SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

MARCH 1, 2003 PAGES 129-144 VOL. 163, NO. 9

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stem cell alternative?

ancient hominid finds

decorative H_2O repellents

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old in the young cosmos

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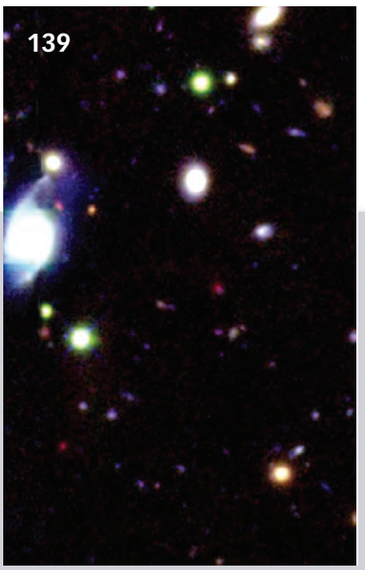

Features

This Week

THIS WEEK ONLINE
www.sciencenews.org

Tribute Scientists and colleagues pay tribute to space-science writer Jonathan Eberhart (1942–2003).
See www.sciencenews.org/jonathan.asp.

Of Note

Meetings

Departments

Cover Color composite of a small patch of sky imaged in visible light and the near-infrared. The striking colors reflect the variety of galaxies and their distances from Earth. The near-infrared observations found several galaxies that appear to have been already elderly when the universe was young. (European Space Agency/NASA)
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Stem Cell Surprise

Blood cells form liver, nerve cells

A person's blood could someday provide replacement cells for that individual's damaged brain or liver, a provocative study suggests. Human blood contains so-called stem cells that can be transformed outside the body into a variety of cell types, according to the report. This unexpected, and accidental, discovery may add a new element to the politicized debate over whether stem cells that persist in adults can match the therapeutic potential of stem cells derived from human embryos.

The possible new source of adult stem cells came to light when a coworker became ill and couldn't attend to petri dishes containing human blood cells called monocytes, says Eliezer Huberman of Argonne (Ill.) National Laboratory. In the body, these white blood cells migrate into tissues and mature into specialized immune cells, such as macrophages. Huberman's team has been studying the cellular signals behind this maturation.

Left without nutrients, some of the unattended monocytes morphed into cells that didn't look like immune cells, Huberman's team noticed. Following up on this chance observation, the researchers identified a subgroup of monocytes that they could convert into various kinds of cells.

For example, exposing these select monocytes to a chemical called nerve growth factor transformed about 90 percent of them into cells with the shape and projections characteristic of nerve cells. These cells also contained typical nerve cell proteins and enzymes, the researchers report in an upcoming *Proceedings of the National Academy of Sciences*. Using different growth factors, Huberman and his colleagues found that they could also readily switch the isolated monocytes into what appear to be liver cells, blood vessel cells, and immune cells unrelated to monocytes or macrophages.

The researchers speculate that the versatile monocytes they've identified help the human body repair itself. "I think the function of these stem cells is to go to organs that are damaged," says Huberman.

Some stem cell researchers, however, remain unpersuaded by Huberman's data. "It is hard to know if this is just a curious artifact of cell culture or reflects cells with actual therapeutic potential," cautions George Daley of the Whitehead Institute for Biomedical Research in Cambridge, Mass.

Researchers must take the various cells derived from the blood monocytes and inject them into animals to confirm that the cells have assumed new functions, says Daley. Such experiments are next on the agenda, says Huberman.

Until recently, researchers had generally assumed that most adult tissues either have no stem cells or harbor ones that can reproduce only the tissue in which they reside. Yet some experiments have suggested that bone marrow, already well known as the source of all blood cells, contains certain cells that can form nerve, muscle, and other types of nonblood cells (*SN: 6/22/02, p. 390*).

Huberman notes that the monocyte population his group identified differs from those multipurpose bone marrow stem cells. "Our cells have the typical monocyte-macrophage markers," he says. And Huberman points out that it will be much easier to harvest the blood cells from a person than to surgically collect bone marrow.

In the past, opponents of research on human embryos have used promising findings from experiments with adult stem cells to argue against work with embryonic stem cells. Abandoning that line of research would be premature, according to Huberman. "It's very difficult to predict which system will give a better payoff. Both embryonic and adult stem cells should be pursued," he says.

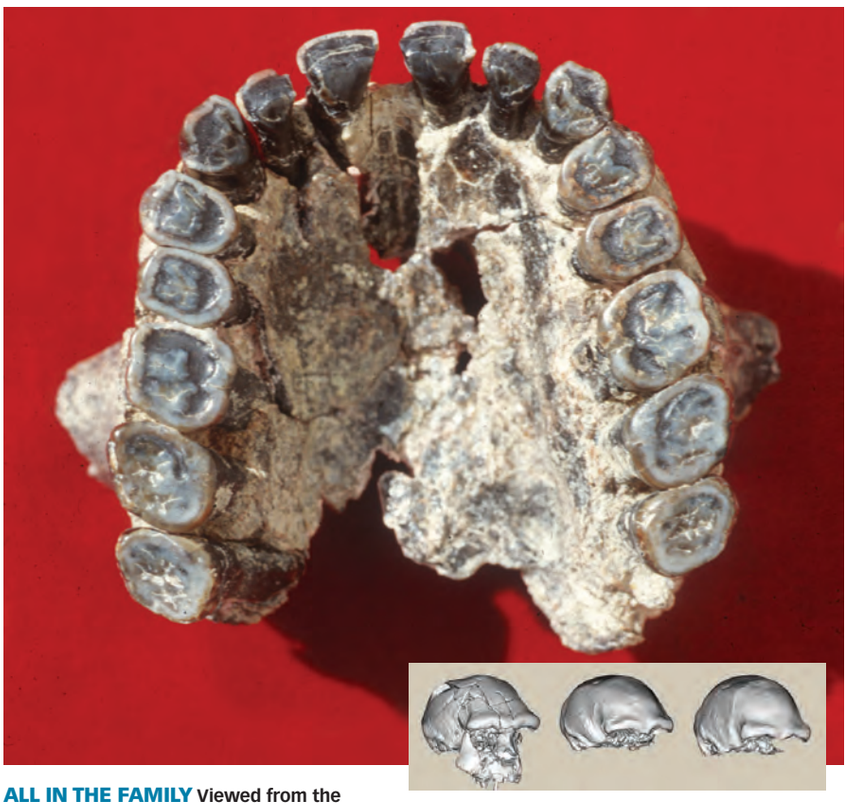
Huberman's team and Argonne National Laboratory have submitted patent applications on the identification and medical use of the monocyte stem cells. —J. TRAVIS

Pieces of a Disputed Past

Fossil finds enter row over humanity's roots

Two scientific teams have presented fossil discoveries with controversial evolutionary implications for two ancient species traditionally regarded as direct ancestors of *Homo sapiens*.

A 1.8-million-year-old upper jaw discovered in eastern Africa solidifies the position of *Homo habilis* as the oldest known member of the *Homo* genus, say anthropologist Robert J. Blumenschine of Rutgers Uni-



BLUMENSCHINE; R.T. KONO

ALL IN THE FAMILY Viewed from the bottom, the recently discovered *Homo habilis* jaw exhibits the roof of its mouth and its full set of upper teeth. Inset shows a digital reconstruction of a newly found *Homo erectus* cranium (middle) between reconstructions of an older (left) and a younger (right) Javanese *H. erectus* find.

versity in New Brunswick, N.J., and his colleagues. Reported in the Feb. 21 *Science*, their analysis also challenges the widespread view that another species, *Homo rudolfensis*, lived in eastern Africa at the same time as *H. habilis*.

In the Feb. 28 *Science*, anthropologist Hisao Baba of the National Science Museum in Tokyo and his coworkers describe an undated *Homo erectus* cranium found in Java that fuels another prehistoric fray. According to the researchers, this specimen supports the contentious theory that *H. erectus* evolved in isolation in Indonesia and died out on Java about 35,000 years ago, after modern humans had settled on the island (*SN: 12/14/96, p. 373*).

Blumenschine's team excavated the *H. habilis* jaw in Tanzania's Olduvai Gorge. Fossil hunters had found the original *H. habilis* specimen, a lower jaw, in the same gorge nearly 40 years ago.

