SCIENCE NEWS
THE WEEKLY NEWSMAGAZINE OF SCIENCE

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surgery, byte by byte
obesity: a social disease
double trouble from ozone
cat's curtain call

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have you seen this bee?

CLUES TO A MASS DISAPPEARANCE

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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JULY 28, 2007 VOL. 172, NO. 4

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Of Note

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Cover Beekeepers in the United States tend some 2.4 million honeybee colonies, which obligingly haul pollen for many of the nation's commercial crops. Researchers are urgently seeking to understand why bees vanished last winter in large numbers, leading to the collapse of countless hives. (iStockphoto) Page 56

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http://blog.sciencenews.org/

Food for Thought People's gut microbes ferment fiber from coffee, making beneficial compounds.

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Weighting for Friends

Obesity spreads in social networks

HEFTY TIES New data from a 32-year investigation indicate that obesity spreads contagiously among networks of friends and relatives.

ISTOCKPHOTO

Although a variety of personal traits influence weight gain, obesity is socially contagious, moving from person to person through networks of friends and relatives, a new investigation finds.

The study, the first to examine how social ties influence the development of obesity over time, finds that if one person becomes obese, others who know that person well have an increased risk of also becoming obese within the next 4 years. This effect occurs especially strongly among people identifying each other as friends.

The proliferation of permissive attitudes about weight gain and large body sizes among social groups has contributed to soaring U.S. obesity rates, propose medical sociologist Nicholas A. Christakis of Harvard Medical School in Boston and political scientist James H. Fowler of the University of California, San Diego.

"Obesity is not just an individual problem, it's a collective problem," Christakis says.

The new findings appear in the July 26 *New England Journal of Medicine*.

Christakis and Fowler tapped into previously unexamined data on 12,067 adults who underwent health assessments every 2 to 4 years, from 1971 to 2003, as part of the Framingham Heart Study. The researchers traced social networks for study participants by consulting records of contact information for each volunteer's close friends and relatives, many of whom also participated in the Framingham study and whose weights could also be tracked.

In this largely white, middle class sample, roughly one in three individuals displayed a body mass index that qualified him or her as obese by the end of the study.

The scientists found that when an individual becomes obese, the likelihood that a person who regards that individual as a friend will also become obese increases by 57 percent. This obesity risk increases far more, by 171 percent, when one of two people who regard each other as friends becomes obese.

Friends' impact on obesity appears equally strong whether they live next door to each other or 500 miles apart. Smaller but significant influences on obesity risk extend to friends of friends of people who become obese as well as to people with even less-direct ties to obese individuals. If one sibling becomes obese, the likelihood of the other following suit increases by 40 percent. A comparable effect occurs between spouses.

The sex of social partners also sways obesity's spread. In same-sex friendships, an individual's obesity risk increases by 71 percent if a friend becomes obese. Same-sex siblings display a comparable pattern. Friends and siblings of opposite sexes showed no such liability.

Obesity doesn't spread among neighbors, unless they're also friends. Nor does the risk of obesity rise in an individual dubbed a friend by someone who becomes obese but who doesn't consider that person a friend in return.

Obese people didn't simply seek out similar-looking friends but actually influenced others, Christakis contends. He says that in many cases, people overweight to begin with were encouraged to eat even more, sending them over the line into obesity.

The new findings suggest that obesity treatment should target groups of people who belong to the same social networks, remarks Harvard Medical School psychologist Matthew Gillman, who heads an obesity-prevention program.

Genes and other biological factors influence individuals' weights (*SN: 3/22/03, p. 179*), "but genes can't explain the obesity epidemic of the past 30 years," Gillman says. —B. BOWER

Good Light

Sun early in life could protect against MS

A half-century ago, doctors from Europe and North America who spent time in central Africa were struck by the absence of multiple sclerosis there. Indeed, the farther from the equator people lived, the more prevalent multiple sclerosis (MS) seemed to become. Scandinavians faced a higher risk than most other people. Thus arose the "latitude hypothesis" of MS, suggesting that a lack of direct sunshine somehow contributed to the nerve-damaging immune malfunction underlying the disease.

Although the geographical connection was strong, says Michael J. Goldacre, an epidemiologist at the University of Oxford in England, "it seemed almost too obvious to be true."

But a study from southern California now lends new credence to the sunshine theory of MS protection by removing a persistent confounder in such studies—the variability in people's genes. The researchers sifted through a large database to find records of 179 sets of identical twins in which one had MS and the other didn't. Estimating these individuals' childhood sun exposures, the scientists found that the twins with MS on

average had gotten less sun.

