SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

OCTOBER 6, 2007 PAGES 209-224 VOL. 172, NO. 14

genes add to meds risk

pitcher-perfect plants

feeble-jawed feline

crowcam captures gadgetry

www.sciencenews.org

satellite saga

THE WEEKLY NEWSMAGAZINE OF SCIENCE

SCIENCE NEWS

OCTOBER 6, 2007 VOL. 172, NO.14

Features

This Week

Of Note

Departments

Cover Fifty years ago this month, the Russians created a sensation and sparked the space race when they launched Sputnik 1, the first satellite to orbit Earth. (JPL/NASA) Page 216

THIS WEEK ONLINE
http://blog.sciencenews.org/

Food for Thought Mouse data suggest that, properly managed, obesity can be benign.

MathTrek A long-lost work by Archimedes shows how close he was to developing calculus.

Science News (ISSN 0036-8423) is published weekly on Saturday, except the last week in December, for $54.50 for 1 year or $98.00 for 2 years (foreign postage is $18.00 additional per year) by Science Service, 1719 N Street, N.W., Washington, DC 20036. Preferred periodicals postage paid at Washington, D.C., and an additional mailing office.

POSTMASTER Send address changes to **Science News**, P.O. Box 1925, Marion, OH 43306. Two to four weeks' notice is required. Old and new addresses, including zip codes, must be provided.

Printed in U.S.A. on recycled paper.

EDITORIAL, BUSINESS, AND ADVERTISING OFFICES 1719 N St. N.W., Washington, D.C. 20036
202-785-2255; scinews@sciencenews.org.
LETTERS editors@sciencenews.org

SUBSCRIPTION DEPARTMENT P.O. Box 1925, Marion, OH 43306. For new subscriptions and customer service, call 1-800-552-4412.

Science News (www.sciencenews.org) is published by Science Service, a nonprofit corporation founded in 1921. The mission of Science Service is to advance the understanding and appreciation of science through publications and educational programs. Visit Science Service at www.sciserv.org.

SCIENCE NEWS

This Week

Dangerous DNA

Genes linked to suicidal thoughts with med use

Two gene variations appear frequently in depressed patients who contemplate killing themselves during treatment with a common antidepressant medication, a new study finds.

In the study, reports of suicidal thoughts occurred from 2 to 15 times as often in antidepressant-treated patients with the key gene variations as in patients without them, say psychiatrist Gonzalo Laje of the National Institute of Mental Health in Bethesda, Md., and his colleagues. Participants received citalopram, a widely prescribed antidepressant related to medications such as fluoxetine (Prozac).

"These findings need to be replicated before we can devise a genetic test to determine who's at risk for suicidal thoughts during antidepressant treatment," Laje says.

The study identifies two crucial genes that contribute to the formation of cell receptors for glutamate, a chemical messenger in the brain that has been implicated in antidepressant effects. Variants of these genes apparently promote suicidal thinking only in depressed people taking antidepressants, the researchers conclude in the October *American Journal of Psychiatry*.

Laje's team studied 1,915 depressed patients recruited from medical facilities across the country for a federally funded trial. Participants received standard doses of citalopram for up to 14 weeks.

The researchers took samples of patients' blood and examined variations in the genetic code at 768 sites on 68 genes that possibly contribute to depression.

Frequencies of various gene versions in the 120 participants who developed suicidal thinking during the trial were compared with DNA patterns in those who did not. Prior studies have estimated that 4 percent of people taking antidepressants start to think about suicide.

Individuals typically inherit two copies of each gene, one from each parent. Some possess two versions of the same gene, while others have a pair of identical genes.

The highest incidence of suicidal thinking occurred in the roughly 1 percent of patients who had inherited at least one variant copy of the first glutamate gene, with or without variant copies of the second glutamate gene. About one-third of these individuals exhibited frequent suicidal thinking.

About 41 percent of participants had one or two variant copies of the second glutamate gene but none of the first. Of these individuals, roughly one-fifth developed thoughts of death and suicide.

A majority of participants—58 percent—had neither high-risk gene version. Fewer than 5 percent of those individuals reported suicidal thinking during treatment.

At a genetics conference next week, Laje's team is to report on two additional gene modifications linked to suicidal thinking in antidepressant-treated patients.

Other researchers who have tracked suicidal thinking among several hundred depressed children and teenagers treated with antidepressants might now try to obtain DNA from those youngsters in order to confirm the new findings, remarks psychiatric epidemiologist Myrna Weissman of Columbia University.

Further research may also yield a genetic test for the likelihood of antidepressant-treatment success, Weissman says. Only 25 percent of patients in Laje's study who developed suicidal thoughts recovered from depression while taking medication, compared with 42 percent of patients who reported no such thoughts. —B. BOWER

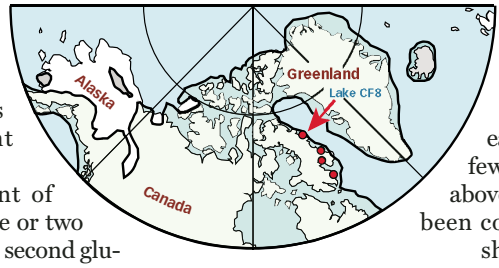
Lake-Bottom Bounty

Some Arctic sediments didn't erode during recent ice ages

The kilometers-thick ice sheets that smothered northeastern Canada and scoured the landscape there during recent ice ages left sediments intact in some locales. This surprising finding could prove a boon to climate researchers.

Most scientists have assumed that the ice sheets that form during ice ages scrape the land clean as they plow across the terrain. Indeed, most of the soil in previously ice-covered arctic areas either formed there since the most recent ice age ended, about 10,000 years ago, or was carried there by wind after the ice sheet disappeared, says Jason P. Briner, a geologist at the State University of New York at Buffalo.

In the past few years, teams of researchers have discovered a few tiny lakes on Canada's huge, northeastern Baffin Island that contain sediments deposited before the most recent ice age. At first, the scientists theorized that those sites, near the island's eastern shore and a few hundred meters above sea level, hadn't been covered by the ice sheet, says Briner. Now, however, research reported by Briner and his colleagues in the October *Geology* suggests that the ice sheet flowed across those lakes but somehow didn't clear away their sediments.



ON THE EDGE At Lake CF8 (arrow) and a handful of other sites (red dots), sediments weren't scraped away by the ice sheet that smothered Canada during the latest ice age (maximum extent denoted by thick black line).

BRINER ET AL.

The team analyzed core samples from a 0.3-square-kilometer lake on Baffin Island, a 10-meter-deep body of water dubbed Lake CF8 that's similar to dozens of others in the region, says Briner. In its deposited sediments, thick layers of organic-rich material alternate with thin bands of coarse sand. The uppermost, 1-m-deep layer of carbon-rich sediment was deposited sometime after the end of the most recent ice age. Carbon dating suggests that material at the base of that layer was laid down about 10,500 years ago, says Briner.

Deeper layers of organically rich sediment from the lake are too old to carbon-date, which indicates that those strata are at least 50,000 years old. Other data suggest that the third-deepest and fourth-deepest layers of organic-rich material accumulated beginning about 105,000 years ago and 194,000 years ago, respectively, during warm intervals between ice ages.

The region surrounding Lake CF8 is strewn with boulders, which flowing masses of ice brought in from distant areas during the most recent ice age, says Briner. He and his colleagues suggest that the small lakes froze solid before the ice sheet reached the area, protecting the lake-bottom sediments from the scouring effect of the ice.

Some of the organic material trapped in sediments that the team analyzed includes mosses and algae that lived in the lake as well as fragments of insects—all of which could provide useful clues about the climate in the region (*SN: 3/5/05, p. 148*).

These sediments "are a time capsule that could go back several hundreds of

thousands of years," says John P. Smol, a biologist at Queen's University in Kingston, Ontario. "Now, let's see what's in there." —S. PERKINS

No Slippery Slope

Physician-aided deaths are rare among those presumed vulnerable

Over the past quarter-century, opponents of physician-assisted death have argued against the practice on the grounds that vulnerable groups—the very old, the poor, and the mentally ill, to name three—would turn to, or be pushed toward, such deaths in disproportionate numbers. A review of records from Oregon and the Netherlands undermines that argument.

Instead, people who receive help dying tend to be better educated and better off than the general population.

The review also finds that, in fact, few people in Oregon have died with a physician's help. Since the practice became legal in 1997, only 292 people—of whom 85 percent were in hospice care—have chosen to end their lives with a lethal prescription. That number amounts to 0.15 percent of all deaths in the state.

In the Netherlands, which has a more flexible euthanasia policy, about 2 percent of deaths annually are via self- or physician-administered lethal narcotics.

"It's something that only a very small fraction are choosing, but many people say the possibility is comforting to explore," says Margaret Battin, a philosophy professor at the University of Utah in Salt Lake City, who led the review. Battin advocates legalized physician-assisted suicide to allow people to "choose the death that is least worst for them." The report, from a team including researchers in Oregon and the Netherlands, appears in the October *Journal of Medical Ethics*.

