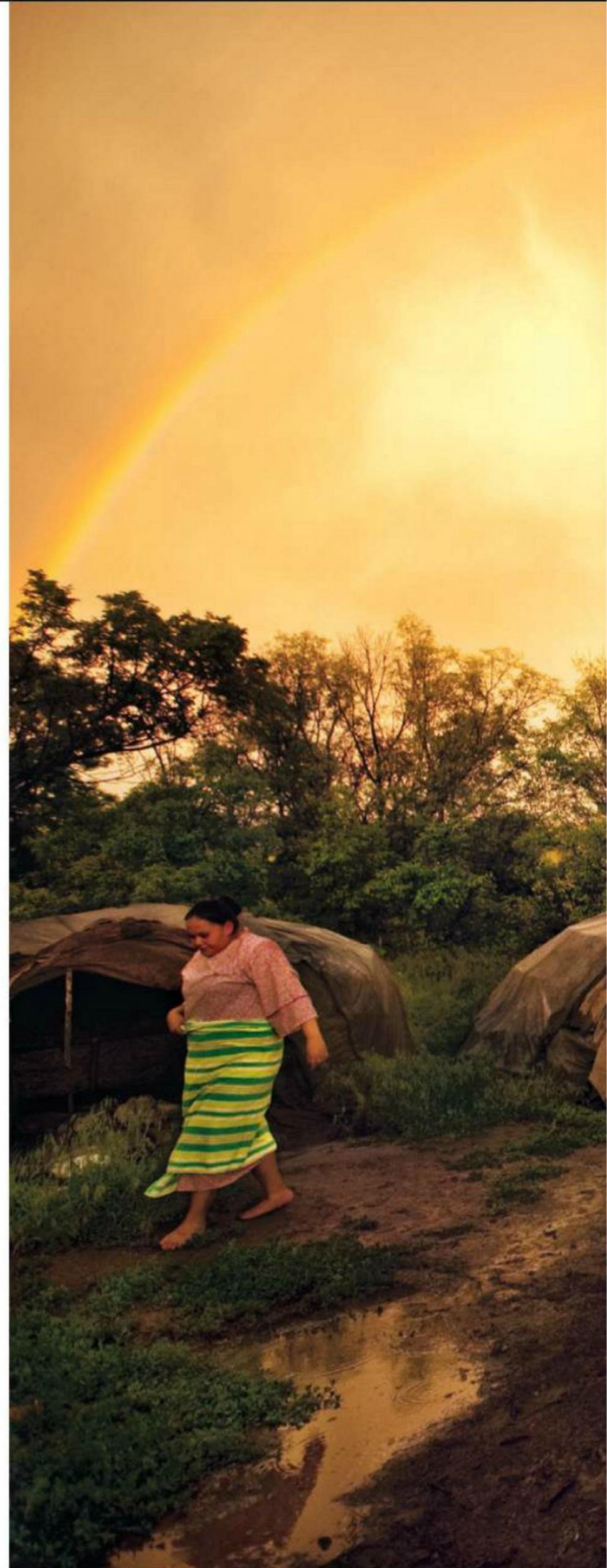






Spiritual Ways

A woman prays beside a sacred Sun Dance tree after the ceremony has ended. During the Sun Dance a medicine man guides certain men in making a solemn offering. They are attached to the ropes by bone pegs piercing their chests or backs and must tear themselves free. The colorful ties on the tree contain tobacco and other offerings and represent prayers for the people and for all of creation.





After intense communication with the spirits, participants emerge from a steaming *inipi*, or purification (sweat) lodge. This ceremony was held by Rick Two Dogs, a medicine man descended from American Horse.

Perhaps you have noticed
that even in the very lightest
breeze you can hear the voice
of the cottonwood tree;

THIS WE
UNDERSTAND IS
ITS PRAYER TO THE
GREAT SPIRIT,

for not only men, but all things
and all beings pray to Him
continually in differing ways.



Black Elk, ca 1863–1950





Nine-year-old Wakinyan Two Bulls places prayer flags in a tree near Mato Tipila (“bear lodge”), or Devils Tower, in Wyoming. The story of the Oglala—their spirituality and their fight to remedy old wrongs—goes well beyond the Pine Ridge Reservation.

Daring Divers GANNETS

Champion divers but clumsy landers, doting parents but hostile neighbors—northern gannets abound in contradictions. Long tied to maritime cultures, they're flourishing today in crowded colonies around the North Atlantic.



At Hermaness National Nature Reserve in Scotland's Shetland Islands, adult gannets soar above the coastal churn. Snugly insulated by thick feathers and fat beneath their skin, these far-foraging seabirds are built for life in cold, turbulent waters.





By JEREMY BERLIN

Photographs by ANDREW PARKINSON

Fifty feet above the storm-tossed North Sea,

a thunderhead of birds has been massing. When the cloudburst comes, it's quick as lightning. They plunge, a score of white tridents, spearing the waves with a thump and a splash. Moments later they bob to the surface, fish in throat. They shake their heads, rise from the water on six-foot wings, and soar to cliffside homes with a swan's grace. There they land badly and bicker loudly.

These are northern gannets, far-ranging seafarers tethered seasonally to crowded colonies. Science tells us *Morus bassanus* is a cousin of the booby, but the eye sees a seagull crossed with an albatross. As elegant in flight as they are hapless on land, they are by turns bumptious and balletic, territorial and tender, dramatic and comical. They are, in the words of the wry Scottish naturalist Kenny Taylor, "birds of contrast."

So let us count the ways, and let us begin with a cheering score. By 1913, centuries of hunting had thinned their ranks, once unknowably large, to perhaps 100,000 birds, their colonies to fewer than 20. A hundred years of protection later, gannets are one of conservation's great success stories. Today 40-odd sites around the North Atlantic harbor some 400,000 nesting pairs, plus tens of thousands of juveniles and nonbreeders.

One large colony resides at Hermaness, a national nature reserve at the top of Shetland. This is the northernmost point in Britain—the edge of the world. With 500-foot gneiss cliffs plunging into tidal cauldrons dotted with arched skerries, the site—named for a giant who loved a mermaid—is steeped in myth. When you reach it, the miles of sodden moorland you've tramped fall away into a chasm of sea and sky, where wind and wave skirl and roar.

Gannets began nesting here in 1917, and in summer months their molting feathers fill the air like fairy dust. The colony itself is a riot of squawking, flapping, and jabbing. The choicest nest sites are in the center, as valuable and rare as rent-controlled apartments in Manhattan. Once acquired, they're defended with life and saw-toothed bill. Single birds lurk on the fringes, seeking a partner and a nest of their own.

To get a site, two males will fight, locking bills and stabbing faces, for up to an hour. When the clash ends, one gannet leaves; the other has a home. "The bird is faithful to the site once it occupies it," says Stuart Murray, a gruff Scotsman who's been surveying Britain's seabirds for four decades. "They attract a mate, she lays an egg, and then they think, Bingo! I've done it!"

Each season equals one egg, plain and white like a goose's. Parents take turns incubating it and, after six weeks, feeding what emerges—a shriveled thing, naked and ebony. Over three months it will become a downy, white powder puff, then a slate-plumed juvenile. Two meals a day swell it swiftly; calisthenic wing flapping tones it crucially. When a chick is ready to leave the nest, it splashes into the sea. "At first it just bobs on the waves, bewildered," says Murray. "But hunger pangs drive it to swim and dive. Then it will learn what to do by watching other gannets." Growing up will be hard and perilous. Less than half will see a third birthday.

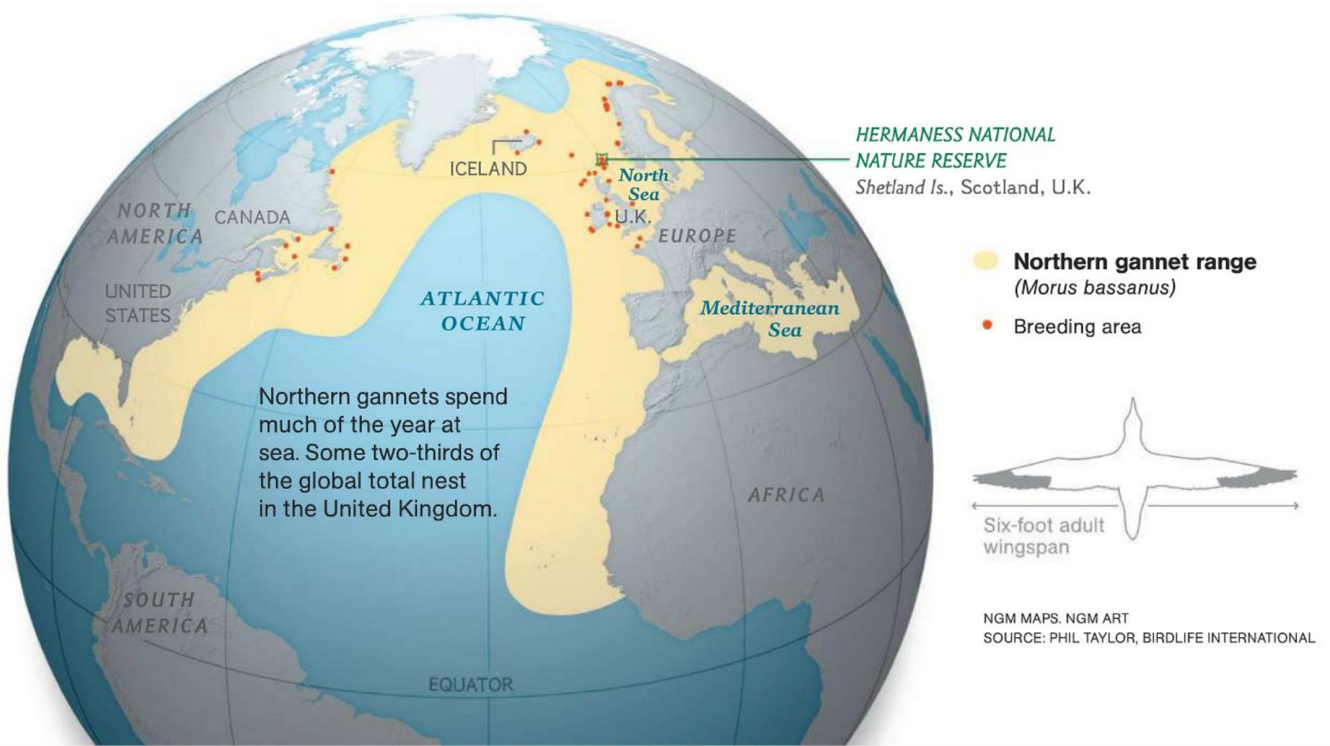
If gannets have a calling card, it is the spectacular feeding behavior called plunge diving. Watching these birds plummet headlong to wrest life from the frigid depths, one thinks of Tennyson's eagle, of crawling seas and falling thunderbolts. One also sees why fishermen have long relied on them as location scouts. Indeed, the human-gannet relationship stretches back centuries. Beowulf's liege lord, Hrothgar, called the ocean a "gannet's bath." John Daniels, who photographed the Wright brothers' first flight, said Orville and Wilbur "would watch the gannets and imitate the movements of their wings with their arms and hands." And melted gannet fat was once used for everything from gout balm to wagon-wheel grease.

