SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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fatty liver fix

hepatitis e vaccine works

female chimps on the hunt

a blacker black

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family portrait

DARLINGS AND ROGUES

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Features

This Week

Of Note

Meetings

Departments

Cover Meerkats make great subjects for researchers studying the costs and benefits of family life. Meerkat babysitters risk their lives taking care of other animals' offspring, but then again, grandmothers not infrequently kill their grandkids. (iStockphoto)
Page 138

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Nice Shot

Hepatitis E vaccine passes critical test

An experimental vaccine for hepatitis E has proved nearly 96 percent protective in a test among soldiers in Nepal. The results set the stage for a final trial that could lead to commercialization of the vaccine, the first to be developed against this virus.

Other hepatitis vaccines don't work against hepatitis E, and there's no effective treatment for the disease that it causes. By some estimates, one-third of the world's population, mainly in Africa and Asia, has been infected at some time. A hepatitis E infection causes fatal liver failure in 1 to 3 percent of patients showing symptoms. Other signs of the disease are abdominal pain, nausea, fatigue, and yellowed skin.

The loss of wages from weeks or months of missed work creates a "huge burden" on families in poor countries where this hepatitis is endemic, says Bruce L. Innis, an infectious-disease physician at GlaxoSmithKline in King of Prussia, Pa.

Innis teamed with researchers from Nepal and the U.S. Army to recruit 1,794 Nepalese soldiers to test the vaccine. Half received three shots of the vaccine over 6 months, while the others got inert injections.

Over an average of 27 months, 3 volunteers who had received the full vaccine regimen came down with hepatitis E, compared with 66 soldiers who got the placebo, the researchers report in the March 1 *New England Journal of Medicine*. Tests on patients' blood or stool ascertained the viral infection.

"The vaccine practically knocks out the disease," says pathologist Krzysztof Krawczynski of the Centers for Disease Control and Prevention in Atlanta. He cautions that the researchers didn't measure whether vaccinated soldiers who appeared healthy were nonetheless infected with the virus. Such subclinical infections might create a group of people who, although feeling well, would spread the virus via their feces to untreated drinking-water sources such as streams.

"Many vaccines don't stop infection," counters Suzanne U. Emerson of the National Institute of Allergy and Infectious Diseases (NIAID) in Bethesda, Md. The successful vaccine for hepatitis A falls in that category.

The main requirement of a vaccine is to prevent disease, which the new hepatitis E vaccine does, Emerson says. She and her NIAID colleagues fashioned the vaccine in 1994 from one of the virus' proteins.

Meanwhile, puzzles linger. Unlike many diseases, which prey mainly on children and old people, hepatitis E usually strikes people between 15 and 40 years of age. And despite probable exposure to hepatitis E in early childhood, people in endemic zones "fail to build up immunity to it—one of the enduring mysteries of hepatitis E," Innis says. Most troublesome is hepatitis E's high death rate—up to 25 percent—in pregnant women.

If the vaccine clears its final hurdle in a large-scale trial, Innis envisions a public health approach that targets adolescents and young adults—with extra efforts to reach girls before they enter childbearing years.

"Combining this with other vaccines would be a practical approach" that could cut costs, says study coauthor Mammen P. Mammen Jr., a U.S. Army infectious-disease physician at Fort Detrick in Frederick, Md.

It's unclear how long the vaccine's protection lasts. If immunity to hepatitis E wanes, Innis says, scientists might design a booster shot, as they did for the whooping cough vaccine. —N. SEPPA

STATS

60%

Lifetime risk in India of getting a hepatitis E infection

Tools for Prey

Female chimps move to fore in hunting

For the first time, researchers have observed wild chimpanzees making and using tools for hunting. What's more, it's mostly the female chimps and juveniles that adopt this style of attack, which occasionally nabs a small mammal that the chimp then eats.

The discovery that tool-assisted hunting among chimps includes females and youngsters challenges the traditional idea that such behavior in people and their ancestors evolved as a solely male pursuit, say anthropologists Jill D. Pruetz of Iowa State University in Ames and Paco Bertolani of the University of Cambridge in England.

Pruetz and Bertolani studied 35 chimps living at Fongoli, a savanna site in southeastern Senegal. Between March 2005 and July 2006, the researchers recorded 22 instances of tool-aided hunting. In these cases, individual chimps made spearlike tools out of tree branches and then thrust the implements into cavities in hollow tree trunks and branches where bush babies sleep during the day.

M. GASPERSIC

MEET THE HUNTRESS **Although Tia, a female Fongoli chimp, looks peaceful, researchers on several occasions observed her using a sharpened branch to hunt bush babies.**

Although most of the observed hunting attempts failed to snare the palm-size mammals, the investigators recorded one instance of a female chimp immobilizing a bush baby by jabbing it with a sharpened branch, pulling the animal out of its nest, and eating it.

Chimps at Fongoli followed as many as five steps in fashioning their weapons, Pruetz and Bertolani report in the March 6 *Current Biology*. After inspecting a tree cavity and breaking off a branch about 0.6 meter long, chimps trimmed off leaves and side branches, frequently stripped bark off the branch, and used their teeth to sharpen one end into a point. Of the 10 chimps that used these tools to hunt bush babies, only one was an adult male.

At other sites, researchers have reported that teams of male chimps, using only their hands and mouths, hunt and kill red colobus monkeys and then divvy up the meat. Male chimps at Fongoli similarly hunt vervet monkeys that live nearby, Pruetz says.

The foresight and intelligence of Fongoli chimps wielding sharpened branches to disable tiny but elusive prey probably matches that of human ancestors living more than 3 million years ago, the scientists assert. However, archaeological sites rarely preserve tools made of wood. The oldest such weapons yet found are 400,000-year-old wooden spears unearthed at a German site.

Hunting with makeshift spears at Fongoli represents "yet another example of chimpanzee cultures," comments anthropologist Linda F. Marchant of Miami University in Oxford, Ohio. She says that different chimp communities develop unique behavioral traditions much as

human groups devise distinctive customs (*SN: 9/3/05, p. 158*).

In the late 1970s, bits of bush baby bones turned up in fecal studies by Marchant and her colleagues at a site near Fongoli. The researchers concluded that chimps ate bush babies, although the team observed no hunting such as that now reported at Fongoli.

"We want to compare this surprising behavior of the Fongoli chimps to that of chimps living in other habitats," Pruetz says.

Anthropologist Adrienne Zihlman of the University of California, Santa Cruz says that the new evidence supports her view that females played a major role in the evolution of tool use. The Fongoli study shows that "females are innovators, socially central, and maintain traditions because they nurture and socialize the young," she says. —B. BOWER

The New Black

A nanoscale coating reflects almost no light

The velvet background on a painting of Elvis looks black because it reflects so little light. But getting a surface to reflect no light at all is surprisingly difficult. Now, researchers have created a virtually reflectionfree surface by coating it with filaments only a few billionths of a meter thick.

Improved antireflective surfaces might have many uses. For example, they could eliminate light-wasting reflections in fiber-optic telecommunications, or the surfaces could brighten low-power light-emitting diode (LED) lamps.

Applied to a clear surface, the coating would make a lens absorb more light, increasing its transparency. On an opaque surface, the filaments would make a silicon solar cell, for example, almost perfectly absorbing.

The coating creates "really a new class of materials," says E. Fred Schubert, a member of the research team at Rensselaer Polytechnic Institute in Troy, N.Y.

Schubert and his colleagues set out to minimize light's reflections. Light rebounds when it strikes the boundary between two materials that have different "refractive indices"—measures of how fast light travels through the substances. For example, sunlight bounces off the surface of a pond because light travels more slowly in water than in air. The greater the difference between the refractive indices of any two materials, the more light is reflected.

To prevent reflections, the team put a transparent piece of aluminum nitride in a vacuum and coated the surface with five layers of nanoscale filaments made either of silicon dioxide or titanium dioxide. Each layer resembles a rug with the yarns leaning at 45°. Together, the five layers are only about 700 nanometers thick—the wavelength of red light. The individual filaments are 20 to 30 nm wide, the team reports in the March *Nature Photonics*.