The newly discovered jaw was in sediment that also contained the bones of extinct gazelles and other animals, as well as simple stone tools. Some of the animal bones had incisions made by such tools, perhaps during the scavenging of carcasses by *H. habilis* members.

The estimated age of the *H. habilis* fossil hinged on analyses of argon isotopes in volcanic ash below the finds and evidence above the finds of a previously known and well-dated reversal in Earth's magnetic field.

Blumenschine says the new fossil bears anatomical resemblances to both the original *H. habilis* fossil and to a partial skull found in Kenya that's usually classified as *H. rudolfensis*. "All three specimens are members of *H. habilis*," he holds. However, several smaller-brained, smaller-toothed Olduvai fossils typically regarded as *H. habilis* represent a separate *Homo* species, Blumenschine and his colleagues conclude.

Bernard Wood of George Washington University in Washington, D.C., disagrees. In his view, larger and smaller Olduvai fossils actually represent, respectively, males and females of a species that wasn't part of the *Homo* lineage. Wood classifies the Kenya skull fragment as a separate non-*Homo* species.

Another thorny debate swirls around *H. erectus*. According to Baba's team, the latest fossil cranium of this species in Java, found by construction workers collecting sand by a river, exhibits an anatomy intermediate between a set of Javanese *H. erectus* fossils dated to at least 200,000 years ago and another set from at least 35,000 years ago. *H. erectus* on Java had little effect on the evolution of *H. sapiens* in that region, the scientists argue.

"*Homo erectus* probably did evolve on Java as a small, isolated population," comments Philip Rightmire of the State University of New York at Binghamton.

Advocates of multiregional evolution reject that view. They say that *H. erectus* was just one variant of *H. sapiens*, which evolved in several parts of the world, including Indonesia.

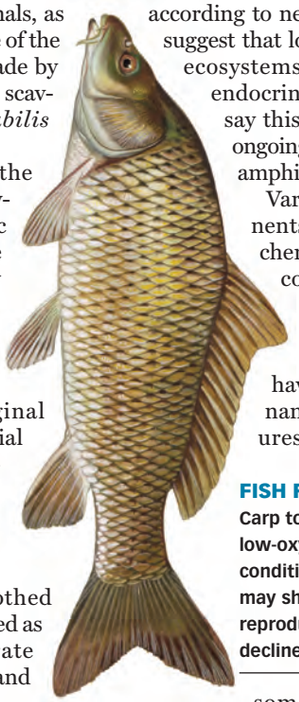
Even amid such debates, "it's nice to have this additional fossil evidence," Wood says. —B. BOWER

Sexual Hang-Up

Fish hormones change when oxygen is scarce

Oxygen deprivation tampers with sex hormones in fish and impairs reproduction, according to new research. The results suggest that low oxygen in freshwater ecosystems can disrupt animals' endocrine systems. Researchers say this link might explain the ongoing decline in some fish and amphibian species.

Various pesticides, components of plastics, and other chemical pollutants known collectively as endocrine disruptors mimic natural hormones such as estrogen. Scientists have linked such contaminants to reproductive failures in many animals and to oddities ranging from deformities in frogs to sex changes in fish. The disruptors are also suspected of underlying some breast cancer in women.



FISH FIND Carp tolerate low-oxygen conditions but may show a reproductive decline.

Researchers have found that other physical factors—including artificial lighting and magnetic fields—can similarly disrupt hormones (*SN: 7/3/93, p. 10*). Now, Rudolf S.S. Wu of the City University of Hong Kong and his colleagues add oxygen deficiency, or hypoxia, to the list of endocrine disruptors.

Human activities that overload fresh water with plant nutrients, such as components of fertilizers and detergents, reduce concentrations of dissolved oxygen in lakes and rivers. Wu and his colleagues found earlier that oxygen-starved fish have an altered metabolism and remain smaller than normal. The team wondered whether the almost suffocating conditions might also stunt fish reproduction.

To find out, the team placed immature adult carp—a species unusually tolerant of hypoxia—in lab conditions of either normal or one-seventh normal oxygen concentrations for 12 weeks. The researchers then ran the two groups through a battery of reproductive tests.

In a forthcoming *Environmental Science and Technology*, the team reports that hypoxia elevated concentrations of one form of estrogen in male fish and decreased testosterone. That hormonal shift inhibited testicular growth, as well as sperm production and motility.

In female fish, the same conditions reduced sex-hormone concentrations and egg production. Furthermore, the oxygen deficit halved the success of sperm at fertilizing eggs and slashed the number of eggs that hatched into healthy offspring.

"There is every good reason to believe that hypoxia may also cause endocrine disruption in other fish and amphibians," Wu says. "More sensitive species [than carp] may be affected to an even greater extent," he adds.

The researchers provide "good evidence that oxygen levels are an environmental factor that needs to be considered" for fish reproduction, says reproductive toxicologist James J. Nagler of the University of Idaho in Moscow. In some parts of the world, he adds, hypoxia might rival chemicals in its importance to endocrine disruption.

For cancer epidemiologist Richard G. Stevens of the University of Connecticut Health Center in Farmington, "the idea that oxygen [concentrations] could alter hormones is fascinating." Perhaps circumstances that reduce oxygen intake—for example, air pollution or high altitude—could affect people's hormone balance, he speculates. —K. MORGAN

Waterproof Coats

Materials repel water with simplicity, style

Scientists have long sought new coatings that zealously repel water. This week, publications describe two promising finds. Research from Japan shows that water-repellant materials can also be decorative.

USFWS

In a separate report, Turkish researchers describe a way to convert a plastic into a new type of cheap, easily produced waterproofing.

Although their final coatings are different, both teams took their inspiration from nature—from the wings of a butterfly and the leaves of the lotus plant. The microscopically rough surfaces of these organisms prevent water drops from flattening, so the drops roll off and carry away dirt. Because water beads so well on these surfaces, they're called superhydrophobic.

Using the brilliantly blue *Morpho sulkowskyi* butterfly as their model, Zhong-Ze Gu of the Kanagawa Academy of Science and Technology in Japan and his coworkers designed a synthetic superhydrophobic coating in a variety of bright colors. The microstructure of the insect's wings not only shuns water but also scatters and diffracts light to create an iridescent color.

Similarly, the microstructure of the new, decorative coating repels water while producing striking colors. Gu's team made the material by permitting 6-nanometer-wide silica particles and several-hundred-micrometer-wide polystyrene spheres to assemble into a film. The researchers then heated the film to remove the polystyrene, leaving the silica particles uniformly spaced with air gaps between them. To this rough surface, the scientists added a layer of fluoroalkylsilane, a commercially available waterproofing compound. The researchers describe the procedure in the Feb. 24 *Angewandte Chemie International Edition*.

The bumpy topography enhanced the fluoroalkylsilane's water-repelling power, says Gu. By varying the distance between air gaps, the team created materials in colors ranging from red to blue and versions with no apparent color.

"It's a very clever trick," comments Manoj K. Chaudhury of Lehigh University in Bethlehem, Pa.

The new technique "may lead to self-cleaning photonic crystals for decoration and optical circuitry," adds Ray Baughman of the University of Texas at Dallas.

The new material may also provide a colorful, self-cleaning coating for cameras or windows, says Gu. It would be environmentally friendly because no organic dye would be required to create color and no detergent would be needed to clean the surface, he adds.

The Turkish research team set its sights on low-cost coatings that are easy to make and use. In the Feb. 28 *Science*, A. Levent Demirel of Koç University in Istanbul and researchers at Kocaeli University report that they've created a superhydrophobic coating from a low-cost, widely produced plastic called isotactic polypropylene, or iPP.

Making the coating is "simple, inexpensive, and time-saving," says Demirel. The Turkish group dissolved iPP in organic solvents, dropped the solution onto glass slides, and then evaporated the solvents. This procedure produced a porous plastic film that, when viewed with a microscope, "resembles a bird's nest made of branched and intermingled sticks and bumps," the researchers report. Just as they do on rough lotus leaves, water drops readily bead up on the rough plastic coating. —J. GORMAN

GU ET AL., ANGEW. CHEM. INT. ED.

RAIN COAT Water beads atop a new hydrophobic material (inset) modeled after the wings of the *Morpho sulkowskyi* butterfly. In both cases, a rough microstructure shuns water.

