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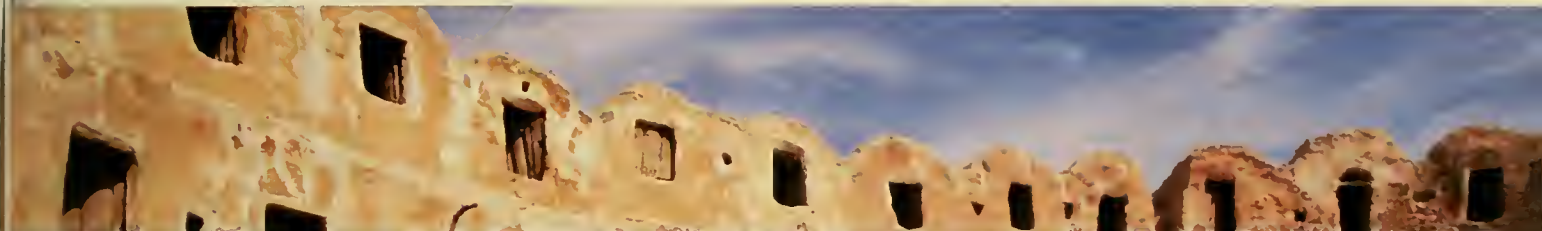
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DECEMBER 2007/JANUARY 2008

VOLUME 116

NUMBER 10



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THE NATURAL MOMENT

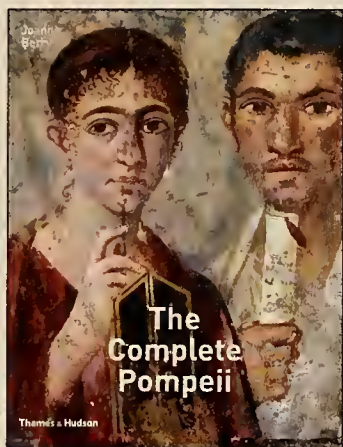
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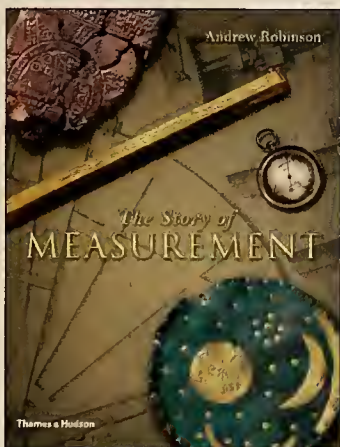




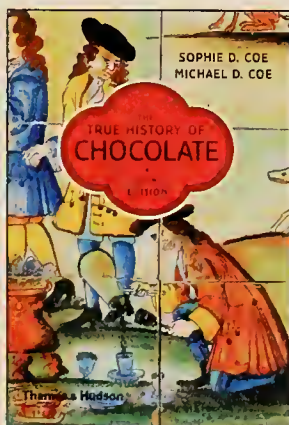
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THE NATURAL MOMENT

◀ See preceding two pages

Caught in the clutches of a cat? You're not alone. In more than 38 million U.S. households, 90 million domesticated cats have owners wrapped around their little pinky claws and are lapping up household luxuries. But the six other feline species in North America—the bobcat (or bay lynx), the Canadian lynx, the jaguar, the jaguarundi, the ocelot, and the puma—must prey in ever more precarious and taxing settings. In fact, of the thirty-six wild cat species in the world, more than two-thirds are either endangered or at risk.

Bobcats, like the one pictured here near the Snake River in southeastern Idaho, are currently classified as being at risk, but that's been up for debate. Six months ago the United Nations considered removing the bobcat (*Lynx rufus*) from its protected list. Many U.S. officials favored such a change in order to ease the trade in bobcat skins. Over 50,000 skins are brought to the global market every year, making the bobcat the most traded cat species on the planet, with the U.S. as the leading exporter.

Are there really that many bobcats to spare? The pointy-eared creatures range widely, from Ontario to California to Florida. Yet the last bobcat

census was conducted more than a quarter century ago, so only rough population estimates exist today. Apart from that, an *L. rufus* skin can be indistinguishable from some other, more vulnerable species, even after DNA testing. Therefore, out of extreme concern for the other cats, the U.N. voted to keep the strictures in place.

Photographer Michael Quinton certainly wasn't out for a pelt when he spotted this bobcat several winters ago in Market Lake Wildlife Man-

agement Area. About twice the size of a domestic cat, it was stalking a fat muskrat. The solitary hunting creatures usually prefer dusk and dawn, but in tough seasons, when rabbits and rodents (even deer) are scarce, longer hours prevail.

"The muskrat had a moment of bravery when it lunged at the bobcat," recalls Quinton, "but it was quickly killed." The cat then proceeded to toss the carcass repeatedly and roll around on it. Finally, after eating about half of its catch, the bobcat ran off with the remains. Having no guarantee of its next meal, the cat likely cached the leftovers under the snow—in its own version of domesticity, refrigeration.

—Erin Espelie



Michael Quinton

After living on the edge of Yellowstone National Park for years, Quinton left in favor of a "real wilderness": a home near Wrangell-Saint Elias National Park in Alaska. There Quinton set up a base for his video and photography production. See www.michaelquintonphotography.com for more of his work.



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Reja Ampas, Papua, Indonesia
photo by CI/Sterling Zimbrun

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WORD EXCHANGE

Hail from the Chief

In case you missed Peter Brown's kind introduction last month, I have now succeeded him as Editor-in-Chief. As it happens, one of the first initiatives I've taken is to use the term "Editor in Chief" without hyphenation, to better conform with our preferred reference dictionaries. Other than that, don't expect wrenching surprises; I wouldn't be approaching my thirtieth year on the staff of *Natural History* if I were not pleased with what we do.

In my view the magazine's hallmark remains the publication of accessible articles by actively engaged scientists describing their primary research. An example is linguist Sarah Grey Thomason's report, in this issue, on the few remaining fluent speakers of Salish-Pend d'Oreille, a Native American language of the Pacific Northwest, and on the threatened extinction of between 60 and 90 percent of the languages spoken around the globe today. Still, we happily make room for those whose stock-in-trade is writing: that enables us to bring you Michael C. Blumenthal's engaging account of his experience in South Africa as a volunteer caring for orphaned baboons. And of course we are proud of our stable of columnists (regrettably, however, Neil deGrasse Tyson's loyal fans will have to make do with fewer "Universe" columns each year, because his other commitments have forced him to cut back).

We will be tweaking a few ingrained practices. For one, you will now find the feature authors' biographical notes at the ends of their articles, instead of on a separate contributors' page. And I'll be keeping any future editorial notes short, to allow more room for your letters.

Vittorio Maestro

Stand Up Straight

Ian Tattersall gives a fine summary of bipedalism in early hominids

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Natural History (ISSN 0028-0712) is published monthly, except for combined issues in July/August and December/January, by Natural History Magazine, Inc., in affiliation with the American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024. E-mail: nhmag@naturalhistorymag.com. Natural History Magazine, Inc., is solely responsible for editorial content and publishing practices. Subscriptions: \$30.00 a year; for Canada and all other countries: \$40.00 a year. Periodicals postage paid at New York, NY, and at additional mailing offices. Canada Publications Mail No. 40030827. Copyright © 2007 by Natural History Magazine, Inc. All rights reserved. No part of this periodical may be reproduced without written consent of Natural History. If you would like to contact us regarding your subscription or to enter a new subscription, please write to us at Natural History, P.O. Box 5000, Harlan, IA 51593-0257. Postmaster: Send address changes to Natural History, P.O. Box 5000, Harlan, IA 51537-5000. Printed in the U.S.A.



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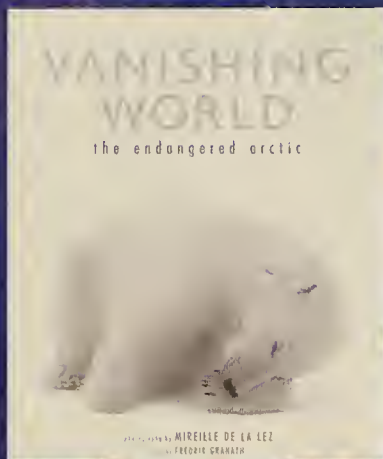
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Outward Bound

By Robert Anderson

In 1958 the prolific science fact and fiction writer Isaac Asimov published "Our Lonely Planet," an article in which he reasoned that given the tremendous distances—four light-years even to the nearest star after the Sun, Proxima Centauri—interstellar space travel would take too long to be practical. But with more than 200 planets now discovered in orbits around nearby stars, it's nice to imagine that we could someday get to one that looks hospitable. On the Internet, Google Earth's new Sky feature makes such flights of fancy a snap. Please visit the magazine online (www.naturalhistorymag.com), where I review Web sites devoted to virtual space travel.

ROBERT ANDERSON is a freelance science writer who lives in Los Angeles.

WORD EXCHANGE

Continued from page 6

["Lucy Goes Walkabout," 10/07] so I was surprised to see that Viktor Deak's cover illustration shows Lucy's close relative in a semi-erect, bent-knee stance. I had the good fortune to examine Lucy when she was in Donald C. Johanson's lab in Cleveland, and I can assure you that the anatomy of the lower back, hips, feet, and knee and ankle joints all provide clear evidence that those early hominids stood just as erect as we do.

C. Loring Brace
University of Michigan
Ann Arbor, Michigan

VIKTOR DEAK REPLIES: The *Australopithecus garhi* in the illustration (which is part of a larger mural on display at the Houston Museum of Natural Science) is shown in a slightly crouched stance, shielding her child. My intent was to catch her at the moment of pulling away from a possible predator (in this case, the viewer)—a gesture that neither human nor ape would do with locked knees. After years of studying Lucy's bones with Gary Sawyer and Ian Tattersall, I have noted their striking similarity to modern human bones, but one can't ignore the fact there are also a lot of differences. Lucy's bell-shaped, robust upper body and small gluteus maximus (well-suited to climbing) probably gave her a slightly different posture from ours.

Lucy Goes Walkabout, but Arizona State University does not. ASU is in Tempe and the University of Arizona is in Tucson.

Paul Aizley
Las Vegas, Nevada

THE EDITORS REPLY: Indeed! We mistakenly stated that the Institute of Human Origins at Arizona State University, where Donald C. Johanson works, is in Tucson. As several of our readers pointed out, ASU is in Tempe. Thanks for keeping us on our toes.

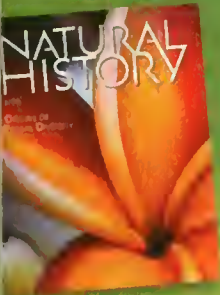
No Translation Necessary

I read Neil deGrasse Tyson's discussion of the space race ["Fellow Traveler," 10/07] with great interest since I worked with the von Braun group on the creation of Jupiter-C, the rocket that launched *Explorer 1*. What Mr. Tyson didn't mention was that Wernher von Braun's German ties gave him inside knowledge of Russia's activities, so he knew about the *Sputnik* program before the rest of America. In fact, we built Jupiter-C six months before *Sputnik 1* was launched and put it in a warehouse! When the Secretary of Defense got around to asking von Braun to put up a satellite, it took only two months to launch *Explorer 1*. The joke going around at the time was: "Do you know how *Explorer 1* was able to speak to *Sputnik*? They both spoke German!"
A.P. Warren, Retired NASA Engineer
Gallion, Alabama

Translation Necessary

Robert Anderson's mention of *Sputnik 1*'s "evocative sounds" ["Beep Beep," 10/07] reminded me of that October morning in 1957 when I hastened from class to my dorm room to switch on my old Hallicrafters S-40B. Fortunately I had the presence of mind to switch on the beat frequency oscillator (BFO), which converted *Sputnik*'s hisses into a few fading beeps. Ham radio operators working with Morse code used the BFO to convert continuous wave (CW) signals into audible beeps. A number of my memory cells have faded into retirement, but I remember thinking that the weak CW signal emitted by *Sputnik* could easily have been overshadowed by the signal emanating from WWV, the national standards station broadcasting from Ft. Collins, Colorado. I suspect that many who reported hearing *Sputnik*'s beeps may have been using smaller, less sensitive shortwave radios lacking BFO capability and mis-

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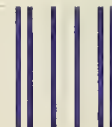
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SAMPLINGS



Salties swim in their element.

The Croc Came Back

Saltwater crocodiles aren't known for their sentimentality, but they are prone to bouts of homesickness, according to a new study. Conducted with the help of the late Steve R. Irwin—the "crocodile hunter"—the study shows that displaced "salties" will travel as far as 250 miles to return to their home estuaries.

Craig E. Franklin of the University of Queensland and several colleagues, including Irwin, captured three large male crocodiles on the Cape York Peninsula in Australia's northeast tropics—no mean feat considering the beasts weigh more than 500 pounds apiece. After securing satellite transponders to the crocodiles' backs, the team helicoptered them thirty-five, sixty, or ninety miles away from their capture sites.

After lingering in their new environs for as long as three months, the crocodiles made a beeline along the coast for their old haunts. The endurance champ—a fifteen-footer who'd been airlifted across the peninsula—swam 250 miles clear around the coast. He covered as many as nineteen miles in a single day, belying the notion that crocodiles are burst swimmers and cannot exert themselves for extended periods.

The study also shows that salties are gifted navigators; Franklin speculates that they, like their closest relatives, birds, use clues from the sun and Earth's magnetic field, as well as their senses of sight and smell, to find their way. (PLOS ONE)

—Brendan Borrell

Did Skimming Fit the Bill?

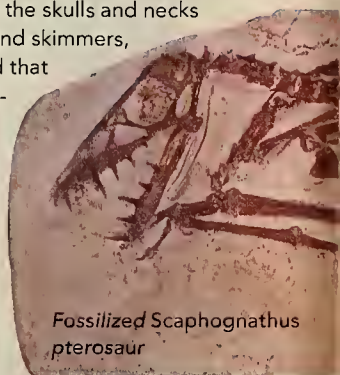
Today, only three bird species have the chops to skim for their supper. Black, African, and Indian skimmers fly low, pushing their lower beaks through the water, then snap their jaws shut when they hit a fish. Anatomical similarities between skimmers and pterosaurs—ancient flying reptiles that included pterodactyls—have led some paleontologists to suggest that pterosaurs also ploughed the water's surface. But Stuart Humphries, now at the University of Sheffield in England, begs to differ.

With three colleagues, Humphries made casts of the lower beaks of skimmers and pterosaurs, pulled the casts through water, and measured the drag force water exerted on the beaks. The team calculated that overcoming drag consumes a fifth of the energy that modern skimmers devote to flying—a substantial handicap that probably explains why skimming is so rare. As for the pterosaurs, Humphries measured

such great drag on their beaks—as much as 68 percent of what their total energy expenditure would have been, he calculated—that flying while skimming would have been impossible for all but the smallest species. The team also compared the skulls and necks of pterosaurs and skimmers, and discovered that pterosaurs possessed few of the thirty adaptations that enable skimmers to do their thing.

It's more likely, says Humphries, that when the largest flying creatures of all time fished, they snatched their meals from the water in one targeted swoop. (PLOS Biology)

—S.R.



Fossilized Scaphognathus pterosaur

On the Trail of a Snail

In 1970 John B. Burch, a malacologist visiting Tahiti, collected *Partula hyalina* snails bearing pretty white shells that islanders often fashioned into jewelry. Little did he know that the species, along with numerous others on South Pacific islands, would be devastated by a carnivorous snail introduced a few years later to control agricultural pests. Now that the damage to the native fauna has been done, however, Burch's snails have helped solve a longstanding malacological mystery: how did *P. hyalina* come to live only on Tahiti, on two of the Cook Islands (600 miles to the southwest), and on four of the Austral Islands (500 miles to the south)—but on none of the region's myriad other islands?

Enter Taehwan Lee of the University of Michigan and several colleagues. They recently compared portions of

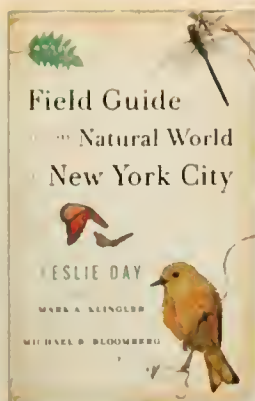
DNA from Tahitian *P. hyalina* snails, collected by Burch and others, with those of individuals from the Cook and Austral islands. The comparison showed that the species originated on Tahiti, and was introduced to the outlying islands within the past 30,000 years.

But how did it get there? *P. hyalina* belongs to a lineage that comes in two color morphs: the white one and a darker one that lives only on Tahiti. Ancient Polynesians, the team thinks, selected the white-shelled morph to establish colonies of Tahitian snails on the outer islands as a source of shells for jewelry. If that's the case, they did *P. hyalina* a big favor: it is all but extinct on Tahiti and now thrives only on its new, far-flung island homes. (Proceedings of the Royal Society B)

—Rebecca Kessler



Partula hyalina



Field Guide to the Natural World of New York City

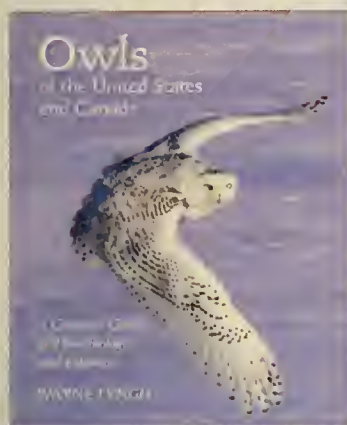
Leslie Day

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—Richard Ellis, author, artist, and research associate at the American Museum of Natural History

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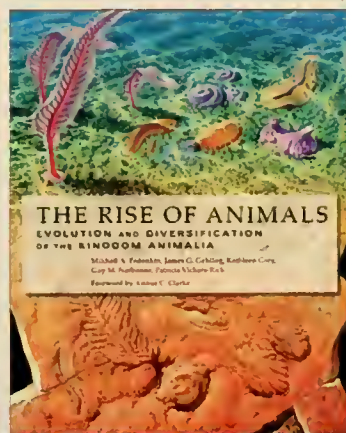


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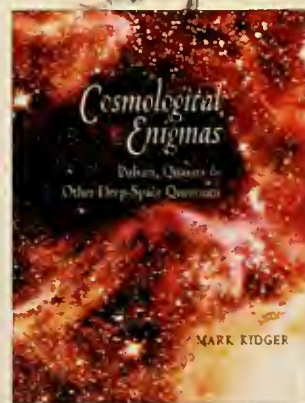
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—*Times Literary Supplement*



The Rise of Animals
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Mikhail A. Fedonkin, James G. Gehling, Kathleen Grey, Guy M. Narbonne, and Patricia Vickers-Rich
foreword by Arthur C. Clarke

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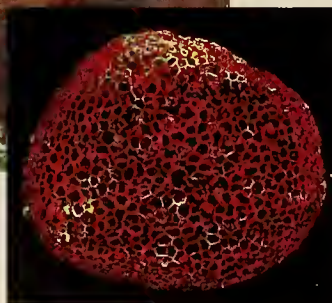


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Black layer found in Arizona, above, and elsewhere containing carbon spheres like the one at right, magnified 130x and colorized, suggests an extraterrestrial cause for a mass extinction.