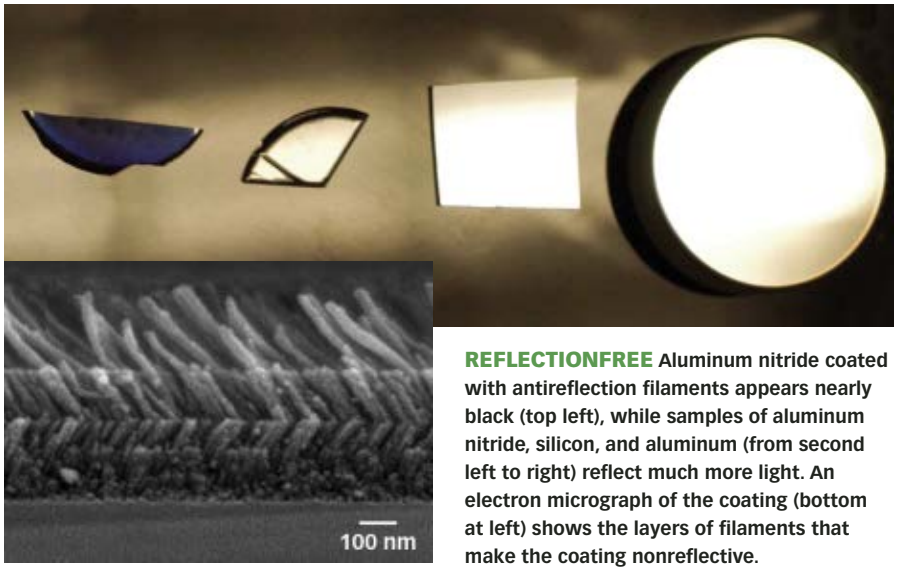
By altering the spacing between the filaments, the scientists gave each layer a slightly different refractive index. The top layer has so much space between filaments that its refractive index is nearly the same as that of air. The filaments in the other four layers are progressively denser, so the layers have increasing refractive indices. The bottom layer's index of 2.15 is the same as that of the underlying surface.

This staggered transition replaces an abrupt boundary with gradual ones, greatly reducing the reflection of light. At its surface, the coating has a refractive index of 1.05, which is close to air's index of 1.0. Even transparent solids such as glass have indices of at least 1.4.

The low-reflection coating works for visible light and all other wavelengths between near ultraviolet and near infrared.

"It certainly is an improvement over the existing state of the art," comments Sri Sridhar, who studies nanophotonics at Northeastern University in Boston.

The current coating has a faint blue tinge, however. Schubert says that this results from diffraction, not reflection. He explains that the thickness of the layers happens to equal the wavelength of the blue light. His team is currently making the layers thinner to avoid this problem. —P. BARRY



REFLECTIONFREE **Aluminum nitride coated with antireflection filaments appears nearly black (top left), while samples of aluminum nitride, silicon, and aluminum (from second left to right) reflect much more light. An electron micrograph of the coating (bottom at left) shows the layers of filaments that make the coating nonreflective.**

SCHUBERT/RENSSELAER POLYTECHNIC INST.

Snail Highways

By following trails, periwinkles save slime

A seaside snail crawling along the gooey streak left by another snail is saving a lot of energy, say researchers, because it doesn't have to ooze so much slime itself.

Scientists have observed various kinds of snails following each others' paths, says Mark S. Davies of the University of Sunderland in England. Now, he proposes that followers are economizing on mucus. Davies and his colleague Janine Blackwell have measured the thickness of new and reused trails of a common periwinkle (*Littorina littorea*), which creeps along rocky Atlantic shores. Following a fresh trail, it secretes much less slime than it expends when laying a new trail, the researchers report in a paper now online for an upcoming *Proceedings of the Royal Society B*.

"It's much, much more expensive to go around on a carpet of mucus than to run, walk, swim, or fly," Davies says. He has calculated that a periwinkle uses more than 35 times as much energy making mucus as it does crawling along it. And he finds that a limpet creeping along seashore rocks spends roughly a third of its total energy intake producing that mucus.

To study snail mucus, Davies and Blackwell permitted a periwinkle to crawl over microscope slides in the lab and measured the thickness of its slime. A second periwinkle following a trailblazer secreted, on average, only 27 percent of the mucus typically laid down in a new trail. After a slide had been exposed to one or more tide cycles along the shore, the streaks deteriorated, and a snail coming along later had to do more resurfacing.

Saving energy by following trails "sounds plausible," says mathematician Eric Lauga of the Massachusetts Institute of Technology. Last year, he and a colleague made a mathematical model of a

snail crawling on mucus. The substance is 95 percent water, with a dash of various salts and a small dose of the glycoproteins that give the mucus cohesiveness. The researchers concluded that the properties of the slime minimize the amount of mucus needed for crawling. Nevertheless, Lauga agrees that producing the trail is more expensive than moving along it.

If mucus saving is such a big issue, then "land snails should be even more given to trail following" because they have a more difficult time replacing water, muses snail neurobiologist Melissa Harrington of Delaware State University in Dover. "However, we see it pretty rarely," she says, noting that land and shore snails may make different energy trade-offs.

The periwinkle work, she says, makes "an interesting observation." —S. MILIUS

Stormy Weather in Space

Craft take panoramic view of solar eruptions

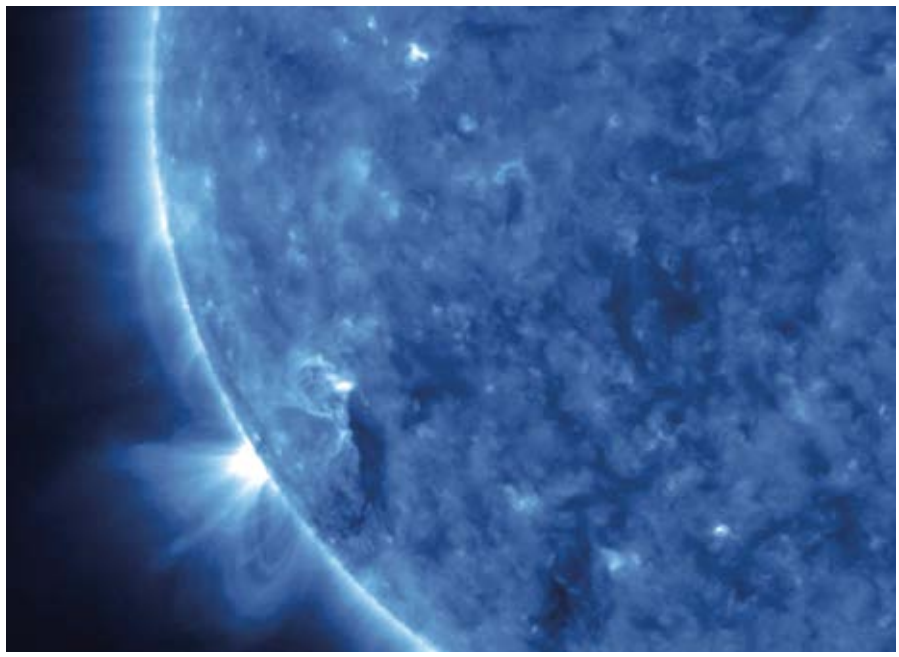
Even at its most quiescent, the sun hurls into space a billion-ton cloud of charged particles every 2 days or so. The few particles that strike our planet can disrupt satellites and knock out power systems on the ground.

Twin spacecraft have for the first time tracked these storms, known as coronal mass ejections, from their birth in the lower depths of the sun's atmosphere all the way to Earth's orbit, scientists announced this week. The new capability will enable solar physicists to forecast the terrestrial arrival time of the storms with an uncertainty of just 3 hours, one-quarter the uncertainty of previous estimates, says Russ Howard of the Naval Research Laboratory in Washington, D.C.

The pair of craft makes up the Solar Terrestrial Relations Observatory (STEREO). One of the pair lags Earth in its orbit about the sun, while the other leads Earth (*SN: 2/10/07, p. 93*). The distance from the Earth-sun line gives each craft a new perspective on storms heading toward Earth.

Other spacecraft, by contrast, have observed solar disturbances only from positions close to the Earth-sun line. That's like watching the evolution of a smoke ring blowing directly at you, notes STEREO scientist Mike Kaiser of NASA's Goddard Space Flight Center in Greenbelt, Md. From that position, it's difficult to measure the shape and velocity of the ring.

Each STEREO craft has a suite of five telescopes designed to observe coronal mass ejections at different points on their journeys toward Earth. By combining images from the telescopes, astronomers can accurately follow the solar storms. At press time, Howard and his colleagues were scheduled to discuss the images during a March 1 telephone briefing.



HOWARD ET AL./SECCHI TEAM, NRL, NASA

HEADS UP! STEREO image of a storm lifting (lower left) off the sun and heading into space.

The newly released STEREO images, taken in late January, show a coronal mass ejection changing from a croissant shape near the sun to a corrugated storm front farther out. Interactions with the solar wind—the breeze of charged particles that blows continuously from the sun—probably altered the storm's shape and speed, says Howard.

Documenting how and when the solar wind slows down or speeds up a solar storm during its journey earthward is critical to improving forecasting, comments Doug Biesecker of the National Oceanic and Atmospheric Administration's Space Environment Center in Boulder, Colo.

By April, the distance between the STEREO craft, which are drifting apart, will be great enough to begin taking three-dimensional images of the sun and its storms. —R. COWEN

Natural-Born Addicts

Brain differences may herald drug addiction

Differences in the behavior and the brain receptors of rats seem to predict which of the rodents will become cocaine addicted, scientists report. The finding supports the idea that some people are predisposed to drug addiction.

