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SCIENCE NEWS

E WEEKLY NEWSMAGAZINE OF SCIENCE

teens at web's cutting edge
better leukemia drugs
a hybrid aflutter
microbes boost calories

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fish out of water

ANCIENT TRANSITIONS TO LAND

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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JUNE 17, 2006 VOL. 169, NO. 24

Features

This Week

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Of Note

Meetings

Departments

Cover Paleontologists have unearthed the remains of *Tiktaalik*, a creature that lived during the 9-million-year gap between the first known land vertebrates and the lobe-finned fish that preceded them. Analyses of these fossils, as well as those of other early tetrapods, are yielding insights about how the earliest land vertebrates got around. (Shawn Gould © 2006 National Geographic) Page 379

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Next Line of Defense

New drugs take on resistant leukemia

In the past few years, the breakthrough drug imatinib has changed chronic myeloid leukemia from a death sentence to a treatable disease. But 17 percent of patients taking the drug, also called Gleevec, become resistant to its protective effects over 5 years, and their cancer recurs.

Now, two experimental drugs pick up where imatinib leaves off. In many patients with chronic myeloid leukemia (CML) that's impervious to imatinib, the new compounds suppress the malignancy, two studies show.

"In the 1990s, when we saw a patient with CML, we gave them the bad news that they were going to live 3 to 5 years," says hematologist-oncologist Hagop Kantarjian of the M.D. Anderson Cancer Center in Houston, who coauthored both studies. With imatinib and the new drugs, most CML patients may live a normal life. "And with some refinements, these drugs might cure most patients," Kantarjian adds.

The new drugs, called dasatinib and nilotinib, target the same protein that imatinib does (*SN: 1/1/05, p. 14*). Called Bcr-Abl, this abnormal protein causes the leukemia by disconnecting the brakes on cells' replication machinery. Like imatinib, both nilotinib and dasatinib bind to Bcr-Abl, thereby killing the cancerous cells that harbor it.

However, the new drugs bind tightly even after the gene that encodes Bcr-Abl has mutated such that imatinib can no longer bind to the altered protein.

Kantarjian and his colleagues tested nilotinib and dasatinib in 180 patients with CML and 23 with a related leukemia. All were resistant to or couldn't tolerate imatinib. Patients received nilotinib for 2 to 9 months or dasatinib for 2 to 19 months.

Patients with the less aggressive phase of the cancer showed the best results. Of 40 such patients given dasatinib, 37 had their disease go into remission, as indicated by their normal blood cell counts. So did 11 of 12 such patients who received nilotinib, the researchers report in the June 15 *New England Journal of Medicine*.

Patients benefited less if their imatinib-resistant CML had already turned aggressive. Fewer than half of such patients went into remission during treatment with either drug. Some patients with highly aggressive leukemia died during the study.

In the United States, more than 90 percent of CML cases are diagnosed in the least aggressive phase, says hematologist Brian J. Druker of the Howard Hughes Medical Institute (HHMI) and the Oregon Health and Science University in Portland.

Some patients had extremely low bone marrow concentrations of Bcr-Abl after treatment. Among such patients taking imatinib, Druker found that the relapse rate dropped to only 7 percent over the next 5 years.

However, such patients may not be cured, cautions cancer biologist Charles J. Sherr of HHMI and St. Jude Children's Research Hospital in Memphis, Tenn. Evidence of a cure would require that these patients remain free of cancer for 5 years after ending drug treatment, he says.

The studies were funded by Novartis Pharmaceuticals of East Hanover, N.J., the maker of nilotinib, and Bristol-Myers Squibb of New York City, the maker of dasatinib. —N. SEPPA

QUOTE

"With some refinements, these drugs might cure most [chronic myeloid leukemia] patients."
HAGOP KANTARJIAN, M.D. Anderson Cancer Center

Mixed Butterflies

Tropical species joins ranks of rare hybrids

A South American butterfly has a checkered past, say biologists. It's one of the few animal species that seems to have arisen via a supposedly rare path: crossing two older species.

A black butterfly flashing bold stripes, *Heliconius heurippa*, came from the natural mixing of two other *Heliconius* species, says Jesús Mavárez of the Smithsonian Tropical Research Institute in Panama.

New experiments with *H. heurippa* suggest an answer to the difficult question of what keeps the hybrid species from blending back into its parent species. The hybrid's preference for mates of the same stripes keeps its species distinct, Mavárez and his colleagues say in the June 15 *Nature*.

"In animals, the dogma has been hybridization is a dead end—it's not important for creating species," comments Bruce McPheron of Pennsylvania State University in University Park, who's studied how some flies form species. The butterfly findings suggest that hybridization "can be a much more important source of new species than people have recognized," he says.

Botanists have long noted that many plant species arise from interbreeding, particularly when the hybrids end up with more chromosomes than the parent species. Altered chromosome number in hybrids has seldom been observed among animals.

Biologists are particularly interested in examples of new species in which the chromosome number remains constant. Mavárez and his colleagues focused on *H. heurippa* as a suspected hybrid butterfly species that has the same chromosome number as its two suspected parent species.

Searching for clues to family history, the researchers found distinctive genetic markers in *Heliconius cydno* and *Heliconius melpomene*. *H. heurippa*, the suspected hybrid, showed markers characteristic of each of the other two species.

More analysis of the genomes suggests

C. SALCEDO

HISTORIC MIX-UP Today's *Heliconius heurippa* butterfly species sports bright stripes combining the patterns of two other species, which were probably its long-ago parents.

that the hybrid split from its parent species at least 300,000 years ago, says Mavárez.

The researchers crossed *H. cydno* and *H. melpomene* in the lab and then backcrossed some of the offspring with *H. cydno* and bred the offspring. The procedure re-created the stripe pattern seen on *H. heurippa*.

To investigate what might keep the wild hybrids from disappearing back into parental populations, the researchers set up courtship tests at the lab of coauthor Mauricio Linares of the University of the Andes in Bogotá, Colombia. Males from the wild *H. heurippa* species were at least twice as likely to court a member of their own species as to court females of either of the other two species.

When researchers blacked out either one of a female's wing stripes, the males' preference disappeared. Tests with variously colored paper wings yielded the same preferences. Thus, the result didn't depend on the insects' scents or behavior.

The experiments are "very thorough and elegant," says Loren Rieseberg of Indiana University in Bloomington, who has traced hybrid speciation in sunflowers.

Mavárez says that the team hopes to test the mating preferences of the lab-bred hybrids. —S. MILIUS

Carbon Goes Glam

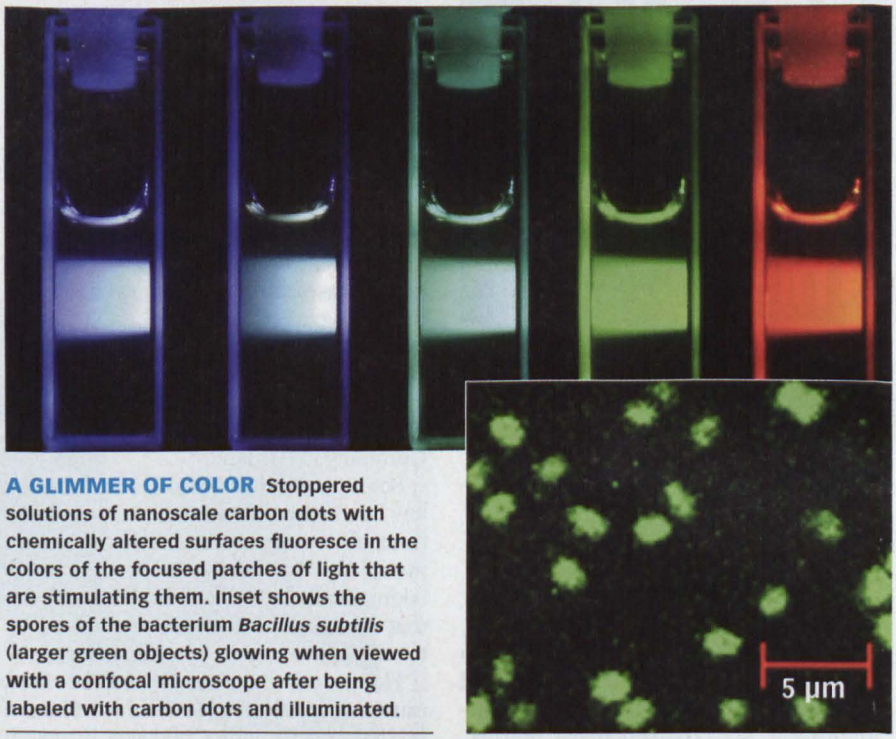
Treated carbon dots fluoresce

Chemists have fashioned tiny dots of carbon that glow in response to light. The nanoparticles may find uses in biological imaging as alternatives to quantum dots, fluorescent spheres of semiconductors.