The study bolsters a 2003 report from Australia that associated greater sun exposure and a history of sunburns in childhood with reduced risk of MS. Also, Goldacre and his colleagues discovered in 2004 that people with MS were only half as likely as the general population to develop skin cancer—a condition linked with exposure to ultraviolet radiation.

"There's clear evidence from multiple publications to suggest this is something that's real," says Avery August of Pennsylvania State University in University Park, an immunologist not part of these studies. "There's a genetic component [to MS] but also an environmental component," he says.

In the new study, epidemiologist Thomas M. Mack and his team at the University of Southern California in Los Angeles analyzed questionnaires that the twins had completed before 1993 to obtain data on childhood sun exposure. The surveys included questions about outdoor sports and time at the beach.

The twin who spent more time outdoors had a 25 to 57 percent lower risk of developing MS, depending on the activity recorded, the researchers report in the July 24 *Neurology*. The people without MS had spent significantly more time than their siblings sunbathing, beachcombing, and getting out on hot days.

"This is a very sound piece of work," Goldacre says. "Dermatologists may feel that [advice to] spend some time in the sun is not a wholly welcome message. But it's all a matter of this being good for you in small doses."

Curiously, the latitude effect in MS seems to fade after adolescence. While this study and earlier ones hint that ultraviolet rays set a child's immune system on a normal course for life, they don't prove it, August says.

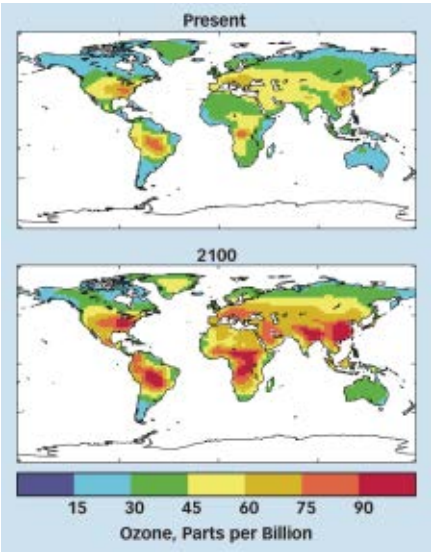
Specifically, the studies don't show how sunshine would thwart the rogue immune attacks on nerves, which cause a loss of muscle coordination in MS patients. —N. SEPPA

Stunting Growth

Ozone will trim plants' carbon-storing power

Increases in low-altitude ozone predicted for the upcoming century will stifle the growth of vegetation in many regions, causing planet-warming carbon dioxide to build up in Earth's atmosphere more quickly than had been expected, a new model suggests.

Low-altitude ozone—as opposed to the planet-protecting layer of the gas in the stratosphere—forms when the sun's ultraviolet radiation stimulates reactions between gases such as nitrogen oxide, carbon monoxide, and methane. Preindustrial concentrations of ground-level ozone typically ranged between 15 and 30 parts per billion (ppb), says Stephen Sitch, an ecologist at the Hadley Centre for Climate Prediction and Research in Wallingford, England. Now, emissions from cars, power plants, and other industrial sources routinely boost ozone in many regions of the world to well over 40 ppb.



GROWING PROBLEM **Top map shows average ozone concentrations June through August today; bottom map predicts concentrations in the year 2100. Estimated increases in ozone could suppress vegetation and thereby exacerbate global warming.**

Such ozone concentrations could easily damage a plant's leaves and stifle its growth, says Sitch. Most current climate models include the planet-warming effect of low-altitude ozone, a relatively weak greenhouse gas, he adds, but previous predictions haven't included warming due to ozone stifling the growth of vegetation. In an upcoming *Nature*, he and his colleagues attempt to calculate that effect. They also improved on current estimates of ozone damage to plants by including the effect of ozone concentrations below 40 ppb, says Sitch.

"I totally agree with this concept," comments David F. Karnosky, a plant geneticist at Michigan Technological University in Houghton. "This [new technique] is a large improvement over previous [climate-change] models," he adds.

According to some current projections, low-altitude ozone will exceed 40 ppb in almost all areas of the world by 2100, says Sitch. Moreover, many regions—including western Europe, eastern North America, Brazil, and southeast Asia—will see ozone concentrations above 70 ppb, he notes.

The researchers simulated the climate from 1901 to 2100, using data from the 20th century to calibrate the model. In 1901, the world's plants absorbed enough carbon dioxide from the atmosphere each year to store about 115 billion metric tons of carbon, Sitch and his colleagues estimate. A simulation with rising carbon dioxide but unchanging ozone concentrations predicted that plants would soak up about 200 billion metric tons of carbon annually by the year 2100.