Today, with few natural enemies and abundant food sources, the northern gannet seems primed to thrive. Still, as with most seabirds, its life is a daily proving ground of water and weather. Even in these days of protection and plenty, says Murray, "it's a high-stress business, being a gannet." □



DAVID TIPLING, BIOSPHOTO

Binocular vision lets gannets spy deep fish shoals. When the birds break the surface, at up to 70 miles an hour, air sacs buffer their heads and chests. Nostrils that seal shut let them dive to depths of 50 feet.



Two landing adults raise the ire of their Shetland neighbors, a common sight in a hectic colony. But beneath the territorial clamoring is a ritualized order. Nests are arranged in a canny geometry of two per ten square feet—just out of jabbing range.





East Side



A diverse population comes and goes near Stamford Hill, Hackney.

Story

The “other London”—gritty, graffitied, but with a rising cool index—gets ready for its close-up as the venue of the Summer Olympics.







Soldiers in the service of Jesus Christ, men and boys of the Nigerian Cherubim and Seraphim Church of Zion Imole in Hackney march up to the collection box to put in their offerings.





Home is where the harbor is for houseboat residents along the latticework of East London's canals. This picnic unfolds by Hertford Union Canal, near the site of the 2012 Olympics.





Pearly Queens Jackie Murphy, daughter Teresa Watts, niece Sharon Crow, and cousin Phyllis Broadbent sing in a Leyton pub. The Pearlies are a traditional Cockney charitable organization.

After the last customers had wiped the stray crumbs of meat pie from their faces. After the last jellied eel had slid down throats. After the last cup of tea had been swallowed,

Fred Cooke, owner of F. Cooke's pie and mash shop at 41 Kingsland High Street, London E8 2JS, flipped the hand-printed cardboard sign on the front door of the establishment his grandfather had founded when George V assumed the throne from OPEN to CLOSED.

"You bet there were tears," Cooke said of that day, February 11, 1997. Cooke, a thick-bodied man with thinning hair on top that gathered momentum to crest in a lush white wave at the back, stared wistfully at a case in the Hackney Museum. The display featured the net he had used to scoop eels out of the tank, pots for boiling potatoes for the mash, steel pie pans, and paper bags with F. Cooke printed on them for carryout. The kitchenware of a three-generation-old family enterprise had become a museum artifact.

"We were the Buckingham Palace of pie and mash shops," he said. The diamond stud in his right ear and a gold bracelet, thick as a handcuff, testified to the rewards. The pie and mash shop on Kingsland High Street, one of six owned by the Cooke family, had been the flagship of the fleet, but the ship had been scuttled in response to the changing social landscape of East London.

Pie and mashed potato drenched in neon green parsley sauce, a bowl of eels in a gelatinous matrix, is a vanishing emblem of East End's white working class, which has been replaced by a tide of emigrants from the Indian subcontinent—the legacy of the London docks that were once the gateway out to the rest of the British Empire and the gateway in for immigrants. The Huguenots arrived in the 17th century seeking freedom from religious persecution. In the 18th and 19th centuries the Irish fled famine. Eastern European Jews escaping the pogroms of Russia were next. Now the predominant ethnic group is Bengali;

most are Muslim. They began immigrating in large numbers in the 1960s for economic reasons and now make up a third of the population—but there are also Africans, West Indians, Pakistanis, Indians, Turks, Chinese, and Eastern Europeans.

On Cambridge Heath Road in Bethnal Green, the Al-Rahman Supermarket, with its HALAL MEAT sign, rubs shoulders with the Polski Sklep Mini-Kłos Polish grocery, across from the Somali Mayfield House Day Centre, down the block from the luxury Town Hall Hotel, with a BMW or two parked in front and its £2,500 (\$4,000)-a-night De Montfort suite (triple-height ceiling, stained glass windows, room for 16 to dine). Around the corner is York Hall, venue for Saturday night boxing ("Bad Boy Promotions presents: a night of white collar boxing with José 'KO' Corrodo and Lee 'the Bomber' Banks"), and steps away, the Gallery Cafe, where mothers with children in prams drink lattes and young professionals hunch over laptops. There is the crackle of energy, the jazz of diversity; it's a bazaar to pick and choose from according to your taste, mood, and wallet.

The number of East End pie and mash shops—Cooke remembered 14 or 15—could almost be counted on one hand now. "East London became cosmopolitan," Cooke explained. It was unclear if he meant this as a compliment. "They want their peas and rice, mon, and their kabobs." It was said lightly, with an undertow of edge but mostly with resignation.

THINGS GO MISSING. We drop a glove. Lose a watch. Misplace our glasses. Sometimes they reappear, are appropriated by others, or stay lost. East London is like that. A landscape of disappearances; streets scribbled with traces of the past, a tangle of bits and bobs that alternately

vanish, then show up again in different form. A turn-of-the-century Jewish soup kitchen for the poor on Brune Street is reborn as luxury apartments. An 18th-century French Protestant church becomes the Spitalfields Great Synagogue in 1897, then 80 years later turns into the Brick Lane mosque, a testament to Lavoisier's dictum that matter is neither created nor destroyed but simply changed from one form to another.

F. Cooke's pie and mash shop in Dalston was sold to a Chinese businessman, who renamed it the Shanghai. Instead of eels, the menu lists baked lobster with ginger and spring onions. Instead of meat pies, pork dumplings. "I carried on as good as I could," Cooke said, "but there was no use in flogging a dead horse. I decided to get out and enjoy the rest of my life. Nonetheless, it broke my heart."

TRACE A LINE starting at Tower Bridge along the north bank of the Thames; go east to the River Lea; turn north, looping in the borough of Tower Hamlets and part of Hackney; go south, to the old Roman walls of the City, and you have the classic East End of Charles Dickens, Jack the Ripper, and the celebrity gangsters of the 1950s and '60s, the Kray brothers—Reggie and Ronnie, of whom one East Ender said: "The Krays were on the streets killing, but they would take care of your mother."

This, historically, is wrong-side-of-the-tracks London. Its proximity to the Thames, and the eastern flow of the river, made the downstream location of shipping and manufacturing a natural consequence. Located beyond the walls of the City, noxious industry—tanneries, abattoirs, lead-smelting furnaces—could operate with minimal oversight. Winds blew from the west, lobbing the stink right across the East End, away from the perfumed air of the genteel West. The industrial revolution and expansion of the British Empire under Queen Victoria exacerbated the sordidness. The huge demand for dockworkers shoehorned even more working-class residents into an area swollen by immigration. Overcrowded housing proliferated. Poor sanitation spread disease. "Not a

very nice neighborhood," observed Sam Weller in Dickens's *Pickwick Papers*.

UNLIKE THE HOMOGENIZED grandeur of West London, with its Parliament and palaces, East London's landscape was—and remains—unruly and unkempt. There are oases of loveliness: The quiet calm of houseboat-lined Regent's Canal; the orderly and expensive Georgian houses on Fournier Street, where the edgy lions of British contemporary art like Tracey Emin and Gilbert & George live; the green of Victoria Park, opened in 1845 by grace of a petition signed by 30,000 East Enders, as well as West Enders who wanted a barrier to the diseased air of the East. But there is squalor in the brutal concrete of low-income housing estates, their corridors shading the furtive transactions of drug dealers, the stale smell of urine in stairwells; in the street gangs; in the brown fields with the toxic detritus of moribund factories; in the marshes scarred by rows of electric line pylons and rusting gasworks.

Today East London broadens out—depending on whom you ask—to include the boroughs of Newham, Barking and Dagenham, Redbridge, Waltham Forest, and Havering. Whatever the boundaries—despite more than a century of regeneration, despite neighborhoods colonized by white-collar professionals and more than 170 art galleries and museums, despite the prosperity of Canary Wharf's financial district and its Masters of the Universe skyscraper headquarters for HSBC, Barclays, and Citibank—East London is still the quarter of the city most haunted by deprivation.

From 1889 to 1903 the Victorian social scientist Charles Booth published a map series of London poverty that scribed the East-West divide. On Booth's map the West End of Kensington and Belgravia gleam with gold rectangles denoting "Upper-middle and upper classes. Wealthy." The East End is riddled with black patches signaling "lowest class" and blue squares signifying

Editor at Large Cathy Newman admires Brits for their wit and civility. East London reminds Alex Webb of Brooklyn, his home borough in New York.



“chronic want.” An index of deprivation in London today would read pretty much the same.

In 2005 the International Olympic Committee awarded the 2012 Olympics to London. The city announced it would use the games as an opportunity to transform East London and tackle “poverty, unemployment, lack of skills and poor health.” The Olympics would be, Jack Straw, then foreign secretary, promised, “a force for regeneration.”

IN EAST LONDON disparities between the haves and have-nots are in high relief. In Bethnal Green you can order a sausage roll (£1.40) and a cup of tea (70 pence) and eat at the Formica tables with plastic-covered chairs at Hulya’s, or nip across the street and ease yourself into the handmade furniture at the Michelin-starred *Viajante* for squid tartare with squid ink granita, followed by, say, duck heart and tongue with mushroom floss and spiced broth (six courses with wine pairing, £115).

“London,” says Danny Dorling, a professor of human geography at the University of Sheffield, “is the capital of inequality.” As they say

on the London Underground: *Mind the Gap.*

Turn right on Hanbury Street off Brick Lane facing toward Bethnal Green Road and you approach some of the meanest low-income housing estates in London. Turn left and you approach the terminally cool district of Shoreditch, home of 300 or more digital-based, high-tech businesses.

“Entrepreneurs need four things,” explained Elizabeth Varley, a founder of TechHub, just off Old Street, where for £3,300 a year, developers of Web apps and cloud-based products who are hoping to come up with the Next Big Thing can buy desk space. “They need power, a superfast connection, unlimited coffee, and great creative people around them.”

East London has become a high-tech nexus, she explained, because of its affordability, its proximity to the city, and the “common vibe.” “The area is full of artists, restaurateurs, and retailers, people who want to do things their way.”

