SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

NOVEMBER 22, 2003 PAGES 321-336 VOL. 164, NO. 21

mini moons

dna and nanotubes unite

marrow heals heart

a whale of a new species

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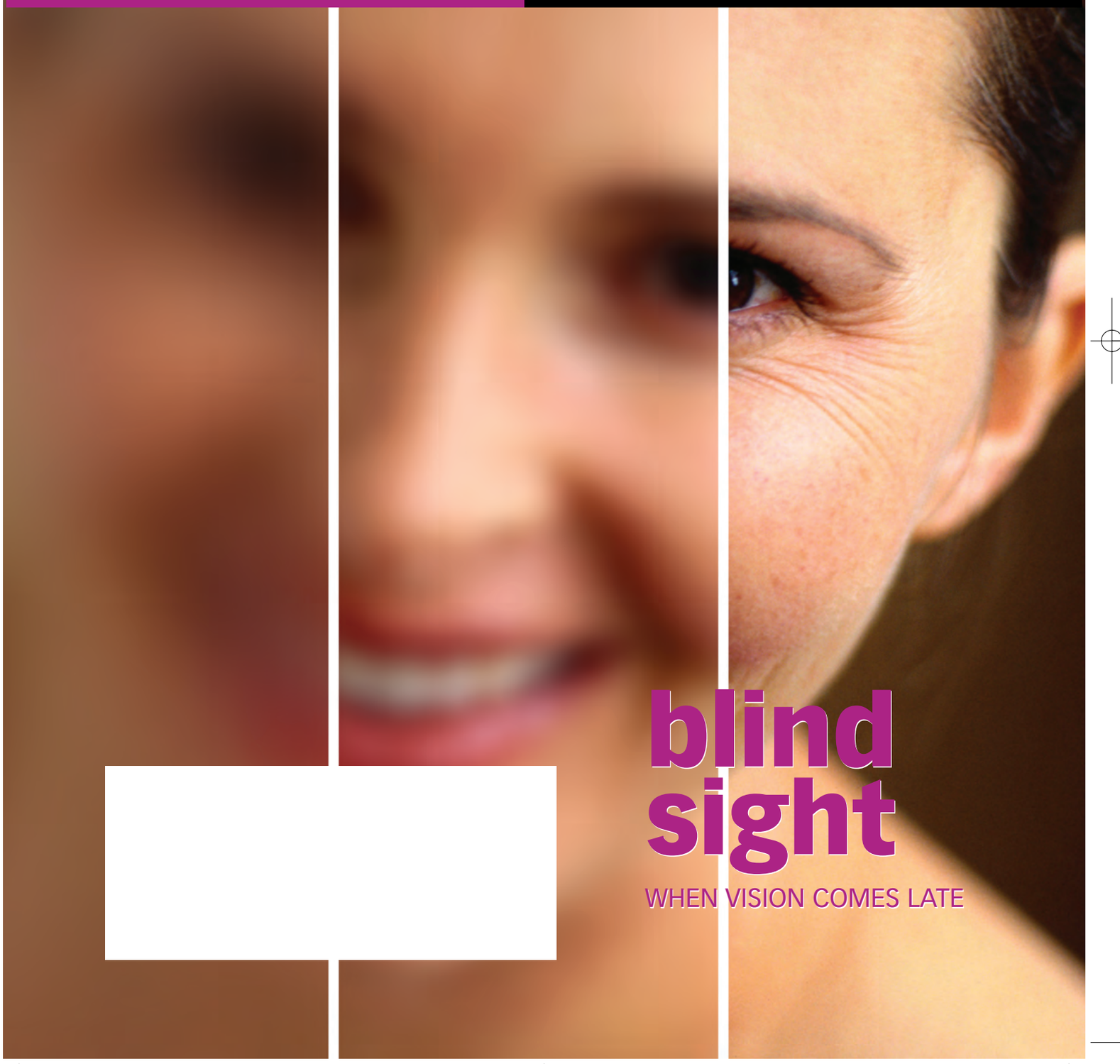

blind sight

WHEN VISION COMES LATE

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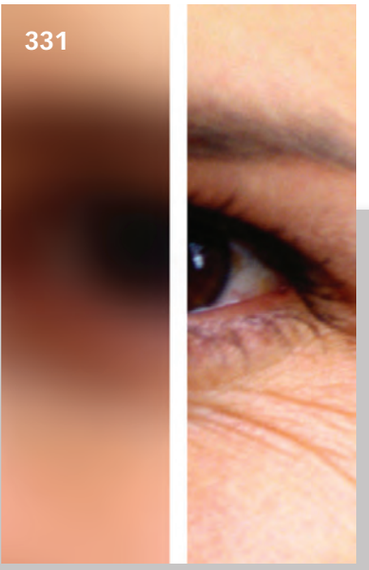

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Of Note

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Cover Children who see only after months or years of cataract-induced blindness may perceive a whole face, even if the features are blurred. Their adjustment to having sight has attracted the interest of scientists trying to figure out how people make visual sense of the world. Page 331

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SCIENCE NEWS
This Week

Rebuilding the Heart

Marrow cells boost cardiac recovery

Experimental therapy that infuses a person's bone marrow cells into his or her damaged heart tissue is showing early success, scientists report. First tried in patients 2 years ago, the technique is designed to stimulate the growth of new, healthy heart cells. The treatment could help people who've had recent heart attacks, as well as those who've been battling heart disease for years, researchers said last week at a meeting of the American Heart Association held in Orlando, Fla.

When a coronary artery becomes obstructed in a heart attack, some heart-muscle cells downstream from the blockage die because they're starved of oxygen and nutrients. Other cells linger in a weakened state. The dead and dying tissue limit a person's stamina by restricting how vigorously the heart can pump blood.

QUOTE

"I think that what is happening is [marrow] cells talk to the residual stem cells in the heart, which can then divide."
HELMUT DREXLER, HANNOVER MEDICAL SCHOOL

Two studies now show that people who have marrow cells inserted into their hearts within days of a heart attack exhibit improvement. In a third investigation, a marrow transfer improved treadmill performance of people with long-term heart disease. A fourth study demonstrated gains in heart output among patients getting a bone marrow–boosting drug, but not marrow cells.

In the first study, a team in Germany enrolled 60 participants who had had heart attacks. All received standard drug treatment and underwent balloon angioplasty, including insertion of a cylindrical mesh stent to prop open a previously blocked artery. Then marrow was extracted from the hipbones of each of 30 of the patients, briefly cleaned, and later that day infused via a catheter into the patient's heart.

Both groups had had about 50 percent of normal heart output immediately after the original angioplasty procedures. After 5 months, magnetic resonance imaging revealed that participants given the marrow cells had improved their output to about 57 percent of normal, while the others averaged 51 percent, says Helmut Drexler of Hannover Medical School.

Another group in Germany conducted a similar study on 40 patients. In 20 people receiving a marrow-cell transfer, the average heart output rose from 55 percent to 65 percent of normal over 3 months. The others showed no change, report Bodo E. Strauer and his colleagues at Heinrich-Heine-University in Düsseldorf.

The third study, presented by Emerson C. Perin of the Texas Heart Institute in Houston, investigated people with severe heart failure who had been in declining health for years. "Many couldn't walk much, even around the house," he said.

The heart's capacity to pump blood through the lungs limits a person's oxygen intake. On treadmill tests, the group averaged oxygen intake of only 18 milliliters per kilogram of body weight per minute, whereas a typical 58-year-old has a rating of 60 ml/kg/min, Perin says. Some of the patients had dipped below 14 ml/kg/min, a reading so low that it made them candidates for a heart transplant.

In Perin's study, 11 of the 20 participants underwent marrow transfer. After 6 months, these patients' oxygen intake had risen to 24 ml/kg/min on average, while the control group stayed at about 18 ml/kg/min.

Because these treatments use a person's own bone marrow cells, they avoid the immune rejection that can arise from conventional marrow transplants.

The research on marrow transfer is "very preliminary and not quite ready for widespread clinical use," says Robert O. Bonow of Northwestern University Feinberg School of Medicine in Chicago. "But it has generated a lot of excitement."

Taking a less invasive approach, Christopher A. Glover of the University of Ottawa Heart Institute in Ontario and his colleagues gave five heart attack patients a drug that spurs bone marrow production. The participants' average heart output went from 31 percent of normal to 41 percent in 6 weeks, Glover says.

The drug, a bioengineered form of a natural protein called granulocyte colony stimulating factor, is already used by people who've donated marrow to others and by cancer patients.

The new studies don't reveal how marrow stem cells affect the heart tissues. Animal tests suggest that some of the immature marrow cells transform directly into heart-muscle cells (*SN: 1/13/01, p. 30*).

Drexler takes a different view. "I think that what is happening is [marrow] cells talk to the residual stem cells in the heart, which can then divide," he says. Some of these activated stem cells in the heart might also differentiate to become new blood vessels to nourish the growing muscle cells, he notes. —N. SEPPA

Pieces of a Pulverizer?

Sediment fragments may be from killer space rock

Scientists sifting through ancient sediments laid down just after Earth's most devastating episode of extinctions may have found minuscule fragments of the massive extraterrestrial object suspected to have caused the catastrophe.

