SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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a drink to your health?
from big bang to big rip
clue to preeclampsia
black cats' lucky genes

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inching ahead

CLIMATE CHANGE IS ACCELERATING BIOLOGY

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Cover Recent changes in climate have accelerated annual biological milestones, such as the spring hatching date of winter moth caterpillars like this one. Such changes sometimes wreak havoc on finely tuned ecosystems. (H. Lemme, www.ForestryImages.org)
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Pregnancy Woe Uncovered

Protein may underlie preeclampsia

Many of the symptoms of preeclampsia, a major cause of maternal death and premature birth worldwide, stem from a single protein, researchers have found. The discovery could lead to new ways of detecting and treating the disease.

Preeclampsia strikes 1 in 20 pregnancies, usually in the final trimester. Symptoms include high blood pressure and proteinuria—excessive protein in the urine. Preeclampsia can escalate to eclampsia, characterized by life-threatening seizures and kidney damage in the mother.

Earlier research had implicated the placenta, the vascular organ uniting mother and fetus. Without more specifics about what underlies the disease, however, early delivery of the baby and placenta is often required to dispel the symptoms. This treatment leads to premature births and sometimes the baby's death.

In search of the condition's molecular bases, nephrologist S. Ananth Karumanchi of Harvard Medical School in Boston and his colleagues compared gene activity in the placentas of healthy and preeclamptic women. Of the hundreds of differences the team uncovered, one stood out. The gene encoding a protein called soluble fms-like tyrosine kinase 1 (sFlt1) was overactive in the preeclamptic placentas.

Scientists already knew that sFlt1 thwarts blood vessel growth. Moreover, previous research had shown that in some cancer patients, a drug with activity similar to sFlt1's induced preeclampsia-like symptoms.

Early in pregnancy, the placenta produces proteins that keep it growing along with the fetus. Later, Karumanchi suspects, the placenta makes sFlt1 to halt that growth. "In preeclampsia, that balance is shifted. . . . The body makes more [sFlt1] too soon," Karumanchi hypothesizes. "Some of that excess spills into the mother's blood," destroying endothelial cells in her body and leading to at least some of the condition's symptoms.

Karumanchi and his colleagues uncovered plenty of evidence incriminating sFlt1. For example, they found that blood concentrations of the protein in pregnant woman with preeclampsia were higher than in healthy pregnant women. The abnormal sFlt1 concentrations dropped after delivery.

The researchers also found that blood serum from preeclamptic women stifled development of human blood vessel cells growing in lab dishes, while serum from healthy women stimulated cell growth. Treatment with blood vessel promoters reversed the vessel-stunting effects of preeclamptic women's blood. One more thing: When injected into rats, sFlt1 elicited preeclampsia symptoms. The researchers report their results in the March *Journal of Clinical Investigation*.

That an inhibitor of blood vessel growth could play a role in preeclampsia "makes a lot of sense in retrospect," says vascular scientist Peter Carmeliet of the Katholieke Universiteit in Leuven, Belgium.

"It's difficult to attack a disease unless there is a known cause," adds Marshall D. Lindheimer, a nephrologist at the University of Chicago and a medical advisor to the Preeclampsia Foundation.

Now that sFlt1's role in preeclampsia has come to light, scientists can work toward a treatment that counteracts the protein's nefarious effects, says Lindheimer. If sFlt1 concentrations rise before the onset of other symptoms, he adds, the factor may also prove useful for early disease detection and prevention.

Karumanchi points to another benefit of the discovery. "There have been no animal models that reproduce all the disease symptoms," he says. Now, rats injected with sFlt1 can serve that purpose, and researchers can test potential preeclampsia therapies on them. —K. MORGAN

Feline Finding

Mutations produce black house cats, jaguars

A symbol of bad luck for others, the black cat may have had good luck itself. Researchers have identified gene mutations that produce the inky coats in house cats and jaguars, and the scientists speculate that some of these mutations protected the black felines from an epidemic long ago.

The mutations occur in two genes previously implicated in coat color in animals ranging from mice to sheep. One gene encodes a protein called agouti, which normally signals skin cells called melanocytes to produce a reddish-yellow pigment. The second gene encodes a switch flipped by agouti, a cell-surface protein called melanocortin-1 receptor (MC1R). If agouti binds to this receptor, melanocytes make the red-yellow pigment. If functional agouti isn't present, however, another signal latches onto the receptor, and the cells make a black-brown pigment.

OH, BROTHER These two jaguars are brothers, but a mutation produces the striking dark coloration in one.

Eduardo Eizirik and Stephen O'Brien of the National Cancer Institute in Frederick, Md., and their colleagues discovered that domesticated cats with solid-black fur have a characteristic mutation in the gene for agouti, one that shortens the protein so much that it's not functional. The researchers also found that black jaguars have a mutation in the gene for MC1R. This defect, a deletion within the gene's DNA sequence, isn't found in tawny jaguars with typical rosette markings.

Similarly, dark-brown jaguarundis, felines native to Central and South America, have their own distinct mutation in the gene for MC1R, the investigators report in the March 4 *Current Biology*. The dark jaguarundi is actually more prevalent than its reddish-hued relatives, notes O'Brien.

While a black coat offers felines camouflage at night, O'Brien suggests another reason that the dark fur may have arisen. Sev-

eral years ago, his team discovered that many people are protected from the virus that causes AIDS because they have a mutation in the gene encoding a cell-surface protein that the virus uses to infect cells. Since MC1R resembles that protein, O'Brien speculates that thousands of years ago, an infectious agent that exploits the receptor caused an epidemic in jaguars and jaguarundi. If so, cats with mutations in the receptor's gene, the dark ones, would have had a better chance of resisting infection. That past survival advantage could explain why black felines are so prevalent today in certain species, he says.

Leslie Lyons, a cat geneticist at the University of California, Davis, notes that the gene for agouti has also been implicated in obesity in mice. Variations in the gene may predispose cats to weight problems, she suggests. "What do these genes do other than make a cat black?" Lyon wonders. —J. TRAVIS

Cosmic Doomsday Scenario

Phantom energy would trigger the Big Rip

Cosmologists have long speculated about the fate of the universe. Will it expand forever or collapse in a Big Crunch? In the latest model, published online last week, the universe instead ends with a Big Rip—every galaxy, star, planet, molecule, and atom torn asunder—21 billion years from now.

The cosmos killer in this scenario is dark energy, an invisible substance suspected of pervading the universe and exerting a force opposite to gravity's usual pull. Albert Einstein first proposed the notion of antigravity in 1917 and later abandoned it. Scientists have resurrected the idea of antigravity several times. Observations of distant supernovas reported in 1998 and more recently suggest that the universe is not merely expanding but doing so at an ever faster rate (*SN: 4/7/01, p. 218*). Because dark energy can turn gravity into a repulsive force, it could account for this acceleration.

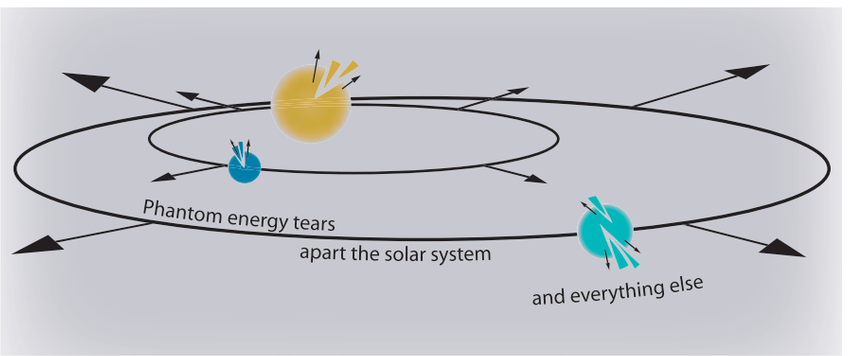
If the density of dark energy is constant or slowly declining, the fate of the universe is simple to chronicle. As dark energy stretches space-time and pushes galaxies ever farther apart, it would create a diluted universe in which stargazers in the Milky Way billions of years from now would be too distant from other galaxies to view any of them. They would see only a desolate canvas (*SN: 8/31/02, p. 139*).

But if dark energy were dense enough, as considered in the recent analysis (*http://xxx.lanl.gov/abs/astro-ph/0302506*) by Robert R. Caldwell of Dartmouth College in Hanover, N.H., and his collaborators, the universe would have a far different fate. In this model, which Caldwell claims is consistent with the latest observations of the early universe, the density of dark energy grows as the universe does and constantly increases its repulsive force.