People like 24-year-old David Tenemaza Kramale, a computer game developer, who sold his first digital product at 13 for £1,000, was looking to raise £300,000 for his latest venture, and had just moved to a one-room windowless basement



The Rising East

“The East End of London is a world in itself,” wrote Charles Dickens. The constellation of skyscrapers in Canary Wharf’s financial district (opposite) is a world within that world, built from docklands abandoned in the 1960s, when shipping moved downriver to deeper water.

flat five minutes from work, for which he was happily paying £1,000 a month.

“I like living here because of the convenience and ability to network,” he said. Kramaley, whose round face is framed by a Beatle-like mop of black hair, relishes the roller-coaster ride of a start-up. “I know I could get a well-paid job doing coding or marketing, but I like being in control of my own destiny.”

His goal?

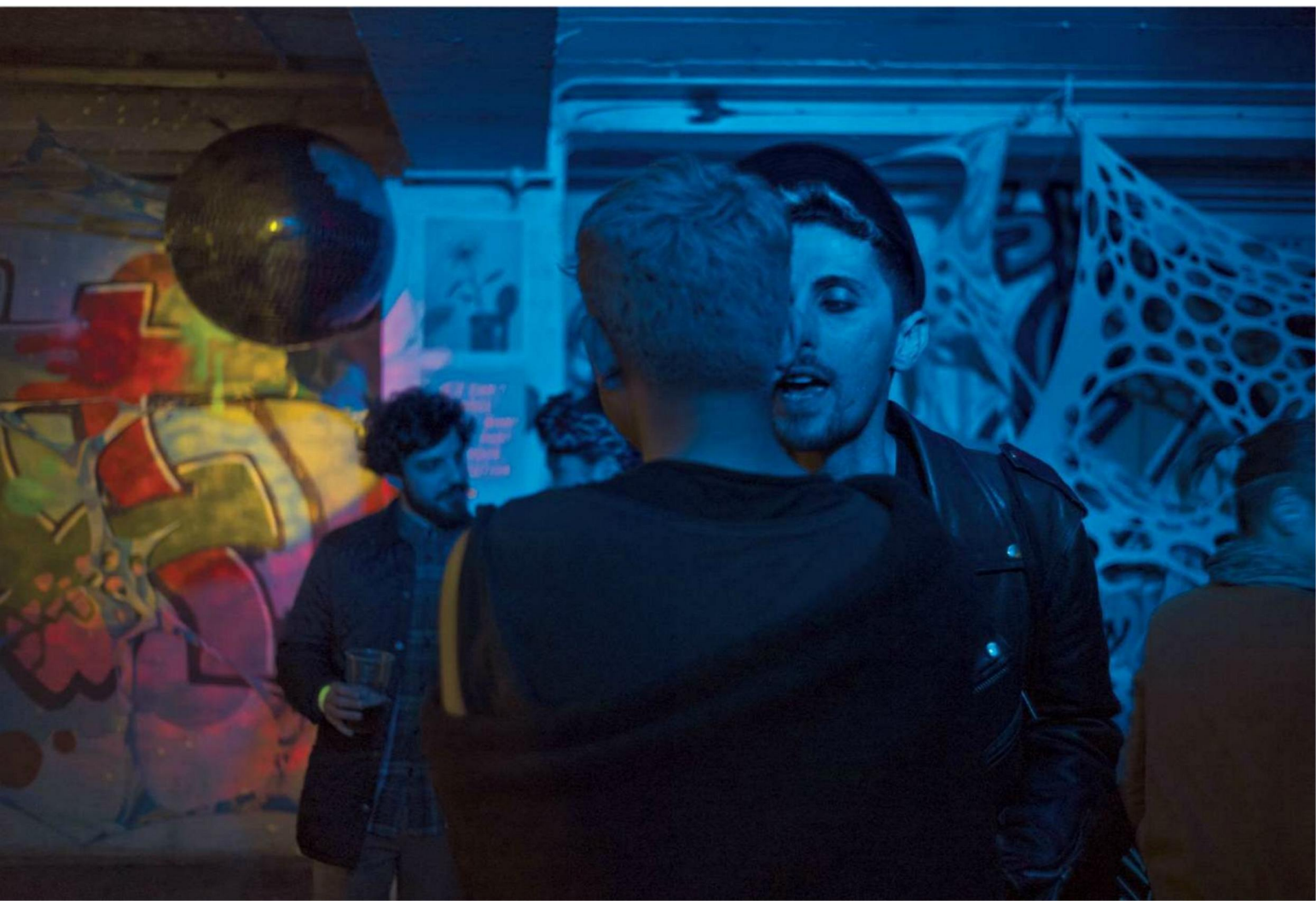
“To make two million pounds.”

“EVERYONE KEEPS LOOKING for the newest immigrants,” said Sotez Chowdhury, 22, a Bengali community organizer for Shoreditch Citizens. “They

keep wondering—which ethnic group is next? I keep saying, These *are* the new immigrants, and you can’t say they don’t belong.” He meant the young professionals who had moved in, lured by the vibrancy and hipness of the place.

One night Sotez; his mother, Rowshanara, who is a family therapist; and I walked down Brick Lane, the heart of Banglatown, as it’s called. The lower end of the street with its curry restaurants (there are more than 50) glowed with the flamingo pinks, acid greens, and garish yellows of neon signs; the air practically vibrated with the smells of curry, cloves, and burning charcoal and the blaring Bollywood music.

At Woodseer Street, *(Continued on page 94)*



**There is
the crackle
of energy,
the jazz of diversity;
it's a bazaar to pick and
choose from according
to your taste, mood,
and wallet.**



THE MIXING BOWL OF EAST LONDON contains young, old, rich, poor, gay, straight, and everything in between. The A1 barbershop on Commercial Road (above) caters mostly to customers from Pakistan and Bangladesh. At day's end young professionals in the Canary Wharf financial district relax over drinks (top left). The Joiners Arms Gay Night takes place at Cordy House, an event space in Shoreditch (left). "There's less tension than one would expect," says Geoff Mulgan, former director of the Young Foundation, which creates programs to address social issues in East London. "It's healthy, the opposite of ghettoization."





Worshippers offer prayers at a funeral service in the Turkish Süleymaniye Mosque in Shoreditch. "Our neighbors accept us and see us as one of them," says director Huseyin Hakan Yildirim.



**Unlike the
homogenized
grandeur
of West London, with
its Parliament and palaces,
East London's landscape
was—and remains—
unruly and unkempt.**



LIVING ON THE ROUGH EDGES, but getting by, John Cook (above), aka John the Poacher, hunts rabbits in nearby marshes and sells them from his “office” in the Anchor and Hope pub. “There’s nowhere else in London I’d rather be than Hackney,” he says. Sibel Beliczynska (left), a Cypriot with two children, is unemployed, on benefits, and looking for work. An older generation favors the Mecca Bingo clubs in Hackney (top left), where a pint sets you back two quid while you wait for the numbers to line up. By any measure—unemployment, income, life expectancy—most East London boroughs sit at the bottom of the barrel.

a Maginot Line of sorts, demographics change: Curry Restaurant Brick Lane turns into Boutique Brick Lane, with vintage clothing stores, music clubs, and bars filled with young men with sandpaper beards and young women in leggings and abbreviated tops. The Brickhouse bar and supper club that week promised the burlesque chanteuse Lady Beau Peep, along with Audacity Chutzpah, Bouncy Hunter, and Vicious Delicious.

An old Bengali man struggled to make his way against a tide of young people. “This used to be his neighborhood,” Sotez said of trendy Brick Lane, beyond Woodseer Street. The street was filled with the careless exuberance of a different generation, with money to spend. Did they have any sense of the deprivation that lay just around the corner? I asked Rowshanara. “They don’t have a clue,” she said.

“I’d come here with my friends from uni,” said Sotez. “It’s vibrant. It’s cool. We’d have a look around. From here you can see the lights of Canary Wharf, but they turned out to be an illusion.” He paused and his face seemed to harden. “My mates all wanted to be investment bankers. None of them are.”

IN ONE OF THOSE gleaming glass towers in Canary Wharf, Jerome Frost, head of design for the Olympic Delivery Authority, leaned forward on an impeccably white-topped table of the sort that telegraphs modern design and explained the driving force behind the London Olympics. “The games present a unique opportunity for London,” he explained. “We would reinvent the event. Make it more sustainable. The bid we made to the Olympic Committee was positioned on what we would leave behind.” The games were dubbed the “legacy Olympics.” In developing the site, the ODA cleaned up a square mile of contaminated land, buried power lines underground, and created 200 acres of new parkland. No environmentally correct detail was too small: 2,000 newts were carefully relocated away from the construction to a nearby nature reserve.

After the Olympics the buildings would find

new life as community sport centers, and the athletes’ village would become private housing—half, it was said, earmarked for low-income buyers. The regeneration bounty would spill over to the surrounding area. Westfield Stratford City, one of Europe’s largest shopping centers, had recently opened in Stratford, gateway to the Olympics, with 1.9 million square feet of brand-name shops.

Impressive, though the trumpeted word “legacy” provoked skepticism in some precincts. “‘Legacy’ is one of those words like ‘cool’ and ‘brand,’” said Stephen Bayley, a London design critic. “You can’t create a legacy. Let us not imagine that great buildings can undo a ghetto.”

“Will they get it right this time?” I pressed Jerome Frost. On the plus side, he said, a chunk of East End had been cleaned up in record time and under budget, an improbable accomplishment if left to the private sector. But would those who live there really benefit? Or would it end up as another Canary Wharf, a walled-off Vatican, one urban studies scholar called it, that merely underlined the economic divide?

“If this doesn’t work,” Frost said with a sigh, “nothing will.”

PERHAPS THE MENU needs updating?

The question was put to Fred Cooke’s cousin Bob, who still runs his pie and mash shop at Broadway Market, Hackney. Bob Cooke set a bowl with a piece of eel floating in a sea of green sauce in front of me and sat down. It was tricky spooning the slippery segment out and trying to nibble around the tiny white cylinder of vertebrae in the middle.

“One of my pals said: ‘Why don’t you sell pizzas? Kids love pizzas.’

“I said: ‘You look after your laundry. I’ll look after my pie shop.’”

Cooke stood up and wiped his hands on his blue-striped apron.

“Yes, we have customers, but they’re older and getting fewer. Yuppies are not our customers,” he said, as a tall young man with a ponytail peered in the doorway, then walked away. “I sell 3,000 pies a week,” he said. “We’ve been here more than a hundred years. We’ll be here another hundred.”

It remains a continuum of arrivals and departures, appearances and disappearances, a human march, sometimes, of simply getting on with it.

