

SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

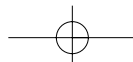
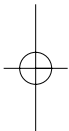
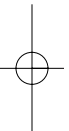
JUNE 28, 2003 PAGES 401-416 VOL. 163, NO. 26
SEMI-ANNUAL INDEX

clearer drinking water
a sexless existence
new plus for propecia?
justice, by the numbers

www.sciencenews.org

rugged sunscape

IMAGING THE SOLAR SURFACE

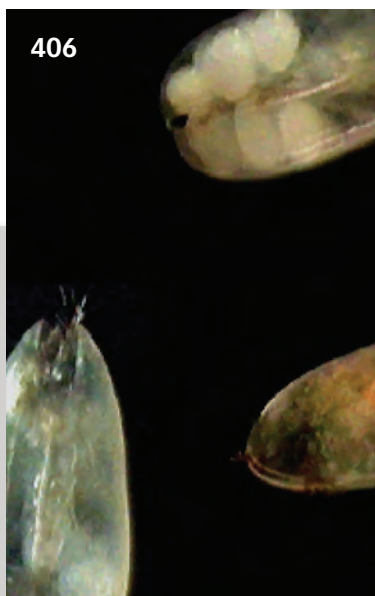


SCIENCE NEWS

JUNE 28, 2003 VOL. 163, NO. 26

Feature

406 Life without Sex So, how many millions of years has it been? by Susan Milius



This Week

- 403 New technology cleans dangerous water**
by Janet Raloff
- 403 Baldness drug might avert prostate cancer**
by Nathan Seppa
- 404 Revealing the sun's complex topography**
by Sorcha McDonagh
- 404 Warming trend affects African ecosystem**
by Sid Perkins
- 405 Novel structural model heals with heat**
by Jessica Gorman
- 405 Mathematicians judge the Supreme Court**
by Erica Klarreich

THIS WEEK ONLINE www.sciencenews.org

Drugfree McNuggets McDonald's new policy aims to reduce the feeding of antibiotics to healthy chickens, pigs, and cattle. See Food for Thought.

Theorems in wheat Crop-circle patterns suggest geometric theorems. See Ivars Peterson's MathTrek.

Of Note

- 408 Alaska in the ice age: Was it bluegrass country?**
Calling out the cell undertakers
African cicadas warm up before singing
Lead delays puberty

Departments

- 409 Semi-Annual Index**
- 415 Books**
- 415 Letters**

Cover An image of the eastern edge of the sun shows the three-dimensional structure of its granular surface. With 75-kilometer-resolution, this image—taken last year with the Swedish Solar Telescope in La Palma, Spain, and released last week—is among the sharpest pictures of the solar surface. (G. Scharmer and M. Löfdahl/Institute for Solar Physics, Royal Swedish Academy of Sciences) [Page 404](#)

SUBSCRIPTIONS
Subscribe to *Science News*
1 year only \$54.50.
Call 1-800-552-4412
or visit www.sciencenews.org.

A SCIENCE SERVICE PUBLICATION

PUBLISHER Donald R. Harless
EDITOR Julie Ann Miller
MANAGING EDITOR Keith Haglund
DESIGN/PRODUCTION DIRECTOR Eric R. Roell
PRODUCTION MANAGER Spencer K.C. Norcross
ASSOCIATE EDITOR Ivan Amato
SENIOR EDITOR/ENVIRONMENT/POLICY Janet Raloff
WEB EDITOR/MATHEMATICS Ivars Peterson
BEHAVIORAL SCIENCES Bruce Bower
ASTRONOMY Ron Cowen
BIOLOGY John Travis
BIOMEDICINE Nathan Seppa
LIFE SCIENCES Susan Milius
PHYSICS/TECHNOLOGY Peter Weiss
CHEMISTRY/MATERIALS SCIENCE Jessica Gorman
EARTH SCIENCE Sid Perkins
ENVIRONMENT/POLICY/HEALTH Ben Harder
MATHEMATICS CORRESPONDENT Erica Klarreich
SCIENCE WRITER INTERN Sorcha McDonagh
COPY EDITOR Linda Harteker
EDITORIAL ASSISTANT Kelly A. Malcom
EDITORIAL SECRETARY Gwendolyn K. Gillespie
WEB SPECIALIST Vernon Miller
BOOKS/ADVERTISING Cait Goldberg
SUBSCRIPTIONS Christina Smith
BUSINESS MANAGER Larry Sigler

BOARD OF TRUSTEES AND OFFICERS

CHAIRMAN Dudley Herschbach; VICE CHAIRMAN Robert W. Fri; SECRETARY David A. Goslin; TREASURER Frederick M. Bernthal; MEMBERS Jeanette Grasselli Brown; Samuel Gubins; J. David Hann; Shirley M. Malcom; Cora Marrett; Eve L. Menger; Mario J. Molina; C. Bradley Moore; Ben Patrusky; Anna C. Roosevelt; Vera Rubin; Willis Harlow Shapley; H. Guyford Stever; HONORARY BOWEN C. Dees; Elena O. Nightingale; Gerald F. Tape; John Troan; Deborah P. Wolfe
PRESIDENT Donald R. Harless
BUSINESS MANAGER Larry Sigler

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. Change of address: Two to four weeks' notice is required—old and new addresses, including zip codes, must be provided. Copyright © 2003 by Science Service. Title registered as trademark U.S. and Canadian Patent Offices. Printed in U.S.A. on recycled paper. ♻️
Republication of any portion of *Science News* without written permission of the publisher is prohibited. For permission to photocopy articles, contact Copyright Clearance Center at 978-750-8400 (phone) or 978-750-4470 (fax).

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 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 on the Web at www.sciserv.org.

SCIENCE NEWS

This Week

Germs Begone

New technology cleans dangerous water

An experimental mix of chemicals permits low-cost home treatment of highly contaminated water. The packet has been designed for use in developing countries, where some 5,000 children die each day from diarrheal disease—primarily because of poor sanitation and infected drinking water.

The new treatment turns even dark, foul-smelling, germ-laden water into a drink as clean as most U.S. tap water, says Stephen Luby of the Centers for Disease Control and Prevention in Atlanta. The chemicals' cost should run about a penny per liter of treated water, according to Greg Allgood of Procter and Gamble's Health Sciences Institute in Cincinnati.

During tests in Guatemala, Kenya, Pakistan, and Bangladesh, residents were instructed to stir a 4-gram packet of the chemicals into a 10-liter jug of river or other water for 5 minutes, until dirt and other suspended materials settled out. Villagers then filtered out the sediment by pouring the water through tightly woven cloth. Over the next 20 minutes, the water's residual chlorine bleach vanquished germs.

The first step of the method resembles the flocculation used to pull algae and their toxins out of seawater (*SN: 11/30/02, p. 344*).

Although bleach alone is a good disinfectant (*SN: 3/1/03, p. 136*), dirt and other organic gunk can chemically disarm it. By first removing organics with clay and ferrous sulfate, the mix reserves its controlled-release bleach until the water clears. Flocculation also removes many metals and other poisons, providing an added benefit over bleach treatment alone.

Philip K. Souter of Procter and Gamble in Newcastle-upon-Tyne, England, designed the mix, which enters the company's PUR line. The water-purifying mix is the company's first product intended for consumers in the developing world.

In the June *Journal of Water and Health*,



WHICH TO SIP? Some people drink organics-laden water (left three glasses) without boiling it. Treatment cleaned Kenyan dam water (leftmost) into clear, germfree water (rightmost).

Souter's team offers data on dirty water collected from sites around the world. The scientists spiked their samples with large quantities of pathogens, including 14 types of bacteria, 2 viruses, and 2 parasites. The PUR mix reduced bacterial loads to less than a hundred-millionth of starting concentrations, the viruses to less than a ten-thousandth, and the parasites to less than a thousandth of initial values. The flocculation also removed more than 99 percent of the naturally occurring arsenic in water from a Bangladesh well.

Final concentrations of these toxicants met World Health Organization guidelines for safe drinking water, Allgood notes. In unpublished studies, the PUR mix removed 95 percent of the DDT, at least 98 percent of lead, and more than 99 percent of chromium in water samples, Allgood told *ScienceNews*.

Last March, Luby and his colleagues reported in the *Journal of Water and Health* that in a Guatemalan test, the PUR mix disinfected the fairly clear local water as well as bleach alone did. However, Luby says that the mix's sedimentation of what had been barely detectable pollution offered a visual sign of the treatment's activity. This encouraged many villagers to stick with the treatment long enough to see a decrease in diarrheal disease. In unpublished work, Luby's group measured a 40 percent reduction in diarrheal disease among households tested over a 4-month period. —J. RALOFF

Prevention in a Pill?

Baldness drug might avert prostate cancer

The drug finasteride plays a curious dual role: It can help a man grow back thinning hair and also alleviate urinary problems. The drug achieves both effects by ratchet-

ing down production of dihydrotestosterone, a hormone linked to male pattern baldness and enlargement of the prostate.

Researchers funded by the National Cancer Institute now report that finasteride also prevents some cases of prostate cancer. Merck and Company of Whitehouse Station, N.J., markets finasteride as Proscar for prostate problems and, in a lower dose, as Propecia for baldness. The company has not announced whether it will ask the Food and Drug Administration to approve finasteride for prevention of prostate cancer. Some cancer specialists, however, doubt that the drug will have widespread value in protecting men against the disease.

In 1994, researchers began recruiting healthy men over age 55 who showed no signs of prostate cancer in physical examinations and blood tests. The scientists randomly assigned 18,882 men to receive a daily finasteride pill or a placebo.

During the trial, the men underwent annual examinations and blood tests, which were followed by biopsies when warranted. The biopsies revealed cancers among 571 men in the placebo group but only 435 of those getting finasteride, reports Ian M. Thompson of the University of Texas Health Sciences Center in San Antonio.

The researchers combined those data with results of biopsies of seemingly healthy men as they reached the end of their 7-year participation in the study. The biopsies turned up hundreds of hidden cancers in both groups. Overall, 18.4 percent of 4,368 men who had taken finasteride and 24.4 percent of 4,692 men getting the placebo were diagnosed with prostate cancer. However, aggressive forms of prostate cancer showed up in 6.4 percent of men on finasteride and in only 5.1 percent of those taking the placebo.

The apparent overall benefit of finasteride led an independent oversight panel to stop the study 15 months early, before the remaining men underwent a biopsy, says Phyllis J. Goodman of the Fred

SCIENCE NEWS

This Week

Hutchinson Cancer Research Center in Seattle. The findings will appear in the July 17 *New England Journal of Medicine* (*NEJM*).

“This is the first intervention that is proven to reduce a man’s risk of prostate cancer,” Thompson says.

Some scientists argue that the findings don’t warrant the drug’s use as a preventive treatment. John D. McConnell of the University of Texas–Southwestern in Dallas notes that doctors did cancer biopsies at the end of the study but not at the start. So, some men might have had microscopic prostate tumors all along, he says. While finasteride might have kept some hidden cancers in check, assessing the drug’s protective effect is difficult when the volunteers’ original cancer status is uncertain.

“I would be very cautious about recommending finasteride to a patient purely to lower prostate cancer risk,” says McConnell.

Furthermore, “the study results suggest that finasteride may accelerate the growth of high-grade [aggressive] cancers,” says Peter T. Scardino of the Memorial Sloan-Kettering Cancer Center in New York, writing in the same issue of *NEJM*. The drug could limit cancers dependent on dihydrotestosterone but give other cancers a competitive advantage, he says. —N. SEPPA

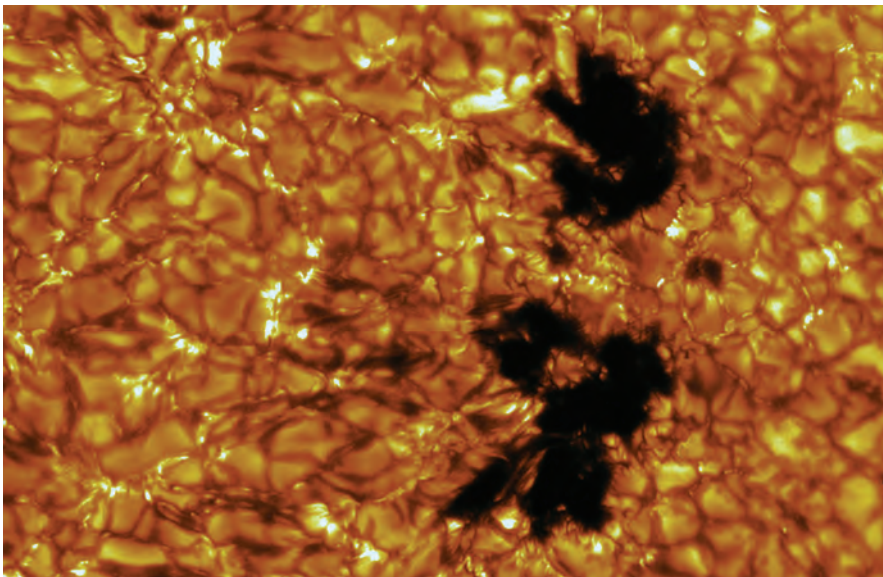
Solar Terrain

Revealing the sun’s complex topography

The sun is no smoothie. The sharpest images of the sun ever taken, released last week, show a rugged surface with gargantuan mesas and valleys formed of scalding gas.

The sun’s surface is textured with short-lived structures, known as granules, each as big as Texas. “Up until now, we saw granules as flat pancakes with no apparent height or detailed structure,” says lead researcher Tom Berger of Lockheed Martin in Sunnyvale, Calif. The new images, captured with the Swedish Solar Telescope in La Palma, Spain (*SN: 11/16/02, p. 310*), show some granular structures that are about 300 kilometers high, while the smallest discernible features are 70 kilometers across.

Berger and his colleagues presented the images in Laurel, Md., at the annual meeting of the American Astronomical Society’s Solar Physics Division. By training the telescope on the edge of the sun, the research-



SCORCHING BREW These beads are vast gaseous granules on the sun’s surface. A granule lasts 6 to 10 minutes. Among the granules are sunspots (dark patches) and faculae (bright areas).

ers depicted the three-dimensional topographies of the granules, which last 6 to 10 minutes.

Some of these structures are molded by the sun’s powerful magnetic field. By studying the features up close, solar physicists may learn how the magnetic field works and how it boosts or dims the sun’s brightness as observed from Earth, Berger says. This is significant, he adds, because changes in brightness may affect Earth’s long-term climate patterns.

