SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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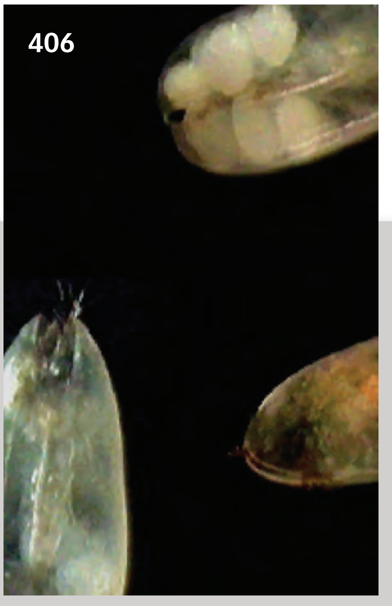
Feature



This Week

Of Note

Departments

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

THIS WEEK ONLINE
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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.

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SCIENCE NEWS This Week

Germs Begone

New technology cleans dangerous water

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).

PROCTER AND GAMBLE

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*, 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 *Science News*.

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 ratcheting 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

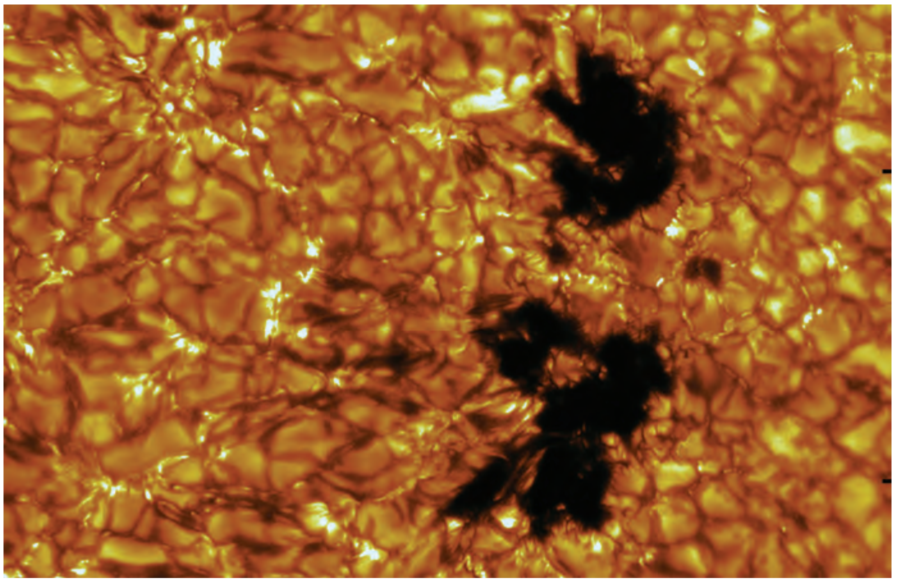
Solar Terrain

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



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).

BERGER/LOCKHEED MARTIN SOLAR AND ASTROPHYSICS LAB.

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 studies 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 temperature 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*).

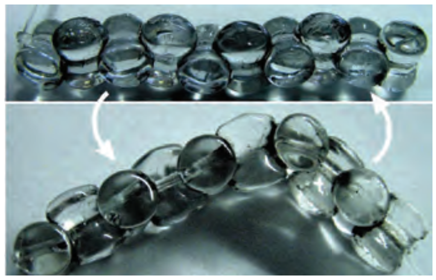
Now, Mila Boncheva and George Whitesides of Harvard University are tapping the vertebral spine for inspiration. Using millimeter-scale polymer beads for vertebrae and thin elastic threads for muscles and ligaments, the researchers have created spinelike structures that can deform drastically, even become 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-shape 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 centimeter 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.



BONCHEVA ET AL./ANGEW. CHEMIE INT. ED.

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.

"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.

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.

HORNE

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 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 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.

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.

MESELSON

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. ■

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

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

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 (μg/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 μg/dl, at least 5 μg/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 μg/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 μg/dl—the threshold for what's deemed "elevated" by the federal government. —J.R.

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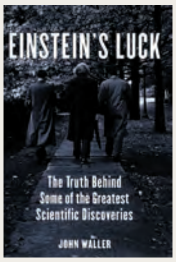
Books

A selection of new and notable books of scientific interest

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

JOHN WALLER

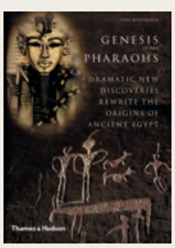
This revisionist look at some of science's greatest discoveries reveals that they might not have been as glorious as they seem. For instance, Waller reports that: Louis Pasteur suppressed data that didn't support his case for the germ theory of disease. Joseph Lister's famously clean hospital wards were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

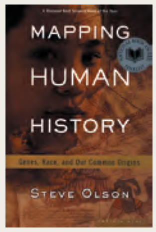
For decades, Egyptologists have puzzled over the origins of the ancient people who populated the Nile Valley nearly 4,500 years ago. Because the archaeological record shows so many changes happening so quickly in these peoples' lives, some moderns speculate that aliens settled the region. Scholars, on 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.***



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

STEVE OLSON

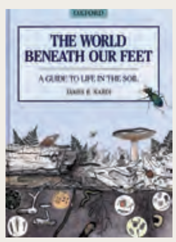
By pulling together evidence from the recent mapping of the human genome, the archaeological record, and linguistic research, Olson argues that the idea of race is merely a social construct with no biological basis. He points to a Mitochondrial Eve, who lived in Africa about 150,000 years ago and from 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 appearance in history to the modern day, Olson explores what our genetic history tells us about the past, present, and future of our species. Originally published in hardcover in 2002. ***Mariner, 2003, 292 p., paperback, $14.00.***



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.***

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.

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.

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