The team reviewed government reports and independent studies of patient records. It also evaluated surveys of the practices of health care workers. Of 10 groups the researchers identified as vulnerable—including people older than 80, women, the uninsured, the poor, people with little education, people with physical disabilities, people with mental illnesses, minors, and racial and ethnic minorities—only people with HIV infections or AIDS were overrepresented in the physician-assisted death statistics.

"These findings call into question the claim that the risks associated with legalization [of physician-assisted death] will fall most heavily on potentially vulnerable populations," says Timothy Quill, a palliative care specialist at the University of Rochester (N.Y.) School of Medicine. Quill wasn't involved in the study.

Thirty-five U.S. states ban physician-assisted suicide, and Oregon is the only state to explicitly permit it. There, two doctors must certify that a patient wanting to end his or her life is mentally competent and has less than 6 months to live. A doctor then can write a prescription for a lethal dose of drugs but can't administer it. The Netherlands allows physicians to assist in the death of a patient who, even if not terminal, faces "unbearable and hopeless suffering." —B. VASTAG

Match Made in Heaven

Nearby galaxies resemble faraway type

Astronomers can't send a telescope billions of light-years into space to take close-ups of the most remote galaxies, but they appear to have done the next best thing. Researchers say they've found a class of galaxies in our cosmic backyard that are nearly identical to some faraway ones.

NEARBY TWIN? X-ray portrait of a nearby galaxy that may resemble some of the most remote galaxies in the universe.

By studying the easily observed nearby population, astronomers may have a novel tool for probing the long-ago era during which the first starlit bodies formed, notes Tim Heckman of Johns Hopkins University in Baltimore. He and his colleagues, including Roderik Overzier of Johns Hopkins, report their findings online (*http://xxx.lanl.gov/abs/0709.3304*).

The team first used NASA's GALEX observatory to find nearby galaxies with the same pattern of ultraviolet light as the distant population known as Lyman break galaxies. Most of the roughly 2,000 members of this distant class lie between 9 billion and 12 billion light-years away.

After identifying several candidates with GALEX and studying them further with NASA's Chandra X-ray Observatory, Heckman's team cast the sharp eye of the Hubble Space Telescope on some of the nearby galaxies, which reside 1 billion to 2 billion light-years from Earth. Blurring the images to simulate what the galaxies would look like if they were much farther away, the team found that eight of them matched the shapes of Lyman break galaxies.

Like the Lyman break type, the nearby galaxies are producing stars at a prodigious rate. Both the near and the faraway galaxies are small, have similar masses, and have low abundances of elements heavier than helium. The presence of streams and tails suggests that the nearby galaxies came into being and forged most of their stars during collisions between smaller, gas-rich galaxies. That strongly suggests that the Lyman break galaxies, which lie too far away for tails and streams to be detected, formed in the same way, Heckman says.

"Our results are the most direct confirmation to date of models that predict that the main mode of star formation in the early universe was highly collisional," the team claims.

The Hubble images show that the eight nearby galaxies pack star birth into several knots or clusters. The finding suggests that the Lyman break galaxies also contain knots, though these features would be too small and far away to be seen. Such dense clusters of stars would ultimately coalesce to form supermassive black holes. These star clusters may be the seeds of some of the universe's first giant black holes, Heckman speculates.

He and his colleagues now plan to use Hubble to determine whether an additional two dozen or so nearby galaxies are also twins of the Lyman break type.

But even as many as 30 nearby galaxies could be too small a sample to reveal the true nature of the Lyman break galaxies, says Alice Shapley of Princeton University. She notes that exploring the neighborhoods of the local galaxies will be crucial for gauging how well the starbursts match the Lyman break galaxies. Just because some galaxies today have the same mass and size as others had in

NASA

the distant past doesn't mean that they'll develop as the earlier ones did, she cautions. —R. COWEN

Fueling a Flu Debate

Do vaccinations save lives among the elderly?

It would seem to be a no-brainer: Vaccinating elderly people against influenza each fall should lead to fewer hospital stays and higher survival rates. But past studies haven't established such trends.

Researchers now report that elderly people who get flu shots indeed appear less likely to die or to become hospitalized during the flu season than those who don't get immunized.

Flu shots limit illness in most age groups but have shown an inconsistent effect in the elderly. And even though flu vaccine coverage of elderly people in the United States grew from 15 percent in 1980 to 65 percent by the mid-1990s, no corresponding drop in the death rate was reported.

Nevertheless, public policy in most Western countries calls for vaccinating the elderly. Ironically, the assumed benefit prevents researchers from conducting a trial in which some older people get shots and others get placebo injections, because not giving flu shots to some study participants would violate ethical standards. This means that scientists can only analyze data drawn from the community, in which elderly people choose whether or not to get immunized.

In the new study, researchers used U.S. and Canadian medical records to review the fates of thousands of people age 65 or older during 10 consecutive winter flu seasons. Starting in 1990, the records identified who got flu shots, revealed each person's medical history, and showed who had died or been hospitalized, says Kristin L. Nichol, a physician and epidemiologist at the Veterans Affairs Medical Center in Minneapolis. She and her colleagues thus assessed more than 700,000 personal flu seasons.

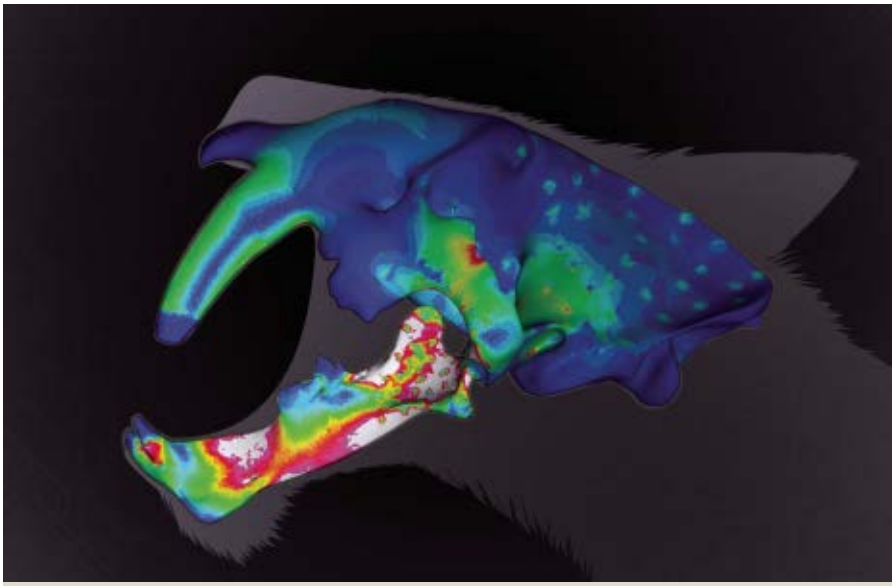
People who got shots during a given flu season were one-fourth less likely to be hospitalized for the flu or pneumonia and half as likely to die of any cause during that season as were unvaccinated people, the team reports in the Oct. 4 *New England Journal of Medicine*.

To test whether elderly people who chose to be vaccinated might be healthier than those who didn't, the researchers checked hospitalization visits during the summer, when flu isn't a factor. They found no difference between the two groups.

"This is the most comprehensive study of this type I've ever seen," says John D. Treanor, an infectious disease physician at the University of Rochester (N.Y.) Medical Center. "The vaccine's got to be doing something," he says, "but I think there are some legitimate doubts about the magnitude of the shots' effects."

Epidemiologist Lone Simonsen of George Washington University in Washington, D.C., says that because the study tabulates deaths from all causes, it sheds little light on the effect of the vaccine. "You need to look at pneumonia-related deaths specifically," she says. Nichol says, however, that death certificates seldom mention influenza, so the disease leaves a poor paper trail.

Simonsen also notes that elderly people who are especially frail might be less likely to get out of their homes than their healthier peers are, and therefore less apt to receive vaccinations. But Nichol says that the vaccinated people in the study were more likely than the others to have diabetes or heart problems, yet showed better survival. The study's findings are "robust," she concludes. —N. SEPPA



J. CONWAY

Just a quick bite

Saber-toothed cats living in North America up to 10,000 years ago relied on a strong pounce and a swift bite to kill their prey. *Smilodon fatalis*, often erroneously called tigers, didn't have jaws strong enough to suffocate their victims as modern big cats do. Instead, says Colin McHenry of the University of Newcastle in Callaghan, Australia, Saber-toothed cats probably tackled prey and used their prominent canine teeth to pierce a victim's airway. McHenry's team used computed tomography to probe densities within saber-toothed cat skulls. As they report in an upcoming *Proceedings of the National Academy of Sciences,* the researchers then created a model of the jaw and surrounding muscles, which they compared with those of a modern lion. White and red areas in the model show where the saber-toothed cat's jaw could sustain the most force. Blue and green areas are weaker. —S. WILLIAMS

Shields Down

A cancer-fighting gene declines in old age

As people age, their risk of cancer increases, primarily because cancer-causing damage to DNA accumulates over time. A new study suggests another possible reason for the increased risk. Experiments in mice show that a key tumor-suppressing gene is less active in old age.