Scientists have long suspected that certain personality traits, including thrill seeking, impulsivity, and a tendency to be antisocial, go hand in hand with drug addiction. Studies have also shown that the brains of monkeys and people addicted to stimulants such as cocaine or amphetamine have significantly fewer receptors for dopamine, a brain chemical that regulates emotion, motivation, and feelings of pleasure.

However, the connection between these mental and physical characteristics and drug addiction has posed a chicken-and-egg problem for researchers. It's unclear whether drug addicts have these qualities before they begin using drugs or whether taking drugs over the long term changes a person's personality and brain properties.

Jeffrey Dalley of the University of Cambridge in England and his colleagues report results in the March 2 *Science* that shed light on this problem. The researchers taught a group of lab rats to poke their noses in a hole to retrieve a treat after seeing a light flash. The team found that about 7 percent of the animals consistently acted impulsively. Rather than wait to collect the treat that appeared after the light blinked, those animals frequently poked their noses into the hole before the treat arrived.

Dalley's team next scanned the rats' brains. In a region known as the nucleus accumbens, the impulsive animals had significantly fewer of the D2/3 type of dopamine receptor than the more patient rats did. Previous studies in people had connected the nucleus accumbens to reward feelings, such as those gained from eating, winning at gambling, and taking drugs.

Finally, the researchers hooked the impulsive and normal animals to a machine that delivered cocaine intravenously when

the rats pressed a lever. The impulsive animals learned to self-administer the drug more quickly and took more of it than the other rats did. Within days, the impulsive rats were using cocaine at nearly twice the rate of the patient ones.

Because the impulsive rats had fewer D2/3 receptors before using drugs, Dalley says, the traits of impulsivity and a low number of these D2/3 receptors seem to be characteristics that make an animal vulnerable to drug addiction.

David Jentsch of the University of California, Los Angeles, who studies the long-term effects of drugs on the brain, calls the study "very exciting." He adds, "This will help us understand what leads people on a pathway to drug abuse."

Jentsch cautions that it's premature to say that all people who become addicts had pre-existing anomalies in personality and brain traits. Rather, long-term drug use may cause these anomalies in some people who didn't have them before.

"It's unlikely that it's an either-or phenomenon," Jentsch says. —C. BROWNLEE

Equal Opportunity Outcome

Different pollutants show same impact

At concentrations present in the environment, each of three dissimilar toxic agents can seize control of a signaling pathway that regulates developing cells in the brain and spinal cord, researchers report. They suggest that scientists might use the pathway to predict the toxicology of a diverse range of chemicals.

Mark Noble of the University of Rochester Medical Center in New York and his colleagues focused on a pathway that controls the development of cells destined to become oligodendrocytes. Those mature cells produce the material that insulates nerve fibers.

Despite vast differences in structure, many toxic agents in the environment can oxidize cells, notes Noble. In normal development, subtle changes in the oxidative state of the oligodendrocyte precursors determine whether they continue to divide or proceed to their final form. To study how oxidizing chemicals would affect this development, the group exposed cultures of the progenitor cells from newborn rats to methylmercury, lead, and the herbicide paraquat. The researchers applied the chemicals in amounts that people or animals encounter in the environment.

Each chemical slightly shifted the oxidative state of the progenitor cells, in effect telling the cells to mature. That action halted division in 25 percent of the cells. This decrease, Noble says, when carried through many cellular generations, "has an enormous effect on the number of cells that you have."

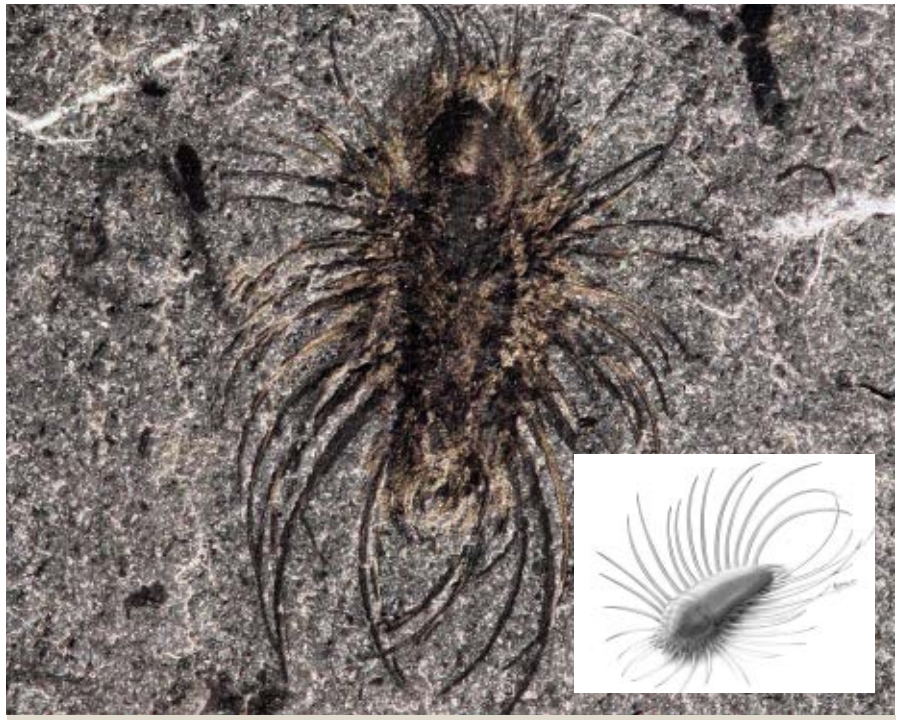
The researchers also investigated the effect of one of the chemicals in animals. They provided pregnant mice with drinking water that contained environmentally relevant concentrations of methylmercury. The brains of the pups from those mothers had 20 percent fewer oligodendrocyte progenitor cells than did brains from pups of untreated mothers, the team reports in the February *PLoS Biology*.

Noble's group plans longer studies to determine the consequences of a decreased pool of oligodendrocyte progenitor cells.

By identifying a pathway that might be vulnerable to different environmental chemicals, the research "provides a framework for predictive toxicology," comments David A. Schwartz, director of the National Institute of Environmental Health Sciences in Research Triangle Park, N.C., which partially funded the study. Because exposure to lead gave a similar biological fingerprint as the exposure to methylmercury did, he says "perhaps it predicts what the fingerprint might be for an exposure to arsenic," which also oxidizes cells.

"It's a little too early to tell how generalizable [the finding] will be," Schwartz continues, but if it proves to hold true for other toxic agents, it could affect "not only how we measure the effects of toxicants, but how we predict risk of disease."

Joel G. Pounds, a toxicologist at the Pacific Northwest National Laboratory in Richland, Wash., agrees. If the pathway is a target for many toxic agents, he says, then by finding ways to measure the pathway's activity, "we can begin to use those probes to understand the relationship between exposure to the toxicant and the role of the toxicant in chemically induced disease." —A. CUNNINGHAM



Ancient slowpoke

A 1-centimeter-long, 505-million-year-old fossil from British Columbia connects two lineages of marine invertebrates from the Cambrian period that scientists hadn't previously linked. One group, the halkieriids, protected themselves with plates and mineralized shells—"like armored slugs," says Simon Conway Morris, a paleontologist at the University of Cambridge in England. Wiwaxiids, the other lineage, carried spiny plates. The newly described creature, *Orthrozanclus reburrus*, had a shell at the front and spines all around (inset: artist's reconstruction). In the March 2 *Science*, Conway Morris and Jean-Bernard Caron of the Royal Ontario Museum in Toronto argue that *O. reburrus,* halkieriids, and wiwaxiids should be put together in a new group. The researchers speculate that the proposed group included various ancestors of modern-day mollusks, annelid worms, and brachiopods. —S. PERKINS

SCIENCE; (INSET) M. COLLINS

FIXES FOR FATTY LIVER

Diabetes drugs attack another disease of obesity

BY BEN HARDER

Several years ago, Carlos Herrera Macias, 55, learned that he had type 2 diabetes. He already knew about that obesity-related disease—his mother had had it too. But his doctors soon delivered a second diagnosis that was unfamiliar to Macias. "They told me that something was wrong with my liver," he recalls.

Macias has fatty liver disease, a condition in which deposits of fat accumulate in the liver and eventually impair the organ's capacity to filter blood. In his case, the problem had progressed to a condition known as nonalcoholic steatohepatitis (NASH), which is characterized by liver inflammation and formation of scar tissue in the organ. People who are obese or who have diabetes are more likely to develop NASH than other people are.

After Macias got his double diagnosis, the 5'8", 210 pounder from Leming, Texas, followed his doctors' recommendation and began trying to lose weight. The former marine also enlisted in a clinical trial that put him on the front lines of a struggle against a growing but largely unrecognized epidemic.

Researchers estimate that among people who aren't alcoholics, fatty liver disease affects 45 to 65 million U.S. adults, and in perhaps 20 percent of those people, the disease has advanced to NASH. Most of these people don't show symptoms of liver problems and don't know that they are at increased risk of liver failure.