Although scientists envision quantum dots in a variety of applications, the toxicity of their starting materials could limit their use, notes Ya-Ping Sun of Clemson University in South Carolina. The dots, from 2 to 10 nanometers (nm) across, are typically made of cadmium selenide or lead sulfide.

Sun and his colleagues set out to create glowing dots from a nontoxic, inexpensive starting material: carbon.

They began by using a laser to break a carbon disk into particles each about 5 nm in diameter. A nitric acid bath oxidized the dots' surfaces, and the scientists then added the organic chemical called polyethylene glycol. Once those strandlike molecules had coated the carbon, the dots fluoresced when activated by colored lights, the researchers report in an upcoming *Journal of the American Chemical Society*.



A GLIMMER OF COLOR Stoppered solutions of nanoscale carbon dots with chemically altered surfaces fluoresce in the colors of the focused patches of light that are stimulating them. Inset shows the spores of the bacterium *Bacillus subtilis* (larger green objects) glowing when viewed with a confocal microscope after being labeled with carbon dots and illuminated.

Unlike the fluorescent colors of quantum dots, the colors emitted by the new carbon dots depend on the color of light that the researchers use to excite them.

A quantum dot's small volume forces its electrons to make large changes in energy in response to absorbed photons. When excited by a light source, the electrons emit energy that corresponds to a color determined by the dot's size.

Sun speculates that the electrons creating the effect in carbon dots are confined to the dots' surfaces rather than to their cores, so their color would depend upon surface chemistry. By precisely controlling the dots' size and manipulating surface properties, scientists might be able to determine the emitted colors as they can with quantum dots, he says.

Sun and his colleagues have already used the carbon dots to label cells for microscopic imaging, and they are continuing to study the mechanisms behind the dots' glow.

"It's a very intriguing result," says Michael S. Strano of the University of Illinois at Urbana-Champaign. "Carbon is a very well studied material. To be able to produce a form of it that has new properties is always exciting."

Although employing carbon dots would avoid the use of toxic metal ions, Strano notes, it's not yet clear whether the carbon nanoparticles are graphite, which is stable, or an amorphous form of carbon, which might contain carcinogenic polyaromatic hydrocarbons. —A. CUNNINGHAM

Mineral Deposit

Asbestos linked to lupus, arthritis

A new study of residents from Libby, Mont., the town where more than 1,500 people have fallen ill from asbestos-contaminated mines, links asbestos exposure with three autoimmune diseases, including rheumatoid arthritis.

Previous research found high rates of asbestos-related lung diseases, including the rare cancer mesothelioma, among miners in Libby. The town's mines once supplied the United States with most of its vermiculite, a mineral used for insulation and gardening. But that vermiculite was contaminated with asbestos also found in the ground there. Residents of Libby who didn't work in the mines, and workers across the country who processed Libby's vermiculite, also had a high incidence of lung diseases (*SN: 7/12/03, p. 21*).

The new research links asbestos exposure with rheumatoid arthritis, lupus, and scleroderma. "We're talking about a whole different class of diseases," says study author Curtis Noonan of the University of Montana in Missoula. In these diseases, a person's immune system attacks body tissues.

Former Libby miners older than age 65 were three times as likely as other Libby

Y. LIN AND SUN

residents to have rheumatoid arthritis and were twice as likely to have any of the three diseases, the study shows. Former miners younger than 65 showed no increased risk, which suggests that prolonged exposure to asbestos increases the chance of illness, Noonan says.

The team reached this conclusion by reexamining a survey given to 7,000 former and current Libby residents in 2000 and by analyzing a follow-up questionnaire sent to people who had reported having at least one of the three autoimmune diseases. In the 2000 survey, 6.7 percent of participants reported having at least one of the diseases. Noonan says that past studies have shown that less than 1 percent of people elsewhere typically have those illnesses.

The new work also found that Libby residents exposed to asbestos in the military had an elevated risk for having at least one of the three diseases, the researchers report in an upcoming *Environmental Health Perspectives*.

"This might have implications for folks exposed to asbestos not like the type we've seen in Libby," says coauthor Theodore Larson of the federal Agency for Toxic Substances and Disease Registry in Atlanta.

Given the unusually high asbestos exposure faced by Libby residents, these findings "still need to be confirmed in other studies," says public health statistician Laurel Beckett of the University of California, Davis. Noonan and Larson agree.

Meanwhile, a separate investigation into the health effects of asbestos, released last week by the Institute of Medicine in Washington, D.C., found evidence that the mineral causes laryngeal cancer and might be associated with pharyngeal, gastric, and colorectal cancers. —E. JAFFE

Fat Friends

Gut-microbe partners bring in more calories

The collaborative efforts of two common gut microbes could increase the calories that a person extracts from food and stores as fat, a new study in mice suggests.

Trillions of bacteria and archaea—single-celled organisms that resemble bacteria but form another branch of life—occupy the intestines of healthy people and other animals. These microbes provide many benefits to their hosts, such as breaking down nutrients. Scientists have suspected that microbial species change each other's digestive roles, and researchers are now beginning to work out these complex interactions.

To investigate how one human-gut bacterium interacts with the most common human-gut archaeon, microbiologists Jeffrey I. Gordon and Buck S. Samuel of Washington University in St. Louis experimented with mice specially bred and raised to be missing all gut microbes.

The researchers fed some of the mice a solution containing the bacterium *Bacteroides thetaiotaomicron* and gave other mice a solution containing the archaeon *Methanobrevibacter smithii*. A third group of animals received both species.

Over the next 2 weeks, all the animals ate sterilized chow rich in polysaccharides, which are sugars that neither mice nor people can digest without the help of certain gut bacteria, including *B. thetaiotaomicron*. The researchers found that the intestines of mice treated with both microbes had 100 to 1,000 times as many individuals from each species as did the intestines of mice treated with only one species.

The finding suggests that *B. thetaiotaomicron* and *M. smithii* somehow benefit each other, says Gordon.

To learn how the microbes boost each other's populations, Gordon and Samuel took samples of the bacteria and archaea several days after the microbes had colonized the mice. Analyses of gene activity showed that in mice with just *B. thetaiotaomicron*, the bacterium consumed various polysaccharides. However, in the presence of *M. smithii*, *B. thetaiotaomicron* focused its appetite on the class of polysaccharides called fructans. Fructan-specific digestion leads the bacteria to produce hydrogen, which fuels *M. smithii*.

Fructan digestion also creates an abundance of acetate, which mice can digest, Gordon adds. Wondering whether the extra calories from acetate produced extra fat, the researchers X-rayed the mice to measure their fat deposits. Gordon and Samuel report in an upcoming *Proceedings of the National Academy of Sciences* that mice with both microbes had about 13 percent more fat than mice colonized with just one species did.

The study suggests that the calories that people and other animals take from foods could be directly related to which microbes have colonized their guts. To understand foods' effects on weight, "we have to consider someone's microbial ecology," says Gordon.

If the scientists' reasoning is correct, then manipulating intestinal flora might eventually be used to treat obesity, notes microbiologist Jeremy Nicholson of Imperial College London. However, he adds that

M. KLINGLER/CARNEGIE MUSEUM NATURAL HISTORY; (INSET) H. YOU/CHINESE ACAD. GEOLOGICAL SCIENCES

Ancient webbed masters

Newly unearthed fossils of a 110-million-year-old species bolster the notion that all modern birds evolved from aquatic ancestors. Fragmentary fossils of *Gansus yumenensis* collected earlier had suggested that it was a wading bird similar to today's sandpipers, says Jerald D. Harris, a paleontologist at Dixie State College in St. George, Utah. The new specimens (one shown in inset) from northwestern China, which together include all the bird's bones except its skull and upper neck, informed this artist's sketch. The bird's shape and its webbed feet indicate that the creature was a foot-propelled diver like modern loons. Features of some bones establish *G. yumenensis* as the oldest known ancestor of modern birds, Harris and his colleagues assert in the June 16 *Science*. —S. PERKINS

because researchers are still investigating the individual functions of the gut's many microbial species, such a treatment might be years or decades away. —C. BROWNLEE

Wasting Away

Prozac loses promise as anorexia nervosa fighter

Psychiatrists often prescribe fluoxetine, or Prozac, to people suffering from the difficult-to-treat, potentially fatal condition known as anorexia nervosa. Yet the medication appears to provide no benefit in treating the eating disorder, a new investigation reports.