Noon was approaching. The street outside was packed with young people trolling the Broadway Market—which once sold utility-grade cabbages, onions, and potatoes—for organic gluten-free banana-walnut cake, pedigreed Devon beef, and truffled olive oil. There was music in the air, and the smell of fresh-baked artisanal bread. There were only five customers in the shop eating pie and mash.

IN EAST LONDON you may hear more than 200 different languages—Bengali, Gujarati, Urdu, Tamil, Swahili, Latvian, among others. Immigration makes itself heard as well as seen, but there are sounds no longer heard—like Yiddish, Brick Lane’s lingua franca at the turn of the 20th century. For the same reasons white working-class Cockneys moved east to places in Essex, East London Jews moved north to suburbs like Golders Green and High Barnet. It was about aspiration: about moving up and out. Until the 1950s Brick Lane was a Jewish high street. Now practically the only trace of its former life is two bagel bakeries.

“That’s my Jewish East End,” said Mildred Levison, showing me the apartment off Brick Lane where she grew up during the Second World War. (“I’m sure the vermin are still there. In London you are never very far away from a rat.”) We walked to Spitalfields Market, a bomb shelter during the blitz, now gentrified to within an inch of its life with boutiques and bistros. Levison, 72, retired from a career in public housing, lives in North London now. She recalled the six pence it cost for the public baths and playing

in bombed-out rubble (“Brick Lane feels different but strangely the same, because my grandparents were immigrants”), as well as the warmth of community and family. “None of it is here anymore.” She paused, then touched her heart. “But it’s here.”

It’s still here, just in a different guise. East London remains a continuum of arrivals and departures, appearances and disappearances, a human march, sometimes, of simply getting on with it. Generations had landed with little or nothing and built a business, a family, a life. If poverty had retained its stubborn grip, one would do well to remember, says Alveena Malik, director of UpRising, a program to train young leaders in East London, that “being economically deprived doesn’t mean you are spiritually deprived.”

“I CAME FROM BANGLADESH in 1973 to continue my studies,” Shahagir Bakth Faruk told me over dinner one night. “My uncle sponsored me, but there was no money, so I found a job as a shop assistant in an electronics shop in Brick Lane for £28 a week. I remember sitting in a park reading a letter from my brother. It had taken 17 days to arrive from home. My tears soaked the paper.”

In time he made a new life. He started a successful business. He ran twice for Parliament as the Conservative candidate from Bethnal Green and Bow. (“And lost twice. Bethnal Green has always been Labour,” he said ruefully.)

Faruk, now 64, became British. And another thing...

“In Bangladesh, if a girl wants to marry outside the Muslim religion, there is a one in a million chance the parents will give their consent. It isn’t done,” he said.

“But when my son came to me to say he wanted to marry a girl whose mother is Christian and whose father is Hindu, I didn’t give it a second thought.

“Now, my younger son wears an earring; when a friend pointed it out, I said: ‘So what?’”

Just then, his cell phone rang. His married son was checking on him.

“This city taught me an important lesson,” Faruk said, putting down the phone.

“The lesson it taught me was tolerance.” □





On Saturdays, East London's newest arrivals—the young and affluent—linger in trendy cafés and trawl the stalls of Broadway Market. Formerly a locus of garden-variety fruit and veg stands, the market now offers eco-friendly bamboo socks, loin of venison, and hand-sliced smoked salmon.



Guided by the laptop weather map reflected in his window, Tim Samaras rushes to catch up to a dying thunderstorm. He hopes to be the first to photograph the split-second event that triggers a lightning strike.



Tim Samaras has a storm in his headlights and the world's fastest high-resolution camera in the trailer behind. Can it catch lightning in the act?



Chasing Lightning

102 NATIONAL GEOGRAPHIC • MONTH 2011



As he waits for a wave of thunderstorms to form along Colorado's Front Range, Samaras readies the 1,600-pound camera he calls the Kahuna. A rainbow (left) signals the end of another chase.



By George Johnson
Photographs by Carsten Peter

It's a good thing there's a rumble strip running along the shoulder, because Tim Samaras can't keep his eyes on the road.

It's summer, and he's driving a big, black Denali pickup pockmarked by hail and pulling a 16-foot trailer outfitted with high-speed cameras and other electronic gear. A laptop computer is mounted inside the cab to the right of the driver's seat, and with one hand on the steering wheel and the other on a trackball, Samaras is mousing his way around a weather radar map of the Oklahoma Panhandle. A blob of colors—red in the middle surrounded like an oil slick by orange, yellow, green, and blue—shows a thunderstorm forming northeast of Boise City.

"It's starting to spit out some pretty good lightning," he says, looking at the little yellow crosses popping up on the radar. He glances again at the laptop, where another window is tracking our position with GPS. Then comes the buzzing of his tires against the rumble strip, and he calmly steers the rolling laboratory back onto the road.

With bugs splashing onto the windshield and a spiderweb of cracks—more old hail damage—gradually growing wider, we pass through Boise City, following the storm east toward Guymon. Ahead of us clouds are boiling up like cauliflower, the classic sign of the warm, moist updrafts that separate negatively charged water droplets and ice particles from positive ones (no one knows exactly how), creating multimillion-volt potentials—like the one that just exploded in the sky ahead of us.

"Did you just see that strike?" Samaras exclaims. Then comes another, and another. He's got a pair of reading glasses dangling from his

mouth, which he puts on to look at the radar, then swipes off to glance at the road. "See how that storm is anchored right there? That's what we want."

The flashes are coming every few seconds now, and the truck is hitting the rumble strip again and again. But just as he's looking for a place to pull over, the blob on the radar starts shrinking. Samaras picks up speed, but by the time we reach Guymon, 60 miles down the road, the sun has appeared, and a rainbow is arcing overhead.

"Whenever you see the rainbow, it's game over," he says. "It's a goner. I can't believe it." But at 6 p.m. his day is just beginning. The radar shows another blob forming over southern Kansas, 80 miles away.

LATE SUMMER IS THUNDERSTORM season in this part of the country, and since 2006 Samaras has been trying to do the impossible: capture an image of a lightning strike the moment it is born. The process typically begins when a descending zigzag of negatively charged electricity—a stepped leader—feels its way from cloud to ground. When it gets near enough, positive fingers of charge reach up from the earth. The instant the two come together, a dazzling surge of current—some 30,000 amps traveling at a third of the speed of light—leaps toward the sky. The burst of light from this "return stroke" is what you see with the naked eye, which often interprets the motion as downward. From beginning to end, the entire process takes as little as 200 milliseconds.

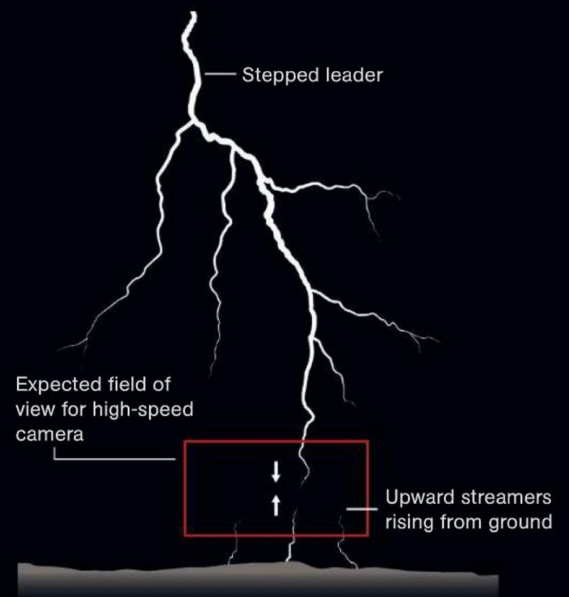
In Samaras's trailer there are two Phantoms, high-speed cameras capable of shooting 10,000 frames per second. They have allowed him to capture stunning slow-motion videos detailing

George Johnson's most recent book is The Ten Most Beautiful Experiments. Carsten Peter's story on Mount Erebus in Antarctica appeared last month.



The Anatomy of a Strike

1. In this high-speed camera sequence a lightning strike begins when a negatively charged “stepped leader” emerges from a thundercloud. 2. The stepped leader zigzags toward earth, branching along the way. 3. When the leader comes close enough to the ground, a positively charged streamer leaps up to meet it. Capturing an image of the moment the two connect requires an ultra-high-speed camera (graphic). 4. The “return stroke”—30,000 amps of current—surges upward, producing the burst of light visible to the naked eye. 5. The return stroke begins to decay. 6. As the light fades, more strikes can follow the same path, so quickly they are seen only as a flicker.



GRAPHIC: SIWEN LI
SOURCE: TIM SAMARAS

the paths of downward stepped leaders and occasionally the upward streamers. But as soon as the two connect—initiating an event called the attachment process—the flash from the return stroke blinds the camera, obliterating the details. Scientists would love to peek behind the curtain and watch the event as it unfolds, with the return stroke lifting off like a rocket from the ground.

Lying within the imagery might be clues to some of lightning's biggest mysteries. Why will a lightning bolt sometimes strike a low tree when right beside it is a tall metal tower? And why, for that matter, does lightning strike at all? For all their intensity, the voltages produced in thunderclouds are not nearly strong enough to overcome the insulating properties of air. Some extra factor is required, and a picture of the attachment process might suggest an answer. Opening this frontier calls for a custom-outfitted camera capable of shooting more than a million high-resolution frames per second. There's just one camera like that, and it too is in Samaras's trailer.

Weighing 1,600 pounds and standing six feet high, the camera is a relic of the Cold War, originally used to film aboveground nuclear tests. Samaras first laid eyes on it in 1980, when he was working as a technician at the University of Denver Research Institute. The massive instrument was a marvel of analog technology. Light entering its main lens would strike a three-sided mirror, which sat at the center of a turbine driven by compressed air or, for really high speeds, helium. Rotating as fast as 6,000 revolutions per second, the mirror swept the light across the lenses of 82 35-millimeter film cameras, mounted shoulder to shoulder around the rim. The result was a sequence of images less than one-millionth of a second apart.

Samaras's job involved studying conventional explosions, and he became the behemoth's keeper, learning its idiosyncrasies, catering to its whims. Twenty-five years later, when he heard that the camera was being auctioned as government surplus, he placed a bid and bought it for \$600—a hair above the price for aluminum scrap. Its proper name is a Beckman & Whitley 192. Samaras calls it the Kahuna.

With the help of funding from National Geographic, he retrofitted the beast, replacing the

film technology with extremely sensitive digital sensors designed for deep-space exploration and adding specially tailored software and circuitry. But no matter how you modify it, an instrument weighing close to a ton has obvious drawbacks. In addition to its lack of maneuverability, the astoundingly fast Kahuna is in another sense very slow. Each time you want to take an ultra-high-speed shot, you have to wait about ten seconds for the turbine to spin up to speed. Then you have about a minute before you have to spin it down so it doesn't overheat. If you've been lucky enough to capture an image, it will take a full 20 minutes to download the 1.8 gigabytes of data to see what you've got. Only then can you recock the trigger and try again.

