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THE WEEKLY NEWSMAGAZINE OF SCIENCE

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another earth?

rock rat joins ancient family

ash, aircraft, and laser beams

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young at art

CHILDREN'S ANCIENT CREATIONS

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http://blog.sciencenews.org/

MathTrek Computers can analyze snippets of music and track down a song without information on its artist or title.

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Cover Investigations indicate that children and teenagers created much Stone Age cave art, including these finger impressions made on a ceiling in France's Rouffignac Cave. Researchers suspect that youngsters were also responsible for many ancient stone-tool remains. (Van Gelder) Page 264

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In the Zone

Extrasolar planet with the potential for life

It's not quite like home, but astronomers this week announced that they had found Earth's closest known analog outside the solar system. The newly discovered planet, which orbits a neighbor of the sun, is about five times as heavy as Earth and probably has an average surface temperature at which water would be liquid.

The planet, which is too small to be imaged, completes one orbit of its star in just 13 days. The distance between this planet and its star is only one-fourteenth the distance between Earth and the sun. But Stephane Udry of the Geneva Observatory in Sauverny, Switzerland, and his colleagues calculate that because the planet's star is less massive and cooler than the sun, the planet's close-in location puts it in the "Goldilocks zone"— neither too hot nor too cold, but just right for liquid water.

This is "arguably the first habitable planet" ever identified, says theorist Alan Boss of the Carnegie Institution of Washington, D.C.

Planet-formation models indicate that a body of this mass would have a solid surface, perhaps rocky or watery, and a diameter 1.5 times that of Earth, Udry's team notes.

The planet's parent star, the red dwarf Gliese 581, resides just 20.5 light-years from Earth and is one-third as heavy as the sun. Dwarf stars are the most common type of star in the galaxy, and the discovery suggests new places to search for life, Udry says.

A decade ago, researchers had ruled out dwarf stars as hosts of habitable worlds, notes astronomer Jill Tarter of the SETI Institute in Mountain View, Calif. One problem, theorists argued, is that a close-in planet occupying the habitable zone around a dwarf would be vulnerable to outbursts of radiation from the star. But a reappraisal now suggests that this problem and others may not be deal breakers and that planets around dwarf stars could indeed support life, Tarter and other researchers report in the spring issue of *Astrobiology*.

Udry's team discovered the Gliese 581 planet indirectly by using the standard technique of searching for back-and-forth motions of the parent star. From a star's tiny wobble, astronomers can infer the minimum mass and orbit of an unseen planet tugging on it. Among the more than 225 extrasolar planets now known, most were discovered using this method.

In their initial study of Gliese 581, Udry and his colleagues found a closer-in planet about 15 times as massive as Earth. Those measurements, obtained with a sensitive spectrometer on the European Southern Observatory's 3.6-meter telescope in La Silla, Chile, showed signs of another planet.

Follow-up studies have now revealed the new "super-Earth" as well as indications of a third, more distant planet, Udry's team reports.

Without direct measurements of size and mass, it's difficult to know "if the planet is indeed rocky or icy, or whether it has a significant gas atmosphere," cautions theorist Sara Seager of the Massachusetts Institute of Technology. For example, if the planet's atmosphere were thicker than that of Venus, "the surface would likely be too hot for liquid water," she notes.

That's why Seager is looking forward to the discovery of a super-Earth that periodically passes between its star and Earth, blocking some of the starlight. These mini-eclipses, she notes, would reveal the planet's density and composition, indicating its potential to support life. —R. COWEN

ESO

HABITABLE? A planet about five times as heavy as Earth orbits the red dwarf star Gliese 581, in this artist's depiction. On the orb's surface, water would probably be liquid.

Inherited Burden?

Early menarche in moms tied to obesity in kids

Women who reach puberty at an unusually early age are more likely to have children who are overweight, a study finds.

Earlier research had linked extreme obesity in childhood with early arrival of menarche, a girl's first period, which marks the onset of puberty. That result caused scientists to suspect that fatty tissue imparts a hormonal impact that hastens menarche. Meanwhile, scientists noticed that early menarche runs in families.

In an attempt to clarify such relationships, pediatric endocrinologist Ken K. Ong of the University of Cambridge and his colleagues tapped into a database tracking the growth of 6,009 children born in England in the early 1990s. Using information supplied by the children's mothers, the team divided the kids into groups according to their mothers' ages at menarche. Children whose moms had reached that milestone of puberty the earliest—by age 11—were three times as likely to be obese at age 9 as were children whose mothers reached menarche after age 15. The heightened rate of obesity showed up in both sons and daughters, the researchers report in the April *PLoS Medicine*.

When making the comparison, the scientists accounted for differences in the mothers' ages and educational levels. After further adjusting their calculations to account for weight differences among the mothers, the researchers found that children born to early-menarche women were twice as likely to be obese as were those born to late-menarche moms.

A closer look at medical records for 914 of the children chosen randomly from the group revealed that those born to early-menarche women were the most likely to gain significant excess weight by age 2 and to retain it throughout early childhood. The early weight gain in these children mostly reflected increases in fat rather than in mus-

cle mass. Compared with kids born to late-menarche women, offspring of early-menarche mothers were, on average, taller in early childhood but not in later years.

Consistent with past studies, girls born to early-menarche women reached puberty earlier than other girls.

Although the study was designed only to show a correlation, it raises the question of whether children are programmed to take a specific growth path, says Ellen W. Demerath, an epidemiologist at Wright State University in Kettering, Ohio. "I buy it, though, that there could be genetic mechanisms involved," she says.

Specifically, mothers who reach puberty early might pass on genetic traits to their children that affect appetite and satiety in infancy, Ong says. Or the moms might send signals to their offspring in utero.

Such predispositions might make evolutionary sense, at least in times of plentiful food, Ong says. In an era when women had many pregnancies and short life spans, he says, "reaching reproductive capacity early would be a benefit, as would having larger progeny."

In modern times, when people live much longer, childhood obesity increases the risk of later health problems. That turns the spotlight on nutrition, particularly during infancy and early childhood, Ong says.

Endocrinologist Mary Horlick of the National Institute of Diabetes and Digestive and Kidney Diseases in Bethesda, Md., says that she would like to see this study continue to track the families and to provide information on the next generation. —N. SEPPA

Living Fossil

DNA puts rodent in family that's not extinct after all

The Laotian rock rat, which is very much alive, belongs to a rodent family that scientists had assumed had vanished 11 million years ago, says an international research team that examined DNA evidence. The family resemblance was also suggested from fossil evidence last year.

The Laotian rock rat (*Laonastes aenigmamus*), or *kha-nyou*, was new to science in 1996 when a wildlife-survey team bought some specimens in a food market in Laos. Since then, scientists have debated what sort of rodent it is, even proposing that it belongs to a new family of mammals.

ALIVE AND SNIFFING An image from the first photo session with a living Laotian rock rat, taken in 2006, comes from retired Florida State University professor David Redfield, who, with biologist Uthai Treesucon, set out on a personal quest to find the living animal.

Now, researchers in five countries have finished the biggest rock rat–DNA analysis yet. Their study dashes the idea of the new mammal family, says Dorothée Huchon of Tel Aviv University. The team argues for an even more dramatic solution: The rock rat is a member of a supposedly extinct family, the Diatomyidae.

"People think the world is explored, and it's not," comments mammalogist Darrin Lunde of the American Museum of Natural History in New York City.

The Laotians who live near the creature's rocky outcrops know of the animals. But until 1996, mammalogists hadn't encountered the dark, squirrel-size creature, which has a long skull, rounded ears, and a furry tail.