Mixed Results

AIDS vaccine falters in whites, may help blacks

In its first large test, an AIDS vaccine has failed to shield an at-risk population from acquiring HIV, the virus that causes the disease.

The results, released by the biotechnology company VaxGen of Brisbane, Calif., may mark a turning point in AIDS-vaccine research, says Norman Letvin of Harvard Medical School in Boston. While VaxGen should be applauded for "a landmark effort" to get a vaccine to trial, he says, many scientists expected this vaccine to fail.

"This was a first-generation approach based on work done at a time when we had a very rudimentary understanding of the virus," says Letvin. The VaxGen vaccine, known as AIDSVAX, seeks to stimulate the generation of antibodies that attack HIV.

Newer, DNA-based approaches to an AIDS vaccine might work better because they deliver genes that encode proteins that could spur production of anti-HIV immune cells, Letvin says. Some such vaccines are entering early-stage human trials.

Meanwhile, VaxGen is continuing to pursue its antibody strategy and might even consider reformulating AIDSVAX to make it more potent, company officials say. Also, the company expects results late this summer from a trial of another antibody-based AIDS vaccine in Thailand.

In the study released this week, researchers found little difference in infection rates of 3,330 people who received the AIDSVAX vaccine and 1,679 people who received inert shots. Over a 3-year period, about 5.7 percent of people in each group developed an HIV infection.

More than 90 percent of the volunteers were homosexual or bisexual men. Participants were from North America, the Netherlands, Puerto Rico, and Australia. More than four-fifths were white.

The study did turn up one provocative result: The vaccine seemed to protect some African Americans. Among the 314 blacks in the study, the infection rate was 8.1 percent in those getting a placebo and only 2 percent among those vaccinated, VaxGen reports. Specifically, 9 of 111 black volunteers who got placebo injections contracted HIV, whereas 4 of 203 blacks receiving the vaccine became infected. Most of the black volunteers were women.

According to statistical standards, this apparent protection probably wasn't due to chance, says Michael F. Para of Ohio State University, one of the study investigators.

Nevertheless, basing a finding on so few cases gives some researchers pause. "The numbers [of infections] are incredibly small," says virologist Jack H. Nunberg, of the University of Montana in Missoula.

The key ingredient of AIDSVAX is a synthetic copy of a protein found on HIV. The vaccine is specifically aimed at HIV subtype B, which is prevalent in North America, Australia, Japan, and Puerto Rico.

Blacks given the vaccine appeared to gen-

erate more anti-HIV antibodies than whites did. Antibody concentrations in blood might be influenced by gender, age, behavior, or even a person's location, says VaxGen's Phillip Berman, inventor of the vaccine. "We need to investigate all these possibilities before we can say there is a racial difference," he says.

In any event, a subtype B vaccine probably wouldn't work in Africa, where other HIV subtypes predominate, says Nunberg.

VaxGen has submitted its findings to the Food and Drug Administration. —N. SEPPA

Ancient Taint

Likely source of old dioxins identified

The burning of peat in coastal areas of Scotland could be responsible for the enigmatic concentrations of dioxins that scientists sometimes find in pre-20th-century European soil samples.

Dioxins are a class of more than 200 chlorine-rich organic chemicals that are highly toxic, trigger birth defects, and can cause cancer (*SN: 5/15/99, p. 309*). Presumed modern substances, dioxins typically are byproducts of the production of industrial chemicals such as polychlorinated biphenyls (PCBs) and some pesticides.

However, dioxins are also created during the incomplete combustion of organic carbon in the presence of chlorine. That's why they can spew from municipal incinerators and residential trash fires (*SN: 1/29/00, p. 70*). Now, biogeochemist Andrew A. Meharg and his colleague Kenneth Killham, both of the University of Aberdeen in Scotland, have shown that dioxins aren't just a modern problem.

For their experiments, the researchers obtained peat samples from a site on the northwestern coast of Scotland. Each kilogram of peat held about 114 nanograms of dioxins—probably from modern atmospheric contamination, says Meharg. However, the researchers found that the smoke and ash produced by burning each kilogram of peat included more than five times the original amount of dioxins. The chlorine required for this spike of dioxin production came from oceanic salt spray that had permeated the peat before it was dried and used as fuel, the team speculates.

If historians' estimates are accurate, each household in the area burned about 20 tons of coastal peat per year. Therefore, the region produced about 1 kg of dioxin annually. For comparison, municipal incinerators throughout the United Kingdom today collectively produce only about 11 kg of dioxins annually, says Meharg. He and Killham report their results in the Feb. 27 *Nature*.

In the Scottish highlands and islands in the 18th and 19th centuries, residents—most of them subsistence farmers—would have been exposed to dioxins in at least two ways. First, home heating came from a peat fire in the center of the floor in windowless structures known as blackhouses, which had low entrances, no chimney, and very little ventilation. Second, the farmers used peat ash as a fertilizer, a technique that would have permitted dioxins to contaminate root crops such as potatoes and turnips.

The new measurements may solve the mystery of how dioxins came to be present in soils excavated and archived in the 19th century, says Ruth E. Alcock, a chemist with Environmental Research Solutions in Cumbria, England. As it turns out, however, blackhouse residents had more to worry about than dioxin exposure. They probably suffered from respiratory illnesses brought on by other chemicals and particulates prevalent in peat smoke, Alcock says. —S. PERKINS

After Invasions

Can an ant takeover change the rules?

A rare before-and-after study of the invasion of an exotic species shows the newcomer swiftly disassembling the community, say ant biologists.

Before Argentine ants (*Linepithema humile*) swept into a nature preserve in northern California, some 20 species of native ants worked the landscape in largely segregated domains, says Nathan Sanders of Humboldt State University in Arcata, Calif. However, the invaders wiped out that pattern, Sanders and his colleagues report in an upcoming *Proceedings of the National Academy of Sciences*.

"This is the first time anyone has shown how fast an invasion can disassemble a community," says Sanders.

The data in the new paper are "very striking and will cause a lot of ecologists to think," says Thomas E. Miller of Florida State University in Tallahassee.

The small but prolific Argentine ant, which is native to South America, has made itself at home in warm climates on six continents. It was first reported in the United States in New Orleans in 1891, and now it occupies 21 states. The invading ants typically wipe out many species of native insects and can cause food shortages for insect eaters, such as horned toads, and create crises for ant-dispersed plants (*SN: 10/20/01, p. 252*).

Sanders attributes the Argentine ants' success primarily to its superior foraging and piracy of other ants' food finds.

As the ant moved north through California, "we tried to take advantage of a natural experiment," Sanders says. In 1993, he and his colleagues started monitoring Jasper Ridge Biological Preserve to see what native ant species appeared together in each of 133 circular, 40-meter-diameter test plots. The team's analysis showed that before the arrival of the Argentine ant, native species were less likely to share a habitat than chance would predict. This might indicate that competition made species keep their distance.

Applying the same analysis after the invasion, the researchers no longer detected the segregated pattern of native-ant associations. The species were either scattered at random or members of two species turned up together more often than chance predicted.

After looking at 7 years' of data, the researchers note that the loss of the segregated pattern occurred rapidly, sometimes during the first year of the invasion. The invasive ant is changing the basic rules by which the studied community operates, says Sanders.

Miller, however, says that he's not ready to accept the idea that the Argentine ants disassembled the community. He was intrigued by the instances in which species seemed to preferentially occur together after the invasion. "Perhaps, it's just assembled in a different way," Miller says. —S. MILIUS

S. PATON, FOLK-LEGACY RECORDS

Jonathan Eberhart 1942–2003

Longtime readers will mourn the death last week of Jonathan Eberhart, following a long illness. A legend among science writers, he covered the birth and adolescence of space flight and exploration for *Science News* from 1960 to 1991. He was also a renowned folk-music writer and performer (*see page 143*).

intel SCIENCE TALENT SEARCH

SCIENCE SERVICE

On behalf of Intel Corporation and Science Service, we would like to congratulate the 40 finalists of the 2003 Intel Science Talent Search. These young scientists have performed years of research for the opportunity to come to Washington, D.C. for the Science Talent Institute. As they compete for the "junior Nobel Prize" we wish them luck, and we are thankful that the future of science and technology is in their hands.