In other words, Samaras will need a stationary storm that is producing lightning again and again, right where the camera is pointing. Some people rate his chances of success at close to zero. There are research facilities where he could reduce at least some of the variables by deploying the Kahuna on lightning triggered by firing rockets into storm clouds. But Samaras is dismissive of manufactured lightning—only the wild type will do.

He is used to having people tell him that what he's trying can't be done. Before he became obsessed with lightning, he spent several years chasing after tornadoes. He had designed electronic probes, mounted with video cameras and other instruments, to lay down in the likely path of a tornado so he could record what it looks and feels like from the inside. People were dubious about that too, but he managed to gather some of the most accurate readings ever of wind speed, barometric pressure, temperature, humidity—the ingredients that when mixed just so erupt into a devastating funnel of wind.

With hopes of catching up to the storm, we pass through Liberal, Kansas, and then head straight north toward Sublette. A dark mass of clouds is building over the plains. As the sun sets, the tops of the clouds cool. That means more uplift, more separation between negatively and positively charged particles, and more lightning. By the time we pull to the side of the road, the storm has become so violent that in the distance it has spawned a small tornado. The twister quickly dissipates, leaving a spectacular lightning show. Two long bolts crisscross the sky like an electrified X, followed by a barrage of ground

■ **Society Grant** Tim Samaras's lightning and tornado research is funded in part by your Society membership.

King of Cameras

Originally designed to record ultra-high-speed images of nuclear explosions on 35-mm film, the 1,600-pound Beckman & Whitley 192 framing camera has been retrofitted with modern electronics. At its heart is a three-sided mirror mounted on a rapidly spinning turbine driven by compressed air or helium.



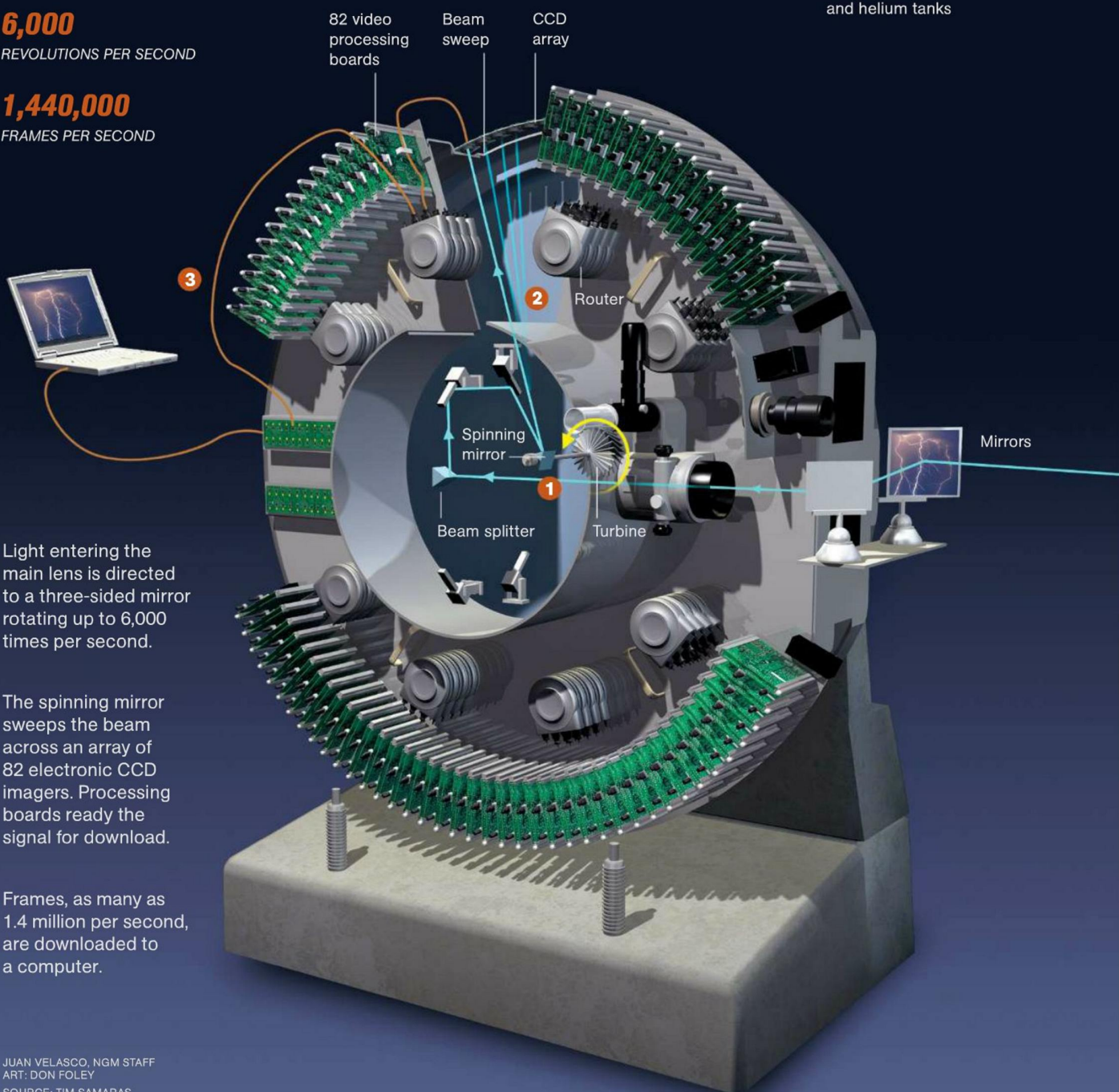
Compressed-air and helium tanks

6,000

REVOLUTIONS PER SECOND

1,440,000

FRAMES PER SECOND



1 Light entering the main lens is directed to a three-sided mirror rotating up to 6,000 times per second.

2 The spinning mirror sweeps the beam across an array of 82 electronic CCD imagers. Processing boards ready the signal for download.

3 Frames, as many as 1.4 million per second, are downloaded to a computer.



Taking aim at a storm with a laser, Samaras waits for the right moment to fire up the Kahuna. The enormous camera is too unwieldy to quickly reposition, so he targets stationary storms that produce frequent strikes.



strikes. Samaras starts up a gasoline generator, and the equipment inside the trailer comes alive. A wall of video screens displays weather information, and an electronic voice—the Lightning Lady, I call her—matter-of-factly announces the distance of the strikes: “17 miles, 15 miles, 11 miles.” Then she gives a warning: “Very high electric field.”

“The electric-field meter is going absolutely nuts,” Samaras observes. A sensor mounted on the shell of the trailer measures the charge of the atmosphere at ten kilovolts per meter and rising, meaning that it’s dangerous to be outside. The two Phantoms aboard the trailer go to work, capturing images of the milliseconds before and during the lightning flashes. Thunder is crackling above us. But throughout the cacophony, the Kahuna sits quietly off-line. The conditions just aren’t right for getting the shot.

We pack up and move on, and soon another rainbow—a double one—appears. Samaras stops the truck in the middle of the main intersection of Clayton, New Mexico, oblivious to the honks and cursing drivers, while the *National Geographic* photographer takes some pictures, of the ordinary kind.

ON LABOR DAY WEEKEND, toward the end of the season, I caught up with Samaras at an exit off I-25 in Belen, New Mexico. By then he and his crew had driven more than 10,000 miles across six states, collecting hundreds of megabytes of data from the Phantoms—but only near misses with the Kahuna.

With only two days left in the summer’s expedition, we followed a battery of storms north of the Magdalena Mountains. In midafternoon we found ourselves parked, purely by coincidence, directly across Highway 60 from the turnoff to the Langmuir Laboratory for Atmospheric Research—a premier spot for studying rocket-triggered lightning. A storm hung suspended over the mountains as if posed for a portrait, sparking lightning obediently above a distant ridge. Standing in the foreground on the other side of the highway, a cow gave us a curious eye. Using the animal as a reference point, Samaras started up the turbine and took aim. The sky flashed, the Kahuna fired, and the long download of data began.

Then, with the camera off-line, there was a better strike—this one directly over the cow.

Unsure of the first shot, Samaras made a split-second decision to terminate the download and try again. The chance never came. He’ll never know whether that first attempt captured an image of the attachment process or just a blurry silhouette of a cow.

BY THE TIME I SAW SAMARAS again, two years later, he had reluctantly decided to try what he felt in his heart was cheating: aiming his camera at rocket-triggered lightning. With a new pickup truck and an improved Kahuna—he had stayed home the previous summer jiggering the electronics—he and his crew had spent another two weeks following storms across the Southwest. Now he was making the long, slow climb to Langmuir’s mountaintop laboratory.