When the researchers allowed ozone concentrations to rise as expected, however, the projected damage to vegetation reduced carbon absorption to only about 170 billion metric tons each year. The warming due to ozone-reduced plant growth would thus rival the warming from ozone's greenhouse effect, says Sitch.

The team's new simulations are "a useful start," says Mike Ashmore, an environmental scientist at the University of York in England. However, he notes, scientists have only limited data about how various plants—especially tropical ones—are damaged by ozone exposure. —S. PERKINS

Sop Story

New porous gel soaks up heavy metal

A team of chemists has created a new porous material that's extremely effective at sopping up mercury. Called a chalcogenide aerogel or simply a chalcogel, the material could be used as a filter for cleaning contaminated drinking water. The material's versatility also makes it a good candidate for a wide range of other applications, including the production of hydrogen fuel.

Mercouri Kanatzidis of Northwestern University in Evanston, Ill., and his colleagues have created several chalcogels by, in each case, combining two ingredients. One ingredient is always a chalcogenide—a compound containing at least one of the elements sulfur, selenium, or tellurium, which lie directly below oxygen in the periodic table, and at least one positively charged element. The second ingredient includes platinum, which links the chalcogenide molecules.

In this case, the researchers combined a platinum compound with a chalcogenide containing sulfur and the semiconductor germanium. After dissolving the two ingredients in water, the researchers poured the mixture onto a petri dish and let it sit for 2 days. The liquid turned into a dark-

SITCH ET AL.

brown gel. Careful washing and drying preserved the gel's highly porous structure.

"It's very simple chemistry," says Stephanie Brock, a chemist at Wayne State University in Detroit. "And that's one of the things that's very elegant about it."

To test the new material's ability to clean water, the team passed solutions highly contaminated with mercury through the chalcogel. Because mercury likes to bind to sulfur, explains Kanatzidis, the heavy metal accumulated on the surfaces of the numerous pores inside the material. In fact, the chalcogel removed up to 99.9 percent of the mercury in tainted solutions, the researchers report in the July 27 *Science*.

The team's initial findings indicate that the chalcogel performs just as well as, and sometimes even better than, commercially available water-filtration materials, says Kanatzidis. Unfortunately, the presence of platinum makes the new material too expensive to use in a commercial setting, he adds. His lab's next goal is to replace the platinum with a cheaper alternative.

Because the material also has interesting electronic and optical properties—due in part to the presence of germanium—such a chalcogel could be used for a range of applications beyond water remediation. Chalcogels can absorb both visible and infrared light, making them good candidates to act as light-triggered catalysts for a variety of reactions, including those that split water into hydrogen and oxygen.

Materials that use solar energy to produce hydrogen could one day generate the large amounts of hydrogen fuel needed to support a hydrogen economy (*SN: 10/30/04, p. 282*). That's one of many applications that Kanatzidis' group is interested in pursuing, he says.

"A lot of people are working on making hydrogen fuel," says Brock. "It's not a simple problem, and I don't think anyone has hit on a solution yet." The chalcogel, she says, could offer a new way forward. —A. GOHO

Grim Reap Purr

Nursing home feline senses the end

Stephen King, take note. A cat in Rhode Island knows when death is nigh.

Two years ago, the staff of Steere House Nursing and Rehabilitation Center in Providence adopted a gray-and-white kitten. They named him Oscar and moved him to the third floor of the dementia unit, where he generally keeps to himself.

Soon, though, the staff noticed something odd: Oscar was always hanging around when someone expired.

"There are two cats on the floor," says David Dosa, a geriatrician for the center and an assistant professor of medicine at Brown University. "One is the friendly cat, and the other one is Oscar, who is sort of unfriendly. [H]e doesn't go out of his way to be social—except when people are about to die."

J. TENO/BROWN UNIV.

NEXT, PLEASE Oscar the cat on his desk in a nursing home in Rhode Island, where he predicts residents' deaths with uncanny accuracy.

Then, Oscar hops on the bed, nuzzles the dying patient, and purrs, Dosa writes in an essay in the July 26 *New England Journal of Medicine*. Staff now regard Oscar as a dead-eye sentinel and begin calling family members of whomever the cat befriends.

"He's had weeks where we've had three deaths on the unit and he's nailed them all," says Dosa. "And then we'll have a week or two, or longer, when nobody dies, and he basically just sits by himself."

Dosa says that in the past year, Oscar has predicted about 25 deaths and missed only one.