The end result would be a runaway expansion, or Big Rip, in which the universe would become infinitely large and time would effectively cease at age 35 billion years, according to calculations by Caldwell and Marc Kamionkowski and Nevin N. Weinberg of the California Institute of Technology in Pasadena.

A billion years before the very end, dark energy, which Caldwell calls phantom energy, would strip apart clusters of galaxies. The Milky Way would succumb about 60 million years before the Big Rip. A few months before the end of time, the dark energy content of the empty space between Earth and the sun would overwhelm the sun's pull, and Earth would float off into space. A half hour before the end, Earth itself would fall apart. Finally, one ten-thousandth of a femtosecond (10^{-19} second) before the Big Rip, molecules and atoms would break up.

"The model is a logical possibility," says Avi Loeb of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. However, he says, it's more likely that dark energy density is constant. If so, galaxies would remain intact even as they rapidly recede from one another. —R. COWEN



CALDWELL

LET 'ER RIP Illustration of phantom energy releasing Earth (blue) and other planets from the sun (yellow) and tearing apart each body, 60 million years after the Milky Way would have disassembled.

Ulcer Clue?

Molecule could be key to stomach ailment

An old adage once held that stomach ulcers arise from "hurry, worry, and curry." Scientists dispelled that notion in the early 1980s with the discovery that the bacterium *Helicobacter pylori* causes most such ulcers. Twenty years later, with the modern knowledge that half the world's people harbor *H. pylori* in their stomachs, scientists remain baffled as to why only a fraction of these infections leads to ulcers.

Research in mice now suggests that a protein on the surface of cells paves the way for a toxin produced by *H. pylori* to damage the stomach lining.

Earlier tests had turned up the protein, known as Ptprz, on cells exposed to *H. pylori* toxin in lab dishes, says Masaharu Noda, a molecular neurobiologist at the National Institute for Basic Biology in Okazaki, Japan. Other research had indicated that the toxin destabilizes cells by causing the development of acid-filled compartments in them (*SN: 10/4/97, p. 218*).

To determine whether Ptprz plays a role in ulcers, Noda and his colleagues gave 24 mice oral doses of the *H. pylori* toxin called VacA. Half the mice lacked the gene that encodes Ptprz; the others produced the protein. Mice without Ptprz showed no ill effects from VacA. Within days of receiving the toxin, 10 of the 12 other mice formed ulcers, the researchers report in the March *Nature Genetics*.

Oddly, acid-filled compartments formed in the stomach cells of both groups, suggesting that this isn't the way *H. pylori* causes ulcers. Instead, the researchers note that the VacA-Ptprz combination disrupts bonds between stomach cells.

Ptprz belongs to a family of proteins involved in cell-to-cell adhesion, says Richard M. Peek Jr. of Vanderbilt University School of Medicine in Nashville. The findings show that when VacA binds to Ptprz on cells, it initiates signals that induce those cells to detach from one another, he says. This tissue breakdown in the stomach lining could expose deeper layers of cells to harsh digestive acids—a recipe for ulcers, Peek says.

Once scientists understand the interplay between VacA and Ptprz, they might recognize a target for a vaccine against ulcers, he says. Or, measurements of Ptprz could identify people at high risk of developing ulcers, Peek says.

The new animal data imply that "if some people produce excess Ptprz, they would have greater risk," Noda reasons. However, scientists don't know much about Ptprz' function and prevalence in people. Shutting off Ptprz doesn't seem to cause side effects, Noda says. —N. SEPPA

Slippin' Slide

Glaciers surge after ice shelf collapses

Five of the six large glaciers that once fed into Antarctica's Larsen A ice shelf have sped up significantly since that floating ice mass collapsed and drifted away in January 1995, scientists report.

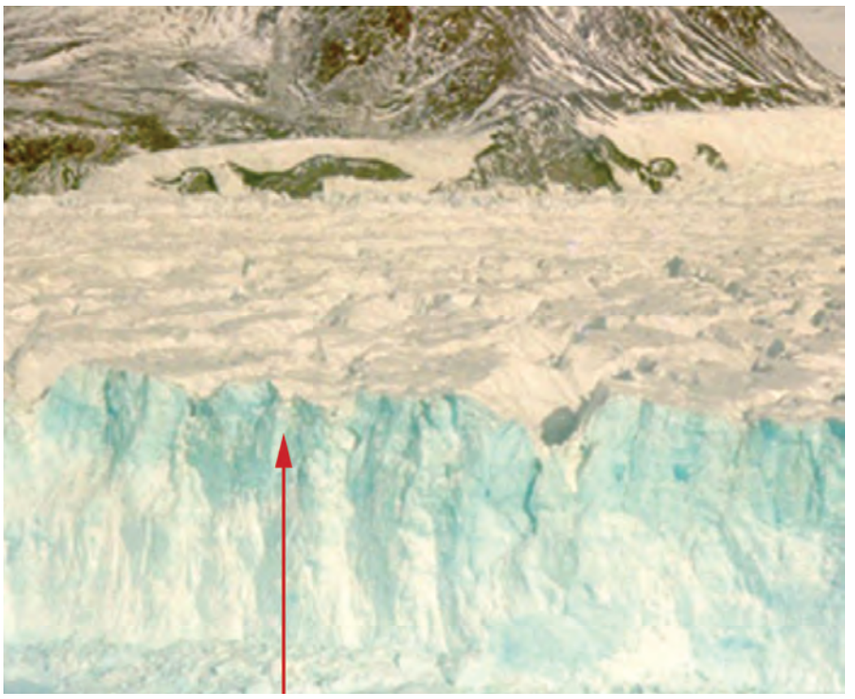
Analyses of satellite images and aerial surveys reveal the glaciers' acceleration, says glaciologist Hernàn De Angelis of the Argentine Antarctic Institute in Buenos Aires. For instance, photos from orbit show that between February 2000 and September 2001, portions of the Sjögren Glacier moved at an average speed of about 2 meters per day. That's about double the speed measured in 1999 and four times the rate clocked in 1995 just after Larsen A's disintegration. De Angelis and his institute colleague Pedro Skvarca report their analyses in the March 7 *Science*.

Although most of the area's large glaciers now flow seaward more quickly, ice upstream at higher elevations has sped up only modestly, if at all. These flow-rate differences affect the glaciers' surface topography. Among the most telling features is a series of 20-to-40-m-tall ice terraces, says De Angelis. Those icy cliffs, first observed in aerial surveys about a year ago, formed as the ice in the glaciers' channels surged seaward and thinned while peripheral ice lagged behind.

Although the breakup of an already floating ice shelf doesn't affect global sea levels, any subsequent flux of new ice from land-based glaciers into the ocean could lead to sea level rises. Because scientists haven't measured the thickness of glaciers that are now freely spilling across the 100-kilometer coastline once fringed by Larsen A, they don't yet know how much global sea levels might be affected, says Skvarca.

Scientists have long debated whether ice shelves retard the flow of the glaciers that feed them. De Angelis and Skvarca's new finding strongly suggests that the presence of an ice shelf can matter, says Eric J. Rignot of NASA's Jet Propulsion Laboratory in Pasadena, Calif.

A glacier's flow rate can also be influenced by climate and other local conditions, Rignot adds. De Angelis and Skvarca agree that many factors contribute to a glacier's flow rate, including the firmness of rocks or sediments that the ice glides across and the presence of subglacial melt water. —S. PERKINS



DE ANGELIS AND SKVARCA/ARGENTINE ANTARCTIC INSTITUTE

COLD CLIFF A fresh ice terrace (arrow), one of many rimming the edge of Antarctica's Sjögren Glacier, indicates that the ice stream's center (foreground) is surging coastward and thinning much faster than the sluggish ice along its edges.

Working Out

Welfare reform hasn't changed kids so far

National welfare reforms enacted in 1996 imposed stricter work requirements for all recipients and established a 5-year limit for receiving federally funded welfare. Reformers and their critics clashed over whether children might suffer if their mothers were moved off welfare and into jobs.

A new study, published in the March 7 *Science*, offers encouraging but far from conclusive evidence that welfare reform hasn't undermined children's mental health or intellectual development, at least in the short-run.

Preschoolers in low-income families exhibited stable emotional health, consistent reading and number skills, and no change in problem behavior during the first 16 months after their mothers left the welfare rolls for either a full- or part-time job, say psychologist P. Lindsay Chase-Lansdale of Northwestern University in Evanston, Ill., and her colleagues. Young adolescents in low-income families also exhibited academic and behavioral stability, as well as a slight increase in emotional health, after their mothers found employment, according to the researchers.