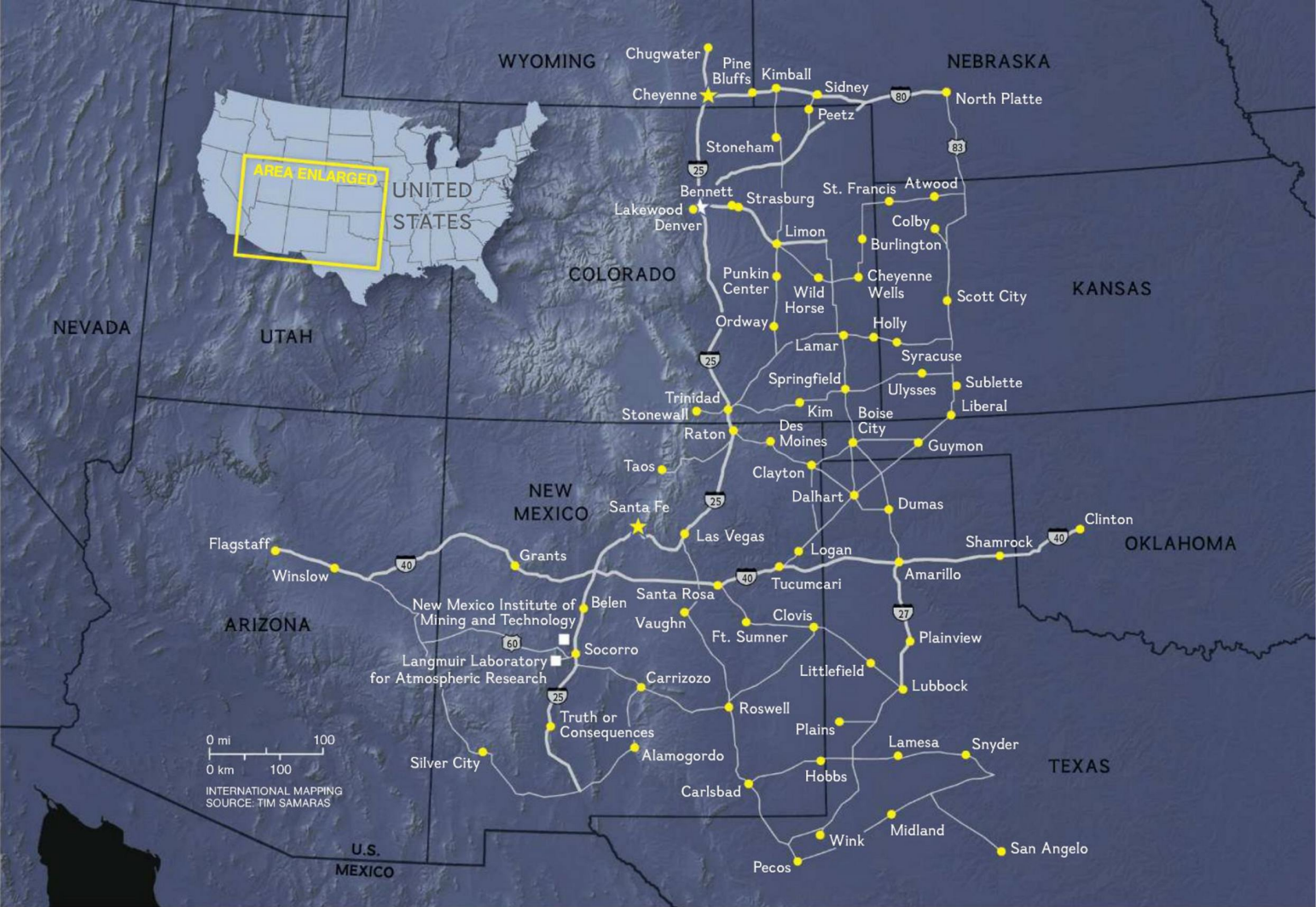
Built in 1963 by the New Mexico Institute of Mining and Technology in Socorro, the laboratory sits in the path of the monsoonal moisture that flows up each summer from the south. Sheltered inside an underground bunker called the Kiva, on South Baldy peak, a researcher remotely fires rockets, each connected to a long wire, into a highly charged storm cloud. Colleagues record the strike with a Phantom and other instruments in a building called the Annex, a mile away.

Bill Winn, head of the lab, seemed as skeptical about Samaras’s approach as Samaras was of triggered lightning. (“Isn’t he just interested in pretty pictures?” Winn had asked me earlier.) But the two men greeted each other cordially.

“You should have been here today,” Winn said. “We had three strikes.”

“Figures,” Samaras said. One of the scientists explained that when conditions were right, a rocket would be armed and a five-second countdown would begin—any longer and the storm might produce a natural flash out of range of their instruments. Samaras looked worried. Since the Kahuna took ten seconds to spin up to speed, he would have to idle the turbine at a loping pace to keep it from overheating, then crank it up before the countdown began.

The next day’s weather was discouragingly calm, but the storm that arose on the third day justified the wait. By early afternoon seven red-centered blobs were registering on the radar—a potent weather system to our northeast headed right for us. By 3 p.m. rain was falling faster and faster, hardening briefly to hail. We retreated inside the trailer and watched out the back.



THE TRAIL OF A HUNTER

Between 2006 and 2011 Samaras logged more than 25,000 miles in his quest to capture the birth of a lightning strike. His work begins in late summer, when damp air masses surge north. Uplifted by mountains and desert heat, the moisture cools and condenses, generating potent thunderstorms.

Thunder, lightning—then the radio call: “Kiva is arming rockets.” One storm had a purple center now, the most intense. Bands of red and orange were passing in front of us.

While the Langmuir crew watched from the safety of the Annex, I huddled on the trailer floor, shifting my attention between the weather outside and its abstraction on the radar. Wind was rocking us back and forth. If it hadn’t been for the anchor provided by the Kahuna, I thought the trailer might blow off the mountain. With another crack of the radio, the Kiva requested a launch window, and Samaras began idling the turbine. Then, “Kiva launch in five.” He ramped up the speed, and in the sky above us a rocket fired, its long, trailing wire instantly vaporized by lightning. But it happened too quickly. As Samaras had feared, the five-second window was too narrow. Over the next hour the Kiva fired five more rockets and triggered three strikes.

But the Kahuna could not be readied in time.

Samaras left the mountain with some beautiful imagery from the Phantoms but once again without the long-awaited shot.

WITH ANOTHER SEASON OVER, Samaras retreated to a home he had recently purchased on a hill east of Denver overlooking the Colorado plains. But he is far from giving up the chase. He has installed an array of 12 computers to drastically reduce the Kahuna’s download time. And with help from a government contract, he is building a “snorkel van” to house the camera, which will be attached to a periscope on the roof that can be nimbly turned in all directions. I would be surprised if he isn’t out there now, one eye on the road and the other on a new storm throwing violent colors onto his laptop screen.

“I’m still in hot pursuit of that image,” he told me. “And I won’t stop until this is done.” □

Back on the highway with the Kahuna in tow, Samaras hunts for the elusive shot. This summer he's on the chase again, with new, nimbler equipment.









A medicinal fungus highly prized in China is fueling a boom on the Tibetan Plateau.

TIBETAN GOLD





■ Faces shielded from the sun, digging tools in hand, Tibetan families can search all day for the larvae, called



yartsa gunbu. Some stalks poke barely a quarter inch out of the ground.

THE THING SILANG IS SEARCHING FOR, ON HANDS AND KNEES, 15,000 FEET ABOVE SEA LEVEL ON THE TIBETAN PLATEAU, IS EXTRAORDINARILY STRANGE.

The part that's above ground is a tiny, capless fungus—just a brown stalk, thin as a matchstick, poking an inch or two out of the muddy soil. Eleven hours a day, from early May to late June, Silang Yangpi and his wife and a large group of relatives and friends crawl along steep mountain slopes, combing through a dizzying tangle of grasses and twigs and wildflowers and sedge, seeking the elusive stalk.

When Silang spots one, he shouts with joy. His wife, Yangjin Namo, rushes over. Using a trowel, he carves around the stalk and carefully removes a wedge of soil. He brushes away the excess dirt. And there, in his palm, is what looks like a bright yellow caterpillar. Dead. Attached to its head, unicorn style, is the slender brown fungus. From his pocket Silang removes a red plastic bag that once held dehydrated ramen noodles. He places his find inside, along with the others he and his wife have unearthed, and carefully rolls the bag up. Silang is 25 years old; his wife is 21. They have an infant daughter. The caterpillar fungus represents a significant portion of their annual income.

Across the Tibetan Plateau, these creatures have transformed the rural economy. They've sparked a modern-day gold rush. In fact, by the time the contents of Silang's bag arrive at the gleaming shops of Beijing, they can easily be priced at more than twice their weight in gold.

The fungus is called *yartsa gunbu*. Translated from Tibetan, this means “summer grass, winter worm,” although it is technically neither grass nor worm. It's the underground-dwelling larva of one of several species of the ghost moth that has been infected by spores from a parasitic fungus called *Ophiocordyceps*

sinensis. The fungus devours the body of the caterpillar, leaving only the exoskeleton intact, and then, come spring, blooms in the form of a brown stalk, called the stroma, that erupts from the caterpillar's head. This process happens only in the fertile, high-alpine meadows of the Tibetan Plateau and the Himalaya. All attempts at farming the fungus have failed.

For centuries yartsa gunbu has been thought to possess miraculous medicinal and libidinous powers. Yaks that graze on it, legend holds, grow in strength tenfold. One of the earliest known descriptions of yartsa comes from a 15th-century Tibetan text, titled *An Ocean of Aphrodisiacal Qualities*, which raves about the “faultless treasure” that “bestows inconceivable advantages” on those who ingest it. Just boil a few in a cup of tea, or stew in a soup, or roast in a duck, and all that ails you will be healed—or so it's said.

The worms, as they're colloquially known, have been prescribed by herbalists to alleviate back pain, impotence, jaundice, and fatigue. Also to reduce cholesterol, increase stamina, and improve eyesight. To treat tuberculosis. And asthma. Bronchitis and hepatitis, anemia and emphysema. They're billed as an antitumor, antiviral antioxidant. A treatment for HIV/AIDS. A balm for those recovering from surgery. They may even help with hair loss.

As the Chinese economy roars, demand for yartsa has intensified—it's become a status symbol at dinner parties and the gift of choice to flatter government officials. In the 1970s a pound of worms cost a dollar or two. In the early '90s

Michael Finkel reported on Greenland's dogsledders in the January issue. Michael Yamashita has shot dozens of stories in Asia for the magazine.



A ten-year-old girl's gloved hand holds the tiny, dirt-covered biological curiosity: Yartsa gunbu is a combination of moth larva (caterpillar) and parasitic fungus. The high-priced "worms," as the infected larvae are called, are believed to cure everything from hair loss to hepatitis.

it was still less than a hundred dollars. Now a pound of top-quality yartsa can retail for \$50,000.

Such outsize demand sparks concern that the total annual harvest, now roughly 400 million specimens, may diminish as yartsa fields become overpicked. To harvest the worms sustainably, pickers would need to leave some stalks in the soil to mature and infect the next season's larvae, says ecologist Daniel Winkler. Instead, most villagers harvest every stalk they find and then move on to higher hunting grounds.