"It started as a 'gee whiz' kind of thing, but now we count on it," says Dosa. Rhode Island's largest hospice organization honored the freaky feline with an award for compassionate care.

Janis Hammer, associate director of the Animal Behavior Institute in Durham, N.C., says that she knows of a cat with similar abilities at a Pennsylvania nursing home. "He would lie on the bed when someone was dying and wouldn't leave," says Hammer, who notes that nursing homes often keep animals for pet therapy.

Animal experts say that Oscar might be sniffing the end.

"Cats can smell much better than people," says Bonnie Beaver, professor of veterinary medicine at Texas A&M University in College Station. "And there certainly is the possibility that when a person nears death, their odors change. [Oscar] may be picking up on that."

Beaver says that dogs, whose sense of smell is even keener than that of cats, can predict human seizures with uncanny accuracy. Some research suggests that canines can even sniff the signals of prostate cancer in urine.

As for why Oscar can sense impending doom while his companion cat on the same floor can't, "We'll probably never know," says Beaver.

"I guess he helps transition people to the other side," says Dosa. "Then that's that, and he goes back to sitting on his desk and minding his own business." —B. VASTAG

Sweet Gatekeeper

Receptor depends on sugar and water

Acetylcholine receptors, structures on the membranes of nerve and muscle cells, act as gateways for the passage of chemical signals. The first high-resolution image of the functional part of these receptors hints at the significance of two common molecules—water and sugar—in its activity. The researchers who created the image also performed tests that confirm the role of the two molecules.

The docking of acetylcholine triggers a change of shape within its receptor that creates a passage allowing a flood of ions through the membrane. Those ions can spur responses in other neurons or in muscle cells.

The new image shows a chain of sugar molecules—known to be part of the acetylcholine receptor but previously considered unimportant—located near the receptor's opening. The sugar chain seems to act as a hinge on the gate of the receptor, a role that "could have a significant impact on the quickness of the signal," says lead author Cosma Dellisanti of the University of Southern California in Los Angeles.

One of the main effects of nicotine is to trigger acetylcholine receptors. Separately, impaired receptors have been linked to Alzheimer's disease and Parkinson's disease. The new findings may help scientists design drugs that target addictions, the brain diseases, and other ailments, says Dellisanti.

To get a high-resolution picture, Dellisanti and his colleagues first painstakingly crystallized the proteins that make up the functional part of the receptor. By analyzing how X rays scattered off the crystals, the researchers deduced the arrangement

of atoms within them. As well as locating the sugar molecules, the team found a pocket of water molecules in the core of the receptor—a surprising discovery because the internal structure of membrane proteins is typically assumed to be hydrophobic, or water-repellent.

The close association of sugar and water molecules led the researchers to suspect that both play a role in the receptor's function, Dellisanti says. To test this hypothesis, researchers removed the sugar chain and found that the truncated receptor failed to open properly.

The team then engineered the receptor to ensure its interior would be hydrophobic, interfering with the function of the water molecules. Again, the change impaired the receptor's activity.

Finally, simultaneously disrupting the roles of both the sugar and water molecules rendered the receptor useless. "These two elements are fundamental for the protein to work and were never considered before," Dellisanti says.

The scientists suggest that water acts as a lubricant for the shape-changing sugar hinge as the receptor opens. Their results appear online and in an upcoming *Nature Neuroscience*.

The mechanism of the receptor is extremely complex, with hundreds of molecular interactions, says Anthony Auerbach of the State University of New York at Buffalo. "Now we also have to think about attached sugars and buried water molecules as being part of the chemical reaction."

While Auerbach notes that this study provides only a snapshot of the receptor's action, he says that the work "brings us closer to understanding how the acetylcholine receptor changes its shape and how drugs alter the function." —C. BARRY

Heavenly Chemistry

Astronomers announce astrophysical anion

The discovery of a negatively charged organic molecule in space may provide new insight into the formation of amino acids, sugars, and other prebiologic compounds in interstellar gas clouds, the regions that spawn stars and planets.

The compound, known as octatetraynyl, is one of only three negatively charged ions identified in the heavens, and it's the longest molecule of the three. Researchers over the past few decades have discovered about 130 neutral molecular species and about 12 types of positively charged ions in space. Not until late last year did astronomers find the first example of a single negatively charged ion, or anion.

Some researchers had suggested that anions, which have one or more extra electrons in comparison with a neutral molecule, might be too fragile to exist for long periods. By contrast, it seemed reasonable that positively charged ions, which can easily be created by cosmic rays striking neutral compounds, should be more abundant.