"We can't make policy recommendations based on these data," remarks study coauthor Andrew J. Cherlin, a sociologist at Johns Hopkins University in Baltimore. Only long-term studies of families living in poverty can untangle the reasons for this pattern of findings, he asserts.

The researchers analyzed survey data on 2,402 children and their mothers—most of whom were single and either black or Hispanic—living in poor parts of Boston, Chicago, and San Antonio. Families with a preschool child, age 2 to 4, or a young adolescent, age 10 to 14, completed interviews and testing in 1999 and 2001.

Preschoolers' development wasn't linked to whether or not their mothers entered welfare, left welfare, took a job, or left a job between the interviews. When mothers of preschoolers worked, their family income rose above the poverty line. Mothers, however, spent about 2 fewer hours each day with their preschoolers while working than while on welfare.

Adolescents reported a modest decrease in symptoms of depression and anxiety and a slight drop in drug and alcohol use after their mothers got jobs. By cutting back on personal and social activities, these women spent nearly as much time with their school-age kids as they had before taking a job.

"These data don't show what's causing

any changes in adolescents," comments Gordon L. Berlin, a senior vice president at Manpower Demonstration Research Corp. in New York, a nonprofit organization that directs studies of welfare programs.

Shortly before the 1996 reforms, the organization's researchers led a series of studies in which single welfare mothers in about a dozen states were randomly assigned to various work requirements or to stay on welfare. In this test of welfare-to-work strategies, grade-schoolers did better academically when their mothers worked and received income supplements. In contrast, adolescents' school performance dropped slightly after their mothers went to work. This trend mainly affected teens forced to care for younger siblings and take on other responsibilities for their working mothers, Berlin says. —B. BOWER

Making Polymers That Self-Destruct

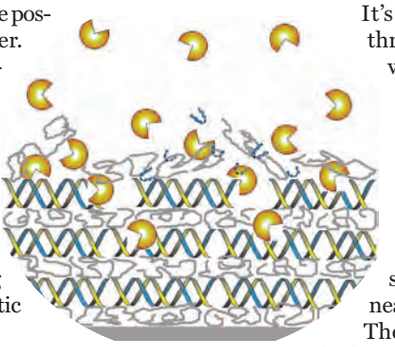
Layers break apart in controlled way

Scientists in Japan have created a polymer film that can chew itself apart, making it a candidate for the controlled delivery of therapeutic drugs.

A major thrust of modern medicinal research is to regulate the release of drugs from pills and biomedical implants so that the therapeutic molecules are liberated over a long period or target selected organs. One of the first steps in developing these drug-delivery methods is the design of materials that can discharge molecules at desired rates. The new multilayer film created at Japan's Kagoshima University might ultimately serve that purpose, says team member Takeshi Serizawa.

The material contains 17 alternating layers of two polymers. One of these is a positively charged synthetic polymer and the other is DNA, a negatively charged biological polymer. To construct the film, the researchers apply a layer-by-layer assembly method developed several years ago to build thin films (*SN: 11/11/00, p. 312*). The researchers dip an experimental substrate, such as a piece of quartz, into a solution of one polymer and then into a solution of an oppositely charged polymer. Electrostatic charges hold the layers together.

To the surface of their film, the Kagoshima researchers added their version of a self-destruct button: a negatively charged layer of the DNA-snipping enzyme DNase I. In the March 10 *Angewandte Chemie International Edition*, the researchers report that this enzyme remains inert while stuck to the surface of the positively charged polymer. When the film encounters a solution of positively charged calcium and magnesium ions, the enzymes break free and begin to chew through successive layers of DNA, disrupting the intervening synthetic polymer layers in the process.



CHEWED UP
Enzymes (notched disks) tear into layers of DNA (helices), causing a multilayered polymer film to break apart.

The concentration of calcium and magnesium ions regulates the rate at which the film degrades, says Serizawa. Because the abundance of these ions varies throughout the body, the researchers aim to create targeted drug-delivery systems, which might include biomedical implants such as artificial blood vessels and artery-opening stents.

The Kagoshima work puts a new and elegant twist on the design of biodegradable, layered films, says Michael Rubner of the Massachusetts Institute of Technology, who designs similar materials. Like other biodegradable layered films, however, the new film is far from a sure thing, he notes. The material has yet to be tested for toxicity and effective drug delivery. —J. GORMAN

Watching the Big Wheelers

In sea of cars, trucks reveal traffic flow

Traffic managers in urban settings monitor networks of roadway sensors as one way to detect congestion. The faster those networks recognize problems, the quicker authorities can alert motorists and emergency teams to possible trouble.

Now, Benjamin Coifman of Ohio State University in Columbus has devised a way to sense jams more quickly by tracking the motion of trucks or other large vehicles within the overall traffic flow. Amid the torrent of vehicles on highways, he says, those big vehicles stand out much the way breadcrumbs do if dropped into a stream of water.

The new sensing strategy, described in the March *Transportation Research Part A*, can identify incipient traffic jams in about a quarter the time of conventional automatic detection methods, Coifman claims. What's more, the data needed to apply the technique can be obtained using the sensors already embedded in many highways.

It's "a significant breakthrough in the way freeways can be operated," comments Joseph A. Palen of California's transportation agency, Caltrans. Palen worked with Coifman to try out the new jam-sensing scheme on a freeway near San Francisco.

The method relies on signals from so-called loop detectors—typically square coils of wire about 2 meters on a side that lie beneath the highway surface and emit electrical signals as vehicles pass over them.

In use since the 1960s, loop detectors have been installed every kilometer or so along major routes in many urban areas. They enable traffic engineers to tally the vehicles that pass a certain spot, for example, or to determine the average speed of those vehicles.

Coifman wondered what loop detectors might reveal about individual cars and trucks. In the past few years, he has measured vehicle length with loop detectors arranged in closely spaced pairs. He found that dual-loop detectors could precisely measure the lengths of trucks and other long vehicles but not of cars. To use these detectors as jam sensors, Coifman created a computer program that scores a "match" each time a particular truck, distinguished by its length, passes successive sets of detectors within an interval of time that would be possible only if traffic were flowing well.

During smooth traffic, the number of matches stays within a certain range, Coifman notes. However, the number of matches suddenly plummets when a slowdown begins.

Calling the new jam-monitoring method "valuable and promising," Carlos F. Daganzo of the University of California, Berkeley points out that conventional loop-detector networks don't respond to congestion until vehicles have slowed down all the way back to the first detector station upstream of the delay.

That can take minutes, Coifman notes. In contrast, the new technique monitors traffic flow between detector stations, so it can recognize the first signs of a jam within tens of seconds. —P. WEISS

ANGEW. CHEM. INT. ED.

SPRING FORWARD

Warmer climates accelerate life cycles of plants, animals

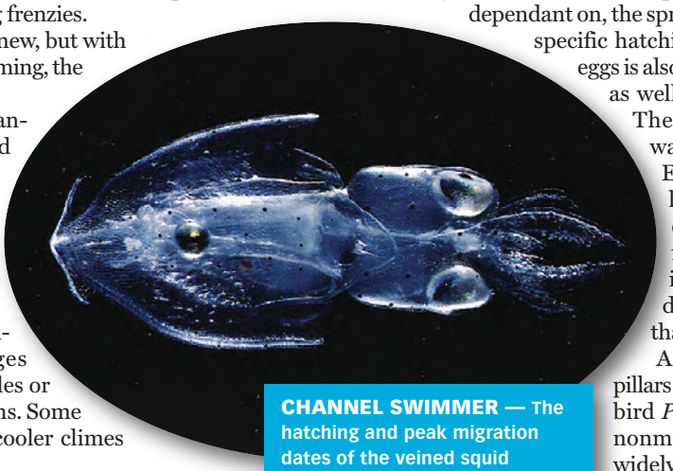
BY SID PERKINS

Ever since the winter solstice last Dec. 22, the days have been getting longer in the Northern Hemisphere and the noonday sun has climbed higher in the sky. These are nature's biggest cues that spring is nigh. As warmth gradually returns to the northern temperate latitudes, so do the birds that migrated south last autumn. Once back, they establish territories, make their nests, breed, and fledge their young. Meanwhile, bulbs and seeds sprout, trees bud, and insects emerge and start consuming the tender foliage. Plankton proliferates in lakes and ocean shallows, whereupon larval fish and seabirds begin their feeding frenzies.

Thus the cycle of life begins anew, but with a recent trend toward global warming, the cycle is changing.

Phenologists, who study organisms' responses to seasonal and climatic changes, have noted that the annual cycles for many creatures are beginning earlier on average, as global temperatures rise. Also, some heat-loving plants and animals have taken advantage of a warmer climate to expand their ranges toward the north and south poles or upslope toward higher elevations. Some organisms that thrive only in cooler climes have retreated from the heat.