The sun’s magnetic activity waxes and wanes in an 11-year cycle. It’s most frenzied during the so-called solar maximum, when the sun is mottled with dark sunspots—regions of intense magnetic force that lie like vast potholes on the sun’s surface. Until 20 years ago, solar physicists thought sunspots would diminish the sun’s brightness. Instead, they found the opposite situation. They attributed the increase in brightness to an increased abundance of what they call faculae—Latin for “little torches”—small, brilliant structures distributed among the granules.

In the new images, the faculae look like towering walls. This is a surprise, Berger says, because most solar physicists model the faculae as tubes sunken into the solar surface. If the faculae loom above the surface, they could radiate light efficiently, thereby boosting the sun’s overall brightness, especially during the solar maximum.

But Berger says the images aren’t conclusive. For example, the solar atmosphere may be distorting the view, making valleys look like peaks, or vice versa.

As one step toward a clearer image, he plans to use a telescope in orbit around Earth to avoid the distorting effects of the planet’s atmosphere.

“We’re finding that the sun is a fascinating place,” says Craig DeForest, who stud-

ies the solar atmosphere at the Southwest Research Institute in Boulder, Colo. “It has a collection of systems that are every bit as complicated as the systems we have on Earth.” —S. MCDONAGH

Slow Turnover

Warming trend affects African ecosystem

Over the past 90 years, rising water temperatures in Lake Tanganyika have dramatically reduced populations of the aquatic microorganisms at the base of the lake’s food chain, a new analysis shows.

More than 650 kilometers long and up to 50 km wide, Lake Tanganyika is by volume the world’s second-largest body of fresh water, surpassed only by Russia’s Lake Baikal. Lake Tanganyika winds through southeastern Africa’s Great Rift Valley and in spots is more than 1 km deep.

Although dissolved nutrients are scarce in the lake’s shallow waters, they’re abundant in waters so deep that there’s no plant life to consume them. Therefore, near-surface microbes such as phytoplankton depend largely on the upwelling of nutrient-rich waters, says Piet Verburg, a marine biologist at the University of Waterloo in Ontario.

This water movement is often driven by winds that sweep surface waters away from shore, allowing underlying water to rise. That sort of mixing, however, has been stifled in recent years by lake warming.

Since 1913, the average temperature at the bottom of the lake’s north basin has risen by about 0.2°C, but water only 100 meters below the surface has warmed about 0.9°C. Because warm water is less dense than cool water, the increasing tempera-

BERGER/LOCKHEED MARTIN SOLAR AND ASTROPHYSICS LAB.

ture spread has made it more difficult for the underlying nutrient-rich water to upwell, says Verburg.

This decline in circulation has affected populations of aquatic microbes, especially in the past few decades. Biomasses of several plankton species measured in spring of 2001 and summer of 2000 averaged only 30 percent of those tallied during spring and summer of 1975, says Hedy Kling of the Freshwater Institute in Winnipeg, Manitoba. She, Verburg, and Robert E. Hecky of the University of Waterloo report their findings in an upcoming *Science*.

Although dramatic, the slump in phytoplankton populations isn't unprecedented, according to analyses of Lake Tanganyika sediments. Since the last ice age, there's been at least one extended period—between 4,000 and 2,400 years ago—when the lake's plankton productivity declined even below today's measure, says Simone Alin of the University of Minnesota in Duluth. —S. PERKINS

Easy Repair

Novel structural model heals with heat

The capacity of biological tissues to heal after being wounded is one of their most enviable traits. In recent years, materials scientists have been trying to emulate this capability by developing synthetic self-healing or easily mendable materials for products ranging from aerospace parts to athletic gear (*SN*: 2/17/01, p. 101).

Now, Mila Boncheva and George Whitesides of Harvard University are tapping the vertebral spine for inspiration. Using millimeter-scale polymer beads for vertebrae and thin elastic threads for muscles and ligaments, the researchers have created spinelike structures that can deform drastically, even become damaged, yet still return to their original forms. The researchers describe two of these structures in the June 16 *Angewandte Chemie International Edition*.

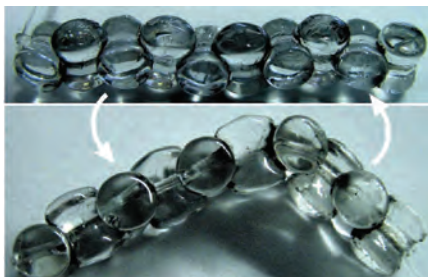
"I've never seen anything like it," comments Richard Syms of Imperial College in London.

To make one of the structures, Boncheva and Whitesides strung 10 hourglass-shaped beads on an elastic thread, which they knotted tightly. The thread exerted compressive forces on the beads, which lined up perpendicular to one another, their waists snugly meshing. Each bead had a small patch of low-melting-point solder on each side of its waist, and these patches bonded the beads into a solid structure.

When part of the chain of beads was held on a surface, it supported around 250 grams—roughly the weight of two sticks of

butter—applied at the other end. With more weight, one of the soldered joints gave out. Gentle shaking in a beaker of warm water realigned the chain. After the solder cooled and hardened, the researchers could repeat the breaking and reforming process.

To make their second structure, Boncheva and Whitesides strung the beads and knotted the ends of the string, then attached each end to a support 1 centime-



A GOOD BREAK A spinelike string of millimeter-scale beads (top) yields to an applied weight, but the damaged structure (bottom) returns to its original structure after it's heated and shaken.

ter from the end beads. The resulting tensile forces on the beads mimicked those in a traction splint, which is sometimes used to hold fractured bones in place. When a solder joint broke, this system required only heating—no shaking—to re-form.

"It's a clever system," says Richard Wool of the University of Delaware in Newark. It could prove useful for designing vehicle-escape panels, car windshields, or even impact-resistant military-tank parts that could regain their original shape when heated, he speculates.

Although they're not yet sure how to do it, the researchers aim to scale down their system using micro- or even nanoscale parts to replace the beads, solder, and elastic thread, says Boncheva. With such miniaturization, researchers might use this strategy for installing healing properties into materials' internal microstructures. —J. GORMAN

Ideal Justice

Mathematicians judge the Supreme Court

The U.S. Supreme Court—already in the news this week for its decisions on affirmative action—is highlighted in a scientific journal. The court is driven by politics far less than Congress is, a new analysis suggests.

Lawrence Sirovich, a mathematician at Mount Sinai School of Medicine in New York City, calculated that the current Supreme Court of nine judges behaves as if it were made up of about 4.68 "ideal" judges—adjudicators who make their decisions completely independently of each

other. To put that figure in perspective, Sirovich says, a court with a strict liberal-conservative divide would behave as if it had only one judge because all decisions would be determined purely by which faction made up the majority.

"The analysis shows that there is a great deal of independence among the justices," he says. Sirovich reports his findings in the June 24 *Proceedings of the National Academy of Sciences*.

In contrast, earlier studies of the U.S. Congress by political scientists Keith Poole of the University of Houston and Howard Rosenthal of Princeton University confirmed the conventional wisdom that members of Congress usually vote along fairly strict party lines.

Sirovich's approach strips the legal content from the decisions, whereas previous studies of the Supreme Court have often been driven by preconceptions, says law professor Yochai Benkler of New York University. "This is a novel mode of analysis that is innocent of hypotheses and simply looks at what is," he says.

To assess judicial independence, Sirovich examined the Supreme Court's rulings over the past 8 years in light of a measure of information content developed in the 1940s by mathematician Claude Shannon. Roughly, the more independent the judges, the less predictable their rulings, so the greater the information contained in each ruling.

Coalitions drive down the number of ideal judges. "Suppose we have two judges who always vote the same way," Sirovich says. "Then, from the point of view of information, we have eight justices, not nine."

During the past 8 years, Justices Antonin Scalia and Clarence Thomas voted the same way more than 93 percent of the time, and Justices Ruth Bader Ginsburg and David Souter voted the same way more than 90 percent of the time. The fact that the number of ideal judges is as high as 4.68 is encouraging, Sirovich says.

Sirovich's work is an interesting analysis, Poole says. However, he cautions, many other studies suggest that the justices are heavily swayed by political viewpoints. "Only about 9 percent of their choices aren't explained by a simple liberal-to-conservative ordering," he says. "The court is very ideological."

Benkler says that, from Sirovich's analysis, it's clear that "judges do a whole lot more than follow the party line. But particular judges with particular worldviews do align."

In the new work, Sirovich applied the pattern-analysis techniques that he had used previously to study turbulent fluid flow, face recognition, and the structure of the brain.

"That's what tickled me most about this paper," says mathematician Steven Strogatz of Cornell University. "The beauty of mathematics is in realizing that some things are the same problem, even though they don't appear to be." —E. KLARREICH

LIFE WITHOUT SEX

So, how many millions of years has it been?

BY SUSAN MILIUS

In barstool speculation on how long it's possible for someone to survive without sex, the phrases "old fossil" and "a million years" certainly do turn up. However—meaning no disrespect to snubbed *Homo sapiens*—our species doesn't even register in the scientific version of the debate. In this, there are genuine geologic fossils. And a million years? Forget it. The species attracting interest now look as if they may not have had sex for tens, or even hundreds, of millions of years.

Yes, there really is a scientific version of the barroom lament, and it's a serious inquiry. Biologists have long held that asexuality is an evolutionary dead end because sex purges the genes of detrimental mutations, provides the genetic variation for coping with environmental change or both. But new methods of genetic analysis are suggesting that certain groups of species have avoided sex and still have done quite well over the eons, thank you very much.

"The question of 'Why sex?' is a very central one to biology," says David Mark Welch of the Marine Biological Laboratory in Woods Hole, Mass.

Three years ago, Mark Welch and Matthew Meselson of Harvard University reported genetic evidence that an entire class of organisms, containing 360 species, seems to have evolved perfectly well without sex. This group of tiny water creatures, called bdelloid rotifers, is thriving in fresh water and soggy land worldwide despite, seemingly, no sex for at least 40 million years.

Since that publication, geneticists and paleontologists have been focusing their most advanced methods on questions of asexuality. The scientists are refining tests that detect sexuality and searching for other celibate lineages.

SEX SIGNS So far, biologists have found some 2,000 living species in which they haven't seen a trace of sexual behavior. Yet keen-eyed study has, on occasion, dashed many previous claims of asexuality. A living insect species once thought not to have male forms, for example, turned out to include males that were perfectly functional but very, very tiny.

Biologists have mused that there might be something funny about the sexual history of bdelloid rotifers, one of the classes of a phylum of little stalk-like water animals crowned with a characteristic circle of hairlike cilia. The father of microscopy, Antonie van Leeuwenhoek, wrote about them some 300 years ago. They may be only 0.1 to 1 millimeter long, but they have differentiated parts, such as nerve ganglia, muscles, light-sensitive structures, digestive organs, and ovaries.

Those ovaries make eggs, but by an unusual means. In sexual organisms, gonads split the genome in half when making eggs and sperm. The ovaries in bdelloid rotifers, however, create eggs containing the full genome. These eggs require no sperm to develop into adults that are essentially genetic copies of their mothers.

The fossil record so far hasn't said much about the history of bdelloid rotifers—only that some specimens found in amber dating from 35 to 40 million years ago didn't include any obvious males.

To explore bdelloid history further, Meselson and Mark Welch looked at modern rotifers. No males have turned up in the whole bdelloid group, suggesting a long evolutionary history of asexuality. For a genetic test, the researchers proposed that one distinctive sign of millennia without sexual reproduction might be a pattern of abundant variability between copies of genes.

The researchers focused on versions of the same gene in different species. They reported in 2000 that the two copies of the gene in the asexual species differ from each other far more than do copies of genes in rotifers that evolved with sexual reproduction (*SN*: 5/20/00, p. 326). The simplest explanation of the patterns, the researchers contended, was that in the asexuals, there had been no reshuffling of the genome, as occurs during sex, so an individual rotifer's two copies of a gene had each had plenty of time to independently build up quirky mutations.

TESTING, TESTING After the unveiling of the bdelloid oddity, researchers threw themselves into testing more predictions about the genetics of asexuality.

Meselson and Irina Arkhipova, a geneticist in his lab, looked at the bdelloid pattern of transposable elements. These snippets of



MOM STILL CARES — A composite image of adult females of a common darwinulid ostracod, each one carrying various numbers of eggs or juveniles at the rear of her millimeter-long outer covering. Scientists wonder how the species of organisms like these persist for eons without sex.

genetic material shoehorn themselves into a variety of spots in a host's DNA. Such pushiness can secure an element's place in subsequent generations, but it can also mess up the gene in which it lands. Arkhipova refers to transposable elements as sexually transmitted parasites.

Two decades ago, a theorist predicted that a species that changed from sexual to asexual reproduction would lose transposable elements because clones without disadvantageous insertions would persist longer than clones bearing such elements.

To explore this prediction, Arkhipova and Meselson surveyed genetic sequences from representatives of 24 phyla of animals, including the lab fruit fly *Drosophila melanogaster*, the tiny lab worm *Caenorhabditis elegans*, and the waterborne pathogen *Giardia lamblia*. Traces of two large families of transposable elements that copy themselves and proliferate when a species reproduces sexually showed up in most of the animals but not in the bdelloid rotifers, the researchers reported in 2000.

Signs of a different kind of transposable element, called mariner-like elements, did show up in the bdelloids as well as many other organisms. There's evidence that these elements can somehow proliferate without sex. Also, Arkhipova says, they're not as damaging as the other two element families are to the neighbors of the gene where they intrude. The pattern observed among these three families of transposable elements strengthens the case that bdelloids evolved asexually, says Arkhipova.

Mark Welch and Meselson tested another genetic prediction about asexuality. Some scientists had speculated that asexual species would accumulate more mutations than sexual species do because the genetic reshuffling of sexual reproduction allows some offspring to escape genetic typos.

Mark Welch and Meselson addressed this notion by comparing sequences of a gene in bdelloids with its counterpart in sexual rotifers. Contrary to the theory, though, the sexual rotifers showed about the same abundance of glitches in the gene, the researchers reported in the May 29, 2001 *Proceedings of the National Academy of Sciences*.

WHO'S NEXT? Now that biologists regard asexuality as being as interesting as sexuality, researchers are looking for examples among creatures as varied as clams, mites and fungi.

One tantalizing case comes from the work of Ian Sanders of the University of Lausanne in Switzerland and his colleagues. They study arbuscular mycorrhizae, a group of Glomales fungi that buddy up with plant roots for mutual nutritional benefit. These fungi have been proposed as ancient asexuals, but figuring out how to make sense of the fungi's genomes is tricky. For example, an individual fungus can receive hundreds of nuclei from its parents.