It's Not Just the Heat

It's the humidity, or so the satellites say. They've been measuring a steady rise in atmospheric moisture over the oceans since 1988, when they first started gathering such data. The mugginess seemed a likely hallmark of global warming, and a new study now shows that human activity is definitely the cause.

The satellite data indicate that the column of atmosphere above every square yard of ocean now holds nearly three more cups of water than it did two decades ago, according to a team led by Benjamin D. Santer of the Lawrence Livermore National Laboratory in California. Combining results from all

twenty-two of the world's major climate models, Santer and his team discovered that the increase came not from solar radiation, volcanoes, or El Niño—factors that climatologists had considered—but from the greenhouse gases people have been pumping into the air.

Greenhouse gases warm the atmosphere and thereby increase its moisture-holding capacity. But water vapor is itself a greenhouse gas—a wicked feedback loop, if ever there was one. Of course, a fraction of the extra vapor condenses and forms clouds, which could offset some of the warming.

Beware though: high humidity can trigger intense hurricanes, the kind of cloudy weather we can definitely do without.

—S.R.

—S.R.

Camels 0, Comet 1

Thirteen thousand years ago camels, giant ground sloths, and mammoths roamed a lush North American landscape, along with the continent's earliest human inhabitants, the Clovis people. A mere hundred years later, however, the megafauna and the people had vanished forever, and an ice age that would last a millennium had begun. What happened? New research points to a seemingly "far out" cause: an enormous comet that exploded over present-day Canada.

More than two-dozen scientists, led by Richard B. Firestone of the Lawrence Berkeley National Laboratory in California, studied a distinct, inch-thick layer of black sediment deposited 12,900 years ago at sites across North America. Fossils of the extinct megafauna and Clovis artifacts have never been found within or above the layer. At the

layer's base, the team discovered minerals and particles that are typical of extraterrestrial objects, as well as soot and charcoal suggesting massive fires.

Firestone and his team think the layer formed immediately after one or more extraterrestrial objects—possibly fragments of a comet—hit an icy region of northern Canada. The explosive impact sent a devastating shock wave and thermal pulse across the continent, incinerating animals and landscapes. It would also have destabilized the ice sheet, upsetting ocean circulation and triggering the ice age. Linger environmental effects of the impact—particularly a lack of food—contributed to the mass extinction, which included the loss of thirty-five mammal genera, the team concludes.

(PNAS)

—Harvey Leifert

Earlier Birds

Birds returning from a winter's retreat are showing up in England earlier and earlier each spring as a result of global warming, a new study confirms. Unexpectedly, populations in decline show a less pronounced shift than thriving ones do, sparking fears that ecologists have underestimated the effect of rising temperatures on migratory birds.

Led by Tim H. Sparks, an ecologist at the Natural Environment Research Council in Monks Wood, England, a

team of investigators studied up to fifty-six years' worth of data, gathered at six English locales, on the arrival and departure dates of thirty-three migrant bird species. On average, they discovered, the birds are arriving in the spring twelve days earlier than they did fifty years ago. That's a big change, and it mirrors advances already noted for migratory birds throughout Europe and in the United States. But the change was even bigger among species, such as the blackcap, whose numbers are on the rise in England: they

now arrive as many as twenty days ahead of schedule. By contrast, species with declining populations have been flying in just five days early.

Why the difference between thriving and declining species? Sparks thinks observers may spot the earliest birds more readily when a species is abundant. If so, the true average advance in European and American arrival times may be even greater than actually measured because, sadly, many migrant bird species are on the wane.

(*Journal of Ornithology*)

—S.R.



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Hiber Nation

Understanding how creatures put their lives on hold could yield therapies for a variety of human ills.

By Olivia Judson

As the nights close in and winter takes hold, I get a hankering to burrow into my duvet, curl up, and hibernate until spring. But alas, humans are not among the large and diverse group of animals that can put themselves on hold for a few months. At least, not yet.

Human hibernation is a hot topic, as I discovered one afternoon when I happened across the *Journal of British Interplanetary Science*. Space agencies are interested because the ability to hibernate on demand would come in handy on long-haul space flights. The immortality crowd is interested too: if you've got an incurable disease or simply won't settle for an 80-year-life span, wouldn't it be great if you could put your head down, catch forty million winks, and wake up when medical science catches up? But the applications aren't all so futuristic; some are much closer to home. For instance, Matthew T. Andrews, a biologist at the University of Minnesota in Duluth, foresees that discoveries from hibernation biology will be useful in treating everything from heart conditions and hypothermia to obesity. Indeed, writing earlier this year in the journal *BioEssays*, he argued that "there is tremendous potential for applying hibernation strategies to improve the human condition." Gosh. I threw off my duvet and went to investigate further.

First off, I discovered that hibernation takes different forms in

different animals. A black bear, for example, drops its body temperature by only a few degrees, and spends the winter in a kind of deep and continuous sleep. During that time, it neither urinates nor defecates. For small mammals such as bats and ground squirrels, in contrast, hibernation typically features profound drops in body temperature, during which the animal is inactive, punctuated by regular bouts of warming up to normal and rousing into activity for some hours. The Arctic ground squirrel in particular may be the most extreme case. During regular life, its core body temperature, like ours, hovers around 98.6 degrees Fahrenheit. But during hibernation, its core body temperature can actually fall below freezing, to as little as 26.8 degrees, for days at a time. How do Arctic ground squirrels manage that? They supercool.

Supercooling is what happens when the temperature of a liquid falls below its freezing point yet doesn't freeze. That can happen if a liquid has no nucleating agents—no particles around which crystals can form. But add a particle—a piece of ice, say—to a cup of supercooled water, and *pow!* The entire cup of water will freeze instantly. Being able to supercool is rare among mammals—but popular among insects. In Alaska, yellowjacket queens of the species *Vespula vulgaris* survive the cold, hanging by their mandibles for nine months in a dry, snow-free cavity,

by allowing the fluids in their bodies to supercool. A supercooled yellowjacket can drop her temperature to as low as 3 degrees, but rather miraculously avoids turning into a waspsicle. Bring her into contact with snow, however, and again, *pow!* She freezes solid—which kills her. Other insects can get even cooler: the beetle *Rhagium inquisitor*, otherwise known as the ribbed pine borer, can supercool to -24 degrees. Is a supercooled Arctic ground squirrel at risk of freezing solid? It's possible, but unlikely. Its skin would have to be pierced by an icicle or something like that.

HIBERNATION, ON MANY LEVELS, looks passive, almost like a temporary death. In a small mammal, the body is cold, the heart rarely beats, the animal scarcely breathes. A hibernating little brown bat, for example, may take a breath less often than once an hour. The cellular machinery shuts down, too: little DNA is copied, few proteins are made. But hibernation is far from being a full suspended animation. For one thing, many hibernating animals remain alert to unusual

noises or disturbances. Cough loudly in a cave full of hibernating bats, and they will start to rouse. Stride into a bear's den, and the bear will wake up—and it probably won't be pleased to see you. Moreover, hibernation is tightly regulated. Ground squirrels move in and out of hibernation with clockwork precision—somehow, they measure time—and their body temperatures are always kept a bit higher than the temperature of their dens.

Hibernation seems to have evolved as a way to save energy when food is scarce, rather than a way to bypass winter months. That is why it isn't found only in cold climates. For instance, the fat-tailed dwarf lemur—a small primate that lives in Madagascar—hibernates to escape not cold, but drought. The animal beds down in a treehole, often snuggled with its mate and

perhaps a couple of their offspring, for as long as seven months, even though the outside air can reach a balmy 85 degrees.

But cold climates do encourage energy-saving methods. Mammals maintain their high body temperatures by burning fuel, and it costs more to stay warm when the difference between the usual body temperature and the outside air is large. It costs more for a small mammal to adjust to dropping temperatures than for a big one (smaller animals lose heat faster). In short, it is hard for an animal the size of a mouse to stay warm when the weather is be-

low freezing for weeks on end; thus, lowering the body's thermostat saves on heating bills. So it's all the more mysterious that ground squirrels bother to warm up every ten days or so. Warming up is expensive. In-



deed, that's the main energetic drain of hibernating.

Perhaps it's necessary to have a brief systems check every so often, depending on housing conditions. For instance, a fat-tailed dwarf lemur doesn't bother to rouse if it's hibernating in a poorly insulated tree-hole, one that lets air temperature exceed 85 degrees. Instead the lemur abandons control of its body temperature altogether, letting it (and presumably also its metabolism) fluctuate with the temperature of the air. But a lemur that's settled into a tree trunk that has thick walls and a cool interior—a castle among tree trunks—keeps its body temperature steady at 77 degrees, and rouses for a few hours about once a week. (Maybe the reason bears don't do such systems checks is that they never let their bodies get much colder than about 90 degrees.)

How does an animal begin to hibernate? It goes to sleep. Indeed, one of the first things that happens in slow-wave sleep (as opposed to rapid-eye-movement sleep) is that body temperature drops a little. But whereas your body temperature won't drop more than a degree or so, the body temperature of a hibernating animal keeps going down as its metabolic processes slow down. Some animals let their temperatures drop low on a daily basis, essentially hibernating for a few hours in the night (or day)—a condition known as torpor. But, interestingly, many animals, such as hummingbirds, that become torpid do not hibernate for longer periods.

And if an animal begins to hibernate by going to sleep, what does it do upon rousing from hibernation? Oddly, the first thing a ground squirrel does is . . . take a nap. Why? No one knows.

BUT WHAT DOES ANY of this have to do with the human condition? It turns out that when they hibernate, animals overcome what currently look to us like intractable medical problems. For instance, cold-temperature hibernators, such as bats and ground squirrels, put themselves through rigors that would kill us. Most mammals that don't hibernate—such as mice, rats, and humans—die of heart failure if you cool the heart below about 70

What does an animal do upon rousing from hibernation? Oddly, the first thing a ground squirrel does is . . . take a nap.

degrees. Similarly, the hibernating brain gets almost no oxygen, yet the animal doesn't suffer brain damage. Understanding how that works could lead to better treatments for stroke and head trauma.

Indeed, ground squirrels have much to teach about brain regeneration. Studies of the golden-mantled ground squirrel show that during hibernation they retract many of their dendrites—the tendril-like nerve-cell endings that receive information from other neurons. Such a disappearance of dendrites is usually associated with senility. Yet each time the animal rouses, though it's only for a few hours, it regrows its dendrites. What's more, the dendrites grow faster when the animal emerges from hibernation than they do during embryonic development—a period usually thought to be the pinnacle of speedy neural growth. In the brain of an embryonic rhesus monkey, for example, den-

drites can grow 114 microns per day (about the thickness of a human hair). The freshly roused adult ground squirrel can accomplish the same growth in just two hours. Strange.

Why would an animal repeatedly dismantle and then rebuild the connections in its brain? Again, the answer isn't clear. One possibility, favored by the hibernation expert H. Craig Heller, a professor of biological sciences at Stanford University, is that during hibernation, it is too difficult to properly maintain the dendrites, so it's better to get rid of them and start over than to have to repair them. In support of that idea, he and his colleagues have shown that retraction is more extensive in animals that get colder. That makes sense: the lower the body temperature, the more complete the general shutdown, and the harder it would be to keep the dendrites in good order. Irrespective of why it happens, though, understanding how ground squirrels regenerate their brains might help develop therapies for the regeneration of damaged human ones.

SEVERAL OTHER ASPECTS OF hibernation turn out to be of potential medical interest. Take black bears. They don't move for months—they often start hibernating in October and don't emerge until April—yet their muscles don't waste away. A man confined to bed for six months would not be so lucky: his muscles would atrophy to about 20 percent of their prior strength, and on getting up, he'd find it difficult to walk. It isn't clear how the bears manage to keep their muscle tone, though preliminary studies suggest that hibernating bears engage in regular episodes (that is, three or four times a day) of vigorous muscle contractions, a k a shivering.

At the same time, bears and other hibernators lose weight—Bears and their kind, because they keep their body temperatures relatively high; the deep hibernators, because of the repeated bouts of warming. More-

over, hibernation burns up fat fast. For those with six months to spare, I foresee the hibernation diet, with the slogan: "Lose weight by doing nothing!" More seriously, hibernation could shed light on obesity and how to treat it. An animal preparing for hibernation suddenly starts gaining weight. The fat-tailed dwarf lemur doubles its mass in a few weeks, storing most of the fat in (you guessed it) the tail. Thus, understanding the underlying mechanisms of weight gain coupled with the subsequent weight loss could eventually lead to new anti-obesity drugs.

BUT HERE'S THE MOST radical research. Instead of trying to mimic natural hibernation, cell biologist Mark Roth and his colleagues at the Fred Hutchinson Cancer Research Center in Seattle have taken a different approach to suspended


animation. By exposing mice to tiny quantities of hydrogen sulfide gas—which in large amounts is poisonous—they seem to be able to switch off the body's ability to keep up its normal temperature. Sensors record a precipitous drop in metabolism along with temperature. In this fashion, the biologists can cause the mice to appear dead—but when the gas is removed from the air six hours later, the mice perk up, apparently unharmed.

Roth hopes his research will lead to new ways to approach surgery and the treatment of strokes; others have wilder ideas. One aspiring Methuselah, Florian Müller, argues that reducing body temperature by just a few degrees would reduce metabolism and thus increase life span. Writing in the journal *Rejuvenation Research*, Müller, now a post-doctoral fellow in aging studies (and not

yet thirty), proposes living in a temperature-controlled box and breathing air mixed with minute quantities of hydrogen sulfide (to bring his temperature down just a smidgen) until medicine has progressed to the point where aging is abolished altogether. Of course, he writes, "one would have to be willing to tolerate . . . the slowing of other biological functions (e.g., probably reasoning, movement)." Is it worth it? Müller thinks "probably yes."

Me, I think I'll take a different approach: follow the swallows and the swifts, and go south for the rest of the winter.

OLIVIA JUDSON, a research fellow in the Division of Biology at Imperial College London, is the author of *Dr. Tatiana's Sex Advice to All Creation: The Definitive Guide to the Evolutionary Biology of Sex* (Owl Books, 2003).



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Skating through the Ages

Skaters have been speeding up over the centuries, thanks to better footwear that allows longer strides for maximum efficiency.

By Adam Summers ~ Illustrations by Tom Moore

My little brother and I grew up on Rollerblades, the terrestrial version of ice skates. We raced on the rumpled streets of New York City, from Greenwich Village north to Central Park, ecstatic not to be circling a small oval of ice. In those days I held two major misconceptions about skating: I imagined that we were pioneering a new form of long-distance transport, and I thought skating was easier than running because of its gliding phase. In neither case was I close to the truth.

As far back as the Bronze Age, 3,000 years ago, skates helped people travel more widely. And it turns out that skating is extremely efficient, taking advantage of biomechanical properties of the muscles throughout the movement cycle—not only during the glide.

To an unmechanized Europe and Russia, ice skates were one of the first useful tools for making winter



trips between towns.

And since the joys of skating are best appreciated on long stretches of smooth black ice, it comes as little surprise that ice skates made their first appearance on relatively flat, snowless waterways.

Early skates were constructed of trimmed horse or cow bones, pierced at one end and strapped to the foot with leather thongs. Rather than being powered by the classic skating motion, those beauties were used in tandem with a long stick; skaters straddled the stick and poled themselves along. Bone blades gave way to iron ones and then to steel. By the 1800s the idea of a steel blade grafted to a fitted leather boot had firmly taken hold. (Although

most skaters still use that design today, the ultimate innovation in the skating world was the “klap” skate; it has a hinge that allows the skater to extend the ankle while pushing, which boosts speeds by 5 percent.)

The advent of thinner blades and a firm attachment to the foot signaled a transition to the longer strides of a modern skater. Those extended strides give skating its advantage over unassisted modes of transport (such as running) because, as it happens, the slower a muscle contracts, the greater the force it develops. To understand how that force difference works on the molecular level, imagine the muscle fiber as a “rope”: slow contractions pull the rope hand-over-hand, as if hauling a bucket from a well; rapid contractions grab and quickly release the rope—delivering a smaller relative force. Since skaters’ leg muscles can contract quite slowly, even at very high speeds, they gener-



Runner at the same given speed as a skater might take six steps for every skating “step”—generating less force per leg-muscle contraction. If both athletes exerted the same effort, with heart rates of 120 beats per minute, say, the skater would be almost four times faster.



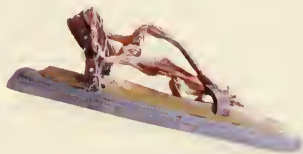


ate more force during each stride cycle. And that slow contraction can be maintained thanks to the fact that less lateral force—the outward push against the ice—is needed at higher speeds. Thus the strides get longer and the skate tracks become more parallel to the direction of travel [see the herringbone tracks that straighten and get farther apart as they pick up speed across the page].

HUMAN-LOCOMOTION biomechanists Federico Formenti of Oxford University and Alberto Minetti of the University of Milan collaborated to trace the efficiency of ice skates through history. Their aim was to measure the evident increase in efficiency from clunky animal-bone skates (1800 B.C.) to iron skates (A.D. 1200 and 1400) to steel skates (1700) to cutting-edge modern skates, also made with steel blades [the five skates used in the experiment are pictured here]. First the researchers fabricated authentic replicas of the ancient skates, adding only a somewhat safer binding to the oldest models. Then they found five retired professionals—short-track ice skaters—with a sense of adventure. After the skaters had familiarized themselves with the historic skates, they were equipped with a small

strap-on apparatus that measured their oxygen intake, heart rate, and (for three of the skates) leg movements. Each skater was then asked to skate both at a slow, comfortable pace and at a faster, more demanding pace with each type of skate. From those data, the researchers derived the energetic demand relative to speed of ice-skating on different kinds of skates.

The oldest bone skates used with the push pole simply would not go very fast; the pros only managed



a single speed of about 2.5 miles per hour (mph). Of course, even to achieve a steady, safe walking pace such as that would have been a big advantage to someone on a flat, icy river. The earliest metal-bladed skates that were tested allowed a near doubling of the slow, steady speed, but also permitted a fast gait of about 9 mph. Better bindings and thinner blades further enhanced speeds, culminating in a fast gait of about 15 mph with the modern non-klap skates that were tested.

Not surprisingly, the more modern skates delivered not only on speed but also on distance covered. By far the most impressive increases, though,

have to do with efficiency relative to speed. Consider a skater working herself to a point of exhaustion in ten minutes; on the oldest skates or the newest ones, she is putting in the same amount of energy. Yet on the newest blades she could travel considerably farther. Her stride frequency stays the same and her leg muscles continue to operate at high power, independent of forward speed (unlike a runner that squeezes out less force the faster the leg muscles move.)