"Anions have so far been neglected in most of the current astrochemical models, but our findings suggest that they might play an important role in these chemical networks," says Sandra Brünken of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., a coauthor of one of two studies on octatetraynyl in the July 20 *Astrophysical Journal Letters*.

"This opens up another avenue in the chemistry of interstellar space," says Jan Hollis of NASA's Goddard Space Flight Center in Greenbelt, Md., a coauthor of the other new study. By identifying molecules in regions of space that may collapse to form new generations of stars and planets, "we're really looking for our molecular origins," says Hollis. "The record of early Earth is lost, but [the record of prebiotic chemistry] may be preserved in these regions."

Hollis and his colleagues identified octatetraynyl, which consists of eight carbon atoms and a single hydrogen atom, in the gaseous envelope around the elderly, giant star IRC +10 216, some 550 light-years from Earth. Brünken's team detected the same anion in a cold cloud of molecular gas called TMC-1, a likely breeding ground for stars that lies 450 light-years from Earth. Both teams recorded the molecule using the 100-meter Green Bank (W.Va.) radiotelescope.

Isolated octatetraynyl molecules are free to tumble. As they change their rate of rotation, they emit a specific set of radio waves. Previous laboratory experiments by the Harvard team had revealed exactly which radio frequencies the molecule emits.

"Until recently, no one was able to measure the spectra of these molecules, so we had no idea" whether these compounds existed in space, comments theorist Eric Herbst of Ohio State University in Columbus.

He suggests that compounds in extremely low-density regions of space acquire a negative charge because electrons striking them stick to the molecules rather than fly off. The discovery will ultimately "help us understand the physical conditions" of these environments, shedding light on how more-complex organic molecules arise, he adds. —R. COWEN

THRASHER/UNIV. TEXAS

Slick serpent

Oil plunging into a pan filled with the same fluid drags along a thin sheet of air, which keeps the streaming fluid from immediately merging with the bath, says Matthew Thrasher of the University of Texas at Austin. By rotating the pan, Thrasher and his colleagues got the falling oil to take a curving path. The air-shrouded stream dipped in and out of the bath several times, looking like a frozen Loch Ness monster whose tail end merged with the fluid around it. Similar effects can occur in fluids in which the velocity difference between the stream and the rest of the fluid creates a slick transition layer between them. Thrasher and his team have submitted a paper—including instructions on how to re-create the phenomenon at home—to *Physical Review E*. —D. CASTELVECCHI

Rewind the Clock. Uncover the Story of Human Origins 2.5 Million Years Ago

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Brian M. Fagan is Professor of Anthropology at the University of California at Santa Barbara, where he has taught since 1967. Born in England, Dr. Fagan earned his B.A., M.A., and Ph.D. in Archaeology and Anthropology from Pembroke College, Cambridge.

Professor Fagan is the recipient of a Distinguished Teaching Award from the University of California at Santa Barbara. His other awards include the Public Service Award of the Society of Professional Archaeologists and the Public Education Award of the Society for American Archaeology. He was a Guggenheim Fellow in 1973.

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A mysterious, pre-Columbian, carved Olmec head

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NOT-SO-ELEMENTARY BEE MYSTERY

Detectives sift clues in the case of the missing insects

BY SUSAN MILIUS

The disappearance of large numbers of U.S. honeybees is so odd that it's attracted Ian Lipkin. Since last fall, beekeepers in at least 35 states have reported colonies that shrank rapidly for no apparent reason. Adult bees just go missing, leaving behind young bees in need of tending. This colony-collapse disorder (CCD), as it's now called, has got bee researchers coast to coast stirred up and looking for causes and remedies.

Lipkin, however, had never studied a bee disease until now. He works in the epidemiology department of Columbia University's Mailman School of Public Health—human health, that is. He's solved mysteries, though, and he says that his methods are yielding results this time too.

Lipkin is the pathogen hunter who in 1999 figured out that a cluster of people with encephalitis in New York had caught a then-obscure virus called West Nile. Since then, his lab has refined ways to use high-speed genetic sequencing to search for novel pathogens worldwide. What involved him in this insect-disease case, he says, is "the same thing that has captured the imagination of the public—the notion that there's been this inexplicable loss of bees."

HARD WORK — Honeybees pollinating crops (here, canola) add an estimated $15 billion to U.S. agriculture by boosting yields and quality. Hence the concern when beekeepers in most states (inset) reported mysterious colony collapses.

Following last winter's losses, beekeepers have had some success in rebuilding their hive numbers. But they remain concerned that next winter, their colonies may again suffer unexplained collapses.