The gene, called *p53*, is one of the most important and thoroughly studied anticancer genes. When a cell's DNA becomes damaged, *p53* orchestrates a response that either repairs the cell or causes it to self-destruct, thus preventing the cell from growing into a tumor. More than half of all tumors in people are estimated to have mutations in *p53*.

Researchers led by Arnold J. Levine of the Cancer Institute of New Jersey in New Brunswick subjected mice of various ages to strong doses of gamma radiation, which triggered the gene's damage-control response. Six hours later, the activity of *p53* in the youngest mice had ramped up by a factor of 7 to 8. In mice approaching the species' 3-year maximum life span, however, the gene's activity increased only twofold to threefold. The damage-control genes regulated by *p53* showed about half

as much activity in the older mice as they did in the youthful mice.

"This work provides a second reason why cancers arise late in life," the researchers say online and in an upcoming *Proceedings of the National Academy of Sciences*.

The slowdown in *p53* activity occurred earlier in females than in males. At 20 months of age, females were already showing decreased responses of the gene, while males of the same age still had youthful responses. The researchers suggest that this ties the change in *p53* activity to life span, not just chronological age, because the natural life span of female mice is about 2 to 3 months shorter than that of males.

The gene-response difference between the sexes also suggests that hormones might play a role in regulating the gene, the scientists say.

The effect appears to go beyond the overall decline in bodily functions with age. Other genes related to tumor formation and longevity maintain youthful activity even after *p53* declines, Levine's team notes. And the scientists accounted for the animals' decline in metabolism by making their measurements relative to the activity of a muscle protein called actin.

"It's really an amazing result," comments Norman E. Sharpless, a cancer geneticist at the University of North Carolina at Chapel Hill. "The data look very convincing."

Levine's team confirmed the results in cells from nine internal organs of mice and by using five different ways to damage the cells, in addition to gamma radiation. The scientists say that further research is needed to determine whether the effect occurs in people. —P. BARRY

Crowcam

Camera on bird's tail captures bird ingenuity

Biologists studying tool use in a tropical crow species have fastened tiny video cameras to the birds and recorded their search for food.

"We are the first ones to do this on wild birds," says Christian Rutz of the University of Oxford in England. He and his Oxford colleagues attached cameras to the tail feathers of New Caledonian crows so that the devices look forward between the birds' legs. The system, which can transmit video to a receiver several hundred meters away, appears to let the crows forage normally in their rugged forest habitat, Rutz says.

EYE IN THE SKY A camera (arrow) looks out between the tail feathers of a New Caledonian crow for a close look (inset) at foraging.

The researchers downloaded some 38 minutes of video from each of 12 birds, until the cameras' batteries died. Videos included scenes of the birds probing for food with plant stems.

"I think this approach has an amazing future," says physiological ecologist Martin Wikelski of Princeton University. The crow work "is very preliminary, obviously," he says. Yet the history of studying animals shows that "as soon as you monitor them remotely you find them doing things you never knew they were doing before."

Rutz credits pioneering "crittercam" research to Greg Marshall, now the in-house specialist for remote imaging at the National Geographic Society in Washington, D.C. In 1986, Marshall worked out a way to hitch a camera onto the back of a captive loggerhead turtle. Since then, he says, he and other people have wired at least 63 species, about half for research and the others in equipment tests or filmmaking projects.

Marshall says that researchers try to keep the weight of any equipment on an animal to 5 percent or less of its body weight, making it hard to equip small animals. "It's predominantly a battery issue," he says.

Cell phone makers are shrinking cameras, Rutz notes. Using new components, the Oxford team slimmed its video system down to 13 grams, not quite as heavy as three nickels.

The crow *Corvus moneduloides*, native to New Caledonia in the South Pacific, makes a worthy bearer of cameras, says Rutz. The crows make several types of hooks and saw-edged probes from twigs and leaves. They use the tools to work insects out of hard-to-reach places (*SN: 3/22/03, p. 182*). Rutz says that some questions can be answered only with details of crows' daily life in the wild. For example, he'd like to know whether foraging is such hard work for the crows that it favors their unusual talent for gadgetry.

Video recordings can help answer such questions, he says. For example, images collected thus far show that crows on the ground pick up only 8 bits of food an hour, he and his colleagues report online and in an upcoming *Science*.

Gavin Hunt of the University of Auckland in New Zealand, the first researcher to report the sophistication of crow tools in the wild, cautions that some of the reported video discoveries aren't that new. A video recording of a crow reusing a tool repeats a finding he reported in 1996 that came from nonelectronic observations in the wild, he says. —S. MILIUS

J. TROSCIANKO; (INSET) ©BEHAVIOURAL ECOLOGY RESEARCH GROUP

150,000 Years Ago, Humans Started Talking and Language Has Been Changing ever since

Explore **The Story of Human Language** in a 36-lecture course taught by one of America's leading linguists

Language not only defines us as a species, but it also intrigues us with its endless mysteries. How did different languages come to be? Why isn't there just a single language? How does a language change, and when it does, is that change indicative of decay or growth? How do languages become extinct?

Professor John McWhorter, one of America's leading linguists and a frequent commentator on network television and National Public Radio, is your guide in this 36-lecture tour for **The Story of Human Language**. He shows how a single tongue spoken 150,000 years ago evolved into the estimated 6,000 languages used around the world today. Explore some of the burning issues in contemporary linguistics.

- Noam Chomsky has famously argued that the ability to use language is innately specified in the human brain. What is the evidence for and against this hypothesis?
- You may have read that words from the world's first language have been reconstructed. What is the reason for this work, and what are the objections to it?

Many of us have encountered what may be the most enticing idea of modern linguistics: Language determines the way we perceive the world. But is this really true? Then there is the Ebonics debate from the mid-1990s, which focused attention on Black English. What is the nature of this dialect, and where did it originate?

This course will teach you how linguists think, and you'll be richly rewarded in investigating the origin and evolution of the marvelous gift of speech.

About Your Professor

Dr. John McWhorter, Ph.D., is Senior Fellow at the Manhattan Institute. An accomplished scholar, he is also a skilled popularizer, whose book *The Power of Babel* was called "startling, provocative, and remarkably entertaining" by the *San Diego Union-Tribune*. The London *Times* calls him "a born teacher."

About Our Sale Price Policy

Why is the sale price for this course so much lower than its standard price? Every course we make goes on sale at least once a year. Producing large quantities of only the sale courses keeps costs down and allows us to pass the savings on to you. This also enables us to fill your order immediately: 99% of all orders placed by 2 pm eastern time ship that same day. Order before October 23, 2007, to receive these savings.

About The Teaching Company

We review hundreds of top-rated professors from America's best colleges and universities each year. From this extraordinary group, we choose only those rated highest by panels of our customers. Fewer than 10% of these world-class scholar-teachers are selected to make The Great Courses.

We've been doing this since 1990, producing more than 3,000 hours of material in modern and ancient history, philosophy, literature, fine arts, the sciences, and mathematics for intelligent, engaged, adult lifelong learners. If a course is ever less than completely satisfying, you may exchange it for another, or we will refund your money promptly.

Lecture Titles

1. What Is Language?
2. When Language Began
3. How Language Changes—Sound Change
4. How Language Changes—Building New Material
5. How Language Changes—Meaning and Order
6. How Language Changes—Many Directions
7. How Language Changes—Modern English
8. Language Families—Indo-European
9. Language Families—Tracing Indo-European
10. Language Families—Diversity of Structures
11. Language Families—Clues to the Past
12. The Case Against the World's First Language
13. The Case For the World's First Language
14. Dialects—Subspecies of Species
15. Dialects—Where Do You Draw the Line?
16. Dialects—Two Tongues in One Mouth
17. Dialects—The Standard as Token of the Past
18. Dialects—Spoken Style, Written Style
19. Dialects—The Fallacy of Blackboard Grammar
20. Language Mixture—Words
21. Language Mixture—Grammar
22. Language Mixture—Language Areas
23. Language Develops Beyond the Call of Duty
24. Language Interrupted
25. A New Perspective on the Story of English
26. Does Culture Drive Language Change?
27. Language Starts Over—Pidgins
28. Language Starts Over—Creoles I
29. Language Starts Over—Creoles II
30. Language Starts Over—Signs of the New
31. Language Starts Over—The Creole Continuum
32. What Is Black English?
33. Language Death—The Problem
34. Language Death—Prognosis
35. Artificial Languages
36. Finale—Master Class

THE TEACHING COMPANY®
The Joy of Lifelong Learning Every Day™
GREAT PROFESSORS, GREAT COURSES, GREAT VALUE GUARANTEED.™

SAVE UP TO $275!
OFFER GOOD UNTIL OCTOBER 23, 2007

1-800-TEACH-12 (1-800-832-2412)
Fax: 703-378-3819

Special offer is available online at
www.TEACH12.com/7sn

The Great Courses
THE TEACHING COMPANY
4151 Lafayette Center Drive, Suite 100
Chantilly, VA 20151-1232

Priority Code 24942

Please send me **The Story of Human Language,** which consists of 36 half-hour lectures and Course Guidebooks.