In 2005, researchers at the Natural History Museum in London placed the rock rat in a new family of mammals (*SN: 5/21/05, p. 324*), the first to be described since the bumblebee bat family in 1974. The Laotian rock rat's family, they claimed, belongs within the Hystricognathi group, which includes guinea pigs, chinchillas, and porcupines.

Huchon says that when she read about the new family, she was unconvinced because the researchers had studied DNA from only one of its sources within cells. She appealed to the London team for tissue samples to expand the genetic analysis. So did other researchers, and an international network was born.

Altogether, the researchers looked at two mitochondrial genes, four stretches of nuclear DNA, and genetic elements that insert themselves randomly into the genome. Overall, the lines of genetic evidence agreed, Huchon says.

The new species doesn't fit easily within the Hystricognathi group. Instead, its closest living relatives are African rodents called gundies, the researchers report in a paper now online for an upcoming *Proceedings of the National Academy of Sciences*.

Fossil evidence had indicated that the gundies are close relatives to the Diatomyidae family. In 2006, a team of paleontologists based at the Carnegie Museum of Natural History in Pittsburgh had argued that the rock rat is a Diatomyidae, making that family a Lazarus taxon, one that reappeared after seeming to be extinct.

Lawrence Flynn, a paleontologist who described some of the Diatomyidae fossils, says that he's happy to welcome a living member to that family. Flynn, at Harvard University's Peabody Museum in Cambridge, Mass., says that the rock rat has such a strong family resemblance that had independently suggested a connection.

Huchon's new genetic study makes "a very nice molecular confirmation," comments Ronald DeBry of the University of Cincinnati, who uses DNA analysis to examine rodent evolution. —S. MILIUS

Sleep on It

Time delay plus slumber equals memory boost

Sleep revs up a person's ability to discern connections among pieces of information encountered in novel situations, a new investigation finds.

So-called relational memory, a key to flexible decision making, improves as time passes after exposure to new information. It gets an extra boost from sleep, say neuroscientist Jeffrey M. Ellenbogen of Harvard Medical School in Boston and his colleagues.

Volunteers learned to pick certain items from each of five pairs of abstract patterns on a computer screen. Study participants who then waited 12 hours—but not others who waited only 20 minutes—could identify basic relationships among the items, regardless of whether they had slept during the delay. However, only participants who waited 12 or 24 hours and slept during that time

FSU RESEARCH IN REVIEW MAGAZINE

showed insight into complex relationships among the pattern pairs, the researchers report in an upcoming *Proceedings of the National Academy of Sciences*.

"The sleeping brain searches for distant relationships in remembered information as a way to develop general rules for dealing with new situations," says Harvard's Matthew P. Walker, a coauthor of the new study.

QUOTE

"The sleeping brain searches for distant relationships in remembered information ..."
MATTHEW WALKER, Harvard Medical School

The scientists trained 56 healthy young adults to choose among six colored patterns as they appeared in a series of five pairings. In the training sessions, experimenters presented in random order the pairs that defined the range of most-preferred to least-preferred patterns. Participants were told that they had made the correct choice when they selected pattern A over pattern B, B over C, C over D, D over E, and E over F.

After varying time delays, volunteers were tested for their knowledge of the hierarchy of patterns. For instance, discerning short-range relationships included choosing pattern B over pattern D, although participants had not previously seen such pairings. Solving long-range relationships included selecting pattern B over pattern E or F.

After a 20-minute, a 12-hour, or a 24-hour delay, volunteers displayed comparably good memories for what they had initially learned, such as picking pattern A over pattern B. However, the 12 individuals tested after 20 minutes correctly discerned the more-preferred item in new pairings, such as B over D, only about half the time, indicating that they were guessing.

In contrast, 31 people were given a 12-hour delay. Of these, 14 were trained in the evening and tested after a night's sleep. The rest were trained in the morning and tested later the same day. Thirteen others were tested after 24 hours that included a night's sleep. These three groups all correctly detected 75 percent of short-range relationships.

The 27 participants who had slept did even better at identifying long-range relationships, correctly spotting them 93 percent of the time. After a 12-hour delay without sleep, the corresponding detection rate reached only 69 percent.

Participants who had slept weren't aware of their newfound knowledge. This finding clashes with the popular view among scientists that relational memory requires conscious thought.

The best evidence that sleep aids memory comes from studies of automatically executed tasks, remarks neuroscientist Howard Eichenbaum of Boston University. These tasks include detecting the orientation of diagonal bars (*SN: 12/2/00, p. 358*).

Ellenbogen's team may have uncovered an unconsciously controlled form of sleep-enhanced relational memory, Eichenbaum says. —B. BOWER

Diabetes from Depression

Older adults face dual risk

Adults 65 and older who report depressive symptoms are 50 to 60 percent more likely to develop diabetes than are their peers, according to a new study.

The study is the first to show that depression alone, apart from lifestyle factors such as poor diet and lack of exercise, can trigger type 2 diabetes in older adults, reports Mercedes Carnethon of the Northwestern University School of Medicine in Chicago.

"This means doctors need to take depressive symptoms in older adults very seriously," she says. Earlier research had shown the connection in younger adults.

Among all age groups, adults 65 and older

Pregnancy and Pollution

Women living in areas with poor air quality have babies with lower birthweights

Pregnant women exposed to moderate amounts of several common air pollutants have babies with lower birthweights than do women in areas with cleaner air, according to a new study.

Newborns with low birthweights face an increased risk of lifelong health problems. Previous studies searching for a link between air pollution and birthweight had yielded mixed results.

Now, in one of the largest studies of this kind, scientists at Yale University looked at records of 358,504 births in Massachusetts and Connecticut. The team found that four types of air pollution correlate with low birthweight. The culprits are carbon monoxide, nitrogen dioxide, and two classes of airborne particles: those smaller than 10 and smaller than 2.5 micrometers (designated $PM_{2.5}$).

"Maternal exposure to air pollution may adversely affect risk of low birthweight, even in areas without high pollution levels," says Michelle L. Bell, lead scientist on the newly reported work. Air-pollution amounts were based on Environmental Protection Agency records for the 15 counties in which the women lived while pregnant. Only two counties—New Haven and Fairfield, Conn.—didn't meet EPA's air-quality standards, exceeding the standard for $PM_{2.5}$.

Carbon monoxide showed the largest effect. In one comparison, the scientists considered the average birthweights in counties at the 75 percent point in rank for a given pollutant and in counties at the 25 percent mark. For carbon monoxide, infants in those groups differed in birthweight by an average of 16.2 grams. The next-worst offender was $PM_{2.5}$, which showed a difference of 14.7 g, the scientists report online and in an upcoming *Environmental Health Perspectives*.

These differences in birthweight can increase the newborn's risk of complications such as gastrointestinal infections and respiratory problems in the first weeks of life, comments Srimathi Kannan of the University of Michigan in Ann Arbor.

However, only 4 percent of the babies in the study met the clinical standard for low birthweight—less than 2,500 g (about 5.5 pounds)—which is associated with life-threatening complications in infancy and heart disease in adulthood. A woman's risk of having a low-birthweight baby increased by no more than 5.4 percent when she lived in a county at the 75 percent mark for air pollutants rather than in a county at the 25 percent mark.

In arriving at these results, the researchers adjusted for many factors that can influence birthweight, such as prenatal care, gestational length, type of delivery, and the child's sex and birth order. They also considered the mother's race, education, marital status, age, and tobacco use, all of which have been shown to influence the weights of newborns.