Symptoms of anorexia nervosa consist of a refusal to eat enough to maintain adequate body weight, intense fears of gaining weight, and disturbed thinking about food, weight, and body image. The predominantly female ailment often includes a denial of the seriousness of weight loss and refusal to participate in treatment.

In some cases, binge eating and purging occur periodically.

National surveys suggest that about 1 in 1,000 adults develops anorexia nervosa. A higher prevalence, 1 in 100, shows up among teenage girls and young women. The illness frequently occurs with mental ailments, such as depression and obsessive-compulsive disorder, that respond to Prozac treatment. Clinicians had anticipated similar success in treating anorexia with the drug.

The new study, directed by psychiatrist B. Timothy Walsh of Columbia University, may dash that hope. "It makes more sense to focus on nutritional restoration and maintenance and the provision of good psychological treatment," Walsh says.

He and his colleagues present their findings in the June 14 *Journal of the American Medical Association*.

The researchers studied 93 women, ages 16 to 45, treated for anorexia nervosa between January 2000 and May 2005. Nearly half of them had binged and purged. Participants had regained weight and maintained it at a healthy level for 2 weeks in hospital programs in New York or Toronto.

Walsh's team then randomly assigned 49 of the women to take physician-monitored doses of Prozac for a year. The rest received placebo pills. All patients attended weekly sessions of cognitive behavioral therapy that focused on identifying and altering anorexia-related attitudes and habits.

Prozac displayed no advantage over placebos, the researchers say. In both groups, 57 percent of participants failed to complete treatment. For those who finished 1 year of treatment, 73 percent of the placebo group and 71 percent of the Prozac group maintained healthy weights and experienced no return of symptoms.

Taking dropouts into account, 51 percent of the placebo group and 49 percent of the Prozac group avoided relapses.

Psychiatrist Scott J. Crow of the University of Minnesota in Minneapolis counters the new results "important but disappointing." Research on the biology and treatment of anorexia nervosa needs to intensify, he asserts.

It's too early to close the door on Prozac treatment for anorexia nervosa, counters psychiatrist Walter H. Kaye of the University of Pittsburgh Medical Center. In a 2001 study, he and his coworkers reported substantially better 1-year results for 16 anorexia nervosa patients randomly assigned to Prozac treatment, compared with 19 patients given placebos.

In Kaye's study, all participants received psychotherapy. A lack of prior bingeing and purging in the group might also have enhanced Prozac responses, he suggests.

"We clearly need more studies and innovative treatments," Kaye says.

Kaye is part of a team that's recruiting for a genetic study 400 families with two or more members diagnosed with anorexia nervosa. —B. BOWER

Greenhouse Glass

Squeezing and heating carbon dioxide yields exotic, see-through solid

As ordinary citizens wring their hands over global warming from carbon dioxide in the atmosphere, scientists are wringing new chemical insights from the usually gaseous compound. In the latest extreme exploration, researchers in Italy have for the first time forged solid glass from carbon dioxide.

Mario Santoro and Federico A. Gorelli of the University of Florence and their colleagues made the glass, dubbed carbonia, by intensely squeezing dry ice—a crystalline arrangement of carbon dioxide molecules—between diamond jaws and heating it in a furnace. The severe conditions produce a disorderly, non-molecular arrangement of carbon and oxygen atoms linked by single bonds, Santoro says, instead of carbon dioxide's typical molecular configuration—a carbon atom double-bonded to each of two oxygen atoms.

The new carbon dioxide glass formed at a pressure of 640,000 atmospheres and a temperature of 700 kelvins, the researchers report in the June 15 *Nature*. An estimated 10 times as hard as quartz yet softer than diamond, carbonia is "the hardest amorphous material known," says Santoro.

The transparent solid is similar in structure to the ordinary amorphous silica in window glass. Six years ago, other researchers made another non-molecular form of carbon dioxide, called carbon dioxide 5, which has a crystalline, quartz-like structure.

These non-molecular carbon dioxides may occur naturally in the high-pressure interiors of giant outer planets such as Neptune, Santoro says.

Both carbonia and carbon dioxide 5 might be technologically useful if the substances could be made to persist under everyday conditions, notes Paul F. McMillan of University College London in a commentary accompanying the new report. The materials might also provide a means of consolidating environmentally troublesome, excess carbon dioxide for disposal, he adds.

So far, neither of the non-molecular carbon dioxide solids maintains its structure when the pressure's off. However, mixing carbonia with silica at even higher temperatures might yield an unusually hard, mixed glass even when returned to room temperature and pressure, Santoro suggests.

The syntheses of carbonia and carbon dioxide 5 are exciting examples of "alchemy under high pressure," comments Cornell University chemist Roald Hoffmann.

Although carbon and silicon are members of the same family in the periodic table of elements, they seem unrelated because carbon dioxide is typically a gas whereas silicon dioxide, or silica, is commonly crystalline quartz or glass. However, high pressure transforms the chemistry of carbon to be more like that of its cousin silicon, Hoffmann notes, evidenced by carbonia resembling silica and carbon dioxide 5 mimicking quartz. —P. WEISS

EXCLUSIVELY ONLINE

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Determining which scores to drop when computing a final grade that is to a student's greatest advantage can be tricky.

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Food for Thought: Chocolate as Sunscreen

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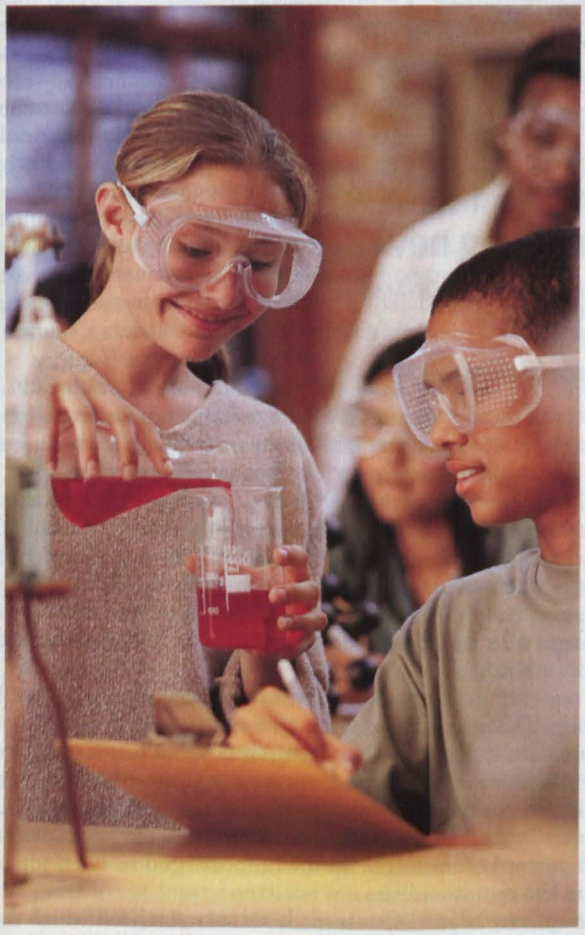

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GROWING UP ONLINE

Young people jump headfirst into the Internet's world

BY BRUCE BOWER

As a conversation unfolds among teenagers on an Internet message board, it rapidly becomes evident that this is not idle electronic chatter. One youngster poses a question that, to an outsider, seems shocking: "Does anyone know how to cut deep without having it sting and bleed too much?" An answer quickly appears: "I use box cutter blades. You have to pull the skin really tight and press the blade down really hard." Another response advises that a quick swipe of a blade against skin "doesn't hurt and there is blood galore." The questioner seems satisfied: "Okay, I'll get a Stanley blade 'cause I hear that it will cut right to the bone with no hassle. But ... I won't cut that deep."

Welcome to the rapidly expanding online arena for teenagers who deliberately cut or otherwise injure themselves. It's a place where cutters, as they're known, can provide emotional support to one another, discuss events that trigger self-mutilation, encourage peers to seek medical or mental-health treatment, or offer tips on how best to hurt oneself without getting caught.

The conversation above, observed during a study of self-injury message boards, occupies a tiny corner of the virtual world that children and adolescents have aggressively colonized. Psychologist Janis L. Whitlock of Cornell University, the director of that study, and other researchers are beginning to explore how young people communicate on the Internet. The scientists are examining how various online contacts affect a youngster's schoolwork, social life, and budding sense of identity. Evidence also suggests that the Internet has expanded the reach of health-education efforts to teens in distant lands and provided unique leadership opportunities to a global crop of youngsters.

New findings, including six reports in the May *Developmental Psychology*, indicate that the Internet holds a special appeal for young people, says psychologist Patricia Greenfield of the University of California, Los Angeles (UCLA). That's because the Internet provides an unprecedented number and variety of meeting places, from message boards to instant messaging to so-called social networking sites such as *myspace.com*.