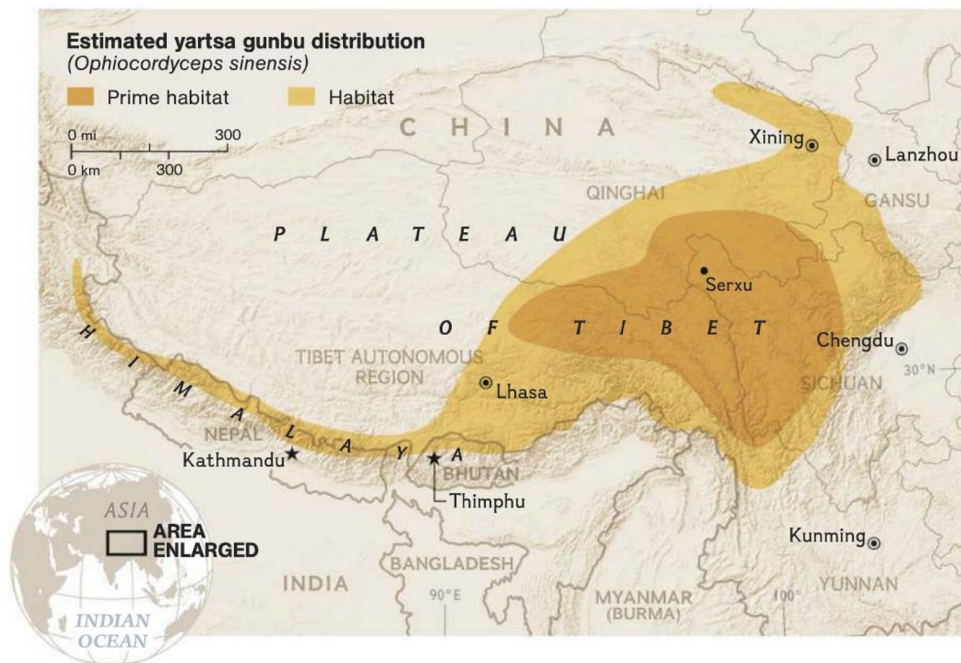
Due to the annual yartsa windfall, thousands of formerly impoverished Tibetan yak herders own motorcycles and iPhones and flat-screen TVs. Battles over worm-picking turf—most areas allow only licensed residents to pick—have resulted in violent encounters, including seven

murders in northern Nepal, where a small percentage of the world's yartsa is picked. In the city of Chengdu, in Sichuan Province, burglars once tunneled, prison-break style, into a shop selling yartsa, making off with more than \$1.5 million worth of product. The Chinese police have established numerous roadside checkpoints to prevent poachers from sneaking on to hillsides reserved for local villages.

There are now places, like the town of Serxu—home to Silang and his wife—where, when the ground warms and the grass sprouts, all else in life is abandoned to the pursuit of yartsa. Children, with keen eyes and low-to-the-ground statures, are often the best pickers. Some school systems, helpless against the lure of the worms, close for a one-month yartsa holiday.

At the end of the long picking day, Silang and Yangjin bring their worms to the local market. Serxu's market, during the height of the season, sprawls along the puddled sidewalks on both sides of the town's main street. It is customary, in this frontier-feeling place, amid treeless hills speckled with herdsman's tents and strung with prayer flags, to dress up for market.

Many wear traditional Tibetan coats, the sleeves so long there's no need for gloves. Men



WORM COUNTRY

Ghost moths and the fungus *Ophiocordyceps sinensis* thrive only at high altitudes (10,000–16,500 feet) and in moist soil, restricting yartsa gunbu's range. An estimated 96 percent of the world's harvest comes from the Tibetan Plateau. Experts worry that the current rate of harvest is unsustainable.

sport wide-brimmed cowboy hats and leather boots. Knives are strapped to waists. Smiles flash with gold teeth. Women strut about in necklaces strung with amber beads the size of golf balls. A few have braided hair that nearly sweeps the sidewalk. There are even a couple of monks, swaddled in vermilion robes. Religious strictures forbid them from picking or eating yartsa, but it's fine to buy and sell.

Yartsa dealers carry tiny brass-colored scales and solar-powered calculators. The sides of their hands are often smudged with jotted calculations. Worms are piled in cardboard boxes and wicker baskets or spread on pieces of cloth. When a dealer is approached by someone like Silang—knees muddy, with a bag of yartsa fresh from the fields—the worms are carefully examined. Their value depends on a number of factors: size, color, firmness. The dealer handles each one, often scraping off caked dirt with a special yartsa cleaning tool that looks like a large toothbrush. A crowd gathers.

It is also common practice, when preparing to make a purchase, for a yartsa dealer to keep up a steady patter of mild insults.

"I've never bought such bad worms."

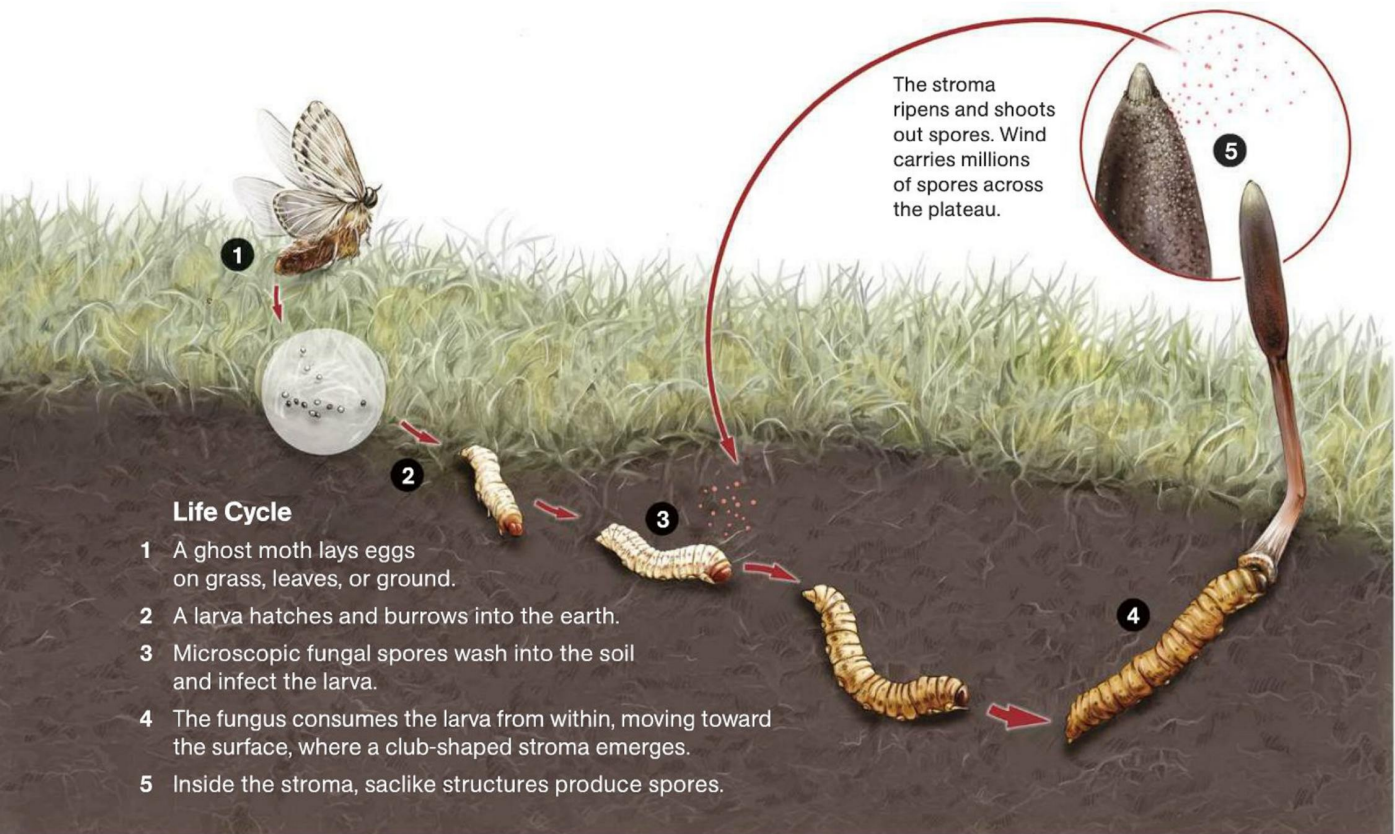
"The color's no good. Too dark."

"I'm going to lose money on these."

Finally, when it's time to do business, the dealer holds out his arm, the sleeve of his Tibetan coat dangling. The seller slips his hand inside. Then, using finger signals, the two haggle in the coat sleeve, shielded from the curious eyes of the crowd. It looks as if a thumb-wrestling match is going on in there—offers rapidly made and countered, the coat's fabric stretching and twisting. When the fingers settle and a price is agreed upon, the money is passed through the sleeve.

Silang and Yangjin approach a dealer they've worked with before, a man whose name is also Silang—Silang Yixi, 33, in business for eight years. He keeps photos of prized worms on his cell phone. The two Silangs conduct the ritual: the worm examination, the gibes—at one point the dealer returns the worms to the ramen bag and pretends he's no longer interested—and eventually the haggling. In the end, for their 30 worms, most too small to command top price, Silang and Yangjin are paid 580 yuan, about \$90.

Zhaxicaiji steps from her chauffeur-driven Platinum Edition Toyota Sequoia, shoulders her Prada handbag, and strolls, high heels clicking, into the flagship store of her yartsa gunbu empire. She is founder and president of Three Rivers Source Medicine Company, one of



Life Cycle

- 1 A ghost moth lays eggs on grass, leaves, or ground.
- 2 A larva hatches and burrows into the earth.
- 3 Microscopic fungal spores wash into the soil and infect the larva.
- 4 The fungus consumes the larva from within, moving toward the surface, where a club-shaped stroma emerges.
- 5 Inside the stroma, saclike structures produce spores.

China's best known yartsa brands. She manages 500 employees and 20 stores; annual sales can top \$60 million.

Growing up, Zhaxicaiji, who's now in her late 40s, was like Silang and Yangjin. She crawled in the hills, picking worms. Her family raised yaks and sheep and lived in a yak-hair tent. She started the business in 1998 with \$120 of her own money and rode the yartsa juggernaut to success. She plans to expand internationally, exporting yartsa to places like Japan, Korea, and Malaysia. Within a decade, she says, her worms will be sold in the United States.

Her store in the central Chinese city of Lanzhou occupies a full city block; mounted over the entrance is a giant video screen playing commercials advertising her worms. Inside are opulent chandeliers, a trickling fountain, uniformed security guards, and vases of fresh-cut flowers. Her yartsa is exhibited in dozens of museum-style glass cases, the temperature and humidity precisely controlled.

Before a worm arrives here, it may change hands a half dozen or more times. Dealers in frontier markets sell to midsize markets, and those businessmen usually head to China's biggest yartsa market, which operates year-round, bustling and loud as a stock exchange, encompassing

an entire district in Xining, a city just west of Zhaxicaiji's headquarters. Many of the largest, firmest, most ideally golden worms are selected by Zhaxicaiji's buyers. Prior to being put on display, all are x-rayed—it's become common to hide bits of lead wire in worms to increase weight.

A black Mercedes pulls up to her store and four middle-aged men, wearing polo shirts and chunky watches, take seats in front of one of the glass cases. They're promptly served by a staff of young women in dark skirts, white button-front shirts, and cotton gloves. The men munch on walnuts and raisins and drink yartsa-infused water as they make their selections. The worms are then neatly packaged in maroon wooden boxes with felt interiors and brass clasps, transforming a startlingly unattractive product—a faintly fishy-smelling Cheez Doodle-colored caterpillar with a strange growth emerging from its head—into something practically regal. The boxes are stacked in cloth shopping bags. In a matter of ten minutes the men spend \$30,000.