About 250 million years ago, at the end of the Permian period, 95 percent of the species in the oceans and 70 percent of those on land went extinct (*SN: 2/1/97, p. 74*). That makes the famous mass extinction that wiped out the dinosaurs some 65 million years ago seem like a minor die-off. Previous chemical analyses of some gases and other matter in sediments deposited during the transition between the Permian and Triassic periods suggest that these materials came from outer space (*SN: 2/24/01, p. 116*). Now, researchers examining the same sediments have extracted microscopic fragments of metals and minerals that also bear an extraterrestrial fingerprint.

The samples that scientists analyzed were excavated from a 25-centimeter-thick, clay-rich layer at Antarctica's Graphite Peak, says Asish R. Basu, a geochemist at the University of Rochester in New York. Researchers used magnets and ultrasound to extract dozens of magnetic particles from the powdery material.

Many of the particles contain iron- and nickel-rich oxide and sulfide minerals, as well as small grains of silicates, says Basu. The chemical composition of the grains in these mixed-mineral particles—including their low concentration of iron oxide and high ratio of manganese to iron—strongly suggests that the minerals didn't crystallize on Earth. Such a chemical mix is found only in a type of meteorite that formed about 4.5 billion years ago, soon after our solar system began to coalesce, Basu notes. He and his colleagues report their research in the Nov. 21 *Science*.

The team's findings could be additional evidence that the impact of an extraterrestrial object caused the Permian extinctions, says Michael R. Rampino of New

York University.

The magnetic fragments that Basu and his team found "clearly are little pieces of meteorite," Rampino says, but he cautions that they could be part of the normal flux of micrometeorites that fall to Earth. Basu counters that similar fragments don't show up in the coal bed that lies just below the clay-rich stratum, so the bits of ancient meteorite aren't part of that everyday accumulation.

Bits of iron similar in size and shape to those found in Antarctica have turned up elsewhere in sediments that mark the end of the Permian period, including some formerly deep-sea accumulations now found on land in Japan and in some Chinese deposits that had accrued in shallow water. Rampino suggests that regardless of the source of the Antarctic fragments, their fall to Earth 250 million years ago was part of a worldwide phenomenon that may or may not have been cataclysmic. —S. PERKINS

No Assembly Required

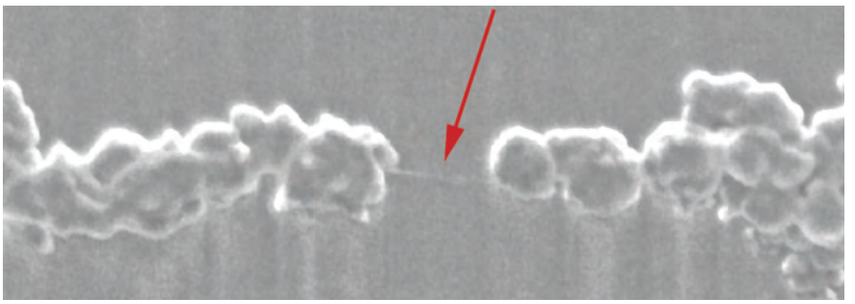
DNA brings carbon nanotube circuits in line

By harnessing the binding patterns of DNA and proteins, researchers have devised an efficient way of making carbon-nanotube transistors. The new technique offers the possibility of assembling nanotubes into complex circuits that could eventually yield computer chips that are faster and more powerful than those available today.

Chip manufacturers are forever trying to squeeze more and more components onto a single chip. The smallest features on today's microchips are about 100 nanometers in width, whereas a carbon nanotube is only about 1 nanometer wide.

Current techniques for assembling carbon nanotubes on chips aren't yet up to the job of making complex circuits. Using an atomic force microscope, for example, researchers can mechanically place carbon nanotubes, one by one, on a chip. Looking through a microscope, researchers find each nanotube and delicately bring it in line with an electrical contact. "It's like using tweezers," says Erez Braun of the Technion-Israel Institute of Technology in Haifa.

Braun and his colleagues took advantage of the binding features of proteins and DNA, which automatically combine in specific, predictable ways and assemble into highly organized structures. Because these materials are on the same scale as nanotubes are, researchers are increasingly using this self-assembling strategy of biology to build nanoscale devices.



TINY TRANSISTOR A carbon nanotube (arrow) is connected to gold electrical contacts on either end. The proteins and DNA aren't visible in this image.

"Self-assembly allows us to make complex circuits without human intervention," says Braun. "The information encoded in the molecules can determine the configuration of a circuit."

To fabricate their transistor, Braun and his colleagues first worked with components in a test tube to devise a way of attaching carbon nanotubes to precise locations on a DNA scaffold. The researchers affixed a bacterial protein to a synthetic piece of single-stranded DNA. When this was mixed with a longer fragment of double-stranded DNA, the two DNA fragments bound where their sequences matched. Next, the researchers decorated nanotubes with several molecules of a second protein.

The scientists used an intervening molecular complex that binds to both of the proteins, thereby bringing together the nanotubes and the DNA molecules.

When the Technion team flowed the test-tube solution over a silicon chip, the DNA-nanotube structures stuck to the chip surface. Finally, the team coated the exposed ends of each DNA fragment with gold contacts, making a simple circuit.

To see whether these devices worked as transistors, with the chip's silicon base functioning as the gate, the researchers applied different voltages. At one voltage, current flowed through the nanotubes; at another voltage, no current flowed. Those two states are equivalent to the 1 and 0 elements of digital computation. "That's how the logic in your computer works," says Braun. The scientists describe their work in the Nov. 21 *Science*.

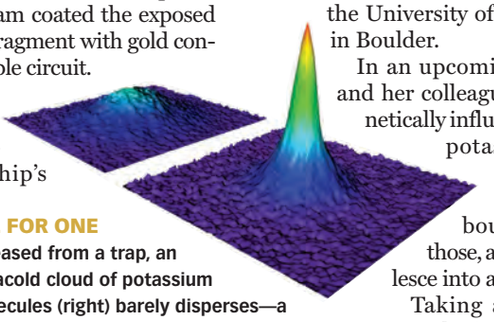
Thomas LaBean of Duke University in Durham, N.C., characterizes the Technion achievement as the "latest advance in a very promising line of research." He and his colleagues are also fabricating DNA scaffolds to use in assembling carbon-nanotube circuits. However, instead of starting with linear strands of DNA, LaBean and his colleagues are fabricating more-complex, two- and three-dimensional DNA scaffolds to serve as their starting material. —A. GOHO

Quantum Pileup

Ultracold molecules meld into oneness

Two independent teams of physicists have coaxed molecules into an extraordinary state of ultracold matter previously demonstrated only with atoms.

In each of the new experiments, the researchers created minuscule gas clouds with an amazing property. All of the constituent two-atom molecules meld to form a single supermolecule, says Deborah S. Jin of JILA, a joint institute of the National Institute of Standards and Technology and the University of Colorado, both in Boulder.



ALL FOR ONE Released from a trap, an ultracold cloud of potassium molecules (right) barely disperses—a sign that nearly motionless molecules have condensed into a new form of matter. Slightly warmer cloud (left), which hasn't condensed, spreads after release.

SCIENCE; M. GREINER

In an upcoming *Nature*, she and her colleagues report magnetically influencing ultracold potassium atoms to make about 200,000 weakly bound pairs. Of those, about a tenth coalesce into a supermolecule.

Taking a different approach, Rudolf Grimm and his colleagues at the University of Innsbruck in Austria cooled 100,000 two-atom lithium molecules into a supermolecule. The team reports its success in a future issue of *Science*.

Blending the identities of atoms, and now of simple molecules, relies on a quantum-mechanical process made possible by wave-

like characteristics of the particles. That merger is the hallmark of so-called Bose-Einstein condensates (BECs).

Satyendra Nath Bose and Albert Einstein independently predicted BECs in 1924, and the first was made in 1995 from rubidium atoms (*SN: 7/15/95, p. 36*). Since then, many laboratories have created BECs from different elements and have studied the condensates' properties (*SN: 8/12/00, p. 102*).

To take BEC science further, researchers have been striving to achieve quantum condensations of simple molecules, such as the potassium or lithium pairs.

The new condensates are an "important milestone," comments physicist Christophe Salomon of the École Normale Supérieure in Paris.

Both teams created long, thin condensate clouds that measured tens of micrometers in diameter. The Innsbruck group claims to have made a relatively long-lived condensate, which lasted more than 20 seconds. The Boulder condensate stuck around for only about 10 milliseconds.

Both groups say that by creating molecular condensates, they have devised a new means to investigate fundamental aspects of physics and chemistry. Potential topics include how electric charge is distributed within individual electrons and the ways in which chemical bonds form and break.

The new accomplishments may also lead to deeper understanding of superfluidity (*SN: 10/25/03, p. 262*), which is the flow of fluids without friction, and of superconductivity (*SN: 10/11/03, p .229*), the resistancefree flow of electrons, comments Wolfgang Ketterle of the Massachusetts Institute of Technology. Ketterle shared the 2001 Nobel Prize in Physics for his pioneering work on BECs.

Physicists have long recognized that elementary particles of ordinary matter fall into two broad classes, bosons and fermions. Chummy by nature, nearby bosons readily occupy the same quantum state. For instance, photons will share a particular energy level in a laser. In contrast, standoffish fermions won't share a quantum state with even one other fermion.