It's a good mystery all right, with any number of hypothetical culprits: mites, bad bee food, cell phones, bee AIDS, pesticides, genetically modified (GM) crops, overwork. Jeff Pettis, based in Beltsville, Md., as head of the U.S. Department of Agriculture's network of laboratories devoted to bees, even suggested to the Washington Post that bees had worn themselves out making crop circles, thus explaining two mysteries at once.

Joking aside, Pettis, his government-bee-lab colleagues, Lipkin, and other researchers have been working in earnest on the problem. So far, they've eliminated several hypotheses. Now, they're mixing old-fashioned case study epidemiology with modern genetics. It now looks, says Pettis, as if "more than one factor may be coming together" in the mystery of the missing honeybees.

WHEN TO WORRY Beekeeper Dave Hackenberg, of Lewisburg, Pa., rents out his bees as migrant laborers, shipping hives around the country as crops come into flower and need pollination. Like baseball teams, his and many other big bee operations retire to Florida for the winter to get their workforce in shape for the stresses of the upcoming season.

But when Hackenburg checked on his hives there last November, he found that they were doing the opposite of recovering. He called Penn State University in University Park and reported that adult bees were disappearing without obvious cause.

Hackenberg's concern alerted researchers at Penn State and elsewhere to the problem, though Frazier says that once they started asking around, earlier cases turned up. In the typical case, colonies dwindled in a matter of weeks. Large numbers of bees simply vanished, and the few that remained showed a loss of appetite. Bees in neighboring colonies reacted oddly too. Instead of raiding an abandoned store of honey as soon as possible, they left the afflicted hive alone for days.

To start tracking down the cause of Hackenberg's troubles, state apiarist Dennis vanEngelsdorp, based at Penn State, and his colleagues undertook detailed case studies of affected beehives.

In mid-December of last year, vanEngelsdorp's team released its first results. From interviews with seven beekeepers in four states, the researchers learned of substantial losses. One beekeeper expected to lose all but 9 of his 1,200 colonies. A hive can empty and collapse in as little as a week, the beekeepers said.

These interviews, and others that followed, didn't disclose an obvious cause for CCD, but they "ruled out some things," says Frazier.

Beekeepers said that they had procured queens from a variety of suppliers, so it seemed unlikely that a bad batch of queens had spread a disease or genetic problems to the colonies of their offspring. They used a variety of mite-controlling drug regimens on their hives, so the drugs weren't the obvious answer. And the colonies had been given several kinds of diet enhancements, such as corn syrup or protein supplements, so feeding practices didn't seem culpable.

What the bees did have in common, though, was recent stress, such as from a lot of travel between assignments. Stress could have left the colonies vulnerable to some other menace, the researchers speculated.

As news spread about the trouble last winter, bells rang for memories of past cases of honeybee-hive disasters, says Jay Evans

ISTOCKPHOTO; (INSET) BEE ALERT TECHNOLOGY

of USDA's Beltsville, Md., bee lab. He cites a 1975 paper titled "Disappearing disease of honey bees" in the *American Bee Journal*. That report cited the paper "Bees evaporated: A new malady" in an issue of *Gleanings in Bee Culture* from 1897. These old reports raise the possibility that a bee pathogen is always lurking in hives but occasionally flares up in an especially virulent form. "It could be like the Spanish flu," says Evans. Flu is ever present, but the legendary 1918 epidemic killed an estimated 25 million people worldwide.

MAYBE NOT As winter and spring passed, researchers failed to find a clear answer, but there was no shortage of ideas.

The most infamous, so far, may be cell phones, described in the British newspaper The Independent in mid-April under the headline "Are mobile phones wiping out our bees?" The story referred to a "limited study" at the University of Koblenz-Landau in Germany reporting that "bees refuse to return to their hives when mobile phones are placed nearby."

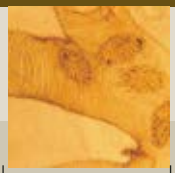
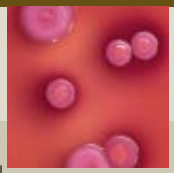
MAYBE All this nay-saying leaves plenty of other possibilities. "My first instinct was, it has to be caused by varroa mites," says Pettis. Unlike tracheal mites, these pinhead-size, blood-sucking parasites attack the bee from the outside. First noticed in the United States during the 1980s, varroa mites feed on bees of all ages, causing deformities in young bees and weakening adults. Infestations can kill a colony.