Come meet these young scientists at the Intel Science Talent Search

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Ethan Street • Livonia, MI
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Byram Hills High School

Scott Zeglin • The Woodlands, TX
Oak Ridge High School

Yi-Chen Zhang • Forest Hills, NY
The Bronx High School of Science

A SAFE SOLUTION

Disinfection at home could provide Africa with cheap and abundant potable water

BY BEN HARDER

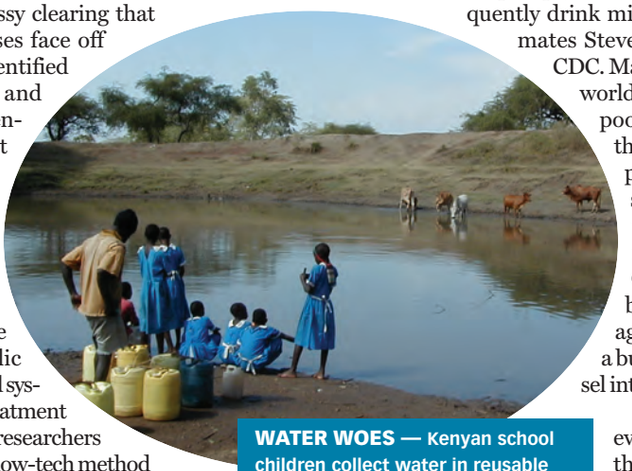
Ogongo, Kenya—To the crowd's delight, the dancer wiggles his hips and flails his arms. His bulky, blue costume—an oversized embodiment of a bottle of chlorine solution—lurches comically. In step with a drum-and-guitar accompaniment, other performers masquerade as a water jug and caricatures of a man and a woman. Among the audience are Kenyan health workers, local farmers and their children, and two conspicuous white foreigners, medical epidemiologist Rob Quick and me.

Sweating and thirsty from the equatorial heat, I take the beverage an event organizer offers me. I'm glad to see that it's a soft drink. Quick has told me more than I want to know about the microbes that flourish in the local water.

A few minutes later, in the grassy clearing that serves as their stage, two actresses face off against three actors who have identified themselves as Typhoid, Cholera, and Amoeba. As the men grimace menacingly, the women recite tips about how to disinfect drinking water. The skit ends when the pathogen impersonators collapse under the women's verbal onslaught.

The drama played out in this western Kenyan village may smack of comedy, but the performers are engaged in a deadly serious public health campaign. The chlorine-based system they're promoting for water treatment could save millions of lives, some researchers say. In areas where the inexpensive, low-tech method has been introduced, it has cut diarrhea rates and won adherents, and it's now poised for a rapid deployment throughout Kenya.

With epidemiological evidence that supports the system's effectiveness, its promoters are working to deliver it to many people. As a journalism fellow working with the CDC Foundation and sponsored by the John S. and James L. Knight Foundation, I saw that effort in action when I followed Quick last September some 10,000 miles from his headquarters at the Centers for Disease Control and Prevention (CDC) in Atlanta.



WATER WOES — Kenyan school children collect water in reusable plastic cans. Drinking water is often contaminated by pathogens that inhabit its source or are introduced during transport and storage.

LET THEM DRINK COKE For many Kenyans, and for much of the world's population, microbe-contaminated drinking water is a fact of life and, all too often, death. Recent calculations suggest that waterborne infectious organisms cause billions of diarrhea illnesses worldwide and more than 2 million diarrhea-related deaths each year. Infants and children are the hardest hit. The World Health Organization estimates that most of these deaths could be prevented if all people had access to safe drinking water and adequate sanitation.

However, the international organization also figures that approximately 1.1 billion people around the globe rely on ponds, streams, and other exposed and untreated sources for their drinking water. Despite concerted international efforts to expand access to wells and municipal waterworks, the number of people drinking water from so-called unimproved sources has remained more or less the same since 1990.

In September 2000, the United Nations set a 15-year goal of providing improved water supplies to half the people who currently lack them. That ambitious target mandates that, not allowing for population growth, about 125,000 new people gain access to safe water every day between now and 2015, Quick notes.

That would solve only part of the problem. In addition to the people who use an unimproved water source, 1 billion or more with access to pumps, wells, or municipal water works also frequently drink microbe-contaminated water, estimates Steve Luby, Quick's colleague at the CDC. Many households in the developing world draw contaminated water from poorly maintained pipelines. Furthermore, Luby says, such municipal systems and other communal sources of running water often work only intermittently, so families store water in the home. The CDC has found that water can become contaminated during storage, especially when its container is a bucket or other wide-mouthed vessel into which people dip hands or cups.

"The ultimate good would be for everyone to be able to open a tap in their house and have clean water come out," says Sally Cowal, a vice president of Population Services International (PSI), a Washington, D.C.–based nonprofit group. It will take years to fund and build the required infrastructure in many parts of the world, she notes.

QUICK FIX That's why Quick and his colleagues are championing a low-tech, interim solution to enhance drinking-water quality—one that can be marketed cheaply on a large scale. Their approach, referred to as the Safe Water System (SWS), emphasizes disinfection at the places where water is consumed. The two physical components of SWS are a chlorine-based disinfection solution and a storage container that prevents recontamination.

The concept behind SWS began to take shape during a series of CDC missions in the early 1990s in response to outbreaks of cholera and other diarrheal diseases in Latin America and Africa. Quick, then a newcomer to the CDC, and his fellow disease investigators

QUICK

observed that people who used water-storage vessels with wide mouths were more likely to get diarrhea than neighbors using narrow-mouthed containers were. Quite simply, people were more likely to stick hands or potentially contaminated objects into containers with larger openings.

To stop this route of disease transmission, the investigators developed a 20-liter plastic vessel with a narrow mouth and a spigot. After filling this container, people can disinfect the water and store it with minimal chance of recontamination. They can also draw water from the vessel without the need to dip cups or ladles into it.

Where such vessels are unavailable, some people familiar with SWS have developed homegrown alternatives. For example, Kenyan pottery collectives now produce narrow-mouthed, spigot-equipped versions of traditional clay pots.

Such vessels represent a step toward storing water safely but don't address the challenge of cleaning water from a contaminated source. For that, Quick and his colleagues turned to sodium hypochlorite, the highly reactive bleach that disinfects swimming pools and municipal water supplies in developed nations.

BIG BLUE — Public health workers, one of them costumed as a bottle of chlorine solution, promote water treatment in rural western Kenya.

In fact, chlorine-treated water can taste and smell a bit like typical swimming pool water—an aspect that some users find unappealing. "But most people don't find it objectionable" once they recognize its impact on health, says Robert Tauxe, who supervises the CDC branch that also employs Quick and Luby. "Some even identify it as the taste of safety," Tauxe says.

Collaborating with nongovernmental organizations, such as CARE, and chemical companies, the CDC scientists have been testing SWS since the mid-1990s. In trial after trial, people who use the chlorine solution and appropriate vessels to treat and store drinking water experience roughly half as much diarrhea as neighbors who don't use the system.

In a study conducted in Zambia and published in the May 2002 *American Journal of Tropical Medicine and Hygiene*, for example, Quick and his colleagues reported that households equipped with chlorine solution and a good storage vessel had significantly less *Escherichia coli* bacteria in their water and 48 percent less diarrhea than did households not using these tools. In other studies, even chlorine use in other storage vessels significantly reduced diarrhea rates and could be expected to save lives, Quick says.

SWS has earned some esteemed followers, including retired waterborne disease researcher Eugene J. Gangarosa, who calls it "a landmark development." Decades ago, Gangarosa contributed to the development of oral rehydration salts, a packaged blend of sugars and electrolytes that when mixed with water can prevent life-threatening dehydration in cholera victims. While that treatment is now credited with saving more than a million lives a year, "this new safe water system that CDC has developed has even greater potential" to prevent deaths from waterborne pathogens, Gangarosa says.

QUICK

MILES TO GO Like many innovations with potential to improve public health, Quick's system must make the pitfall-fraught transition from the proof of concept to real-world implementation. The cost, accessibility, and acceptability of SWS all factor into how widespread it becomes.

Supporters of SWS are using mass media, from billboards to radio advertising, to supply and promote its water-purification tools through distribution channels already in use for other commercial products. "You can't just go community by community," says Quick. "You need some sort of mass production and mass distribution."