- ☐ **DVD $99.95** (std. price $374.95) **SAVE $275!** plus $15 shipping, processing, and Lifetime Satisfaction Guarantee
- ☐ **Audio CD $69.95** (std. price $269.95) **SAVE $200!** plus $10 shipping, processing, and Lifetime Satisfaction Guarantee
- ☐ **Audiotape $49.95** (std. price $199.95) **SAVE $150!** plus $10 shipping, processing, and Lifetime Satisfaction Guarantee
- ☐ **Check or Money Order Enclosed**

* Non-U.S. Orders: Additional shipping charges apply. For more details, call us or visit the FAQ page on our website.
** Virginia residents please add 5% sales tax.

Charge my credit card:

☐ VISA ☐ ☐ ☐

Account Number _____ Exp. Date _____

Signature _____

Name (please print) _____

Mailing Address _____

City/State/ZIP _____

Phone *(If we have questions regarding your order—required for international orders)* _____

☐ **FREE CATALOG.** Please send me a free copy of your current catalog (no purchase necessary).

Special offer is available online at www.TEACH12.com/7sn
Offer Good Through: October 23, 2007

SPUTNIK + 50

Remembering the dawn of the space age

BY RON COWEN

Well, I say the fun has just begun
We're on Sputnik Number One
A'flying through outer space
At a rockin' rollin' pace
Oh! We're gonna get our kicks
On a little ole thing called a Sputnik
—Sputnik (Satellite Girl)

In the fall of 1957, pitcher Lew Burdette's fastball gave the Milwaukee Braves a surprise World Series win over the New York Yankees. In Little Rock, Ark., white mobs rioted after nine black students dared to attend Central High School. On television, *Leave It to Beaver* made its debut. But for many people across the globe, the most riveting show was playing out overhead.

Reaching an altitude as high as 940 kilometers, a shiny aluminum sphere was circling Earth 14 times a day. Scientists tracked its orbit, while ham radio operators tuned in to its alien "beep-beep"—a sound that radio and television stations around the globe rebroadcast to millions. Some feared that the beeps were a sinister code that would help the Russians drop a nuclear bomb. Others simply marveled at how a 184-pound hunk of metal could rocket into the sky and stay there.

The space age began on Oct. 4, 1957, when the Soviets launched Sputnik, the first artificial satellite to orbit Earth. "Soviet Fires Earth Satellite Into Space," blared the New York Times headline. "Myth has become reality: Earth's gravity conquered," read the banner of France's Le Figaro.

Fifty years later, satellites for science, surveillance, and communication have become commonplace. But if Sputnik was supposed to usher in an era of human colonies on the moon and astronauts rocketing off to other planets, that part of the story seems to have sputtered.

FIRST STAGE If the U.S. public was caught off guard by Sputnik's launch, the country's scientists were not. Two years earlier, they and their Soviet counterparts had agreed to launch satellites carrying scientific instruments during the International Geophysical Year, beginning in July 1957, during which the sun would reach the peak of its 11-year activity cycle.

In the United States, the Army, Navy, and Air Force argued over which of them should build a rocket that could put a satellite into Earth orbit. The Soviets, meanwhile, forged ahead. During the summer of 1957, they even announced the two radio frequencies at which their satellite would broadcast—but not when it would launch.

To make sure of beating the Americans to the punch, the Russians shelved plans for a scientifically sophisticated satellite and went with a far simpler model, building the device in just a month without the help of blueprints.

On the evening of Oct. 4, New York Times reporter Walter Sullivan was at the Russian embassy in Washington, D.C., attending a reception for scientists, when he received an urgent telephone call from his Washington bureau chief. Tass, the Russian press agency, had just announced the launch of Sputnik—Russian for "traveling companion." Sullivan shared the news with the U.S. scientists at the gathering, who made an impromptu speech congratulating their Russian colleagues. The party then repaired to the embassy's rooftop so that everyone could try to catch a glimpse of the satellite.

In fact, Sputnik was visible, but just barely. It was a mere 23-inch-diameter sphere with four swept-back antennas that, up close, gave the satellite a sleek, sci-fi look. It had but a single watt of power to transmit its radio signals. The duration of the beeps indicated the temperature and pressure, and that the craft had not been punctured by a meteorite.

That night, 22-year-old engineering student Sergei Khrushchev was with his father, Nikita, in Kiev. The Soviet leader was meeting with Ukrainian officials when he got a phone call and returned to the room smiling. "He told me a great thing has happened," Sergei Khrushchev now recalls.

"We had entered a new age," Khrushchev says, but at first "we didn't understand all the significance." The next day's edition of Pravda, the official Russian newspaper, carried just a brief mention of the launch. "It was a shock to the West," he says. U.S. scientists and leaders thought that "the Soviet Union was far behind them. We didn't think we were far behind."

Sputnik "changed the dynamics on Earth of what our society [was] going to be like," says historian Roger Launius of the Smithsonian Institution's National Air and Space Museum in Washington, D.C. "The ability to fly in space has utterly transformed our lives. Sputnik marks the beginning."

Despite the Cold War, fear wasn't the first reaction of most Americans, Launius says. By coincidence, anthropologist Margaret Mead and a coworker were doing a survey about spaceflight just as Sputnik launched. What they found, says Launius, was "overwhelmingly a sense of excitement."

And there were some light-hearted responses. Jerry Englerth, who worked at Eastman Kodak and called his band Jerry Engler and the Four Ekkos, penned a rockabilly tune about Sputnik and went on tour with Buddy Holly. A bartender invented the Sput-

nik cocktail, a blend of vodka and grape juice—from sour grapes, of course. Sputnik burgers included Russian dressing and a satellite olive on a toothpick.

In rural Indiana, 7-year-old Steve Dick got a new puppy, which his family promptly named Sputnik. "I don't remember being scared at all ... it was just an awesome thing that people watched as it went overhead," recalls Dick, now NASA's space historian in Washington, D.C.

But before long, fear took hold. "I think it was the result of a concerted effort on the part of several groups," says Launius. The Democrats, including presidential hopeful Lyndon Baines Johnson, realized that they could turn the Russian feat into a critique of President Dwight D. Eisenhower's administration. Many other groups—national-security personnel, aerospace-industry executives, space scientists who suddenly had access to the White House, and space-exploration enthusiasts who had been tagged "space cadets" and largely dismissed as kooks—saw a chance to push their views on a fascinated but anxious public, says Launius.

In response, Eisenhower tried to dismiss Sputnik, noting its lack of data-gathering equipment. Members of his administration called Sputnik "a silly bauble."

But there was also a growing rhetoric, like this verse by G. Mennen Williams, the Democratic governor of Michigan:

O little Sputnik, flying high
With made-in-Moscow beep,
You tell the world it's a Commie sky
And Uncle Sam's asleep.

DUDNIK — With news cameras ready to record the liftoff of the first U.S. satellite and this country's answer to Sputnik, the rocket launching Vanguard TV-3 exploded at an altitude of 4 feet on Dec. 6, 1957.

SMITHSONIAN

SECOND SURPRISE The anxiety and recriminations may have abated, but less than a month later, on Nov. 3—just in time to celebrate the 40th anniversary of the Bolshevik revolution—the Soviets launched Sputnik 2. Ten times as heavy as Sputnik 1, the satellite carried into orbit the first live cargo, a dog named Laika—which made a strictly one-way journey. The U.S. press promptly dubbed the dog Muttnik.

At Red Square in Moscow, throngs cheered chief Sputnik engineer Sergei Korolev as well as Nikita Khrushchev. "A birthday flexing of Red biceps," *Life* magazine called it.

The second Russian launch further agitated the Eisenhower administration. "The thing to remember is that anything put on a rocket [was] also only a shadow away from putting a nuclear weapon on top of an intercontinental ballistic missile," notes Air and Space cultural historian Margaret Weitekamp. "There were peaceful purposes [for the satellites], but they were also a demonstration to the world of the capability of the Russian [military presence in space.]"

On Dec. 6, the press was invited to Cape Canaveral, Fla., to witness the U.S. response to Sputnik. Newsreel cameras rolled as a modified Navy Vanguard rocket carrying a small satellite lifted off the launch pad. It rose just 4 feet before erupting in a fireball, sending the grapefruit-size satellite in its nose cone hurtling across the sands. The next day's headlines provided the postmortem: "Flopnik," "Dudnik," "Kaputnik."

Wernher von Braun, whose earlier plan to adapt an Army rocket had been ditched in favor of the Navy's project, was now brought back into the game. On Jan. 31, 1958—with no press in attendance—von Braun's Jupiter-C rocket successfully launched the first U.S. satellite, Explorer I. A Geiger counter on the satellite recorded the first evidence of what are now known as the Van Allen radiation belts, bands of energetic charged particles trapped by Earth's magnetic field.

In March, President Eisenhower founded NASA, the National Aeronautics and Space Administration, a civilian agency devoted to space exploration. Spurred by what would soon become a well-worn phrase—"Soviet children are playing chess while American children are playing checkers"—politicians poured money into math and science education. Educators revised the K-12 science curriculum and introduced the baby-boom generation to "new math." Every classroom, it seemed, got an overhead projector as its new, high-tech weapon against the Russians.