On a regional scale—say, a forest—phenological effects on an organism may be masked by factors such as habitat loss, competition from non-native species, short-term variations of climate, or odd circumstances of local geography. On a global scale, however, scientists say the picture is clear: Global warming, regardless of its cause, is having discernable and generally detrimental effects on the planet's ecosystems. In the future, the winter solstice may presage a radically transformed set of biological responses.



CHANNEL SWIMMER — The hatching and peak migration dates of the veined squid (shown here in larval form) into the English Channel are strongly influenced by water temperatures off the southwestern coast of England.

J. FORSYTHE/CEPHBASE

THE HEAT IS ON In the past century, the average global temperature has risen about 0.6°C. That sounds like a small amount, but research on a wide variety of organisms shows that it's enough to drive major biological changes.

If a species responds to warming, it usually does so in one of several ways, says Terry L. Root, an ecologist at Stanford University. The population density of a species may change at locations within its normal range, or that range may shift, she notes. Or the timing of major events in the life cycle of the species—migration, flowering, or egg laying, for example—can accelerate or lag. Other changes, such as in body size or genetic variability within a species, might occur over longer periods, Root notes.

Significant problems can crop up when the intimately connected species in an ecosystem experience life cycle changes at different rates. Consider Europe's winter moth, *Operophtera brumata*, and the oak tree *Quercus robur*, which produces the young leaves that are the caterpillar's predominant food. Thirty years ago, the budding of the oak and the hatching of the caterpillars were synchronous, says Marcel E. Visser, a biologist at the Netherlands Institute of Ecology in Heteren. However, he notes, the past quarter century's trend toward warmer springs in Europe has disrupted that timing.

Precisely when the oak buds open is related to, but not solely dependant on, the spring's rise in temperatures. The specific hatching time of the winter moth's eggs is also related to rising temperatures as well as other factors, says Visser. The recent spate of particularly warm springs in some parts of Europe is causing the caterpillars to hatch 2 to 3 weeks before oak buds open. That's not good for the caterpillars, which typically can survive only 2 or 3 days—and absolutely no more than 10 days—without food.

A dearth of winter-moth caterpillars bodes ill for the small European bird *Parus major*, or great tit. This nonmigratory species—a common, widely studied bird that's similar to North America's chickadees—depends on winter-moth caterpillars to feed its fledglings. A 23-year study of great tits and winter moths at one site in the Netherlands revealed that by 1995, the early caterpillars were hatching about 9 days sooner and developing into moth pupae more quickly than they did in 1973. The birds' egg laying and hatching schedule hadn't changed dramatically, so the fledglings' caterpillar food source was disappearing just when the young birds needed it.

Visser and his colleagues recently conducted a broader analysis of great tits at 23 sites in six European countries. That study showed that some populations have been able to respond to climate change. In Britain, for example, the birds' egg-laying date has shifted earlier, so it now more closely follows the availability of food, Visser and his colleagues report in the Feb. 22 *Proceedings of the Royal Society of London B*.

SEA CHANGES Although ocean temperatures vary less from year to year and from season to season than air temperatures do, seabirds nevertheless can suffer from phenological shifts in the

availability of prey. One spot that's been particularly affected in recent years is Triangle Island, the home of British Columbia's largest colony of seabirds.

From 1971 to 1996, the peak of the spring bloom in marine zooplankton off the coast of British Columbia leapt forward more than 2 months. That acceleration was driven mostly by ocean warming in the area, says Douglas F. Bertram, a conservation biologist with the Canadian Wildlife Service in Delta, British Columbia. The 1990s, in particular, brought warmer-than-normal temperatures to the region's offshore waters, he notes.

One of the plankton species affected by the warming—*Neocalanus cristatus*, an orange crustacean no more than 6 millimeters long—has traditionally spent only about 2 months of its life near the ocean's surface. When sea-surface temperatures are above normal, however, these small animals develop more quickly and spend even less time at the surface, where many of their predators roam.

That can be good news for *N. cristatus*, but it can be exceedingly bad news for *Ptychoramphus aleuticus*, commonly known as Cassin's auklet. This 20-centimeter-long seabird breeds along the North American coast from Alaska's Aleutians to Mexico's Baja California. However, up to half the world's population of the species breeds at Triangle Island, a small outcrop just off the northwestern tip of Vancouver Island. A poor year in this island's rookeries can mean a bad year for the entire species.

Even though Triangle Island's auklets in the 1990s were generally breeding earlier in the year than they were in the 1970s and 1980s, phenological disconnects still occurred. In the summer of 1998—in the late stages of the strongest El Niño Pacific-warming phenomenon on record—sea temperatures were much higher than normal. That meant that the zooplankton bloom had largely come and gone by the time the birds hatched. As a result, auklet parents returned to their burrow nests with gullets filled with larval rockfish—"an unappetizing gray mush," Bertram notes—instead of *N. cristatus*, the preferred prey. Accordingly, large numbers of auklet chicks died that year, and those that survived grew more slowly than normal.

In 1999, when zooplankton was available throughout the auklets' breeding season, the chicks survived and grew at normal rates, says Bertram. He and his colleagues reported their 4-year analysis of climatic effect on the Cassin's auklets' breeding success in the March 20, 2002 *Marine Ecology Progress Series*. Even though El Niño causes only short-term variations in ocean temperatures, scientists believe that organisms will respond similarly to long-term temperature changes brought about gradual trends toward global warming.

Nearly half a world away from British Columbia, researchers have linked differences in ocean temperatures to changes in the timing of annual migrations of squid. Each year large numbers of *Loligo forbesi*, the veined squid, hatch in cold waters 75 to 100 meters deep in an area hundreds of kilometers southwest of England, says David W. Sims of the Marine Biological Association in Plymouth, England. Then, the squid move into the English Channel and the North Sea, where they spend the only summer of their yearlong lives.

OUT OF SYNC — Warmer springtimes in Europe have led to disconnects between when caterpillars of the winter moth (top) hatch and when the great tit (bottom) fledges its young on a diet of caterpillars.

H. LEMME, WWW.FORESTRYIMAGES.ORG; A. MORRIS/VIREO

Sims and his colleagues analyzed squid-migration data garnered by their organization's trawlers between 1953 and 1972, a period before commercial fishermen eagerly sought *L. forbesi*. The researchers found that in years when water temperatures on the sea floor near Plymouth were warmer than normal, the peak of the squid migration occurred earlier in the year. In years when the water was warmest, peak migration occurred between 4 and 5 months earlier than it did in the coolest years, says Sims.

Although Sims and his colleagues are still conducting their summer trawling surveys, they don't collect many squid these days. "Commercial fishing is obscuring our view of what's happening with the squid," Sims notes. "It's hopeless, really."

TIME TO HEAD NORTH Migratory birds are already displaying effects from long-term global warming, as well as responses to year-to-year variations in temperature, that scientists believe indicate how future climate change might permanently affect the animals.

Since 1909, researchers have been trapping birds on the island of Helgoland, which lies about 70 kilometers off the northwestern coast of Germany. This 2-square-kilometer, flat-topped outcrop of sandstone lies on an avian flyway that links Africa and central Europe to Scandinavia, says Kathrin Hüppop, a phenologist at the Institute of Avian Research, an agency of the regional government on the island.

Bird studies on Helgoland were interrupted by two world wars, but data collection has been consistent and uninterrupted since 1960. In that time, researchers have trapped about 12,000 birds of 200 different species, says Hüppop. She and Ommo Hüppop recently analyzed the reams of accumulated data to look for changes in migration dates that could be related to climate changes.

Of the 24 most-frequently trapped species, half were long-distance travelers that typically spend the winter in sub-Saharan Africa, and the other 12 were short- or medium-distance trekkers that winter in Europe or northern Africa. Over the 41-year period, 7 of the long-distance migrants and 11 of the other species generally passed through Helgoland earlier in years when the temperature there was warmer.

The Hüppops found an even stronger correlation between early migration and a regional climate parameter known as the North Atlantic Oscillation (NAO) Index. That number reflects the difference in atmospheric pressure between a long-lived

low-pressure area south of Iceland and a high-pressure area off the northwestern coast of Africa. When the NAO index was high, 9 of the 12 bird species that migrated short distances and all 12 of the long-distance migrants passed Helgoland earlier in the year.