To that end, CDC recently reached an agreement with PSI, which already tends a network of kiosks in Kenya that sell condoms and insecticide-treated mosquito nets. Beginning this spring, PSI will also supply chlorine solution throughout the country. Each 33-cent bottle of the solution, branded WaterGuard, could last a typical Kenyan family several weeks.

Do-it-yourself

A grab bag of water treatments

Heat, ultraviolet radiation, filtration, or some combination of these can disinfect water, just as chlorine can. A few researchers consider these alternatives safer because chlorine can react with organic material in murky water and produce organochlorine compounds, which carry cancer risks. That hazard has elicited hesitation among some health workers in countries where the Atlanta-based Centers for Disease Control and Prevention (CDC) is promoting chlorination. However, most researchers agree that any risks from chlorination byproducts over a lifetime of drinking treated water are more than compensated for in developing countries by the reduced risk of death from diarrheal diseases at an early age.

Straining water through a cloth or using some other method to remove sediments before adding chlorine mitigates the formation of potentially harmful byproducts and also reduces how much chlorine is required for treatment. Furthermore, according to a report by Rita R. Colwell and her colleagues in the Feb. 4 *Proceedings of the National Academy of Sciences*, cloth straining by itself can reduce cholera infections by 48 percent.

Some people use other low-tech disinfection methods to kill bacteria that can't be removed by straining water. Boiling kills pathogens, but fuels for heating often are too expensive or hard to obtain. Such fuels can also pose environmental and health risks.

Practitioners of solar disinfection put water into used soft-drink bottles or other clear containers—sometimes painted black on one side to improve heat absorption—and set them out in the sun. In strong sunlight, heat and ultraviolet radiation can render microbe-contaminated water potable in as little as 3 hours. Kenyan children who treated water this way suffered diarrhea 20 to 30 percent less often than did those who drank from bottles they left in the shade, Ronán M. Conroy and his colleagues at the Royal College of Surgeons in Dublin, Ireland, reported in 1996.

Filtering water through densely packed sand or storing it for several weeks also appears to improve water quality in certain conditions, says Conroy, but for many other alternatives in use, researchers "just don't have data on whether these things work."

Furthermore, such methods may purify water without preventing recontamination during storage, says CDC's Robert Tauxe. One advantage of chlorine is that some of the chemical remains in the water and continues to work as an antimicrobial agent. "If there is any recontamination, the chlorine will knock it out," says Tauxe. —B.H.

Both organizations suggest that the partnership could have a rapid impact. PSI obtained funding to roll out a similar program in Malawi in southeastern Africa last September, and marketing of SWS was in full swing in that country by November, says PSI's Cowal.

Meanwhile, Quick is on the road much of the year, bouncing along decaying asphalt or dirt arteries on his way from one project site to the next. Malawi, Madagascar, Rwanda, and Zambia already have nationwide SWS programs, and Kenya is among 11 other countries in Africa, Asia, and Latin America with regional ventures. Afghanistan is scheduled to join that number this year.

SCENT OF ACCEPTANCE No matter how well a public health practice is designed, tested, and marketed, its potential impact is limited by how widely it's put to use.

With SWS, the powerful and immediate benefit—avoiding the common and sometimes lethal problem of diarrhea—appears to make an impression on people.

This seemed evident to me one morning in Tororo, Uganda, about 2 weeks after I encountered the dancing chlorine bottle in Ogongo. Quick and I had gathered with a team of research assistants working with him and the CDC on a study of SWS. This team was charged with monitoring diarrhea rates and collecting stool samples from area residents, half of whom had been provisioned with chlorine solution.

JUG HEAD — A Kenyan performer, his costumed head designed to resemble a clay pot with a narrow rim and a spigot, encourages the use of safe water-storage vessels.

Few reports of diarrhea had been coming in, even from the residents who hadn't been given bottles of chlorine or SWS storage vessels. Quick quizzed the assistants in search of clues to understand why.

Some participants who initially complained of the taste of the treated water were now refusing to drink any water that didn't give off a telltale whiff of chlorine. They'd noticed a reduction in how frequently they had diarrhea and concluded that SWS was the answer. One worker recalled how a study participant carried along a personal supply of chlorine-treated water on a trip to a relative's funeral.

Then another worker shared an insight: Some residents receiving chlorine were sharing their treated water with people in the study's control group, who weren't supposed to receive the intervention until the study's end. The people in the latter group had apparently also noticed the beneficial effects of the treatment and availed themselves of it through their neighbors' generosity.

By blurring the line between people getting and not getting chlorine-treated water, the villagers' actions were confounding the data. But they also seemed to indicate that the SWS strategy had achieved acceptance among its most critical audience, its potential beneficiaries. By fostering that outcome, perhaps Quick's endeavor has already made the step from scientific study to public health program. ■

HARDER

MATURE BEFORE THEIR TIME

In the youthful universe, some galaxies were already old

BY RON COWEN

This winter has been one of the hottest on record for cosmologists. A flurry of new reports suggests that a surprising number of galaxies grew up in a hurry, appearing old and massive even when the universe was still very young. If this portrait of precocious galaxies is confirmed by larger studies, astronomers may have to revise the accepted view of galaxy formation. The provocative reports started pouring in just before Christmas. In mid-December, scientists announced in a press release that they had found a group of distant galaxies that were already senior citizens, chockablock with elderly, red stars a mere 2 billion years after the Big Bang. The same team found another surprise: Some of those galaxies were nearly as large as the largest galaxies in the universe today.

On Jan. 7, another team posted an online report asserting it had found the oldest, and therefore most distant, galaxy known. If confirmed, the study indicates that some galaxies were in place and forming stars at a prolific rate when the universe, now 13.7 billion years old, was just an 800-million-year-old whippersnapper.

The next galaxy-shaking event occurred on Jan. 9, when astronomers reported in Seattle at a meeting of the American Astronomical Society that they had found the farthest known quasar. This quasar is so distant that the light it emitted 13 billion years ago, when the universe was so young that galactic structures were still forming, has only now reached Earth. Quasars shine because they're powered by a supermassive black hole. The light of the newly discovered quasar is so bright that it almost certainly was fueled by a supermassive black hole that already had coalesced and weighed several billion times the mass of the sun.

In the Jan. 23 *Nature*, other researchers reported evidence that such black holes indeed formed early in the history of the universe and were already devouring matter voraciously a mere billion years after the Big Bang (*SN: 1/25/03, p. 51*).

Finally, on Feb. 11, cosmologists unveiled at a NASA press briefing in Washington, D.C., what may be the *pièce de résistance*. When David N. Spergel of Princeton University and his collaborators used a NASA satellite to study the cosmic microwave background, the radiation left over from the Big Bang, the team found something surprising. An analysis of the radiation revealed that the universe had already managed to make a plethora of stars—which had enough collective energy to ionize all the hydrogen in the cosmos—just 200 million years after the Big Bang (*SN: 2/15/03, p. 99*). That's several hundred million years earlier than many astronomers had estimated.

This early start in stellar mass production—and the formulation of galaxies that housed those stars—may explain why some galaxies appear old and massive when the universe was still quite young, Spergel says. However, astronomers caution, it's still uncertain how much of the chapter on early galaxy formation will need to be rewritten.

NASA

RED VIEW — Artist's depiction of the Space Infrared Telescope Facility in orbit. Launch is scheduled for April.

SEEING RED Astronomers have known for more than a decade that a few rare galaxies, which arose in unusually dense regions of the universe, managed to acquire a large amount of mass in a short amount of time. "A simple way to understand their early formation is that [these galaxies] are embedded within even bigger overdense regions in the same way that the tallest mountain peaks are usually sitting on the shoulders of a broader mountain range," explains Avi Loeb of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. "Because their environment is denser than average, they collapse earlier than the collapse time that is typical of objects of the same mass in the rest of the universe," he says. For these galaxies, in other words, the cosmic clock began ticking earlier.

That scenario might seem to jibe with the standard model of galaxy formation. In the model, the vast majority of galaxies are relatively late bloomers, taking many billions of years to pack on mass either by pulling in gas from the surrounding intergalactic medium or merging with neighboring galaxies. In regions of the universe that started out particularly dense, this mass-gathering action could begin sooner than elsewhere. But the standard model still can't easily account for a large number of mature or massive galaxies in the early universe.