A more emphatic claim for ancient asexuality comes from researchers studying the widespread fossils of millimeter-long crustaceans called darwinulid ostracods. Most biologists who study the extant populations agree that they're asexual. As paleontologist David Horne of the Natural History Museum in London recalls events, "Other people were making all those flamboyant claims about bdelloid rotifers, and we said, 'Hang on a minute.'"

The paired outer shells of fossilized darwinulid ostracods turn up by the thousands in ancient lake sediments around the world, so these species offer the unusual advantage of a potential asexual

with an abundant fossil record.

Extant ostracods range widely throughout salt and fresh water and include lineages that certainly do have sex. "They are renowned for their rather large [male] copulatory organ," says Horne. The complex paired appendages can take up as much as a third of the volume of the whole animal. Sperm in one freshwater species can be up to 15 millimeters long, losing out to only water bugs for the title of world's longest sperm.

Some female ostracods, including darwinulids, care for their brood, carrying the youngsters in a bulge at one end of the adult's protective, paired shells. Thus, the relatively large female shells show a bump at one end and other asymmetries.

Among the darwinulid ostracods, all available modern specimens show these motherly characteristics. There was a 19th-century report of a male, lacking the bulge, in a common extant species of darwinulid. But Horne has been unable to locate that specimen, and no researcher has reported a male since then.

Fossil darwinulid ostracods have been more controversial because it's difficult to agree on what would represent subtle differences between the sexes. Yet, a systematic review of fossils shows no evidence of males for at least 200 million years, Horne and his colleagues argue in the April 7 *Proceedings of the Royal Society of London B*.

Ostracods have very different genetic characteristics from those

of bdelloids, says Isabelle Schön of the Royal Belgian Institute of Natural Sciences in Brussels. She and her Brussels colleague Koen Martens started analyzing darwinulid ostracod genes as part of a European multicenter research project during the mid-1990s. Schön and Martens wondered whether they'd find the extra variation between copies of an individual's genes that's been observed in bdelloids, what's now sometimes called the Meselson effect.

"We saw the opposite," Schön says. The genes showed remarkably little variation. "It was a very puzzling surprise," she recalls. In the April 22 *Proceedings of the Royal Society of London B*, she and Martens report on three genes that have far less variety compared with counterparts in a sexual ostracod species.

This finding hasn't made ostracod scientists doubt that the darwinulids evolved asexually, but it has inspired speculation on why these organisms seem to have been spared the need for sex. Last year, the Schön-Martens group argued that a representative species, *Darwinula stevensoni*, has "a general-purpose genotype." It can grow in distilled water, seawater, and every salinity tested in between, the researchers say in the July 2, 2002 *Oecologia*. It copes with temperatures from 10°C to 30°C. With a genome flexible enough to do all that, maybe actual variation in the genes isn't as important as it is in many other organisms.

The ancient asexuals then, if they really are asexuals, are giving mixed results for the theories explaining sex. Bdelloids seem to be getting rid of menacing transposable elements, but so far as biologists know, don't seem bothered by an abundance of other mutations. This undermines the view that mutation buildup is a major problem solved by sex.

The darwinulid ostracods show a different genetic pattern, with extreme uniformity instead of bdelloids' rampant variation. These ostracods may get their environmental flexibility from a route other than variation in genes fostered by sex.

Clearly, science won't resolve the barstool speculation any time soon. ■



ANCIENT ASEXUAL — Geneticists argue that this bdelloid rotifer's ancestors stopped having sex perhaps as long ago as 80 million to 100 million years ago.

OF NOTE

PALEOBIOLOGY

Alaska in the ice age: Was it bluegrass country?

At the height of the last ice age, northern portions of Alaska and the Yukon Territory were covered with an arid yet productive grassland that would have supported an abundance of large grazing mammals, according to a new analysis of fossils from the region.

Botanical species in this ancient ecosystem included sagebrush, bluegrass, sedges, and herbs. That's a combination unlike any on the arctic tundra today, says Charles E. Schweger, a paleoecologist at the University of Alberta in Edmonton.

Previous studies of the region's fossil pollen came up with a similar botanical mix, but some scientists questioned those analyses because pollen grains can waft long distances on the wind. Schweger and his team, who published their findings in the June 5 *Nature*, analyzed fossilized plant parts from three sites in the Yukon. Some of the specimens came from a 24,000-year-old rodent nest, and others were preserved in a 26,000-year-old peat deposit that also held mammoth remains.

Although average temperatures in the region probably were around 6°C cooler than today, a dearth of precipitation precluded the formation of large volumes of permafrost, says Schweger. Therefore, he and his coworkers surmise, soil nutrients were more readily available to plants that in turn supported many mammoths, bison, horses, and camels. —S.P.

BIOLOGY

Calling out the cell undertakers

Millions of cells die naturally each day in a person. Scientists have now discovered that these dying cells send out a chemical signal to attract other cells that specialize in disposing of cellular corpses.

Over the past few years, biologists have begun to understand how macrophages and other cells recognize dying cells. For example, a cell about to die sprouts what scientists refer to as eat-me signals, which tell a

macrophage to consume the cell before it falls apart and triggers inflammation (*SN*: 9/28/02, p. 202).

But what if there is no macrophage close at hand to a dying cell? No problem, say Sebastian Wesselborg of the University of Tübingen in Germany and his colleagues. In the June 13 *Cell*, they report that dying cells from monkeys, mice, and people secrete a molecule called lysophosphatidylcholine. Previous research showed that the chemical attracts macrophages and other immune cells that may be some distance away. This lure ensures that dying cells are removed efficiently, Wesselborg's group concludes. —J.T.

ZOOLOGY

African cicadas warm up before singing

The first study of how African cicadas keep themselves warm enough to sing shows that they depend on muscle power much more than North and South American cicadas do.

When most Western Hemisphere cicadas get chilly, they move to a sunny spot and bask, explains Allen F. Sanborn of Barry University in Miami Shores, Fla. Males, in particular, need to keep warm so they can sing to win mates.

Sanborn and other scientists, however, have found a few cicadas in North and South America with a backup plan. When sunlight is hard to come by, these cicadas warm themselves by clenching their flight muscles.

By measuring the insect's body temperatures under various environmental conditions, Sanborn and his colleagues determined whether a cicada uses these large muscles to warm up.

In an upcoming *Naturwissenschaften*, the researchers describe such experiments with African cicadas of the genus *Platypleura*. Three of the species tested were primarily self-warmers and one was a sunbather, the scientists found. Unpublished data identify even more self-warming *Platypleura* species. This abundance of self-warming species in one cicada genus is unusual, Sanborn says.

Self-warming isn't a strategy to undertake lightly, says Sanborn. Adult cicadas

don't get much energy from the plant sap they suck, so a muscle surge depletes their reserves and can shorten their lives.

The self-warming African species often sing at dusk, a chilly hour but one with fewer predators around than during daytime. Most unusual, says Sanborn, are the cicadas that rely on muscle heat even in daylight. They seek shade, Sanborn says, a tactic that also could protect them from predators. —S.M.

ENVIRONMENT

Lead delays puberty

In children, even trace residues of lead can wreak harm. One recent study reported evidence of IQ deficits in children with blood concentrations of the metal below 5 micrograms per deciliter ($\mu\text{g}/\text{dl}$) (*SN*: 4/26/03, p. 269), an amount found in 90 percent of U.S. kids. Now, epidemiologists have turned up evidence that similarly low lead concentrations delay puberty in girls.

Tiejian Wu of East Tennessee State University in Johnson City and his colleagues correlated signs of puberty in a nationally representative sample of 1,700 girls, ages 8

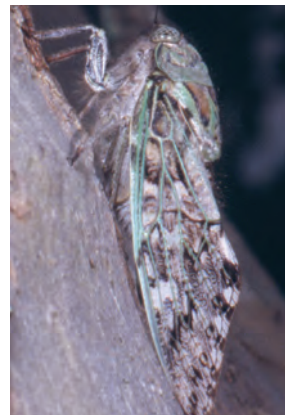
to 16, with the kids' blood-lead concentrations. The data came from a federal health and nutrition survey of the U.S. population.

Wu's group divided girls at each age into three groups on the basis of blood-lead concentrations: under 2 $\mu\text{g}/\text{dl}$, at least 5 $\mu\text{g}/\text{dl}$, or somewhere between those values. Among 10-year-olds, the share with pubic hair was 60 percent in the group with the lowest lead levels, 51 percent in the middle group, and just 44 percent in those whose blood concentrations were 5 $\mu\text{g}/\text{dl}$ or higher. By age 12, 68 percent in the lowest group had reached

menarche compared with 38.5 percent in the group with the highest blood-lead concentrations. No firm link between blood lead and breast development emerged.

Wu says his team is now looking for evidence of a similar lead-linked slowing of reproductive maturation in boys.

The new findings, reported in the May *Environmental Health Perspectives*, are consistent with earlier animal data. Wu says they suggest that children can suffer significant development impacts at lead concentrations well below 10 $\mu\text{g}/\text{dl}$ —the threshold for what's deemed "elevated" by the federal government. —J.R.



FEEL THE BURN One of the African *Platypleura* cicadas, a group that depends mostly on muscle power for warmth.