WORLDWIDE TRENDS Climate change is only one factor in a long list of influences on the size, health, and distribution of animal populations. Other pressures include loss of habitat, the introduction of exotic species, and the extinction of a critical member of an ecosystem, such as a pollinator, says Stanford's Root. Such factors can make it difficult for scientists to identify the effect of climate change on plants and animals. But they don't make it impossible, Root notes.

> More than 80 percent of phenological changes have changed in the direction expected if global warming were the culprit.

Scientists looking for long-term, global patterns often analyze data pooled from others' studies. That's the technique Root and her colleagues used in their search for the effect of climate change on various species.

The team looked at 61 long-term analyses that collectively focused on life cycle changes among almost 700 species or groups of related species during the past 50 years. Those research projects show that some animals have been reaching life cycle milestones, such as breeding and egg laying, an average of about 5 days earlier per decade. The budding or blooming of trees, however, had advanced only 3 days per decade. Trees have a smaller shift partly because some of them also base the timing of their spring wake-up on the photoperiod. That's the amount of daylight received each 24 hours, an astronomical factor related to Earth's rotation that hasn't changed as the climate has warmed.

Overall, the analysis by Root and her colleagues revealed that many springtime life cycle events have changed. More than 80 percent of these changes are in the direction expected if global warming were the culprit. This strong trend is support for the idea that climate change is already affecting ecosystems worldwide, the researchers asserted in the Jan. 2 *Nature*.

Furthermore, among species at latitudes above 50°N—those of Winnipeg, Manitoba; Brussels, Belgium; and Kiev, Russia—Root and her colleagues found that spring life cycle milestones moved forward an average of 5.5 days per decade. Research projects that studied the phenology of species from the latitudes below 50°N showed life cycle milestones advancing by only 4.2 days per decade, on average.

In an analysis of a different set of research projects, Camille Parmesan of the University of Texas, Austin and Gary Yohe of Wesleyan University in Middletown, Conn., discerned evidence bolstering the idea that climate change is affecting plants and animals worldwide. Their study, which combined long-term phenological studies of more than 675 species, showed that warming had advanced spring life cycle milestones of various organisms about 2.3 days per decade, on average. Purported effects of warming include earlier frog breeding, bird nesting, and plant flowering. This team's study also appeared in the Jan. 2 *Nature*.

When shifts in phenology occurred, more than 87 percent of the time they swung in the direction expected from climate change, says Parmesan.

Says Root: "The more species you look at, the broader the area, the longer the study period, the more you believe that global warming's at work here." ■

WHEN DRINKING HELPS

Sorting out for whom a nip might prove therapeutic

BY JANET RALOFF

Downing a cocktail or other alcoholic drink at least three to four times a week appears to substantially cut a man's risk of heart attack, Boston-area researchers reported in early January. Less than a week later, a U.S.-Canadian team of epidemiologists focusing on African Americans announced it had found no clear benefit to people drinking the same amount of alcohol per week. These reports joined other seemingly conflicting studies on the health impacts of alcohol that have emerged in the past few years.

Some research found that regular, moderate drinking not only helps preserve mental clarity in both young and elderly people but also increases blood-sugar control in people with diabetes. Other studies linked low but regular consumption of alcohol with an increased risk of certain cancers and a stunting of children exposed to alcohol in the womb. These subtle detrimental effects, of course, add onto the potentially catastrophic acute events caused by alcohol-impaired judgment.

With dozens of conflicting reports spilling out each year, is it any wonder that the public is confused about alcohol and health?

Yet, in probing the scores of published papers on alcohol's impacts, researchers have begun to discern a few trends. Chief among them: Alcoholic beverages can offer large pharmacological benefits, especially to people at elevated risk of heart disease. Various studies have begun unveiling why (*SN: 1/5/02, p. 8*).

In fact, argues Jürgen Rehm of the Centre for Addiction and Mental Health in Toronto, because alcohol's benefits appear primarily from slowing the progression of chronic diseases that usually emerge in or after middle age, there seems to be little health justification for drinking alcohol before age 40.

Among older adults, however, benefits of moderate drinking "appear to be huge," notes Tim Stockwell, director of the National Centre for Research into the Prevention of Drug Abuse at Curtin University of Technology in Perth, Australia. Data in his country indicate that among people who regularly down a few drinks a day, "there are approximately 6,500 lives saved each year by alcohol's protective effects on cardiovascular disease." Even factoring in alcohol-associated deaths from breast cancer and other malignancies, he says, "the net benefit for [moderate] drinking here appears to be about 5,000 lives a year."

"Although I think alcohol can be part of a healthy lifestyle, it's not a necessity," says Eric B. Rimm of the Harvard School of Public Health in Boston. Moreover, he adds, one wouldn't want to push abstainers to start drinking if they have cultural, religious, or other prohibitions against it—or an inability to hold their drinking to a few glasses per day. And drinking should never, he says, be portrayed as a substitute for exercise, eating a healthy diet, or giving up cigarettes as the best ways to stave off heart disease.

But among people who now drink occasionally, Rimm says, the accumulating evidence of alcohol's potential benefits is "so overwhelming that there are probably many cases where some people should be told to drink a little more."

RISKS IN ABSTAINING Alcohol is without question a poison. People die from binging, and many children enter the world with a retardation that traces to prenatal alcohol exposure. In fact, Rehm says, more than 60 diseases have been linked to excessive consumption of alcohol.

Although one might expect those risks to increase linearly with consumption, they don't. Stockwell points to hundreds of studies showing that a little daily drinking is more healthful than either abstaining or drinking to excess.

Epidemiologists refer to this as alcohol's "J-shape curve," for the contour that the risk data take when plotted on a graph. That provocative contour emerged strongly in a new review of 35 studies on stroke performed by researchers at Tulane University in New Orleans. In the Feb. 5 *Journal of the American Medical Association*, Kristi Reynolds and her colleagues confirm "a J-shaped association between alcohol consumption and the relative risk of . . . ischemic stroke," a disorder that traces to blockages in the brain's blood vessels.

> "There are probably many cases where some people should be told to drink a little more."
>
> —ERIC B. RIMM

Two years ago, Rehm and his colleagues reported a J-shape curve for alcohol consumption and premature deaths from all causes in their 11-year study of 5,200 U.S. men and women.

Economists at Duke University in Durham, N.C., published data 2 years ago showing a J contour in alcohol's impacts on disability claims. For 6 years, Jan Ostermann and Frank A. Sloan followed 12,650 people initially in their 50s or 60s. People drinking one or two drinks a day were least likely to report a disabling event, such as stroke or arthritis, "whereas abstainers generally were most likely to be disabled."

No matter how many possibly confounding factors they investigated, Sloan says, "we could not make the effect go away."

Rimm's team also observed a disadvantage for abstainers in a new 12-year study of heart-disease risks in 38,000 male health professionals. Overall, the researchers report in the Jan. 9 *New England Journal of Medicine*, disease risk fell as the volume of regularly consumed alcohol rose.

SWEET NEWS A J-shape curve has emerged in alcohol's effects on diabetes and also on cognition. Last spring, federal scientists at the Beltsville (Md.) Agricultural Research Center linked alcohol consumption directly to blood sugar and insulin benefits in a trial with 63 healthy postmenopausal women.

In one 8-week phase, the women drank orange juice laced with 15 grams of alcohol each night before bed; in another, they drank juice containing 30 grams a night, the equivalent of two drinks. To keep other aspects of the diet from affecting the parameters

being measured, the scientists administered carefully controlled meals to every woman throughout the trial. Such costly, controlled-feeding trials represent the gold standard of nutritional studies.

In the May 15, 2002 *Journal of the American Medical Association*, David J. Baer and his colleagues report that the women's insulin values, blood sugar, and cholesterol were healthiest during the two-drink-per-day regimen.

Although this trial used straight ethanol in juice, other studies have shown that certain pigmented compounds, called phenolics, that show up in beer and red wine can have their own healthful effects on people's hearts and blood sugar.

Pierre-Louis Teissedre and his colleagues at the University of Montpellier, France, gave diabetic rats phenolics-enriched white wine for 6 weeks in amounts equivalent to a person's intake of a half-liter per day. Afterward, the rats' blood quashed oxidative reactions—a major cause of diabetes complications—as well as the blood of healthy rats did. The treated animals also showed slightly improved control of blood-sugar concentrations. The findings appear in the Jan. 1 *Journal of Agricultural and Food Chemistry*.

The researchers then further enriched the wine with phenolics to achieve what Teissedre describes as pharmacological doses. In just-completed tests, this doctored wine "corrected the diabetes" by bringing control of the animals' blood sugar into a normal range, Teissedre reports.

One interesting observation: The antidiabetes effect diminished when the animals received phenolics without alcohol.