The one constant is that teens take to the Internet like ants to a summer picnic. Nearly 9 in 10 U.S. youngsters, ages 12 to 17, used the Internet in 2004, according to a national survey conducted by the Pew Internet & American Life Project in Washington, D.C. That amounted to 21 million teens, half of whom said that they go online every day. About three in four U.S. adults used the Internet at that time, Pew researchers found.

Teenagers, in particular, provide a moving target for Internet researchers, remarks psychologist Kaveri Subrahmanyam of California State University in Los Angeles. "By the time you publish research on one type of Internet use, such as blogging, teenagers have moved on to something new, such as *myspace*," she says, with a resigned chuckle.

EXPRESS YOURSELF Cyberspace offers a bevy of tempting opportunities to pretend to be who you're not. Yet teens don't typically go online to deceive others but to confront their own identities, according to recent studies. That's not surprising, Subrahmanyam notes, since adolescents typically seek answers to questions such as "Who am I?" and "Where do I belong?"

Consider the self-injury message boards studied by Whitlock's team. Five Internet search engines led the researchers to a whopping 406 such sites. Most of these attracted participants who identified themselves as girls between ages 12 and 20.

On message boards, as in chat rooms, participants register as members and adopt screen names, such as "Emily the Strange." In many cases, both members and nonmembers can view messages, although only members can post them.

> "By the time you publish research on one type of Internet use... teenagers have moved on to something new."
>
> — KAVERI SUBRAHMANYAM, CALIFORNIA STATE UNIVERSITY

Whitlock and her coworkers studied the content of 3,219 messages at 10 popular self-injury message boards over a 2-month period in 2005. Many postings provided emotional support to other members. Participants also frequently discussed circumstances that triggered self-mutilation. These included depression and conflicts with key people in their lives. Some message senders detailed ways to seek aid for physical and emotional problems, but others described feeling addicted to self-injury.

More ominously, a substantial minority of messages either discouraged self-injurers from seeking formal medical or mental help or shared details about self-harm techniques and ways to keep the practice secret.

Online teen chat rooms generally don't have specific topics but, like message boards, attract a wide range of kids and present both helpful and hurtful communications. Subrahmanyam and her colleagues examined typical conversations at two online chat sites for teens. They monitored more than 5 hours of electronic exchanges selected at various times of the day during a 2-month stretch in 2003.

On one site, an adult monitored conversations for unacceptable language. The other site was unmonitored.

More than half of the 583 participants at both sites gave personal information, usually including sex and age. Sexual themes constituted 5 percent of all messages, corresponding to about one sexual comment per minute. Obscene language characterized 5 percent of messages on the unmonitored site and 2 percent on the monitored site.

One-quarter of participants made sexual references, which was

not unexpected given the amount of daily sex talk that has been reported among some teens. In the chat rooms, however, all members were confronted with the minority's sexual banter.

The protected environment of the monitored chat room resulted in markedly fewer explicit sexual messages and obscene words than the unmonitored chat room did, Subrahmanyam says. Moreover, the monitored site attracted more participants who identified themselves as young girls than did the unmonitored venue, which featured a larger number of correspondents who identified themselves as males in their late teens or early 20s.

Much of the explicit sexuality on the unmonitored site amounted to degrading and insulting comments, adding to concerns previously raised by other researchers that youths who visit such sites are likely to encounter sexual harassment from either peers or adults.

Subrahmanyam's team also conducted in-person interviews with teens who hadn't participated in the chat room study. The results suggest that only a small minority ever pretend to be other people on the Internet.

Intriguingly, teens who write online journals, known as blogs, often forgo sex talk for more-mundane topics, such as daily experiences at home and school, Subrahmanyam adds. In 2004, she analyzed the content of 600 entries in 200 teen blogs.

Teen blogs offer an outlet for discussing romantic relationships and, especially for boys, disclosing hidden sides of themselves, says psychologist Sandra L. Calvert of Georgetown University in Washington, D.C. In a 2005 online report with David A. Huffaker of Northwestern University in Evanston, Ill., Calvert described entries in 70 teen blogs, evenly split between bloggers who identified themselves as girls and as boys. The ages given ranged from 13 to 17.

Bloggers routinely disclosed personal information, including e-mail addresses and other contact details, the researchers found. Half the blogs of both boys and girls discussed relationships with boyfriends or girlfriends. Ten boys, but only two girls, wrote that they were using the blogs to openly discuss their homosexuality for the first time.

"Teenagers stay closer to reality in their online expressions about themselves than has previously been suggested," Calvert asserts.

HELLO OUT THERE — New research probes various ways in which children and teenagers use, and are affected by, the Internet.

NET GAINS Give a middle school child from a low-income household a home computer with free Internet access and watch that child become a better reader. That's the conclusion of a new study that highlights potential academic consequences of the so-called digital divide separating poor kids from their better-off peers.

A team led by psychologist Linda A. Jackson of Michigan State University in East Lansing gave computers, Internet access, and in-home technical support to 140 children. The mostly 12-to-14-year-old, African-American boys and girls lived in single-parent families with incomes no higher than $15,000 a year. The researchers recorded each child's Internet use from December 2000 through June 2002.

Before entering the study, these children generally did poorly in school and on academic-achievement tests. However, overall grades and reading achievement scores—but not math-achievement scores—began to climb after 6 months of home Internet use. These measures had ascended farther by the end of the study, especially among the kids who spent the most time online.

Participants logged on to the Internet an average of 30 minutes a day, which isn't much in the grand scheme of teenage Internet use: Teens in middle- and upper-class families average 2 or more Internet hours each day. Only 25 percent of the children in the study used instant messaging, and only 16 percent sent e-mails or contributed to online chat. These low numbers probably reflect a lack of home Internet access among the kids' families and friends. Also, their parents forbade most of the participating kids from contacting strangers in chat rooms.

Still, text-heavy online sites seem to have provided reading experience that translated into higher reading scores and grades, the researchers suggest. Although participants remained below-average readers at the end of the study, their improvement showed promise, according to Jackson and her colleagues.

These findings raise the unsettling possibility that "children most likely to benefit from home Internet access are the very children least likely to have [it]," Jackson's team concludes.

In stark contrast to their poor peers, wealthier middle school and high school students spend much of their time on the Internet trading instant messages with friends, an activity with tremendous allure for young people trying to fit into peer groups, says psychologist Robert Kraut of Carnegie Mellon University in Pittsburgh.

For teens, instant messaging extends opportunities to communicate with friends and expands their social world, Kraut suggests. He and his colleagues probed instant messaging in interviews with 26 teens in 2002 and in surveys completed by 41 teens in 2004.

Instant messaging simulates joining a clique, without the rigid acceptance rules of in-person peer groups, in Kraut's view. Each user creates his or her own buddy list.

Within these virtual circles, teens become part of what they regard as a cool Internet practice and, at the same time, intensify feelings of being connected to friends, even when sitting by themselves doing homework, Kraut says.

Still, Internet-savvy youngsters typically have much to learn about the social reach and potential perils of online communication, says education professor Zheng Yan of the State University of New York at Albany.

Yan interviewed 322 elementary and middle school students in a New England suburb. Participants also drew pictures to show what the Internet looks like and, when told to think of the Internet as a city, what types of people one would see there.

By ages 10 to 11, children demonstrated considerable knowledge of the Internet's technical complexity, such as realizing that Internet sites act as data sources for many computers.

Not until ages 12 to 13, however, did youngsters begin to grasp the Internet's social complexity, such as the large numbers of strangers who can gain access to information that a person posts publicly. Even then, the kids' insight into the online social world's perils remained rudimentary compared with that previously observed in adults.

Children and teens plastering personal thoughts and images on Web sites such as *myspace.com* "often don't realize how many people have access to that information, including sexual predators," Yan asserts. He encourages parental monitoring of Internet activities and regular discussions of online dangers with children.

WORLDWIDE PEERS Adolescents who form global Internet communities show signs of developing their own styles of leadership and social involvement, a trend that Northwestern University psychologist Justine Cassell and her coworkers view with optimism.

Cassell's team examined messages from an online commu-

nity known as the Junior Summit, organized by the Massachusetts Institute of Technology. University officials sent out worldwide calls for youngsters to participate in a closed, online forum that would address how technology can aid young people. They chose 3,062 applicants, ages 9 to 16, from 139 countries.

Those selected ranged from suburbanites in wealthy families to child laborers working in factories. Computers and Internet access were provided to 200 schools and community centers in convenient locations for those participants who needed them.