Nevertheless, "there were 5 to 6 years of almost unparalleled Soviet dominance" in space, notes Launius. The highlight may have come on April 12, 1961, when Yuri Gagarin became the first person to orbit Earth, circling once in a Vostok spacecraft.

Eisenhower always maintained that there was no space race, but he couldn't really afford to say otherwise, says Weitekamp. "Because if we were in a race, the Soviets [had] beaten the pants off the Americans. They had the first satellites, the first man in space, the first woman, the first time to have two capsules [in space together], the first rendezvous."

Jolted into action, Eisenhower's successor, John F. Kennedy, decided that the United States should embark on a major project that would eclipse Russian superiority. After consulting his advisors, including LBJ, Kennedy spoke before a joint session of Congress on May 25, 1961, and announced "the goal, before this decade is out, of landing a man on the moon and returning him safely to Earth."

Through 1972, NASA focused almost exclusively on that goal with the Apollo missions, which put 12 men on the lunar surface, beginning with Neil Armstrong's "one small step" on July 20, 1969. But after Apollo, just as the country was undergoing a cultural upheaval, NASA found itself without a clear-cut goal. "I kind of imagine all these military-buzz-cut engineers who pop their heads up and suddenly they're in an environment of stagflation, their budget shrinking instead of exploding, and it's a whole other ball game," says Weitekamp.

Says space-policy analyst John Logsdon of the George Washington (D.C.) University, "Kennedy decided to go to the moon to be there first. Period. And we got there first and then stopped."

LASTING LESSONS "What we've learned from Sputnik is that a shock can get you started ... but you'd better have a good, sustainable science initiative to [keep] going," says Logsdon. "We haven't done a very good job of providing goals for ourselves in space." For the first decade after Sputnik, "we had this competition with the Soviet Union and then we chose what turned out to be a dead-end—space shuttle and space station."

The shuttle ended up being an unwieldy, costly, and ultimately dangerous way to take astronauts into space—especially after 3 decades of use. The space station has been roundly criticized by scientists for draining NASA's budget while having limited research value.

Plans for a human presence beyond Earth's orbit seemed to get

(continued on page 221)

STALKING THE GREEN MEAT EATERS

Why ecologists love these toothless predators

BY SUSAN MILIUS

Ecologist Nick Gotelli walks on water, and he appears to have every confidence that his two visitors soon will too. A man who speaks and moves with precision, he sounds plausible. It's easy to overlook slightly alarming details about the field trip that he's leading for his two visitors, an ecologist from Spain and a reporter.

He's taking his guests to see his study subjects: meat-eating pitcher plants. They absorb nutrients from ants or other little animals that slip into their pitcher-shaped leaves and drown in the liquid at the bottom. The plants that Gotelli studies spend their lives, some longer than 50 years, rooted in mats of sphagnum moss that float on wetlands like soggy, giant sponges. The moss mats can build up to such a cushy, buoyant thickness that, Gotelli says, a person can walk out onto them and admire the plants at will.

DEATH OR LIFE — Water inside the leaves of northern pitcher plants drown occasional visitors, but other creatures such as the pitcher plant mosquito thrive there as larvae.

Gotelli's visiting colleague, Fernando Maestre of King Juan Carlos University in Madrid, is spending the summer working with bogmeister Gotelli at the University of Vermont in Burlington even though Maestre specializes in very dry places. Both researchers, Gotelli explains, are developing statistical methods for analyzing communities. He says that pitcher plants make good organisms for studying ideas that apply to many kinds of communities.

Gotelli and other researchers are designing such studies on several levels. Bogs hosting pitcher plants offer nicely isolated systems for studying the impact of environmental change. And Gotelli's also working on the habitat within pitcher plant leaves.

Death traps for some visitors, these pools are also home to aquatic creatures that stay very much alive. Ecologists use the pools for experiments that they could otherwise do only in their dreams. Researchers add top predators or diminish the habitat with a few dips of a pipette, something that they could never do with lions on the Serengeti or acreage in Yellowstone.

A pitcher plant is "an ecosystem you can hold in the palm of your hand," says Gotelli.

PUDDLES Gotelli is leading the way to an unspoiled gem of a bog with plenty of northern pitcher plants (*Sarracenia purpurea*). The landscape looks green enough, but now we've turned down a farm road and eased to the edge of woods beside a cultivated field. Gotelli gets out. A little way into the woods lies the bog, he says. But shouldn't things be, well, wetter?

No, and that's part of the beauty of this kind of bog, he explains. As glaciers scoured this landscape 10,000 years ago, they gouged big holes in otherwise firm ground. No rivers ran into or out of them. Filled with rainwater and snowmelt, they became water worlds virtually isolated from the rest of the local hydrology. The bog we are visiting is "like a sealed bowl," Gotelli says.

Its isolation made the bog a good field site for a study that Gotelli and Aaron Ellison of Harvard University have done of humanity's nitrogen excesses. In recent decades especially, farming and the burning of fossil fuels have added nitrogen in biologically reactive form to the air and water.

Earlier studies of the impact of excess nitrogen on forests and streams were complicated by the fact that these ecosystems get nitrogen through many different routes. In the bog, almost all the extra nitrogen arrives via rain and snow. From 1998 through 2000, Gotelli and Ellison used the nitrogen-absorbing power of pitcher leaves as a handy way to tinker with nutrients.

When a new pitcher leaf formed on one of their test plants, the researchers pipetted out its natural pool of liquid and replaced it with one of nine watery solutions dosed, for example, with extra nitrogen or with nitrogen plus phosphorus. Every 2 weeks, each pitcher got a refill. Gagging the plants by stuffing a wad of glass wool in the mouths of the leaf traps, the researchers kept insects from complicating the experiments by adding more nitrogen to the mix.

Gotelli and Ellison measured how much plants grew and reproduced on various nitrogen diets and then created a computer model to predict pitcher plants' futures under various nitrogen regimens.

"Nitrogen is a fertilizer—in some respects, it's a good thing," Gotelli says. But he and Ellison found that more is not better for pitcher plants. Boosting nitrogen pushed up the death toll among young plants. The researchers predicted that even a 1 percent annual increase in extra nitrogen in the environment would raise a substantial risk of the population going extinct within the next century.

STOPPING BY WOODS Gotelli pushes into low, shrubby woods with black spruce and larch trees almost dense enough for their branches to interlock like Velcro. Dead tree trunks have wedged

UNIV. OREGON

Science Mall Shopping
www.sciencemall-usa.com

"It's a Curious World" Frog Poster

"Colorful, amazing and simply beautiful"... are some of the words that describe this science poster. The red-eyed tree frog is surely among the world's most interesting creatures. Size: 24" X 36", Laminated Order #JPT-4448, Cost: $19.95; 2 for $38

"We Choose to Go to the Moon" Poster

An excerpt of President John F. Kennedy's famous memorial speech is placed on this science poster. "We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard..." Size: 24" X 36", Laminated; Order #JPT-6438, Cost: $21.95, 2 for $40

Meerkat Family Portrait - Poster

Meerkats are very cute and photogenic. This is a great, classic picture of these adorable creatures. If you have always wanted a great meerkat poster, this is the one to get! Size: 24" X 36", Laminated Order #JPT-88164, Cost: $21.95

Meteorite Impact Craters on the Earth poster is a NEW full-size, fully revised color poster that provides a great introduction to impact science. The poster features a table with all new information about the size, location, types of materials found and features of 177 verified craters discovered on Earth **(copyright 2008)**.

The world map shows all 177 craters plotted geographically with the names of the craters, latitude and longitude and keyed to a data table. There are pictures and text about some of the amazing rock and mineral types that are created ONLY by hypervelocity impacts. A sectional graphic shows how craters are formed when the meteorite/ asteroid/ comet hits the ground, and the types of crater they produce. A section is devoted to Gene Shoemaker, considered to be the "father of impact science." A handy time line graph on the bottom of the poster shows the dating of 6 extinction events and their titles. The poster comes with a 4 page in-color information sheet with photos of meteorites, interesting questions and answers.