Although electrons, protons, and neutrons, the building blocks of atoms, are all fermions, some atoms are bosons and some are fermions. It's easy to tell which is which: If an atom's total number of building blocks is even, the atom is a boson. If the total number is odd, it's a fermion.

To make BECs, scientists trap and cool bosons to temperatures just above absolute zero. Attempts to do the same with molecules made of bosonic atoms failed, however, because collisions shattered those molecules before condensation could take place.

Earlier this year, the BEC scientific community discovered that molecules composed of just two fermionic atoms are far less vulnerable to such disintegration. Conveniently, such molecules—because they contain an even number of fermions—are actually bosons.

The discovery has proved critical in the race for molecular BECs, Grimm says. Turning to molecules made of fermionic atoms, the Innsbruck and Boulder groups both achieved the coveted goal. —P. WEISS

Bias Bites Back

Racial prejudice may sap mental control

Racial bigotry creates undeniable hardships for its targets. Such prejudice may cut two ways, though. A provocative new study suggests that intolerance undermines the mental resources of biased individuals when they interact with those whom they deem inferior.

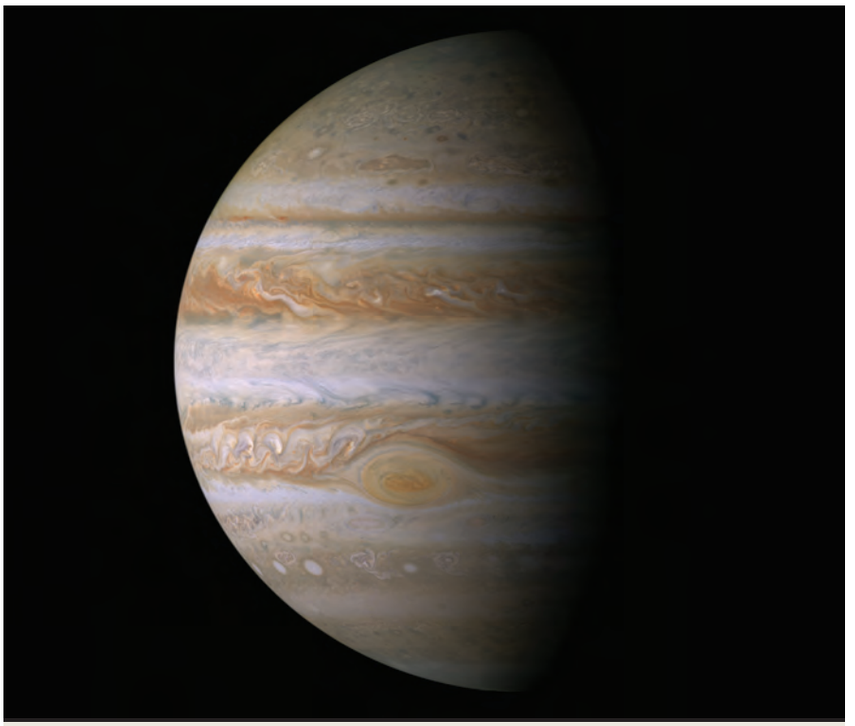
White people who hold biased feelings toward blacks have to work to control their thoughts and behaviors during interracial encounters, say psychologist Jennifer A. Richeson of Dartmouth College in Hanover, N.H., and her coworkers. This social strategy depletes the limited pool of mental resources available for monitoring and using various types of information, the scientists propose.

Their investigation appears in the December *Nature Neuroscience*.

The results "suggest that harboring racial bias may be maladaptive to optimal cognitive functioning," Richeson's group concludes. Further research will be needed to establish how such laboratory findings relate to racial attitudes and behaviors in real-world situations, the team adds.

The researchers measured 14 male and 16 female college students, all of whom were white, for unconscious, or implicit, racial attitudes. First, participants were instructed to press a certain computer key when they saw a name paired with a word with positive connotations and to press another key when they saw a name paired with a negative word.

Volunteers generally were slower and less accurate at reacting to combinations of typically black names, such as Lakisha and Tyrone, with positive words, such as health and beauty, than with negative words, such



NASA/JPL/SSI

Giant picture of a giant planet

Saturn-bound Cassini captured this arresting view, the sharpest global portrait of Jupiter ever produced, as the spacecraft passed within 10 million kilometers of the planet on Dec. 29, 2000. Released by NASA last week, this true-color composite shows cloud features as small as 60 km across. White thunderstorms punctuate several of Jupiter's cloud bands, while the Great Red Spot, a vortex bigger than Earth, sheds a wake. The thin, dark band in the planet's northern half is Jupiter's fastest jet stream. To assemble the 27 images that Cassini captured during an hour, scientists digitally repositioned and artificially re-illuminated each picture to correct for Jupiter's rotation, thereby showing the entire planet as it would have appeared when the first image was taken. —R. COWEN

as filth and ugly. One-third of the volunteers exhibited strong implicit racial bias, indicated by a pronounced difficulty in pairing black names with positive words and white names with negative words.

Participants then briefly conversed with either a black or a white experimenter.

Next, the students performed a task that required considerable mental control. They had to indicate the ink color in which color words such as *red* and *green* were printed. This task requires a person to override the impulse to read the word and instead report the ink color.

After talking with a black experimenter, volunteers who had scored high on implicit racial bias performed more poorly on the color-naming task than the other people did, the researchers say. No such pattern appeared after participants talked to the white experimenter.

Finally, when shown pictures of black faces, the people rated high on implicit racial bias showed more activity in brain areas involved in controlling thoughts and actions than the others did.

Richeson's investigation remains open to alternative interpretations, say psychologist William J. Gehring of the University of Michigan in Ann Arbor and his colleagues in a comment published with the new study.

For example, a high score in implicit racial bias may occur when a person has been exposed to lots of racially biased information, even if he or she doesn't endorse it, Gehring and his coworkers hold. Moreover, participants may have monitored their thoughts and actions during testing because they figured out that the experiment concerned race and feared that they had been tagged as racists.

Racial bias may have a broad influence on thinking processes, remarks psychologist Elizabeth A. Phelps of New York University. The new results need to be confirmed with different measures of bias and mental control, she says. —B. BOWER

Whales of Distinction

Old specimens now declared a new species

Japanese scientists have named a new category of living baleen whales to explain a series of puzzling specimens that has been accumulating since 1976.

NEW SPECIES Belly side of a whale (top), facing left, that has been classified as a new species. Researchers analyzed DNA and the skeletons of several specimens (one at bottom).

S. SHIMIZU

Members of the just-identified species, *Balaenoptera omurai*, look like fin whales but have distinctive physical and genetic characteristics, report Shiro Wada of the Fisheries Research Agency in Yokohama, Japan, and his colleagues. Distinguishing marks include a broad, flat head with a uniquely shaped central joining of the skull bones. In its mouth, this whale has unusually few of the baleen plates that such whales use to filter food from the water. The researchers report in the Nov. 20 *Nature* that their analysis brings the number of known living baleen whale species to eight, although other scientists come up with different totals.

Classifying whales presents special problems that don't plague catalogers of mice, comments James G. Mead of the Smithsonian Institution in Washington, D.C. Whale specimens are too large to store and ship readily, for example, and some of the taxonomy relies only on observations at sea. Although he and his colleagues named a new beaked whale only last year, Mead says that scientists generally describe a whale species perhaps once a decade.

Wada traces his interest back to work he did in the late 1970s on eight whales captured by Japanese research-whaling ships in the Solomon Sea and the eastern Indian Ocean. After he analyzed variations in certain enzymes, he suspected that the specimens represented a new species. When Wada compared the bones of these whales to museum-preserved skeletons of other whales, he strengthened his case.

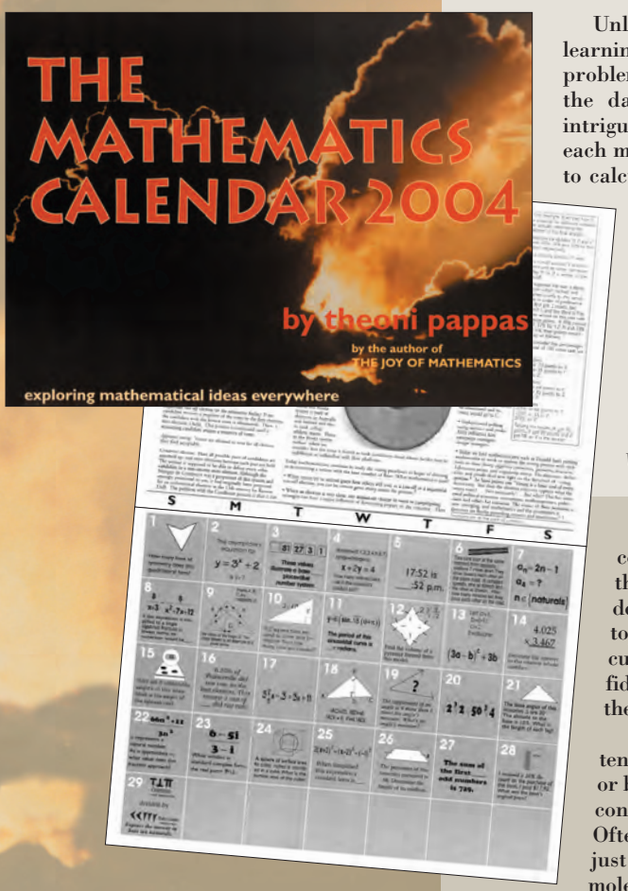
In 1998, just after Wada had finished drafting a manuscript that described the new species, a carcass turned up on an island in the Sea of Japan. The whale looked like the eight that he'd included in his report, so Wada abandoned his draft and joined the analysis of the new specimen. It was preserved by Tadasu K. Yamada of the National Science Museum in Tokyo, a coauthor of the new paper.