During the last 3 months of 1998, children logged on to online homerooms, divided by geographic regions. Members of each homeroom generated and voted on 20 topics to be addressed by the overall forum. Topic groups then formed and participants elected a total of 100 delegates to an expenses-paid, 1-week summit in Boston in 1999.

Cassell's group found that delegates, whom the researchers refer to as online leaders, didn't display previously established characteristics of adult leaders, such as contributing many ideas to a task and asserting dominance over others. While the delegates eventually sent more messages than their peers did, those who were later chosen as online leaders—regardless of age or sex—had referred to group goals rather than to themselves and synthesized others' posts rather than offering only their own ideas.

> "Children most likely to benefit from home Internet access [may be] the very children least likely to have [it]."
>
> — LINDA A. JACKSON, MICHIGAN STATE UNIVERSITY

Without in-person leadership cues such as height or attractiveness, online congregants looked for signs of collaborative and persuasive proficiency, the researchers say.

Outside the controlled confines of the Junior Summit, teens even in places where few people own home computers find ways to obtain vital Internet information. Ghana, a western Africa nation in which adolescents represent almost half the population, provides one example.

Researchers led by Dina L.G. Borzekowski of Johns Hopkins Bloomberg School of Public Health in Baltimore surveyed online experiences among 778 teens, ages 15 to 18, in Ghana's capital, Accra.

Two-thirds of the 600 youngsters who attended high school said that they had previously gone online, as did about half of the 178 teens who didn't attend school. Among all Internet users, the largest proportion—53 percent—had sought online health information on topics including AIDS and other sexually transmitted diseases, nutrition, exercise, drug use, and pregnancy.

Out-of-school teens—who faced considerable poverty—ranked the Internet as a more important source of sexual-health information than the students did, the investigators say.

In both groups, the majority of teens went online at Internet cafés, where patrons rent time on computers hooked up to the Internet.

Internet cafés have rapidly sprung up in unexpected areas, UCLA's Greenfield says. She conducts research in the southeastern Mexico state of Chiapas, which is inhabited mainly by poor farming families.

Small storefronts, each containing around 10 Internet-equipped computers, now dot this hard-pressed region, Greenfield notes. Primarily young people frequent these businesses, paying the equivalent of about $1 for an hour of Internet surfing.

"Even in Chiapas, adolescents are in the vanguard of Internet use," Greenfield remarks. ■

AMPHIBIOUS ANCESTORS

Vertebrates' transition to dry land took some fancy footwork

BY SID PERKINS

Imagine a scale-covered fish that uses fleshy limbs that end in fins to haul itself out of the water. Its mosaic of body features also includes sturdy ribs, the first vertebrate neck, and both gills and lungs. Paleontologists recently unearthed fossils of such a creature, which met their expectations for a proposed missing link between fish and the earliest land vertebrates. These relics derive from an era that corresponds to a 9-million-year gap in the vertebrate fossil record.

The new fossils turned up in an Arctic region decades ago pinpointed as a likely location for a transitional creature that would be well adapted to life in the shallows but also mobile on land. Some paleontologists are predicting that the species will become an evolutionary icon as important as *Archaeopteryx*, the first bird.

These fossils and a reexamination of others found decades ago are providing insights into ancient vertebrates' transition from water to land. Scientists are also developing a new understanding of how some of the earliest land vertebrates moved.

UP NORTH Situated far north of the Arctic Circle, Canada's Ellesmere Island is a cold, harsh place. Temperatures rarely rise above the freezing point, soil and vegetation are sparse at best, and the weather is so foul that paleontologists can conduct fieldwork for only a month or so each summer. Even during those short stints, blustery conditions can make prospecting for bones difficult.

After spending several days during the 2004 field season hammering at the ice-covered rocks in one of Ellesmere's bluffs, researchers spied a portion of a fish skull protruding from the stone. "That's ideal, having the snout sticking out, because in the cliff behind it is likely the rest of the animal," says Neil H. Shubin, a University of Chicago paleontologist who was on that expedition.

Deeper digging in the rocks—laid down as floodplain sediments some 382 million years ago—did indeed reveal the near-complete remains of a 1.3-meter-long fish unlike any previously discovered. About 8 m away, the researchers found another specimen, this one twice as long as the first. And then, they found yet another, close in size to the first.

"Within 2 weeks, we had three specimens of a creature that we knew was sitting at the cusp of the transition between aquatic and land-dwelling animals," says Shubin. The fossils revealed all the hallmarks expected of a missing link between fish and land vertebrates. The team gave the animal the genus name *Tiktaalik*, which means "large, freshwater fish" in Inuktitut, a native language of the region that includes Ellesmere Island.

The upper surface of the *Tiktaalik* body was covered with distinctive bony scales similar to those of other fish of the same era. Grooves along certain bones at the rear of the creature's skull hinted that *Tiktaalik* had well-developed gills, says Edward B. Daeschler of the Academy of Natural Sciences in Philadelphia.

However, the fossils don't include an operculum, or gill cover, that would have protected the delicate structures and moved oxygenated water across them. The lack of that bony structure freed the animal's skull from its shoulder girdle, giving the creature's spinal column extra flexibility and, in essence, a neck. *Tiktaalik* is the only fish known to have had a neck, notes Daeschler. He, Shubin, and their Harvard colleague Farish A. Jenkins Jr. describe the creature in the April 6 *Nature*.

Tiktaalik probably relied on both gills and lungs to obtain oxygen. The creature's broad, flat head, which was shaped like a bellows, would have enabled it to gulp air efficiently, the technique used by early air breathers to transfer oxygen into their primitive lungs.

Other physical features highlight *Tiktaalik*'s transitional position between fish and land vertebrates. The creature's four fleshy appendages contained bones analogous to the upper- and lower-limb bones of all subsequent tetrapods. These protolimbs could flex at the shoulder, elbow, hip, and knee just as the limbs of people and other modern land animals do. That range of motion and the length of the protolimbs enabled *Tiktaalik* to assume a posture in which the appendages bear weight.

> "This really is what our ancestors looked like when they began to leave the water."
>
> — JENNIFER A. CLACK, UNIVERSITY OF CAMBRIDGE

Unlike the fins of its ancestors, those at the end of *Tiktaalik*'s protolimbs included bones analogous to those in human wrists and fingers. Analyses of how those *Tiktaalik* bones fit together suggest that the creature's fins could flex outward about 90°, placing them in a position like that of a person's hand when doing a push-up, says Shubin.

Such a configuration would have provided a stable yet flexible extremity that could conform to a variety of surface textures and terrains. Therefore, *Tiktaalik* was well adapted to walking along the bottoms of lakes and streams, wading in the shallows, and even walking on land if necessary. "It was one of the world's first multitaskers," quips Shubin.

Says Jennifer A. Clack, a vertebrate paleontologist at the University of Cambridge in England, "This really is what our ancestors looked like when they began to leave the water."

The creature's body structure hints that *Tiktaalik* could also have spent considerable time out of water. Unlike the rodlike ribs of a typical fish, those of *Tiktaalik* are broad, flat, and overlapping. Such an arrangement provides a stiffer body, which would have better supported the creature when it made excursions onto land. Fish that never left the water, where buoyancy counteracts gravity, wouldn't have needed such ribs, says Daeschler.

INTO THE GAP About 385 million years ago, what is now Ellesmere Island was part of a continent that straddled the equator and reached what are today subtropical latitudes. Scientists have dubbed that landmass Euramerica because it later

broke apart to form Europe and North America. The fern-filled rain forests that covered the region teemed with wingless insects and other arthropods, and the tropical rivers and coasts were crowded with fish.

The earliest known tetrapods lived in regions that became Latvia and Scotland about 376 million years ago. So, paleontologists suspected that the vertebrates of the water-to-land transition lived in the waters of Euramerica. Waters of the future Latvia produced a fish called *Panderichthys*, previously the closest known relative to early tetrapods. Its protolimbs were fleshy and ended in fins. So, Shubin and his colleagues looked to the 382-million-year-old rocks of the once-nearby Ellesmere Island for an earlier transitional creature.

The well-preserved remains of *Tiktaalik* go a long way, but not quite the whole way, toward filling the gap in the fossil record between the earliest tetrapods and the lobe-finned fish that preceded them, says Clack. Even though the bones in *Tiktaalik*'s fin resemble those of tetrapod digits, they're still very much part of a fin. If the digits of early tetrapods evolved from these bones, the process must have involved considerable changes in anatomical development, Clack notes.