Science News Index

Vol. 163, Nos. 1-26, January-June 2003, pp. 1-416

A

- Abel, Tom 214
 Abortion 174
 ACE inhibitors *See* Angiotensin converting enzyme inhibitors
 Acetylcholine 184
 Acetyltransferase 102
 Acids 148
 Acoustics 168
 Acrylamide 84
 Adams Jr., Reginald B. 397
 Adaptive optics 373
 Adenoviruses 349
 Adey, W. Ross 115
 Adhesives 356
 Adolescents 20, 36, 77, 149, 270
 Adolph, Karen E. 380
 Afghanistan 118
 Africa 371
 Aggression 102
 Aging 184, 222, 260, 296, 372
 Agriculture 67, 100, 126, 389
 AIDS 173, 237
 AIDS vaccines 133
 Air pollution 166, 334
 Aircraft 20, 168
 Akal, Tuncay 169
 Alaska 206
 Alavanja, Michael 291
 Alcock, Ruth E. 134
 Alcohol 155
 Alford, Bernadette 59
 Algae 61, 196, 364, 365
 Align, C. Andrew 222
 Ailin, Simone 405
 Allivisatos, A. Paul 107
 Allen, Richard M. 276
 Allergies 163
 Allgood, Greg. 403
 Alligators 203
 Alloys *See* Metal alloys
 Alpacas 26
 Alpha decay 286
 ALS *See* Amyotrophic lateral sclerosis
 Altman, David 187
 Alzheimer's disease 211, 341
 Amann, Kerstin 19
 Amemiya, Shonan. 19
 Americas, early civilizations 126, 302
 Amino acids 53
 Ampullae 68
 Amygdala 54, 397
 Amyotrophic lateral sclerosis 310
 Anagnostakis, Sandra 284
 Anderson, Adam K. 54
 Anderson, N. Leigh 171, 172
 Anderson, Norman G. 171, 172
 Andersson, Malte 212
 Androgen deficiency in aging males 296
 Andromeda galaxy 291
 Andropause 296
 Anemia 13, 109
 Anesthesia 87
 Aneuploidy 213
 Angiogenesis 344
 Angioplasty 126, 389
 Angiotensin converting enzyme inhibitors 189
 Animals, communication 330
 Anseth, Kritis S. 261
 Antarctica 149, 220, 292, 314
 Anthrax 116
 Arthropods 180
 Anti-thymocyte globulin 29
 Antibiotics 78, 390
 Antibodies 163
 Antidepressants 77
 Antioxidants 141, 238
 Ants 134, 190
 Anyons 124
 Apes 115
 Apoptosis 408
 Archaeobacteria 264
 Archaeology 157
 Archaea 366
 Arctic 29, 69, 189
 Argo float 75
 Arkhipova, Irina 406
 Arkin, Adam 267
 Arms, Steven 230
 Arroyo, Ernesto 280
 Arsenic 342
 Art 346
 Artificial insemination 381
 Asbestos 263, 350
 Asexuals 406
 Ashworth, Allan C. 292
 Asperger's syndrome 212
 Assisted reproductive technology *See* Infertility
 Asymmetric dimethylarginine 293
 Atherton, Michael 93
 Atkeson, Thomas 72
 Atkins, Robert C. 89
 Atomic physics *See* Particle physics
 Atrazine 120
 Atresia 334
 Atrial fibrillation 21
 Attention 94, 222
 Attention-user interfaces 279
 AuBuchon, James P. 60
 Augsburg, Larry L. 360
 Aum Shinrikyo 116
 Australia 173
Australopithecus 261, 302, 349
 Autism 212
 Autoimmune diseases 278
 Autonomous Underwater Vehicles (AUVs) 75
 Awschalom, David D. 118
 Axel Heiberg Island 317
 Ayasse, Manfred 67
- ## B
- Baba, Hisao 132
 Babbling 357
 Babcock, Donner F. 196
Bacillus thuringiensis 85
 Backe, Harmut. 349
 Bacteria 53, 78, 344, 366, 390
 Baer, David J. 156
 Bahcall, John N. 99
 Bakken, George 388
 Baldness 404
 Baldwin, James M. 332
 Ballistics 23
 Ballou, Susan M. 25
 Banack, Sandra 310
 Barber, Iain 166
 Bar codes 94
 Barkana, Rennan 51
 Barker, Juliet N. 14
 Barnard, Neal 89
 Barnes, John 299
 Barrett, Craig 70, 165
 Barsoum, Michel W. 141
 Bartoshuk, Linda 142
 Basson, Marc 142
 Bats 173, 310
 Batteries 388
 Baughman, Ray 133, 275, 372
 Baumeister, Roy F. 365
 Bdelloid 406
 Becher, Mark W. 102
 Beebe, David 102
 Beebe, Reta F. 357
 Beer 155, 157
 Bees 45, 190, 324
 Begelman, Mitchell C. 214
 Behr, Jean-Paul 44
 Behrensmeier, Anna K. 302
 Beldade, Patricia 104
 Bellingham, James G. 76
 Bender, Michael T. 73
 Benkler, Tochai 405
 Bennett, Charles L. 99
 Bennett, Peter 228
 Bennison, Stephen J. 261
 Berger, Sarah E. 380
 Berger, Tom 404
 Berlin, Gordon L. 150
 Berman, Phillip 134
 Bernaudin, Françoise 30
 Bernhard, Joan M. 265
 Bernstein, Peter S. 371
 Bertorelle, Giorgio 307
 Bertram, Douglas E. 153
 Bertranpetit, Jaume 91
 Beryllium 62
 Bevacizumab 358
 Bicknell, William J. 218
 Big Bang 387
 Biggs, Douglas C. 375
 Biodiversity 228, 323
 Bioengineering *See* Genetic engineering
 Biological warfare 285, 362
 Biosolids 205
 Biotechnology 141, 267
 Bioterrorism 116, 218
 Bipolar disorder 20
 Birds 102, 182, 203, 206, 212, 228, 269, 355
 Birth defects 155
 Bismuth 286
 Bisphenol A 120, 213, 334
 Black holes 14, 51, 180, 214, 317, 394
 Blackman, Roger 20
 Blindness 158
 Blomberg, Richard D. 83
 Blood 52, 59, 77, 101, 126, 171, 270
 clots 37, 38, 77
 pressure 5, 19, 68, 189
 sugar 158
 transfusions 253
 vessels 147, 270
 Blood-brain barrier 115
 Bloomfield, Frank H. 333
 Bloomfield, Louis A. 174
 Bluestone, Jeffrey A. 281
 Blumenschine, Robert J. 131
 Blumer, Evan 27
 Bockenbauer, Ron 282
 Body heat 388
 Body wraps 253
 Boehlert, Sherwood 86
 Boehlert, George W. 70
 Boetius, Antje 265
 Boggs, Carol 106
 Bogosavljevic, Milan 52
 Bogucki, Peter 67
 Boles, Larry 4
 Bolometer 286
 Bonacic, Cristián 27
 Boncheva, Mila 405
 Bond, Howard 252
 Bone marrow 29, 54
 Bones 52, 261, 309
 Bonow, Robert 90
 Booth, Alan 36
 Borden, Sherrie L. 361
 Borg, Scott 220
 Borozdin, Konstantin N. 179
 Bourgeron, Thomas 212
 Bowler, James M. 173
 Bowling, Gary L. 101
 Boyd, Robert W. 252
 Bozette, Samuel A. 220
 Bradley, Albert M. 76
 Brady, David J. 200
 Brain 4, 8, 14, 37, 54, 92, 94, 102, 115, 179, 205, 206, 245, 324, 330, 397
 imaging 14, 30, 173
 Brakefield, Paul 104
 Brand, Vance D. 215
 Brand-Miller, Jennie 88
 BRCA genes 398
 Bread 84
 Breastfeeding 142
 Breathing 8
 Brehm, Bonnie J. 88
 Brenner, Barry M. 19
 Brenner, David J. 245
 Brenner, Ruth A. 62
 Breuker, Casper 105
 Brevetoxin 364
 Brigham, John C. 251
 Bril, Blandine 235
 Brodie, Ed 12
 Bromine 72
 Brown, Brandon 68
 Brown, Paul 340
 Brown, Sally 205
 Brown, Simon G.A. 252
 Brown, Tom 291
 Brown, W. Ted 260
 Brownell, Philip 52
 Bruford, Michael W. 27
 Brunner, Bryan 11
Bt See Bacillus thuringiensis
 Bubbles 189
 Buckholtz, Neil S. 211
 Budowle, Bruce 117
 Bullets 23
 Bureau of Alcohol, Tobacco and Firearms 23
 Burgett, Jeff 205
 Burrows, Adam S. 38, 164
 Butterflies 104
 Butylate 291
 Buzsáki, György 94
- ## C
- Caffeine 5, 11
 Cahn, Robert W. 309
 Calcium 100
 Caldwell, Robert R. 148
 Camels 26
 Cameras 200
 Campbell, Earl 11
 Cancer 46, 62, 78, 84, 157, 184, 398
 blood 14
 breast 174, 398
 chemotherapy 358, 398
 colon 100, 142
 colorectal 358
 diet 84
 leukemia 13, 84
 prostate 291, 403
 testicular 22
 treatment 100
 vaccines 398
 Canfield, Donald E. 3
 Canfield, Richard L. 269
 Cannibalism 211, 229
 Cantor, Charles 268
 Cantwell, Brian J. 187
 Carbohydrates 344
 Carbon 243, 309
 Carbon dioxide 260
 Carbon monoxide 126
 Carcinoembryonic antigen (CEA) 398
 Carcinogens 62
 Carey, James 372
 Carlson, Jane Cummings 283
 Carmeliet, Peter 147
 Carpenter, Scott J. 333
 Carrière, Yves 85
 Carrithers, Stephen L. 101
 Carroll, David L. 309
 Carroll, Sean 104
 Carson, Daniel 36
 Cassano, Patricia 5
 Cassin's auklet 152
 Cassini mission 356
 Catalysis 318
 Catechins 141
 Cathey, W. Thomas 201
 Catnip 238
 Cats 147, 190
 Celiac disease 392
 Cell membrane 264
 Cellier, Christophe 393
 Cells 267
 Cellular phones 94, 115
 Cenotes 163
 Ceramics 3, 141
 Cerda, Enrique 173
 CERN 387
 Cesium iodide 174
 Cetuximab 358
 Chan, Warren C.W. 107
 Chandra X-ray Observatory 214
 Charge symmetry 227
 Chartas, George 214
 Chase-Lansdale, P. Lindsay 149
 Chatoyancy 263
 Chaudhury, Manoj K. 36, 133, 262, 292
 Chauhan, Anuj 238
 Cheeger, Jeff 378
 Chemical weapons 285, 362
 Chemokines 230
 Chen, Chihchen 101
 Chen, Gang 213
 Chen, Yi-Han 21
 Cherlin, Andrew J. 149
 Chestnut blight 282
 Chiaverini, Martin 188
 Chicxulub crater 163

INDEX CHILD DEVELOPMENT – GAO

- Child development . . . 149, 234, 330, 380
 Childhood diseases . . . 222
 Childrearing . . . 62
 Children . . . 77
 Childs, Nancy . . . 360
 Chimpanzees . . . 349
 China . . . 323
 Chlordane . . . 22
 Chlorine . . . 136
 Chlorine bleaching . . . 403
 Chlorpyrifos . . . 291
 Choi, Augustine . . . 126
 Choi, Sunghye . . . 390
 Cholera . . . 136
 Cholesterol . . . 364
 Cholestyramine . . . 364
 Christensen, Philip R. . . 45, 116
 Chu, James W. . . 390
 Chu, Y.H. . . 328
 Cicadas . . .
 Cigarettes . . . 270
 Citric acid . . . 11
 Civilization, evolution of . . . 389
 Clapham, David . . . 277
 Clark, Deborah A. . . 260
 Clarke, John T. . . 357
 Clifton, Peter M. . . 89
 Climate . . . 29, 152, 189, 260, 317, 373
 Climate change . . . 404
 Clinker . . . 298
 Cloning . . . 141, 286
 Coal fires . . . 298
 Coal mining regions . . . 298
 Coatings . . . 132
 Cocoons . . . 141
 Cod . . . 318
 Cody, George D. . . 265
 Coffee . . . 5
 Cognition . . . 155
 Coifman, Benjamin . . . 150
 Cold receptor . . . 294
 Cole, Julia . . . 100
 Cole, Stewart T. . . 318
 Collagen . . . 141
 Collembolans . . . 180
 Collinger, John . . . 229
 Collins, Francis S. . . 123, 245, 260
 Collins, James . . . 268
 Colonial America . . . 157
 Columbia space shuttle . . . 83
 Colwell, Rita R. . . 87, 137
 Communication . . . 196, 324
 Composite materials . . . 3, 372
 Compton, Dave . . . 29
 Computer chips . . . 267
 memory . . . 118
 robots . . . 267
 science . . . 243, 279, 346
 simulations . . . 197
 Computers . . . 200
 quantum . . . 77, 118, 124
 Cone, Roger D. . . 179
 Conklin, Brian S. . . 185
 Conrey, Brian . . . 195
 Conroy, Glenn C. . . 275
 Conroy, Ronan M. . . 137
 Contact lenses . . . 238
 Continents . . . 285
 Contraception . . . 62, 195
 Convection . . . 404
 Convit, Antonio . . . 158
 Cook, Edwin . . . 212
 Cook, Geoffrey . . . 38
 Cooke, John P. . . 184, 185
 Cooking . . . 355
 Copper . . . 339
 Corals . . . 100
 Corash, Laurence . . . 60
 Corbetta, Daniela . . . 236
 Corbin, Michael R. . . 278
 Cornforth, Michael . . . 245
 Coronaviruses . . . 198, 262
 Cortisol . . . 333
 Cosmetics . . . 339
 Cosmic Dark Ages . . . 227
 Cosmic microwave background . . . 99
 Cosmic rays . . . 179
 Cosmology . . . 99, 148, 174
 Cotanche, Douglas . . . 355
 Cotinine . . . 120
 Cotter, Robert . . . 363
 Coumaphos . . . 291
 Counting skills . . . 212
 Cowal, Sally . . . 136
 Cowie, Robert H. . . 229
 Cox, Paul A. . . 310
 COX-2 enzyme . . . 285
 Crack propagation . . . 230, 261
 Crater, Gusev . . . 285
 Creatine . . . 270
 Cribb, Paul . . . 270
 Crick, Francis H.C. . . 248
 Crocidolite . . . 263
 Cronquist, Alicia . . . 253
 Cross, Emily S. . . 254
 Crows . . . 182
 Crustaceans . . . 180
 Cryptobranchids . . . 222
 Crystallography . . . 243, 342
 Cuckoos . . . 206
 Cullen, Heidi M. . . 118
 Cummings, Molly E. . . 196
 Cunningham, David . . . 358
 Cunningham, Glenn . . . 301
 Cuomo, Vincenzo . . . 220
 Curl, Cynthia L. . . 120
 Cycads . . . 310
 Czarnik, Anthony . . . 362
- D**
- Daganzo, Carlos F. . . 150
 Dahl, Jeremy E.P. . . 310
 Daley, George . . . 131
 Daley, Tamara C. . . 293
 Dally, Andrew J. . . 174
 Daniell, Henry . . . 350
 Dapice, Ann N. . . 186
 Dark energy . . . 148
 Dark matter . . . 51, 99, 286
 Daszak, Peter . . . 203
 Datskos, Panos G. . . 285
 Davidge, Tim . . . 373
 Davidson, Michael . . . 249
 Davis, Barry R. . . 45
 Davis, E. James . . . 22
 Davis, Mark . . . 44
 Day, Nancy L. . . 156
 DDT . . . 120, 403
 De Angelis, Hernán . . . 149
 De Beaune, Sophie . . . 235
 De Feo, Vincenzo . . . 233
 de Jong, Martijn P.D. . . 286
 de Jonge, Niels . . . 14
 de Marcillac, Pierre . . . 286
 de Waal, Frans B.M. . . 331
 Deacetyltransferase . . . 102
 Deamer, David W. . . 264
 Deary, Ian J. . . 92
 Deferoxamine . . . 13
 DeForest, Craig . . . 404
 Dehaene-Lambertz, Ghislaine . . . 30
 Dejneka, Matthew J. . . 94
 Demirel, A. Levent . . . 133
 Denham, Tim P. . . 389
 Denke, Margo A. . . 53
 Dennis, Phillip A. . . 184, 185
 Depression . . . 110
 DePriest, Paula . . . 40
 Dereniak, Eustace L. . . 200
 Derrickson, Scott . . . 21
 DES . . . 371
 Descour, Michael R. . . 202
 Deshusses, Marc . . . 294
Desmodus rotundus salivary plasminogen activator (DSPA) . . . 37
 Detergents . . . 292
 Deuterium . . . 227
 Deuterons . . . 227, 387
 Deutsch-Jozsa algorithm . . . 77
 Developmental biology . . . 19, 104, 230, 324
 Dew, Mary A. . . 85
 Diabetes . . . 155, 158, 278, 333, 389
 Disabilities . . . 155
 Diamonds . . . 3, 310
 Dickinson, Mark . . . 140
 Diet . . . 46, 237, 333, 359
 Digital image analysis . . . 200
 DiGrandi-Hoffman, Gloria . . . 324
 Dinosaurs . . . 51, 211
 Dioxins . . . 134, 334
 Galaxies, distant . . . 227
 Dittmore, Ron . . . 83
 Diuretics . . . 45, 164, 189
 Djorgovski, George . . . 52
 DNA . . . 43, 122, 150, 244, 245, 248, 267, 326
 chips . . . 344
 fingerprinting . . . 232
 Dodd, Roger . . . 59
 Dodson, Stanley I. . . 196
 Doherty Jr., Paul E. . . 228
 Dolphins . . . 365
 Domestication . . . 40
 Dopamine . . . 205
 Doppler shift . . . 276
 Downey Jr., Wayne F. . . 299
 Downeyite . . . 298
 Down's syndrome . . . 122, 213
 Downski Jr., Edward R. . . 200
 Drayn, Dennis . . . 189
Dreissena polymorpha . . . 365
 Drela, Mark . . . 83
 Drenner, Ray . . . 196
 Driving . . . 20, 94
 Drought . . . 118
 Drug delivery . . . 150, 181, 238, 318
 Drugs . . . 78, 196
 psychoactive . . . 77
 Drummond, Hugh . . . 102
 Du, Xiaoping . . . 38
 Dubertret, Benoit . . . 109
 Dungan, Art . . . 73
 Dunn, Robert R. . . 229
 Dust . . . 206
 Dust devils . . . 94
 Duty, Susan M. . . 339
 Duvall, Tom . . . 62
 Dyes . . . 107
 Dyslexia . . . 173, 324
 Dysentery . . . 136
- E**
- Escherichia coli* . . . 53, 100
 Earth mantle . . . 307
 Earthquakes . . . 220, 276
 Ebbini, Emad S. . . 169
 Eberhart, Jonathan . . . 134
 Ebinghaus, Ralf . . . 73
Echinacea . . . 359
 Echinoderms . . . 19
 Ecuador . . . 126
 Eden, Guinevere . . . 324
 Edmonds, Hedy . . . 37
 Education, science and engineering . . . 157
 Eells, Janis T. . . 158
 Eggs . . . 69, 195, 230, 349
 Egypt . . . 45
 Eiler, John M. . . 373
 Einhorn, Thomas A. . . 310
 Einstein, Albert . . . 61, 190
 Eisenbach, Michael . . . 69
 Eizirik, Eduardo . . . 147
El Niños . . . 118
 Elasticity . . . 173, 261
 Elastomers . . . 261
 Elderly . . . 85
 Electricity . . . 110
 Electron microscopes . . . 14, 339, 388
 Elements . . . 349
 Eleutherodactylus . . . 11
 Elle, Elizabeth . . . 68
 Ellis, Richard S. . . 140
 Elovitz, Michael . . . 268
 Embryonic stem cells . . . 349
 Emil, Stein . . . 5
 Emilia, Reggio . . . 229
 Emotions . . . 54, 397
 Empathy . . . 330
 Emphysema . . . 323
 Endangered species . . . 237
 Endler, John . . . 196
 Endo, Tetsuya . . . 365
 Endocrine disruptors . . . See Hormones, environmental
 Endoscopes . . . 200
 Endy, Drew . . . 269
 England . . . 67
 Enterotoxin . . . 100
 Enzymes . . . 102
Ephedra . . . 237, 359
 Ephedrine . . . 237
 Eppig, John . . . 349
 Epstein, David M. . . 25
 Ericsson, K. Anders . . . 251
 Erosion . . . 100
 Erythropoietin . . . 109
 Eskenazi, Brenda . . . 222
 Estrogen . . . 22, 62, 341, 390
 Ethynylestradiol . . . 390
 Eubacteria . . . 264
 Eukaryotes . . . 264
 Everglades . . . 72
 Evolution . . . 104, 122, 198, 406
 Evolution, molecular . . . 115, 198
 Exercise . . . 270
 Extinctions . . . 228
 Extraterrestrial life . . . 366
 Eye tracking . . . 279
 Eyewitness memory . . . 250
- F**
- Facial expressions . . . 397
 Factor VII . . . 77
 Facula . . . 404
 Falco, Charles M. . . 346
 Farrell, William M. . . 94
 Fat . . . 110
 Federal Bureau of Investigation . . . 23
 Fearing, Ron . . . 356
 Feces . . . 317
 Federal budget . . . 86
 Feldman, Jack . . . 8
 Fenical, William . . . 78
 Ferguson, Harry C. . . 140
 Ferguson, Lisa . . . 340
 Fermium . . . 349
 Ferrarese, Laura . . . 52
 Fertility . . . 46, 222, 390
 Fiber . . . 372
 Fiber optics . . . 53, 252, 342, 373
 Fibrinogen . . . 101, 157
 Figs . . . 259
 Filippenko, Alex . . . 77
 Film . . . 150
 Filson, John R. . . 276
 Finasteride . . . 403
 Finger, Kim . . . 251
 Fink, Mathias . . . 168, 169
 Finstad, Greg . . . 41
 Fiore, Stephen M. . . 250
 Fiorillo, Christopher D. . . 205
 Firearms . . . 23
 Fish . . . 46, 132, 165, 196, 237, 246, 334
 Fisher, Donald M. . . 263
 Fisher, Susan J. . . 35
 Fisheries . . . 318
 Fission . . . 243
 Flagella . . . 366
 Flame retardants . . . 334
 Flannagan, Michael J. . . 20
 Flatté, Michael E. . . 118
 Flegal, A. Russell . . . 74
 Flies . . . 292
 Flocculents . . . 403
 Flow sensors . . . 110
 Flowers . . . 397
 Fluid dynamics . . . 189
 Fluorescent dyes . . . 107
 Fluorochromes . . . 245
 Fluorophores . . . 107
 Flynn, James R. . . 293
 Fogue, Jean-Pierre . . . 169
 Folch, Albert . . . 101
 Fomalont, Edward B. . . 61
 Fonofos . . . 291
 Fontanarosa, Phil B. . . 237
 Food . . . 142, 238
 aversion . . . 173
 contamination . . . 317
 Forbes, Scott . . . 102
 Forensics . . . 23
 Forests . . . 166
 Fornari, Daniel J. . . 75
 Fossils . . . 51, 211, 222, 244, 261, 275, 292
 Foster, Paul M. . . 339
 Fox, Derek W. . . 180
 Fractures, bone . . . 230, 261
 Franx, Maijn . . . 140
 Franz, Elizabeth A. . . 254
 Fratantoni, David M. . . 75
 Free radicals . . . 141
 Freedman, Michael . . . 124
 Fregosi, Ralph E. . . 270
 Frelinger, Jeff . . . 341
 Frenzilli, Giada . . . 68
 Freshwater ecosystems . . . 196
 Freudling, Wolfram . . . 278
 Frogs . . . 11
 Frohlich, Edward D. . . 189
 Fuels . . . 187, 382
 Fukuhara, Kiyoshi . . . 141
 Fullerenes . . . 309
 Fungi . . . 366
 Furans . . . 134, 334
 Fusion . . . 252
- G**
- Gabriel, David . . . 294
 Gagneux, Pascal . . . 116
 Galactic winds . . . 214
 Galaxies, collisions . . . 291
 formation . . . 51, 139
 satellite . . . 380, 397
 structures of . . . 394
 Galaxy Evolution Explorer mission . . . 364
 Galbaatar, Tuvdendorj . . . 28
 Galen, Candace . . . 397
 Gallium arsenide . . . 342
 Galupo, Patricia . . . 24
 GABA . . . 270
 Gamma rays . . . 245
 Gamma-ray bursts . . . 77, 180, 317
 Gangarosa, Eugene J. . . 137
 Ganz, Tomas . . . 345
 Gao, Ke-Qin . . . 222