NASH especially concerns doctors because it sometimes leads to cirrhosis. Viral hepatitis or alcoholic fatty liver disease, which results from heavy long-term drinking, can also cause cirrhosis, the symptoms of which may include fatigue, weight loss, frequent infections, and esophageal bleeding. Nationwide, cirrhosis kills about 27,000 people per year.

It's not clear how often or how rapidly fatty liver progresses to NASH, or how typical it is for NASH to lead to cirrhosis, but physicians worry about a possible boost in cirrhosis deaths.

"With the epidemic of obesity and the epidemic of diabetes, which promote [fatty liver], in 5 or 10 years, we're going to have a major public health problem," says endocrinologist Kenneth Cusi of the University of Texas Health Science Center in San Antonio. "We're going to have a lot more people with damaged livers."

For now, weight loss is the only useful treatment. There is no specific therapy for NASH, but that might soon change.

Recent drug studies, including the trial in which Macias participated, have suggested a slate of potential therapies. The three leading candidates are already proved treatments for type 2 diabetes.

INSULIN INSULT Macias was one of 55 men and women with NASH who participated in the recent trial of pioglitazone (Actos). Researchers had suspected that pioglitazone and some other diabetes drugs might work against fatty liver because they act as insulin sensitizers. That is, they increase cells' responsiveness to the hormone.

In people with type 2 diabetes, the drugs restore insulin's role in triggering cells to properly metabolize blood sugar. Insulin also promotes the storage of fatty acids in specialized fat cells. If the hormone isn't doing that second job, fatty acids circulate in the blood and can end up in the liver.

"Most people think that insulin resistance is a major factor contributing to fat accumulation in the liver," says endocrinologist Kristina Utzschneider of the University of Washington in Seattle.

In the recent trial of pioglitazone, all the participants had either type 2 diabetes or impaired glucose tolerance, a condition sometimes called prediabetes, but they hadn't been prescribed medication for those conditions. Doctors had unambiguously diagnosed NASH in the participants by using long needles to extract liver samples for biopsy.

For 6 months, Macias and 28 other randomly selected volunteers received 30 to 45 milligrams of pioglitazone per day, which is within the range of doses that doctors use to treat diabetes. The other 26 volunteers got a daily placebo pill instead.

> "For the first time, we have a pharmacological agent that appears to reduce the amount of fat in the liver."
>
> — KENNETH CUSI, UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER

Everyone in the trial also received frequent counseling from a dietitian, who worked with volunteers to reduce their calorie consumption. Those who took the placebo lost 3.2 kilograms on average. But pioglitazone is known to cause weight gain, and the volunteers who took the drug gained an average of 2.5 kg during the study, despite the dietitian's efforts.

At the study's conclusion, liver and blood tests showed that the drug had outperformed the placebo by several measures. For example, biopsies revealed a 54-percent decrease in the livers' fat content in pioglitazone-treated participants, while the comparison group showed no change in liver fat.

"For the first time, we have a pharmacological agent that appears to reduce the amount of fat in the liver and possibly reduce the long-term complications," says Cusi. He and his colleagues reported their findings in the Nov. 30, 2006 *New England Journal of Medicine*.

Cusi's team obtained one-third of its funding for the study from pioglitazone's manufacturer, Takeda Pharmaceuticals of Deerfield, Ill., and Cusi and one of his colleagues have done work for Eli Lilly and Co. of Indianapolis, which also has rights to make the drug.

"We need to wait for larger, placebo-controlled studies to solidify use of [pioglitazone] as a treatment for NASH," comments Utzschneider.

Pioglitazone is "promising but not ready for prime time," says Arthur McCullough of the Cleveland Clinic and neighboring Case Western Reserve University. More patients must be studied, he says, and "the study period was extremely short for this disease.

Future studies need to be at least 1 to 2 years in duration."

"Any therapy shown to be effective [against NASH] will need to be lifelong, making careful assessment of the risk-benefit ratio paramount," McCullough adds.

McCullough, who has financial ties to Takeda, is a principal investigator in a newly begun placebo-controlled trial of pioglitazone. The 2-year study, which aims to include 240 patients, is also testing vitamin E against the disease (*see sidebar*).

That study is supported by the National Institute of Diabetes and Digestive and Kidney Diseases in Bethesda, Md., and conducted by the NASH Clinical Research Network, which includes researchers at eight medical institutions.

Some researchers are considering a related insulin-sensitizing compound called rosiglitazone (Avandia). In a preliminary, manufacturer-funded study published in 2003, liver specialist Brent Tetri of Saint Louis University Hospital and his colleagues found that 48 weeks of rosiglitazone treatment for 25 NASH patients produced improvements in insulin sensitivity and reduced liver fat, inflammation, and fibrosis. Here, too, weight gain was a problem—two-thirds of the volunteers gained weight while taking the drug.

Utzschneider, too, is conducting a trial of rosiglitazone. Her 6-month, placebo-controlled test of 48 people who have NASH will also examine a cholesterol-lowering drug.

AIMING AT INSULIN Metformin is the most widely used therapy for type 2 diabetes, and the American Diabetes Association recommends it as the first-line treatment for the disease. It's generally less expensive than rosiglitazone and pioglitazone, which scientists classify as peroxisome proliferators–activated receptor (PPAR)-gamma ligands. Those compounds bind to receptors in cell nuclei, altering the activity of metabolism-related genes.

STATS

45 million

Estimated number of U.S. adults with fatty liver disease—most of whom don't have symptoms

On the other hand, metformin reduces the liver's production of glucose, which in turn lowers insulin production, says gastroenterologist John W. Haukeland of Aker University Hospital in Oslo. Since insulin boosts cell metabolism of sugar and signals the liver to synthesize fat, a drop in insulin production could be therapeutic for fatty liver disease.

Several studies have tested metformin against NASH. In the largest, 55 people took the drug daily for nearly a year, while a similar number of volunteers received either daily vitamin E or dietary counseling. During the study, metformin-treated volunteers experienced the greatest improvements in insulin sensitivity and liver-enzyme concentrations, a group of Italian researchers reported in 2005.

At least some patients who received metformin in that trial also lost liver fat. But that finding is tentative because only 17 volunteers' livers were evaluated by biopsy at the study's end.

Haukeland is conducting a 6-month trial in which he aims to give either metformin or a placebo to 90 people who have fatty liver or NASH and either diabetes or prediabetes. In this trial, all volunteers will undergo liver biopsy at the beginning and end of treatment.

"The metformin studies that I've seen have not been very impressive," says Tetri. "It might have a role in conjunction with rosiglitazone or pioglitazone, just as it does in diabetes."

"No medications have been shown to be clearly effective [against NASH]," Haukeland says. "We have no established therapy, except for weight loss."

But if the trials under way prove that any of the drugs are effective in stopping NASH, he adds, it will be an important coup for preventive medicine. ■

Weighing All Options

Potential liver treatments abound

An array of potential therapies besides the insulin-sensitizing drugs is being tested against fatty liver disease. They range from surgery to bonus bacteria and include some that have shown promise in people in at least one clinical trial.

WEIGHT-LOSS Researchers are evaluating the effect of gastric-bypass surgery on fatty liver disease. That procedure shrinks the stomach and leads to reduced calorie intake and weight loss, which is known to reverse the liver condition. The weight-loss medication orlistat (Xenical), which blocks intestinal fat absorption, has also decreased volunteers' liver fat in pilot trials. However, excessively rapid weight loss that the surgery or orlistat might cause could paradoxically aggravate fatty liver.

HERBS AND SPICES Chinese and Japanese scientists have collaborated to test several traditional Asian herbal remedies in rats that are predisposed to fatty liver. Last October at a meeting of the American College of Gastroenterology in Las Vegas, researchers led by Hisao Takayama of Tottori University in Japan reported that a diet composed of 6 percent cinnamon by weight decreased the fat in the animals' livers.

VITAMIN ANTIOXIDANTS Studies suggest they might prevent inflammation and therefore reduce formation of scar tissue in the liver. A 2003 trial of 45 people found that a combination of the antioxidant vitamins E and C reduced liver scar tissue over a 6-month period. Researchers, however, observed no change in inflammation. Now, some volunteers in trials of pioglitazone or metformin are receiving vitamin E in addition to one of the drugs.

GOOD FATS In a yearlong Italian study of 56 people, liver fat declined in those who each day took a capsule containing 1 gram of polyunsaturated fatty acids. The report appeared in the April 15, 2006 *Alimentary Pharmacology & Therapeutics*. Animal data from other studies suggest that these healthful fatty acids act as pioglitazone and rosiglitazone do.

IRON-DEPLETION THERAPY Doctors conducting a small U.S. study are bleeding patients—although, unlike medieval physicians, they're extracting blood with sterilized needles rather than leeches or lacerations. The rationale behind the study, which is sponsored by the National Institutes of Health in Bethesda, Md., is that removing excess iron from the body by withdrawing blood may improve insulin activity.