More of these galaxies have recently popped into view because astronomers now can peer more easily into the universe at infrared wavelengths, which are invisible to the human eye. Infrared observations are critical because the galaxies that cosmologists typically want to study lie billions of light-years from Earth.

The light from distant galaxies is not only extremely faint. Because of the expansion of the universe, the light from these galaxies is also shifted to substantially longer wavelengths. For extremely distant galaxies, the visible light they originally radiated has shifted into infrared wavelengths. Viewing the visible and

infrared light emitted by galaxies is crucial for determining their mass. The old stars that make up the bulk of a galaxy's mass radiate most of their light at visible and infrared wavelengths.

Because the only infrared detectors available until recently had been small, astronomers couldn't conduct vast surveys for mature, distant galaxies. From the few that they detected here or there, scientists had no way of knowing how rare or abundant such galaxies were, notes Richard S. Ellis of the California Institute of Technology in Pasadena.

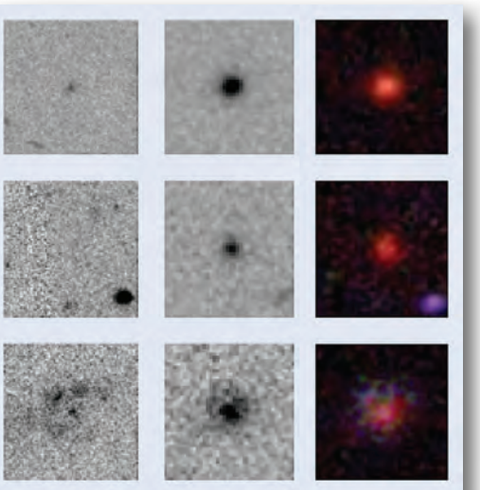
The recent arrival of larger infrared detectors has lifted this limitation. Now, "we have infrared cameras that are nearly as large as the detectors we've had for a decade in visible light," says Ellis.

BODY OF EVIDENCE Using one of these large-format infrared cameras on a high-precision telescope in Parnal, Chile, astronomers recently examined the Hubble Deep Field South, a patch of sky that previously had been viewed for a solid week in visible light by the Hubble Space Telescope. Viewing the patch of sky for 100 hours with one of the four telescopes collectively known as the Very Large Telescope, Maijn Franx and Ivo Labbé of Leiden Observatory in the Netherlands and their colleagues made some of the farthest-reaching near-infrared observations ever.

Two findings surprised the astronomers. One was that their data suggest that when the universe was only 2 billion years old, as much as half of its stellar mass resided in galaxies brimming with mature stars. That's in sharp contrast to the surveys of distant galaxies recorded in visible light, which have imaged the relatively small population of stars that were young and hot.

Franx and Labbé also found that some galaxies from this long-ago epoch were already unexpectedly large. Some even show spiral structures similar to those seen in other galaxies, including our own, today.

"These results demonstrate that very deep observations in the near-infrared are essential to obtain a proper census of the earliest phases of the universe," says Franx. "Almost all [the galaxies surveyed] would have been overlooked without the near-infrared data," adds Labbé.



GALACTIC MENAGERIE — A few of the galaxies imaged in a tiny patch of sky known as the Hubble Deep Field South. Left column shows the galaxies recorded in visible light; middle depicts them in the near-infrared, and right, in a combination of those wavelengths. Three old galaxies that lie far from Earth show up brightly in the near-infrared. The galaxy at bottom is nearly as large as the Milky Way yet hails from a time when the universe was only 2 billion years old.

The biggest challenge to the standard model of galaxy formation, Labbé says, could be the number of large galaxies showing the spiral structure that he and his colleagues found in the early universe. Astronomers hold that the formation of spiral galaxies is a simple process, he notes. According to the standard theory of galaxy formation, each galaxy is surrounded by a halo of slow-moving, invisible material dubbed cold dark matter. The size of a spiral galaxy is directly related to the properties of this halo, but the number of large spirals the team found is double that predicted by the standard theory, he says.

One caveat, Labbé notes, is that Hubble Deep Field South is an extremely tiny patch of sky, taking up less than 1 percent of the area of the full moon. There's no consensus on whether the galaxies there are representative of the universe at large, Labbé says. Indeed, near-infrared observations of another tiny patch, known as Hubble Deep Field North, don't show a similar population of old or large galaxies, notes Mark Dickinson of the Space Telescope Science Institute in Baltimore.

"Larger surveys of similar quality are needed to decide if the differences between Hubble Deep Field North and South are normal variations or whether one of the fields is atypical of the rest of the universe," Labbé says.

"Personally, I think that Franx and his collaborators have indeed found some very interesting . . . galaxies that may be more massive than most of the ones we find in the Hubble Deep Field North," says Dickinson.

The findings reported by Franx, Labbé, and their collaborators aren't the only evidence for a significant population of rapidly matured galaxies in the early universe. At a galaxy-formation meeting in mid-January in Aspen, Colo., Ellis reported other evidence that the 2-billion-year-old universe was populated with as many galaxies marked by red, senior stars as by blue, more youthful stars. He and his colleagues, Patrick McCarthy of the Carnegie Observatories in Pasadena and Andrew J. Bunker of the University of Cambridge in England, base their findings on a survey of galaxies conducted with a near-infrared camera at Las Campanas in La Serena, Chile. To prove that galaxies in the survey that appeared to be mature, elliptical galaxies really were distant and therefore date from a time when the universe was young, the team took spectra with the Keck telescope atop Hawaii's Mauna Kea. The amount by which light emitted by a galaxy is shifted to longer wavelengths indicates its distance.

"We may have uncovered a population of galaxies that completed star formation in short order, cohabitating with galaxies that are still forming stars," says Ellis.

"This is an important result if true, but it's an extrapolation" from a limited data set, cautions Harry C. Ferguson of the Space Telescope Science Institute. If accurate, this new view of galactic demography might force astronomers to rethink the fundamentals of galaxy formation.

It would also solve a puzzle cited by Ferguson and his collaborators in the April 20, 2002 *Astrophysical Journal*: Young, star-forming galaxies seen in the early universe don't have enough energy to have stripped hydrogen atoms of their lone electrons. If hydrogen atoms in the intergalactic medium had remained unionized, they would have absorbed all the starlight and the universe would have stayed dark. Ferguson speculates that the population of massive galaxies seen only with infrared detectors might be the hidden dynamos responsible for the extensive ionization that must have occurred early in the history of the cosmos.

According to Loeb, these early-to-mature, massive galaxies now reside in galaxy clusters, some of the densest and oldest groupings of galaxies in the universe today. He and Jim Peebles of Princeton University have calculated that such galaxies could indeed have formed quickly in dense regions of space and not changed their basic character for billions of years. The two scientists describe their work in an upcoming *Astrophysical Journal*.

Although many astronomers still contend that there is too little data to convince them that galaxy-formation models may need revision, that may be about to change. In April, NASA plans to launch the Space Infrared Telescope Facility. The spacecraft will view the universe at infrared wavelengths that can't penetrate Earth's atmosphere and will provide a panorama 30 times larger than both Hubble Deep Fields combined. With this purview, astronomers will have the first dependable census of just how many galaxies in the early universe were old and massive.

With that orbiting telescope, "we'll nail this stuff down in the next year or so, I'm sure," says Dickinson. ■

EUROPEAN SPACE AGENCY

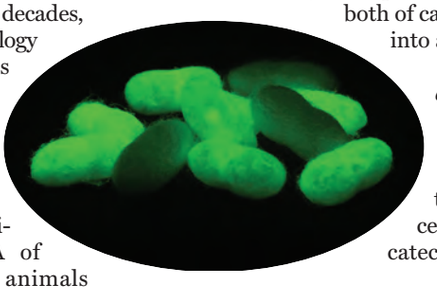
OF NOTE

TECHNOLOGY

Worms may spin silk fit for skin

Silk cocoons could become puffs of valuable human proteins if a new bioengineering method developed by Japanese scientists pans out.

In the past few decades, various biotechnology research teams have devised ways to mass-produce medically or industrially useful proteins by modifying the DNA of organisms. The animals create the proteins in their cells, milk, urine, or eggs (*SN: 4/6/02, p. 213*).