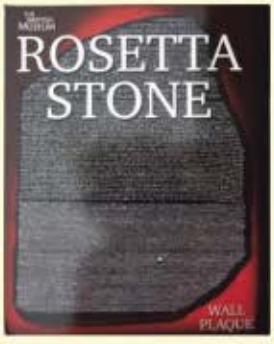
The 38.5 x 27 inch poster is printed in full color with a UV protective laminate.
Published by Jensan Scientifics, LLC, for www.sciencemall-usa.com

Order #JPT-7401, Cost: $23.95, 2 for $40

Butterflies of the World Poster

and some moths. Over 100 species are beautifully illustrated. Large globe and arrow icons are used to indicate where they live. Useful information at bottom. Standard poster is large 24" x 36" size that fits standard frames. Printed on heavy, acid-free paper using non-fade inks, then coated to provide satin finish. Comes laminated. Order #JPT-31622, Cost: $15.95, 2 for $30

United States Fossils, Rocks and Gems State Poster State-by-State - *poster* This United States Fossils, Rocks and Gems State Poster (state-by state) has all 50 states shown with information and a picture available for each. Features 54 images about state fossils, state gems, state stones/ rocks, and minerals. Featured National Parks include: Clayton Lake State Park, New Mexico; Crater of Diamonds State Park, Arkansas; Dinosaur National Monument, Utah; and The Mammoth Site Museum, South Dakota. Information about many other national parks is included. Great in-color pictures with plenty of interesting description. This poster should be in every earth science classroom, national park gift shop, natural history museum, and science center.
Size: 26" X 38" Laminated, Copyright 2007 Order #JPT-8012, Cost: $24.95; 2 for $45



Rosetta Stone Puzzle

Quite possibly the most difficult puzzle you will ever assemble is the Rosetta Stone Puzzle. Anyone who loves a challenge will enjoy this die-cut jigsaw of the Rosetta Stone. For ages 12+ Details: 800 printed cardboard pieces, finished size 64 x 49cm. Challenge your mind! Order #JPT-rosetta 16; Cost: $38

The Rosetta Stone was discovered in 1799, by which time all knowledge of the ancient Egyptian language had been lost for over 1,000 years. The known Greek section at the bottom of the stone helped scholars decipher the two Egyptian scripts, the middle one written in cursive demotic script and the top version in ancient hieroglyphs.
This reduced-sized replica measures 12 3/8"H X 10 5/8"W X ½" D and is supplied with a fixture for wall hanging. Produced by the British Museum. Order #JPT-rosetta; Cost: $85

Sterling Silver Meteorite Pendant

The meteorite in this jewelry pendant is a NWA 869 (North West Africa). Many beautiful meteorites are coming from this part of the world. It is among the prettiest class of chondrite meteorites, and is a L-5 type chondrite. The meteorite was discovered in 1999 near Tindouf, Algeria, Africa. One side has been coated with a protectant material that helps you see the natural beauty of the meteorite better. The other side has been left uncoated so you can see what they look like naturually. Certified authentic: Jensan Scientifics, LLC Comes with information in an attractive black velvet jewelry box.

Size: 1" X 1" Sterling Silver Order #JPT-1065, Cost $85
This pendant comes with a braided Sterling Silver Chain 20" For the person that has everything. We bet they do not have this!

Also available in 14K gold, Order #JPT-1165, Cost: $265

Mammoth Ivory Rose Pendant Set

This jewelry was carefully carved out of extinct mammoth ivory. It comes wire wrapped in 14K gold with a matching 20" braided 14K gold chain.

The ivory rose pendant was made from ancient fossil *Mammoth Ivory* that lay buried in the snows of Alaska for over 50,000 years. The yearly melting of the snow and minerals in the earth have given the mammoth ivory it's unique color. The ivory was unearthed by Eskimos and carved by a master carver.
A perfect gift for anniversary, birthday, Christmas or "just because." Actual pendant size: 2"L X 1 1/4"W Ivory rose dimensions: 1 1/8" X 1 1/8"
Order #JPT-mamset; Cost: $360
Order #JPT-rose, for rose pendant only; Cost: $185.00

WWW.SCIENCEMALL-USA.COM
P.O. Box 1864
Dubuque, IA 52004-1864

VISA MasterCard DISCOVER

Shipping is *not included.*
Please call Toll Free:
1-800-720-5451 for information

aslant among the living. We work our way about 10 feet forward, and Gotelli suggests that he push ahead alone to search for the path.

While Gotelli threads his way into the foliage, Maestre tells me that in his dry-land work, he comes across occasional carnivorous plants. They're unusual, according to a specialist I call later, Barry Rice of Davis, California, conservation chair of the International Carnivorous Plant Society. Meat-eating plants typically grow in wet places with poor nutrition but plenty of sunlight. Because their leaves have to assume shapes that work as traps, "they suck at capturing light," says Rice. So pitcher plants don't have an edge over others, except in fringe habitats.

An estimated 500 to 700 plant species around the world kill and eat meat to some degree. Asked how many pitcher plant species North America has, Rice says, "It depends on who you want to get into a fistfight with." Answers range from 8 to 12.

The one that Gotelli studies grows from Canada to New Jersey. Pitcher plants can't stand too much competition from other plants, Gotelli explains—a point that becomes clear during our trip through the woods. As we clamber toward his voice, we see life aplenty: lichen beards on twigs, ankle-high bunchberries, waist-high blueberry bushes, and, at last, a continuous, soft carpet of lettuce-green sphagnum moss. But in this dense jumble, we don't see pitcher plants.

WATER WALKWAY — What looks like the shore of a Vermont bog is actually a floating mat of sphagnum moss.

Finally, we step into an almost perfectly circular clearing. The dimpled carpet of sphagnum rolls out of the woods and onward some 30 feet ahead of us to the bog's central circle of open water. The moss turns sunburn red, and hardly anything grows taller than our knees. Only out here—in the full sun and amid the squelching moss where most other plants would drown—do we finally see pitchers.

On each plant, pitchers grow in rosettes, presenting irregular circles of potbellied vases. Each is leathery green, red veined, and lightly furred with pale, downward-pointing hairs.

Exotic looking they may be, but they're not particularly deadly, says Gotelli. In the 1990s, Sandra Newell of Indiana University of Pennsylvania and a colleague videotaped pitchers and found that they actually trapped fewer than 1 of 100 of their insect visitors.

As we pick our way among the pitchers and a scattering of young, ankle-high cranberry plants, our rubber boots sink into the moss as if we're walking in mud. I ask Gotelli to point out where the solid ground will give way to the floating mats. "Back there," he says. "See. You can jump up and down here, and the sphagnum will bounce." He demonstrates. The moss around him heaves and wobbles in slow motion. I start to ask how deep the water is below us but decide the question can wait.

LEAVES STAY I admire the pitchers Gotelli is pointing out. One leaf swells into a plump, full-throated tube. The other's just a skinny vase with a flattened frill, or keel, down its side.

When Gotelli and Ellison were tinkering with the nutrient supplies in pitcher pools, they found that extra nitrogen decreased the proportion of plump pitchers to thinner-leaf tubes that catch light better, starting even in the first season of the test. "We were surprised to see the response so rapidly," he says.

With more nitrogen available from the environment, plants need less from insects. As a result, the plants make smaller pitchers or even flat leaves with no pitcher at all, Gotelli and Ellison reported in 2002. It's not a conscious decision, of course, but the plants start investing in flatter leaves that capture sunlight better. "It's almost like thinking about the plant in terms of an animal," says Gotelli.

In a sense, the northern pitcher plant is part animal. To show us, Gotelli whisks out a pipette and draws the liquid out of a pitcher, emptying it into a petri dish that he's conjured from another pocket. In this liquid, he explains, live small creatures such as insect larvae, rotifers, protozoa, and bacteria. When an unlucky ant expires, the pool's residents break it down, providing nutrition for the pitcher plant.

The water has just a tinge of brown, a hint of tea. He waves the dish under our noses. "It's had dead animals in there, but it doesn't smell, and it's clear," he says. Like all photosynthesizing plants, the pitcher releases oxygen, which helps keep the water fresh.

The denizens of this liquid constitute a miniature ecosystem. Midge and fly larvae and mites rip the carcass of an expired insect into small pieces. The small chunks nourish a community of bacteria, which in turn feeds micropredators such as protozoa and rotifers. These provide food for the next level of predators, particularly the aquatic larvae of the mosquito *Wyeomyia smithii*.

"Top predator" may be an odd term for something you can hold in a petri dish, but at least the mosquito larvae are visible to the naked eye. Barely. Gotelli points out squirming beige threads perhaps a quarter of an inch long.

They live what seems to be a precariously specialized life. Adult female *W. smithii* lay their eggs only in the pools within pitchers. The species achieved notoriety in 2001 when William Bradshaw and Christina Holzapfel of the University of Oregon in Eugene reported finding genetic changes in the mosquito resulting from climate change. As winters become milder, mosquitoes can wait until later in the year, when the days are shorter, to begin hibernation. The length of day that triggers hibernation is a genetic trait, and Bradshaw and Holzapfel found that over the past 30 years, mosquitoes with shorter-day genes have gotten more common.

LITTLE BIG GUYS Gotelli and Ellison have devised a string of experiments that rely on manipulating the contents of pitcher plant pools. In this way they plan to explore the way in which a variety of organisms comes together to form an ecosystem, with implications far beyond this particular case.

For example, the researchers can shrink a habitat simply by reducing the amount of liquid in a pitcher. That holds lessons for what happens to birds and bears forced to live in the narrowing confines of forests falling to loggers. To explore the importance of losing big predators, on the other hand, the researchers plucked the *W. smithii* mosquito larvae and other top predators from the pitcher liquid.

After altering pitcher ecosystems and letting them develop over a growing season, the researchers counted the remaining residents and compared the numbers with predictions from ecological models. Even though habitat shrinkage gets a lot of attention in the larger world, models that took it as the most important factor didn't make successful predictions. Models made better predictions when they emphasized interactions of the food web, for example, showing that a loss of top predators lets midlevel ones boom, which in turn overeat and cut the numbers of their prey.