BENEFICIAL BACTERIA Preliminary studies hint that disturbances in naturally occurring bacteria in the gut may contribute to fatty liver disease. Last year, for example, researchers at Imperial College London and the University of Oxford in England found that unidentified intestinal microbes tend to use up the dietary supply of the nutrient choline in a strain of mice that's susceptible to fatty liver. Choline deficiency has been linked to fatty liver in lab animals, so the bacteria may contribute to that strain's high rates of fatty liver disease. However, researchers at Johns Hopkins University in Baltimore recently conducted a trial that tested a probiotic bacterium—a harmless bug that might control harmful ones—in people who have fatty liver disease. The researchers found no benefit from the bacterial strain that they used. —B.H.

SCIENCE BEHIND THE SOAP OPERA

The cute and the shocking at Meerkat Manor

BY SUSAN MILIUS

Tim Clutton-Brock has suddenly said, for reasons not at all clear to me, "Hard-boiled egg." Perhaps it's best to ignore this. So, I ask him again in our phone conversation what he would pick as the highlights of his past 13 years of directing a field study of meerkats in the Kalahari Desert. Meerkats, a type of mongoose, cluster in family groups and share the job of raising the top female's pups. Clutton-Brock and his colleagues have published reports on meerkat behaviors ranging from altruism to infanticide. But it turns out that the first highlight that he wishes to discuss actually is a hard-cooked egg.

When Clutton-Brock, a behavioral ecologist at the University of Cambridge in England, was setting up the desert study, most meerkats ran away if people got within 300 meters. He and his colleagues "tried everything," he says, to find treats that would encourage the animals to tolerate people so that the team could collect data.

"We tried locusts," says Clutton-Brock. "We tried obvious things that other sensible mongooses eat, like peanuts and peanut butter and minced chicken, various sorts of insectivores' [packaged] diets, mealworms, and God knows. They wouldn't eat it at all."

WATCH KAT — A meerkat takes a turn on guard duty as its group searches the ground for insects and other delicacies. Its periodic chirps tell the group that it's safe to keep foraging.

Because meerkats occasionally eat wild-bird eggs, the researchers offered them chicken eggs. But the animals weren't interested. However, when the meerkats came back to hang around their burrow entrance in the evening after foraging, some egg contents earlier spilled on the ground had been cooked by the day's heat. Several youngsters sniffed at it, tasted it, and finally ate it.

"It hadn't occurred to us that they would actually rather like their eggs cooked," says Clutton-Brock.

After that breakthrough, judicious use of hard-boiled egg crumbs enabled the researchers and collaborators from other institutions to collect the most detailed data yet on free-living meerkats. The animals' subsequent tolerance of people has benefited the world of entertainment as well as science. It has given film crews access to intimate views of animal life.

Several projects are in the works, and the television series *Meerkat Manor*, already a hit, follows the fortunes of one group of meerkats at Clutton-Brock's study site. Despite their species, the characters' adventures with illicit pregnancies, wayward children, and neighborhood rivalries resonate with themes in typical television dramas.

Meerkat close-ups show both the charms of a highly cooperative life and the trade-offs that it requires. To the scientists, the dramatic behaviors have broad implications for the study of social behavior and evolution. But they also make for some great soap opera.

ONE FOR ALL Meerkats' cooperative side, easy for people to like, is also easy to see. The animals live in groups of 3 to 50 animals, mostly close family members with about equal numbers of males and females. They defend territories of 2 to 10 square kilometers. The animals spend the night together in one of the burrows in their territory. By day, they rove through the scrubby vegetation looking for scorpions, lizards, and other small animals.

As a meerkat group searches the ground, one member typically stands guard. Depending on how robust the volunteer is and how fast the group moves, guard duty can last half a minute to half an hour. When the guard leaves to forage or the group moves on, another meerkat takes over the watch.

The sentinel clambers up on whatever's available for the best view, be it a tree snag or the hat of a note-taking scientist. The guard stands on its hind legs as stably as a person does and watches intently, turning its head this way and that, and twitching its nose. Its paws dangle by its side or cross in front of its body, like someone waiting politely, perhaps in white gloves.

The sentinel provides "a more advanced antipredator system than everybody looking up now and then," says behavioral ecologist Andrew Young, also of Cambridge. Marta Manser, now at the University of Zurich, has investigated the guard's role by recording the soft little chirps that it makes—on average, 10 every minute. When a meerkat heard the recording, it spent more time head-down, searching and eating, than it did in the absence of the calls. Silence made the forager look up more often and eat less.

Another social nicety shows up when the group has young pups. Until the kids are old enough to tag along with foragers, one of the older meerkats stays home and babysits. For the first 2 or 3 weeks of pups' lives, the babysitter spends the day underground with the

ISTOCKPHOTO

newborns. When the pups are old enough to clamber out of the burrow, the nanny keeps watch near the burrow mouth. Youngsters tumble over each other in wrestling matches and chases and then nap, often cuddled against the babysitter. Should a youngster stray too far, the nanny picks it up by the scruff of the neck and carries it back to safety.

Nannies have to stay alert for attacking birds or other predators and for rival groups of meerkats that occasionally invade and kill pups. "One of the most spectacular things a babysitter will do is defend against a raid," says Young.

Faced with a raid, a babysitter sends the pups into the burrow and takes a stand in front of them. Because meerkat tunnels are narrow enough to force raiders to enter one at a time, the babysitter has a chance of holding off even a big party, at least for a while. However, the raiders soon start digging around the main entrance, and "get very excited," says Young. If they widen the tunnel enough, they can gang up on the babysitter or even reach the pups directly. When they do, "it's gruesome," says Young.

Yet even excited meerkats need time to excavate. Young says that he has watched a babysitter fight off attackers for more than 2 hours before the rest of the family came home and chased away the intruders.

A more mundane, but serious, threat to the caregiver is weight loss, says Young. The other adults don't bring home anything for the babysitter to eat. Thanks to the magic of hard-boiled eggs, the researchers coaxed meerkats onto a scale at the beginning and end of several days. During a 24-hour period that included a daylight shift with the kids, a meerkat typically lost 1.3 percent of its body weight, the team reports. An animal that hunted all day gained 1.9 percent of its body weight during the same period.

DAY CARE — Supervising naptime isn't so tough, but a meerkat babysitter may have to risk its life fighting off a rival gang that threatens to kill the pups.

YOUNG

Although the colony's most dominant male and female parent 80 percent of the pups, "one of the most striking things is that dominant individuals hardly ever babysit," says Young.

He speculates that the mother doesn't baby-sit much because she needs to eat to keep providing milk. She becomes fertile again soon after giving birth, which may explain the dominant male's behavior. "The last thing he wants to be doing is sitting at the burrow with the pups, when she's out there fertile and available," says Young.

So, it's the subordinate adults, with teenage backup now and then, that do most of the child minding. Both females and males babysit, but the females do it more often.

As far as the researchers can tell, meerkat babysitters volunteer for the job. An animal, apparently spontaneously, hangs back at the burrow as the rest of the group sets off. There's none of the snarling and nipping that meerkats use for coercion. Rarely does the same meerkat volunteer two days in a row, and younger and underweight animals are less likely to babysit than are more-robust animals.

Hormones may have something to do with the sitter's self-selection, says Anne Carlson, based in Missoula, Mont., who works for the Tropical Biology Association, headquartered in Cambridge, England. She investigated hormones known in several species to vary with care giving to youngsters. For example, scrub jays that are feeding younger siblings tend to have blood higher than normal in prolactin.

Carlson and her colleagues found that a male meerkat about to spend the day with the kids has higher blood prolactin concentrations than does a similar male in the same group preparing to go off on a day's foraging. After a day at the burrow, though, the babysitter's prolactin concentration has gone down, the team reported in the June 2006 *Hormones and Behavior*.

Clutton-Brock considers an evolutionary question: What drives a meerkat to go hungry and risk death in battle for somebody else's pups? The standard answer to such a riddle invokes the power of kinship, he says, but the meerkat data are leading him elsewhere.

Among meerkats, he says, tighter kinship bonds don't match up with extra babysitting or other effort on behalf of the group. So, he and his colleagues began thinking about an additional factor: the importance of group size. A small group may not field a full complement of sentinels or babysitters, and rivals may snatch territory, kill pups, or even take over a comfortable burrow. "As group size declines, life goes to hell in a hurry," Clutton-Brock says. "It's in everybody's interest to maintain group size."

DARK SIDE In some ways, meerkats look as if they have "the ultimate family life—one for all and all for one," says Clutton-Brock. But that tight intimacy leads to extremes in family feuds.

Young and his collaborators have been studying dominant female meerkats' tendency to violence during the last month of a pregnancy. The supermoms attack subordinate, mature females in the group—even their own daughters—seemingly without cause. The dominant female often wounds subordinates around the base of the tail. Eventually, supermom harries the subordinate out of the group. However, after the dominant animal gives birth, the exile often returns home.

However "bizarre," to use Young's word, such behavior might seem at first glance, the researchers have proposed an explanation. If the stress of eviction reduces the chances of a subordinate getting pregnant, aggressive behavior would increase the chances that the dominant meerkat would bear the only pups in the group.