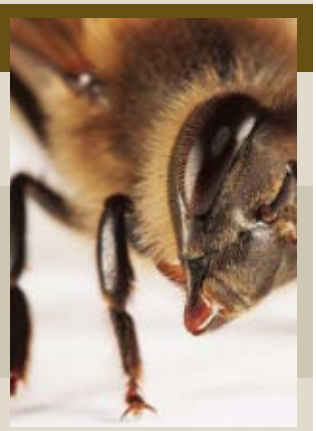
To check for them, Pettis washed batches of bees from collapsed colonies and examined the parasites that came loose. He found varroa mites on only about half of the batches of bees, making mites an unlikely culprit for the whole phenomenon. Still, "we can't rule out varroa," he says.

Pettis has begun experiments to see whether some infective agent remains within afflicted hives. He collected combs from hives that had collapsed and irradiated half of them at a facility normally used to sterilize medical equipment. He then introduced new bees into both the irradiated and untreated structures. He's keeping track of these colonies throughout the season to see if differences show up. All he can say so far is that bees in the unsterilized hives "didn't die instantly."

Some Suspects

A status report on plausible and implausible causes of colony-collapse disorder

Cell Phones	Tracheal Mites	Other Pests	Pesticides	Stress	Unknown Pathogen
					
Confused newspaper accounts put the blame on cell phones.	Survey found these mites in only 10 percent of bees in afflicted hives.	The varroa mite and some other pests have not yet been cleared.	Pest-control chemicals may make bees more susceptible to other risks.	Excessive work and travel may take a toll on bees' health.	Evidence may point to an emerging microbial cause of disease.
Not seriously investigated	**Ruled out**	**Under active investigation**	**Under active investigation**	**Under active investigation**	**Under active investigation**



Pettis wondered why, if this were true, he was having such a hard time getting phone reception when visiting afflicted hives in rural areas. But what deflated this hypothesis most dramatically were the German researchers themselves, who denied that their work had anything to do with colony-collapse disorder. "None of us ever wanted to do research on CCD," says Stefan Kimmel, a graduate student and coauthor of one of the phone-bee studies.

The researchers hadn't even used what Americans would call a cell phone but were experimenting instead with the base of a cordless phone. They were developing a setup to test for effects of electromagnetic radiation on honeybees, and for a source of electromagnetic waves had placed the phone's base unit inside a hive.

It was hardly a realistic test. Evans adds that the bees in the German group's experiment "may have just been offended by having this phone [in their hive]." For the time being, he says, the possible effects of electromagnetic fields on bees have moved down the list of CCD culprits. So has the suggestion that bees are losing their ability to navigate back to their hives because Earth is starting to reverse its magnetic field. Evans asks why that would upset U.S. bees more dramatically than it would bees in other nations, where CCD reports have not been as widespread.

By the end of May this year, Pettis says, he had virtually ruled out two more suggested explanations for CCD. "It's not tracheal mites," he says, referring to tiny parasites that infest the tubes making up the bee's breathing system. "I've personally looked at thousands [of bees from afflicted hives], and less than 10 percent of them have tracheal mites." Nor, he says, is the small hive beetle to blame. These common pests in fact seem unexpectedly rare in hives that have collapsed.

Another hypothesis is that pesticide exposure has either wiped out the colonies directly or contributed to their demise by enfeebling them. Rental hives travel extensively, and the bees visit fields treated with a wide variety of substances.

Bees may have encountered crops that have been genetically modified to produce their own pesticide, a bacterial toxin nicknamed Bt. The toxin is intended to target the caterpillars of moths and butterflies rather than bees, which belong to a different taxonomic order. In any case, one of the major Bt crops, corn, relies on wind for pollination and isn't a top pollen choice for foraging bees.

A new lab experiment found no effect on the weight and survival of honeybees fed for 35 days on pollen of a Bt sweet corn variety. Still, say Robyn Rose of the USDA's Animal and Plant Health Inspection Service in Riverdale, Md., and her colleagues, that doesn't rule out all possible risks from pesticide-bearing crops. In reporting their results, now online for a future issue of *Apidologie*, they suggest protocols to look for more-subtle effects.

A USDA research plan, released in July, raises another question about the genetically modified crops: European beekeepers have now reported die-offs too, and GM crops aren't grown there.

Bt crops are far from the only pesticide sources a bee might buzz into. For example, the neonicotinoids, a class of insecticides based on nicotine, are toxic to honeybees. The recent USDA report says that research it has funded suggests that widely used fungicides enhance the effects of the neonicotinoids. The report adds that one of them, imidaclorprid, has been found in pollen from corn, sunflowers, and rape at concentrations potentially harmful to bees.