Formenti and Minetti have gone on to test the bone skates in different locations, and have found that their benefits must have varied with the topography, particularly the number and length of lakes; Finland, with more than 60,000 lakes, seems the ideal locale and the likely place of origin for them. Considering my poor ankles, I might opt for the skates of yore on my next visit to the rink and punt around on horse metacarpals, big stick in hand to fend off any whizzing, would-be Bobby Orrs.



ADAM SUMMERS (asummers@uci.edu) is an associate professor of bioengineering and of ecology and evolutionary biology at the University of California, Irvine.



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While you're in Tucson, make sure to spend some time at the **Lost Barrio Shopping District**,

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No visit to Arizona would be complete without a stay in Red Rocks Country, and the chic, sophisticated **Sedona Rouge Hotel & Spa** is the perfect place to stay. Its architecture and interiors are inspired by eleventh-century Andalusia, Spain. The resort offers a full range of spa treatments and amenities, six exclusive Spa Guest Rooms with soaking tubs, and one exclusive suite that accommodates a private spa





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The swimming pool area at The Buttes Resort



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AT A LOSS FOR

The Native-American language Salish–Pend d’Oreille is on the brink of disappearing. More than half the world’s 6,000 languages will be gone by the end of the century.

By Sarah Grey Thomason

John Peter Paul, a rugged, dignified man, was extremely ill during the summer of 2000. He was ninety-one years old and suffering from stomach cancer. Still, every week he insisted on wheeling himself into the *Usšnéłx*[™] (Longhouse) on the Flathead reservation in northwestern Montana. There, he and other elders of the Salish and Pend d’Oreille tribes would gather in meetings I had set up to expand and fine-tune the dictionary of their language and the collection of texts that we had been working on together for many years.

On one occasion in midsummer, when John’s illness reached a crisis point, he refused to go to the hospital because he didn’t want to miss our scheduled meeting the next day. As a result, he had to be rushed to the hospital in desperate condition the next morning. His fierce dedication to the task of documenting and preserving his language almost cost him his life.

Other elders I work with share his dedication to their language and the culture it expresses. Some are Pend d’Oreilles, like John; the rest are Bitterroot Salish (also called Flatheads). Although they are different tribes, they share the same language—which is called, logically enough, Salish–Pend d’Oreille—albeit with minor dialect differences.

But like so many indigenous languages on every populated continent, Salish–Pend d’Oreille is on the point of vanishing. Fewer than thirty fluent native speakers remain, and nearly all of them are elderly. The great majority of the roughly 6,000 Salish and Pend d’Oreille tribal members do not speak their ancestral language at all.

Flathead River area in Montana where the Hell Gate Treaty of 1855 established a reservation for the Native American Pend d’Oreille, Salish, and Kootenai tribes. The Pend d’Oreilles had lived in this area for thousands of years; the Salish originally lived farther south.

WORDS

The fluent Salish-Pend d'Oreille speakers who work with me report that the only opportunities they have to "talk Indian" are at the tribes' Culture Committee's weekly elders' meetings from the fall through the spring, and in their weekly language sessions with me during the summer. John Peter Paul, who died in 2001 at the age of ninety-two, was married to his wife Agnes Pokerjim Paul, a Bitterroot Salish, for seventy-two years; they were the last married couple who spoke their language regularly at home. Their oldest daughter, Josephine Quequesah, is a fluent and highly skilled speaker of the language, but some of her younger siblings have a more passive level of fluency.

What happened to bring Salish-Pend d'Oreille to this precarious position? The obvious answer—the absolute necessity for most Americans to speak English in order to survive economically, together with the appeal of mainstream American culture to most younger tribal members—tells only part of the story. Another factor is the boarding schools that many Native children were forced to attend, starting in the nineteenth century. Those schools implemented the United States government's policy of assimilating Indians by replacing their



Salishan languages, twenty-three in all, were widely spoken in the Pacific Northwest before Whites arrived in force in the 1800s. The Salish and Pend d'Oreille tribes were allies of the neighboring Nez Perce and Kootenai tribes, and enemies of the Blackfeet.



Pend d'Oreille elder John Peter Paul (1909–2001) stands near the spot in Montana's upper Bitterroot Valley where the Salish tribe first encountered the Lewis and Clark expedition. Paul and his wife Agnes were the last married couple to regularly speak Salish-Pend d'Oreille at home.



native cultures, including their languages, with Anglo culture and English. (The policy had close parallels in Canada and Australia.)

THE ASSIMILATION POLICIES THAT took place on the Flathead reservation—and elsewhere—were often brutal. Some teachers and principals beat children for speaking their language anywhere on the school grounds.

Louis Adams, a Bitterroot Salish elder in his late seventies, recounts what happened to him in the first grade, in a public school on the reservation. He and his friend Peter Pierre were talking Indian in the hallway of the school; a teacher heard them and broke her yardstick over Peter's head, then hit Louis with the biggest of the broken pieces. Next she took them to the principal, who said that if they spoke Indian again, he'd whip them with his belt. Louis complained to his father about the treatment and was told that he should do what the teachers wanted in school, but go on talking Salish outside of school. "Don't throw away your language," his father told him. Louis didn't, but many of his peers did.

The policy encouraged tribal members to suppress their own language. Harriet Whitworth, a Bitterroot Salish woman now in her late eighties, who—like all the remaining fluent speakers of Salish-Pend d'Oreille—has native-speaker fluency in both English and Salish, once told me she raised her five children to speak only English: "I didn't want my kids to go through what I went through." I asked whether she'd do things differently if she had known then that her language was in grave danger of vanishing forever: "Yes," she told me. "But it's too late now."

The circumstances that brought Salish-Pend d'Oreille to the brink of extinction differ from the stories of other

communities only in the details. All dwindling languages fight against time in the face of increasing pressures to speak a dominant language. English, Spanish, French, Portuguese, Arabic, Russian, Mandarin, Quechua (before the Inca Empire was destroyed by invading Spaniards), and other expanding languages have all been spoken by powerful outsiders who imposed their own order and language on subjugated, or at least less powerful, peoples. Two obvious questions arise here: Just how widespread is the phenomenon of language loss? And, more fundamentally, so what?

Before answering those questions, let me clarify that when linguists talk about language death, we are not referring to languages like Latin. Latin certainly qualifies as a dead language, but it did not die by losing all its speakers to another language; instead, it evolved into a sizable group of descendants, the modern Romance languages, almost all of which still thrive. The vanishing languages that I'm talking about leave no descendants.

Estimates of the number of threatened languages vary. About 6,000 languages are spoken in the world today. Pessimists like the linguist Michael Krauss of the University of Alaska Fairbanks predict that 90 percent of them will be dead by the end of this century; optimists predict the demise of only about 60 percent by then. Either way, we are looking at a future of catastrophic language loss.

There are, of course, quite a few languages that are certainly not going to vanish in the foreseeable future: all the languages listed above except Quechua are safe, for instance. Millions of people speak those languages, many of which are official in one or more nations. In fact, among the 200 or so nations in the world, English ranks as the most popular official tongue, cited in fifty-two

The principal told the two first graders that if they “spoke Indian” again, he’d whip them with his belt.

countries (not counting the United States, which stands nearly alone in having no official language). French follows, official in twenty-nine countries; Arabic and Spanish are tied, each with twenty-four; and Portuguese has eight countries that recognize it as official. Do the math. The count for those five languages totals 137 nations—a great majority of the world’s languages.

One might assume that other languages with at least a million speakers should also be safe, but that’s not necessarily so. Quechua, with several million speakers and official-language status in Bolivia and Peru, is steadily losing ground to Spanish, which is also official in both countries. If that is so, consider the plight of “smaller” languages, those with only 100 to 10,000 speakers—

sands. One recurrent argument, voiced loudly by proponents of the “English Only” and “Official English” movements in the U.S., is that reducing the number of languages will promote understanding and therefore national (and, ultimately, world) peace. It’s hard to take this argument seriously in a country that fought both a Revolution and a Civil War in which both sides spoke English, and in an era when Sunni and Shiite Iraqis, all speakers of Arabic, are killing each other by the hundreds almost daily.

Another common argument claims that English (or Arabic, or Spanish, or French, or Mandarin, or . . .) enables you to communicate anything you might want to say. According to that view, the loss of a language can be



Salish enduring forced removal from the Bitterroot Valley in Montana in 1891 by the United States government, which enacted the policy to open the entire valley to White settlement.

nearly half the languages in the world. Only the most isolated can be considered stable in their communities. But geographic and social isolation is itself vanishing fast, in every part of the world.

DOES LOSING A LANGUAGE matter so much? Some people favor moving toward one world language, or at least toward a drastic reduction in the cacophony of thou-

compared to the disappearance of the type of frigate that dominated Western navies in the eighteenth and early nineteenth centuries: the sailors who had mastered the intricate manipulations of the sails surely mourned their loss, but the need for effective fighting vessels made it inevitable that technological progress would sweep the sails away.

I believe, along with most other linguists and a great

many minority language communities all over the world, that any such comparison fails. Sure, tearing down language barriers would streamline international business and tourism. But a language cannot be evaluated solely on grounds of efficiency. In a very real sense, you cannot say anything you want in any language. This is not a question of translatability—of course it's possible to translate sentences like "Please pass the salt" into any language in the world—but of less tangible things, such as cultural ties, through language, to one's great-grandparents and to traditional ethnic ways of thinking about the world. Languages place special emphases on things and concepts that are important to their speakers: shapes of objects, meanings of certain plants and animals, fundamental ways of seeing the world. For instance, the word for "automobile" in Salish-Pend d'Oreille, *p'ip'úyşn*, is named for the appearance of tire tracks—literally, "it has wrinkled feet"!

Most Americans who have spoken English all their lives, and whose parents and grandparents also speak (or spoke) English, may find it hard to understand how a heritage language could matter so much. I got my first inkling of its importance when, right after college, I spent a year in Germany, speaking German constantly and becoming fluent. Although I was delighted with my new linguistic skill, I spent the whole year with the uncomfortable feeling that I wasn't quite the same person as when I was speaking English. It felt like a slight personality transplant, with different rhythms of thought and speech. I was glad to return to my English-speaking self when the year ended. This sort of discomfort must have a far more profound effect on people like the elders who grew up speaking Salish-Pend d'Oreille, but have had no chance to use it regularly for decades. And the elders I've talked to feel their own loss, and their community's loss, acutely.

In addition to the profound loss to the community, every language that dies without being thoroughly documented and analyzed robs us of potential insights into human linguistic capabilities, and reduces our chances of arriving at a comprehensive understanding of the workings of the human mind. That may sound grandiose—

after all, even if upwards of 60 percent of the world's languages vanish during this century, we'll still have a couple of thousand left, and besides, scholars have other tools for figuring out how the mind works. But there's a lot to the old notions that language is what makes us human and that its structures open a window into the mind.

The variation in human languages is not infinite. The fact that any human baby can learn any human language with equal ease is evidence of a fundamental similarity in all our languages. Nevertheless, the amount of variation is immense, and our understanding of the range and details of such variation can help challenge our theories about the nature of human language.

Even with the growing popularity of Chinese, Japanese, and Arabic, most foreign-language study in the West involves familiar European languages. English, French, Spanish, German, Italian, Russian, and Portuguese all belong to just one of the world's hundreds of language families, the Indo-European family. As a result, they share numerous structures in their grammar, sound systems, and ways of organizing their vocabularies. Studying an unrelated language is an eye-opener: it's not just a matter of memorizing a lot of new words and learning how to fit relatively familiar pronunciations and grammatical patterns into new configurations. Languages outside the Indo-European family are different in ways you can't imagine until you experience them.

SALISH-PEND D'OREILLE SURPRISES me every summer. It includes sounds that are rarely heard in Indo-European lan-

guages: stops produced with a glottal catch, sounds produced with the air sliding noisily past the sides of the tongue (lateral fricatives), sounds pronounced far back in the pharynx (pharyngeal consonants). The alphabet used to spell the language therefore contains letters that look very different from English letters, as the following examples illustrate. The language has no detectable limits on the number of consonants that can occur in a row, so that there are marvelous words like *Ta qesm'l'm'él'čstmstxw* ("Don't play with it!"), with eight consonants in a row at the end, and *sxw'čst'sqá* ("someone whose job it is to take care of livestock"), with seven consonants at the begin-



Elders such as Johnny Arlee (standing) who try to pass down the Salish language to the next generation face an uphill battle. But some younger Salish, including Chaney Bell (seated, center), have embraced this mission; in fact, Bell named his son the Salish word for "Whirlwind."

ning. It has words as long as your tongue, for instance *qʷo qʷt-č-taxʷl-m-nt-sút-m-nt-m* (“he would come up to me”). The short word, *qʷo*, means “me;” the long word has a root, *taxʷl* “start,” preceded by two prefixes and followed by six suffixes, some of them repeated. Words in Indo-European languages don’t have anything approaching this exuberant deployment of prefixes and suffixes.

Salish makes subtle distinctions that would require much more verbiage if expressed in an Indo-European language. Both *čtputés* and *čtputém* mean “s/he hunted it,” for instance, but the verb ending in *-és* indicates that the hunter is the most prominent character in the narrative, whereas the verb ending in *-ém* indicates that some character other than the hunter—maybe the hunted creature—is more prominent than the hunter in this context. It’s not that this distinction can’t be expressed in English or any other Indo-European language; of course it can. But not as easily, and such specificity certainly isn’t obligatory in Western languages, as it is in Salish–Pend d’Oreille. Storytellers often used this grammatical distinction to signal a subtle shift of attention from one character to another.

But like other aspects of Salish–Pend d’Oreille culture, some of the most “exotic” features of the language are fading: the last native speakers all speak English much more often than they speak Salish–Pend d’Oreille. To give one example of the effect that has on sound systems, only about three or four of the elders I work with pronounce clear pharyngeal consonants.

And in some semantic domains, most strikingly in the area of kinship categories and terminology, the much simpler English system has replaced much of the elaborate native Salish–Pend d’Oreille system. In my most recent session with the elders, in the summer of 2007, I wanted to find out how many of the old kinship terms are recognized by the current generation of elders. The kinship terms were compiled in 1976 with the help of a group of elders who are all now deceased.

At first the current group of elders said that they had never learned the old words; but the more they talked about their extended families, the more words they remembered. Dolly Linsebigler mentioned her father’s brother: she always called him her *smamáʔ*, but “after my dad died, everything changed—then he was my *twésti* (“aunt or uncle after the death of the connecting relative”). Josephine Quequesah remembered a word, *sméʔet*, that meant either uncle or nephew, and then Louis thought of another reciprocal kin term: “Yeah, like my *t’or’ó* used to call me her *t’or’ó* (“great-grandparent or great-grandchild”).

Dolly also commented that people who come from big families like hers got used to all the complicated terms, like *tqáqceʔ* (“woman’s older brother”), *q’é’éw’s* (“middle brother”), and *sísu’ceʔ* (“woman’s younger brother”). But many words were already beyond their memories, unrecognized. Like other complex systems of kin terms

around the world, Salish–Pend d’Oreille offers insights into the possible range of categories for human relationships. But the old system teeters on the brink of oblivion, and the same is true of intricate kinship systems all over the world.

Within the next twenty or thirty years, there will be no speakers left who learned Salish–Pend d’Oreille as a first language, spoke it regularly in their younger years, and revisited it throughout their lives. There are twenty-two other languages in the Salishan family, and they await the same sad fate. When there are no longer any Salishan speakers who remember how their grandparents and great-grandparents spoke, the old kin terms will vanish, along with the other cultural and historical riches encoded in the ancestral languages.

Language death, much too much language death, seems inevitable in this and future decades. But the picture is not completely dark. Many communities whose languages are threatened, including the Salish–Pend d’Oreille tribes, have begun vigorous efforts to document and revitalize their languages, so that today’s and tomorrow’s children will be able to learn them. In a few spectacular recent cases, notably Maori in New Zealand and Hawaiian in the U.S., heritage languages have been restored to the community’s children. And in perhaps the most dramatic historical case, Modern Hebrew emerged as the native language of a new nation’s children after 2,000 years of near-death.

Even when efforts to save heritage languages fail, that doesn’t mean the effort has been wasted. If fluent native speakers help document a dying language, with a full grammatical description, a dictionary, and a collection of narratives, the possibility of revival will always be there. The revived version won’t match the earlier version, but it can still serve its community. It can allow traditional practices and values to be expressed without the disruptions of translation, making the past more accessible. It can contribute its unique data to the scientific understanding of the universal human capacity for language.

Ultimately, though, if a community loses its language as its main vehicle of communication, both the community and its individual members lose an irreplaceable part of their identity. And at the same time, a part of our common world that their language uniquely illuminated goes dark.

Sarah Grey Thomason

Thomason has worked with the Salish–Pend d’Oreille Culture Committee since 1981, compiling a dictionary and text collection in collaboration with tribal elders. Thomason, who is currently co-authoring a textbook on endangered languages for Cambridge University Press, is the William J. Gedney Collegiate Professor of Linguistics at the University of Michigan and is a former president of the Society for the Study of the Indigenous Languages of the Americas.



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TRACES IN THE SAND

A photograph of a series of nested rectangular openings in a desert wall, creating a tunnel-like effect. The openings are framed by rough, textured stone or mud-brick. The light is warm and golden, suggesting a sunset or sunrise. The perspective is looking down the length of the nested rectangles, which recede into the distance.

**LIBYA BOASTS ANCIENT RUINS BUILT OVER THE CENTURIES BY BERBERS,
PHOENICIANS, GREEKS, ROMANS, AND ARABS.**

Photographs by Ellen Kaplowitz ~ Text by Mary Knight



A Natural History Photo Essay

ong before it was dominated by sand and oil wells, Libya hosted a diverse fauna that feasted in its fertile green valleys. Such natural resources in turn lured prehistoric human populations more than 10,000 years ago. The climate became increasingly arid, though, and within a few thousand years the region's inhabitants were congregating on the more hospitable shores of the Mediterranean. The indigenous peoples—speakers of Berber languages primarily—were later joined by waves of colonists from abroad: first Phoenicians, around 1000 B.C., from what is now Lebanon and Syria, and then Greeks, Romans, and finally Arabs. For all those who claimed portions of Libya, the scarcity of water posed a challenge.

The historian Herodotus, writing in the fifth century B.C., tells the story of the founding of the first Greek colony in Libya: The king of the island of Thera complained to the oracle at Delphi that his land was without water. The priestess advised him to “colonize Libya.” Of course, the irony of this advice (to emigrate to a permanently dry place from one in a temporary drought) was lost on the Greeks of the time. But colonize Libya they did. And ultimately, the Greek city of Cyrene became famous for its philosophers and mathematicians. Oddly enough, its wealth grew from the region's production of silphion, a now extinct plant, which caused abortion—much like an ancient version of “Plan B.”