In the Aug. 8, 2006 *Proceedings of the National Academy of Sciences*, the team reported an analysis of observations of banished females. Those meerkats were much less likely to conceive when they encountered a male during exile than they were while living with a group, and they were more prone to abortions than were subordinates in their group. Blood concentrations of stress-related hormones were unusually high in the outcasts, and tests showed that their pituitary glands did produce the surge of hormones needed for ovulation. Young suggests that the work provides some of the strongest evidence yet that dominants can monopolize reproduction by stressing out their underlings.

If harassment doesn't keep her colony mates from getting pregnant, the top female meerkat can always kill the subordinate's pups. Never mind that many of them are her grandchildren.

Meerkat infanticide is difficult to study because most of it probably happens underground, says Young. He and Clutton-Brock combed through records that they'd compiled over years and found only 13 cases of a female meerkat carrying one or more pups out of the burrow and killing them. "Often, she eats them," says Clutton-Brock.

In seven of those cases, the dominant female was the killer, but in the other six, the killer was a subordinate. On two startling occasions, a subordinate killed the dominant's pups, Young and Clutton-Brock reported in the Sept. 22, 2006 *Biology Letters*.

The big motivator was pregnancy. In 12 of the 13 cases, the observers knew that the killer female was pregnant.

Another analysis confirmed the violent tendencies of pregnant subordinates. In looking at records of 248 litters, the researchers found that pups faced half the normal chance of surviving their first 4 days if any of the subordinate females was pregnant.

In the logic of meerkat survival, pup killing makes sense, the researchers say. When youngsters first venture out on a group-foraging trip, they're such inept hunters that they depend on handouts from the older meerkats. As the number of pups rises, the older foragers catch and distribute more prey, but not enough to compensate fully for the extra pups. So, more pups result in less food for each. An infanticidal mom improves the odds of her offspring getting a square meal.

SAY AUNT — In a dominance tussle between female meerkats, the loser lies back and presents the base of her tail within biting range. Females that have been exiled from their group by the top female often bear bite marks on their backsides.

Although female meerkats have this pup-killing streak, Young notes that, unlike lions, the males don't kill the offspring of other males. Male meerkats commandeer groups now and then, driving out the resident males and taking over their family roles. As the usurpers settle in, though, they don't typically attack pups of the previous dads. The new arrivals even take a turn feeding the youngsters during foraging. The researchers note that killing pups doesn't trigger fertility in female meerkats as a cub's death does in lionesses.

The evolutionary force of sexual selection bears down more intensely on female meerkats than it does on males, Clutton-Brock and his colleagues argue in the Dec. 21/28, 2006 *Nature*. In the fight to reach the top spot in the group, female meerkats look forward to the bigger prize.

A supermom can dominate a colony for a decade if she's fit, tough, and smart, and top females average 17 pups during their tenure. Males tend not to hold the top spot for as long, and they father only 9 pups, on average.

Throughout their lives, the females show more aggression than the males do. For example, females start more of the clashes in a group than males do, and females are also more often on the receiving end of aggression. And as pups play together as they grow up, females win more of the tussles than males do.

Such tough gals may not be everybody's ideal moms. Yet they're invaluable to researchers studying the forces that underlie such matters as infanticide.

Clutton-Brock says that he watches with interest to see how filmmakers attracted by the animals' charisma handle such shocks to human sensibilities. *Meerkat Manor*, he says, has been "prepared to tell the hard side, the down side, the dark side, as well as the cute side and the up side. I salute that."

More projects are in the works that will face the same challenge. "How meerkats are presented," says Clutton-Brock, "is an interesting test case in whether we are happy to allow animals to be animals." ■

YOUNG

OF NOTE

CHEMISTRY

Lighting up for uranium

A portable sensor that borrows a trick from biotechnology could lead to rapid detectors of environmental uranium contamination, researchers say.

Yi Lu of the University of Illinois at Urbana-Champaign and his coworkers built a sensor containing catalytic DNA, which can split another DNA strand at a specific site. Most catalytic DNAs require a metal ion to function, and the uranyl ion triggers activity in the sensor. This ion is the most stable form of uranium in water and can be readily taken up in tissue.

The sensor is a solution containing the catalytic DNA along with its target DNA strand, which is attached to a fluorescent molecule. A so-called quencher sits next to the fluorescent molecule and normally keeps it turned off. When the researchers add uranyl ions to the solution, the catalytic DNA clips the target DNA, releasing the fluorescent molecule. Freed from the quencher, the molecule glows, signaling the presence of uranium.

In laboratory tests, the sensor detected as little as 11 parts per trillion of uranium in less than 2 minutes, the researchers report in the Feb. 13 *Proceedings of the National Academy of Sciences*. That amount is below the concentration considered toxic in drinking water.

The sensor's performance compares favorably with that of large laboratory machines, Lu notes. An additional advantage is portability. "We want to fill in the gap for on-site, real-time detection," he says. —A.C.

ANTHROPOLOGY

New age for ancient Americans

Researchers have long regarded remains of the prehistoric Clovis culture as the oldest solid evidence of people in the Americas. However, new radiocarbon dates for North American Clovis sites challenge that assumption.

Clovis culture lasted from 11,500 to 10,900 years ago, according to prior radiocarbon measures. That estimate should be revised to extend only from 11,050 to 10,800 years ago, contend Michael R. Waters of Texas A&M University in College Station and Thomas W. Stafford Jr. of Stafford Research Laboratories in Lafayette, Colo. Thus, Clovis people—who made distinctively shaped stone spear points—inhabited the New World considerably later and for a much shorter time than suggested by earlier data, the scientists assert in the Feb. 23 *Science*.

CLOVIS REVISED North America's ancient Clovis culture, exemplified by these stone points, was not the first to reach the New World, according to a new study.

Their conclusion rests on evidence from 11 Clovis sites across North America. Waters and Stafford combined radiocarbon dates previously obtained from five of those sites with new radiocarbon measurements of bone, ivory, and seeds from the remaining sites.

Previously obtained radiocarbon ages for six sites of non-Clovis people in North and South America overlap with the revised Clovis dates. The scientists thus suspect that people from northeastern Asia spread throughout the New World before purveyors of Clovis culture showed up along the same route. It's unlikely that Clovis people entered North America, expanded in numbers, adapted to a variety of environments, and then founded different cultures down to the southern tip of South America within a mere 250 years, Waters and Stafford say. —B.B.

BIOMEDICINE

How antipsychotic drugs can cause weight gain

A study of mice has identified a biological mechanism by which certain psychiatric medications cause people to gain weight.

Researchers linked the appetite-increasing effects of three such drugs—the so-called atypical antipsychotics clozapine (Clozaril), olanzapine (Zyprexa), and risperidone (Risperdal)—to their capacity to neutralize the protein histamine, just as the antihistamine drugs that are used to treat allergies do.

"Histamine also has a long history as a suspect in weight control," says neuroscientist Solomon Snyder of the Johns Hopkins School of Medicine in Baltimore. "The connection we've made ... opens new avenues for research on weight control, possibly including drugs that suppress appetite safely."

The new finding might also lead to safer treatments for schizophrenia and other manifestations of psychosis, Snyder and his colleagues say.

The researchers injected the drugs into mice and found that they quadrupled the activity of AMP kinase, an enzyme previously shown to increase appetite. They then gave the mice leptin, an appetite-suppressing hormone, and found that AMP kinase concentrations dropped back toward normal.

Mice that lacked sensitivity to histamine experienced no increase in AMP kinase when given the drugs. That result suggests that atypical antipsychotic drugs block histamine activity and thereby increase AMP kinase, the researchers say.

Their results appear in the Feb. 27 *Proceedings of the National Academy of Sciences*. —B.H.

PHYSICS

Breaking a molecule's mirror image

Physicists have demonstrated how a molecule's symmetry can be broken.

Reinhard Dörner of Johann-Wolfgang-Goethe University in Frankfurt, Germany, and his colleagues began an experiment with a single, symmetrical molecule made of two hydrogen atoms. They then fired a single photon at the dumbbell-shaped molecule to split it. The photon's energy caused one of the hydrogen molecule's two electrons to peel away.

However, the ejected and the stay-at-home electrons maintained a lingering interdependence, as the laws of quantum physics dictate. Accordingly, when the researchers measured the ejected electron's path, that measurement influenced the behavior of the other electron, they say.

When the molecule subsequently fell apart into a single hydrogen atom and an H^+ ion, the process of dissociation wasn't symmetrical, Dörner's team reports in the Feb. 2 *Science*. The paths of the atom and the ion weren't random with respect to that of the emitted electron.

Comments Andrei Sanov, a chemical physicist at the University of Arizona in Tucson, "Asymmetry came from the act of measurement." —B.H.

CENTER FOR THE STUDY OF THE FIRST AMERICANS/TEXAS A&M UNIV.