NEON COCOONS Green signifies the presence of human collagen in the cocoons' silk.

Now, Katsutoshi Yoshizato of Hiroshima University and his colleagues have genetically altered silkworms to produce a partial form of human collagen in their silk. Collagen is the structural protein in skin, cartilage, tendons, ligaments, and bones.

Given that silkworms worldwide annually spin about 60,000 tons of silk, the technique could lead to inexpensive, high-volume manufacture of collagen for artificial skin grafts. The method might also produce the blood-serum component albumin and other proteins, the scientists say.

In the January *Nature Biotechnology*, Yoshizato and his team report attaining concentrations of 0.8 percent collagen in the altered silkworms' cocoons. "If we raised the yield to 10 percent per total protein weight, we could produce it cheaply enough," Yoshizato predicts. —P.W.

BIOCHEMISTRY

A safer antioxidant?

Numerous diseases and complications associated with aging trace to damage from so-called free radicals that form naturally in the body and are chemically reactive. Many people attempt to cope by self-medicating with natural antioxidants, including vitamins C and E and the polyphenols found in plant-derived foods and drinks. There's a problem with that: Taken in excess, most antioxidants start to foster the damage they were meant to prevent. That's why a new Japanese synthetic antioxidant looks so intriguing.

Kiyoshi Fukuhara of the National Institute of Health Sciences in Tokyo and his coworkers developed what they describe as a chemical analog of catechin, which is among the more potent antioxidants in tea, chocolate, and many fruits. Catechin molecules ordinarily have two structural elements that bend around a pivot point. The result is that each element lies in a separate plane. In their new synthetic version, the Japanese scientists have locked both of catechin's structural units into a common plane.

In the January *Chemical Research in Toxicology*, Fukuhara's group describes test-tube experiments showing that even at high concentrations, the synthetic catechin remains an antioxidant. Fukuhara speculates that supplements of this compound might someday "be useful for the prevention and treatment of radical-associated disease," including cancer, Alzheimer's disease, stroke, and radiation injury. —J.R.

MATERIALS SCIENCE

Ceramic rebounds from stressful situations

Say the word *ceramic* and many people think of teacups or plates that shatter when dropped. Although scientists value high-quality ceramics, such as those used to shield spacecraft from heat, for their combination of heat resistance, stiffness, and lightness, even these ceramics are brittle and difficult to cut or drill without breaking.

INTERIOR DESIGN The microstructure of Ti_3SiC_2, shown here, combines with even finer atomic-scale structure to give the material unusual traits.

Recent experiments reveal that an unusual ceramic material, titanium silicon carbide (Ti_3SiC_2), can fully recover after being compressed with a stress that would leave most ceramics shattered and most metals permanently deformed. The studies also indicate that the ceramic readily dissipates energy, meaning that it could be useful for damping vibrations in machinery. In the February *Nature Materials*, Michel W. Barsoum of Drexel University in Philadelphia and his coworkers describe repeatedly putting cylinders of the new ceramic under stresses of 1 gigapascal, or about 10,000 times atmospheric pressure.

The newly reported properties of this ceramic could make it a standout material for a variety of applications, from less-wobbly disk drives to quieter tools, says Barsoum.

In previous studies of this ceramic, Barsoum and his colleagues had found that it has other unusual properties. It's easily machined with an ordinary drill or saw, and it won't shatter at temperatures far beyond those that would destroy other ceramic materials.

Barsoum says that Ti_3SiC_2 is just one member of a large family of unusual ceramics, and further studies may reveal related materials with even better properties. — J.G.

BIOLOGY

Dolly, first cloned mammal, is dead

Dolly, the most famous sheep since Mary's little lamb, was euthanized on Feb. 14 to prevent further suffering after she acquired a severe lung infection. The sheep, which was 6 years old, was the first mammal to be cloned from the DNA of an adult, and its birth set the stage for the current furor over human cloning (*SN: 4/5/97, p. 214; 10/20/01, p. 250*).

For most of her life, Dolly was as healthy as a typical sheep, although many other mammalian clones have had severe, if not fatal, physical defects. While there was speculation that Dolly was aging prematurely because the tips of her chromosomes appeared shorter than normal for a sheep her age, her creators at the Roslin Institute in Edinburgh say there is no definitive evidence of such a problem.

Domestic sheep can live up to a dozen years, but it's not unusual for sheep kept in stalls to contract infections and die young, according to the Roslin Institute researchers. Nonetheless, they will do a full autopsy of the animal. At the moment, there are no plans to clone Dolly. —J.T.

M. TOMITA/JAPAN SCIENCE AND TECHNOLOGY CORP.; PATRICIA LYONS, MOORESTOWN, N.J.

MEETINGS

Retroviruses and Opportunistic Infections
Boston, Mass.
Feb. 10 – 14

MICROBIOLOGY

Designer RNA stalls hepatitis in mice

Using strips of synthetic RNA that interfere with normal gene action, scientists working with mice have stopped the progression of hepatitis, a lethal inflammation of the liver often caused by a virus. The study is the first to show that this technique, called RNA interference, can improve the health of a mammal.

RNA is the genetic material that serves as a template for protein production by cells. The body sometimes sabotages its RNA as a way to dispose of a cell that has been infiltrated by viruses that have genes consisting of RNA rather than DNA. Earlier test-tube studies suggested that RNA molecules could silence viral genes, as well as some genes associated with cancer. Some research further indicated that RNA interference could halt the proliferation of viruses in lab dishes (*SN: 8/10/02, p. 93; 9/21/02, p. 189*).

In the new study, Judy Lieberman of Harvard Medical School in Boston and her coworkers used mice with a form of hepatitis that is exacerbated by an inflammatory protein called Fas. Most such mice die within 3 days.

But when the scientists synthesized RNA designed to inactivate the gene encoding Fas, more than 80 percent of mice treated during a 10-day test period survived. The interfering RNA accumulated in the liver, the researchers found.

Deactivating a specific gene with synthetic RNA offers hope that this approach will work against pathogenic viruses, including the AIDS virus, says Mario Stevenson of the University of Massachusetts in Worcester. —N.S.

VIROLOGY

HIV in breast milk can be drug resistant

A drug called nevirapine, sold as Viramune, can reduce the risk of mother-to-newborn transmission of HIV when taken by a woman at the onset of labor. Scientists now report that after taking nevirapine, the women often harbor a form of HIV with genetic mutations that make it resistant to the drug. Moreover, the mutant virus is more prevalent in the breast milk of infected women than in their blood.

The finding suggests that these women could be passing along resistant forms of the virus to their children during breast-feeding, says Esther Lee of Stanford University. HIV-infected mothers who choose to breastfeed have about a one-in-six chance of transmitting the virus to their babies via breast milk.

Lee and her colleagues analyzed blood and breast-milk samples from 20 nursing mothers in Zimbabwe who had received nevirapine when they went into labor. Thirteen of the women harbored nevirapine-resistant HIV in their breast milk, and eight of the women had these mutant viruses in their blood, Lee says. The samples were taken 2 and 8 weeks after birth.

Lee says that she and her colleagues expect to conduct a new study to determine how long the resistant HIV versions persist in the women. —N.S.

MEETINGS

American Association
for the Advancement of Science
Denver, Colo.
February 13 – 18

BIOLOGY

Good taste in men linked to colon risks

Men with exceptionally good taste may pay for it in health risks.

About 25 percent of people have extra taste buds on their tongues. They live in "a neon taste world" instead of a "pastel" one, as Yale University researcher Linda Bartoshuk puts it (*SN: 7/5/97, p. 24*).

There may be a nasty consequence to the benefit. Among men over 65, intense tasters have significantly more colon polyps than other tasters, according to Bartoshuk and Marc Basson of Wayne State University in Detroit. Extra polyps suggest an extra risk of colon cancer.

Bartoshuk speculates that sensitive tongues lead these men astray in food choices. Supertasters often cringe at intense vegetable flavors, and the supertasting seniors eat fewer vegetables than do their counterparts with normal taste sensitivity. The supertasters also tended to weigh more. Low-vegetable diets and extra weight both raise the risk of colon cancer.