Gao, Wei-Qiang 355
 Gardner, Howard 93
 Gardner, Timothy 267
 Garnett, Donald R. 328
 Gash, Don M. 246
 Gaskin, John F. 233
 Gaze tracking 279
 Glial-cell-derived neurotrophic factor 245
 Geary, David C. 21
 Gehman Jr., Harold 308
 Geim, Andre 356
 Gels 68
 Gelsinger, Jesse 43
 Gemini North telescope 373
 Genetic testing 398
 Gene splicing See Genetic engineering
 Gene therapy 43, 349, 355
 Genes 43, 92, 104, 115, 147, 221, 267, regulation 102
 Genetic mutations 68
 Genetic engineering 53, 141
 Genetic recombination 262
 Genetics 147
 Genetically modified organisms See Transgenic plants
 Genghis Khan 91
 Genomes 122
 Genzel, Reinhard 394
 Geoid 6
 Geomagnetic storms 46
 Geometrical perspective 346
 Gerberding, Julie 198
 Gerberich, William W. 197
 Gercken, Jens 120
 Germ cells 230, 372
 Ghez, Andrea M. 394
 Gilkeson, John 73
 Gill, Steven S. 246
 Gilroy, Christine M. 359
 Ginkgo 359
 Giribet, Gonzalo 181
 Gislén, Anna 308
 Glaciers 149
 Global warming 29, 30, 189
 Glucose 158
 Gluons 387
 Gluten 392
 Gluten intolerance 392
 Gluten-free diet 392
 Gluten-sensitive enteropathy 392
 Goldman, Lynn 120
 Goldstein, Joel 218
 Goldstein, Michael H. 357
 Goldston, Daniel A. 195
 Goodman, Morris 349
 Goodman, Phyllis J. 403
 Goodrich, Ray 60
 Gordon, Jeffrey I. 344
 Gordon, Leslie 260
 Gore, Al 116
 Gorinstein, Shela 156, 157
 Gostomski, Peter 294
 Gottesman, Daniel 126
 Gottfredson, Linda 294
 Gould, Andrew 395
 Gould, Fred 85
 Gowlett, John A.J. 235
 Grando, Sergei A. 184, 185
 Grapefruit 359
 Graphite 243, 309
 Graves' disease 278
 Gravitational lens 61
 Gravity 61
 Gray, Russell 182
 Great Barrier Reef 100
 Great tit 152
 Green, Harry 388
 Green tea 238
 Greenberg, David A. 206
 Greene, George A. 179

Greenfield, Thomas K. 156
 Greenhouse warming See Global warming
 Gregg, Anthony R. 293
 Griffin, Gary 283
 Griffin, John H. 393
 Griffin, Lucille 283
 Gruenewald, David 297
 Gu, Zhong-Ze 133
 Guam 310
 Guarente, Leonard 373
 Guillette, Lou 390
 Gulde, Stephan 77
 Gulf Stream 375
 Gurley, Bill J. 359
 Gurubhagavatula, Sarada 398
 Guyton, David 309
 Gyulaszt, Miklos 387

H

Haber, Daniel A. 115
 Habitat loss 45
 Haddock 382
 Haddock 382
 Hamann, Fred 278
 Hamann, Stephan 54
 Hamilton, Jeffrey A. 84
 Hamilton, Richard 379
 Hansen, Heidi B. 325
 Hammock, Bruce 52
 Handin, Robert I. 29
 Hands 254
 Hanford nuclear reaction 238
 Hanotte, Olivier 27
 Hansen, Brad 395
 Happiness 365
 Hardell, Lennart 22
 Hardness 197
 Hari, Pertti 166
 Harlow, Francis H. 189
 Harman, S. Mitchell 296
 Harmon, Elizabeth H. 302
 Harpending, Henry 230
 Harrison, Neil L. 87
 Hartmann, Colleen 158
 Hasler, Clare M. 360
 Hasty, Jeff 268
 Haugland, Jason 315
 Hauser, Russ 339
 Havens, Kayri 232
 Hawaii 11
 Hawley, R. Scott 214
 Hays, Jennifer 342
 He, Fangliang 323
 He, Ka 46
 Head, James W. 316
 Heaney, Peter J. 263
 Hearing 355
 Heart 21, 29, 349
 Heart disease 38, 45, 155, 157, 189, 253, 398
 Hebard, Fred 282
 Hebener, Joel F. 179
 Hecky, Robert E. 405
 Heeger, Alan 312
 Heffern, Ed 300
 Heimann, Mikael 331
Helicobacter pylori 148
 Helix nebula 382
 Hepatitis 142, 349
 Hep2 protein 157
 Herbal medicine 237, 359
 Herceptin 157
 Herpes 229
 Herre, Allen 259
 Herriot, Glen 373
 HETE-2 satellite 77
 Hexachlorobenzene 22
 Hexachlorocyclogexanes 330
 Hexapods 180
 High blood pressure See Hypertension
 High-energy physics 387

Hill, Susan T. 158
 Hippocampus 87, 94, 158
 Hirdes, Danny 101
 Histones 102
 HIV 59, 133, 142, 173, 237
 Hockney, David 346
 Hodgkiss, William S. 169
 Hoffman, Ronald 13
 Holman, Matthew J. 78
 Holmlund, Mikael 165
 Holtz Jr., Thomas R. 211
 Holzman, Philip S. 116
 Hominids 115, 261, 275, 302, 349
Homo erectus 131, 302
Homo habilis 131
Homo rudolfensis 131
Homo sapiens 131, 173, 302, 349, 371
 Homocysteine 5
 Hopper, Lora V. 344
 Hoppin, Jane A. 339
 Hopwood, David E. 302
 Horber, Fritz F. 179
 Hormone replacement therapy 296, 341
 Hormones 371, 390, aggression and 36, environmental 22, 32, 34, 62, 334
 Horn, John 93
 Horne, David 407
 Horvitz, Eric 279
 Hot stars 328
 Houston, David C. 190
 Houston, Fiona 340
 Hovers, Erella 236
 Huang, Leaf 44
 Hubbell, Jeffrey 261
 Hubble Space Telescope 356, 382
 Huberman, Eliezer 131
 Hudson, Melissa 398
 Hui, Chung-Yuen (Herbert) 261
 Hull, Richard 374
 Hulvat, James 313
 Human genome project 245
 Human-computer interactions 279
 Humans, evolution 115, 173, 234, 275, 302, 349, 371
 Hunt, Gavin 182
 Hunt, Patricia A. 213
 Hunt, Sarah 269
 Huntingford, Felicity 166
 Huntington's disease 102
 Hüppop, Kathrin 153
 Hurwitz, Herbert I. 358
 Hybridization 232
 Hydrogel 238
 Hydrogen 382
 Hydrogen fuels 373
 Hydrophilic elements 36, 356
 Hydrophobic interaction 36, 132, 356
 Hydrothermal vents 37, 75, 264, 366
 Hynes, Anthony 72
 Hypertension 45, 164, 293
 Hypocretin-orexin neurons 181
 Hypothalamus 181
 Hypoxia 132

I

Iacoboni, Marco 330
 Ice age 408
 Ice shelves 149
 Imitation 330
 Immune suppression 5
 Immune system 229, 252

Immunization 218
 Immunoglobulins 163
 Implants, medical 142
In vitro fertilization 195
 Incinerators 197
 Index of refraction 252
 Indium 342
 Indonesia 298
 Infants 30, 62, 357, 380
 Infectious diseases 203
 Infertility 35, 69, 381
 Influenza 78, 198
 Infrared astronomy 139
 Insects 35, 52, 67, 85, 180, 259, 324, 358
 Insulation 350
 Integrated Ballistics Identification System 23
 Intel 326
 Intel Science Talent Search 70, 165
 Intelligence 92, 269, 293, tests 92, 293
 Interferometry 387
 Interferons 5, 333
 Interleukins 5
 International Space Station 189
 Intersex 334
 Intestines 344
 Invertebrates 19
 Iodine 109
 Ion channels 21, 277
 Ion trap 77
 IQ 269, 293
 Iris identification 200
 Iron, dietary 13
 Iron sulfide 264
 Irwin, Michael 85
 Ischemic disease 157
 International Science and Engineering Fair 326
 Isotopes 317, 333
 Iwamoto, Martha 253

J

Jack jumper ant 252
 Jacobs, Dennis 340
 Jacobson, Elliott R. 203
 Jacobson, Michael F. 84
 Jacques, Paul F. 5
 Jaguars 147
 Jahren, A. Hope 317
 Jakosky, Bruce M. 116
 James, Ralph 179
 Janda, Kim D. 185
 Jeanloz, Raymond 308
 Jeffery, William 35
 Jensen, Arthur R. 92
 Jevtic-Todorovic, Vesna 87
 Jianlin, Han 27
 Joannopoulos, John D. 277
 Johnson, Kurt 26
 Johnson-Frey, Scott H. 254
 Jones, Christopher W. 318
 Jones, Joshua 253
 Jones, Steve R. 298
 Jones, Susan S. 358
 Jupiter 56

K

Kacelnik, Alex 182
 Kahn, Richard 390
 Kamionkowski, Marc 148
 Kanamori, Hiroo 276
 Kaplan, Edward H. 219, 341
 Kaposi's sarcoma 229
 Karabeyoglu, Arif 187
 Karumanchi, Ananth 147
 Kashefi, Kazem 366