BIOMEDICINE

A cornea that's got some nerve

Scientists have developed a technique to grow corneal tissue that includes nerve cells, an advance that may enable researchers to test consumer products in lab dishes rather than in live animals.

Previously, scientists had created tissues that in many respects mimic the human cornea, says Rosemarie Osborne, a cell biologist with Procter & Gamble in Cincinnati. When exposed to chemicals for extended periods, those substitutes become cloudy and inflamed and show other signs of irritation, just as human corneas do. However, because those tissues lacked nerve cells, researchers couldn't monitor cellular activity associated with pain. Also, corneal tissue without nerves doesn't heal as quickly as a wounded human cornea does.

Now, by carefully controlling the chemical environment in their petri dishes, Osborne and her colleagues have added nerve cells to their cornea recipe. Those cells spread their fibers through the tissue in a pattern similar to the one found in natural corneas, she notes. The nerve fibers respond to stimuli, carry electrical signals, and release nerve-signaling chemicals. The innervated tissues also heal as quickly as corneas do, she notes.

Osborne says that the team's new tissue-making technique might also lead the way to lab-grown corneas suitable for human transplants. —S.P.

EARTH SCIENCE

Subglacial lakes may influence ice flow

The flow of water into and out of massive, ice-covered lakes in Antarctica may influence the speed at which overlying glaciers move toward the sea, a new study suggests.

Some of the speediest glaciers in the West Antarctic Ice Sheet are hundreds of kilometers long, 50 km wide, and up to 2 km thick, says Robert Bindschadler, a glaciologist at NASA's Goddard Space Flight Center in Greenbelt, Md. Many of the continent's ice streams nourish ice shelves, which are country-size ledges of floating ice still attached to the land.

When Bindschadler and his colleagues scrutinized satellite observations of the Whillans and Mercer ice streams between 2003 and 2006, they noted significant changes in the altitude of 14 regions within those features. The researchers suggest that the areas cover subglacial lakes and attribute the altitude fluctuations to water flowing among those bodies. Such shifts have been reported elsewhere in Antarctica (*SN: 6/17/06, p. 382*) but haven't been noted below fast-moving ice streams.

One subglacial body of water, dubbed Lake Englehardt, is about 10 km wide and 30 km long. Between 2003 and 2006, the upper surface of the kilometer-thick ice over the lake dropped an average of about 9 meters. So, about 2 cubic kilometers of water drained from the lake during that period, says Bindschadler. In the same interval, the ice rose over a smaller, nearby subglacial lake, signifying that the lake gained about 1.2 km^3 of water.

The movements of water beneath ice streams may lubricate the flow of ice, says Bindschadler. "Water is critical because, essentially, it's the grease on the wheel, but we don't know the details yet," he notes. —S.P.

NUTRITION

Cocoa compound increases brain's blood flow

Cocoa that retains compounds usually removed to soften the product's flavor can significantly improve blood flow to the brain, say researchers. The finding could eventually lead to treatments for a variety of ills, including strokes and dementia.

Since the early 1990s, Norman Hollenberg of Harvard Medical School in Boston and his colleagues have been studying the Kuna, native people that live on islands off the Caribbean coast of Panama. Unlike typical Americans, the Kuna people have a low incidence of high blood pressure and their blood pressure doesn't usually rise with age. These factors lower their risk of diseases associated with high blood pressure, such as heart attacks, diabetes, strokes, and some types of dementia.

Hollenberg's team noticed that Kuna who moved away from the islands onto the Panamanian mainland lost this protection from high blood pressure. When the researchers searched for factors that differed between the island and mainland populations, they found that island Kuna drink several cups of cocoa during the day but that mainlanders typically don't.

Unlike the cocoa sold in most U.S. stores, Kuna cocoa is only minimally processed, leaving in large quantities of compounds called flavonoids. Since these compounds have a bitter taste, they're often removed from mass-produced cocoa.

In a recent study in the United States, Hollenberg and his colleagues gave cups of flavonoid-rich cocoa to a group of people age 50 or older. Other people received cocoa without flavonoids.

Tests showed that people who drank the flavonoid-rich beverage had about a 10 to 15 percent increase in blood flow to the brain. People who drank cocoa without flavonoids had no significant blood-flow increase.

Hollenberg notes that some U.S. chocolate manufacturers are starting to make bars and beverages that contain large quantities of cocoa flavonoids, which could provide some health benefits to consumers. In the future, he adds, researchers may develop highly potent pill versions of cocoa flavonoids to fight high blood pressure and associated diseases. —C.B.

BIOMEDICINE

Fungus produces cancer drug

Several varieties of fungi that attack hazelnuts produce high quantities of the widely used cancer drug paclitaxel, researchers report. Companies currently extract the powerful but expensive drug from the bark of yew trees.

Since the early 1990s, doctors have been using paclitaxel, sold under the brand name Taxol, to fight cancers of the lung, ovary, and breast, and some other tissues. However, since paclitaxel comes from slow-growing trees, the drug is in limited supply.

In a chance discovery, Angela Hoffman of the University of Portland in Oregon and her colleagues found that several types of fungi that plague hazelnuts contain tiny amounts of the drug. While growing the fungus in a nutrient-rich broth, however, the researchers observed that the fungi produce an increasing amount of paclitaxel as sugar in the broth becomes depleted.

From the lab studies, Hoffman estimates that fungi growing in 10 liters of broth for 3 weeks could provide enough paclitaxel to treat one person's cancer. Extracting a comparable amount from yews could take many trees and years of growing time, she says.

The researchers next plan to look for the paclitaxel-producing gene in the fungi, with the aim of ramping up production of the drug by fungi or other organisms. —C.B.

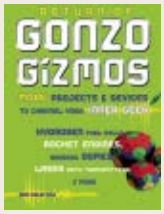
Books

A selection of new and notable books of scientific interest

GONZO GIZMOS: More Projects and Devices to Channel Your Inner Geek

SIMON QUELLEN FIELD

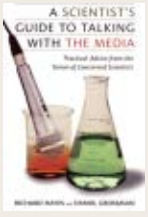
How would you like to be able to tell someone you built a radio transmitter? Or made ice cream without an ice cream maker? These projects and more are included in this guide to building scientific gadgets using materials readily found around the house or at a local store. The end products demonstrate the principles of chemistry, electromagnetism, aerodynamics, and more. Each project includes a detailed explanation of the science at work, a shopping list, a list of required tools, and step-by-step instructions. Projects include making a miniature rocket engine out of aluminum foil, paper clips, and matches. The projects can be refresher courses in basic science or an avenue to reviving your inner kid. ***Chicago Review Press, 2006, 147 p., b&w photos, paperback, $16.95.***



A SCIENTIST'S GUIDE TO TALKING WITH THE MEDIA: Practical Advice from the Union of Concerned Scientists

RICHARD HAYES AND DANIEL GROSSMAN

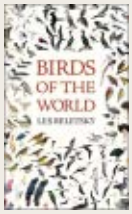
Hot topics such as global warming and stem cell research garner a great deal of media coverage, but this book asserts that such coverage is often lacking in factual information. As a result, many adults are poorly informed about the science behind these issues, the authors write. Hayes, media director of the environmental-advocacy group the Union of Concerned Scientists, and Grossman, a science journalist, present this guide so that science professionals can communicate more effectively with the media. The authors guide scientists through the interview process, providing advice on how to create talking points, how to simplify research without being simplistic, and how to help a reporter stay on message. The authors also explain the differences among media including newspapers, magazines, radio, television, and the Internet. Hayes and Grossman aim to help scientists cultivate relationships with reporters, become trusted sources, get media coverage of their work, and write their own press releases, letters to the editor, and op-ed pieces. ***Rutgers, 2006, 200 p., paperback, $18.95.***



BIRDS OF THE WORLD

LES BELETSKY

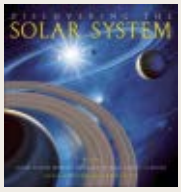
Some of bird-watching's appeal lies in its simplicity, writes Beletsky. An ornithologist and a writer, he offers not a comprehensive encyclopedia or a field guide, but rather a richly illustrated introduction to various wild birds. The book is organized with a few pages devoted to each bird group. Associated color plates feature illustrations of representative species from each group by top bird artists. The text provides noteworthy facts about each group, including its classification, geographic distribution, morphology, breeding behavior, and conservation status. A final chapter answers common questions about avian diversity and distribution, including which are the most abundant birds and the most threatened species. ***Johns Hopkins, 2006, 513 p., color illus., hardcover, $50.00.***