Romans settled primarily in the west, in Tripolitania, the “land of three cities”: Sabratha, Oea (modern Tripoli), and Leptis Magna. All three were originally Phoenician trading outposts, but the Romans outfitted them in style for a king, Septimius Severus (ruled A.D. 193–211), who hailed from Libya. By the fourth century, his cities had begun to fall to ruin, plundered by lawless bands and prolonged droughts. As ruins go, however, the beaux arts of his time are remarkably well preserved.

The Islamic “opening up” (*al-fath al-islamiya*) of the region west of Arabia, beginning in 643, brought a new style of architecture specially adapted to the desert. The Arab mud-brick structures were painted white, for instance, to reflect sunlight, and their thick walls and high ceilings kept their inhabitants cool.

Libya's natural resources, particularly its oil, continue to draw people and nations from around the world into its economic orbit. Twenty years of trade sanctions have arguably overshadowed the region's past. But its ancient ruins, largely obscure to Western travelers, may still stand out to archaeologists a thousand years from now—long after today's conflicts have been forgotten.



Mud-daubed walkway in Ghadames, opposite page, allows residents to stay cool in the hostile Saharan heat. Occupied for centuries by Romans, Ghadames operated as a trading town and remains inhabited today. Above: a panpiper from a marble pilaster in the apse of the Severan Basilica of Leptis Magna reflects the city's Roman roots. Left: the Roman-era theater at Sabratha, a city founded by Phoenician colonists.



Severan Basilica (built under the rule of Septimius Severus), above, viewed through fallen colonnades, stood at the head of the central road leading through the city of Leptis Magna. Opposite page: other ruins at Leptis include a gorgon head—one of many decorating the arcade of Severus, top middle; marble latrines in the great Roman baths, top right; and an open-air theater, middle. Bottom of opposite page: portions of the "labyrinth mosaic" of the house of Jason Magnus, a wealthy citizen of Cyrene, reveal that the opulence of that city, founded by Greeks, continued into the Roman period.





Granary, above, was built some 700 years ago in the Berber town of Nalut, which sits high above the surrounding desert. Locals call the structure a *gasr* ("castle"), but the rooms were simple storage facilities used by local families for grain and oil. A high exterior wall (not shown) protected the granary from attack as well as from the ravages of sand and wind. Left: Berber messages imprinted on stone by Saharan nomads may date from ancient times or from yesterday.

Ellen Kaplowitz and Mary Knight

Ellen Kaplowitz's images have appeared at a number of museums, including the Field Museum in Chicago and the American Museum of Natural History in New York, and in her most recent book, *A World of*



Decent Dreams: Vietnam Images (Weatherhill Press, 2003). Visit www.ellenkaplowitzphotography.com for more. Mary Knight is currently a visiting scholar at New York University and a member of the Cyrenaica Archaeological Project. She has spent much of the past decade working in and traveling throughout North Africa.



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Clockwise starting top left. Caño Negro Wildlife Refuge; Tortuguero Park Canal Cruise; White Faced Monkey; Keel Billed Toucan; Manuel Antonio Park, Rainforest Hike

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BABOON HEAVEN

A SOUTH AFRICAN ANIMAL REHABILITATION CENTER GIVES AN UNPOPULAR PRIMATE TLC AND A CHANCE TO RETURN TO THE WILD.

BY MICHAEL C. BLUMENTHAL
PHOTOGRAPHS BY ATTIE GERBER

HOW DID I GET HERE, WITH DENNIS HUDDLED AGAINST MY CHEST, TORTILLA GROOMING THE HAIRS ON MY ARMS, SABRINA ON MY LEFT SHOULDER, AND MAGGIE ATOP MY HEAD, BEHAVING LIKE A HAIRDRESSER? AS I SMACK MY LIPS IN AN ATTEMPT TO MIMIC MY COMPANIONS'

grunts and chatterings, Sinamo does a backward somersault between my legs, chasing after Cory and Jagger.

Friends and colleagues, perhaps secretly envious, have predicted that as a city boy and literature professor, I would feel out of place among these orphaned chacma baboons. Yet here I am, on the bank of the Olifants River in South Africa, yards away from wild crocodiles and elephants and hippos and the occasional lion. And it feels good—this grooming and chattering, these small baboon bodies hunkering against my chest.

THIS IS THE BABOONS' STORY, not a woman's, yet it must begin with a woman nonetheless—for it is with her that it all began. Rita Neumann was in love with animals as early as she can remember. Born in 1931 in Germany, she dreamed of becoming a veterinarian, but that path was closed to her because higher educational institutions granted preferential admission to soldiers returning from the Second World War. Rita went to work instead at Hamburg's renowned Hagenbeck Zoo and then, in 1953, emigrated to Johannesburg, South Africa. There she soon married her German fiancé, Lothar Simon, and the couple had a daughter. In 1963 Rita bought a fifty-acre tract of bush wilderness near Phalaborwa, about 250 miles northeast of Johannesburg, that was destined to become her intimate link with the animal life she loved. But before that, in 1972, tragedy struck: Rita's husband and their seventeen-year-old daughter were both killed in a small-plane crash.

Eight years after the accident, during her brief second marriage to Piet Miljo, an Afrikaner, Rita made what might be regarded as the transforming acquaintance of her life. While traveling in

northern Namibia, she encountered a baby female chacma baboon named Bobby. (In fact almost all anonymous baboons in South Africa were dubbed Bobby, after the Afrikaans name for the species, *bobbejaan*.) The animal had been plied with alcohol and abandoned in a trash bin at a military encampment. In defiance of the requirement for permits, Rita took Bobby home, and a bond between baboon and human was forged. In 1989, along with Bennett Serane, a like minded South African, Rita founded the Centre for Animal Rehabilitation and Education (C.A.R.E.), and her fifty acres of bushland became a refuge where injured wild animals—various birds, reptiles, and small mammals, initially—were treated and released.

As increasing numbers of injured or abused chacma baboons, mostly orphaned babies, were brought in, the center began to specialize. Agricultural lands had encroached on the baboons' natural habitat, and wherever crops were threatened, farmers had the right to shoot the offending "vermin." Poaching, poisoning, illegal trade in pets and experimental animals, as well as environmental hazards (natural or otherwise), also left behind baboons in need of C.A.R.E.

"You know, they are the last creatures under the sun that nobody cares about," Rita says. "When I first started, everybody said to me, 'With all that energy you've got, why don't you look after rhinos?'—or cheetahs, or whatever else it was they cared about. And I answered, 'Because these guys need me.'"

THESE GUYS DO NEED HER, as I quickly find out when I arrive in May (South African autumn) to serve as a C.A.R.E. volunteer for three weeks. At the Phalaborwa airport I am picked up by the Centre's manager, thirty-eight-year-old Lee Dekker, a cheerful woman who exudes an air of commitment and competence. Normally she would be carrying an infant baboon in a shawl tied around her waist, but today the only baboon she's wearing is the one imprinted on her T-shirt. Since she has to stop in town



Stefan, about one year old in photograph on opposite page, was born within a chacma baboon troop made up of animals rescued by the Centre for Animal Rehabilitation and Education (C.A.R.E.). Located near Phalaborwa, map above, C.A.R.E. attracts volunteers to act as foster parents for its young orphans and to perform many other duties.

Stefan pictured at about two weeks of age, right, with his mother, Schatzi, and other female members of his troop. Known as Tito's Troop for its alpha male, the troop was released on farmland but had to be relocated when landowners began to exercise their right to kill "vermin." Below: Baboon that, when an at-risk infant, was transported by C.A.R.E.'s director, Rita Miljo, without the required permit. He was given the name James Bond because the rush rescue required a detour to avoid a roadblock. A judge acquitted Rita of wrongdoing on the grounds that she acted out of necessity to save the baboon.



to do some food shopping, she's left the baby she's foster-mothering, Suzie, behind.

"The situation for wildlife in Africa is essentially hopeless," Lee tells me en route, "but we keep trying." Nearing the Centre, we drive along the crocodile- and hippo-filled Olifants River—a tributary of the "great grey-green, greasy" Limpopo, of Rudyard Kipling fame, where the Elephant's Child of the *Just So Stories* got his nose stretched into a trunk by a crocodile. I see a memorial wreath along the water's edge. "Don't ever walk along the river bank by yourself at night," Lee warns me, "and, for God's sake, don't ever go swimming in it. We don't want to have to put one of these up for you."

How I got to C.A.R.E., like so many of the volunteers, is by watching the Animal Planet network—to be precise, a show called "Growing Up Baboon," featuring the work of Rita Miljo and her staff. Another volunteer, Kim Solbakk, a former real estate investment manager from California making her fourth visit in less than two years, echoes my own sentiments: "I had always been interested in primates," she says, "and I wanted to do something hands-on."

What a volunteer does have on his or her hands, almost from the moment Lee's truck pulls into the Centre, is baboons—including baboons jumping on the back of the truck to help themselves to the victuals before Lee can frighten them off with stones and pull in behind the fenced gate. You quickly learn that there are actually *two* populations of

baboons in residence—a “wild” group numbering around 120, affectionately dubbed the “Longtit troop” by Rita for reasons that take little time to become apparent, and the 300 to 500 captive baboons, whose relatively spacious metal-and-wire-reinforced enclosures are dispersed all over the property. The wild baboons arrived uninvited, but their presence has had the serendipitous effect of showing that wild and caged baboons can interrelate. The younger caged baboons learn about foraging, playing, fighting, and copulating by observing and interacting with the older free ones, and—since baboons are able to figure their way around virtually any obstacle—adult members of the two groups freely copulate.

Rita and her staff’s most radical innovation over the years, however, has been the artificial formation of coherent troops that can succeed on their own in the wild. Previously it had been largely taken for granted that a troop had to form naturally, through a matrilineal lineage, with females spending their lifetimes in the same troop and a few dominant males moving in and out. But Rita discovered that by combining compatibly aged, sexed, and spirited baboons into troops within the cages, then allowing them to reach maturity, she could release them back into the wild together.

C.A.R.E.’S WEANING PROCESS ATTEMPTS to closely parallel what takes place in nature. During the first month or two, a newly arrived orphan infant spends twenty-four hours a day, seven days a week (including time in the shower and on the toilet) either tied around its surrogate mother’s waist in a shawl, or in her arms. When the surrogate mother, the staff, and Rita think the infant is ready, it is moved to the nursery with the other infants for several hours a day, returning to sleep with the mother at night. This phase slowly morphs into the next, usually at around two months, when the infant grows comfortable spending the entire day in the nursery, and only nights with its mother.

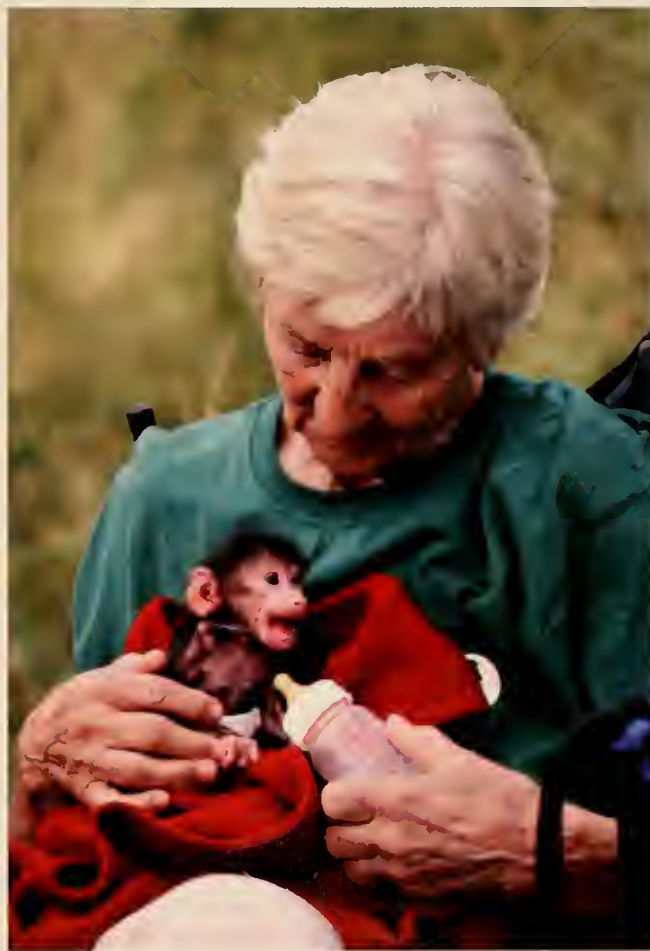
During the final phase, the most trying for the little babies, the infant continues to sleep in its surrogate mother’s room at night, but in a small cage. This prepares it for its real “move” into post-infancy, when it will begin to sleep with its contemporaries—and, of course, their stuffed animals. Those youngsters are cozily set up in the main house, in Rita’s bathroom.

MY SCHEDULE IS FAIRLY TYPICAL for a volunteer: from 11:00 A.M. until noon I prepare bottles from powdered milk—several hundred bottles are distributed daily; then, from 1:00 P.M. to 2:00 I play and socialize with the “mediums” (baboons between eight months and a year old); from 2:00 to 3:00, with the “smalls” (between four and eight months); and from 4:00 to 5:00, with the infants in the nursery. At around 5:30—it gets dark early—all three groups of babies are brought indoors to spend the night.

In the mediums’ cage I have my first exposure to being

mobbed by a group of frightened baboons. There are seventeen of them, ten females and seven males. Dennis, one of the lower-ranking males, quickly decides I’m a threat. Just when I think we’re beginning to develop a rather friendly, if cautious, relationship, something I do—perhaps an inadvertently raised eyebrow, or a set of teeth too conspicuously revealed—triggers his anxiety and, before I know it, a high-pitched warning cry issues from his lips. In seconds, all seventeen of the mediums, teeth bared, make for my calves, my arms, my thighs, my waist.

Ah! Ah! Ah! cries Zurika Potgieter, who along with Elena Pasotti supervises the volunteers, mimicking the



Rita acts as foster mother for an abnormally small female baby. The infant was the first-born of a very young female, and under natural circumstances most likely would not have survived.

baboon cry that means “Cut that out!” She yanks several of the young tykes off me by their arms, legs, scruff of the neck, ears, and tails. (Baboons have amazing abilities to tolerate pain and to heal from injury—a baboon can be dragged, pulled, bitten, and clawed so much in the course of the average day that its very survival, much less its prospering, seems a near miracle.) Later, in the nursery cage, I also learn that baboon society is profoundly gender-

oriented, and that the animals have very discriminating eyesight. From the moment I first enter the cage, these infants know I am both a stranger and a man, and they beat a hasty retreat into Elena's already baboon-filled arms. "They just need to get used to you," she consoles me. "They're terribly afraid of new men."

A volunteer has little time to waste in learning how to navigate life among the young baboons. Once you have picked, cajoled, lifted, and forced enough of the little guys and girls from your head, thighs, shoulders, and waist to have a seat on one of the plastic crates provided for that purpose, you must wrestle with the first of many challenges about to confront you: How do you tell Dennis from Kimberly, Tortilla from Yoshi, Judy from Jagger? Everyone else seems able to do it—so why not you?

The male/female bit is easy enough. If you can't stop them moving long enough to spot a penis, or lack of one, there's another simple method: in males, the callosities, or buttocks, are fused below the anus; in females, they are conveniently separated to make room for the sexual organs. And then, slowly but surely, you become aware of more subtle differences: Kimberly has rough, thick gray fur and—with the exception of Sinamo, the alpha female—is the largest of the troop; Icarus has several scar markings on his left cheek; Maggie is not only nearly inseparable from her brother, Dennis, but is also missing her tail; Cory is the one who attempts to masturbate on your left knee. After a few weeks of this, you could swear your eyes are becoming as focused and discriminating as the baboons'!

ONE OF THE OTHER THINGS you need to learn quickly is baboon language: lip-smacking, grunting, warning calls, laughing sounds, mating cries—the emotional range is rather astonishing. I've already become acquainted with the warning cry—and its repercussions—thanks to Dennis. In the meantime, I arduously practice my lip-smacking, the ultimate accompaniment to the come-hither face, in front of the mirror. My attempts more closely resemble a forlorn lover blowing kisses than a baboon trying to be friends, but I'm just a beginner, after all.

"You can pick your friends and you can pick your nose, but you can't pick your friend's nose," was a popular elementary school joke when I was growing up in Manhattan, but it certainly isn't the prevailing ethos here. Maggie, who is clearly becoming my friend, is not at all averse to picking at my nose, my ears, my eyelids, my lips, and my gums, as well as virtually any other protrusion or orifice her adept little hands can reach.

In the nursery one afternoon, I meet Shanti, a two-month-old female who greets me with a flattering, and utterly archetypal, gesture: the presentation of her *derrière*. The presenting of the female buttocks, in the hope that the one so honored will comply by scratching them, is a gesture of incipient friendship and interest (it can also have



other functions, such as expressing a desire for grooming or copulation, or surrender after a fight). So I scratch, and Shanti, temporarily satisfied, scoots off playfully into Elena's arms.

Shanti's story—heartbreaking, but not uncharacteristic of orphans who have the good fortune to end up at C.A.R.E.—is that her previous owner had nourished her largely on alcohol, a substance infant baboons will ingest all too readily. Within days of her arrival at C.A.R.E., it became clear that poor Shanti was going through detox. Originally Lee's baby, she also takes a liking to one of the volunteers, Jacob, who agrees to take on the rather unique status of being a male "stepmother" until his departure.

TO SAY THAT BABOONS ARE not earth's most beloved creatures is to establish oneself as a master of the art of understatement. Not only do baboons not lend themselves to being dressed up in overalls or tutus and paraded onto the *Late Show with David Letterman*, they also, when grown, have an elongated snout, reminiscent of a dog's,



Volunteer Maria Corales and her foster "child" (in diapers), left, socialize with some young baboons. At first infants are carried by their foster mothers twenty-four hours a day, but then are gradually weaned. Top photo: Young baboons play on a tree used as the sleeping place of Tito's Troop. Above: members of the troop before they had to be relocated.

not the relatively flat, humanlike face of a chimpanzee. Contemporary folk tales in Africa and elsewhere freely portray baboons as stupid and lazy. And in South Africa, where people once received a monetary reward if they could hand in a baboon scalp and tail, all sorts of unflattering myths endure.

Nor are baboons in general especially endangered primates. But as Rita says, "Why do we have to wait until the baboons are almost extinct until we care for them?" In any case, the loss of any regional population can be significant. By one reckoning all baboons belong to the same species, *Papio hamadryas*, and the chacma baboon, *P. h. ursinus*, is one of five subspecies. Even within that subspecies, two or three forms can be distinguished: the Cape chacma, the gray-footed chacma, and perhaps the Ruacana chacma.