A clear J-shape curve is also showing up in studies of alcohol's effects on cognition. For instance, a year ago, Dutch researchers found that moderate drinkers have a lower risk of Alzheimer's disease and dementias than do abstainers or heavy drinkers (*SN: 2/2/02, p. 67*).

While that study was in the works, Constantine G. Lyketsos and his colleagues at Johns Hopkins University in Baltimore investigated effects of long-term drinking on reasoning, memory, decision making, and psychomotor speed in nearly 1,500 people. Scores on the test used in the study typically drop about 1 point per decade during early adulthood and 2 to 3 points per decade for people in their 60s. But in the new 13-year study, both young and old adults who regularly drank outperformed abstainers of the same age.

The finding was particularly robust for women, the Johns Hopkins team reported in the Oct. 15, 2002 *American Journal of Epidemiology*. Nondrinking women declined a point more on the test during the study than did moderate, habitual drinkers. For perspective, Lyketsos notes, "people with Alzheimer's disease tend to decline an average of 3 to 4 points on this scale every year, so a 1-point drop is not negligible." In fact, he concludes, because even heavy drinkers outperformed teetotalers, "the findings suggest that maybe the worst thing you can do is not drink."

FORTIFIED WHITE — Domaine Virginie of Bezier, France, has begun marketing Paradoxe Blanc as "the first white wine offering the same health benefits as red wine." The chardonnay, developed at the University of Montpellier, is enriched with phenolics that are good for the heart.

TROUBLING TESTIMONY Such statements trouble Nancy L. Day of the Western Psychiatric Institute and Clinic in Pittsburgh. Many women don't know they're carrying a child until well into their pregnancy, she notes, and her data indicate that "no amount of alcohol is healthy during pregnancy"—at least for the child.

Over the past couple decades, she and her colleagues have been measuring the growth and development since birth of 565 children from low-income, inner-city families. In the October 2002 *Alcoholism: Experimental and Clinical Research*, Day's group reported that 14-year-old children who had been exposed in the womb to alcohol were—as they had been at birth—shorter and leaner than the offspring of women who eschewed alcohol during pregnancy. The finding was true even for the women who downed just one or two drinks per month during their first trimester—a finding that "blew us away," Day told *Science News*.

By age 14, children of the lightest drinkers averaged 3 pounds less than nondrinkers' children; offspring of the heaviest drinkers, 16 pounds less. Though smoking during pregnancy also yields smaller babies, those kids "usually catch up within the first year or so," Day notes.

What concerns her most is that teenage children of drinkers had a smaller average head circumference—"a very crude measure of brain size"—than nondrinkers' teens had. Indeed, her latest findings show that fetal-alcohol exposure correlated with subtle changes in information processing that could impair learning.

For adults, drinking alcohol has also been tied to cancer. Many analyses show a steadily increasing risk of breast cancer as the average daily consumption of alcohol increases. For example, one 1998 study found that alcohol equivalent to one drink a day increases the risk of breast cancer by about 9 percent.

Characteristics of drinking can have an effect, too. People who down a significant share of their alcohol outside of meals, for instance, face at least a 50 percent higher risk of cancer in the oral cavity, pharynx, and esophagus than do people who drink only at meals (*http://www.sciencenews.org/20030215/food.asp*).

BINGEING BACKFIRES A growing number of studies are finding new risks from binge drinking, which is usually defined as downing five or more servings of alcohol in one day. Lyketsos and his colleagues found in their study that people who typically binged had more cognitive decline than did heavy, frequent drinkers consuming comparable volumes of alcohol.

Indeed, Rehm and Christopher T. Sempos of the University of Buffalo's Department of Social and Preventive Medicine suspect that bingeing may account for the results of their team's analysis of drinking and health in 2,000 African Americans.

They analyzed 19 years' of dietary data for blacks in the National Health and Nutrition Examination Survey (NHANES). The epidemiologists compared alcohol consumption per week with death from any cause. In the January *Alcoholism: Experimental and Clinical Research*, they report that the data for the African-Americans didn't follow the J curve, but risk of death "increased with increasing average consumption."

Rehm and Sempos note that the survey asked only how many servings of alcohol people typically down in a week. If the answer was 10 to 14, for example, but that amount was consumed only over the weekend, that's bingeing, Sempos says.

In fact, the researchers cite three studies since 1995 indicating that the African-American community has a higher proportion of abstainers and bingers than the white population does. Moreover, says Thomas K. Greenfield of the Alcohol Research Group in Berkeley, Calif., some studies have reported "that because of larger containers and higher-alcohol-content products marketed to African-Americans, surveys [like NHANES] may even underestimate the heavy quantities consumed by ethnic minorities."

Fuzzy reporting of consumption patterns compromises data from most alcohol surveys, Rehm observes. That's why many researchers would prefer data from experiments in which people drink alcohol only under researchers' supervision.

Shela Gorinstein of the Hebrew University-Hadassah Medical School in Jerusalem says her team expects to begin just such a clinical trial soon. Some lucky recruits will get free beer for 10 years. ■

TEISSEDRE

OF NOTE

ARCHAEOLOGY

Grave surprise rises in Jamestown fort

Excavations in the 17th-century fort at Jamestown, Va., have yielded the grave of a high-ranking male colonist. Physical and historical evidence indicates that the man was one of the community's leaders, according to William Kelso, archaeology director of the Association for the Preservation of Virginia Antiquities' Jamestown Rediscovery project.

The most exciting possibility is that the grave, which included a ceremonial staff attached to the coffin lid, holds the remains of Captain Bartholomew Gosnold. The Englishman was the principal promoter of this expedition to establish a settlement in the New World. Gosnold died in 1607, at age 36, 4 months after serving as second-in-command of the fleet that had landed 107 settlers. The skeleton might also have belonged to any of four other prominent male colonists who died in their mid-30s between 1607 and 1610, Kelso says.

The researchers plan to extract DNA from the skeleton and compare its molecular structure to that of DNA from Gosnold's living descendants. —B.B.

FOOD & NUTRITION

Why beer may deter blood clots

Downing a beer a day alters the structure of fibrinogen, a blood protein active in clotting. The preliminary finding by an international research team could be good news for people with artery-narrowing atherosclerosis. They might be able to diminish their risk of heart attacks and strokes by routinely lifting a mug.

For their investigation, Shela Gorinstein of the Hebrew University–Hadassah Medical School in Jerusalem and her colleagues recruited 48 men who had just recovered from coronary-artery-bypass surgery. Half received 12 ounces of pale lager every day for a month; the rest got an equivalent amount of mineral water. All participants ate a roughly 1,700-calorie daily diet rich in fruits, vegetables, and olive oil.

When Gorinstein's team compared blood samples from each recruit both before and at the end of the trial, big changes emerged—but only in the men drinking beer. Not only did about 10 percent of their clot-promoting fibrinogen disappear, but more detailed analyses also revealed that much of the remaining fibrinogen underwent structural changes that compromise the clotting process.

The end result: The men should be less prone to cardiovascular disease stemming in part from clots, Gorinstein says. Her team reports its findings in the Jan. 29 *Journal of Agricultural and Food Chemistry*.

Earlier work by the group suggests that at least some of the newfound fibrinogen effects trace to polyphenols—pigmented antioxidant compounds in beer, tea, wine, and fruit juices. Moreover, the team's earlier studies of people with high cholesterol showed that regular, moderate beer drinking lowered their total cholesterol by about 25 percent and their low-density (bad) cholesterol by more than 27 percent. —J.R.

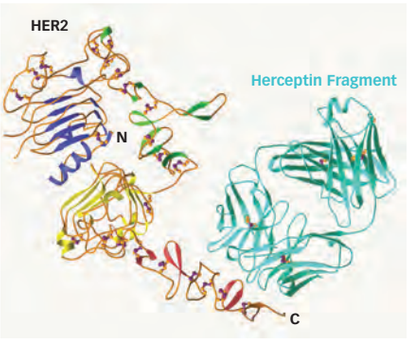
BIOMEDICINE

Portrait of a cancer drug at work

As researchers seek better drugs for breast cancer, they have a revealing new picture that could guide their way. It shows where the breast cancer drug Herceptin binds to and inhibits the protein HER2 on cancer-cell surfaces.

In 20 to 30 percent of breast cancer cases, overproduction of HER2 stimulates cell proliferation. To determine the structure of HER2 at the atomic level, Daniel J. Leahy, a Howard Hughes Medical Institute investigator at Johns Hopkins University School of Medicine in Baltimore and his colleagues shined X rays through crystallized HER2 with and without fragments of Herceptin bound to it. "It gives people a view of the exact interactions" between the drug and its target, says Leahy, whose team reports its work in the Feb. 13 *Nature*.