Kathirithamby, Jeyaraney 358
 Kavelaars, J.J. 78
 Keating, Mark T. 29
 Keegan, Sarah 86
 Keim, Paul 116
 Keith, Jason 229
 Keller, Bob R. 198
 Keller, Irene 46
 Kelso, William 157
 Kemp, Darrell 105
 Kemp, Martin 346
 Kenny, Anne M. 297
 Kenyon, Cynthia 373
 Keratin 356
 Kervella, Pierre 387
 Kessler, Mark A. 314
 Key, Jeffrey R. 189
 Keyzers, Christian 331
 Khosla, Chaitan 392
 Kidneys 19
 Kieffer, Hugh H. 45
 Kiluaea 78
 Killham, Kenneth 134
 Kim, Ann G. 299
 Kimber, Susan J. 36
 King, Andrew P. 357
 King, Jeffrey C. 372
 Kirsch, Jack 54
 Kitaev, Alexei 124
 Klein, Harvey 59
 Klima, Rachel L. 316
 Kling, Hedy 405
 Knight, Thomas 269
 Knot theory 124, 382
 Kobrick, Michael 163
 Kochendoerfer, Gerd 109
 Koga, Yosuke 266
 Kolesnick, Richard N. 46
 Kolpin, Dana W. 196
 Komar, Nicholas 204
 Koning, Frits 392
 Kopeikin, Sergei M. 61
 Korbiling, Martin 54
 Korists, Kirk T. 278
 Kotov, Nicholas 397
 Krause, Diane 54
 Kremen, Claire 45
 Krochmal, Aaron 388
 Krueger, Gerald 5
 Kuhl, Christiane K. 398
 Kuntz, Joshua D. 3
 Kuperman, William A. 169
 Kuritzkes, Daniel R. 116
 Kutcher, Stanley P. 21

L

La Niñas 118
 Labbe, Ivo 140
 Lactose 67
 Lagace, Diane C. 20
 Lahann, Joerg 36
 Lahiri, Joydeep 94
 Lai, Henry C. 115
 Lai, Michael M.C. 262
 Lake Tanganyika 404
 Laker, Jerry 27
 Lambert, David M. 244
 Lamin 260
 Laminar flow 381
 Lander, Eric S. 122
 Landis, Matthew S. 73
 Landrigan, Philip J. 120
 Lane, J. Michael 218
 Langer, Robert 44
 Langmore, Naomi E. 206
 Language 30, 250, 357
 Largiadèr, Carlo R. 46
 Larsen A ice shelf 149
 Larson, Douglas W. 228
 Larsson, Joakim 62
 Larynx 142
 Lasers 77, 252, 276, 317, 349

INDEX LASZLO – PERMETHRIN

- Laszlo, Joe 29
 Lavrik, Nickolay V. 285
 Law enforcement 23
 Lead 120, 205, 269, 309,
 326, 403, 408
 Leahy, Daniel J. 157
 Learning 14, 173, 324, 357
 Leben, Robert R. 376
 Lee, Esther 142
 Lee, Hyun-Chul 376
 Leech, Christopher M. 382
 Leibler, Stanislas 268
 Leisner, Thomas 22
 Leitherer, Claus 329
 Lemurs 198
 Lenses 200, 346
 Lepeshkin, Nick N. 252
 Letsinger, Robert 327
 Letvin, Norman 133
 Leukemia
 See Cancer, leukemia
 Leung, Donald Y.M. 163
 Levi, Marcel 77
 Levy, Jeremy 118
 Levy, Nicolas 260
 Liberty Bell 230
 Lieberman, Judy 142
 Light echo 252
 Light therapy 158
 Light-emitting diodes 342
 Lim, Lee P. 222
 Lim, Unhee 5
 Lindberg, Steve 72
 Lindheimer, Marshall D. 147
 Lipshultz, Steven E. 398
 Lipton, Stuart A. 37
 Liquid crystal 53
 Liquid lenses 373
 Liofylline 333
 Lissauer, Jack 58
 Lithium 388
 Lithium niobate 53
 Liu, Feng 44
 Liu, Hung-wen (Ben) 53
 Liu, Jie 275
 Liu, Juewen 326
 Lizards 356
 Llamas 26
 Lobet, Alfonso 27
 Lloyd, Seth 125
 Lobel, Alex 110
 Lobsters 4
 Lockman, Felix J. 397
 Lockman, Jeffrey J. 236
 Lockwood, G. Wesley 325
 Loeb, Avi 148
 Logic 267
 Lohmann, Kenneth 4
 Longevity 372
 Look, A. Thomas 84
 Look, David C. 342
 López, José A. 38
 Lopez-Boada, Yolanda 366
 Losick, Richard 390
 Lotto, Lorenzo 346
 Lu, Yi 326
 Luby, Stephen 136, 403
 Luciano, Michelle 92
 Lucy hominid 302
 Ludwig, David S. 89
 Lungs 323
 Luppi, Mario 229
 Lyketos, Constantine G. 156
 Lynch, Jessica 330, 332
 Lyon, Bruce E. 212
 Lyon, G. Reid 325
 Lyons, Leslie 148
- M**
- MacDiarmid, Alan 312
 Machado, Carlos 259
 Mack, Thomas 219
- Mackinnon, Roderick 277
 Macrophages 131, 408
 Mad cow disease 340
 Maelicke, Alfred 185
 Magnetic fields 94, 404
 Magnetic signals 4
 Magnetic resonance
 imaging 4, 77, 398
 Magnetism 118
 Magnetosphere 381
 Magnets 270
 Maguire, Eleanor A. 4
 Mahadevan, Lakshminarayan 173
 Mait, Joseph N. 200
Majungatholus 211
 Makino, Shinji 262
 Malaria 59
 Malliaras, George 312
 Mammography 398
 Manic depression
 See Bipolar disorder
 Mann, Daniel H. 314
 Marburger, John H. 86
 Marchant, David R. 315
 Marijuana 220
 Marine organisms 78, 365
 Mark Welsh, David 406
 Marler, John R. 37
 Marra, Peter P. 203
 Mars 116, 221, 285, 341, 366
 composition of 45, 116,
 221
 Global Surveyor 221, 341
 Pathfinder spacecraft 221
 rover 285
 Marsden, Brian G. 78
 Marshall, John L. 377, 398
 Martin, Robert D. 198
 Martin, William 264,
 265, 265
 Martins, Koen 407
 Mass spectrometry 22
 Mast cells 163
 Mateo, Mario L. 291
 Materials science 197, 243,
 261, 276,
 309, 342
 Mathematics 20
 Mathematics, proof 259, 378
 Matheson, Tom 317
 Matsumoto, Alvin 297
 Mattoussi, Hedi 108
 Maunder, Mike 232
 Mautz, William J. 11
 Mayer, Lucio 56
 Mayfield, Carl 283
 Maynard, Charles 283
 Maysinger, Dusica 318
 Mazur, Allan 36
 McArdle, John J. 93
 McCarthy, John 281
 McCarthy, Patrick 140
 McComas, David J. 46
 McConnell, John D. 404
 McCrimmon, Donald 9
 McCulloch, Malcolm 100
 McDonald, William 283
 McFadden, Sandra L. 69
 McKeegan, Kevin D. 3
 McKinlay, John B. 296
 McMahon, Richard G. 227
 Meat 317
 Medcalf, Robert L. 37
 Medina, Daniel 174
 Meharg, Andrew A. 134
 Mehl, Ryan 53
 Mehlhorn, Thomas A. 252
 Meis, Paul J. 371
 Meissner, Christian A. 250
 Melatonin 359
 Mellors, John 116
 Melting 309
- Meltzer, Martin I. 219
 Meltzoff, Andrew N. 330
 Memantine 211
 Memory 4, 87, 94, 155, 158,
 220, 250, 254
 Mendez, Julio C. 229
 Meng, Hong 312
 Meningitis 253
 Menthol 294
 Mercury 72, 120
 Meselson, Matthew 406
 Mesons 333
 Messing, Charles G. 20
 Metallurgy 309
 Metals 309
 Metal Alloys 243
 Metasequoia 317
 Microchips 158
 Methotrexate 5
 Methyl bromide 291
 Metzger, Henry 163
 Mezey, Eva 54
 Mezitt, Wayne 233
 Mice 142, 148, 372
 Micelles 292, 318
 Michaëlsson, Karl 52
 Microchips 101
 Microelectronics 118
 Microfluidics 101, 381
 Microgravity 189
 Micromachines 110
 Microraptor 51
 Microscopes 200
 Microwaves 115
 Mid-ocean ridges 37
 Mignot, Emmanuel 181
 Migration 152
 Milgroom, Michael 284
 Milk 67
 Milky Way Galaxy 380, 394, 397
 Miller, Thomas E. 134
 Milnor, John 378
 Milosavljevic, Milos 395
 Minna, John D. 186
 Minsky, Yair 259
 Mirabel, I. Felix 14
 Miralles, G. Diego 116
 Mirkin, Chad 327
 Mirrors 346
 Miscariage 213
 Mitchell, Charles E. 233
 Mitochondria 158
 Molbo, Drude 259
 Moldovan, Oana 302
 Molecular biology 107
 Molecular tags 94
 Mollidren, Jeffrey J. 13
 Mongolia 40
 Monkeypox 374
 Monkeys 205
 Monocytes 131
 Monson, Russell K. 166
 Monteiro, Antonia 105
 Montgomery, Allen 361
 Montgomery, Hugh L. 195
 Mooi, Richard J. 20
 Moore, Patrick S. 229
 Morales, Alvaro 296
 Morens, David M. 78
 Morley, John 296
 Morris, Cassandra E. 270
 Morris, Mark 394
 Mother-of-pearl 397
 Mothers, working 149
 Motion sensing 200
 Moustakas, Aris L. 169
 Mowat, Allan 393
 Mucci, Lorelei A. 84
 Mühlethaler, Michel 181
 Mukherjee, Amiya K. 3
 Mummies 45
 Muons 179
 Muscles 270
- N**
- Nacre 397
 Nagasawa, Takashi 230
 Nagler, James J. 132
 Nanoclusters 174, 309
 Nanotechnology 3, 14, 36,
 174, 197, 238, 243, 275,
 285, 292, 318, 326, 372
 Nanotubes 275, 372
 Narcolepsy 181
 Nardi, Francesco 180
 Naser, Saleh A. 366
 Natan, Michael 363
 National Aerospace Plane 215
 National Integrated Ballistic
 Information Network 23
 Nayak, Chetan 126
 Naze, Yael 328
 Nebulas 328
 Nedelman, Jeff 84
 Nef, Ed. 40
 Neff, Bryan 246
 Neff, John M. 218
 Nekola, Jeffrey C. 228
 Nelson, Mark R. 45
 Nephron 19
 Neptune 78, 325
 Nest decoration 165
 Neumann, Katharina 389
 Neuroglobin 206
 Neuroigin 212
 Neuron 54, 211, 245, 294
 Neutralino 286
 Neutrons 227
 Neutrophils 366
 Nevirapine 142
 New Guinea 229, 389
 New Zealand 244
 Newman, David J. 359
 Niagara Escarpment 228
 Nicastro, Fabrizio 174
 Nicholas, Wayne 366
 Nicolaidis, Kypros H. 293
 Nicotine 184, 222, 270, 366
 Nie, Shuming 107
 Nijhiut, H. Frederik 104
 Nikolov, Alex D. 292
 Nitrogen cycle 166
 Nitrogen oxides 166
 Nuclear magnetic resonance
 imaging See Magnetic
 resonance imaging
 Nobel Prizes 165
 Noda, Masaharu 148
 Noise 11, 68
 Nolter, Melissa A. 300
 Nonylphenols 334
 Norepinephrine 68
 Norlund, Kai 243
 Norris, David J. 277
 North Atlantic Deep Water 29
 Norway maple 232
 Nøst, Ole Anders 69
 Nouwen, Johan 197
 Novelli, Paul C. 373
 Nuclear 238
 decay 286
 reactors 243
 weapons 179
 Nucleus 260
 Number theory 195
 Nunberg, Jack H. 133
 Nutraceuticals 359
 Nutrition See Diet
- O**
- Oberdörster, Günter 356
 Obesity 110, 179, 270
 Ocean currents 375
 Ocean floor 78
 Oceanography 69, 75, 168
 Odyssey spacecraft 45, 116
 Oey, Lie-Yauw 376
 Ohashi, Tim J. 69
 Ohlemiller, Kevin K. 11
 Oil 292, 310, 382
 Oktay, Sarah D. 109
 Olduvai Gorge, Tanzania 131
 Olney, John W. 87
 Ols, Martin G. 24
 Olson, James M. 102
 Olson, Storrs 21
 Omenn, Gilbert 171
 Opper, Allena K. 227
 Optical correlators 200
 Optics 53, 200, 252,
 276, 342, 346, 373
 Orchids 67
 Organ transplant 253
 Organothiophosphates 291
 Ornish, Dean 88
 Osteoclasts 52
 Ostermann, Jan 155
 Östlund-Nilsson, Sara 165
 Ostroff, Stephen 374
 Otoliths 333
 Ovaries 372
 Overfishing 318
 Owens, W. Brechner 75
 Owren, Michael 357
 Oxidation 72
 Ozone 72, 166
 Ozone holes 373
- P**
- Paint 326
 Palen, Joseph A. 150
 Palm, Wolf-Ulrich 334
 Pan, Janet L. 342
 Panger, Melissa A. 236
 Papanicolaou, George C. 169
 Paper 334
 Para, Michael F. 133
 Paraffin 187
 Paramyxovirus 198
 Parasites 181
 Parasitism 206, 212, 358
 Parent, Marie-Elise 291
 Parenting 36, 62, 246, 397
 Parkinson's disease 245, 285
 Parkman, Camille 154
 Particle physics 77, 174, 227,
 333, 387
 Partridge, Timothy C. 261
 Patapoutian, Ardem 301
 Patel, Nipam H. 180
 Paternity 246
 Patil, Bhimanagouda S. 360
 Patterned ground 314
 Patterson, David 9
 Paulding, Charles A. 115
 Payne, Sebastian 67
 Pealer, Lisa N. 253
 Peanuts 163
 Peat bogs 134
 Pediatric medicine 87
 Peebles, Jim 140
 Peek Jr., Richard M. 148
 Pellmyr, Olle 259
 Peltonen, Leena 213
 Pendry, John B. 277
 Pepper, David M. 168
 Perception 250
 Perelman, Grigori 259, 378
 Perepichkas, Dmitrii 313
 Perfect, Timothy J. 251
 Permafrost 244
 Permethrin 291