On the fifth floor of a modern high-rise apartment building on the east side of Beijing, resting on her sofa and flanked by her bichons frises—Quan Quan (Little Circle) and Dian Dian (Little Dot)—Yu Jian sips a

cup of freshly brewed yartsa gunbu tea. Yu is 40 years old; she's wearing a cheery flower-patterned blouse and leopard-print slippers. Until recently, she was an executive at a health food company. But in October 2010 she was diagnosed with uterine cancer.

She pursued a modern course of treatment, including extensive rounds of chemotherapy. But she also decided to visit a traditional Chinese herbalist. He prescribed yartsa. She's been using it for about six months.

Each evening she places two worms in a glass of water and lets it sit overnight. In the morning she boils the water along with some dried dates. She drinks the tea and then eats the softened worms. Yu buys only the highest quality yartsa, from the Tongrentang chain of pharmacies—one of the few brand names more famous, and more expensive, than Zhaxicaiji's. A bag of 24 midsize worms, enough to last a couple of weeks, costs her more than \$550. "I think it's worth it," she says, though she is aware of the skepticism surrounding its effectiveness. So far the proof for the power of yartsa gunbu is not in.

Some studies, conducted primarily in China, reveal that it does contain an immune system modulator known as beta-glucan and an antiviral agent called cordycepin. A few clinical trials suggest it can help alleviate many of the conditions it's long been prescribed for, including bronchitis, asthma, diabetes, hepatitis, high cholesterol, and sexual dysfunction. But critics say the studies have been small and the methodology suspect.

"Until someone does a large clinical trial using a high-quality product, the science we have to rely on so far is not suggestive of a significant effect," says Brent Bauer, director of the Complementary and Integrative Medicine Program at the Mayo Clinic in Minnesota, who has extensively studied herbal medicines.

What's more, says mycologist Paul Stamets, wild yartsa may be tainted by any number of unidentified fungal molds, some of which might be harmful. "People could be poisoned," says Stamets, who has written six books on mushroom cultivation and sells his own mushroom products. "For the inexperienced, it is a form



of Russian roulette." Whether the worms are a potent elixir or an exorbitantly expensive myth, there's little sign the yartsa gold rush will be over anytime soon. The evidence may be far from certain, but the belief is pervasive.

Yu Jian claims she can feel the worm's effect—both physically and psychologically. She says it improves her spirits and revitalizes her "life energy"—what's known in China as *qi* (pronounced *chi*). Her actual energy, though, can be variable.

Though she's quite thin, Yu does have a soft



ruddy color and a palpable vigor. On better days, it's easy to give the worms the credit. Other times, she's reminded that all cures, ancient and modern alike, have their limits. Yet on her most recent medical visit, she recalls, her doctor was shocked by the swiftness of her improvement. "He didn't even remember I was a cancer patient," she says. □

EPILOGUE Since the reporting for this article was completed, Yu Jian's cancer turned virulent and ended up taking her life.

Every day during harvest season, Tibetan sellers arrive in Serxu with their batch of worms. Above, they dry them on one of the town's two streets, evaluating each: Is it undamaged and a good size? Does it have the desired yellow hue? Serxu's worms have a reputation for quality.



■ Tibetan sellers negotiate with urban buyers, like the man at left in Serxu, following a predictable ritual:



Buyers mock the quality of the worms. Sellers hawk their wares to many buyers before striking a deal.



■ Serxu is booming thanks to the growing yartsa gunbu trade. Many Tibetan harvesters arrive at the market



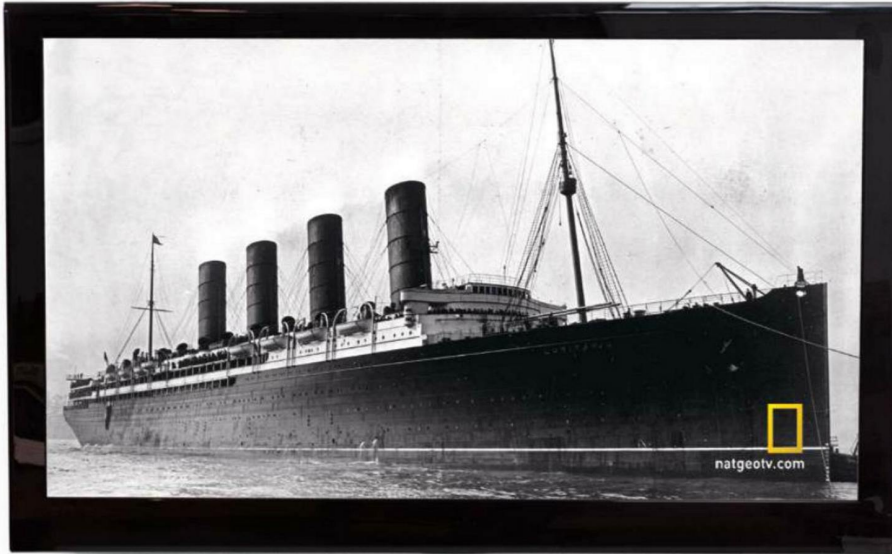


■ Women sort, clean, and bundle fungal larvae at the Zhong Shi Caterpillar Fungus Hall in Chengdu. For 1,500



high-quality worms—that's about two pounds—the firm could reap up to \$100,000.

NATIONAL GEOGRAPHIC ON TV



Dark Secrets of the Lusitania

Nicknamed the Greyhound of the Seas, the *Lusitania* (left) had its last run in 1915. Damaged by a German torpedo, then again by an unexplained explosion, the ship and most of its passengers sank off Ireland's coast. This month on the National Geographic Channel scientists visit the wreck, aiming to finally solve the mystery behind that second blast.

EXHIBIT

CRITTERCAM National Geographic's Crittercam technology reveals the secret lives of penguins, whales, bears, and more. Check it out and design your own Crittercam at the Discovery Place in Charlotte, North Carolina, through September 16. See discoveryplace.org.

TRIP



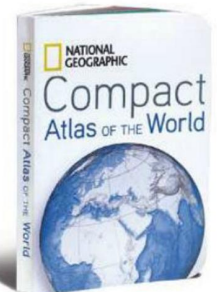
ON SAFARI Explore Africa on a National Geographic wildlife safari. Offerings include a trip by private aircraft to the Okavango Delta and Victoria Falls and a journey to Tanzania to view the legendary wildebeest migration, the Serengeti, Ngorongoro Crater, and more. The full list of safaris is at ngexpeditions.com/safaris.

EVENT

BIOBLITZ How many species live in Rocky Mountain National Park? Join the quest to tally them during this year's BioBlitz, happening on August 24 and 25. For more go to nationalgeographic.com/bioblitz.

BOOK

PUT THE WORLD IN YOUR POCKET More than a hundred maps and graphs fill National Geographic's first ever mini-atlas. Available in stores now, this small but mighty package holds a formidable amount of cartographic information (\$14.95).



Free Download of the Month



Forro in the Dark *Light a Candle*

Four New York-based Brazilian expats make up Forro in the Dark: Mauro Refosco, Davi Vieira, Guilherme Monteiro, and Jorge Continentino. The quartet is dedicated to updating *forró*, Brazil's version of country music, and bringing this traditional sound into the 21st century. To download a free song visit natgeomusic.net/free.

Cover Potential Photographer Aaron Huey was hanging out with young Wanahca Rowland and her cousin near Wounded Knee, South Dakota, when he had an idea. He asked the kids if they'd like to be on the cover of *National Geographic* and held up the mock yellow border he'd printed on a piece of acetate. For these girls—as well as other members of the tribe whose photos don't appear in the story—the frame generated smiles and, Huey hopes, a sense of inclusion. “It was a way that I could say, This is about you too.” —Catherine Zuckerman



BEHIND THE LENS

Why is this picture important to you?

AH: It represents the positive side of the Oglala world. There are happy people on the reservation. These girls, Wanahca Rowland (holding frame) and Nape Pejuta Win Rowland, live a free life out in the hills. Wanahca's mother is Olowan Thunder Hawk Martinez, who is leading an antialcohol campaign. Her house became a home base, of sorts, for me.

How has your relationship with the people of Pine Ridge evolved?

It started as a statistic. I was going to do a larger survey on poverty, and Pine Ridge was one of my stops because it had been one of the poorest counties in

America for 30 years in a row. I didn't know much about treaties or any of the other issues when I first went out there in 2005. But I got sucked in and just couldn't believe what I was seeing, that this was real. Over time I became

very close with a bunch of families; we call each other brother, sister. The evolution is incredibly complex, and I will definitely return. A few years ago I chose to take a side—their side—and to be not just a journalist but also an advocate.



Mushroom Cap This hat, shaped from the fibrous interior of *Fomes fomentarius*, was mailed to National Geographic headquarters by William J. O'Reardon in 1920. Its accompanying letter cataloged the cap's dimensions and alerted the editors that this "very rare and extraordinary cap [is] made from a mushroom."

The Latin *fomes* means "tinder," but it has long defied being just a fungus used to light fires. Up to a foot and a half long, the tree-encircling mushroom continues to be transformed into millinery today. According to an eyewitness report in the newsletter of the North American Mycological Association, *Fomes* caps of Hungarian origin were spotted for sale at the 12th International Fungi and Fibre Symposium in 2005. The attendee bought four. —*Johnna Rizzo*

👉 **Flashback Archive** Find all the photos at ngm.com.

PHOTO: CHARLES MARTIN, NATIONAL GEOGRAPHIC STOCK

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Marine Otter (*Lontra felina*)

Size: Head and body length, averages approx. 55 cm (21.6 inches); tail, averages approx. 35 cm (13.8 inches) **Weight:** 3.2 - 5.8 kg (7.1 - 12.8 lbs) **Habitat:** Long patches of rocky shore, preferably with access to caves that remain above water at high tide **Surviving number:** Unknown; populations declining



Photographed by Kevin Schafer

WILDLIFE AS CANON SEES IT

Adore the shore? The marine otter certainly does, spending 80% of the day at or near the rocky coastline before retiring to a den or refuge for the night. Females give birth in cave dens, with both parents then sharing the task of bringing back crustaceans, bivalves, octopuses and fish to feed their hungry families. Scientists believe the marine otter may be one of the most recent mammals to adapt to a marine habitat and lifestyle. But humans

are also drawn to places where water meets land, and with humans come poaching, overexploitation of food resources, and dogs that prey on otters. The shore is becoming a dangerous place to be.

As we see it, we can help make the world a better place. Raising awareness of endangered species is just one of the ways we at Canon are taking action—for the good of the planet we call home. Visit canon.com/environment to learn more.

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