The newly revealed HER2 structure also explains why the protein is a powerful cancer promoter. Unlike related proteins, HER2 is normally in an active state and doesn't need to be triggered by another molecule, says Leahy. —J.T.



LEAHY ET AL./NATURE

TAKE THAT! This X-ray–based diagram shows where the breast cancer drug Herceptin binds the cancer-cell protein HER2. In the HER2 structure, the colored ribbons represent distinct regions of the protein.

EPIDEMIOLOGY

Miscarriages foretell heart trouble

A woman's experiences in childbearing may presage her risk of heart disease, according to new research. Women who spontaneously lose one or more fetuses early in pregnancy are about 50 percent more likely than other women to later suffer ischemic heart disease, in which constricted or obstructed blood vessels choke the flow of blood to the heart.

Elective abortions don't appear to influence women's risk for ischemic heart disease, Gordon C.S. Smith of Cambridge University in England and his colleagues say.

The researchers reached these conclusions after analyzing data on all 129,290 women in Scotland who delivered their first live baby from 1981 through 1985. Additional data showed that those women who had had an early miscarriage in a previous pregnancy were more likely than other new mothers to have died from or been hospitalized with ischemic heart disease between 1981 and 1999.

The loss of a fetus probably doesn't directly influence heart disease risk, Smith and his colleagues say in the Feb. 22 *British Medical Journal*. Rather, women with circulatory defects that predispose their blood vessels to become blocked face an elevated risk for both fetal loss and heart disease, the researchers hypothesize. —B.H.

SCIENCE & SOCIETY

Doctoral seesaw

Throughout most of the 1990s, the number of doctoral degrees that U.S. universities awarded in science and engineering climbed steadily, according to a new

OF NOTE

national survey. By 1998, the class of newly minted Ph.D.s peaked at an all-time high of 27,300, after which new doctoral awards started falling.

By 2001, the most recent year for which data are available, U.S. institutions awarded just 25,500 science and engineering Ph.D.s—the lowest number since 1993. Over the same period, Ph.D.s in health, the humanities, education, and other fields remained fairly constant, according to data compiled by the National Science Foundation (NSF) in Arlington, Va.

For science and engineering, the recent decline "was almost across-the-board," although some fields suffered more than others, observes NSF's Susan T. Hill. For instance, annual chemistry doctorates have declined by 12 percent since 1994, while physics doctorates have gone down 23 percent. However, Hill points out, a new 2-year upswing in graduate-school enrollments suggests that the science and engineering dip may be bottoming out.

The new survey contains some encouraging sociological data. For instance, women in 2001 earned 36.5 percent of all doctorates in science and engineering, whereas in 1997 they received only 32.8 percent of such degrees. —J.R.

BIOMEDICINE

Light could be therapy against blindness

Beaming red light at animals soon after they've drunk methanol partially protects their eyes against that chemical's blinding effects, research on rats suggests. Such light therapy might find applications in people who accidentally ingest methanol or who suffer from other forms of acquired blindness, such as age-related macular degeneration and glaucoma, says Janis T. Eells of the Medical College of Wisconsin in Milwaukee.

Strong, red light is high-intensity, low-frequency radiation. Eells and her colleagues chose to experiment with such radiation because other studies had shown that it can protect cells' energy-producing parts, the mitochondria, from some forms of chemical and metabolic injuries.

Methanol harms sight mainly by damaging mitochondria in cells in the eye's retina and optic nerve. People and animals can go blind within 2 days of ingesting methanol, an alcohol used in windshield-wiper fluid and other solvents.

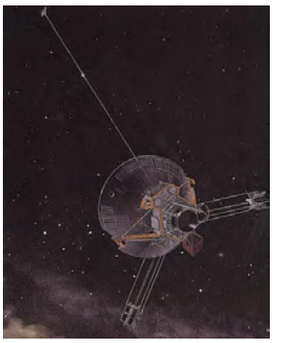
Eells and her colleagues fed lab rats three doses of methanol over 2 days and exposed some of the animals to three periods of intense red light, each lasting almost 2.5 minutes. Cells in the light-treated animals' eyes were subsequently more responsive to normal light and suffered less structural damage from the methanol poisoning than eye cells in animals not treated with light therapy. The researchers report their findings in an upcoming *Proceedings of the National Academy of Sciences*.

Since mitochondrial damage may play a role in other sight disorders, light therapy could prove useful against multiple causes of blindness, Eells says. She cautions that commercially available red lights don't shine with the intensity that seems necessary to achieve therapeutic effects. —B.H.

ASTRONOMY

Death of a pioneer

Pioneer 10, the first spacecraft to venture to the edge of the solar system, appears to have sent its last signal to Earth. NASA's Deep Space Network of radio receivers last recorded a feeble signal from the venerable craft on Jan. 22, when it was 82 times as far from Earth as the sun is. Another search on Feb. 7 for a signal failed, and NASA plans no further attempts to contact the craft. Engineers propose that Pioneer 10's radioactive power source has finally become too weak for the craft to contact Earth.



SPACE SILENCE Artist's depiction of the Pioneer 10 spacecraft, now at the fringes of the solar system. The craft appears to have broadcast its last feeble signal to Earth on Jan. 22, and NASA plans no further search for a signal.

NASA

Launched in 1972, Pioneer 10 was the first spacecraft to pass through the asteroid belt, the swath of rocky debris that lies between the orbits of Mars and Jupiter. It traveled by Jupiter in 1973 and was the first craft to obtain close-up images of the giant planet. In 1983, Pioneer 10 became the first craft to pass the orbit of Pluto, and it continued to make observations of the solar wind and cosmic rays until its science mission ended in 1997.

"Pioneer 10 was a pioneer in the true sense of the word," says Colleen Hartman, director of NASA's Solar System Exploration Division in Washington, D.C. "After it passed Mars on its long journey into deep space, it was venturing into places where nothing built by humanity had ever gone before," she says. —R.C.

NEUROSCIENCE

Blood sugar processing tied to brain problems

People with diabetes experience more short-term-memory problems on average than do people without the disease. Researchers now report that some nondiabetic people who nevertheless have slightly elevated blood sugar concentrations also have short-term memory impairment.

Moreover, these people have a smaller hippocampus on average than do those without high blood sugar, report Antonio Convit, a psychiatrist at the Nathan Kline Research Institute for Psychiatric Research in Orangeburg, N.Y., and his colleagues. The hippocampus is a part of the brain that retrieves short-term memories, such as what one had for breakfast.

The findings, which appear in the Feb. 18 *Proceedings of the National Academy of Sciences*, could explain some memory lapses in elderly people who otherwise appear healthy, says Convit.

He and his colleagues tested 30 individuals with an average age of 69. None had Alzheimer's disease or another dementia. After fasting overnight, the volunteers performed a test requiring them to recall elements of a brief story read to them. Then the researchers gave each person an infusion of glucose and took blood samples over 4 hours. Slowly falling blood-glucose concentrations indicate inefficient sugar metabolism.

Volunteers showing such a trend had fared worse on the recall tests than those whose blood-glucose concentrations normalized more quickly, Convit says.

Using magnetic resonance imaging, the researchers found that people slow to metabolize sugar had smaller hippocampi relative to their head size than the others, the team reports.

Previous studies have shown that the hippocampus can atrophy in animals with poor sugar metabolism. This damage correlates with an inability of the animals to retrieve memories, says Convit.

Why the shrinkage occurs remains baffling, Convit says. The good news, he adds, is that such loss might be reversible, since exercise and a good diet can improve sugar uptake. —N.S.