The potential for future tragedy motivates Rita and the staff not only to nurture the orphans in their care, but also to return animals to the wild. In the nearly twenty years of C.A.R.E.'s operation, some eight troops totaling roughly 150 baboons have been released all around South Africa. The process is time-consuming and complex. Not only must an appropriate release site be located, permits applied for, and the troop transported, but also two "release managers" (one of whom needs to have bonded tightly with the troop's alpha males) must accompany the troop to make sure the animals can successfully forage on their own. The release managers select a sleeping tree as a central gathering place, sleep at the site, and lead the baboons to water, fruiting trees, and other resources until the males are able to find them on their own. One of the managers may have to remain with them for as long as five months.

During my stay as a volunteer, a troop is being readied for release. The same troop was released once before, five years ago, and survived two years on land owned by a sympathetic farmer. When a tolerant neighbor died, however, the animals fell prey to shooting and poisoning. Rita and Lee then brought them back to begin the whole process over again!

IT'S WITH DENNIS—THE "medium" whose warning cries first led to my being mobbed—that I develop my most complicated, and at times perplexing, relationship. Along with his devoted sister Maggie, my hairdresser, he spends much of the time when I'm in the cage grunting and vocalizing in my arms and grooming me to calm himself. He repeatedly comes to me for comfort, but—when I apparently don't satisfy him—begins biting me, or crying out for help.

Several days into my stay, thanks to Dennis's instigation, I get mobbed twice. My mistake: projecting human reactions onto the baboon world. I'm expecting simple gratitude—after all, who's been protecting and cuddling him these past several days?—but I've not reckoned with baboon politics. The fact is, Dennis falls very low, perhaps lowest, in the troop hierarchy, and those of low rank will often "switch sides" against a common enemy (me!) as a way of trying to ally themselves with their more powerful cohorts.

Making eye contact with me obviously frightens Dennis: whenever I look at him, or try out my lip-smacking, he runs off screaming. I decide to adopt a new strategy, which actually seems to work: I studiously look away whenever he tries to meet my gaze. I sense he is just waiting for our eyes to meet to give out the *help!* cry and have the others mob me, and I'm not buying.

The fact that your spirits rise when young baboons are nicer to you than they were the previous day may not signify that you have risen within our own not-so-humble species, but that's how I'm starting to feel. It's another day, and the mediums seem genuinely happy to see me, with Kimberly jumping down on me at least a dozen times

from the wooden post above and lying playfully in my lap, and Tortilla and Sabrina madly vying for Maggie's hairdresser role. My Dennis strategy seems to be working, too: he constantly tries to make eye contact, first from my lap and then from various vantage points around the cage, but I steadfastly hold to my resolve—stroking and lap dancing are okay; eye contact, no.

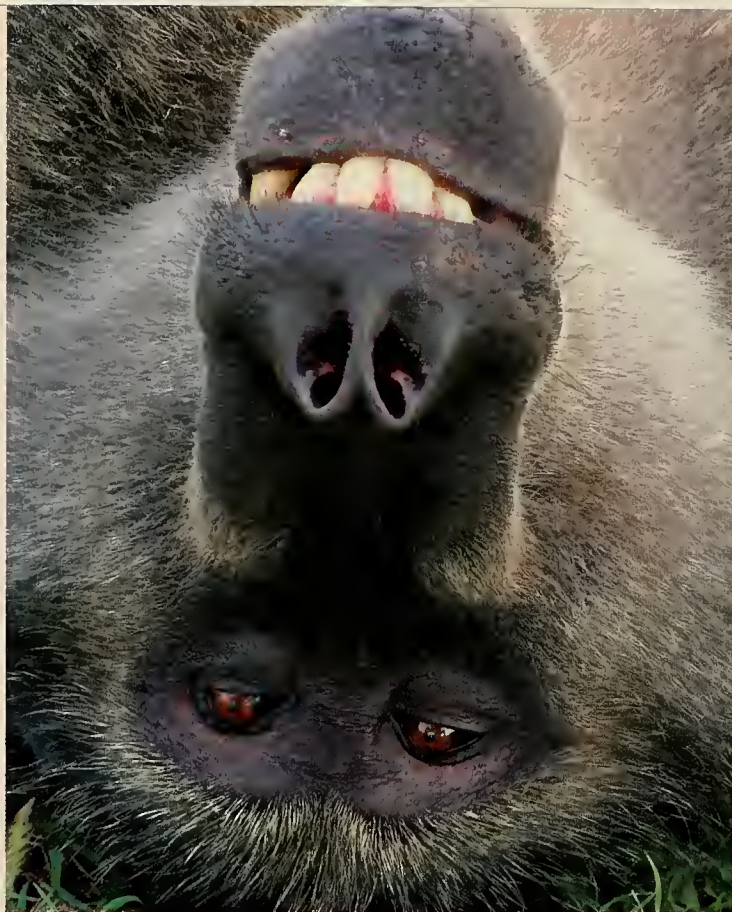
This morning, though, one of the adult baboons has been found dead. His purplish-black tongue reveals he has died of asphyxiation, the result of a black mamba bite, the deadliest snakebite of all. In the brief time since my arrival, three baboons have now died (two from snakebite, one from tetanus).

Several others have been mauled by baboons from the wild troop, reaching into the cages. Each day brings its small and large emergencies—illnesses, accidents, deaths, injuries, escapes, fights.

BY THE END OF MY SECOND week, I'm beginning to feel a bit baboony myself. It's not a bad life, being the alpha male. Somebody up there on my head—Tortilla? Sabrina?—madly grooms my hair, my eyes, then moves on to my chest and, along with periodic yanks on my chest hairs, methodically chews off all three buttons on my shirt. Then, also, there are lots of soft kisses along my eyes, nose, and ears today, not only from Maggie—who has also taken to kissing me on the lips—but from Kariba and Tortilla as well. I'm slowly fitting in, I find, just becoming another one of the family.

But before I know it, my stay at C.A.R.E. is drawing to a close. Suddenly one of those “super-emotional human things” Rita likes to speak of takes possession of me: I am actually going to have to say good-bye to Dennis and Maggie and the others. Sentimental to the core, I decide to put it off: I'm spending a week in Phalaborwa before my flight; I'll just come back before I leave and do the dirty work then.

On the day of my flight, I rent a car and drive back to the Centre. As soon as I arrive, I make one of those “human errors” (Rita's favorite expression) and leave my car outside the volunteer lodge, instead of locking it up behind one



Tito, the alpha male, photographed on awakening (a second later he jumped up and displayed his canine teeth in warning).

of the fences. Though I've removed any obvious sign of food, I should, after three weeks of living among my primate cousins, know better. By the time I've walked down the hill to Rita's house, the wild troop has ripped the passenger-side mirror off in search of something to eat. “Stupid baboons?” Not at all—just another example of a rather careless human.

When I walk into Rita's living room, Suzie, Lee's baby, is so glad to see me that she leaps onto the sofa to play. But there's also been bad news during the night: Nathan has died of pneumonia after eleven years at C.A.R.E. While shaving his chest to do the chest X-ray, they made a disturbing discovery: a

number had been tattooed on him by the experimental lab where he was used as a subject before Rita rescued him.

Before leaving, there's one last thing I need to do. I enter the mediums' cage, where I am immediately greeted and climbed upon by Dennis and Maggie, along with Sabrina and Tortilla. I take a seat on one of the crates, Maggie and Dennis firmly planted on my right knee as usual, Maggie fervently grooming me.

But I don't have much time for the hairdressers today; I've got a plane to catch. So I turn and look Dennis right in the eyes, lip-smacking and smiling as I do so. He looks back at me, neither running for cover nor sounding the alarm cry, lip-smacking as well.

And I could swear he is smiling too.

Michael C. Blumenthal

Formerly a New Hampshire law clerk to now-Supreme Court Justice David Souter, a science writer/editor for *Time-Life Books*, and director of creative writing at Harvard, Blumenthal occupies the Darden Endowed Chair of Creative Writing at Old Dominion University in Norfolk, Virginia. It was only in hindsight that he realized that one of his motives in experiencing and writing about C.A.R.E.'s mission may have sprung from a deeper connection with the animals: “Not only were the infant baboons separated from their mothers at birth, I was too—adopted away from my natural mother when I was eight days old.” Blumenthal's own family circumstances are recounted in his book *All My Mothers and Fathers: A Memoir* (Perennial, 2003).



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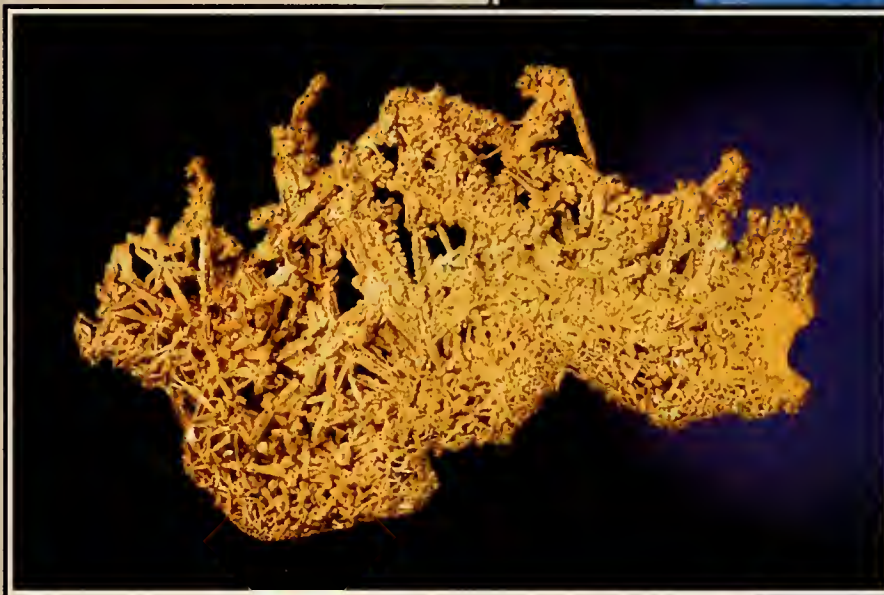
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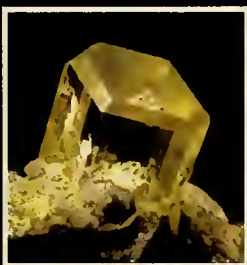


Aquamarine
Shigar Valley,
Pakistan; 7 inches



Gold, 4.2 inches
Wire Patch Mine
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(mined in the 1880's)
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Grotto Spring Run, sixteen miles south of Florida Caverns State Park, is one of the Chipola River's many tributaries.

Florida Underground

At a state park riddled with caves, even the Chipola River ducks below the surface.

By Robert H. Mohlenbrock

As its name implies, Florida Caverns State Park is a place to see stalactites, stalagmites, and other cave features, but it also boasts a variety of natural plant communities, including one in which Appalachian Mountain species reach their southernmost limit. The park lies about sixty-five miles northwest of Tallahassee, near the small city of Marianna, the seat of Jackson County. It covers a two-square-mile area that ranges from 65 to 180 feet above mean sea level. Flowing through it from north to south is the Chipola River, whose name is said to be Choctaw for "sweetwater." The river is eighty

feet wide in some places, but it also sinks underground for about half a mile (though some of the water flows



Southern magnolia

across the surface in a ditch cut 100 years ago for a logging run).

The park owes its geological features to a complex history. Some 300 million years ago, two primeval supercontinents, Gondwana and Laurasia—themselves the products of earlier tectonic movements—collided to form a single landmass, Pangaea. When, about 100 million years later, Pangaea began to break up, a fragment of the African continental plate remained attached to North America. That rock ultimately underlies what is now Florida and adjacent areas. During the past 100 million years, the region was often covered by the

Appalachian forest Vegetation along the Beech Magnolia Trail is reminiscent of that in the Chattahoochee National Forest of northern Georgia, with such trees as American beech, American holly, black walnut, southern magnolia, white ash, white basswood, and yellow poplar

towering over blue phlox, daisy fleabane, elephant's-foot, hairy phlox, mistflower, partridgeberry, Solomon's-seal, Virginia snakeroot, and other Appalachian wildflowers. Species just barely reaching Florida from the Appalachians are Allegheny spurge, bloodroot,

Chattahoochee River wake robin, false rue anemone, lance-leaved wake robin, mayapple, waxy meadow rue, and two very uncommon wake robins: purple toadshade (*Trillium underwoodii*) and spotted wake robin (*T. maculatum*). Species that fall between the canopy trees

and the wildflowers include bigleaf snowbell bush, needle palm, red buckeye, southern flame azalea, and sweetshrub.

Upland forest The uppermost elevations of the park, along its eastern and western sides, are relatively dry. Among

sea, which laid down layers of shells, corals, and other carbonate deposits. Those deposits eventually formed an enormous platform of limestone tens of thousands of feet thick.

Once formed, the limestone was subjected to the whims of sea-level fluctuation. When the sea level was high, acidic ground water found fissures and cracks in the soluble limestone, and slowly enlarged those



The coral snake is highly venomous.

building up residues in the form of columns, draperies, rimstone pools, soda straws, stalactites, and stalagmites. Visitors to the park may view such wonders by taking a guided tour along a lighted pathway in one cavern.

A number of underground chambers known in the park are not included in the tour. One is Salamander Pond Cave, which contains an underground pool 183 feet long, 13 feet wide, and more than 8 feet deep. Two rare cave species live in that aquatic cavern, the Dougherty Plain cave crayfish (*Cambarus cryptodytes*) and the Georgia blind salamander (*Haideotriton wallacei*).

Geological activity has hardly ground to a halt in the region. The Chipola River continues to erode the limestone; the River Sink is where the river disappears about 100 feet below ground before emerging downstream. Blue Hole Spring, a pool nearly 100 feet in diameter and 39 feet deep, is fed by an artesian spring, where water emerges under pressure at a rate that has been measured at 56.8 cubic feet per second. The overflow creates picturesque Carter's Mill Branch, which eventually flows into the Chipola River.

The Chipola is a small tributary of the Apalachicola River, which originates to the east of the park as a confluence of the Chattahoochee

and Flint rivers. The Chattahoochee has its headwaters in the mountains of northern Georgia, and this connection has provided a pathway for plant species of the Appalachians to

migrate into northern Florida. The park's trails, including the Beech Magnolia Trail and the Bluff-Floodplain Trail, provide a cross-section of the vegetation. If you hike in the park, be aware that alligators, coral snakes, cottonmouths, dusky pygmy rattlesnakes, eastern diamondback rattlesnakes, and snapping turtles live there as well.

ROBERT H. MOHLENBROCK is distinguished professor emeritus of plant biology at Southern Illinois University Carbondale.



VISITOR INFORMATION
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Marianna, FL 32446
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www.floridastateparks.org/floridacaverns/

pathways into caverns channeling underground streams. When the sea level and water table fell, the caverns drained, and in the presence of air, calcium carbonate that was dissolved in dripping water precipitated out,

the trees flourishing here are flowering dogwood, hop hornbeam, laurel cherry, laurel oak, live oak, loblolly pine, and spruce pine.

Floodplain forest The fairly flat and low-lying terrain that borders the Chipola River and its tributaries is inundated

each year when the river and streams overflow. Trees that inhabit the wettest areas include American hornbeam (also known as musclewood), bald cypress, green ash, loblolly bay, Ogeechee lime, overcup oak, swamp gum, sweet bay, tupelo gum, water hickory, and water locust.

Bluestem palmetto is plentiful beneath the trees.

Limestone cliff Low limestone cliffs, up to thirty feet tall, appear in places along the Chipola River. False rue anemone and wild columbine are common, growing from crevices in the cliff face. A

close examination of the cliff face reveals bicolored spleenwort, ebony spleenwort, modest spleenwort, and Morzenti's spleenwort, the rare one-sorus spleenwort, and southern maidenhair fern. The attractive oak-leaf hydrangea hangs from the tops of the cliffs.



"Wedding cake" dripstone formation in the cavern

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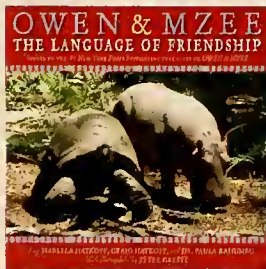
Best Books for Young Readers, 2007

By Diana Lutz

FOR BEGINNING READERS

Owen & Mzee: The Language of Friendship, told by Isabella Hatkoff, Craig Hatkoff, and Dr. Paula Kahumbu; photographs by Peter Greste (Scholastic Press; \$16.99)

This tender photo-essay, a sequel, chronicles the unlikely friendship that began when a baby hippo, Owen, orphaned by the terrible tsunami of 2004, was taken to the Kenyan wildlife sanctuary where a 130-year-old tortoise, Mzee, was living. Since the last book, the two friends have worked out a “language” of their own. Owen has learned to steer the tortoise by nipping or nuzzling a hind leg; Mzee blocks Owen’s way when the hippo gets upset and prepares to charge. Both speak in a grunt unknown to either hippos or tortoises in the wild.



At least six illustrated books by various authors have covered the pair’s story, a natural for children. But this team—a publisher, his young daughter, a naturalist, and a photojournalist—has authored the best of them.

How Big Is It? A Big Book All About Bigness, by Ben Hillman (Scholastic Reference; \$14.99)

Many objects of scientific interest are so very big (or so very small) that

it’s difficult to grasp just how big (or small) they are. The giant squid, *Architeuthis dux*, can grow to fifty-five feet. But how long is fifty-five feet? To show his daughter Maizy, five years old at the time, Ben Hillman used photo-editing software to park a giant squid in their home’s driveway. That image inspired *How Big Is It?*, a book of startling composites. The two-mile-thick ice sheet that covered the northern hemisphere during the last ice age looms over the Chicago skyline, dwarfing the Sears Tower. The massive corpse flower, *Rafflesia arnoldii*, makes a surreal umbrella for two. Hillman’s



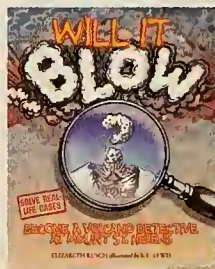
witty images will stick in a child’s mind long after standard comparisons to the weight of an elephant or the height of the Empire State building are forgotten.

FOR INTERMEDIATE READERS

How Underwear Got Under There: A Brief History, by Kathy Shaskan; illustrated by Regan Dunnick (Dutton Children’s Books; \$16.99)

Organized around eight functions that underwear has served through the centuries (cleanliness, exaggeration, modesty, protection, shaping, status, support, and warmth), Kathy Shaskan’s book takes readers on a fascinating tour of historical solutions to very human problems. Shaskan points out that the smock was the first answer to body odor, that corsets couldn’t be laced really tight until metal eyelets were invented, that elastic didn’t exist until 1820, and that the bra hasn’t even celebrated its centennial yet. Regan Dunnick’s lighthearted cartoons perfectly match Shaskan’s playful tone.