The new study is "much more comprehensive in its investigation" than previous research, Kannan says, noting that the biological mechanisms linking these pollutants to reduced fetal growth are still poorly understood. —P. BARRY

suffer the second-highest rate of depression and the highest rate of type 2 diabetes, which appears after tissues develop resistance to the body's natural insulin.

A link between depression and diabetes emerged in a number of previous studies, leading researchers to wonder which condition came first. "It's been this whole chicken-and-egg sort of debate," says Carnethon. "People think that diabetes would come first because the difficulty of dealing with a chronic condition [might lead] to depression."

But the new research shows that, at least in older adults, depression often precedes diabetes. The four-state study monitored 4,681 men and women for a decade. Each year, participants filled out surveys on mood, lifestyle, and other health-related factors.

Participants who scored poorly on a standard depressive-symptom questionnaire, or whose depressive symptoms increased year by year, faced a 50 to 60 percent increased risk for developing diabetes later, Carnethon and her colleagues report in the April 23 *Archives of Internal Medicine*.

After the researchers accounted for known diabetes risks such as a high body mass index, smoking, and excessive alcohol consumption, the association between depression and diabetes persisted.

Excess weight is the primary risk factor for diabetes. Carnethon says that overweight adults are two to three times as likely to develop diabetes as their normal-weight peers are. Depression is a "smaller but still very important risk factor, especially given the high prevalence of depressive symptoms in older adults," she says.

Carnethon suspects that stress hormones—which tend to be elevated in depression—link the two conditions. Too much cortisol, in particular, can build abdominal fat and an apple-shaped body, which are strong risk factors for diabetes. The Northwestern team plans follow-up research investigating cortisol as the depression-diabetes link.

Carnethon urges doctors to be on the lookout for depression in older adults because treating the condition may prevent some diabetes.

Treatment of depression is even helpful for adults who already have diabetes, according to a report in the April *Diabetes Care*. In that study, Patrick Lustman and his colleagues at Washington University in St. Louis found that treatment with the antidepressant sertraline (Zoloft) was useful in diabetes management. Says Lustman: "We know that controlling depression by whatever method—whether with exercise, activity, cognitive therapy, or medication—improves the likelihood that blood glucose will be better controlled. That's the key to preventing the complications of diabetes." —B. VASTAG

Ash Detector

Laser device could protect aircraft in flight

Analysis of a volcanic plume that wafted over central Alaska suggests that polarized laser beams can detect airborne ash, which in large concentrations can be a significant threat to aircraft. Instruments that fire such beams and interpret their reflections could be ground based, mounted on satellites, or even installed on airplanes, the scientists say.

On Jan. 11, 2006, the Augustine volcano on an uninhabited island about 275 kilometers southwest of Anchorage began a monthlong series of eruptions. Plumes from the eruptions occasionally reached heights of 12 km and interrupted flights in and out of Anchorage International Airport, says Ken Dean, a volcanologist at the University of Alaska in Fairbanks. Thick clouds of volcanic ash can clog an aircraft's engines, sandblast its cockpit windows, and cause millions of dollars' worth of damage (*SN: 9/13/03, p. 168*).

At first, winds blew Augustine's plume of ash and steam toward the east, away from densely populated areas. Then, late in January, weather patterns shifted. Parts of the plume then headed northeast toward Fairbanks, where the university operates various ground-based instruments that probe the atmosphere.

One of those devices analyzes the reflected signals from a high-powered laser that fires polarized beams of infrared light. This radar instrument "is not routinely turned on," says Dean, but when computer models suggested that the plume from Augustine would be carried over the area at altitudes below 6 km, "we looked at [the plume] as a target of opportunity."

On the afternoon of Feb. 2, the plume wasn't thick enough to be visible and caused no problems for flights in and out of Fairbanks, says Dean. However, a redder-than-normal glow at sunset hinted that the atmosphere over Fairbanks, about 700 km from the volcano, contained a tenuous veil of particles. Observations with the laser confirmed the presence of airborne ash, Dean and his colleagues report in the April 28 *Geophysical Research Letters*.

When polarized light reflects off spherical particles, such as water droplets, it remains polarized, Dean explains. However, light reflected from the plume aerosols was partially depolarized, a sign that some of the airborne particles were irregularly shaped. The largest effect came from particles suspended at altitudes between 1.7 and 3.8 km above sea level, a range that roughly matched the computer-predicted dispersal of the ash.

Satellites monitor Earth in various wavelengths that can detect airborne ash. However, space-based observations didn't reveal signs of volcanic ash over Fairbanks in early February, probably because the plume had largely dissipated before it reached the region, says Tom Murray of the Alaska Volcano Observatory in Anchorage.

The new findings indicate that ground-based laser radar can detect volcanic ash in atmospheric concentrations far below those that would cause damage to aircraft, says Dean. Such instruments, as well as devices installed on aircraft, could provide an important complement to the system that now warns pilots about threats from airborne ash. —S. PERKINS

ROUGH STUFF The eruption of Alaska's Augustine volcano (seen here on Jan. 24, 2006) spewed a plume of jagged ash particles (inset), some of which were detected over Fairbanks by a ground-based laser system.

M. COOMBS/ALASKA VOLCANO OBSERVATORY AND USGS; (INSET) P. IZBEKOV/AVO, USGS, AND UNIV. ALASKA FAIRBANKS

CHILDREN OF PREHISTORY

Stone Age kids left their marks on cave art and stone tools

BY BRUCE BOWER

Walk about 300 meters into Rouffignac Cave in southern France, turn left into a dark chamber, raise a lantern, and gaze up at a prehistoric marvel. A welter of undulating, curving, crisscrossing lines blankets the ceiling in abstract abandon. Single, double, and triple sets of lines zigzag and run together in swirls. In other parts of the cave, similarly configured lines appear beside, inside, underneath, and on top of drawings of now-extinct mammoths. Archaeologists refer to such marks as finger flutings, the lines that human fingers leave when drawn over a soft surface. In Rouffignac Cave, finger flutings cut through pliable red clay to expose hard white limestone underneath.

LINE DESIGNS — Prehistoric people used their fingers to create patterns on the ceiling of a chamber in France's Rouffignac Cave. A child made the three-fingered, horizontal units near the center of the image, a new study suggests.

VAN GELDER

Soon after the discovery of Rouffignac's finger flutings about 50 years ago, researchers started speculating about the mysterious marks. One influential account referred to the decorated ceiling as the "Serpents' Dome." Others interpreted the finger flutings as depictions of mythical creatures or streams of water, symbols from initiation rites into manhood, or shamans' ritual signs.

New evidence, gathered by Kevin Sharpe of the University of Oxford in England and Leslie Van Gelder of Walden University in Minneapolis, challenges those assertions. They argue that 2-to-5-year-old kids generated the bulk of Rouffignac's ancient ceiling designs. Teenagers or adults must have hoisted children so that the youngsters could reach the ceiling and run their fingers across its soft-clay coat.

Sharpe and Van Gelder's study joins a growing number of efforts aimed at illuminating the activities of Stone Age children. Researchers who conduct such studies regard much, but certainly not all, of prehistoric cave art as the product of playful youngsters and graffiti-minded teenagers.

Stone Age adults undoubtedly drew the famous portrayals of bison, mammoths, and other creatures at sites such as France's Lascaux Cave and Spain's Altamira Cave. However, less attention has focused on numerous instances of finger fluting, pigment-stained handprints and hand outlines, and crude drawings of animals and people, all of which may have had youthful originators.

"Kids undoubtedly had access to the deep painted caves [during the Stone Age], and they participated in some of the activities there," says Jean Clottes, a French archaeologist and the current president of the International Federation of Rock Art Organizations. "That's a hard fact."