The researchers sequenced a section of 900 or so nucleotide building blocks in the DNA of the fresh specimen, two of the older ones that Wada had included in the proposed new species, and some other whales. DNA differences between the newest find and the specimens tentatively assigned to the new species were less than one-tenth as great as those between any of these whales and the others.

The new name, *B. omurai*, honors the late Japanese cetologist Hideo Omura. However, Mead cautions that it's too early to tell whether the thicket of earlier whale nomenclature includes a name that might preempt this one.

Mead says he's not surprised that a new species has turned up on this branch of the whale family tree because specialists have recognized confusion there for at least 2 decades. Straightening out the whole complex would take an entire career, he says. "At least, this [new paper] ties down the description of one species," Mead says. —S. MILIUS

Explore Math *with Theoni Pappas*



Unlock a fascinating world of mathematical challenges and learning with *The Mathematics Calendar 2004*. It features math problems for every day of the year; in each case, the solution is the date. An informative essay, mathematical curiosity, or intriguing problem—plus a handsome graphic—accompanies each month. Problems cover the spectrum from basic arithmetic to calculus. The answer is only one small part in the process of solving a problem. The challenge is discovering how to arrive at the solution and possibly discovering more than one method of solving it.

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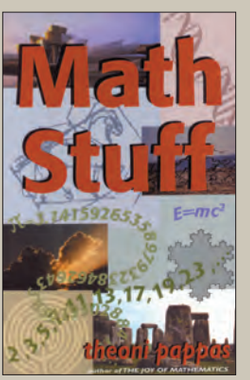
Math Stuff is not a book of numbers, formulas, or computations. It's a book of ideas. The mathematics behind these ideas is discussed in general terms, and each chapter is designed to be self-contained allowing the reader to open a topic at random. Many of the ideas presented are on the cutting edge and deal with anything from abstract concepts to fiddlehead ferns, from a number to numeral, from software to the nuts and bolts of a computer.



Stuff is the layperson's unpretentious word, which has no limits or boundaries. Math Stuff fills both conscious and unconscious space. Often we're oblivious to math stuff, just as we're oblivious to atoms and molecules. When crossing a bridge, most of us never think about the multiple equations and numbers crunching that went into the bridge's design and construction. When hiking or gardening, we don't think about the mathematics behind rock formations or plant forms. Or when flipping on the TV or using a cell phone, the mathematics of wave theory is farthest from our minds. Yet, math stuff is there describing, explaining, and influencing our lives.

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As we look around us, occasionally we see subtle impressions of the presence of mathematics. Some are current; some are left from past centuries. Tracking and discovering the trail of mathematical footprints is both fascinating and rewarding. These impressions help us understand our world and the universe, even as we discover the enormous influence of mathematics on our lives.

Mathematical Footprints follows the trail of mathematics. The order in which these mathematical footprints is presented is random, simply because that is often how they occur. For example, the Pythagoreans did not expect to uncover irrational numbers in the diagonal of a square. Nor did Fibonacci or future mathematicians expect the Fibonacci numbers to be so prevalent in nature. Or, who would have predicted fractals would become so important in describing everyday objects?

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MOONOPOLIES

The solar system's outer planets host a multitude of irregular satellites

BY RON COWEN

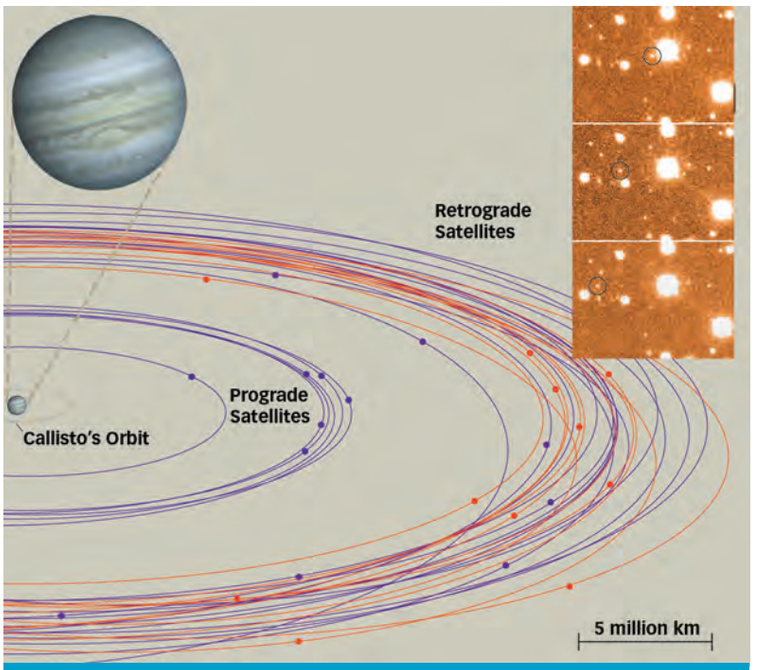
Not long ago, the solar system seemed to be a simple, orderly place. Anyone taking a trip to the local planetarium would have heard that the planets have 60 or so moons orbiting them on neat, nearly circular paths. That picture has now become a lot messier. Over the past 6 years, astronomers have discovered a passel of new moons around Jupiter, Saturn, Uranus, and Neptune, more than doubling the known number.

Compared with Earth's moon and most of the other satellites that planetary scientists have studied throughout the solar system, these recently discovered bodies appear downright unruly. They swoop in and out of the plane in which the planets orbit the sun and have highly elongated, rather than circular, paths. Some even orbit in the direction opposite to the rotation of their host planets. Because of these strange features, these objects are known as irregular satellites.

Most irregulars are tiny—less than 100 kilometers in diameter, or smaller than one-thirtieth the size of Earth's moon—and can barely be detected from Earth. Many reside so far from their planetary chaperones that gravity barely holds them in place.

Besides revealing our solar system to be far more cluttered than astronomers had suspected, these piffling objects are providing new clues about what conditions were like during the system's infancy. In particular, these moons may reveal details about a critical, last step in the formation of the outer planets.

For studying planet formation, irregular satellites are "one of the last [unexplored] frontiers," says Matthew J. Holman of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass.



MOONS BY JOVE — Orbits of all the outlying moons of Jupiter relative to the orbit of Callisto, the outermost of the planet's regular moons. A trove of 44 recently discovered irregular moons is shown in red. Inset: Motion of a faint body (circle) in this sequence of images reveals it's an irregular satellite of Jupiter.

SHEPPARD ET AL./U. HAWAII

SATELLITE REVOLUTION Until recently, discoveries of irregular satellites were nearly as irregular as are the satellites themselves. For more than a century after researchers spotted the first small irregular satellite, Neptune's Triton in 1846, only a handful had been found. Then, in 1997, a windfall began.

At observatories around the world, exquisitely sensitive solid-state light detectors, known as charge-coupled devices (CCD), had superseded photographic film, enabling astronomers to record objects hundreds of times fainter than ever before. Moreover, using large-format cameras consisting of millions of CCD pixels, researchers could search for the faint objects over large patches of sky.

Those were just the right tools for finding irregular moons, Philip D. Nicholson of Cornell University realized in September 1997. Nicholson and Brett Gladman, now at the University of British Columbia in Vancouver, were traveling to the medium-size Hale Telescope at Mount Palomar in California to search for objects in the Kuiper belt, the reservoir of comets that lies beyond the orbit of Neptune. But while on the airplane en route to Mount Palomar, Nicholson calculated that Uranus would be in the same field of view. He and Gladman decided that during their two nights at the Hale telescope, they and their colleagues would devote any spare time to a search for outlying moons around that planet.

The team succeeded. Gladman and his collaborators discovered the first two irregulars known to orbit Uranus.

A flurry of discoveries followed. Since Gladman's finding, his team and another have spotted 70 more of the irregular satellites. Astronomers announced the latest find, an irregular satellite of Uranus, in an Oct. 9 circular of the International Astronomical Union.

The number of moons added to the roster since 1997 is "stunning," says Joseph A. Burns of Cornell.

Finding irregulars isn't just a matter of scouring the sky with a sensitive detector. In a single snapshot of the heavens, a tiny moon can look just like a galaxy billions of light-years distant. But there's

one distinguishing feature: The motions of moons are discernible as each inches across the sky in synchrony with the planet it orbits. In contrast, distant galaxies appear to remain still.

Astronomers use two strategies to identify distant moons. One method, recently employed by Holman, J.J. Kavelaars of the National Research Council of Canada in Victoria, and Gladman uses a medium-size telescope to take a dozen or so precisely timed images of the same patch of sky during a single night.

In each image, they then shift all objects back to the position they would have had, if they truly were moons, at the time when the astronomers took their first exposure of the night. Finally, they combine the images.