Ear infections may exacerbate this cancer risk. The nerves from the tongue pass through the ear, and ear infections distort neural mechanisms so that the tongue increases its sensitivity to fat. Bartoshuk has found that among men with a history of ear infections, supertasters are especially likely to be very overweight. —S.M.

MATERIALS SCIENCE

Technique may yield vocal cord stand-in

A plastic material used in some biological implants could someday form a foundation for tissue that can repair or replace human vocal cords, new experiments suggest.

Developing a surrogate for the body's soft tissues can be difficult because the components often have a complex cellular structure, says Patrick A. Tresco, a bioengineer at the University of Utah in Salt Lake City. Vocal cords are particularly challenging because any implant would need to be especially sturdy. Although human vocal cords are only about 1 centimeter long, they undergo 1-millimeter vibrations and experience accelerations about 200 times that of Earth's gravity.

Tresco and his colleagues have induced certain human cells to grow upon and fill the pores within an elastic foam that's about 70 percent open space. When the foam was stretched once every 4 seconds, 8 hours per day for 9 days, the living cells became structurally aligned like those deep within vocal cord tissue. When the foam was also vibrated at high frequency while it was being stretched, the cells took on a more disordered pattern, like that in the tissue just beneath a vocal cord's skin.

Tests of the tissue-foam combination showed that under stress and strain, the material behaved just like vocal cord tissue does when it's similarly exercised. Also, because patients could donate their own cells to create a vocal cord implant, the tissue would probably not be rejected. —S.P.

Books

A selection of new and notable books of scientific interest

THE CHICAGO GUIDE TO COMMUNICATING SCIENCE

SCOTT L. MONTGOMERY

From writing grant proposals to crafting speeches, this guide offers detailed, practical advice on all kinds of scientific communication. Samples from a wide variety of scientific disciplines illustrate where and how to revise different texts and how to visually enhance the written word. The guide explores how to write scientific papers, abstracts, grant proposals, and technical reports. The book also tells readers how they can profit from the review process, deal with the press and public, get published, work on the Internet, and write in English when it's not their native language. ***U Ch Pr, 2003, 228 p., b&w illus., paperback, $15.00.***

THE FOUNDING FISH

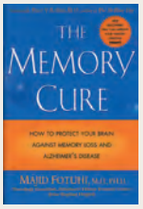
JOHN MCPHEE

Fans of this Pulitzer prize–winning columnist from *The New Yorker* will surely be delighted as McPhee details his exploits as a shad fisherman. Shad are schooling ocean fish that annually spawn in rivers. Like salmon, they return to their place of birth and eat nothing on their spawning run, though they do snap at lures, perhaps out of irritation or distraction. In an effort to better know his catch, the author visits the labs of ichthyologists, who school him on fish behavior and anatomy, and takes instruction in catching the fish. He blends this natural history with a dose of American history and lots of personal experience. ***FSG, 2002, 358 p., hardcover, $25.00.***

THE MEMORY CURE: How to Protect Your Brain Against Memory Loss and Alzheimer's Disease

MAJID FOTUHI

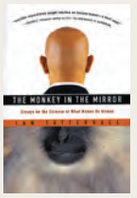
A neurologist affiliated with Harvard Medical School and the Alzheimer's Disease Research Center at Johns Hopkins University updates readers on cutting-edge research on memory. He reports that significant memory loss is not necessarily associated with aging and that you can reduce your risk of developing Alzheimer's disease in the same way you can minimize your chance of heart attack. Citing hundreds of studies, Fotuhi explains how memory works and the molecular changes in the brain that accompany Alzheimer's. Then he explains how high blood pressure and cholesterol affect Alzheimer's and details how diet, exercise, and vitamin E can help ward off the disease. ***McGraw, 2003, 240 p., b&w illus., hardcover, $21.95.***



THE MONKEY IN THE MIRROR: Essays on the Science of What Makes Us Human

IAN TATTERSALL

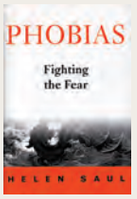
In eight short essays, renowned paleoanthropologist Tattersall eloquently details what we know about diversity among hominids and how we came to know it. In presenting these data and the relevant theories, he reveals some of the questions about human evolution that still loom. Not the least of these is how we became who we are. Tattersall writes that in the evolutionary process, there's "continual evolutionary experimentation, with constant origins of new species, triage among those species by competition, and the extinction of the unfortunate." He declares that humans owe much to chance and that we are not finely engineered organisms with every component perfectly in place. Essays examining the first hominid bipeds and toolmakers bolster this thesis. Originally published in hardcover in 2002. ***Harcourt, 2003, 203 p., paperback, $13.00.***



PHOBIAS: Fighting the Fear

HELEN SAUL

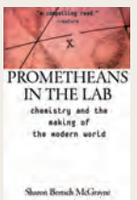
An estimated 8 percent of adults in the United States—11.5 million people—suffer from some type of phobia. For some, it's a fear of flying; for others, it's the number 13 or crossing bridges. Saul examines phobias from psychological and physiological perspectives and reveals how scientists have come to understand this phenomenon. Case studies focus on treatments and illustrate how physicians and psychologists have learned to focus on phobias as distinct, treatable conditions, rather than mysterious parts of larger mental problems. Originally published in hardcover in the United Kingdom in 2001. ***Arcade, 2002, 306 p., hardcover, $25.95.***



PROMETHEANS IN THE LAB: Chemistry and the Making of the Modern World

SHARON BERTSCH MCGRAYNE

Profiles of nine chemists and their pervasive though generally overlooked achievements reveal the impact of chemistry on our everyday lives. McGrayne tells the stories behind the advent of soap, clothing dye, fertilizer, nylon and polyester, lead-free gasoline, refrigeration, DDT, and inexpensive sugar so readers appreciate how these inventions shape our lives in both good and bad ways. For instance, Thomas Midgely invented tetraethyl lead, which became an important ingredient of cheap, powerful gasoline. But the chemical caused psychosis in factory workers who made it, and it damaged the environment. In this regard, McGrayne profiles Clair Patterson, who discovered that leaded gasoline was polluting the planet and spearheaded efforts to curtail the use of tetraethyl lead. Originally published in hardcover in 2001. ***McGraw, 2002, 243 p., paperback, $14.95.***



IN MEMORIAM

Jonathan Eberhart: Scientist as journalist

For 3 decades within our pages, Jonathan Eberhart chronicled space science and exploration, winning kudos along the way. But hobbled by multiple sclerosis, he retired from journalism early—in 1991. On Feb. 18, at 60, he died from complications of the disease.

A burly, pony-tailed Harvard dropout, Jonathan first worked as a disc jockey for college radio stations and a record-store clerk, all the while writing protest songs. But captivated by the nascent science of space, he pleaded to cover it for *Science News*. He started with summer stints, joining the staff full time in 1964. He left twice for several-month singing gigs—in 1969, as part of the initial crew of performers on the sloop *Clearwater* with Pete Seeger and several developing folk legends, and in 1970, at the World's Fair in Japan.

Despite his unconventional career path, Jonathan developed into an intense and scholarly professional. "Beneath [Jonathan's] hippielike and seemingly carefree exterior lay a deeply inquiring mind and laserlike intellect," recalls planetary scientist James W. Head III of Brown University in Providence, R.I.

"Jonathan was fundamentally a very bright scientist," says David Morrison of NASA's Astrobiology Institute in Mountain View, Calif. "He thought deeply about the issues, asked penetrating questions, and, when appropriate, offered his own hypotheses. Discussing [space] missions with Jonathan resembled talking with another team scientist." In the end, says Morrison, Jonathan "became part of the process of discovery in NASA's golden age."

Charles W. Petit of *US News and World Report* recalls, "When he spoke up at press conferences, we all listened carefully, as his questions often had more meaning than the answers he got. Then, we'd all wait to see what he wrote but we missed."

Jonathan applied the same intense focus to the research that went into his music. A folklorist, folk song writer, and performer, he recorded one solo and two group albums. Among his creations are some of the only odes to space—especially to the planet Mars.

Adds space scientist Carolyn Porco of the Southwest Research Institute in Boulder, Colo., "Jonathan romanced us and put our business to song. What a gift."

Tributes and some of Jonathan Eberhart's songs are available at http://www.sciencenews.org/jonathan.asp.