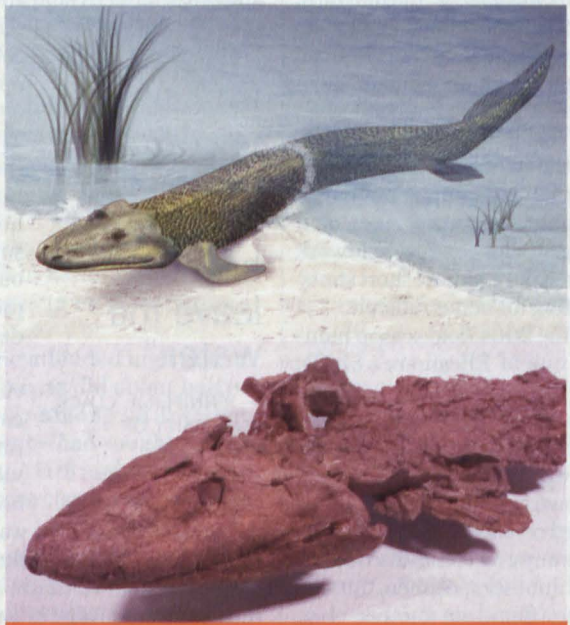
Much of the importance of transitional fossils such as *Tiktaalik* lies in how they resemble and differ from their nearest neighbors on life's family tree, Clack comments in the April 6 *Nature*.

Tiktaalik wasn't a full-time land dweller, which indicates that the evolutionary development of weight-bearing limbs began early. But why would aquatic animals leave the water? Land life presents many difficulties. Besides having to deal with gravity, animals on land run the risk of desiccating and are exposed to damaging wavelengths of solar radiation that are blocked or diminished by water.

Plants had colonized dry land, and arthropods such as giant millipedes and wingless insects scurried through the resulting ecosystems. However, the tooth structure of *Tiktaalik* suggests that it—and possibly other such experiments in evolution—weren't exploiting those previously untapped food sources, says Shubin. It's more likely that such creatures, not wanting to become a meal themselves, were escaping aquatic predators, he proposes.

Water quality might have been another evolutionary pressure driving fish out of water. The evolution of plants that shed their leaves on a regular basis resulted in large amounts of organic material ending up in rivers, streams, and coastal waters, Clack notes. The decomposition of that material, along with the plants and animals that those nutrients nourished, robbed the water of oxygen. Because gases aren't as soluble in warm water as they are in cold water, long-term warming of the climate exacerbated the decrease in oxygen dissolved in the world's waters.

At the same time, plants, including those that had expanded onto land, were pumping ever-increasing amounts of oxygen into Earth's atmosphere (*SN: 12/17/05, p. 395*). This made breathing air a more efficient way to obtain oxygen.



HAULING OUT — *Tiktaalik* provides an evolutionary link between early land vertebrates and their lobe-finned ancestors. Artist's reconstruction (top) was based on 382-million-year-old remains (bottom) unearthed on Canada's Ellesmere Island.

ON THE MOVE As *Tiktaalik*'s successors spent more time on land, fins evolved into digits. The best known of these early land-dwelling tetrapods are *Ichthyostega* and *Acanthostega*, both of which lived about 365 million years ago in what is now Greenland. Nevertheless, some aspects of *Ichthyostega*'s anatomy, including the structure of its ear, suggest that the creature spent a significant amount of time in the water (*SN: 9/13/03, p. 173*).

Paleontologists have unearthed hundreds of specimens of *Ichthyostega*. However, all those fossils are fragmentary, and no single specimen includes a complete spinal column, says Clack. Previous reconstructions of *Ichthyostega*, which were typically based on just a few bones, portrayed all the creature's vertebrae, from its neck to its tail, as being similar. However, a new analysis by Clack and her colleagues Per Ahlberg and Henning Blom of Uppsala University in Sweden indicates that those interpretations are probably wrong.

In their study, the researchers scrutinized the six *Ichthyostega* specimens that include substantial portions of the creature's vertebral column. Clack and her colleagues found that the vertebrae in some segments of *Ichthyostega*'s spinal column were shaped differently than those in other segments. In particular, the bony flanges that protrude upward from the vertebrae—structures called neural arches—were tilted at different angles in four different regions. These differences hadn't been seen in previous reconstructions.

Ichthyostega is the earliest known tetrapod to have had a spinal column segregated into such sections, says Clack. She, Ahlberg, and Blom described their reconstruction in the Sept. 1, 2005 *Nature*.

Like *Tiktaalik* but unlike fish, *Ichthyostega* had wide ribs, reports Clack. The ribs were so broad that, per her team's reconstruction, each would have overlapped three of its neighbors. This bony girdle would have provided support for the creature's body, but it would also have diminished its side-to-side flexibility.

Bony protrusions on *Ichthyostega*'s spinal vertebrae would also have constrained sideways movement. However, the size and shape of muscle attachments on the spinal vertebrae suggest that the creature could flex its lower back as people do when bending forward to touch their toes.

Therefore, *Ichthyostega* probably had one of two gaits, says Clack. The creature could have walked with diagonally synchronized limb movements—that is, by moving its front-right limb and left-rear limb together, then moving its front-left limb and right-rear limb. Many modern animals travel in this way.

Alternately, *Ichthyostega* could have moved along, inchworm-style.

Detailed analyses of the surfaces in *Ichthyostega*'s joints may shed additional light on the creature's walking style, the researchers note.

Researchers speculate that *Tiktaalik* propelled itself through the water with its tail, but they haven't yet investigated how the creature moved on land.

Although *Tiktaalik* has shrunk the gap in the fossil record between tetrapods such as *Ichthyostega* and the lobe-finned fish that preceded them, that gap hasn't gone away, says Clack. Another breach exists between partially aquatic species such as *Ichthyostega* and *Acanthostega* and the fully terrestrial tetrapods that arose millions of years later.

Clack is optimistic that further research will fill those holes. "The world is peppered with large areas of unexplored rocks of the right age to yield more transitional fossils," she says. The discovery of *Tiktaalik* may herald many groundbreaking finds to come. ■

Z. DERETSKY/NATIONAL SCIENCE FOUNDATION, DAESCHLER

OF NOTE

ASTRONOMY

Spewing superdust

Astronomers have identified a type of supernova as the main source of space dust, one of the building blocks of stars and planets.

A core-collapse supernova—the most common type of exploding star—is triggered when a massive star can no longer resist the power of its own gravity. The star's core implodes while its outer layers blast into space. The material that's expelled in this way eventually condenses, and new observations suggest that most cosmic dust comes from this condensation.

DUST THRUST Satellite-observed emissions from supernova 2003gd, which is the green dot at the center of this infrared image, suggest that such exploding stars are the main source of space dust.

SPITZER

Angela Speck of the University of Missouri–Columbia and her colleagues used data from visible-light telescopes as well as NASA's infrared Spitzer Space Telescope to study the supernova 2003gd, about 30 million light-years from Earth. Mid-infrared observations of the supernova 499 to 678 days after it appeared indicate that there were large amounts of dust coming from the explosion. Theory suggests that the dust from the supernova may be as heavy as 2 percent of the mass of the sun, Speck and her colleagues report in an upcoming *Science*.

If that rate of dust expulsion is typical, it would suggest that core-collapse supernovas have been major producers of dust throughout cosmic history. —R.C.

ENVIRONMENT

Gasp! Ozone limits don't protect babies

In healthy infants, even ozone concentrations well below those allowed by federal law trigger asthmalike symptoms, a new study shows.

The finding indicates that federal limits on this pervasive pollutant, a prime constituent of smog, don't protect infants "from rather severe respiratory symptoms," says epidemiologist Elizabeth W. Triche of the Yale University School of Medicine.

Triche's team recruited 691 women with 3-to-5-month-old infants from nonsmoking households around Roanoke, Va. Sixty-one moms had asthma, signaling that their babies were at high risk for developing the disease. The researchers collected daily respiratory data, as reported by the mothers, on all the children for 83 days in summer—the peak ozone season—and then correlated the infant's symptoms with outdoor measurements of several air pollutants.

As ozone values climbed, so did the risk of wheezing and troubled breathing in the babies, Triche's team reports in the June *Environmental Health Perspectives*. The other pollutants, such as fine particulates, didn't show that correlation.

For each 11.8 parts per billion (ppb) increase in average daily concentrations in ozone, the likelihood of wheezing increased by 41 percent in all the infants and 91 percent in those with asthmatic moms. Each 11.8 ppb increase in ozone also increased the risk of labored breathing by almost 30 percent for all kids and more than doubled it in babies with asthmatic moms.

These findings dovetail with those that Triche's group reported 3 years ago in 6-to-12-year-old children. The big difference: Those children had asthma. In the new infant study, she notes, "children were not asthmatic." —J.R.

BEHAVIOR

Sharp rise noted in meds for youths

Antipsychotic-drug treatment of children and teenagers seen by office-based physicians increased dramatically between 1993 and 2002, according to a national study.