Moreover, archaeologists suspect that many of the relics found at prehistoric stone-tool sites around the world are the largely unexamined handiwork of children and teenagers who were taking early cracks at learning to chisel rock.

"I suspect that children's products dominate stone-tool remains at some of those sites," remarks archaeologist John J. Shea of Stony Brook (N.Y.) University.

CAVE TOTS Sharpe and Van Gelder have long speculated that prehistoric kids created many of the patterned lines that adorn caves such as Rouffignac. Their suspicion was kindled in 1986, when Australian archaeologist Robert G. Bednarik published the first of several papers contending that the walls and ceilings of caves in western Europe and southern Australia contained numerous examples of child-produced grooves as well as some made by adults. He coined the term finger fluting for this practice.

Bednarik, who heads the Australian Rock Art Research Association in Caulfield South, noted that, because of the spacing and width of the marks, a large proportion of the grooves must have been the work of small fingers. "Approximately half the markings were clearly made by children, even infants," he says.

To date, Bednarik has investigated finger fluting in about 70 Australian and European caves. Analyses of wall and ceiling sediment in a portion of these caves indicate that the line designs originated at least 13,000 years ago, and in some cases 30,000 years or more ago.

At Rouffignac, Sharpe and Van Gelder took Bednarik's ideas an empirical step further. First, the researchers asked children and adults to run the fingers of one hand across soft clay. The scientists then measured the width of the impressions of each individual's central three fingers. Participants included 124 pupils and 11

teachers from four schools—three in the United States and one in England. Their ages ranged from 2 to 55. The volunteers held their fingers close together during the exercise, mimicking the finger-fluting style at Rouffignac. Even with adult assistance, 2-to 3-year-olds usually just smacked the clay with an open hand.

Comparisons of modern finger widths with those arrayed on the French cave's ceiling indicate that 2-to-5-year-olds made the vast majority of Rouffignac markings, Sharpe and Van Gelder reported in the December 2006 *Antiquity*. Either teenagers or adults crafted a few finger flutings at the site, since members of these age groups possess similar, larger finger widths than children do. In the modern sample, a 12-year-old girl and a 14-year-old boy displayed wider fingers than any adult did. Hand sizes of late Stone Age people are comparable to those of people today, Sharpe says.

IMPRESSIVE REACH — New evidence suggests that a prehistoric child, presumably held up by someone else, created patterns of lines by running his or her fingers across the soft coating on the ceiling of this chamber in France's Rouffignac Cave.

A 5 foot, 10 inch–tall person standing on tiptoes could just reach the ceiling of the Rouffignac chamber, Sharpe notes. Adults must have hoisted children on their shoulders while weaving their way through the inner sanctum, so that their passengers could trace curved, elongated lines. This activity occurred sometime between 27,000 and 13,000 years ago, according to estimates of the extinction dates of animals depicted in drawings in the cave.

Perhaps finger fluting was simply a playful exercise, a form of ancient finger painting, Sharpe suggests.

While Bednarik welcomes the new evidence on youthful finger fluting, he suspects that such marks mimicked visual sensations produced by reactions of the brain in response to prolonged darkness and sensory deprivation deep inside caves. In such situations, people—and especially children, in Bednarik's view—temporarily see wavy lines, points of light, and other geometric shapes.

Stone Age kids at Rouffignac may have translated these visions into finger fluting without adult assistance, Bednarik holds. Since soil movements can alter the height of cave floors, prehistoric children might once have been able to reach the chambers' ceilings on their own, he suggests.

In contrast, Clottes accepts the notion that prehistoric adults lifted young finger fluters at Rouffignac. However, he hypothesizes that ancient people regarded caves as portals to spirit worlds and as places for important rituals. "Children were brought inside the caves to benefit from the supernatural power the caves held by touching the walls, putting or printing their hands on the walls, drawing lines, and perhaps occasionally sketching animals or geometric signs," Clottes says.

Paul Bahn, an independent archaeologist in England, sees no way to confirm Clottes' contention. "Finger fluting may have been deeply significant or may have been almost mindless doodling," Bahn remarks. "The fact that some kids were lifted up by bigger people in no way helps us to decide."

HANDY BOYS In September 1940, three teenage boys in rural France set out to find a rumored underground passage to an old manor. Their search led them to a small opening in the ground that had been blocked off to keep away livestock. After returning the next day with a lamp, the boys crawled into the hole and entered the Lascaux cave with its gallery of magnificent Stone Age drawings.

Caves exerted a hypnotic pull on boys long before Lascaux's discovery, says zoologist R. Dale Guthrie of the University of Alaska in Fairbanks. In fact, he contends, teenage boys played a big part in producing the prehistoric cave art, not just in finding it thousands of years later.

Guthrie, who studies the remains of Stone Age animals and is himself an artist, made his case in a 2005 book titled *The Nature of Paleolithic Art* (University of Chicago Press).

Adolescent boys, at times joined by female peers and children, decorated cave walls and ceilings for fun, not to commune with spirits, Guthrie holds. Exploring caves and decorating underground chambers with personal marks provided an outlet for creative play that readied boys for the rigors and challenges of big-game hunting as adults, he suggests.

Youngsters made up a hefty proportion of ancient populations. In a Stone Age band of roughly 35 people, about two dozen individuals were in their twenties or younger, Guthrie estimates. Few elders lived past age 40.

Several European Stone Age caves contain sets of footprints of teens and children, suggesting that prehistoric kids of different ages went exploring together, Guthrie says.

The most extensive evidence of a youth movement in ancient cave art comes from Guthrie's comparison of the size of hand impressions at some sites with corresponding measurements of people's hands today. In at least 30 European caves, ancient visitors rendered hand images by pressing a pigment-covered palm and fingers against a wall or by blowing pigment against an outspread hand held up to a wall to create a stenciled outline.

Guthrie assessed nine different dimensions characterizing each of 201 ancient hand impressions. He obtained the corresponding hand measurements for nearly 700 people, ages 5 to 19, in Fairbanks.

Teenagers ranging in age from 13 to 16 left most of the prehistoric handprints, Guthrie concludes. He classifies 162 prints as those of adult or teenage males, based on traits such as relatively wide palms and thick fingers. The remaining 39 prints belong either to females or to young boys.

Guthrie contends that much Stone Age cave art was concocted hastily, yielding simple, graffitilike images with no deep meaning. For instance, a few caves contain hand outlines with missing fingers or other deformities that teenage boys with normal hands made for fun, in Guthrie's view. He has replicated the "maimed-hand look" by spattering paint around his own bent fingers onto flat surfaces.

Stone Age caves also contain many unfinished or corrected sketches of animals as well as drawings of male and especially female sexual parts. Small groups of boys, flush with puberty but not yet old enough for adult duties, probably invested considerable energy in exploring caves and expressing their hopes and fears on chamber walls, Guthrie proposes.

"Paleolithic art books are really biased in showing only beautiful, finished cave images," he asserts. "The possibility that adolescent giggles and snickers may have echoed in dark cave passages as often as did the rhythm of a shaman's chant demeans neither artists nor art."

Sharpe, a supporter of Guthrie's conclusions, notes that teenage boys apparently jumped up and slapped the walls of chambers in Rouffignac and in a nearby French cave, making hand marks about 2.5 m above the floor.

VAN GELDER

Clottes, however, doubts that youthful thrill seekers took the lead in generating prehistoric European cave art. "In most caves, images were made by adults," he says. "A majority of those images display both artistic mastery and technical expertise."

KNAP TIME Guthrie's labeling of prehistoric teenagers as big-time cave artists stimulated a related insight by John Shea. The Stony Brook researcher realized, after reading Guthrie's book, that nearly every set of stone tools and tool-making debris found at Stone Age sites includes the likely handiwork of children.