DISCOVERING THE SOLAR SYSTEM

DAVID W. HUGHES AND CAROLE STOTT

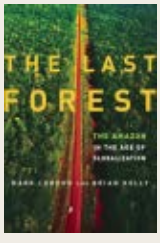
Complete with two books, a desktop mobile, and an interactive wall chart, this pack covers a range of information about the solar system. The first book, written by Hughes, vice president of the Royal Astronomical Society, provides an overview of the solar system, from the birth of the sun and formation of the planets to a description of terrestrial planets and gas giants as they appear today. He also covers the solar system's comets and asteroids. In the second book, Stott, a space-science writer and an astronomer, provides an inventory of various space missions throughout the solar system, including the moon landings, probes sent to the inner planets and the sun, the Mars rovers, and planned missions. Included with these books are cardboard cutouts for constructing a desktop model of the solar system and a wall chart depicting the planets, with statistics on each one, such as its distance from the sun, orbital period, and average temperature. A sheet of stick-on mission markers is included, each listing a different satellite or rover with its launch date and mission description. ***Barron's, 2006, 96 p., color images, paperback, $29.99.***



THE LAST FOREST: The Amazon in the Age of Globalization

MARK LONDON AND BRIAN KELLY

The Amazon rainforest in Brazil is larger than the area of the United States west of the Mississippi River, and it houses the world's richest concentration of animal and plant life. London and Kelly chronicle how the forest has changed in the past 25 years and outline what measures are required to save it. They explain how the first settlers of the Amazon arrived more than 10,000 years ago. They detail the political fight between the Brazilian government, wanting to maintain sovereignty of its lands, and the United Nations, intent on enforcing its environmental policy. They look at the opportunities for loggers and farmers that the forest offers and at the complexities that arise in balancing environmental with economic issues. They discuss the occasional violence that has erupted between factions. Finally, they look at options for saving the forest while maintaining the land's production of commodities. ***Random House, 2007, 312 p., hardcover, $25.95.***



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LETTERS

Up, down, around

I haven't seen any reference to the similarity between the "morphing" wing ("Ahead of the Curve: Novel morphing wing may reduce aircraft's fuel use," *SN: 12/23&30/06, p. 406*) and the "warping" wing that the Wright brothers used on their gliders and powered aircraft. It seems we've come full circle in our quest to emulate the flight of birds.

PAUL BAKER, BROWNS VALLEY, CALIF.

Missing matchmaker

"No-Dad Dragons: Komodos reproduce without males" (*SN: 12/23&30/06, p. 403*) seems to gloss over an important issue. With only 4,000 dragons left in the world, why was this female, one of only a thousand females remaining, not paired with a mate? I read several versions of this story, none of which touched on this topic. I believe this reveals an even more interesting story concerning the care of endangered animals.

DAVID LAMM, SAN DIEGO, CALIF.

A hole too far

The statement in "A New Spin: X rays shed light on black holes" (*SN: 1/6/07, p. 8*) that astronomers "don't yet have" a probe to journey to the vicinity of a black hole is puzzling. As far as I know, the closest known black hole is V4641, more than 1,500 light-years away. Given that, the implied assumption that a probe will someday be able to reach a black hole seems misleading.

BEN BEASLEY, KERNERSVILLE, N.C.

Bone to pick

Regarding "Bad to the Bone: Acid stoppers appear to have a downside" (*SN: 1/6/07, p. 3*), without a corresponding study of bone densities, it's not possible to determine whether the link between proton-pump inhibitors and increased fractures in people over age 50 is due to increased numbers of falls (dizziness, etc.) or to bone damage. It would be extremely helpful to try to tease out the cause behind this linkage.

DAN WINICUR, WEST CHESTER, PA.

Some falls could be attributed to dizziness caused by a proton-pump inhibitor (PPI). But tests have shown that less than 2 percent of people taking omeprazole (Prilosec), a commonly used PPI, report dizziness. In contrast, this drug and other PPIs reduce acid production substantially in volunteers, leading scientists to investigate a connection between that effect and bone fractures. —N. SEPPA

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"The New Solar System" Poster

"The New Solar System" Poster

This new in-color poster is based on the 8 planet solar system with Pluto being addressed in light of the new parameters for the definition of a planet. The 5 sections on this poster are entitled: *"Mysteries of Our Solar System," "Pictures of the Solar System"* (up-close pictures of Venus, Mercury, Jupiter, comets, and asteroids); *Planetary Size Comparative*; the chart *"Solar System Facts"* which is shown on a graph information on each planet's diameter, numbers of moons, rotation time, etc.; and *"The Trouble with Pluto."* This poster is designed so Pluto is addressed as being a planet or not. Includes the Oort Cloud and the Asteroid Belt with the planets. Produced by Jensan Scientifics. Laminated, Size 26.5" X 38." **Order #JPT-80114, Cost: $23.95; 2 for $45**

Beautiful! Antarctica - Poster

Antarctica - Poster - New poster by well-known artist Suzanne Duranceau, who also did the *Fragile, Handle With Care!* poster about the Earth. Size: 26.75" X 38.5" Laminated. Order #JPT-19014, Cost: $16.95. JPT-19016 - 2 for $31.95. Great science poster about one of the Earth's changing frontiers.

The World's Most Dangerous Water Creatures -Poster

"The World's Most Dangerous Water Creatures"

This amazing, well-illustrated poster depicts 26 water creatures that are some of the most dangerous animals on our planet. Information about each is provided on the poster. Some of the animals are: Piranha, Barracuda, Cone Shell, Sea Snake, Stingray, Stonefish, Electric Eel, Sea Wasp, Pufferfish ,and many more. Information covered: habitat; method of contact; symptoms; and treatment. Size: 26 1/2" X 38", Laminated, Produced by Jensan Scientifics. **Order #JPT-10894, Cost: $23.95, 2 for $45**

The Age of the Earth

The Age of the Earth - Specimen Display Set -

Information on the display talks about the age of certain rocks and minerals and how they relate to the age of the Earth and our solar system. Physical samples shown are: chondrite meteorite, Allende meteorite, Barberton Greenstone, and Acasta gneiss. A Jack Hills zircon is pictured, and the product comes with information. This unusual product will be *available only as long as supply lasts.* A superb addition to any earth science class, or for the avid earth science enthusiast. Plastic display case size with matching hinged see-through lid is 7 1/2" L X 5" W X 1/2" D. ***Order #JPT-48401, Cost: $68***

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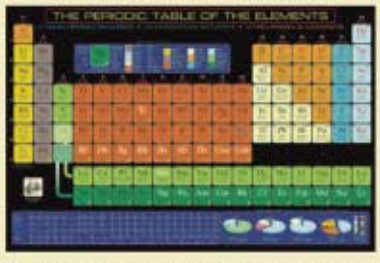
Anorthosite is a relatively lightweight silicate rock that forms much of the crust of the Moon. When we look at the Moon at night, the white that we see is "anorthosite," the material that makes up the lunar crust. This beautiful sample of terrestrial anorthosite is of the finest quality and is a superb analog for the lunar crust. It has been polished and set in a 14K Gold pendant. Size: 1" diameter. Comes with matching 20" gold chain and information, in an attractive black velvet jewelry box. ***Order #JPT-19784, Cost: $230;*** *also in Sterling Silver,* ***#JPT-19641, Cost: $75.00***

EMR - Poster

EMR Poster

This chart includes all known ranges of EMR including: gamma rays, X-rays, ultraviolet light, visible light, infrared, microwaves, radio waves (ULF, VLF, LF, MF, HF, long, short, HAM, VHF, UHF, SHF, EHF), cosmic microwave background radiation and brain waves, all organized by octaves. The audio frequency spectrum is also included. Descriptions are included for all ranges and properties of EMR, including reflection, refraction, LASER, television, gravity waves, emission and absorption. There is also a chart of SI unit prefixes ranging from yocto to yotta. All items are placed on the graph using custom programmed formulas. Great chart on a difficult subject! Size: 24" X 36," Laminated. Order #EMR - 1020, Cost $19.95

The Periodic Table of the Elements - Poster



The Periodic Table of the Elements - Poster

This periodic table poster has the regular information, a picture of Dimitri Mendeleev and a legend denoting: atomic number, electron configuration, atomic weight, atomic symbol and whether the element is radioactive or not. This poster has the typical color designations according to alkali metals, alkaline earth metals, transition metals, etc. A well-designed graph on the bottom portion shows when the element was discovered and the percentage of certain types of elements found in the atmosphere, biosphere, hydrosphere, and lithosphere. Size: 26.5" X 38.5", Laminated *Order#JPT-3103, Cost: $15.95, 2 for $30, Order #JPT-3103-2*

Famous Scientists - Poster

Famous Scientists Poster -

54 of some of the world's premier scientists are shown in photographs on this 24"W X 36"L laminated poster. The poster lists their name under each picture as well as their nationality, life span and field of study. A time line at the bottom of the poster shows the seven sciences with their major branches. ***Order #JPT-2000, Cost: $15.95, 2 for $30, order #JPT-2000-2***

Famous Inventors - Poster

Famous Inventors Poster -

50 of some of the world's well known inventors are shown in photographs on this 24"W X 36"L laminated poster. The poster lists their name under each picture as well as their nationality, life span and invention. A time line at the bottom of the poster shows many of the major inventions, corresponding to the inventors listed. ***Order #JPT-87033, Cost: $15.95, 2 for $30, order #JPT-87033-2***

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