Gotelli starts to look for one of the animals that specializes in eating pitcher plants, a moth whose caterpillars feed on the leaves. I start to move but my leg won't budge. While I was listening, I've sunk almost up to my knees in the sphagnum. "Oh, it's a good idea to keep moving around," says Gotelli. Walking on water isn't so hard. But standing still … ■

J. BROWN

(continued from page 217)

a boost with President George W. Bush's 2004 announcement that NASA would return people to the moon and then go on to Mars. But those plans lack the financial support that Kennedy and LBJ garnered, notes Logsdon. They also appear to lack broad support from politicians and the public.

In many ways, the visions of space exploration that flowered soon after Sputnik, including complex space colonies, didn't materialize. Von Braun envisioned human flights to Mars, using a nuclear-powered rocket, by 1984.

But in other respects, Sputnik's legacy has endured. Among the remarkable accomplishments over the past 50 years, says Logsdon, is that "we've revolutionized our knowledge of the solar system and the universe, primarily through robotic missions." In addition, "satellites are now managing the world," he adds. With some 850 operational devices now circling Earth, satellites are at the core of worldwide communications, the Global Positioning System, and data gathering on topics as vital as global warming.

Today, it's taken for granted that "every local news station has access to [regional] satellite views" to forecast storms, notes space historian David DeVorkin of the National Air and Space Museum.

Most satellites are now launched by private industry. "There are more launches on a regular basis than people realize," says DeVorkin. "There's a booming business in launching satellites and a whole space industry."

NASA

LUNAR LEGACY — Astronaut Buzz Aldrin, pilot of the first lunar lander, poses for a photograph beside the U.S. flag during the Apollo 11 mission on July 20, 1969, the first time people set foot on the moon. The lunar module is at left, and the footprints of the astronauts are visible in the soil.

The race among entrepreneurs into space exploration is heating up. As a follow-on to the $10 million Ansari X prize, awarded in 2004 to the first private company to fly a piloted craft twice into space within a 2-week period, the Internet company Google last month announced a new space competition: the $30 million Lunar X prize to the first company to land a robotic rover on the moon and beam pictures back to Earth.

Does the United States need another Sputnik to spur space exploration? Competition pushes progress, says Launius. "Mickey Mantle and Roger Maris were both great home run hitters, but neither of them did as well as when they competed with each other."

For DeVorkin, the new Sputnik—the crisis at hand begging for a U.S. response—is global warming. "U.S. space technology is extraordinarily good at understanding global systems and the Earth-sun connection," he says. A fleet of data-gathering satellites could be used by climate scientists needing to better understand and address global warming.

"It's a question of personal moral responsibility," says DeVorkin. "We don't deserve to go [further] into space" unless this problem is solved. A program devoted to the study of global warming would involve international collaboration more than competition. Scientists—and society—still have the chance to build on Sputnik's legacy, DeVorkin says, by using the technology developed during the space race to "galvanize and really focus on self-preservation" of the planet. ■

OF NOTE

PLANETARY SCIENCE

Neptune's balmy south pole

The first temperature map of Neptune's lower atmosphere shows that the planet's south pole is about 10°C warmer than any other place on the planet. The average temperature of the atmosphere's lower depths is –200°C. The south pole is warm enough for gaseous methane to rise into the upper atmosphere, says study coauthor Glenn Orton of NASA's Jet Propulsion Laboratory in Pasadena, Calif.

The escaping methane could explain a long-standing puzzle—the presence of methane in Neptune's stratosphere.

Neptune's tilt means that its south pole is heated by continuous sunlight. That's been the case for the past 40 years of Neptune's 165-year orbit around the sun. Eighty years from now, when it's summer at the north pole, methane may escape from that region instead, says Orton.

Large temperature differences between the south pole and adjacent regions may stir up gases and generate 2,000-kilometer-per-hour winds, the strongest planetary winds in the solar system.

The study, which used the European Southern Observatory's Very Large Telescope in Paranal, Chile, appears in the Sept. 18 *Astronomy & Astrophysics*. —R. C.

PHYSICS

Hot stuff

Researchers have used a plasma to ramp up a laser's intensity by an unprecedented 20,000 times.

Standard lasers produce orderly streams of light by pumping energy into a medium—usually a gas, liquid, or crystal—and then coaxing the medium's atoms to release the energy in the form of synchronized electromagnetic waves.

A laser can also be used to amplify the output of another laser. But amplifying an already highly concentrated pulse requires expensive optical components that spread the pulse's energy over a longer time and then recompress it after amplification. Without such equipment, the concentrated beam would damage the lasing medium. Such complex lasers can cost tens of millions of dollars, says Szymon Suckewer of Princeton University.

To create a lower-cost alternative, Suckewer and his team replaced the lasing medium with a plasma, the hot state of matter in which electrons and atoms move separately. A plasma can in principle withstand unlimited laser intensities. "You cannot break the plasma," Suckewer says.

In the team's device, which cost less than $1 million, an ultrashort pulse from an ordinary laser traveled into the plasma. Standing waves in the plasma, excited by another laser, transferred energy into the

first laser pulse. At the same time, the plasma compressed the pulse down to a duration of 50 femtoseconds, or millionths of a billionth of a second. The resulting pulse was 20,000 times more intense than the original one, the researchers report in the October *Nature Physics*.

Plasma technology could improve laser-surgery tools or provide a relatively low-cost way of accelerating particles for high-energy physics experiments (*SN: 10/2/04, p. 212*). —D.C.

ZOOLOGY

Tough-guy bluebirds need a frontier

Among western bluebirds, the scrappier males push into new territory first. But mild-mannered dads eventually take over, a long-term analysis finds.

Western bluebirds (*Sialia mexicana*) are recolonizing their former range in valleys of western Montana, say Renée Duckworth of Harvard University and Alex Badyaev of the University of Arizona in Tucson. Logging and farming in the late 1930s wiped out old trees with good nesting holes. In the past 40 years, though, people have set up nest boxes for bluebirds.

SMACKDOWN Western bluebirds are retaking territory in Montana. The most aggressive males lead the invasion but then give way to family guys.

The first species to move in was the mountain bluebird (*Sialia currucoides*). Western bluebirds, however, have been rapidly kicking them out of the territory.

This ongoing bluebird switch offers a rare chance to study how behavior affects a species' range, says Duckworth. She and Badyaev traced bluebird history through 3 decades of records. And from 2001 through 2005, Duckworth tested male bluebirds in eight study areas for aggression.

Western males leading the takeover of nesting sites ranked high on aggression. Westerns that stayed near their birthplaces ranked low. However, in the 5 years after the westerns conquered an area, the researchers saw a decline in average male aggression.

Aggressive males make terrible dads, says Duckworth. They rarely feed chicks, and their offspring aren't as likely to survive as a less aggressive male's are. Hot-tempered birds are the ones that disperse readily and continue to press on into new territory. In their wake, the quieter, fatherly types settle in and establish a population, Duckworth and Badyaev report in the Sept. 18 *Proceedings of the National Academy of Sciences*. —S.M.

CLIMATE

Iron to blame

Huge algal blooms in the Indian Ocean dance to their own rhythm. In other places, such blooms occur every spring, when masses of tiny plants multiply in surface waters. But off the coast of Madagascar, the greenery erupts in late summer, and only every few years. Now, one researcher attributes this unusual pattern to typhoons that boost the amount of iron in the ocean.

Springtime blooms occur as surface-temperatures rise, warming nutrient-rich water that has risen from the cold ocean depths all winter. This creates the perfect environment for single-celled plants to thrive. But the erratic summer timing of the Indian Ocean bloom has puzzled scientists.

Sifting through meteorological data in search of a cause for these occasional blooms, which can span an area the size of Alaska, Baris Mete Uz of the University of Maryland at College Park noticed a pattern. Whenever a typhoon hit Madagascar, an algal bloom flared up shortly after, he reports in the Sept. 15 *Journal of Geophysical Research*.

Typhoons drench the land and wash soil into the ocean, Uz explains. While nitrogen and phosphorus in this runoff would cause immediate plant growth in waters near the shore, iron is slower to trigger growth, and thus could cause a slow, far-from-shore bloom like the Indian Ocean one.

"It's surprising, however, because people don't expect blooms triggered by iron to be so large," says Uz.

Blooms caused by iron have important climate implications, he adds, because they soak up carbon dioxide from the atmosphere. Typical algal blooms instead thrive off nutrients that well up from the deep ocean. —S.C.W.

IMMUNOLOGY

Lonely white cells

The white blood cells of chronically lonely people display abnormal patterns of gene activation, according to a new report.

Study leader Steve Cole of the University of California, Los Angeles says the findings may indicate that the "biological impact of social isolation reaches down into some of our most basic internal processes."

Many studies have found that lonely people have increased rates of infectious diseases, cardiovascular problems, and even cancer. But the reason for the connections has been unclear. The new study hints that an altered immune response may play a key role.