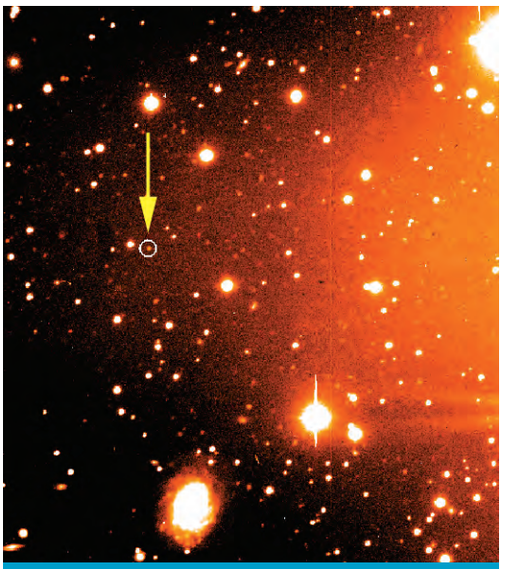
In this so-called shift-and-add technique, the objects that are satellites end up in exactly the same position in each superimposed image, producing a bright, easy-to-spot point of light.

The other strategy, adopted by David C. Jewitt and Scott S. Sheppard of the University of Hawaii in Honolulu, uses a large telescope capable of finding extremely faint bodies in individual images. The astronomers take three sequential images of a patch of sky. A computer scans the trio for any object that has changed position from one image to the next. Starting with that information on the object's location, the team can then track the candidate satellite with a smaller telescope to discern its orbit and motion.

With these moon-spotting techniques, both teams have vastly enlarged the satellite retinue. Jupiter is the undisputed king, with 53 irregular satellites. This is followed by Saturn, which has 14; Uranus, with 9; and Neptune, with 7.

By finding large numbers of irregulars and measuring their dynamic and physical properties, researchers hope to uncover new insights about planet formation, says Jewitt.

Although astronomers continue to scan the distant reaches around the four outer planets for more irregular satellites, Gladman says observers have nearly reached the limit of what they can do with current telescopes and CCD cameras. Now, he says, "it's time to figure out what it all means."



CAPTURED OBJECT — Caliban (arrow) is one of the nine known irregular moons of Uranus.

GLADMAN ET AL.

ALL ABOUT MOONS According to theorists, all the planets formed billions of years ago from a disk of gas, dust, and ice particles that surrounded the young sun. At first, this disk, or protoplanetary nebula, consisted of tiny particles only micrometers to centimeters in diameter. But the particles eventually coalesced into boulder-size bodies, some of which ultimately merged to make planet-size embryos.

The standard picture of planet formation has the solid cores of rock and ice in Jupiter and Saturn providing the gravitational muscle to snare enormous amounts of hydrogen and helium gas from the protoplanetary disk. Over about 10 million years, these planets became the gas giants they are today.

In contrast, Uranus and Neptune currently don't have massive, gaseous envelopes, and it's unclear whether they ever did so. These planets are akin to the heavy, icy cores of Jupiter and Saturn.

The so-called regular moons have several features in common with the planets they orbit. This suggests that each retinue of regular moons was born around the planet that it circles. The moons coalesced from miniature versions of the protoplanetary nebula that surrounded their fledgling planets.

However, irregular moons almost certainly weren't formed where they now reside. Rather, astronomers suspect that irregulars, like asteroids and comets, are debris left over from the planet-making process. These small objects never stuck together to make planet-size bodies but instead zipped through the solar system at some 5 to 8 kilometers per second. As they roamed the young solar system, some of these bits of detritus were gravitationally captured by newly formed planets.

Before being captured, these small bodies had to be slowed down. Today, it would be nearly impossible for a planet to trap such a high-speed body. But some theorists have proposed that in their youth, Jupiter and Saturn had bloated atmospheres that extended far above the current extent of their cloud tops. A body whizzing through this extended atmosphere would encounter friction, slowing it down enough to fall under the influence of the planet's gravity.

"If this is right, we should see the irregulars as survivors of gas giant-planet formation," notes Jewitt. "The captured satellites in this model would consist of exactly the same type of matter that went into growing the ice-rock cores of the outer planets." He views the distant moons as "bits that were neither incorporated into the planets nor thrown out of the system."

The most exciting thing about the irregulars, says Jewitt, is that they haven't been altered by the heat and countless collisions that merged other bodies into planets. The irregulars appear to be pristine relics of planet formation, refugees from the era 4.5 billion years ago when the solar system emerged.

IRREGULAR INFLUENCES Things get more complicated in a competing model of planet formation known as the instability model. In that scenario, proposed by Alan P. Boss of the Carnegie Institution of Washington (D.C.), Jupiter and Saturn didn't grow bit by bit. In his view, they never had a solid core that then could gradually annex a massive envelope of gas. Instead, he argues, these giant planets arose rapidly when a huge, puffy cloud of material within the protoplanetary nebula suddenly collapsed. In this fast-paced scenario, as in the previous one, friction from gas surrounding the planets would slow down passing objects, permitting them to be captured as irregulars, notes Boss.

Puzzling Pair

The split personality of Mars' moons

While scientists analyze the spate of irregular moons recently found around the outer planets, they continue to puzzle over two more familiar objects—Phobos and Deimos, the two moons that orbit Mars. "These two satellites are still a mystery," says Scott S. Sheppard of the University of Hawaii in Honolulu. "Their orbits are not like the irregular satellites of the giant planets," since they're close to Mars and have nearly circular orbits with nearly zero inclination, he notes. "It is hard to obtain orbits like the current Martian satellites have from captured bodies."

On the other hand, he notes, their color resembles that of C asteroids, a common type of asteroid found in the outer part of the asteroid belt. So "based on their physical characteristics, they may be captured asteroids and should be classified as irregulars," says Sheppard. "It is still a debate if they were captured or not." —R.C.

Boss' model presupposes that the solid bodies destined to become irregulars were already roaming the solar system when the outer planets appeared, says Jewitt. "Some models of giant-planet formation involve very short timescales, just thousands to tens of thousands of years," he notes. "It's not obvious that . . . the largest irregulars would have formed on such short timescales."

Boss says that although the outer planets may have formed quickly, they probably didn't begin forming until after the infant solar system was a few hundred thousand years old. So, they didn't reach maturity until a multitude of potential irregular satellites had been produced.

Boss' theory about the formation of Uranus and Neptune may be at odds with the presence of the irregulars around these planets, according to Jewitt. In Boss' model, the young Uranus and Neptune had huge envelopes of gas, just as Jupiter and Saturn do. But because Uranus and Neptune reside farther out in the solar system, they were more vulnerable to the ultraviolet light from a passing star. Boss proposes that such radiation would have stripped away the gas that had once enveloped Uranus and Neptune, leaving behind giant cores of ice—the planets as we know them today.

Jewitt takes issue with this model. He suggests that as the vast shrouds of gas around Uranus and Neptune were ablated, the planets would suddenly have had a lot less gravity and any irregulars would have escaped. But if Uranus and Neptune captured satellites in a different manner than Jupiter and Saturn did, then the similarity of all of these satellite systems begs an explanation.

SATURNIAN SWARM — The loopy orbits of the irregular moons around Saturn. The planet has 14 known irregulars.

Several teams have recently found that some of the irregulars orbiting each planet belong to the same family, an indication of a shared origin. For instance, Jupiter's Himalia and few other irregulars orbiting the giant planet have colors and orbital characteristics similar to those of the Hilda group of asteroids, which lies in the outer part of the asteroid belt. That suggests these Jovian moons are captured members of the Hilda asteroid group. Burns and Matija Ćuk of Cornell describe their analysis in an upcoming *Icarus*.

The resemblances among some irregulars strongly suggest that members of each group derive from one large body that was fragmented—either by another satellite or a passing comet. For such collisions to have been commonplace, there must have been "much larger initial satellite populations or a much larger initial population of comets and asteroids than scientists now observe, says Jewitt. "Both seem plausible," he adds.

The collision theory will soon be put to the test. When the Cassini spacecraft enters orbit around Saturn this summer, it will pass near the planet's largest irregular satellite, Phoebe. The spacecraft's images should reveal whether Phoebe has the large gouge that would be expected if it had suffered an ancient collision that gave rise to a host of smaller irregulars orbiting Saturn.

"In the last 10 years or so . . . we have made observations that give a new and different view of our solar system," says Jewitt. "Where this will lead is still unclear, but few people would doubt that the end result will be a much improved understanding of the complex process of planet formation." ■

B.J. GRAY, PLANET PLUTO

VISION SEEKERS

Giving eyesight to the blind raises questions about how people see

BY BRUCE BOWER

One witheringly hot day last summer, a 10-year-old boy performed a few miracles at a hospital near Calcutta, India. For openers, he caught a balled-up piece of paper thrown to him. Then, he picked up paper clips and inserted them into a holder through a small opening. Looking determined, the boy proceeded to identify drawings of an elephant and other animals. Finally, he greeted all of his physicians and nurses, referring to each by name.

Not impressed? These accomplishments sure looked miraculous to Pawan Sinha, a neuroscientist at the Massachusetts Institute of Technology (MIT) who was in Calcutta visiting the hospital. Sinha knew that the boy had had severe cataracts in both eyes since birth. He had grown up in a poor family, and the reason for his blindness went undiagnosed until he tripped and broke his leg at age 10. A physician treating the boy's leg instantly noticed the youngster's cataracts and arranged for free surgery.