Perrett, David I. 331
 Persistent organic pollutants 22, 197, 334
 Peru 302
 Pesticides 11, 291
 unconventional 11
 Peterson, Bruce J. 29
 Peterson, Chris 238
 Petroleum 292, 310, 382
 Pettit, Donald R. 189
 Pezdek, Kathy 251
 Phan, Tai 381
 Phenology 152, 382
 Phillips, John 4
 Phillips, Polly K. 408
 Phorate 291
 Photolithography 101
 Photonic crystals 276
 Photonics 373
 Photoresist 101
 Phthalates 120, 339
 Phytoplankton 382
 Piantadosi, Steven 323
 Piezoelectricity 168
 Piga, Antonio 13
 Pike, John 308
 Pilkington, Mark 164
 Pindak, Ronald 53
 Pinsonneault, Marc H. 387
 Pinstrup-Anderson, Per 85
 Pioneer 10 158
 Pions 227
 Piper, Steohen C. 260
 Piperno, Dolores R. 126
 Piran, Tsvi 180
 Pirkle, Jim 120
 Pirozzo, Sandi 88
 Pitari, Giovanni M. 100
 Pitt, Will 12
 Placenta 147
 Planets, climate 164
 extrasolar 38, 56,
 164, 301
 formation 38, 56
 motion 38
 Plants 30, 259
 Plasmas 171
 Plastics 339
 Platelets 38
 Platt, Trevor 382
 Plemmons, Robert 201
 Plomin, Robert 92
 Plow, Edward F. 38
 Plutonium 179, 245
 Pneumonia 198
 Poinar, Hendrik N. 244
 Poincaré conjecture 259, 378
 Poisson's ratio 173
 Polar climate 72
 Polarization 53, 99
 Pollination 45, 67
 Pollution 132, 196, 390
 Polybrominated diphenyl
 ethers 120, 334
 Polycarbonate 213
 Polychlorinated biphenyls 22,
 120, 197
 Polychlorinated dibenzo-*p*-
 dioxins 197
 Polychlorinated dibenzofurans 197
 Polydimethylsiloxane 101
 Polyimide 356
 Polymer fume fever 355
 Polymers 43, 150, 261,
 312, 373
 conducting 312
 Polyphenols 155, 157
 Polytetrafluoroethylene (PTFE)
 355
 Polythiophenes 312
 Pomerance, Carl 195
 Poole, Keith 405
 Pope Jr., Harrison G. 297

Post, Jeffrey E. 263
 Posthuma, Danielle 92
 Potatoes 84
 Poulin, Philippe 372
 Pounds, Joel G. 171
 Powell, William A. 283
 Power, Alison G. 233
 Prairie dogs 374
 Predation 190, 196
 Pre-eclampsia 147, 293
 Pregnancy 147, 157,
 164, 270,
 293, 371
 Premature labor 371, 333
 Preskill, John 124
 Preston, Stephanie D. 331
 Prestwich, Glenn 101
 Primates 198
 Prime numbers 195, 350
 Prinz, Wolfgang 331
 Prions 229, 340
 Prochaska, Jason X. 278
 Progesterone 371
 Progestin 341
 Prostaglandins 309
 Proteins 53, 109, 148,
 171, 179
 Proton auroral spots 381
 Protons 227
 Prum, Rochard O. 51
 Przedborski, Serge 285
 Pseudomorphism 263
 Psoriasis 5
 Psychiatric disorders 77
 Psychology 279
 Puberty 408

Q

Qaim, Martin 85
 Quantum chromodynamics 227, 333, 387
 Quantum dots 107
 Quantum mechanics 77
 Quark-gluon plasma 387
 Quarks 227, 333, 387
 Quartz 263
 Quasars 51, 61, 278, 317
 Quick, Rob 136
 Quillen, Alice C. 395
 Quinn, Thomas 56

R

Radial Velocity Experiment 380
 Radiation 46, 243, 245
 Radiation therapy 158, 398
 Radioactivity 238, 349
 Radiography 179
 Radon 245
 Ragweed 30
 Rain forests 260
 Raisz, Lawrence G. 310
 Ramirez, Marino 9
 Ramsdell, John S. 364
 Raphael, Yehoash 355
 Rare-earth elements 94
 Rasky, Daniel 215
 Ratain, Mark J. 101, 398
 Ratcliffe, John M. 174
 Rats 220
 Rayleigh instability 22
 Rayner, Jeremy M.V. 51
 Raz, Erez 230
 Reading 173, 324
 Reading, Richard P. 27
 Reaven, Gerald 90
 Rebuffi, Gustavo 27
 Recycling 334
 Reed, Evan J. 276
 Reed, Kurt D. 374

Reefs 100
 Reeves, Roger H. 123
 Refrigerators 213
 Regeneration 29, 355
 Rehm, Jurgen 155
 Reid, Christopher M. 189
 Reindeer 40
 Reisberg, Barry 211
 Relativistic Heavy Ion Collider 387
 Relativity theory 61, 190
 Relethford, John H. 307
 Repke, John T. 293
 Rice, Barry 35, 372, 390
 Reproductive risks 408
 Republican National
 Committee 116
 Respiration See Breathing
 Reynolds, Kristi 155
 Rhoads, Ann F. 233
 Rice, Barry 232
 Richardson, Christopher D. 349
 Richardson, Ken 93
 Riemann hypothesis 195
 Rightmire, G. Philip 132, 371
 Rignot, Eric J. 149
 Rimm, Eric B. 155
 Rintoul, Stephen R. 377
 Risk assessment 20
 Risk-taking behavior 205
 Ritalin 77
 Rivers 29, 237
 Rizzolatti, Giacomo 331
 RNA 110, 221
 RNA interference 142
 Roberts, Robert 21
 Robson, Mark E. 398
 Rochat, Philippe 332
 Rock climbing 228
 Rockets 187
 Rogacki, John 216
 Rogers, John A. 53, 374
 Rogers, Raymond R. 211
 Romanowicz, Barbara 285
 Root, Terry L. 152
 Ropes 382
 Rosiglitazone 389
 Rosner, Jonathan L. 333
 Rothenberg, Mace L. 358
 Rothstein, Stephen 212
 Rubner, Michael 150
 Rubies 252
 Russell, Daniel 279
 Russell, Michael J. 264
 Ruvkun, Gary 110
 Ruvolo, Maryellen 115
 Ruxton, Graeme D. 190
 Ryan, Michael J. 196

S

Sabloff, Jeremy A. 21
 Sacks, Oliver 310
 Saetre, Glenn-Peter 228
 Sailor, Michael 363
 Saito, Takashi 243
 Salamanders 222, 366
 Salerno, Judith A. 342
 Salford, Leif G. 115
 Salt 174
 Sampson, Hugh A. 163
 Sanborn, Allen F. 408
 Sanchez-Lavega, Agustin J. 357
 Sanders, Ian 407
 Sanders, Nathan 134
 Sarcopenia 270
 SARS See Severe acute
 respiratory syndrome
 Sasselov, Dimitar D. 38
 Saturn 356
 Scanning tunneling
 microscope 339
 Scardino, Peter T. 404

Scavenging 190
 Schaal, Barbara A. 233
 Schatz, Bertrand 190
 Schell, Mark 344
 Schernthaner, Johann P. 350
 Schiestl, Florian P. 67
 Schilthuisen, Menno 229
 Schimmel, David S. 260
 Schizophrenia 164, 292
 Schon, Isabelle 407
 Schonemann, Peter 93
 Schooler, Jonathan W. 250
 Schramm, Karl-Werner 197
 Schrier, Stanley, L. 13
 Schultz, Irv. 390
 Schultz, Peter 53
 Schwartz, Sophie 14
 Schweger, Charles E. 408
 Science policy 21
 Scorpions 52
 Sedimentation 100
 Seiders, Barbara 362
 Seiffert, Erik R. 198
 Seismic anisotropy 285
 Seismometers 220, 276
 Seizures 147
 Selectins 35
 Self-assembly 36
 Self-esteem 365
 Self-healing materials 405
 Selker, Ted 280
 Semiconductors 117, 213
 Sempos, Christopher T. 156
 Sensors 230, 285, 326, 362
 Sensory organs 68
 Sepkowitz, Kent A. 218
 Serengeti 190
 Serizawa, Takeshi 150
 Serotonin 110
 Setae 356
 Severe acute respiratory
 syndrome (SARS) 198,
 262, 374
 Sex hormones 132, 339
 Sex ratios 259
 Sexual behavior 67, 196
 reproduction 406, 407
 Sexual selection 165, 228
 Shao-Horn, Yang 389
 Sharks 68
 Sharpe, Richard 22
 Shekelle, Paul 237
 Shells 397
 Shellfish 46
 Sherratt, Andrew 67
 Shiflet, Gary 243
 Ships 382
 Shirakawa, Hideki 312
 Shock waves 276
 Shoemaker, Janet 86
 Showman, Adam P. 357
 Shubin, Neil H. 222
 Shull, Kenneth R. 262
 Shumaker, Sally A. 342
 Siberia 244
 Siblicide 102
 Sickle cell disease 29
 AIDS See Sudden infant death
 syndrome
 Siegel, Jerome M. 181
 Siegel, Richard W. 3
 Sildenafil 38
 Silicon carbide 197
 Silicon chips 267
 Silk 141
 Silkworms 141
 Silverman, David P. 45
 Simberloff, Daniel 233
 Simerly, Calvin 286
 Simon, Herbert A. 251
 Simon, Sanford 107
 Simpson, Michael 269
 Sims, David W. 68, 153
 Sivovich, Lawrence 405

Sivak, Michael 20
 Skakkebaek, Niels E. 22
 Skalak, Thomas 270
 Skin 349
 Skrutskie, Michael 237
 Skuse, David 213
 Skvarca, Pedro 149
 Sleep 62, 85, 94, 181, 222
 Sleep, Norman H. 307
 Slifka, Marka 340
 Sloan Digital Sky Survey 341
 Sloan, Frank A. 155
 Slocum glider 75
 Slocum, Joshua 76
 Small, Larry 21
 Smallpox 218, 253,
 340, 374
 Smell 54
 Smit, Mathijs G.D. 365
 Smith, Gary D. 381
 Smith, Gordon C.S. 157
 Smith, James N. 22
 Smith, Jeffrey C. 8
 Smith, Ken 372
 Smith, Kim 360
 Smith, Val H. 196
 Smithsonian Institution 21
 Smog 72
 Smoking, passive 222
 Snails 228
 Snakes 388
 Snow 61
 Snyder, Peter J. 296
 Sobel, Noam 54
 Sodium hypochlorite 136
 Solids 261
 Sohn, Rob 76
 Sohngen, Mariola 37
 Solar and Heliospheric
 Observatory 62
 Solar wind 381
 Soljacie, Marin 277
 Sollid, Ludvig M. 393
 Song, Jun-Feng 24
 Sood, Ajay K. 110
 Sørensen, Holger J. 164
 Soto, Ana 120
 Souter, Philip F. 403
 South Pole 220
 Soybeans 29
 Space Infrared Telescope
 Facility 139
 Space shuttle 83, 163, 187,
 215, 308
 Space travel 215
 Space-time 124, 190
 Species diversity 275
 Species, introduced 11, 134,
 232, 282
 Spectrometers 200
 Spectroscopy 349
 Speech 30, 254, 357
 Spehr, Marc 195
 Spence, John 389
 Spencer, Peter 310
 Spergel, David N. 99, 139,
 278, 341
 Sperm 69, 195, 222,
 230, 339, 381
 Spindles 286
 Spintronics 118
 Spongiform encephalopathies 340
 Spriggs, Matthew 389
 Springtails 180
 Squire, Larry R. 5, 244
 Squyres, Steven W. 285
 Sromovsky, Larry A. 325
 St. John's wort 359
 St. Louis Declaration 232
 Stanton, Maureen 397
 Stapleton, Jack T. 173
 Starbirth 227
 Starr, Douglas 171

INDEX STARS – ZITO

Stars 252, 278, 385, 387
 massive 110
 O 328
 shape 387
 solar neighborhood 365
 Statistics 405
 Steding, Douglas J. 72
 Steffan, Joan S. 102
 Steidel, Charles C. 227
 Steinmetz, Matthias 380
 Stem cells 54, 131
 Stenseth, Nils 228
 Stephenson, Edward 227
 Sternberg, Leonel S.L. 317
 Stevens, Richard G. 132
 Stevens, Robert K. 73
 Stevenson, David J. 307
 Stevenson, Mario 142
 Stockwell, Tim 155
 Stomach 148
 Stone Age tools 234, 302
 Stoneking, Mark 307
 Storhoff, James 327
 Stork, David G. 346
 Stothert, Karen E. 126
 Stout, Deitrich 234
 Strand, Michael 358
 Strayer, David I. 94
 Strepsiptera 358
 Stress 68, 230
 String theories 227
 Stringer, Christopher 371
 Strogatz, Steven 405
 Stroke 37, 46, 155, 157, 206, 341
 Strong force 333
 Stuart, Douglas L. 360
 Stupp, Samuel 313
 Suarez, Susan 69
 Subiaul, Francys 332
 Subliminal messages 116
 Submarine detection 168
 Sudden infant death syndrome 270
 Sudhoff, Thomas 213
 Sues, Hans-Dieter 211
 Sulfides 3
 Sullivan, Dennis 380
 Sun 46, 404
 Sunscreens 29
 Sunspots 404
 Supergiant star 252
 Supernovas 14, 206, 317
 Supersymmetry 286
 Supertasters 142
 Supreme Court 405
 Surface science 36, 339
 Surface tension 189
 Surfactants 292
 Surgery 77, 323
 Sutherland, Lisa A. 270
 Suzuki, Wendy A. 245
 Svendsen, Clive N. 246
 Swan, Shanna H. 339
 Swanson, Don 78
 Swerdloff, Ronald S. 297
 Swift, James H. 70
 Swordy, Simon P. 179
 Symbiosis 259, 264
 Syms, Richard R.A. 405
 Synapses 212
 Synthetic estrogen 390
 Szalay, Alex S. 341
 Szoka, Francis 43