In the United States, the number of office prescriptions of antipsychotic medications for young people increased from about 201,000 in 1993 to 1,224,000 in 2002, reports a team led by psychiatrist Mark Olfson of Columbia University. The results, for people 20 years old or younger, come from data collected annually from about 3,000 randomly selected physicians with office practices. The team reports the findings in the June *Archives of General Psychiatry*.

Psychiatrists, rather than primary care physicians, wrote the majority of antipsychotic prescriptions for the youths. Nearly all prescriptions were for the newest such medications—clozapine, risperidone, olanzapine, and quetiapine—which can produce weight gain and diabetes. The Food and Drug Administration has yet to endorse any of the new antipsychotics for use by youngsters.

White males were more likely to receive antipsychotic prescriptions than were females or males of any other race, the scientists say. Youths who received the drugs typically had diagnoses of conduct disorder or other behavior problems; mood disorders; developmental disorders or mental retardation; or psychotic disorders.

Declining psychiatric-hospital treatment for children and teens during the study period may have boosted the number of kids with mental disorders seen in physicians' offices, contributing to the upswing in antipsychotic prescriptions, the researchers say. Data from office visits don't include young people who received antipsychotic treatment elsewhere, such as in community clinics, the study authors add. —B.B.

GENETICS

Variety spices up Neandertals' DNA

A surprising amount of genetic diversity characterized Neandertals, the Stone Age species with a disputed place in human evolution, a research team reports. The new finding stems from a small piece of DNA recovered from a 100,000-year-old Neandertal tooth previously found at the Scladina cave in Belgium.

Until now, DNA has been retrieved from Neandertal fossils dating to no more than 42,000 years ago (*SN: 5/17/03, p. 307*).

Catherine Hänni of École Normale Supérieure in Lyon, France, and her colleagues compared the chemical sequence of the 100,000-year-old Neandertal DNA with sequences previously extracted from later Neandertal specimens as well as with corresponding sections of DNA from people today. In all cases, the genetic material came from mitochondria, energy-producing cell structures, rather than from a cell's nucleus.

DNA from Scladina differs in some ways from that of later Neandertals, a sign that genetic diversity diminished over time, the researchers conclude in the June 6 *Current Biology*. The Neandertal sequences exhibit chemical arrangements not observed in people, supporting the theory that Neandertals produced no or few offspring with our ancient forerunners, they say.

Still, such findings don't settle the debate over whether Neandertals interbred with Stone Age *Homo sapiens* (*SN: 3/20/04, p. 181*). —B.B.

OF NOTE

ASTRONOMY

Not a planet?

Two years ago, European astronomers found what they hailed as the first image of an extrasolar planet. New observations of the object add to evidence that it's not a planet after all.

The body, about eight times as heavy as Jupiter, resides next to a failed star, a brown dwarf dubbed 2M1207 (*SN: 5/7/05, p. 291*). The brown dwarf is only about three times as heavy as its companion.

The European group suggested that the planetary-mass object coalesced from the outer reaches of a gas-and-dust disk surrounding the brown dwarf. But other astronomers argued that a massive planet probably couldn't have formed in the sparse outer part of the disk.

At the June meeting of the American Astronomical Society in Calgary, Alberta, Ray Jayawardhana of the University of Toronto and his colleagues reported new observations of the companion to the brown dwarf. Their study indicates that the smaller object also has its own gas-and-dust disk.

This makes it likely that the body and the brown dwarf formed together, just as a pair of stars would, from the collapse of a single gas cloud, Jayawardhana says. If a planetary-mass object formed as a star does, rather than coalescing within a disk, then the object shouldn't be called a planet, according to the International Astronomical Union.

"The discovery of a disk around the planetary-mass companion to 2M1207 should be a bit of a relief to planet-formation theorists" who doubted a planet could arise so far from a brown dwarf, says Alycia Weinberger of the Carnegie Institution of Washington (D.C.). —R.C.

BIOMEDICINE

Inactivity, not altitude, is probably behind blood clots

Low cabin pressure isn't to blame for the rare but dangerous blood clots that some passengers get during long flights, new evidence suggests. The likely explanation for the phenomenon, sometimes called economy-class syndrome, is that long periods of sitting promote clots, particularly in susceptible people, investigators say.

Deep-vein thrombosis—a condition in which blood clots form in veins deep in the legs—can be lethal if a clot breaks away and travels to the lungs. Past studies suggested that the low air pressure on flights increases the tendency of blood to coagulate.

To test that possibility, William D. Toff of the University of Leicester in England and his colleagues simulated the atmospheric conditions of a daytime, long-haul flight. A few at a time, 73 healthy volunteers sat in an airtight chamber for 8 hours, as if they were in a cramped plane cabin.

Experimenters controlled the chamber's air pressure so that it was nearly 1 atmosphere, or sea level pressure, for some experiments and, for others, just 0.74 atmosphere, the least permitted on international flights.

Drawing blood samples from the volunteers before and after each test, the researchers measured changes in 21 substances that reflect activation of the blood's clotting mechanisms. They found some differences between the morning and the afternoon samples. But those fluctuations occurred regardless of the air pressure to which volunteers were exposed.

The team concludes that although low pressure doesn't contribute to blood clots in most healthy passengers, the study doesn't rule out a possible effect in people at higher risk of thrombosis or with genetic predispositions to it. The researchers report their findings in the May 17 *Journal of the American Medical Association*. —B.H.

MEETINGS

American Geophysical Union
Baltimore, Md.
May 23 – 26

EARTH SCIENCE

Subglacial lakes may not be isolated ecosystems

Large volumes of water occasionally flow between the lakes that lie deep beneath Antarctica's kilometers-thick ice sheet, a new analysis suggests.

In late 1996, radar altimeters on a European Space Agency satellite began to measure a drop in elevation across a 600-square-kilometer area of eastern Antarctica. During the next 16 months, the surface elevation fell about 3 meters, indicating a loss of water from a lake that probably lies beneath the region, report Andrew Shepherd of the University of Edinburgh and Duncan J. Wingham of University College London. During that same period, the ice over two subglacial lakes 290 km away rose about 50 centimeters and 2 m, respectively.

Researchers have found more than 145 subglacial lakes in Antarctica, some of which may contain microbes (*SN: 10/9/99, p. 230*) and higher forms of life (*SN: 3/3/01, p. 139*). Most scientists had presumed that those ecosystems have been isolated since the continent's ice sheet formed millions of years ago. However, the new findings hint that many of the lakes may be linked by subglacial tunnels that transfer water and organisms between the covered bodies of water. —S.P.

ENVIRONMENT

Cleaning up pollution, whey down deep

Lab and field tests hint that dairy whey, a lactose-rich by-product of the dairy industry, could be used to clean up underground water supplies tainted with the solvent trichloroethylene (TCE), an industrial degreaser.

Consuming TCE or inhaling its fumes can cause liver and kidney damage, affect heart function, and possibly cause cancer (*SN: 5/29/99, p. 343*). The chemical is in groundwater at more than half of the Environmental Protection Agency's Superfund sites.

To treat the tainted groundwater, engineers often pump hydrogen-yielding substances such as sodium lactate into the ground, where they react with TCE by removing its chlorine atoms. That turns it into a relatively harmless hydrocarbon, says Elizabeth S. Semkiw, a chemist at Western Michigan University in Kalamazoo.

Her team's tests indicate that a slurry of whey pumped into the ground may do the same trick, if sufficient numbers of bacteria are added. Whey-munching microbes generate lactate compounds as well as acetates, butyrates, and other substances that can strip chlorine atoms from TCE.

In the lab, a whey-microbe mix eliminated a 10-parts-per-million concentration of the pollutant from simulated groundwater in less than 2 weeks, says Semkiw. Also, field tests showed that groundwater laced with TCE, after flowing through a subterranean curtain of whey, contained breakdown products of the chemical.

Further tests will assess whether remediation with whey is more cost-effective than the use of chemicals such as sodium lactate, says Semkiw. —S.P.