Five weeks later, the boy—a newcomer to the world of sight—dazzled Sinha with visual feats. It's not yet clear whether a child deprived of sight for many years can learn to see the world with all the subtlety and skill of a person who grew up with normal vision, however. Researchers are just beginning to piece together how the brain responds to blindness early in life and then how it reacts to the sudden unleashing of vision, however years or even decades later.

EYE SEE YOU — In a village near Calcutta, India, Pawan Sinha tests the vision of an 11-year-old girl who was blind until she underwent cataract surgery in one eye at age 7. A few of the girl's relatives and other villagers look on.

SINHA

What's evident, though, is that sight requires far more than simply opening one's eyes and letting reality in. Perception, whether through vision or any other sense, is an acquired taste. People learn to make visual sense of faces and other items of interest, often during infancy and early childhood but sometimes over much longer periods.

A person's view of the world feeds off his or her past experiences with three-dimensional space, the physical details of particular settings, and the predictable shapes and colors of various items, to name a few.

When the loss of sight deprives young eyes of visual experience, other faculties fill the void: Brain regions traditionally thought to handle only vision commit to duties ranging from touch processing to verbal memory.

Sinha now finds himself in a position to explore how kids' brains adapt to years of blindness and then respond to the onset of sight. He and his coworkers are tracking the progress of 20 children in India, ages 6 to 15, who grew up sightless before the surgical removal of their cataracts. "I'm amazed at how much these kids can do based on vision shortly after cataract surgery," the MIT scientist says. "No one knows if the visual modality will reclaim areas in their brains that it lost to other senses due to blindness."

FACE TIME It's particularly gratifying to observe the success of formerly blind children at recognizing the faces of their family members, physicians, and other familiar people, Sinha says. He estimates that cataract-induced blindness affects as many as 100,000 children in India.

The "fairly crummy" level of visual detail available to most of the Indian children after cataract surgery encourages them to concentrate on the geography of entire faces, while ignoring the nuances of eyes, mouths, noses, or hair, Sinha says. These children also often recognize even partial or faded pictures of familiar faces, indicating that the youngsters refer to a mental catalogue of whole faces, Sinha says.

Babies, whose vision is also blurry, may similarly perceive whole faces rather than specific facial features, he theorizes.

Yet such speculation runs smack into scientists' limited knowledge about the nature of face perception in formerly blind children, as well as in infants (*SN: 7/7/01, p. 10*).

At least some data on the subject come from studies of Canadians directed by psychologist Daphne Maurer of McGill University in Hamilton, Canada. Children subjected to cataract-induced blindness in only the left eye for the first 2 to 6 months of life lose an element crucial for discerning facial configurations, Maurer's team reports in the October *Nature Neuroscience*. As teenagers and young adults, these individuals find it difficult to detect differences in the spacing of eyes and other facial features from one person to another.

In contrast, people of the same age who had right-eye cataracts for 2 to 6 months after birth can discern the distance between facial features as well as people with no prior vision problems do.

Despite lacking this face-recognition skill, adults who had left-eye cataracts removed during infancy still manage to recognize their friends and family and don't report any problems in telling familiar faces apart.

Individual facial features evidently guide recognition. McGill psychologist Catherine J. Mondloch and her coworkers found that people deprived of left-eye vision as babies could accurately tell when the researchers had substituted different eyes or mouths on previously seen images of faces or had digitally thinned or fattened the faces.

The results, which so far derive from 10 volunteers born with left-eye cataracts and another 10 born with right-eye cataracts, implicate the brain's right side in expert face processing, Mondloch says. It is only during infancy that visual information entering the left eye goes mainly to the right hemisphere, while the right eye sends most of its visual input to the left hemisphere. Thus, the capacity to notice the spacing of facial features develops only if the right hemisphere receives visual stimulation during that brief period of time. Even then, according to other studies directed by Mondloch, this skill isn't fully developed until about age 18.

For instance, when asked to identify matches between pairs of faces with assorted head angles—posed so that the spacing of facial features appeared to vary—10-year-olds with no prior eye problems performed as poorly as adults with former left-eye cataracts did. Given normal visual development, face processing improves sharply between ages 16 and 18, Mondloch says.

She plans to conduct brain-scan and brain-wave studies of cataract patients to determine their neural responses to faces. The McGill researchers also want to see whether people who had left-eye cataracts removed can be trained to recognize faces solely on the basis of the spacing of eyes and mouths.

Sinha hopes to direct similar studies of Indian youngsters treated for cataracts. Those children will undoubtedly become visually adept in many ways, but they were blind far too long to become face-processing experts, Mondloch suspects. "It's already too late if you receive cataract surgery 2 months after birth," she says.

NEW LOOKS — Each face in the top row has different eyes and mouth, those in the middle row differ in external contour but have matching features, and faces at bottom differ only in the spacing of the eyes and mouth. People deprived of sight to the left eye as infants, but not those who lacked sight to the right eye, had difficulty discerning the differences in the bottom row. Both groups could recognize the variations in the top two rows.

EYE REVIVAL Even if improvements in vision are marginal for those children surgically thrust into the sighted world after years of blindness, there's room for optimism regarding their adaptation to whatever sight they acquire.

"The kids I've studied show good emotional adjustment after cataract surgery," Sinha says. "It probably helps that adults don't have a lot of expectations about what these children should be able to do as sighted individuals."

Adults who regain their sight after being blind for all or most of their lives are often not so fortunate. Published reports of such cases, which date to 1,000 years ago, often describe an initial elation at being able to see, followed by emotional turmoil, depression, and even suicide.

In his book *An Anthropologist On Mars* (1995, Knopf), neurologist Oliver Sacks of Albert Einstein College of Medicine in New York recounts the story of Virgil, a man who saw little until having cataract surgery at age 50. Sacks calls Virgil's behavior after cataract removal that of a "mentally blind" person—someone who sees but can't decipher what's out there.

Virgil's perceptual identity, his sense of himself, was tied to experiences that had nothing to do with sight. He often felt torn between first looking at objects or touching them instead, as he had always done. When feeling visually overloaded, he would act as if he were still blind. Often confused, Virgil rapidly sank into depression. About 4 months after his surgery, he died of pneumonia.

Michael G. May has adapted much better to his recovered vision. A stem-cell transplant delivered sight to his right eye in 2001 when he was 43, after 40 years of blindness. Ione Fine of the University of Southern California in Los Angeles and her colleagues describe May's visual progress in the September *Nature Neuroscience*.

May regards the challenge of learning to see as an exciting new chapter in his life. It helps that he's an outgoing, optimistic person with a supportive spouse, according to Fine.

"Mike certainly sees the world differently than others do," she notes. Two years after his surgery, May still has no intuitive grasp of depth perception. As people walk away from him, he perceives them as literally shrinking in size and has to remind himself that they're farther away than they were before.

Objects and faces also puzzle May. He has difficulty identifying everyday items, distinguishing male from female faces, and recognizing emotional expressions on unfamiliar faces. May keeps track of people's faces by noting hair length, eyebrow shape, and other individual features.

May does track his own and others' movements with precision. He also distinguishes shaded areas from illuminated surfaces. With these capabilities, he's made a transition from being an expert blind skier, who depended on verbal directions from a sighted guide, to being a competent sighted skier.

May's chipper outlook and visual accomplishments so far are inspiring, remarks psychologist Richard L. Gregory of the University of Bristol in England. Says Gregory: "It is possible to live happily with delayed sight and to gain from the new experiences."

BLIND BRAINS The transition from prolonged blindness to sudden sight doesn't demand just psychological resilience. It requires unprecedented accommodations from the brain.

Brain-imaging studies indicate that neural areas devoted to vision, which comprise as much as one-quarter of the brain in primates, take on entirely different responsibilities in blind individuals. For instance, vision-associated regions of the brain appear to facilitate the sensitivity of touch among those without sight. In 1996, researchers reported that the visual cortex at the back of the brain showed increased activity when blind people use the tips of their fingers to read Braille publications.

Moreover, psychological investigations suggest that blind people perform better than their sighted peers do on tests of verbal memory. Parts of the brain's visual system—including tissue that otherwise serves as an entry point for visual information from the eyes—become more active when blind participants recall previously studied words and generate verbs for a list of braille nouns, according to a report in the July *Nature Neuroscience*.

Blind volunteers with the strongest verbal memories displayed especially intense activity in these brain areas when they performed the word tasks. In sighted volunteers, these neural tissues remained calm during the same verbal tests, say neuroscientist Ehud Zohary of Hebrew University in Jerusalem and his colleagues. In sighted people, language-related brain areas far removed from the visual cortex handle verbal memory.

Studies such as Zohary's suggest that the brain undergoes a major reorganization in people who are blind from birth to adulthood, enabling tissue that would otherwise deal in vision to take on other sensory duties, as well as language and memory assignments.

If so, the brains of formerly blind children should yield scientific surprises. Sinha's 10-year-old cataract patient in India undoubtedly relishes the possibility of mustering a few neural revelations. In this boy's case, eyesight may spark insight. ■

LEGRAND, MONDLOCH, MAURER, BRENT

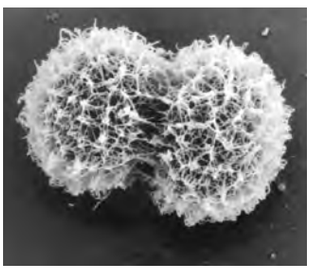
OF NOTE

ENVIRONMENT

Toxic cleanups get a boost

Researchers have developed and field-tested a new technique that identifies specific soil microbes that can break down environmental pollutants. The bacteria could be used to clean up toxic-waste sites.