"Almost every stone-tool assemblage includes unusually small, simple artifacts, overproduced in an obsessive way, that children could have made," Shea says.

These tiny, rudimentary implements—many dating to hundreds of thousands of years ago—were made from poor-quality rock, an additional sign that they were fashioned by kids taking early whacks at tool production, Shea asserts. Seasoned stone-tool makers used high-quality rock.

Shea teaches a college class in stone-tool making, also known as flint knapping. Observations of novice flint knappers, combined with the likelihood that prehistoric people learned to make stone tools at young ages, bolster his argument—published in the November-December 2006 *Evolutionary Anthropology*—that children produced many previously discovered small stone artifacts. Researchers have already established that modern children can learn to make basic stone tools starting at age 7.

Shea plans to develop criteria to distinguish beginners' stone artifacts from those of experienced flint knappers. For instance, he has noted that beginners create lots of debris as they experiment with tool-making techniques. Also, the shape and quality of their finished products vary greatly from one piece to the next, unlike experts' uniform implements.

As early as 1998, Harvard University archaeologist Ofer Bar-Yosef suggested that Stone Age kids may have watched adults making tools, picked up toolmakers' discarded stones, and tried to imitate what their elders had done. At the time, his suggestion went largely unnoticed.

"Children's activities have been ignored at [Stone Age] sites and at most later archaeological sites as well," remarks archaeologist Steven L. Kuhn of the University of Arizona in Tucson.

Questions remain about whether children and other novices invariably generated smaller stone artifacts than experienced tool makers did, Kuhn says. Research into children's activities in modern hunter-gatherer societies might offer clues to youngsters' behavior long ago, in his view.

Stone Age kids may eventually rewrite what scientists know about ancient stone tools and cave art. It's enough to make a prehistoric parent proud. ■

ANCIENT HANDIWORK — Young boys used pigment to make hand prints and crude drawings of animals on a wall at France's Chauvet Cave, a researcher argues. Dots arrayed near one animal's mouth may represent blood coming out, a common occurrence in creatures speared through the chest.

GUTHRIE

FLOTSAM SCIENCE

You can learn a lot from floating junk

BY SID PERKINS

In January 1992, a freighter crossing the Pacific from Hong Kong to Tacoma, Wash., ran into rough weather near the International Date Line. As the ship heaved through the storm-tossed seas, several cargo containers on deck—including one filled with tens of thousands of plastic tub toys—came loose, fell overboard, and broke apart. Seven months after the spill, the plastic ducks, beavers, turtles, and frogs began washing up on beaches. Scientists who track ocean currents were ecstatic.

Even today, additional members of the tub-toy armada occasionally make landfall. The date and place of each of the nearly 1,000 toys recovered to date provide a data point, says Curtis Ebbesmeyer, a retired oceanographer in Seattle. Some of the toys are well traveled indeed—one frog washed ashore in Scotland, and a duck turned up near Maine. However, most of the drifters have remained stuck in the Pacific Subarctic Gyre, a set of deep-water and surface currents spanning an area the size of the continental United States that generally flows counterclockwise around the northern Pacific Ocean.

Worldwide, about 10,000 cargo containers fall overboard each year. In most parts of the world, the dispersal of flotsam isn't of major interest to researchers. But along the bustling trade routes that link eastern Asia to North America, the tennis shoes, kids' sandals, hockey gloves, and other stuff that drops off ships is enabling scientists to fill in details of how the Pacific Subarctic Gyre works.

Often, the lost items float and can be readily identified as coming from a ship at a certain location. Recently, Ebbesmeyer and his colleagues used almost a century of data from such floating objects to map the gyre's major subcurrents and swirls.

Now, for the first time, scientists have determined that a lap around the Pacific Subarctic Gyre takes about 3 years. That information, in turn, led Ebbesmeyer and his colleagues to identify long-term variations in water temperature and salinity in the North Pacific that hadn't been noted previously.

All this from studying flotsam.

M. GONDO/NIRAI-KANAI GROUP

BON VOYAGE! — The release of satellite-trackable buoys and wooden tops near Japan in 2005 and 2006 is providing data about trans-Pacific currents.

HIGH SEAS DRIFTERS The ocean is teeming with a variety of scientific instruments. When it comes to measuring surface currents, however, these devices have their limitations.

For example, in the past 7 years, scientists have deployed about 2,800 heavily instrumented, satellite-monitored probes called Argo floats (*SN: 2/1/03, p. 75*). They drift through the ocean at depths of about 2 kilometers. Every 10 days or so, they pop up to measure the overlying water's temperature and salinity. However, the direction and speed of deep currents, where these high-tech probes spend most of their time, don't necessarily match those of currents in the top few meters—let alone centimeters—of ocean, says Ebbesmeyer. So, the path of an Argo float provides little information about surface currents.

Probes specifically designed to ride surface currents face different problems. Their sensors can quickly become obstructed by algae, barnacles, and other organisms that thrive in the sunlit portion of the ocean.

What's more, regardless of the depths at which modern probes operate, their batteries fail within months. Generally, the probes haven't traveled more than 1,000 km in that time, says Thomas C. Royer, an oceanographer at Old Dominion University in Norfolk, Va. That's only a small fraction of the path around the gyre.

"We've never had a good handle on how long it takes [floating] objects to go around the gyre, or even if they do," Royer adds.

To map the currents and clock their speeds, Ebbesmeyer, Royer, and their teammates circumvented the disadvantages of modern electronic probes by harnessing the power of floating junk. Because the Pacific is crisscrossed by major trade routes, "there's a lot of stuff out there," Ebbesmeyer notes. Many of those items can be traced back to specific spills, and if the lost objects are durable, they can drift in currents for years.

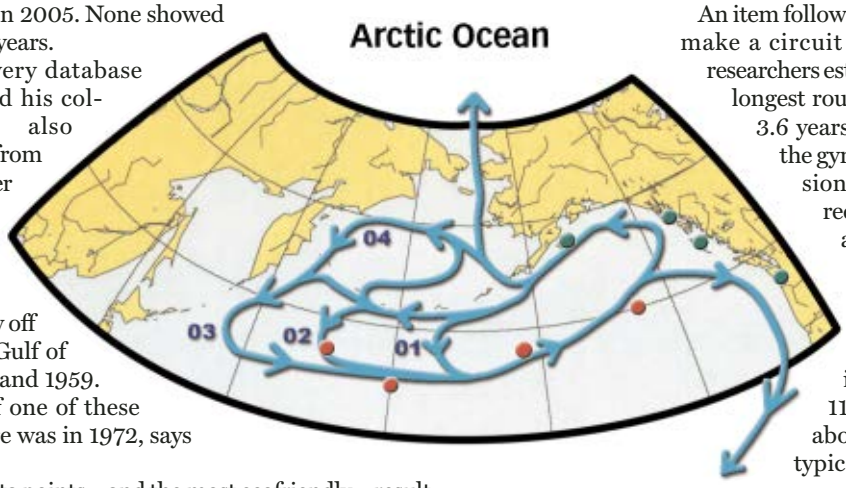
Take, for instance, a container that dropped overboard in the North Pacific in May 1990. It held 80,000 Nike sneakers—each of which carried a code number unique to its shipment. About 2,000 of those shoes have turned up on beaches since then. Ebbesmeyer's group stays in touch with networks of beachcombers who report finds from ship spills.

In January 2000, a cargo box contributed another batch of accidental tourists. It contained children's sandals that, like the sneakers, carried code numbers linking them to the particular shipment. Ten of the sandals have washed ashore on Alaska's Kodiak Island—

some in 2001, others in 2005. None showed up in the intervening years.