T

T cells 13, 398
 Takahashi, Hiroshi 116
 Takayama, Shuichi 381
 Takemoto, Paul 20
Tamarix 232
 Tanabe, Shinsuke 197
 Tanida, Jun 201
 Taniguchi, Yoshiaki 228
 Tanter, Mickael 170
 Tapeworms 181
 Tapley, Byron D. 6
 Taste 189
 Tatsumi, Takashi 318
 Tattersall, Ian 275
 Tautz, Jurgen 324
 Tauxe, Robert 137
 Tea 238
 Technetium 238
 Teegarden, Bonnard 365
 Teflon 355
 Teissedre, Pierre-Louis 156
 Telecommunications 53, 342, 373
 Telescopes 200
 Telling, Rob H. 243
 Temperature 294, 301, 366
 Temple, Elise 173
 Tenover, J. Lisa 297
 Termites 238
 Terrones, Mauricio 309
 Terrorism 179
 Testosterone 36, 296
 Thackeray, Michael 389
 Thallium 286
 Thermoelectricity 68, 213
 Thermonuclear fusion
 See Fusion
 Thermoregulation 408
 Thiemens, Mark H. 3
 Thin films 189
 Thiophenes 312
 Thomas, Richard H. 181
 Thompson, David D. 309
 Thompson, F. Christian 292
 Thompson, Ian M. 403
 Thompson, Paul M. 92
 Thompson, William W. 78
 Thorpe, Lorna 253
 Three Georges Dam 323
 Thurston, William 379
 Thyroid 278
 Time reversal 168
 Tin 309
 Tissue engineering 101, 261
 Tissue plasminogen activator 37
 Tissue transglutaminase 392
 Titanium 243
 Titus, Timothy N. 45
 Tomanek, David 244
 Tombs 45
 Tools 182, 234, 254, 380
 Tooth decay 222
 Topology 124, 259, 378
 Traffic engineering 150
 Transfusions 59, 77
 Transgenic plants 350
 Transplants 14, 29, 229, 243
 Transportation 150
 Trash 197

Trees 282
 Tresco, Patrick 142
 Triclosan 196
 Trinkaus, Erik 302
 Trucks 150
 Tuberculosis 318
 Tumor necrosis factor 333
 Tundra 408
 Tung, Tiffany A. 302
 Tunstall, Daniel B. 237
 Turbulence 189
 Tutankhamen 45
 Twin primes 195
 Two-Df Survey 341
 Two Micron All Sky Survey 237
 Tyler, Christopher W. 346
 Tyler-Smith, Chris 91
 Typhoid 136
Tyrannosaurus rex 190, 211

U

U.S. Pharmacopoeia 359
 Ulcers 148
 Ultrasound 168
 Ultraviolet astronomy 328
 Ultraviolet radiation 101, 269
 Umbilical cord 14, 29
 Undersea communications 168
 Universe, age of 99, 148
 Universe, structure of 99, 214
 Uranium 179
 Urology 381
 Uterus 35

V

Vaccines 78, 218, 253, 318, 340
 Vaccinia 218
 Vader, Willemijn 393
 van Belle, Gerard 388
 Van Dongen, Hans P.A. 222
 Van Dover, Cindy L. 37
 van Eyck, Jan 346
 van Kessel, Julia 366
 van Kolck, Bira 227
 van Leuven, Bert 25
 Vaughn, Richard T. 24
 VaxGen 133
 Veazey, Ronald S. 237
 Velander, William 101
 Venkatasubramanian, Rama 213
 Venom 52
 Verberg, Peit xxx
 Verde, Licia 341
 Verhoef, Petra 5
 Vermiculite 350
 Vertegaal, Roel 279
 Viaclovsky, Jeff 259
 Viagra 38
 Vice, Daniel H. 298
 Vicuña 26
 Vidal-Madjar, Alfred 164
 Villet, Martin H. 408
 Vinci, Richard P. 197
 Vining, Cronin B. 213
 Violets 232
 Vision 14, 200, 308
 Visser, Marcel E. 152

Vitamin A 52
 Vitamin C 349
 Vitt, Pati 233
 Vog 78
 Vogel, Dirk 334
 Vogelmann, Thomas C. 61
 Volcanoes 78
 vom Saal, Fred 120
 Von Ehr, James 372
 Vorburger, Theodore V. 24
 Voyager missions 356

W

Wachtershauser, Gunter 265
 Wahl, Karen 363
 Wahlsten, Douglas 93
 Wahr, John M. 6
 Wai, Chien M. 359
 Walba, David M. 53
 Waldman, Scott A. 100
 Walther, Diego J. 110
 Wan, Shiqiang 30
 Wang, Xuanji 190
 Wang, Zhengnan 125
 Wania, Frank 334
 Warburton, Dorothy 214
 Ware, James H. 324
 Wasan, Darsh T. 292
 Washtershauser, Gunter 265
 Wasps 259
 Wassertheil-Smoller, Sylvia 342
 Water 136, 189
 drinking 403
 Water pollution 365, 403
 Water treatment 136, 196
 Watermelon snow 61
 Watersheds 237
 Waterston, Robert 122, 245
 Watkins, Michael M. 6
 Watson, James D. 248
 Wax 187
 Webb, R. Clifton 356
 Weeds 232
 Weight loss 237
 Weinberg, Nevin N. 148
 Weinberger, Daniel R. 164
 Weinberger, Joel 116
 Weisbrodt, Norman W. 182
 Weislo, William T. 190
 Weiss, David J. 238
 Weiss, Martha R. 286
 Weiss, Ron 267
 Welfare programs 149
 Werner, Bradley T. 314
 Werner, Klaus 301
 Wesselborg, Sebastian 408
 West Nile virus 203, 253
 West, Meredith J. 357
 Westinghouse 165
 Westman, Eric 89
 Westneat, David 246
 Whales 69, 365
 Wheeler, Jane C. 26
 Whey 270
 White, Tim D. 275, 371
 Whiting, Michael F. 35, 181
 Whitesides, George M. 405
 Wicker, Linda S. 281
 Wiechert, Uwe H. 3
 Wiemann, Brian M. 292
 Wilkinson Microwave
 Anisotropy Probe 99

Will, Clifford M. 61
 Willersley, Eske 244
 Willinger, Marian 62
 Willott, Chris 317
 Wills, Ron B.H. 360
 Wilson, Brittan A. 196
 Wine 155
 Wings 35
 Winkler, P. Frank 206
 Winter moth 152
 Wireless telecommunications 168
 Wisdom, Jack 190
 Wise, Robert A. 323
 Witten, Edward 124
 Wolf-Rayet stars 328
 Wolpoff, Milford 371
 Women's Health Initiative 341
 Wood, Bernard 132, 275
 Wool, Richard P. 405
 Woolbright, Larry 11
 Woosley, Stan E. 180
 Work hardening 197
 World Trade Center 109
 Wounds 101, 184
 Woychik, Rick 123
 Wrinkles 173
 Wu, Jianguo 323
 Wu, Rudolf S.S. 132
 Wu, Toejian 408
 Wu, Xingyong 108
 Wudl, Fred 312

X

X rays 179
 X-ray crystallography 157, 277
 XMM-Newton Observatory 214
 Xu, Shi-Je 21
 Xu, Xing 51

Y

Y chromosome 91
 Yaghi, Omar 382
 Yang, Zangdong 333
 Yildirim, Cem Y. 195
 Yoder, Anne D. 198
 Yoder, Charles 221
 Yohe, Gary 154
 Yon, Sylvain 170
 Yoshizato, Katsutoshi 141
 Young, Douglas B. 318
 Young, Steve 42

Z

Z-pinch 252
 Zavala-Hidalgo, Jorge 376
 Zebra mussels 365
 Zebrafish 29, 84
 Zeiss, Carl 201
 Zeolites 318
 Zera, Anthony 35
 Zhang, Shuguang 44
 Zhou, Otto 276, 372
 Zilberman, David 85
 Ziliac, Greg 188
 Zito, Julie M. 77

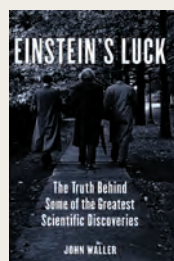
Books

A selection of new and notable books of scientific interest

EINSTEIN'S LUCK: The Truth Behind Some of the Greatest Scientific Discoveries

JOHN WALLER

This revisionist look at some of science's greatest discoveries reveals that they might not have been as glorious as they seem. For instance, Waller reports that Louis Pasteur suppressed data that didn't support his case for the germ theory of disease.

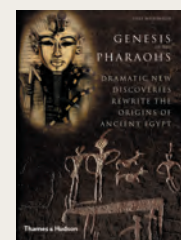


Joseph Lister's famously clean hospital wards were anything but. Alexander Fleming misled the world about his role in the discovery of penicillin. Moreover, Waller cites political struggles and ethical shortcomings that resulted in some unproved ideas being advanced purely on the names of the famous scientists putting them forth. Then there is the element of luck, which isn't generally documented in science history but can be an important force behind a great idea. Waller contends that facts were often omitted in the historical record as a way of preserving the hero status of certain scientists and inspiring others by example. He believes that it's time to set the record straight and tell people the truth about the path that many scientists take in making and promoting their great discoveries. *OUP, 2003, 308 p., b&w photos, hardcover, \$30.00.*

GENESIS OF THE PHARAOHS: Dramatic New Discoveries Rewrite the Origins of Ancient Egypt

TOBY WILKINSON

For decades, Egyptologists have puzzled over the origins of the ancient people who populated the Nile Valley nearly 4,500 years ago. Because the archaeological record shows so many changes



happening so quickly in these peoples' lives, some moderns speculate that aliens settled the region. Scholars, on the other hand, wrangle between the theory that earthlings from elsewhere in the world brought civilization into the valley or that it emerged within the region itself. Wilkinson believes he's found the answer to all such speculation in petroglyphs he discovered in the desert between the Nile Valley and the Red Sea. He believes that the pharaohs' distant ancestors made the rock carvings there that depict afterlife journeys, royal hunting, and the iconography of gods and kings. Many of these images foreshadow classic Egyptian art, yet they were carved 3,500 years before the pharaohs built tombs in the Valley of the Kings. Wilkinson's findings made headlines about 3 years ago. Here he describes his research in the desert and details of his theories.

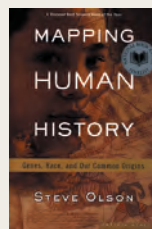
Thames Hudson, 2003, 208 p., color plates/b&w photos/illus., hardcover, \$29.95.

HOW TO ORDER To order these books, please contact your favorite bookstore. *Science News* regrets that at this time it can't provide books by mail.

MAPPING HUMAN HISTORY: Genes, Race, and Our Common Origins

STEVE OLSON

By pulling together evidence from the recent mapping of the human genome, the archaeological record, and linguistic research, Olson argues that

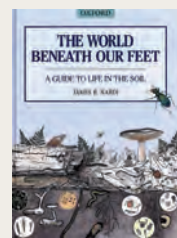


the idea of race is merely a social construct with no biological basis. He points to a Mitochondrial Eve, who lived in Africa about 150,000 years ago and from whom all people descended. By tracking people of five broad regions of the world—Africa, the Middle East, Asia and Australia, Europe, and the Americas—from their first

THE WORLD BENEATH OUR FEET: A Guide to Life in the Soil

JAMES B. NARDI

Whether you walk on pavement or dirt each day, chances are you give little thought to the living world beneath your feet. Just one acre of fertile ground can



support about 8 million earthworms, 400 million potworms, and 80 billion eelworms or nematodes. Nardi profiles more than 100 such creatures that make soil a vibrant yet hidden ecosystem. Each profile features a drawing of the specimen and details the classification, size, role in the food chain, and number of related species among microbes, invertebrates, and vertebrates. These data accompany an overview of each creature's contribution to the ecosystem and an explanation of how the organism interacts with its mineral and organic neighbors. The book also includes a summary of soil ecology and details how people enrich the soil. *OUP, 2003, 223 p., b&w photos/illus., hardcover, \$35.00.*

Y: The Descent of Men

STEVE JONES

Most men like to believe that they're the superior sex, but geneticist Jones lists several reasons that isn't so. Men's life spans are shorter than those of women, and men are more prone to genetic diseases and predisposed to baldness, just to name a



few. Testosterone may make a man a man, but it also seems to suppress his immune system. As evidenced in his earlier work, *Darwin's Ghost*, an update of Charles Darwin's *Origin of Species*, Jones is a clever and provocative popularizer of scientific ideas. In a chapter titled "Hydraulics for Boys," he describes the physics of a man's most private appendage and reveals, for instance, that even before they're born, boys have erections for an hour a day. Jones elaborates on scores of physiological as well as sociological elements of maleness to paint a startling look at what it is to be a man. *HM, 2003, 252 p., hardcover, \$25.00.*

LETTERS

Wrong on two accounts

I would like to correct two errors in the article "Ancestral Bushwhack: Hominid tree gets trimmed twice" (*SN: 5/3/03, p. 275*). The scientific meeting of the Paleoanthropology Society was held in Tempe, Ariz., not Phoenix. Furthermore, Tim D. White was not a codiscoverer of Lucy. After my discovery, I invited Dr. White to help analyze and describe Lucy and other fossil hominid finds from Hadar, Ethiopia.

DON JOHANSON, ARIZONA STATE UNIVERSITY, TEMPE, ARIZ.

The meeting of the Paleoanthropology Society indeed was in Tempe, and Tim White was not a codiscoverer of Lucy. However, Tom Gray, who worked with Donald Johanson as a graduate student, told Science News that that distinction belongs to him. Gray says that he was present at Lucy's discovery and that although Johanson was first to see a piece of the skeleton, Gray found several crucial parts. —B. BOWER

Regarding "Ancestral Bushwhack: Hominid tree gets trimmed twice," consider how many species current *Homo sapiens* would be divided into using the criteria of paleoanthropologists, considering Pygmies and basketball players.

RICK FISHER, RICHLAND, WASH.

Out and about

There is another interpretation of the mitochondrial DNA data presented in "Stone Age Genetics: Ancient DNA enters humanity's heritage" (*SN: 5/17/03, p. 307*). The data make it clear that the more advanced Cro-Magnon males only mated with Cro-Magnon females; however, there is no evidence that the Cro-Magnon females didn't mate with the more muscular Neandertal males.

JEFF NICOLL AND JOAN CARTIER, WASHINGTON, D.C.

Much mixing between Neandertals and *Homo sapiens* could have occurred without leaving any evidence in mitochondrial DNA, which is inherited only from mother to daughter. This would happen if the women stayed with the groups they were born in while the men wandered about and interbred.

BRUCE R. MEHLMAN, RICHMOND, CALIF.

SEND COMMUNICATIONS TO:

Editor, *Science News*
1719 N Street, N.W., Washington, D.C. 20036
or editors@sciencenews.org
All letters subject to editing.