Eugene Madsen of Cornell University and his colleagues tested their technique at a coal tar waste site associated with an old gasworks. The researchers labeled a test sample of naphthalene—a common, seemingly benign coal tar component—with the isotope carbon-13 and released the chemical into the soil. The researchers then covered patches of soil with 250-milliliter glass jars. If a plot harbored soil bacteria capable of metabolizing the naphthalene, carbon dioxide that included carbon-13 built up in the jar over that soil.



FUZZY BUSINESS A new strain of naphthalene-metabolizing bacteria was discovered at a coal tar waste site.

Because these bacteria also incorporate carbon-13 into their DNA, Madsen and his coworkers could identify a specific strain of naphthalene-degrading bacteria. The findings will appear in an upcoming *Proceedings of the National Academy of Sciences*.

Although other researchers have isolated bacteria in the lab that can degrade specific toxic chemicals, the same bacteria usually die off when released at a cleanup site, says Madsen. The trick, he says, is finding which bacteria metabolize pollutants in their natural environment. The researchers plan to test their screening technique to find microbes that break down carcinogenic chemicals at coal tar waste sites. — A.G.

BIOMEDICINE

Acid blockers stop stomach ulcers, too

For people beset by arthritis or other chronically painful conditions, nonsteroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen, naproxen, and COX 2 inhibitors offer considerable relief. However, these NSAIDs can cause heartburn and ulcers.

Researchers now report that simultaneously taking an acid-blocking drug with an NSAID significantly lowers the occurrence of both complications.

Gastroenterologist James M. Scheiman of the University of Michigan Medical School in Ann Arbor and his colleagues randomly assigned 388 people taking an NSAID daily to also get an acid blocker called esomeprazole, one of a new generation of drugs known as proton-pump inhibitors. Another 197 people took an NSAID plus an inert pill. Everyone in the study was considered to be at risk of getting an ulcer, either because they were more than 60 years old or had a history of ulcers. Esomeprazole is marketed as Nexium by AstraZeneca of Wilmington, Del., which funded the study.

After 6 months, 5 percent of the participants taking an NSAID and the acid blocker had developed an ulcer, compared with 12 percent of those getting an NSAID and a placebo, Scheiman reported at a meeting of the American College of Gastroenterology in Baltimore last month. He predicts that the results will lead to changes in the use of NSAIDs for people at risk of ulcers. Some doctors already prescribe acid blockers for patients taking NSAIDs, he notes. —N.S.

ANTHROPOLOGY

Anklebone kicks up primate debate

An anklebone excavated last year in southern Asia may put a controversial theory of primate evolution on firmer footing. The nearly 40-million-year-old fossil adds to evidence that anthropoids, a primate group that includes monkeys, apes, and humans, originated in Asia, according to a team led by Laurent Marivaux of Université Montpellier II in France.

The identity of comparably ancient primate remains, unearthed near the site of the new find in Myanmar, has inspired plenty of debate (*SN: 10/16/99, p. 244*). Some researchers classify these finds as remains of anthropoids, while others regard them as fossils of adapiforms, a group that includes extinct species related to lemurs and lorises.

On close inspection, the Myanmar anklebone resembles the bones of living and extinct anthropoids more than those of adapiforms, Marivaux and his coworkers report in an upcoming *Proceedings of the National Academy of Sciences*. The ankle fossil's anatomy indicates that it supported a roughly 15-pound creature capable of moving deftly through trees using its arms and legs, the researchers say.

However, the new fossil also contains similarities to the ankles of lemurs and lorises and could just as easily have belonged to adapiforms, contends Gregg F. Gunnell of the University of Michigan in Ann Arbor. On the basis of fossil teeth found earlier in Myanmar and Thailand, Gunnell theorizes that all of the region's ancient large-bodied primates, which weighed between 13 and 20 pounds, were adapiforms. He supports the traditional view that anthropoids originated in Africa. —B.B.

BIOMEDICINE

SARS virus can spread in lab animals

Virologists have found that ferrets and domestic cats can acquire and transmit the virus that causes severe acute respiratory syndrome (SARS). An independent group of researchers has determined that Chinese animal traders—particularly those dealing in wild mammals—have particularly high rates of past exposure to the virus.

Cats that researchers intentionally exposed to the virus didn't become visibly ill, but the virus did replicate in the animals' blood. Ferrets similarly infected did get sick, and one died. Both cats and ferrets housed with infected members of their species also acquired the virus, Albert Osterhaus of Erasmus Medical Center in Rotterdam, the Netherlands, and his colleagues report in the Oct. 30 *Nature*. Either species could be used to test the effectiveness of future vaccines or drugs, the scientists say.

In a separate study, researchers at the Guangdong Center for Disease Control in Guangzhou, China, tested blood from 792 people in Guangdong Province, where the SARS epidemic began last November. In the Oct. 17 *Morbidity and Mortality Weekly Report*, the researchers note that 13 percent of animal traders, but only 2.1 percent of medical workers and other volunteers in the study, had evidence in their blood of past exposure to the SARS virus. Exposure rates among animal merchants ranged from 19 percent in those selling cats to 73 percent in traders of masked palm civets. —B.H.

PNAS

NUTRITION

Greek diet reduces inflammatory proteins

A diet rich in olive oil, fresh fruits, and vegetables—and that includes little red meat—seems to suppress a host of proteins implicated in heart disease.

Researchers in Greece used questionnaires to collect data on eating habits of 2,282 people during 2001 and 2002. The information enabled the scientists to generate a score for each person that reflected how closely he or she followed the so-called Mediterranean diet, which many studies have correlated with a reduced risk of heart disease (*SN: 2/20/99, p. 116*).

Blood samples taken from each participant at the end of the 2 years revealed that those people adhering closely to the Mediterranean diet were likely to have lower concentrations of C-reactive protein, interleukin-6, and tumor necrosis factor-alpha than were people who ate other foods regularly. All these compounds are inflammatory proteins linked to increased risk of heart disease, says Demosthenes B. Panageotakos of the University of Athens, in Glyfada, who presented the findings.

People sticking to the diet also averaged lower blood concentrations of fibrinogen, a protein that abets clotting; white blood cells, a sign of inflammation; and homocysteine, an amino acid implicated in heart disease. —N.S.

CARDIOLOGY

Weight-loss compound may cause arrhythmia

Herbal weight-loss drug Metabolife 356 can cause subtle changes in a person's heartbeat, the kind of alterations that sometimes lead to dangerous heart arrhythmias, researchers say.

Metabolife 356 is the best-selling weight-loss supplement sold in the United States, accounting for roughly half of that market and garnering nearly $7 billion in annual sales for its maker, Metabolife International of San Diego. The drug contains 18 herbal ingredients, including ephedra, an herb that has been linked to dozens of fatalities.

Because it's classified as a nutritional supplement and not a drug, Metabolife 356 hasn't had to go through the rigorous testing that pharmaceuticals must undergo to secure approval from the Food and Drug Administration, says Jeffrey Kluger of the University of Connecticut in Hartford. However, Kluger says, after he and his colleagues completed this study on the heartbeat patterns of people taking the drug, the FDA requested their data.

The researchers randomly assigned 15 healthy volunteers, average age 26, to receive either a small dose of Metabolife 356 or an inert pill. A week later, the doses were reversed. The investigators performed electrocardiograms (EKGs) on the volunteers before taking the drug or placebo and again after 1, 3, and 5 hours.

The tests showed that 8 of the 15 volunteers registered an expanded gap on their EKG readout, at a point called the QTC interval, after getting Metabolife 356. The interval represents the time between heartbeats. The longer it is, the greater the risk of arrhythmia, says coinvestigator Brian F. McBride, also at the University of Connecticut.

While the FDA has no published guidelines on what constitutes a dangerous lengthening in the QTC interval, Kluger notes that there have been numerous drugs approved by the FDA and subsequently found to increase the risk of sudden death. Scientists later determined that these drugs affected the QTC interval with much less severity than Metabolife 356 does. "These drugs have been removed from the market," Kluger says.

Next, the researchers plan to test ephedra-free versions of Metabolife to ascertain whether ephedra or some other ingredient is responsible for lengthening the QTC interval. The FDA is already investigating ephedra, which has been associated with heart attack, stroke, high blood pressure, and irregular heartbeat. —N.S.

SCREENING

Protein may predict heart problems

Low blood concentrations of a small protein called adiponectin can signal high risk of heart disease, a study finds. Scientists suggest that the molecule might join the growing list of previously obscure compounds that might help doctors detect signs of potential cardiac troubles in otherwise healthy individuals.

Tobias Pischon and his colleagues at the Harvard School of Public Health in Boston assessed adiponectin concentrations in blood samples taken in 1994 from 18,130 men who were free of heart disease. After 6 years, 266 of them had either suffered a nonfatal heart attack or died of heart disease.

The men who had initially registered the highest concentrations of adiponectin were only one-third as likely as those with the lowest concentrations to have had a heart attack. The correlation held up even when researchers accounted for the men's physical activity, family history, hypertension, alcohol consumption, and other factors.