Will It Blow? Become a Volcano Detective at Mount St. Helens, by Elizabeth Rusch; illustrated by K.E. Lewis (Sasquatch Books; \$18.95)



In 2004, scientists began to detect swarms of small earthquakes under Mount St. Helens, and wondered whether the volcano was about to erupt again. In *Will It Blow?* five volcanologists struggle to understand the data they collect. The reader can speculate with them

as they compare seismograms of the current tremors to those made by a helicopter on the ground and a steam explosion, among other phenomena. The scientists become increasingly baffled by their data. Why is no gas escaping from the rumbling volcano? What’s that bulge in the crater floor, and that spot in the glacier that melts and then boils away? Readers won’t

"Evocative and informative"¹ natural history from YALE

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David Attenborough, Susan Owens, Martin Clayton, and Rea Alexandratos

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The sumptuous drawings and watercolors reproduced in this volume bear witness to the endeavors of Merian, Leonardo da Vinci and other artists. . . The coupling of words and images is primal, yet transcendent."—Susan P. Williams, *Washington Post Book World*
160 color illus.



TIGHT LINES

*Ten Years of the Yale Anglers' Journal*⁴

Illustrated by James Prosek
Edited by Joseph Furio, Wyatt Golding, David Holtom, Steven Hayhurst, Joseph Kingsbery, and Alexis Surovov
With a Foreword by Nick Lyons

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⁴For more information: www.yaleanglersjournal.com
52 color illus.



BEARS

A Brief History

Bernd Brunner
Translated by Lori Lantz

"A much-welcomed book about the shared and surprising connections between two amazing animals. Brunner covers numerous matters—ursine-human—in an easy to read and compact work. Packed with facts, stories, and light humor."—Marc Bekoff
105 illus



MARSHES

The Disappearing Edens

William Burt

"For more than 30 years naturalist and photographer Burt has prowled North America's wetlands, finding beauty in unexpected places. . . Burt's evocative and informative writing complements the book's gallery of beautiful marshes."

—Audobon¹
92 color illus.



THE LAST HUMAN

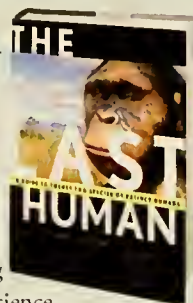
A Guide to Twenty-Two Species of Extinct Humans

Created by G. J. Sawyer and Viktor Deak

Text by Esteban Sarmiento, G. J. Sawyer, and Richard Milner
With Contributions by Donald C. Johanson, Meave Leakey, and Ian Tattersoll

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Fascinating."—Adrian Barnett, *New Scientist*
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I TO MYSELF

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Edited by Jeffrey S. Cramer

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—Wayne Franklin
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Eleanor Jane Sterling, Martha Maud Hurley, and Le Duc Minh
With illustrations by Joyce A. Powzyk

This book, the first comprehensive account of Vietnam's natural history written in English, is "comprehensive and knowingly illustrated . . . [and] engagingly readable."—John Balzar, *Los Angeles Times*
22 b/w + 54 color illus.

WILD CARIBBEAN

The Hidden Wonders of the World's Most Famous Islands

Michael Bright, with Karen Bass and Scott Alexander

"This concise, readable natural history of our nearest island neighbors will provide exciting reading for travelers as well as armchair naturalists."—Margaret D. Lowman
Co-published with BBC Books on imprint of Ebury Publishing
116 color illus.

MAMMALS OF MADAGASCAR

A Complete Guide
Nick Garbutt

This comprehensive and fully illustrated field guide to all the extraordinary mammals of Madagascar includes many new species only recently identified. An essential volume for every ecotourist or scientist visiting the island.
Published in association with Christopher Helm/A&C Black Publishers Ltd.
67 b/w + 175 color illus. + 188 maps



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be able to predict the answer, but the book makes sense of all the clues.

Will It Blow? provides an exciting glimpse into the science of volcanology, but the text is somewhat encumbered by the design. The book is dressed up as a private eye's case file, with notes paper-clipped to documents rubber-stamped "CASE FILE OPEN" OR "CASE CLOSED." Yes, scientists sometimes think like detectives, but the metaphor gets in the way of a story intriguing enough on its own.

Comets, Stars, the Moon, and Mars: *Space Poems and Paintings*, by Douglas Florian (Harcourt Children's Books; \$16.00)

In his latest children's book, Douglas Florian, an accomplished poet-painter and father of five, romps through the universe. Each spread features light verse printed over gouache images of planets and other heavenly bodies decorated with collage and rubber stamps. As always, Florian loads his paintings with witty details. Mercury, for example, is outlined in numerous small feet, a glancing reference to Mercury the messenger in Roman mythology.

The book's design entertains as much as its illustrations do. As one turns the pages, celestial bodies dance from left to right and a rusty brown planet glimpsed through a cut-out hole turns bright blue. Playful though the book may be, it is al-

ways accurate. Venus's atmosphere is toxic and Uranus really does spin on its side. Florian accepts the discipline of fact as well as that of poetic form, and so it is always a pleasure to see his name on a book's spine.

FOR ADVANCED READERS

George's Secret Key to the Universe, by Lucy and Stephen Hawking, with Christophe Galfard; illustrated by Garry Parsons (Simon & Schuster Books for Young Readers; \$17.99)

The first in a three-part series, *George's Secret Key* is an illustrated chapter book written by the renowned physicist Stephen Hawking and his daughter Lucy, a journalist and author. The hero, a boy named George whose parents are technophobe environmentalists, lives next door to Eric, a physicist with a computer that can open portals in spacetime. George, accompanied by Eric's daughter, jumps through the portal to tour the solar system, hitching a ride on a comet.

The joyride is interrupted by a science teacher portentously named G. Reeper. To get his hands on the computer for devious ends, Reeper lures Eric out to the nether regions of the universe, where a black hole swallows the physicist whole. In order to save his neighbor, George must overcome a series of obstacles, including, amusingly, his fear of scientific jargon.

People who know real scientists will appreciate Eric's enthusiasm, naïve idealism, and tendency to lecture. The book gets points for tackling the recurrent tension between environmentalism and science, but it succeeds first and foremost as a good old-fashioned adventure tale.

Tsunami Warning, by Taylor Morrison (Houghton Mifflin Company; \$17.00)

A shocking revelation of the 2004 tsunami was that nations bordering the Indian Ocean had no system for tsunami detection and warning. Nor, for that matter, did the Atlantic coast of the United States. The Pacific coast, however, did have a sensor network, installed after a devastating tsunami hit Hilo, Hawaii, in 1946. Taylor Morrison describes that system, as well as the advanced warning system that has since subsumed it.

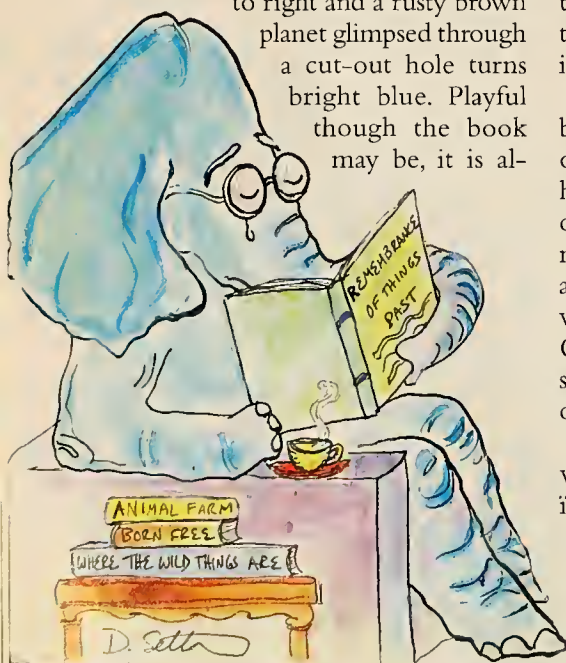
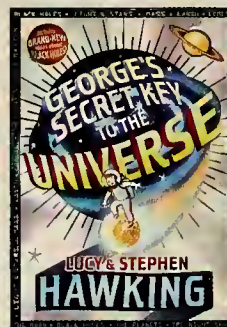
Tsunami Warning, like Morrison's earlier books, *The Coast Mappers* and *Wildfire*, has a slightly old-fashioned feel: his paintings resemble popular graphic arts of the 1940s and his palette of forest green, black, and gray distinguishes itself from the screamingly bright colors of most modern children's books. Both text and illustrations are of a piece with his subject matter: feats of engineering that have stemmed Nature's blind fury. At a time when environmentalism dominates children's literature and technology is largely ignored, one is grateful that Morrison speaks for the engineers.

The Secret of Priest's Grotto: A

Holocaust Survival Story, by Peter Lane Taylor with Christos Nicola (Karben Publishing; \$18.95)

In 1993 an American caver named Christos Nicola, exploring a maze-like Ukrainian cave south of Kiev, was startled to find hand-built rock walls, old shoes, buttons, and other signs of human habitation. Four years later, he tracked down the cave's inhabitants: three families of Jews, now living in the United States and Canada, who hid in the cave during the Nazi occupation.

The Secret of Priest's Grotto, a photo-illustrated book, interleaves an account



of an expedition to the cave with the story of the families who hid there. Living underground in the seventy-seven-mile-long cave for nearly a year (after five months in a smaller cave), the Jews suffered hypothermia, malnutrition, and sensory deprivation. But the greatest danger was other people. When Ukrainian peasants realized Jews were hiding in Priest's Grotto, they worked for days with picks and shovels to block the entrance. Only two former neighbors remained trusted friends. Had Nicola not been curious about an old shoe and a few buttons, we might never have heard the survivors' story.

Tracking Trash: Flotsam, Jetsam, and the Science of Ocean Motion, by Loree Griffin Burns (Houghton Mifflin Company; \$18.00)

In 1990, during a storm in the Pacific, the ship *Hansa Carrier* lost five containers that held roughly 80,000 Nikes. When more and more sneakers began washing up on beaches, Curt Ebbesmeyer, an oceanographer, decided to track them to their source. He soon realized the sneaker spill was "the largest (and cheapest) ocean drift experiment ever undertaken." Thousands of containers fall overboard every year, so other experiments followed—with bathtub toys, hockey gloves, computer monitors, and more.

After that lighthearted beginning, *Tracking Trash* takes a darker turn. In 1997, Charles Moore, a research-vessel captain, discovered a convergence zone in the North Pacific where plastic bags, shampoo caps, and soap bottles have collected to form a floating garbage patch the size of Alaska. Meanwhile



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abandoned, drifting “ghost nets” entangle and kill untold thousands of sea animals annually; scientists are trying to tag and track them with satellites. *Tracking Trash* is the latest in Houghton Mifflin Company’s *Scientists in the Field* series, notable for its high production values and reliance on first-hand reporting. Loree Griffin Burns has loaded the book with information, insight, and intellectual twists.

Alter Ego: Avatars and Their Creators, by Robbie Cooper, Julian Dibbell, and Tracy Spaight (Chris Boot Ltd; \$35.00)

Several years ago, Robbie Cooper, a photojournalist, began asking online gamers to let him photograph them and take a screen grab of their avatar, or game character. *Alter Ego* combines his gamer/avatar image pairs with Tracy Spaight’s interviews. The result is a fascinating glimpse into the psychology of masquerading and secret identities. Clearly, the Internet allows people to shrug off stereotypes that plague them in real life. Beautiful young women enjoy playing undead rogues or warriors because they can do what they want without guys bothering them. A severely disabled man is free online to ride futuristic speed bikes and fight monsters. But other choices scratch more obscure psychological itches, such as a male economics professor whose avatar is a dwarf girl.

Kids will be fascinated by this book, which addresses their culture in an intelligent way. Parents should be warned, however, that *Alter Ego* covers the dark side of gaming, including Chinese “game farms” where chain-smoking young men work twelve-hour shifts to advance wealthy gamers’ avatars. Even nongamers might want to pick up *Alter Ego*, if only because gaming is the future: more than 150 colleges have virtual campuses in the online game Second Life.

DIANA LUTZ is a freelance science writer and editor, as well as the former editor of *Muse*, a science magazine for young people. She lives in Madison, Wisconsin.

AS HEARD ON PAUL HARVEY NEWS

Famous EdenPURE® portable heater that can cut your heating bill up to 50% is now much better

Heats a large room in minutes with even heat wall to wall and floor to ceiling

Does not get hot, cannot start a fire and will not reduce humidity or oxygen

By John Whitehead,
Media Services

The famous infrared portable heater, the EdenPURE®, which can cut your heating bills by up to 50%, has been greatly improved.

The new heater heats better, faster, saves more on heating bills and runs almost silent.

You have probably heard about the remarkable EdenPURE® as heard on Paul Harvey News and on television features across the nation.

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A major cause of residential fires in the United States is portable heaters. But the EdenPURE® cannot cause a fire. That is because the quartz infrared heating element never gets to a temperature that can ignite anything.

The outside of the EdenPURE® only gets warm to the touch so that it will not burn children or pets. Pets can sleep on it when it is operating without harm.

The advanced space-age EdenPURE® Quartz Infrared Portable Heater also heats the room evenly, wall-to-wall and floor-to-ceiling. And, as you know, portable heaters only heat an area a few feet around the heater. With the EdenPURE®, the temperature will not vary in any part of the room.

Unlike other heating sources, the EdenPURE® cannot put poisonous carbon monoxide into a room or any type of fumes or any type of harmful radiation.

Q. What is the origin of this amazing heating element in the EdenPURE®?

Never be cold again



Cannot start a fire; a child or animal can touch or sit on it without harm

A. This advanced heating element was discovered accidentally by a man named John Jones.

Q. What advantages does infrared quartz tube heating source have over other heating source products?

A. John Jones designed his heating source around the three most important consumer benefits: economy, comfort, and safety.

In the EdenPURE® system, electricity is used to generate infrared light which, in turn, creates a very safe heat.

After a great deal of research and development, very efficient infrared heat chambers were developed that utilize three unique patented solid copper heat exchangers in one EdenPURE® heater.

Q. How can a person cut their heating bill by up to 50% with the EdenPURE®?

A. The EdenPURE® will heat a room in minutes. Therefore, you can turn the

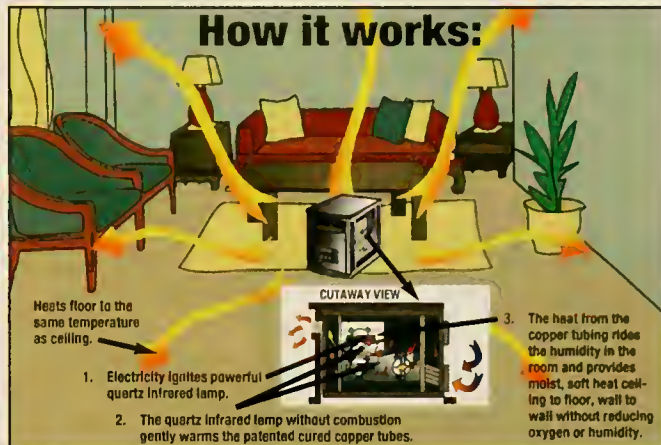
heat down in your house to as low as 50 degrees, but the room you are occupying, which has the EdenPURE®, will be warm and comfortable. The EdenPURE® is portable. When you move to another room, it will quickly heat that room also. This can drastically cut heating bills, in some instances, by up to 50%.

The EdenPURE® heater is now greatly improved. The EdenPURE® comes in 2 models. Model 500-XL heats a room up to 300 square feet and Model 1000-XL heats a room up to 1,000 square feet.

End of interview.

Readers who wish can obtain the EdenPURE® Quartz Infrared Portable Heater at a \$75 discount if they order in the next 10 days. Please see the Special Reader's Discount Coupon on this page. For those readers ordering after 10 days from the date of this publication, we reserve the right to either accept or reject order requests at the discounted price.

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2) The XL heats better. The XL thermostat has been vastly improved so that it operates within a tighter range of degrees. The previous model used a mechanical thermostat which could produce a 6 degree variance in heat. This could be uncomfortable especially for the more heat sensitive elderly. The XL's electronic

thermostat does not only eliminate the problems of a mechanical thermostat, but it is set to a much lighter tolerance. This will promote an extremely more comfortable even stable heat.

3) The 1000-XL features digital controls. It has a simple 3 large button control which turns the unit on, and you set the comfort level that you want which reads out on the front of the unit. It also has a remote control so you can adjust the comfort level without getting up.

4) The 500-XL has a single on/off switch and adjustable digital thermostat.

5) The XL is much more reliable. The thermostat and electronics are all solid state and the infrared bulbs are greatly improved to last for a very long time.

SPECIAL READER'S DISCOUNT COUPON

The price of the EdenPURE® Model 500-XL is \$372 plus \$17 shipping for a total of \$389 delivered. The Model 1000-XL is \$472 plus \$27 shipping and handling for a total of \$499 delivered. People reading this publication get a \$75 discount with this coupon and pay only \$297 delivered for the Model 500-XL and \$397 delivered for the Model 1000-XL if you order within 10 days. The EdenPURE® comes in the decorator color of black with burled wood accent which goes with any decor. There is a strict limit of 3 units at the discount price - no exceptions please.

Check below which model and number you want:

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☐ Model 1000-XL, number _____

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And for the Coffee Table

By Laurence A. Marschall

***The Deep: The Extraordinary Creatures of the Abyss* by Claire Nouvian** (The University of Chicago Press; \$45.00)

***Oceanic Wilderness* by Roger Steene** (Firefly Books; \$59.95)

Until twenty-five years ago, the deep sea was virgin territory to biologists, and even today virtually every research dive into the abyss turns up a profusion of previously unknown



species. In *The Deep*, journalist Claire Nouvian has assembled a portrait gallery of these exotic creatures, accompanied by eloquent essays by more than a dozen ocean scientists. The denizens of the deep are so bizarre they seem to have been sculpted by Salvador Dalí on acid. Fish with skeletal heads and protruding fangs glow into the camera, some with lower teeth so long that a reckless bite could take out their own eyeballs. Smooth-skinned octopuses float in the blackness, resembling embryos attached to bundles of wormlike tentacles. Other creatures look like ball-point pens, paper lanterns, baby's buttocks, and Pokémon cartoon figures, while the spooky vampire squid reminded me of a bat's head grafted onto the webbed

foot of a duck. Since only a few percent of the ocean's depths have so far been explored, one can hardly imagine what phantasms of this remarkable bestiary the next edition will display.