Books

A selection of new and notable books of scientific interest

AQUAGENESIS: The Origin and Evolution of Life in the Sea

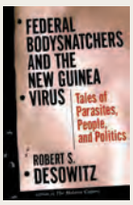
RICHARD ELLIS

In lucid and engaging prose, Ellis traces the history of life on Earth as animals moved from sea to land and back to sea again. He discusses not just how but why this journey occurred. By comparing creatures living in and around water today with those in the fossil record, he provides an overview of the prevailing theories of paleontology and evolutionary biology. In the process, he introduces a bevy of interesting creatures—living and extinct—and describes the physical attributes that enabled them to integrate themselves into their habitats. From accounts of the bacteria that prosper on the ocean floor to the giant crocodiles, turtles, and manatees that swam in the seas millions of years ago, Ellis imparts a thorough evolutionary history of the oceans. Originally published in hardcover in 2001. ***Penguin, 2003, 304 p., b&w illus., paperback, $15.00.***

FEDERAL BODYSNATCHERS AND THE NEW GUINEA VIRUS: Tales of Parasites, People, and Politics

ROBERT S. DESOWITZ

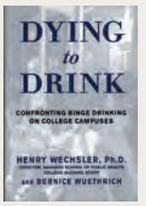
In the 20 years since the publication of Desowitz' book *Tape Worms and Jewish Grandmothers*, the science of genetics in disease has advanced dramatically, as have potential treatments based on that science. However, as Desowitz elaborates, a series of social and political forces has impeded progress in some perilous diseases such as malaria and AIDS. The author details patent disputes, profit motives, and political wrangling to illustrate how some therapeutic advances can be thwarted, especially in the world's poorest and most afflicted regions. Moreover, he considers how Crimean-Congo hemorrhagic fever is afflicting Russians, why the originally African-Asian hantavirus has appeared in the United States, and how the emergence of such diseases can be tied to global warming. ***Norton, 2002, 262 p., hardcover, $24.95.***



DYING TO DRINK: Confronting Binge Drinking on College Campuses

HENRY WECHSLER AND BERNICE WUETHRICH

In the United States, two out of every five college students regularly binge drink. That's defined as at least four and five drinks in a row, respectively, for women and men. There are approximately 1,400 deaths associated with this behavior annually, in addition to at least half a million unintentional injuries. In 1993, Harvard University researcher Wechsler conducted the first national survey of college binge drinking, which he's updated three times since then. Teaming with science-writer Wuethrich, he reveals some startling findings that point to binge drinking as the leading health issue on college campuses. Considering that students spend $5.5 billion a year on alcohol—more than they spend on schoolbooks and all other drinks combined—the problems are not so surprising. The authors reveal how a disproportionate number of assaults and rapes are linked to this behavior and examine how drinking is entrenched in college life. Wuethrich and Wechsler offer several suggestions for what can be done by students, college administrators, and parents to curb the college-campus drinking problem. ***Rodale Pr, 2002, 322 p., hardcover, $24.95.***



SIX DEGREES: The Science of a Connected Age

DUNCAN J. WATTS

How do small outbreaks of disease become epidemics? How do populations of flashing fireflies or beating pacemaker cells manage to synchronize their rhythms? How vulnerable is the U.S. power grid or the Internet to attack? Reporting from the front line of the emerging science of networks, Columbia University sociologist Watts gives an insider's account of how this field is defining our connectedness. Watts reveals how individual behavior aggregates into collective behavior—a phenomenon that can be understood only through work in several scientific disciplines. Once he defines the nature of networks, he discusses the myriad ways that networks bind together everything from our economy to our airports and highway systems. ***Norton, 2003, 368 p., hardcover, $27.95.***

SYNAPTIC SELF: How Our Brains Become Who We Are

Joseph LeDoux

In LeDoux's last book, *The Emotional Brain*, he discussed the biological foundation of memory and emotion. In *Synaptic Self,* he explores the biological mechanisms by which the brain makes the self. LeDoux provides a primer in brain science, illustrating how the transmissions between neurons create and maintain personality. The synapses between neurons, he proposes, are not only the means by which we think, act, imagine, feel, and remember, but also the places where combinations of these processes create memory. Synapses are responsible for encoding the essence of the individual, which allows each of us to be the same person from minute to minute and year to year. Nurture and nature both influence our synapses and ultimately construct our personality, LeDoux writes. The author doesn't argue with people who say that the self is psychological, social, moral, aesthetic, or spiritual—rather than neural—in nature. Instead, he attempts to anchor these ways of understanding the self in a neurological framework. LeDoux makes clear that he's offering only a working hypothesis, but he presents it ably. Originally published in hardcover in 2002. ***Penguin, 2003, 406 p., b&w illus., paperback, $16.00.***

LETTERS

Love for the love frog?

The nocturnal singing of coquies is beloved in Puerto Rico, especially after several years of unexplained population decline ("Hawaii's Hated Frogs," *SN: 1/4/03, p. 11*). Is there any chance that the little coquies can be returned from Hawaii?

MARIO A. LOYOLA, MAYAGUEZ, PUERTO RICO

The Coqui Hawaiian Integration and Reeducation Project (CHIRP) is applying for an export license for coquies. —J. RALOFF

Your article was extremely one-sided. In fact, many people here in Hawaii love the frogs' sound, and they may prove beneficial since they eat invasive insects. We need to develop humane environmental control methods, not cut-and-burn environmentalism, as has been proposed.

SYDNEY ROSS SINGER, CHIRP, PAHOA, HAWAII

This article confuses me. For years, I've been reading about the mysterious worldwide decline in frog populations. Also, why does caffeine kill off frogs and slugs but not insects?

LORIEN DAVY, SANTA BARBARA, CALIF.

Frogs seem to be disappearing in lots of places for a variety of reasons, from habitat loss to poisoning and introduction of new predators. As for caffeine, the compound easily penetrates frogs' and slugs' moist skin but not insects' hard exoskeleton. —J. RALOFF

You ask the question "Whose dinner are the coquies stealing?" In fact, dinner for coquies or any other carnivore in Hawaii contains mostly items among the 5,200 native insect species. The loss of insect species is an irreplaceable loss to world biodiversity.

JAMES K. LIEBHERR, ITHACA, N.Y.

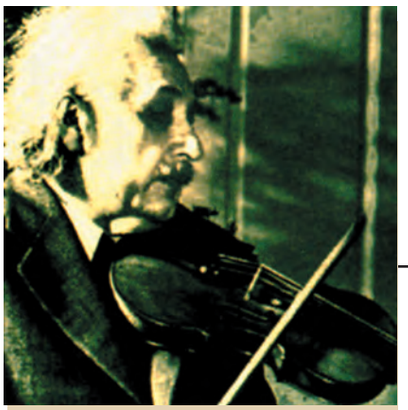
My wife and I find that the crickets are nosier than the frogs, and best of all, the mosquitoes have all but disappeared from our macadamia orchard. If the frogs control the mosquitoes, maybe native birds at lower elevations can be saved from avian malaria.

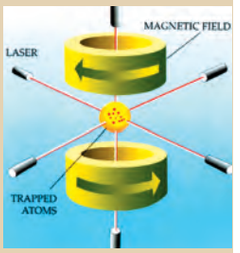
MICHAEL M. KRAUS, HILO, HAWAII

Tough stuff

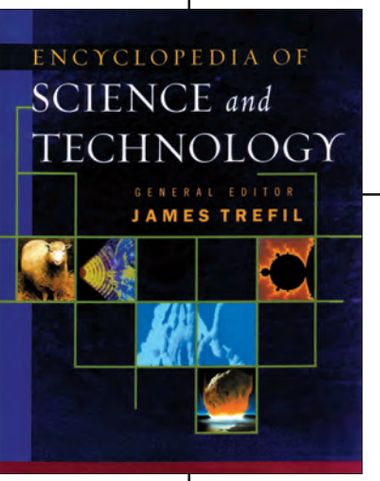
"Fracture Protection: Nanotubes toughen up ceramics" (*SN: 1/4/03, p. 3*) reports that adding single-wall carbon nanotubes to a ceramic can "nearly triple its resistance to fracturing." The similar technology of adding tubes (straw) to bricks has been around for thousands of years and is of comparable effectiveness.

LEE W. CASPERSON, PORTLAND, ORE.





ENCYCLOPEDIA OF SCIENCE and TECHNOLOGY



Destined to be the leader in the field, the *Encyclopedia of Science and Technology* is a revolutionary, full-color, A-to-Z guide that sets a new standard for science reference. Edited by acclaimed physicist and science writer James Trefil, the encyclopedia's nearly 1,000 entries and 750 illustrations combine in-depth coverage with a vivid graphic format to bring every facet of science, technology, and medicine into stunning focus. From absolute zero to the Mesozoic era to semiconductors to the twin paradox, Trefil and his coauthors how the universe works and show readers how to apply that knowledge to everyday problems.

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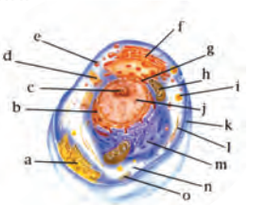
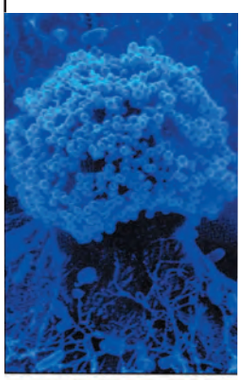


—from Routledge

Routledge, 2001, 554 pages, 8 ¾" x 11 ¼", hardcover, $50.00



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