The flotsam-recovery database that Ebbesmeyer and his colleagues maintain also includes information from some of the 19,000 beer bottles—containing identification numbers and contact information—that oceanographers threw off a boat far out in the Gulf of Alaska between 1956 and 1959. The last recording of one of these bottles washing ashore was in 1972, says Ebbesmeyer.

The team's oldest data points—and the most ecofriendly—result from the eruption of Alaska's Mount Katmai on June 6, 1912. Some of the pumice spewed by that volcano fell into the Gulf of Alaska. In mid-August 1914, large chunks of that frothy rock, waterlogged but still floating, washed up on beaches of British Columbia's Queen Charlotte Islands.



LONG, STRANGE TRIP — Floating objects may take any of several routes (labeled 01 through 04) around the Pacific Subarctic Gyre, a new study suggests. Red dots denote spills, and green dots denote recovery sites.

CRUNCHING THE NUMBERS Each entry in the researchers' flotsam database includes the latitude and longitude of the place where the item entered the ocean and of the site where it was discovered—in essence, a start point and an end point. "You use a lot of imagination about what goes on in between," says Royer.

For most of its years at sea, flotsam in the gyre wouldn't have been directly affected by winds, the scientists speculate. The message-containing beer bottles were heavy and typically drifted on their sides, the waterlogged pumice rode low in the water, and the sandals and sneakers floated upside down with their soles barely exposed. The tub toys originally floated with a high profile, as they were designed to do, but after just a few weeks in the open ocean, they'd have sprung leaks and barely remained afloat, says Ebbesmeyer.

Because of the sheer volume of flotsam data, the scientists have been able to discern the typical configuration and average speed of the currents in the Pacific Subarctic Gyre, even though their overall pattern continually shows slight shifts and speed changes in response to the passage of large ocean eddies (*SN: 6/14/03, p. 375*) or variations in weather patterns caused by climate cycles such as El Niños.

Results of computer simulations indicate that floating objects can be swept along several paths in the Pacific Subarctic Gyre, Ebbesmeyer and his colleagues noted in the Jan. 2 *Eos*. The easternmost portions of all routes flow north along the Alaskan panhandle and then turn west to skirt the state's southern coast. Items following the shortest route, a 7,400-km loop, are carried a little more than halfway out the chain of Aleutian Islands before they are swept back to the West Coast.

Currents along the next-longest path, a 10,200-km route, tour all the Aleutians before returning east. The longest paths, which stretch all the way to the Russian coast, measure 12,600 km and 13,500 km.

ART AND SCIENCE — Some of these wooden tops, embellished by Japanese schoolchildren and released by scientists near Okinawa, may soon wash up on North American shores.

D. INGRAHAM; M. GONDO/NIRAI-KANAI GROUP

An item following the shortest loop would make a circuit in just over 2 years, the researchers estimate, and items taking the longest route would make a lap every 3.6 years. The average trip around the gyre took 3 years. This conclusion fits with observations of recoveries of items that came at intervals of several years rather than being spread evenly through time.

According to the simulations, current speeds in the gyre range between 11 and 13 cm per second, or about one-fifth the speed of a typical human swimmer.

Once the researchers came up with these answers, they analyzed long-term records of water temperature and salinity at various sites in the North Pacific. They observed 3-year-long cycles in the data—"a pattern nobody noticed until the ducks came along," says Royer.

Studying the dispersal patterns of flotsam is "interesting and creative," says Howard J. Freeland, an oceanographer at the Institute of Ocean Sciences in Sidney, British Columbia. However, he cautions, the date of recovery of an item found on a beach may not reflect when it actually washed ashore, especially for flotsam found on remote areas of the North Pacific. Ebbesmeyer and his colleagues "have good measurements, but I'm not sure of what," he notes.

The flotsam-researchers' techniques may not seem scientifically rigorous, comments Richard Thomson of the institute in Sidney. However, he adds, "with oceanographers, the more data, the better. … [Studying flotsam] is one of the few ways to get it."

The findings add to the overall knowledge of currents within the North Pacific, he notes.

INCOMING DATA New entries to the team's flotsam database are undoubtedly forthcoming, and some will be less serendipitous than beachcombers' reports of washed-up sandals. For example, a Japanese donor interested in the flotsam research provided $100,000 for researchers to release 500 wooden tops—and a buoy that can be tracked by satellite—into the ocean off Okinawa every 2 months during a 2-year period that began in 2005.

Each top is stamped with Ebbesmeyer's name, home address, and e-mail address, so that people who find the tops can report their discoveries. Beachcombers in Japan have already recovered a few dozen of the tops. However, trans-Pacific currents aren't fast enough to have driven any tops to North American shores yet.

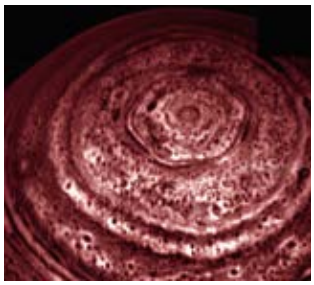
Nevertheless, Ebbesmeyer urges people to take a good look around next time they head to the shore. He notes, "There's a lot of scientific information just lying on the beach." ■

OF NOTE

PLANETARY SCIENCE

A hexagon on the ringed planet

Something has put the hex on Saturn. NASA scientists are puzzled by a giant, hexagon-shaped feature that hovers above Saturn's entire north pole. The Voyager 1 and 2 spacecraft first spotted the hexagon more than 2 decades ago. New infrared images taken by the Cassini spacecraft show that the feature has persisted and that a second, darker hexagon surrounds the brighter, previously recorded one.



GEOMETRY PUZZLE A mysterious hexagonal feature circles Saturn's north pole.

JPL/NASA

"We've never seen anything like this on any other planet," says Cassini scientist Kevin Baines of NASA's Jet Propulsion Laboratory in Pasadena, Calif. Saturn's thick, swirling atmosphere, with its circular-flow patterns, wouldn't seem the place to find a nearly perfect six-sided figure, he notes. Indeed, the north pole hexagon contrasts sharply with a hurricane raging at Saturn's south pole and resembling a giant eye.

The winds within the hexagon may be similar to Earth's polar vortices, which occur intermittently as winds blow in circles around the poles. However, with a diameter of nearly 25,000 kilometers, the hexagon could fit about four Earths inside it. NASA released the images on March 27. —R.C.

ZOOLOGY

Killer mice hit seabird chicks

Gangs of mice have been caught on surveillance video nibbling to death rare seabird chicks on a remote island.

Conservation biologists haven't worried much about mice, according to Ross Wanless of the University of Cape Town in South Africa. Programs to wipe out the rats on islands get far more attention and money.

Ordinary house mice are the only nonnative mammals on Gough Island in the south Atlantic. That's the breeding site for what may be the last self-sustaining populations of the Tristan albatross (*Diomedea dabbenena*) and the Atlantic petrel (*Pterodroma incerta*). In 2000–2001, year-round monitoring found unusually high chick losses.

Researchers returned to the island in 2003 with video cameras. They recorded mice poking around petrel burrows and killing six chicks. The researchers also recorded fatal attacks on two albatross chicks (for a sometimes-disturbing video, see *www.sciencenews.org/20070428/mouse.wmv*).

The albatross chicks weigh several hundred times as much as a mouse and can fend off attacks by big predatory birds. Yet the chicks don't fight off the tiny mice. The raids didn't kill albatross chicks immediately, but repeated feeding by up to 10 mice at a time finally did in the birds.