Published online in *Genome Biology*, the study looked at patterns of gene activation—which genes were turned on and off, and to what degree—in the white blood cells of six chronically lonely and eight nonlonely middle-aged adults. Degrees of isolation were assessed by a standard questionnaire, and each participant ranked in the same category for 3 consecutive years.

In the lonely people, 208 genes were activated much more or much less than the same genes in the nonlonely individuals. Many of the genes abnormally expressed in the isolated people are involved in immune processes such as inflammation, response to viruses, and antibody production.

Although the study was small, the authors say it provides an early window into understanding how social factors affect health. —B.V.

AGRICULTURE

They fertilized with what?

Talk about your high yuck factor. Researchers in Finland have just published results of a study showing that farmers can substitute human urine for conventional fertilizer and get a notable increase in cabbage yields.

Surendra K. Pradhan of the University of Kuopio and his colleagues grew cabbages using a conventional fertilizer, human urine that had been stored for 6 months, or no soil amendment at all. In an upcoming issue of the *Journal of Agricultural and Food Chemistry*, the researchers report that the urine treatment yielded cabbages that were bigger and carried fewer germs than those grown by either other approach.

Although the nutrient content of urine depends on what someone has eaten, analyses of the urine used in these experiments showed that its nitrogen, phosphorus, and potassium contents were comparable to those of commercial fertilizer.

Urine collected from one individual over the course of a year could fertilize a 90-square-meter plot, yielding more than 160 cabbages, the team calculates. The data indicate that a urine-treated plot would yield 64 kilograms more cabbage than one fertilized conventionally.

Earlier this year, the Kuopio scientists reported that cucumbers benefit from the use of urine as fertilizer. —J.R.

BADYAEV

Books

A selection of new and notable books of scientific interest

EARTH THEN AND NOW: Amazing Images of Our Changing World

FRED PEARCE

This collection of images proves, perhaps once and for all, that a picture's worth a thousand words.

Paired images, taken at different points in time, reveal the ways in which human-made and natural forces have altered Earth's landscape. Pearce, an environmental writer, arranges the images to accentuate how such factors as urbanization, land transformation, war, and culture are evidenced by changes in various locations worldwide. From a restaurant hanging on the edge of a retreating glacier to a sandstorm in China's Tiananmen Square to the aftermath of floodwaters in New Orleans, the images attest to Earth's ever-changing landscape. The intervals between the paired images range from minutes to centuries. Each before-and-after image is accompanied by a caption detailing the when, how, and why of its salient features. ***Firefly, 2007, 288 p., b&w and color photos, hardcover, $39.95***.

THE SURVIVAL IMPERATIVE: Using Space to Protect Earth

WILLIAM E. BURROWS

The possibility that an asteroid may crash into Earth ranks near the bottom of most people's worry lists. However, Burrows points out, such a collision is

possible, and its impact could be catastrophic. What, if anything, can be done to prevent such a disaster? Burrows, a veteran science journalist, sets forth the necessary elements for a planetary-defense program and gauges the threat posed not only by asteroids and other near-Earth objects but also by natural disasters and by people's own destructive technologies. Burrows' ideas extend to using space to protect Earth against all manner of threats. The suggested defense mechanisms range from using spacecraft to track the movement of weapons of mass destruction to monitoring weather patterns and climate change. He points out that spaceflight may be imperative to the survival of humanity, as the need to create remote settlements becomes more pressing. ***Forge, 2006, 317 p., paperback, $15.95***.

THE RED VOLCANOES: Face to Face with the Mountains of Fire

G. BRAD LEWIS AND PAUL-EDOUARD BERNARD DE LAJARTRE

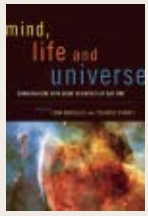
Hidden beneath our feet lies the molten heart of Earth, composed of a fire that reveals itself in furious, erupting volcanoes. All Earth's elements were once a part of this furnace. Hawaii's Kilauea, the most active volcano on Earth, and Furnace Peak (*Piton de la Fournaise*) on Reunion Island in the Indian Ocean, with their dramatic lava flows and geologic formations, are living displays of Earth's subterranean force. The two volcanoes are the focus of this book, which contains more than

100 full-color images that convey a wondrous combination of heat, fiery light, and smoke. The images, taken by renowned volcanologists and photographers Lewis and de Lajartre, offer close-up details of two otherwise unapproachable subjects. The book also includes a glossary of volcano-related terms. ***Thames & Hudson, 2007, 144 p., color photos, hardcover, $34.95.***

MIND, LIFE, AND UNIVERSE: Conversations with Great Scientists of Our Time

LYNN MARGULIS AND EDUARDO PUNSET, EDS.

Based on interviews conducted by Spanish science-television personality Punset and American microbiologist Lynn Margulis, this book

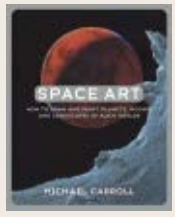


seeks to bring to life the passion and enthusiasm, as well as the vast knowledge, of 36 leading scientists from a wide range of disciplines. Among the luminaries featured are sociobiologist Edward O. Wilson, biologist Richard Dawkins, theoretical physicist Lisa Randall, and primatologist Jane Goodall. Each interviewee provides insight into the most interesting questions being pursued within his or her respective field. Topics range from the consequences of nanotechnology to the similarities between warring people and aggressive chimpanzees to the human brain's hidden powers of perception. Each interview is edited so as to let the flavor of the scientist's personality shine through. The book ends with brief biographical notes about all the interviewees. ***Chelsea Green, 2007, 358 p., hardcover, $35.00.***

SPACE ART: How to Draw and Paint Planets, Moons, and Landscapes of Alien Worlds

MICHAEL CARROLL

Despite the availability of telescopes and cameras mounted on space rovers, there is still room for the artistic touch in portraying the landscapes of other



planets and moons. Carroll, who has had a 25-year career as an astronomical artist, provides instructions for composing such images, emphasizing the art of combining traditional principles of landscape painting with the images provided by space cameras. He explains how to use shading and coloring techniques to paint water and ice, rocks and geological formations, craters, and alien skies. He offers a list of basic artists' materials and tips for drawing spheres, mountains, mesas, and craters as well as other suggestions. He describes each step in the creation of 14 paintings, of varying degrees of difficulty, including the Earth as seen from the moon, a Jupiter cloudscape, ancient Mars, and a world with two suns. Carroll includes scientific background, including NASA photos, on the major formations and physical features of each image. ***Watson-Guptill, 2007, 144 p., b&w and color images, paperback, $24.95.***

HOW TO ORDER Visit *http://www.sciencenews.org/pages/books.asp* to order these books or others. A click on a book's title will transfer you to the Amazon.com bookstore. Sales generated through these links contribute to Science Service's programs to build interest in and understanding of science.

LETTERS

Cat scam?

Oscar the cat possibly does identify dying patients ("Grim Reap Purr: Nursing home feline senses the end," *SN: 7/28/07, p. 53*), but the story you printed presents anecdotal rather than scientific evidence and does not belong in a science magazine.

JULIE ENEVOLDSEN, SEATTLE, WASH.

Correlation is not causation. Could it not be that, somehow, Oscar the cat is killing these patients?

JAN STEINMAN, SALT SPRING ISLAND, BRITISH COLUMBIA

Bees' killer

In "Not-So-Elementary Bee Mystery" (*SN: 7/28/07, p. 56*), the researchers postulate six reasons for the collapse of the bee colonies. The reason, in my opinion, is evident when considering the extensive use of insecticides throughout the world.

WALLY MCMILLAN, PALO ALTO, CALIF.

Walk this way

A simpler explanation for orangutans walking upright like humans ("Red-Ape Stroll," *SN: 8/4/07, p. 72*) is that this feature evolved in a common ancestor that did not include African apes. In other words, orangutans, not chimpanzees, are our closest living relatives. This would make sense of all the similarities in sexuality, reproduction, physiology, anatomy, and behavior that are unique to humans and orangutans.

JOHN R. GREHAN, BUFFALO, N.Y.

Numbers game

It's certainly true that "[T]he most important factor that correlates with success in college is what is done in high school math" ("More math helps young scientists," *SN: 8/4/07, p. 78*). But is the headline true? How about, "More years of team basketball makes kids grow taller"? That's a strong correlation, too.

JOHN M. FLANIGAN, KANEOHE, HAWAII

While some self-selection certainly happens—the kids who take more math tend to be those who are more proficient at it—long-term trends show that as higher percentages of kids have taken more math, those same kids have been more likely to graduate from college. —D. CASTELVECCHI

Correction *The size of the hotspot on the extrasolar planet described in "Passages"* (SN: 7/14/07, p. 24)*, at 1.5 times Earth's diameter, should have been given as about 19,000 kilometers.*

SUBSCRIBE TODAY

AS LITTLE AS 94¢ PER ISSUE

WWW.SCIENCENEWS.ORG

1-800-552-4412

6 months (26 issues for only $1.05/issue).
1 year (52 issues for only $1.05/issue).
2 years (104 issues for only $.94/issue).

SOURCE CODE:
A02HR