Books

A selection of new and notable books of scientific interest

WALKING ZERO: Discovering Cosmic Space and Time along the Prime Meridian

CHET RAYMO

In 1884, the marking of the prime meridian—that invisible north-south line through Greenwich, England, that universalized time throughout the world—also marked a monumental change in the way in which people thought about time and space. The passing of days could no longer be measured only locally. As commerce expanded internationally and voyages between continents shrank to a matter of days and then hours, time became a planetwide phenomenon. In this book, Raymo describes a walk along the meridian from Brighton north through Greenwich to a point on the North Sea near Barrow upon-Humber. Along the way, the author visits the former residences of many of science's greatest leaders, such as Isaac Newton's chambers at Cambridge and Charles Darwin's home in Kent. From those points and others, the author ponders how people came to view the notion of time and the cosmos as things independent of and separate from human experience. The scientific method was the key to viewing the world objectively and thus discovering the fundamental nature of the universe, Raymo says. Eratosthenes calculated the Earth's circumference in the fourth century B.C. Galileo discovered that Earth revolved around the sun, and not the other way around. Geologists of the18th century, such as Charles Lyell and Georges Cuvier, discovered fossils that hinted at the antiquity of Earth. These discoveries and others uprooted centuries of traditional and religious thought that had placed humankind at the center of the universe. ***Walker, 2006, 194 p., hardcover, $22.95.***

THE STORM: What Went Wrong and Why during Hurricane Katrina—The Inside Story from One Louisiana Scientist

IVOR VAN HEERDEN AND MIKE BRYAN

On Aug. 29, 2005, New Orleans officials believed that they had dodged a bullet. Hurricane Katrina, the category-4 storm that threatened to smash the city with a direct blow, had followed a different, less damaging path. The worst was yet to come, however. New Orleans became victim to a scenario that had been predicted for years, according to van Heerden, deputy director of the Louisiana State University Hurricane Center. The city's position below sea level made it vulnerable to flooding. With the failure of the levees in the hours following the storm's landfall, that's exactly what happened. Van Heerden and Bryan unapologetically reveal the hurricane specialist's take on the many failures that resulted in the destruction of many parts of New Orleans. As the scope of the tragedy became apparent, van Heerden was sought out by reporters to explain the event. Here he collects his thoughts in harrowing detail on that subject. With Bryan, he describes the levees built by the Army Corp of Engineers and how storm-surge models for years had demonstrated their insufficiencies. He charges that the Federal Emergency Management Administration ignored his and others' scientific models of hurricane damage to the city when conducting an exercise in 1994. He explains how Louisiana's unique geography and eroding wetlands made it all the more vulnerable. At every turn, bureaucracy, petty politics, and breakdowns in communication combined to create a highly preventable tragedy, Van Heerden and Bryan assert. Finally, the authors outline the necessary steps that New Orleans officials must take to prevent such a catastrophe from recurring. ***Penguin, 2006, 320 p., b&w illus., hardcover, $29.95.***

PETE DUNNE'S ESSENTIAL FIELD GUIDE COMPANION: A Comprehensive Resource for Identifying North American Birds

PETE DUNNE

Packed with details to aid in the identification of hundreds of North American birds, this book is not a field guide per se. Oversize and text heavy, it's intended as a reference by serious birders. Instead of illustrations, the guide "companion" provides extensive descriptions that emphasize birds' overall features, habitats, behavioral traits, and differences. A typical field guide focuses much more on specific body parts and plumage than Dunne's book does. Director of the Cape May Bird Observatory in New Jersey and author of many books for bird-watchers, Dunne encourages his readers to narrow their focus and to concentrate on the birds that live near them. In each species account, he first details that bird's range, habitat, cohabitants, and movement and migration. Then, he describes the size and shape of the bird and its plumage, behavior, flight styles, vocalizations, and other important traits. ***Houghton Mifflin, 2006, 710 p., hardcover, $29.95.***

RICHARD DAWKINS: How a Scientist Changed the Way We Think

ALAN GRAFEN AND MARK RIDLEY, EDS.

In 1976, Richard Dawkins, an Oxford biologist, published the landmark book *The Selfish Gene*. In it, he proposed a novel way of looking at evolution. Catapulted to fame, Dawkins became one of the most influential thinkers in biology and went on to publish a string of best sellers. This book, published to coincide with the 30th anniversary of *The Selfish Gene*, is a collection of essays by various scientists, philosophers, and writers, including Daniel Dennett, Steven Pinker, and John Krebs, who reveal how Dawkins' work has affected their own understanding of such topics as the battle of the sexes, evolution, cognitive science, and genetics. The editors, former graduate students of Dawkins, include essays detailing disagreements with Dawkins' ideas. The collection ends with perspectives on how atheist Dawkins changed popular notions about religion, people's search for meaning, and human evolution. ***Oxford, 2006, 283 p., hardcover, $25.00.***

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LETTERS

Cuts on the bias

After taking some of the bias tests, I am very skeptical ("The Bias Finders: A test of unconscious attitudes polarizes psychologists," *SN: 4/22/06, p. 250*). Since the major tool is speed of reaction, and since my eyes are not too good now, the results were very curious and probably totally unreliable: Though a lifelong, unprejudiced heterosexual, the test has me biased in favor of gays; as a lifelong champion of color blindness regarding race, I am indicated as being biased against blacks. Sorry, I don't buy either of these results.

TIBOR R. MACHAN, SILVERADO, CALIF.

I took the IAT racial-prejudice test several months ago. The reversal between the first half of the test (whites good) and the second half (blacks good) also reverses the presentation of the choices to be clicked. It was a bit like buying a new laptop and having to get used to the shift key in a different position. I could feel myself slowing down. Obviously, I wound up with a score of "biased," although nothing else in my life supports that conclusion. I find it interesting that about half of the blacks taking the test also have a "pro-white bias." Perhaps, in addition to bias, the test measures the speed with which a person learns or unlearns a given multiple-choice pattern. It would have been more confidence inspiring if the researchers had controlled for that factor before using the test to draw broad conclusions about racial attitudes.

MIA MOLVRAY, PORT HUENEME, CALIF.

During my years of world travel, I've noticed a color bias everywhere. Black is associated with death, impurity, and the unknown; white with purity, cleanliness, life, and spirituality. The two colors, by themselves, evoke a bias in all people. If researchers say they have taken this into account, I'd love to know how.

CARL ABBOTT, SANTA CRUZ, CALIF.

Since xenophobia and ethnocentrism are traits in all known human populations, it is probable that these traits are in part hardwired, rather than totally learned. Therefore, it's not surprising that the IAT finds these traits even among those who profess to be free of ethnic and racial prejudice.

DAVID M. GILLIAM, DERWOOD, MD.

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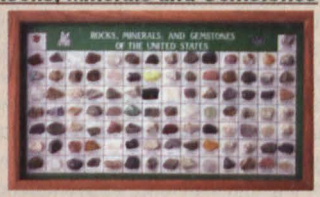

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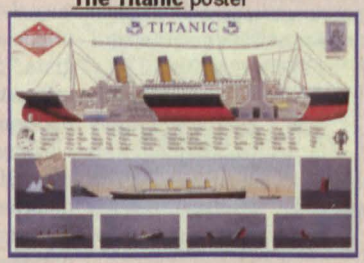

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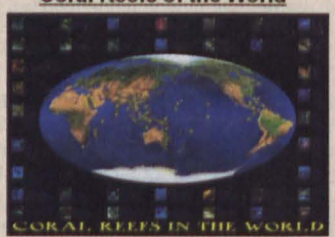
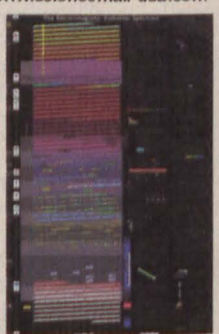
Coral Reefs of the World



Coral Reefs of the World - poster New! Great poster on the subject! 38 reefs are covered with associated pictures. Some representative pictures are: Belize, Coco Island, Florida Keys, Great Barrier Reef and more. Size: 26 1/4" WX 39"L, Laminated, Order#JPT-reefs, Cost: $21.95



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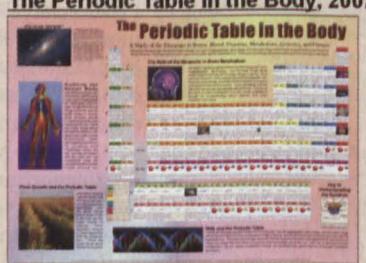
The Periodic Table in the Body, 2007



The Periodic Table in the Body - poster discusses each of the elements on the Periodic Table in relation to how the body uses them. There are five sections to this periodic table poster. One section examines why we are indeed "star stuff" and our chemical ties to the universe; others profile the chemical makeup of the human body, plant growth, DNA, and the role of the elements in brain metabolism. Full color, laminated, 2cd Edition, 28"W X 38"H poster, Copyright 2007.....#JPT-4191.... Cost $28.95, Special: 2 for $50.

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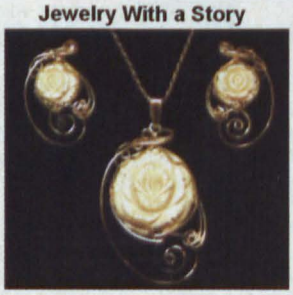

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