It's rare for mice to be the only invasive mammals on an island, so their menace may have been overlooked, Wanless and his colleagues note in a paper now online and in an upcoming *Biology Letters*. They caution that ridding islands of cats or other predators of native wildlife may be ineffective unless the mice go too. —S.M.

BIOLOGY

Uncommon cancer gets start in muscle cells

A cancer thought to arise in joint tissue instead forms in nascent muscle cells, a study in mice shows. By creating for the first time an animal that develops this cancer, known as synovial sarcoma, the researchers clear the way for similar research into other sarcomas and for possible drug development.

Synovial sarcoma is so named because it arises near the synovium, the membrane that makes the lubricant for joints. Not all cancers readily reveal their cells of origin, however, and previous studies hadn't established that the cells of this cancer begin as synovial cells.

Meanwhile, that research found that synovial sarcoma cells have a characteristic DNA arrangement. In these cells, two genes from separate chromosomes fuse and encode a rogue protein called SYT-SSX that scientists suspect influences cell growth.

Researchers developed mice that make the aberrant protein in muscle cells during various developmental stages. All mice that made the protein in early-stage muscle cells developed synovial sarcoma tumors, says geneticist Mario R. Capecchi of the Howard Hughes Medical Institute and the University of Utah School of Medicine in Salt Lake City. He and his colleagues report the findings in the April *Cancer Cell*.

The fusion protein failed to induce malignant growth during other stages of muscle-cell maturation or in other cell types.

Fusion proteins are a common and random occurrence in the body, and they often show up in sarcomas, Capecchi says.

The new study has importance for sarcoma research in general because it shows the "remarkable specificity" required for such aberrant proteins to initiate a cancer and suggests that only specific cell types are susceptible to their transforming effects, say Sean R. Davis and Paul S. Meltzer of the National Cancer Institute in Bethesda, Md., writing in the same journal issue. —N.S.

CLIMATE

Dry winters heat European summers

When southern Europe receives scant rainfall in the winter, the whole continent tends to bake the following summer.

Each of Europe's 10 warmest summers between 1948 and 2005 followed a winter in which the continent's Mediterranean countries experienced significant deficits in rainfall, says Robert Vautard, a climate scientist at the French National Center for Scientific Research in Gif sur Yvette. For those years, moreover, the scarcer the wintertime rainfall, the hotter the following summer, he notes.

Vautard and his colleagues turned to climate simulations to investigate the theoretical effect of wintertime droughts at latitudes below 46°N, an east-west line that runs just north of Venice and splits France in half. When portions of Europe south of that latitude began the summer with a soil-moisture content of only 15 percent, average July temperatures there would be as much as 6°C higher than if the soil had a more typical 30 percent moisture.

Also, some regions north of 46°N, such as Switzerland and southern Germany, would experience average July temperatures up to 2°C higher after a dry winter than after a wet one, even if the previous winter's drought had been confined to southern Europe, the researchers note in the April 16 *Geophysical Research Letters*.

Because many climate projections suggest that southern Europe will become drier

OF NOTE

in the coming decades, the new findings suggest that European heat waves will become more frequent. —S.P.

PHYSICS

Liquid origami

A French team has created the first mini-origami figures that fold themselves around droplets of water.

Benoît Roman of the Institute of Industrial Physics and Chemistry in Paris and his colleagues cut shapes out of flat plastic sheets and then dabbed them with water.

The plastic is of a type that attracts water molecules, and as a droplet evaporates and shrinks, that attraction wins over the plastic's tendency to stay flat. Each droplet "wraps itself like in a blanket to minimize its surface of contact with air," Roman says.

However, once the water completely evaporates, the folds open back up. Roman says special glues activated by ultraviolet light might keep them in place.

The team reports in the April 13 *Physical Review Letters* that, so far, it has fashioned millimeter-size cubes, pyramids, faceted spheres, and calzone-shaped objects. But Roman says the technique could easily be scaled down by orders of magnitude.

Such self-assembling structures could be parts of future microscopic mechanical devices. Last year, a team at Harvard University developed similarly self-folding origami figures (*SN: 11/25/06, p. 344*).

The French team plans to develop more-complicated shapes by cutting the plastic in new ways. "It could be interesting to collaborate with a fashion designer," Roman says. —D.C

FOLD ME As it evaporates, a water droplet bends a plastic sheet into a 3-millimeter-wide pyramid. The same mechanism could work at microscopic sizes.

BIOMEDICINE

No heart risk from hormones taken near menopause

Contrary to some earlier indications, hormone replacement therapy might not impart heart risks to women who take it during their 50s.

Studies over the past 2 decades have produced mixed findings on whether estrogen—alone or in combination with progestin—is good, bad, or neutral for postmenopausal women who take it to ward off hot flashes and night sweats (*SN: 4/15/06, p. 228; 5/31/03, p. 341*).

To gauge the risks of various ailments from hormone therapy, Jacques E. Rossouw of the National Heart, Lung and Blood Institute in Bethesda, Md., and his colleagues combined data from two trials that included more than 27,000 women. Those who had had hysterectomies got estrogen or a placebo, while those who hadn't got an estrogen-progestin combination or a placebo.

The new analysis indicates that hormone therapy confers no greater risk of heart disease in women under 60 than placebos do. But the therapy does increase heart risks for women older than that, the researchers report in the April 4 *Journal of the American Medical Association*.

Women in all age groups saw an increased risk of stroke from hormone therapy, the new analysis confirms. —N.S.

MEETINGS

American Physical Society
Jacksonville, Fla.,
April 14 – 17

PARTICLE PHYSICS

Fermilab could beat CERN to the punch

If it exists, the Higgs boson would explain why matter has mass. A new particle accelerator due to start operations next year at the European Organization for Nuclear Research (CERN) in Geneva should finally find the Higgs, physicists say.

The more powerful an accelerator, the more energetic the particles it smashes together and the heavier the particles that those collisions can create.

The Higgs boson has long been estimated to weigh up to the equivalent of 200 protons. That might make it just too heavy for the most powerful existing accelerator, the Tevatron at the Fermi National Accelerator Laboratory in Batavia, Ill, to create. But it would be well within reach of CERN's new machine, the Large Hadron Collider.

But Fermilab physicists now say that they might have a shot at discovering the Higgs within the next 2 years, possibly before the CERN collider could.

Fermilab teams announced new and higher estimates of the masses of two known particles. Those revised masses, according to standard theory, imply a Higgs lighter than 150 protons. Of course, that's assuming the theory itself doesn't need revision—something physicists aren't sure of. —D.C.

GRAVITY

Putting Einstein to the test

NASA's longest-running mission is accomplished—almost.

Gravity Probe B went into orbit in 2004 after 4 decades of development and seven NASA reviews that often threatened to cancel it. It was meant to test general relativity, Albert Einstein's theory of gravity (*SN: 11/5/05, p. 302; 11/1/03, p. 280*).

The $700 million probe incorporated numerous technologies to keep four gyroscopes—near-perfect spinning spheres the size of ping-pong balls—virtually free of external disturbances. Magnetic readouts tracked the gyros' rotation axes, which Newtonian physics predict would be perfectly stable. However, two distinct relativity effects would make the axes drift.

But unexpected anomalies appeared during the mission. Electrostatic fields due to micron-size irregularities in the metal casings of the gyros may have affected the data, said Stanford University's Francis Everitt. He and his team are confident that they will weed out the noise, and they plan to release final results at the end of the year. For now, they released preliminary results.