Underwater photographer Roger Steene frequents shallower waters in and around coral reefs throughout the world. In *Oceanic Wilderness* he records underwater scenes few of us have the resources, skill, or patience to behold, rendered with a startling sharpness and brilliance. In one picture a rain-bow mantis displays so many colors it looks as if it is wearing a clown costume; even its huge goggle eyes are purple. Elsewhere, collages of close-ups highlight the kaleidoscopic patterns of markings on sponges, sea urchins, and corals. Most remarkable is a series of pictures showing the tender embraces of tropical fish making love (how did he get those shots?). All in all, this collection of undersea glamour is a pleasant foil to the nightmarish vision of *The Deep*.

***The Pompeii Pop-Up* Text by Peter Riley with Dr. Thorsten Oppen; design by David Hawcock** (Universe Publishing; \$29.95)

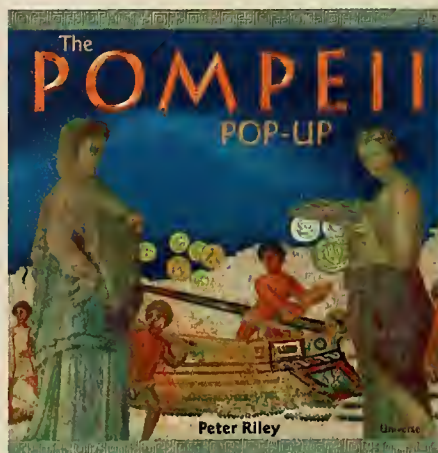
***The Red Volcanoes: Face to Face with the Mountains of Fire* by G. Brad Lewis and Paul-Edouard Bernard de Lajartre** (Thames and Hudson; \$34.95)

The catastrophic explosion of Mt. Vesuvius on August 24, 79 B.C. not only put an untimely end to the city of Pompeii, but also etched an impression of the enormous destructive power of volcanoes in our collective memory.

True to form, Vesuvius erupts from the centerfold of this infernally clever Pompeii primer when the book is opened and its scenes unfold. In the foreground, residents desperately try to outrun the blast, or, with equal futility, cower in houses that will soon be sealed under a blanket of ash. Yet the hot ash that interred them froze time in the city, saving it for archaeologists to uncover two millennia later. Now, thanks to paper engineer Hawcock and writers Riley and Oppen (a British Museum curator of antiquities), readers can manipulate 3-D models of Pompeii's old marketplaces, inns, and villas, and explore its monumental forum from the comfort of an armchair. Clearly, Vesuvius was an agent both of destruction and of preservation.

Volcanoes are also agents of creation, especially at places in the Earth's crust where magma wells up to form new land in the sea. Two of the most active of these are Kilauea, on the Pacific island of Hawaii, and Piton de La Fournaise, on the Indian Ocean island of Réunion. Distinct from stratovolcanoes like Mt. St. Helens and Vesuvius, which explode with catastrophic violence, these so-called "red volcanoes" merely ooze and spray, creating meandering lava flows and fantastic pyrotechnic displays that can be viewed, albeit cautiously, with minimal risk.

Two skilled nature photographers, G. Brad Lewis, in Hawaii, and Paul-Edouard Bernard de Lajartre, in Réunion, have devoted years to recording the red volcanoes, creating abstract compositions in earth, darkness, and fire. Daytime views show the delicate



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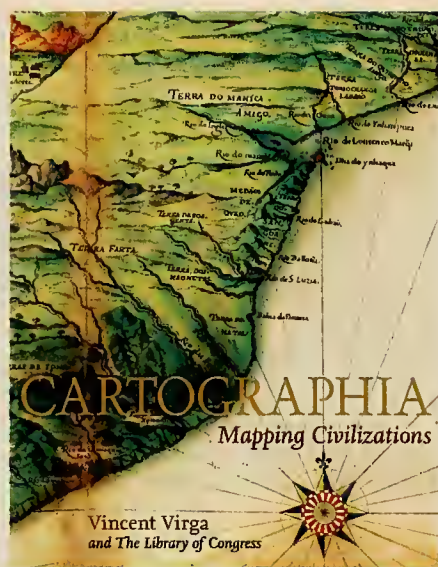
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texture of cinder, lava, and venting gases, but the nighttime shots, in their simple beauty, are the most compelling. In one, a splash of orange-red lava bursts into the blackness, its tracery suggesting the quiet power of the famous wave woodcut by Japanese artist Hokusai. In another, thin rivulets of lava, looking like the glowing fangs of a dragon, drip from an elongated precipice into the ocean.

Cartographia: Mapping Civilizations
by Vincent Virga and the Library of Congress (Little, Brown and Company; \$60.00)

If a picture is worth a thousand words, then a map is worth at least a thousand pictures. Not only does each place on a map evoke a story, but so too does the map itself: we want to know who made it and why, and what impact the map had on those who used it. Picture editor Vincent Virga,



drawing on the resources of the Library of Congress, which houses the largest cartographic collection in the world, lays forth a spectacular cultural history of cartography, organized by geographic region—starting with the Mediterranean, the oldest region to be mapped, and ending in Antarctica.

The highlights of the book, of course, are exquisite reproductions of noteworthy examples of the cartographic art, from a Babylonian world map—an abstract diagram of circles, lines, and symbols inscribed on a clay tablet—to a 1996 chart of the estuary of the Mississippi, so detailed it seems almost to replicate the river itself. Though cartography has obviously become more precise with time and technology, it is clear from this book that the history of mapmaking is not just a constant striving for geographic verisimilitude. Mapmakers usually had other things in mind. A seventh-century Persian chart represents land in the shape of a bird, a poetic vision of the motherland. As recently as the nineteenth century, a Japanese map of the prefecture around Mt. Fuji embodies more artistic stylization than true-to-life rendition. And even when the goal of the mapmakers

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was strictly utilitarian, their maps often displayed truths that were political, social, economic, or military rather than strictly topographic. That is what makes maps so delightful and fascinating; they do not show us the world as it is, but rather the world as seen through other eyes, in other places and times.

Antarctic Fishes

Boshu Nagase



Mitsuo Fukuchi (top) and Harvey J. Marchant

through the snow, swimming in watery leads between drifting floes of ice. There are equally detailed portraits of walruses, arctic foxes, whales, and arctic terns. And there are gorgeous landscapes, organic forms sculpted in ice and rock or ice and water. Except for a few paragraphs here and there, none of the pages are captioned, as if the authors relied on the

Vanishing World: The Endangered Arctic Photographs by Mireille de la Lez; text by Fredrik Granath (Abrams; \$40.00)

Antarctic Fishes Illustrations by Boshu Nagase; text by Mitsuo Fukuchi and Harvey J. Marchant (The Johns Hopkins University Press; \$45.00)

Mireille de la Lez and Fredrik Granath spent five years at the top of the world, traveling by sledge and

snowmobile, tenting in snowdrifts, and keeping a wary eye out for angry polar bears, hidden crevasses, and swiftly advancing blizzards. The photographs that they worked so hard to create are beautifully reproduced here in full color, but they depict a world etched mostly in subtle tones of blue-gray and white. There are intimate close-ups of bears—in repose, jumping

Arctic to speak for itself. And speak it does: these images of barren, rugged terrain and hardy, solitary animals convey an overwhelming sense of the lonely and precarious state of life in the far, far North.

From the opposite pole of the Earth comes *Antarctic Fishes*, an illustrated catalog by a polar marine ecologist and an Antarctic biologist

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of the finned species that swim the southernmost oceans. Readers will want it on their coffee tables, but not as a field guide; few of us will ever encounter a Nichol's lanternfish or a sailfin plunderfish, either in the wild or at the fish market. The book's appeal, rather, is in its illustrations, produced by the unusual Japanese art of *gyotaku*, or "fish rubbing." In *gyotaku* (which was developed in the mid-1800s, and so is no more ancient than photography), a thoroughly washed fresh fish—in this case, fresh-frozen for transport from the Antarctic—is covered in clinging, semi-transparent tissue paper. Then layers of colored inks are carefully dabbed



undulating ribbons, ovoids, and cones, as well as phantasmagorical forms with spikes and excrescences that seem to deliberately defy any notion of regularity. Some shell surfaces seem to bear the monochrome glaze of primitive pottery; others are as crowded with iridescent jewels as a Fabergé egg.

Ingrid Thomas, an artist and concholo-

gist, draws from her extensive collection and research in *The Shell: A World of Decoration and Ornament*, but while the illustrations here are as meticulously reproduced as Starosta's photographs, Thomas's book is far more than a gallery of natural forms. Thomas provides an ample text and more than 500 photographs and art reproductions to show how shells and shell-like forms have been used in jewelry, pottery, domestic design, and a wide variety of other decorative and fine arts from prehistoric times to the present. What difficulty Thomas must have had choosing only 500 examples of this lovely craftsmanship! Should she have left out the ornate cup made from a nautilus shell in early seventeenth-century Holland, cut to the shape of an ostrich's body, with neck, head, and legs made of pure gold? Or the pectoral ornament from New Guinea, embroidered with hundreds of cowrie and nassa shells? Or the Art Nouveau alabaster table light sculpted in the shape of a conch shell, with a young maiden emerging, Venus-like, from its interior? Looking at what Thomas did include, one can only wish for a book with twice as many pages, and perhaps for coffee tables twice as strong.

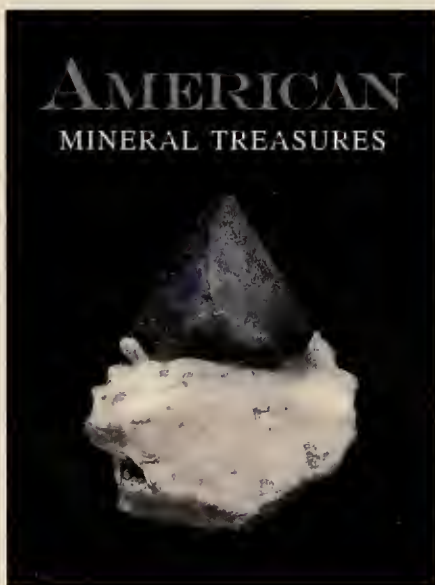
over the surface using a cotton wad. When the tissue is lifted off and laid flat, a luminously textured, anatomically accurate rendition of the living creature appears. Each of the fifty-four plates in *Antarctic Fishes* was created by this process, and each print, bearing the calligraphic signature of *gyotaku* master Boshu Nagase, stands on its own as an elegant and informative work of art.

Shells by Paul Starosta and Jacques Senders (Firefly Books; \$85.00)

The Shell: A World of Decoration and Ornament by Ingrid Thomas (Thames & Hudson; \$65.00)

These opulent books document two of the world's most dazzling collections of shells. *Shells*, photographed by Paul Starosta, showcases the one malacologists Jacques and Rita Senders assembled over fifty years of travel and diving. There's a brief introductory essay by architect Paolo Portoghesi, noting how the shell has influenced art and building, from King Solomon's Temple to the Sydney Opera House. But the real treasure of this book is more than 300 pages of heart-stopping photographs. Starosta has posed every specimen against a black background, lit dramatically from the front and above, and sometimes from behind as well, to emphasise symmetries in shape and nuances in color. Leafing through the pages, the senses are overloaded with variations on a few repeating themes: hearts, spirals, fans,

LAURENCE A. MARSCHALL, author of *The Supernova Story*, is W.K.T. Salm Professor of Physics at Gettysburg College in Pennsylvania, and director of Project CLEA, which produces widely used simulation software for education in astronomy.



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 Carl F. Welser
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Cutting-edge Science?

I cringed at the description of the surgery on the pregnant ewe ["A Human Cell in Sheep's Clothing," 7-8/07]. Author and surgeon seem oblivious to the operation's severity and the ewe's painful recovery.
 Laurie Sexton
 New York, New York

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Erratum

In last month's biographical note for Sandra L. Postel ["Contributors," 11/07], the Global Water Policy Project she founded was mistakenly identified as "geared toward sustaining the Connecticut River watershed." Though based in western Massachusetts, the project is designed to promote the preservation and sustainable use of freshwater throughout the world, through research, writing, outreach, and public speaking. The error was introduced during editing of the biographical text provided by the author, and slipped through our fact-checking process. For information on the Global Water Policy Project see www.globalwaterpolicy.org

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MARYLAND

19. CHESAPEAKE BAY MARITIME MUSEUM

Located in historic St. Michaels, the Museum boasts ten waterfront exhibits, working boat yard, and the largest collection of Bay boats.

20. CHOOSE CALVERT COUNTY

Less than an hour from D.C. discover Chesapeake Bay history. Hunt for fossils at the 15-million-year-old Calvert Cliffs.

21. DORCHESTER COUNTY

Home to world-renowned Blackwater National Wildlife Refuge; explore the heart of Chesapeake Country on Maryland's Eastern Shore.

22. FREDERICK COUNTY

Maryland's Crossroads of History. Antiques, battlefields, covered bridges, parks, wineries and more close to Gettysburg and DC.

23. KENT COUNTY

A scenic peninsula on the Chesapeake Bay, offering fishing, boating, kayaking, small beaches, great shopping, and museums.

24. MARYLAND VACATIONS

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25. MONTGOMERY COUNTY

Experience transportation history along the C&O Canal and the National Capital Trolley Museum. So many things to do.

26. ST. MARY'S COUNTY

Potomac River lighthouses, Chesapeake Bay seafood, and maritime history. Cozy inns, waterside dining and fantastic festivals.

27. TALBOT COUNTY

Five beautiful rivers, 602 miles of shoreline, unique charming hamlets St. Michaels, Oxford, Tilghman Island and Historic Easton offer a timeless treasury of natural beauty & history.

28. WORCESTER COUNTY

Maryland's only seaside county. Visit Assateague Island National Seashore. Kayak, canoe, bird watch, golf, bed and breakfast inns.

MISCELLANEOUS

29. ATHENA REVIEW

Athena Review, journal of archeology, history and exploration, invites you to send for more information on a free issue.

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Mercury is difficult, if not impossible, to view in December: it is at superior conjunction with the Sun (on the opposite side of the Sun from Earth) on the 17th. In January, however, Mercury will be an evening object, setting after the Sun, and by the 9th should be visible with the naked eye. The planet swings widest of the Sun on the 22nd, its tiny disk a little more than half illuminated from our point of view. Decreasing rapidly in brightness and phase after that peak performance, Mercury fades precipitously.

Venus rises in the east to east-southeast between 3:15 and 4:15 A.M. local time during December. At the beginning of the month that is about two hours before the first hint of dawn. By the time morning twilight is under way, Venus shines fairly high in the southeast as the December "Morning Star." It gradually sinks a little lower during the month, and by the end of January it rises less than a half hour before the start of morning twilight. During the latter half of January Venus slowly approaches Jupiter, much lower in the sky; they'll be closest together on February 1, when they'll be separated by only 0.6 degrees.

Mars rises at about 6:20 P.M. local time at the beginning of December, some fifteen minutes after evening twilight ends, but just a week later it is already above the horizon as twilight fades to night. The planet is retrograding (moving westward) through the stars of Gemini, the Twins, and will cross over into Taurus, the Bull, on December 30. Along the way it will arrive at opposition to the Sun (on the opposite side of Earth from the Sun) on Christmas Eve, when it will be visible all night long, shining at magnitude -1.6 and passing nearly overhead at midnight as seen from the southernmost United States.

The Red Planet will be 54.8 million miles from Earth on December 18, its minimum distance for 2007. That's 11.7 million miles farther away than at our

last close encounter, which occurred just before Mars reached opposition to the Sun in 2005. On this upcoming occasion, however, Mars will climb much higher in the sky. This apparition of Mars is the best we'll get until 2016; a good 4-inch telescope should show Mars's bright north polar cap and quite a few dark features (the maria, or "seas")—on those nights when the atmosphere is steady.

In January, Mars increases its distance from Earth to 72.3 million miles, and in the process fades almost a full magnitude, from -1.5 to -0.6 . A little higher above the eastern horizon each day at dusk, the Red Planet (shining yellow-orange) continues to move "backwards" into Taurus. It will sit between the Bull's horns on January 30, when it resumes its normal forward (eastward) motion against the star background.

Jupiter might be glimpsed with binoculars in the evening sky during the first few days of December, just above the southwestern horizon about fifteen or twenty minutes after sunset. It then falls completely out of sight, passing behind the disk of the Sun on December 23. The planet starts the New Year as undetectable, rising less than thirty minutes before the Sun, but each morning it appears about three minutes earlier and gets a little higher before it disappears in the morning light. By month's end it will team with Venus (about seven times brighter) to make an eye-catching duo low in the southeast, visible as morning twilight begins to brighten.

Saturn is in Leo, the Lion, during December and January; it can be found about 8 degrees to the east of Leo's brightest star, Regulus. The planet rises soon after 11 P.M. local time in early December. By New Year's Eve it's coming up before 9:30 P.M., and by the end of January, it will rise soon after 7 P.M. and will reach its highest point in the sky around 2:00 the following morning. The planet's famous ring system, observable through small

telescopes, is now tilted less than 7 degrees to our line of sight.

Many observers consider the Geminid meteor shower, expected between December 7 and 17, to be the best shower of the year. The peak will be the night of December 13–14, when up to 120 meteors may be seen every hour under ideal dark-sky conditions. The Geminids are one of the few showers that perform well before midnight. On the evening of the 13th, the waxing crescent Moon sets around 8:15 P.M. local time. By then, the shower's "radiant" (the place in the sky from which the meteors seem to fan out), near the star Castor, is quite high—20 or 30 degrees up in the east—so the meteor rates should be appreciable.

The Moon reaches Last Quarter on December 1 at 7:44 A.M. The New Moon falls on December 9 at 12:40 P.M.; First Quarter is on the 17th at 5:18 A.M.; and the Full Moon appears on the 23rd at 8:16 P.M. Last Quarter occurs for a second time in December on the 31st, at 2:51 A.M. In January New Moon occurs on the 8th at 6:37 A.M.; First Quarter is on the 15th at 2:45 P.M.; and Full Moon is on January 22 at 8:34 A.M. Last Quarter comes on January 30 at 12:03 A.M.

The solstice, when the Sun arrives at that point where it is farthest south of the celestial equator, takes place on December 22 at 1:10 A.M. Winter officially begins in the Northern Hemisphere, and summer begins in the Southern Hemisphere.

Earth will arrive at perihelion—the closest point in its orbit to the Sun—on January 2 at 7:00 P.M. To get to the Sun you would have to travel only 91.4 million miles.

JOE RAO (hometown.aol.com/skywayinc) is a broadcast meteorologist and an associate and lecturer at the Hayden Planetarium in New York City. Unless otherwise noted, all times are eastern standard time.



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At the Museum

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D. FINNIN/AMNH

Young and very, very old: Leonye Dreiser, 12, and her brother Luis, 9, of Cologne, Germany, take in the brilliant hues of the 80-million-year-old ammonite fossil recently installed in the Museum's Grand Gallery.

If your idea of fossils is dull, dusty, old bones, a dazzling new specimen on display in the 77th Street Grand Gallery at the American Museum of Natural History is sure to challenge that notion. The fossilized shell of an ammonite that lived approximately 80 million years ago is alive with color, shimmering with orange, yellow, purple, red, and green like psychedelic mother-of-pearl.