Meanwhile, another team of researchers studying 178 postmenopausal women found that low adiponectin coincided with excess weight, a factor that increases risk of heart problems. Lewis Kuller of the University of Pittsburgh reported that lean women had adiponectin concentrations of 18.7 micrograms per milliliter of blood, whereas heavier women averaged concentrations of only 14.1 µg/ml.

The women with low adiponectin also tended to have small low-density lipoprotein molecules, the specific form of the so-called bad cholesterol thought to pose the greatest risk for heart disease.

The mechanism by which fat cells turn on adiponectin secretion is unclear, as is the compound's role in the body. —N.S.

EMERGENCY CARE

Defibrillator access pays dividends

Making electronic heart stimulators available in public facilities and training lay people there how to operate them can boost the chances of survival for people who suffer cardiac arrest—a loss of pulse—in such places, according to new findings.

Researchers went to 993 shopping malls, apartment buildings, office buildings, sports facilities, and other public places in the United States and Canada and trained nearly 20,000 people in these facilities how to spot cardiac arrests and how to administer cardiopulmonary resuscitation (CPR). At half the sites, researchers also taught people how to operate a heart-shocking defibrillator and stored one on-site. All participants in both groups were instructed to call 911 first in the event of a cardiac arrest.

Over nearly 22 months, the trainees at sites equipped with defibrillators resuscitated 29 people who had suffered cardiac arrest compared with only 15 CPR-only resuscitations by their counterparts in the places without the devices, says Joseph P. Ornato of Virginia Commonwealth University in Richmond. There are roughly 460,000 out-of-hospital deaths attributed to cardiac arrest each year in the United States. —N.S.

Books

A selection of new and notable books of scientific interest

CITY IN THE SKY: The Rise and Fall of the World Trade Center

JAMES GLANZ AND ERIC LIPTON

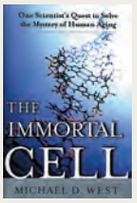
When the scale model of the twin towers first arrived in architect Minoru Yamasaki's office, it was too tall for the ceiling. At that point, even the buildings' designers stood in awe of how massive the 1,350-foot towers would be when constructed in 1970. Most people's emotions about the buildings are quite different today. Two reporters for The New York Times reflect on the World Trade Center by detailing the history of the towers' construction and collapse.

They begin with David Rockefeller and William Zeckendorf's zeal for the project, which overcame stiff opposition from storekeepers around the site as well as design and construction hurdles. Glanz's background in physics serves this writing team well as the authors dissect the engineering intricacies of the buildings and explain why the structures crumbled on Sept. 11, 2001. Glanz and Lipton remind readers that the Empire State Building withstood the impact of a B-25 bomber—loaded with fuel—that crashed into the building and burned in 1945. The authors reveal that from the twin towers' inception, several people questioned the buildings' capacity to sustain such a hit. This heavily researched book carefully dissects the events and aftermath of 9/11 and looks toward the future, as new structures for the site are contemplated. ***Times, 2003, 428 p., b&w plates, hardcover, $26.00.***

THE IMMORTAL CELL: One Scientist's Quest to Solve the Mystery of Human Aging

MICHAEL D. WEST

Two years ago, while anticloning legislation was under consideration in Congress, West and his colleagues cloned seven human embryos in a laboratory in Worcester, Mass. Their goal was not to produce a baby but to obtain stem cells, through the process called therapeutic cloning, that could someday cure age-related diseases. The scientists' efforts led to their condemnation by both President Bush and the Pope. Today, West heads the only for-profit entity in the United States pursuing human therapeutic cloning research. West's story is a little unusual because he once shared the views of people who are now his staunchest critics. As he reveals in this memoir, he spent the early years of his career as a committed creationist on a quest to disprove the theory of human evolution. His study of the fossil record convinced him to abandon that effort. While his opponents argue that people shouldn't tamper with cells that have potential for human life, West makes a passionate case for using stem cells for the benefit of people living with disease. The book includes a primer on stem cell research and an argument for its legitimacy. ***Doubleday, 2003, 244 p., hardcover, $24.95.***



NATURAL HOME HEATING: The Complete Guide to Renewable Energy Options

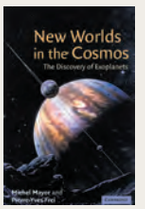
GREG PAHL

As home heating costs continue to escalate and blackouts hit sporadically, this book considers some cheap, reliable, and ecologically friendly alternatives to electricity and gas for powering one's home. This comprehensive review of avenues of renewable-energy home heating helps readers determine which option is best for their needs. An introductory chapter dissects home heating components and describes the basic equipment that's available to most people. Four core sections discuss solar, geothermal, biomass, and wood sources for heat and power. Pahl explains how to incorporate these energy sources into new construction plans as well as existing structures that may not always seem conducive to such alternatives. The author offers extensive information about building codes, safety, and furnace options. He also supplies straightforward data about costs, drawbacks, and maintenance involved in each energy option. Illustrations and photographs help explain how different stoves operate. ***Chelsea Green, 2003, 281 p., b&w photos/illus., paperback, $30.00.***

NEW WORLDS IN THE COSMOS: The Discovery of Exoplanets

MICHEL MAYOR AND PIERRE-YVES FREI

In 1995, Mayor and Didier Queloz discovered the first planet outside our solar system. This finding, and the detection of more than 100 other exoplanets since then, provokes speculation about the possibility of life elsewhere in the universe. Mayor teams with science journalist Frei to recount his personal story in this search for planets orbiting suns other than our own. The authors elaborate on the ramifications of Mayor's and others' discoveries and current thinking about the elements and life-forms the universe harbors beyond this solar system. Originally published in France in 2001. ***CUP, 2003, 248 p., color plates/b&w illus., hardcover, $30.00.***



TRANSPLANT: From Myth to Reality

NICHOLAS L. TILNEY

More than 40,000 organ transplants are carried out each year, making such surgery a fairly routine treatment for people with organ failure. Tilney traces the idea of transplantation from biblical times. In 1954, the first kidney was transplanted between twins. The author describes how physicians since then have overcome the obstacles to successful transplants, including suppressing the immune system, increasing host tolerance of another person's organ, and matching donors. Details on the innovations in transplanting specific organs lead to a discussion of ethical issues, such as buying and selling organs and transplant surgery as a lucrative business. ***Yale U Pr, 2003, 320 p., b&w photos, hardcover, $30.00.***

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

Tragedy travesty

The reporting of the activity surrounding the tragic loss of Columbia continues to anger me ("After the Tragedy," *SN: 9/27/03, p. 203*). Columbia was lost because of program ignorance of a flight condition that should not have been permitted to exist or continue. It is a cruel and self-serving action to criticize a wonderful piece of engineering because its operators have been deficient.

DON THOMPSON, GARDEN GROVE, CALIF.

"The U.S. has lost 17 astronauts in space accidents . . . 17 years apart," according to the article. During that same period, we killed 714,000 people in traffic crashes, yet no scientists have demanded that we ground all automobiles.

ROBERT N. RADER, MOORE HAVEN, FLA.

Right on time

In the era before global positioning system (GPS) instruments, determining longitude was difficult since it required a fairly accurate clock, in addition to a sextant ("North vs. Northwest: Lewis and Clark diaries provide directional clue," *SN: 10/4/03, p. 213*). I was under the impression that one of the clocks Lewis and Clark used was Jupiter's moon Io, which would have made them pretty sophisticated navigators.

MICHAEL D. DELANO, BROOKLYN, N.Y.

The explorers had a good chronometer, but researcher Robert E. Criss says that not much more is known about it because it was auctioned off after the trip. He didn't find any mention in the party's diaries of Jupiter's moon, but the team did rely on Earth's moon for some measurements. —K. RAMSAYER

Deep enough

The article on waning glaciers ("On Thinning Ice," *SN: 10/4/03, p. 215*) states that a loss of 100,000 cubic kilometers of ice would result that in a half-meter rise in sea level. That means that if the 32 million km^3 polar ice pack melts, sea levels will rise 160 meters. But I have always heard a figure of around 50 feet. Being on a small island in the South Pacific makes the matter less than academic.

D. ERIC HANSON,
AMERICAN SAMOA COMMUNITY COLLEGE,
PAGO PAGO, AMERICAN SAMOA

In fact, researcher Roger B. Barry says that global sea level would rise closer to a quarter of a meter if all the world's glaciers were to melt, and 70 meters (250 feet) if Greenland and Antarctica went, too. —S. PERKINS

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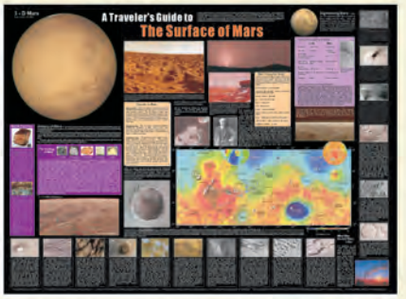
Traveler's Guide to the Surface of Mars



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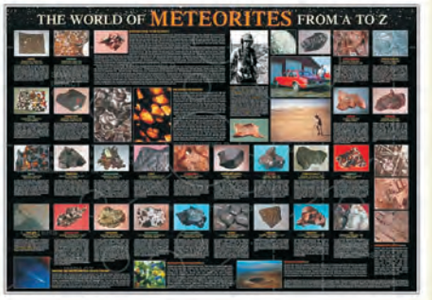

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