Gravity Probe B confirmed the so-called geodetic effect—in which the curvature of space shortens the length of the craft's orbit by 1.1 inches—to a precision of 1 percent. The other, even subtler effect, called frame dragging, is the result of Earth's twisting the fabric of space around itself as it rotates. Frame dragging was expected to tilt the gyros' axes by just 0.000011 degree over 1 year, but the data are still too noisy to show that signal.

"We have some glimpses of the frame-dragging effect," Everitt said, adding that his team still hopes to measure it to 1 percent accuracy, as initially planned. —D.C.

C. PY AND C. BAROUD/ESPCI

Books

A selection of new and notable books of scientific interest

FLY ME TO THE MOON: An Insider's Guide to the New Science of Space Travel

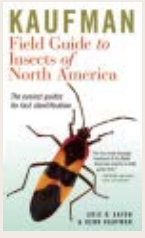
EDWARD BELBRUNO

Space flight as we know it is expensive. The tons of fuel alone necessary to catapult a rocket from the grip of Earth's gravity can cost millions of dollars, making the notion of lunar vacations for the average person a tall order. However, mathematician and NASA consultant Belbruno claims that his research could make low-fuel-consumption space travel a reality. The author describes the possibility of maneuvering an object through space by using the chaos of gravitational waves around orbiting bodies. He describes the phenomenon, called ballistic capture, and explains how a Japanese craft was coaxed into the moon's gravity without the consumption of fuel. The method, he says, could also be applied to deflecting an asteroid on a collision course with Earth. Finally, the author speculates on how a natural version of ballistic capture might explain the moon's origins. ***Princeton, 2007, 148 p., b&w illus., hardcover, $19.95.***

FIELD GUIDE TO INSECTS OF NORTH AMERICA

ERIC R. EATON AND KENN KAUFMAN

The overwhelming number and variety of insects are often underappreciated. The pesky fly found buzzing around a picnic table could be one of 16,000 kinds of flies found on the North American continent alone. Identifying the thousands of insects, from beetles to ants to sphinx moths, is a daunting task. In this guide, Kaufman and Eaton present information on the insects most commonly found in Canada and the United States. In the introduction, the authors provide an overview of insect reproduction and development, describing insect metamorphosis, anatomy, nomenclature, and classification. A pictorial table of contents helps readers quickly identify the category of an observed insect, which is detailed in a subsequent chapter. Each of these includes a one-page summary of insects' common names, genera, species, physical traits, common locations, and behaviors. ***Houghton Mifflin, 2007, 392 p., color images, paperback, $18.95.***



TOO FAR FROM HOME: A Story of Life and Death in Space

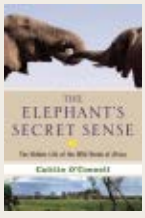
CHRIS JONES

What does it take to go into space? How does the experience change the people who do it? In this book, journalist Jones recounts the mental and physical experiences of three men caught up in one of the most dramatic episodes in space exploration. While the world grieved after the Columbia Space Shuttle disaster in 2003, three men came to terms with the event from a perspective unlike any other. U.S. astronauts Donald Pettit and Kenneth Bowersox and Russian cosmonaut Nikolai Budarin were orbiting Earth aboard the International Space Station when the disaster suddenly left them with no scheduled return home. Jones chronicles the emotional race against time for these space travelers and their mission-control counterparts. ***Random House, 2007, 304 pages, hardcover, $24.95.***

THE ELEPHANT'S SECRET SENSE: The Hidden Life of the Wild Herds of Africa

CAITLIN O'CONNELL

O'Connell went to Africa in 1992 to study elephant communication via low-frequency vocalizations. During observations that lasted 14 years, she noted a peculiar listening behavior in the elephants that seemed to have nothing to do with vocal communication. The animals would often stand with one leg lifted, seemingly sensing ground vibrations. Through further experiments, O'Connell established that through their feet, elephants feel the vibrations created by approaching friends and foes and that those vibrations travel to the middle ear through an animal's bones. Here, O'Connell chronicles her research and examines elephants' political and economic impact on the African people. She documents farmers' efforts to deter the elephants from crop raids, attempts at elephant birth control, and the need for balance between wildlife conservation and economic development. ***Free Press, 2007, 241 p., b&w plates, hardcover, $24.00.***



HEADLESS MALES MAKE GREAT LOVERS: And Other Unusual Natural Histories

MARTY CRUMP

Insects, as Crump demonstrates, can lead weird lives. For instance, the male preying mantis typically sneaks up on a female to mate, gets his head chewed off, and yet continues to copulate. Crump details other bizarre denizens of the animal kingdom, from hermaphroditic slugs to pregnant male seahorses and blood sucking bats. In short, whimsical essays, Crump, a professor of biological sciences at Northern Arizona University, provides a broad survey of unusual behaviors. For example, male deep-sea anglerfish attach themselves to their mates, parasite-style, for life, and horned lizards squirt blood from their eyes to ward off attackers. Other lizards and starfish sacrifice parts of their bodies to escape predators—and then grow back those parts. Throughout the book, Crumb sprinkles anecdotes about human behavior, including our occasionally strange dietary selections, such as other animals' milk, and the idea that people release and respond to pheromones. ***Univ. Chicago Press, 2007, 199 p., b&w illus., paperback, $14.00.***

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LETTERS

Long ago gas

Finding CO_2 levels that are 2,500 times higher in 5,000-year-old fulgurites than in modern samples, scientists have speculated that the extra CO_2 resulted from vaporization of organic material by lightning ("Stroke of Good Fortune: A wealth of data from petrified lightning," *SN: 2/17/07, p. 101*). Could some of this gas reflect elevated atmospheric CO_2? And if so, could current laments regarding "unprecedented levels" of CO_2 be insupportable?

JOHN M. CORBOY, MILILANI, HAWAII

Other archives of preindustrial carbon dioxide, such as ice cores and corals, don't indicate that concentrations of the greenhouse gas were abnormally high 5,000 years ago. —S. PERKINS

Fractal fairy tales?

Fractal characteristics associated with Jackson Pollack's paintings are interesting ("Fractal or Fake?" *SN: 2/24/07, p. 122*), but to determine authenticity, it would seem that two propositions would have to be proved: first, that Pollack's paintings always had fractal character; and second, that only Pollack's paintings had fractal character. Both seem highly dubious.

STEVE JOHNSON, PRAIRIE VILLAGE, KAN.

In doing drip or splash painting, the artist defines the overall upper-level structure of the image, but the higher-magnification patterns are the result of the physics of liquids falling on a solid surface, only slightly affected by the artist's intention. Any drip painting that looks like a Pollack overall will look in details like one as well.

BRUCE MCINTOSH, MADRID, N.M.

Not planning on it

In regards to "Bird Plans: Jays show foresight in breakfast menus" (*SN: 2/24/07, p. 117*), I find it hard to rule out an interpretation that would not require anything similar to planning. This could simply be pattern completion, similar to building a nest or bower. The animal is not necessarily planning, but simply filling in missing pieces.

ROBERT FIZZELL, BELOIT, WIS.

Corrections *In "Warming Sign? Larger dead zones form off Oregon coast"* (SN: 2/24/07, p. 118)*, "southerly" winds should have been described as blowing toward the south. In "Faster, Cheaper, Better"* (SN: 4/14/07, p. 235)*, the last name of Laurence Kedes, scientific director of the X Prize for Genomics, was misspelled.*

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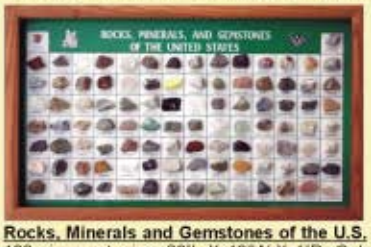

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