The two-foot-diameter fossil is a large and particularly rare example of a marine cephalopod that was once one of the most common invertebrates in the ocean. They went extinct around 65 million years ago, after a massive asteroid impact wiped out nearly half of all living species, including most of the dinosaurs, at the end of the Cretaceous Period.

The name ammonite comes from the Egyptian god Ammon, whose ram-like horns resemble the spirals in the sea creature's shell. The shape of the shell is reminiscent

of today's chambered nautilus, but the ammonite's nearest living relative is the modern squid.

High temperatures and pressures acting on this shell for millions of years preserved its iridescent nacreous layers. Ammonite fossils that exhibit this characteristic are known as ammolites, and share the spotlight with amber and pearl as one of only three gemstones produced by living organisms.

Scientists greatly value ammonites, colorful or not, as clues to the relative age of the rocks in which they are found, because different species of ammonites lived during different time periods. Their presence also indicates the location of ancient seas, such as the Western Interior Seaway in the middle of North America where this ammonite lived.

The fossil was unearthed by ammolite miners near Lethbridge in Alberta, Canada, and donated to the Museum by Korite International and Canada Fossils Ltd.



R. MCKENNA/AMNH

Holiday Spirits

This year, the Origami Holiday Tree (on view through January 1) is more magical than ever, teeming with the stuff of legends and fables: dragons, mermaids, unicorns, as well as real animals like narwhals and peacocks, echoing the popular exhibition *Mythic Creatures*, which closes January 6.

The approximately 500 enchanting ornaments were crafted by members of Origami USA to match the tree's theme, *Fantastic Creatures: Mythic and Real*. The tree, a Museum tradition for over 30 years, is located in the Theodore Roosevelt Memorial Hall on the first floor. As in years past, volunteers will be on hand to teach visitors the ancient art of paper folding.

Rethinking *Velociraptor*

New Study Finds They Had Feathers

Remember those rapacious *Velociraptors* stalking children in the film *Jurassic Park*? It appears now that these prehistoric predators could use a costume change: they weren't leathery-skinned toughs after all!

Scientists have known for years that many dinosaurs had feathers. Now, after a new look at some old bones, paleontologists at the American Museum of Natural History and the Field Museum have documented the presence of feathers in *Velociraptor*, one of the most iconic of dinosaurs and a close relative of birds.

The fossil specimen the group examined was a *Velociraptor* forearm unearthed in Mongolia in 1998. They found on it clear indications of quill knobs—places where the quills of secondary feathers, the flight or wing feathers of modern birds, were anchored to the bone with ligaments. Quill knobs are also found in many living bird species and are most evident in birds that are strong flyers. Those that primarily soar or that have lost the ability to fly entirely, however, were shown in the study to typically lack signs of quill knobs.

"A lack of quill knobs does not necessarily mean that a dinosaur did not have feathers," said Alan Turner, lead author on the study and a graduate student of paleontology at the AMNH and at Columbia University in New York. "Finding quill knobs on *Velociraptor*, though, means that it definitely had feathers. This is something we'd long suspected, but no one had been able to prove."

The *Velociraptor* in the current study stood about three feet tall, was about five feet long, and weighed about 30 pounds. These dimensions, coupled with relatively short forelimbs compared to a modern bird, indicate this creature could not fly. The authors sug-

gest that perhaps an ancestor of *Velociraptor* lost the ability to fly, but retained its feathers. In *Velociraptor*, the feathers may have been useful for display, to shield nests, for temperature control, or to help it maneuver while running.

"The more we learn about these animals, the more we find that there is basically no difference between birds and their closely related dinosaur ancestors like *Velociraptor*," said Mark Norell, Curator in the Division of Paleontology at the American Museum of Natural History and coauthor on the study. "Both have wishbones, brooded their nests, possess hollow bones, and were covered in feathers. If animals like *Velociraptor* were alive today our first impression would be that they were just very unusual-looking birds."

The research team also included Peter Makovicky from the Field Museum in Chicago. The work was supported by the National Science Foundation and the American Museum of Natural History, and a paper describing the discovery appeared in the September 21, 2007, issue of the journal *Science*.



MATT MARTINUK

An artist's rendition of *Velociraptor* in life

Saturdays in Winter: We're All Wet!

In four workshops on Saturday afternoons in January and February, youngsters are invited to delve into the science of water, the subject of *Water: H₂O = Life*, the engaging exhibition that opened in November and runs through May 26, 2008.

In the first hands-on session, on Saturday, January 12, children will ponder the presence of water on Mars, learning how we have come to know that there was water on the Red Planet, and discuss the implications of that knowledge. Next, in a hydrology workshop, children will explore the basic engineering principles that underlie the design of dams and ancient waterways. The third session revolves around the unique properties that make water the only substance able to exist in three phases—gas, liquid, and solid—in the normal range of Earth's temperatures. In the final workshop, children will construct their own terrariums to learn about groundwater, where it comes from, and why it is so important.

Two separate series of workshops are being offered, one for children ages 4 through 6 accompanied by an adult, and the other for children 7 through 9. Participants who attend all four sessions will earn a certificate.



Ice is water in solid form.

Museum Events

AMERICAN MUSEUM OF NATURAL HISTORY



www.amnh.org

EXHIBITIONS

Water: H₂O = Life

Through May 26, 2008

Live animals, hands-on exhibits, and stunning dioramas invite the whole family to explore the beauty and wonder of water and reveal one of the most pressing challenges of the 21st century: humanity's sustainable management and use of this life-giving, but finite, resource.

Water: H₂O = Life is organized by the American Museum of Natural History, New York (www.amnh.org), and Science Museum of Minnesota (www.smm.org) in collaboration with Great Lakes Science Center, Cleveland; The Field Museum, Chicago; Instituto Sangari, São Paulo, Brazil; National Museum of Australia, Canberra; Royal Ontario Museum, Toronto; San Diego Natural History Museum; and Singapore Science Centre with PUB Singapore.

The American Museum of Natural History gratefully acknowledges the Tamarind Foundation for its leadership support of *Water: H₂O = Life*, and the Johns Hopkins Center for a Livable Future for its assistance.

Exclusive corporate sponsor for *Water: H₂O = Life* is JPMorgan.

Water: H₂O = Life is supported by a generous grant from the National Science Foundation.

The support of the National Oceanic and Atmospheric Administration is appreciated.

The Museum extends its gratitude to the Panta Rhea Foundation, Park Foundation, and Wege Foundation for their support of the exhibition's educational programming and materials.

The Butterfly Conservatory

Through May 26, 2008

Mingle with up to 500 live, free-flying tropical butterflies, and learn about the butterfly life cycle, defense mechanisms, evolution, and conservation.

Mythic Creatures: Dragons, Unicorns, and Mermaids

Through January 6, 2008

Mythic Creatures traces the cultural and natural history roots of some of the world's

most enduring legendary beings of land, sea, and air.

Mythic Creatures: Dragons, Unicorns, and Mermaids is organized by the American Museum of Natural History, New York (www.amnh.org), in collaboration with The Field Museum, Chicago; Canadian Museum of Civilization, Gatineau; Australian National Maritime Museum, Sydney; and Fernbank Museum of Natural History, Atlanta. *Mythic Creatures* is proudly supported by MetLife Foundation.

Undersea Oasis: Coral Reef Communities

Through January 13, 2008

Brilliant color photographs capture the dazzling invertebrate life that flourishes on coral reefs.

Beyond

Through April 6, 2008

Exquisite images from unmanned space probes take visitors on a journey through the alien and varied terrain of our planetary neighbors.

The presentation of both *Undersea Oasis* and *Beyond* at the American Museum of Natural History is made possible by the generosity of the Arthur Ross Foundation.

Unknown Audubons: Mammals of North America

Through August 2008

The stately Audubon Gallery showcases gorgeously detailed depictions of North American mammals by John James Audubon, best known for his bird paintings.

Major funding for this exhibition has been provided by the Lila Wallace-Reader's Digest Endowment Fund.

LECTURES

Wolf Empire

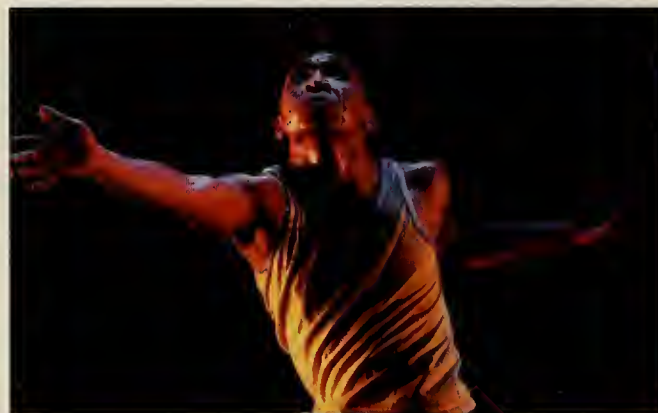
Tuesday, 12/11, 7:00 p.m.

With wildlife photographer and environmentalist Scott Ian Barry.

The 3.5 Billion-Year History of the Human Body

Wednesday, 1/23, 6:30 p.m.

With Neil Shubin, University of Chicago, Department of Organismal Biology and Anatomy.



RON K. BROWN/EVIDENCE

The Ron K. Brown/Evidence Dance Company will perform at Kwanzaa.

GLOBAL WEEKENDS

The City Celebrates Kwanzaa

Saturday, 12/29, 12:00 noon–5:00 p.m.

Celebrate Kwanzaa's seven principles, the *Nguzo Saba*, with an afternoon of song, dance, and spoken word.

This event is coproduced by Community Works and the New Heritage Theatre Group under the artistic direction of Sistah Aziza.

Living in America: Rivers of Life

Three Saturdays, 1/12–26, 12:00 noon–5:00 p.m.

Consider the meanings, uses, and values placed on water with performances, discussions, films, and workshops for adults and families.

Global Weekends are made possible, in part, by The Coca-Cola Company, the City of New York, the New York City Council, and the New York City Department of Cultural Affairs. Additional support has been provided by the May and Samuel Rudin Family Foundation, Inc., the Tolan Family, and the family of Frederick H. Leonhardt.

WORKSHOPS

Lunchtime Winter Bird Walks

Three Wednesdays, 1/30–2/13, 12:00 noon–1:30 p.m.

With Paul Sweet, Collections Manager, AMNH Department of Ornithology.

Understanding Our DNA

Three Thursdays, 1/31–2/14, 6:30 p.m.

Participants sequence their own DNA and discuss their findings.

Public programs are made possible, in part, by the Rita and Frits Markus Fund for Public Understanding of Science.



ROSE CENTER FOR EARTH AND SPACE

Sets at 6:00 and 7:30 p.m.
Friday, 12/7

The 7:30 performance will be broadcast live on WBGO Jazz 88.3 FM.

Friday, 1/4

Visit www.amnh.org for lineup.

FAMILY AND CHILDREN'S PROGRAMS

Field Trip to the Moon

Every Wednesday, 10:30 a.m.
Fly to the Moon in the Hayden Planetarium, guided by a live presenter.

Adventures in Cryptozoology

Saturday, 12/1, 1:00 p.m.
Discover the world of "hidden" creatures, such as Bigfoot, with Loren Coleman, one of the world's leading cryptozoologists.

WATER SATURDAYS

Hands-on workshops; take all four and earn a certificate.
11:00 a.m.–12:30 p.m. (Ages 4–6, each child with one adult)
1:30–3:00 p.m. (Ages 7–9)

Water on Mars?

Saturday, 1/12
Hydrology Workshop

Saturday, 1/19

The Properties of Water

Saturday, 1/26

Groundwater and the Water Cycle

Saturday, 2/2

HAYDEN PLANETARIUM PROGRAMS

LECTURES

Why Are We So Lonely?

Monday, 12/3, 7:30 p.m.

With Chris Impey, University of Arizona, Department of Astronomy.

Supercollider

Monday, 1/14, 7:30 p.m.

With Chris Tully, Princeton University, and Nima Arkani-Hamed, Harvard University.



Egg Nebula

NASA W. STARKS (STSC) AND R. SACHA (JPL)

TUESDAYS IN THE DOME

Virtual Universe

How Deep Is the Universe?

Tuesday, 12/4, 6:30–7:30 p.m.

A New Year in the Milky Way

Tuesday, 1/8, 6:30–7:30 p.m.

Celestial Highlights

Myths in the Winter Sky

Tuesday, 1/29, 6:30–7:30 p.m.

HAYDEN PLANETARIUM SHOWS

Cosmic Collisions

Journey into deep space to explore the hypersonic impacts that drive the formation of our universe. Narrated by Robert Redford.

Cosmic Collisions was developed in collaboration with the Denver Museum of Nature & Science; GOTO, Inc., Tokyo, Japan; and the Shanghai Science and Technology Museum.

Made possible through the generous support of CIT.

Cosmic Collisions was created by the American Museum of Natural History with the major support and partnership of the National Aeronautics and Space Administration's Science Mission Directorate, Heliophysics Division.

IMAX MOVIES

Dinosaurs Alive!

Great dinosaur finds by

AMNH scientists past and present come to life with archival and contemporary footage and scientifically accurate, computer-generated images.



B. MICHEN/AMNH

One Step Beyond brings the party to the Rose Center.

LATE NIGHT DANCE PARTY

One Step Beyond

Friday, 1/25, 9:00 p.m.–1:00 a.m.

This monthly party in the Rose Center features the biggest names in techno, electronica, and indie rock. Food and drink keep the party going.

INFORMATION

Call 212-769-5100 or visit www.amnh.org.

TICKETS AND REGISTRATION

Call 212-769-5200, Monday–Friday, 9:00 a.m.–5:00 p.m., and Saturday, 10:00 a.m.–4:00 p.m., or visit www.amnh.org. A service charge may apply. All programs are subject to change.

AMNH eNotes delivers the latest information on Museum programs and events to you monthly via email. Visit www.amnh.org to sign up today!

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Who's Watching Whom?

Story and photographs by Barbie Bischof

To make ends meet during the summer—a season when graduate students like me often lack funding—I took the job of “naturalist” aboard the *Juliet*. The 104-foot, steel-hulled, three-masted schooner embarks out of Miami each week. Carrying about fifteen passengers, mostly scuba divers, she leapfrogs along the reefs of the turquoise and teal-ribboned waters of the Bahamas.

When your life is at sea, time passes differently, and every voyage is unique, even if you’ve been in the same waters hundreds of times. But some of those moments stick to your soul and change your perspective forever. Such an event began one sunset when the *Juliet* was anchored in preparation for a night dive: suddenly a pod of more than one hundred dolphins came toward the schooner from all sides. My shipmates and I watched as they jumped and dove, surrounding our boat; and then, in a matter of minutes, they vanished into the dying embers on the horizon. For the next three days, about ten dolphins—primarily Atlantic spotted dolphins (*Stenella frontalis*)—paid us a visit two or three times each day.

When someone spotted “our” dolphins, the dive master and I would each grab a mask, snorkel, and fins, and with an approving nod from Captain John, we’d leap overboard. Typically, dolphins in the wild ignore humans. Yet in my struggle to keep up with the creatures, I accidentally hit on a way to

get their attention. I would free-dive down about fifty feet—and here’s the key—kicking with my legs and feet locked together, like a dolphin. Seeing this, seven or eight members of the small pod would immediately rush towards me and then swim alongside, clicking and squeaking.

If I turned, they’d turn; if I spun, they’d spin. They nailed my every move. When I ran out of breath, I’d head up. Some of my escorts would bolt ahead with effortless flicks of their tails. Those defectors would wait in a circle near the surface, and watch as I emerged in its center for much-needed air. Taking a few short gasps, I’d quickly dive again. They lingered until I was about ten feet under, before swooshing down around me. After the fifth or sixth round of our up-and-down game, my energy spent and my head light from the want of air, I needed to rest. But a rest broke our rhythm and usually ended the game.

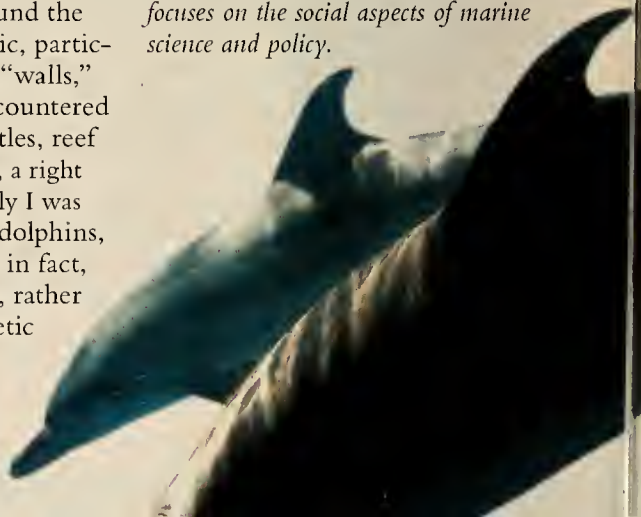
IN MY OWN RESEARCH around the reefs of the Western Atlantic, particularly at the edges of coral “walls,” as divers call them, I’ve encountered barracuda, rays, sharks, turtles, reef fish galore, a few manatees, a right whale, and more, but typically I was ignored or avoided. These dolphins, however, chose to interact: in fact, they were playing with me, rather than vice versa. Their frenetic reaction to my swimming style reminded me of the

way researchers get excited when a chimp copies human behavior. They made eye contact, peering into my mask and inspecting me as we swam side by side. I felt as if I was in their laboratory, possibly a subject in an experiment.

Each diving experience was exhausting but utterly amazing. The creatures never made physical contact, though I was only inches away. Once I tried, but they avoided my touch, and I didn’t want to spoil it.

The *Juliet* saw its little pod for the last time in the early afternoon of the day we sailed back home to Miami. Needing to stay on schedule, we could no longer stop. We watched the dolphins from the bowsprit as they surfed and played in the pressure wake. After about an hour, they simply moved off towards the northwest to deeper water as they had done so many times before.

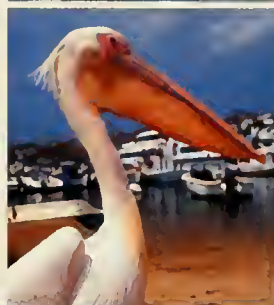
BARBIE BISCHOF is a doctoral student in the Department of Geography at Florida State University. Her work focuses on the social aspects of marine science and policy.



Family Greece

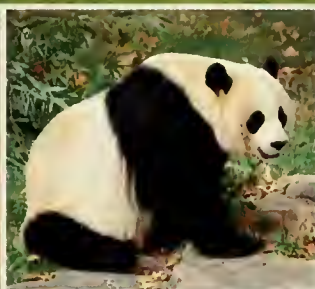
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