ISTOCKPHOTO; USDA

Frazier is coordinating research on bees and pesticides. So far, she says, one analysis of pollen that bees had stored in affected and unaffected hives has been completed, but the work didn't point to a culprit. The colonies with the greatest variety of pesticides at the highest concentrations "are doing quite well," she says.

That doesn't settle the matter. Frazier says that she and her colleagues are designing direct tests of pesticide effects, for example by exposing caged colonies to chemicals in monitored quantities.

Some of Evans' work, too, has touched on pesticides. He specializes in honeybee genetics, and he's approaching the problem by looking at activity in genes known to kick in when bees encounter certain stressors. He and his colleagues are checking bees from affected and healthy colonies for any heightened responses by genes known to indicate exposure to pesticides or pathogens.

As of the end of June, no clear pattern had emerged in either the pesticide- or pathogen-related genes. "I keep looking," Evans says.

His project and others', he says, are hampered by the limitations of the samples. The disorder doesn't leave heaps of dead bees in the hives. The workers leave and presumably die far from home. Would the bees still buzzing around a depleted colony—the majority of bee researchers have been able to collect for study—still show signs of whatever afflicted their hive mates? Or would the survivors escape with no trace of the malady? "I think we would have solved this months ago if there had been more dead bodies," says Evans.

GONE MISSING — A comb from a troubled bee hive in Georgia shows plenty of the covered cells where larvae develop but far too few workers left to tend them.

USDA—ARS NATHAN RICE

Lipkin uses genetics, too, but in a different way. He sequences genetic material from samples of bees from afflicted colonies and compares the results with sequences from healthy ones. The samples contain genetic material from the bees themselves plus whatever mites, viruses, fungi, or other creatures were living on and in the bees' bodies.

The critical step is in the analysis of this hodgepodge. Discounting bee DNA plus any traces of genes from the people who handled a colony, Lipkin and his collaborators look for genetic sequences that show up in sick colonies but not in healthy ones. Identifying the source of those sequences could reveal a pathogen.

Starting in March, Lipkin and his epidemiology team have thrown themselves into the search, working with bee labs. "This has been a huge project, absolutely huge," Lipkin says.

After all this work, Lipkin's tight-lipped about what his analyses have revealed. He will say, however, that his lab, with help from others, is closing in on a suspicious infectious agent.

It probably won't tell the whole story by itself, he says. Pesticides or some other insult might need to weaken the bees to make them susceptible to attack by a microbe. He hopes that the agent his work has tagged might at least become "an excellent marker" for colony collapse. In the end, it may be that what bee detectives need to catch their villain is a consult from human epidemiology. ■

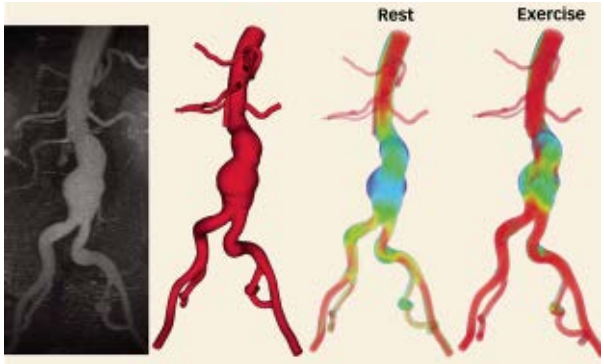
VIRTUAL SURGERY

Doctors can simulate heart operations with the click of a mouse

BY ERICA KLARREICH

Board an airplane and you can rest assured that it underwent rigorous safety testing before its first flight and, in fact, before it was even built. You can feel confident that engineering software searched across a vast range of design parameters to find the most aerodynamic shape, the sleekest wings, the sturdiest fuselage. Competing designs were "test-flown" in computer simulations to predict how they would perform in both friendly and turbulent skies.

Go into the hospital for open-heart surgery, however, and your doctor will have designed your treatment using a very different process. Most likely, the surgeon will have considered what treatments have worked best on patients with symptoms similar to yours and then used a combination of medical protocols and intuition to decide on your case. Doctors can estimate the risks and benefits of a procedure by looking at how well it has gone in the past, but they can't guarantee the outcome in your particular case. Advanced diagnostic tools and new drugs notwithstanding, medicine remains what it has always been: an empirical science.



WEAK WALLED — The SimVascular simulator converts magnetic-resonance images of blood vessels (left) into a geometric model (center left). In this patient, the bulge at the center of the large vessel is an aneurysm, or weakened wall. Blood-flow simulations show decreased velocity (blue and green) at the aneurysm, both during rest (center right) and exercise (right).

Charles Taylor, a bioengineering professor at Stanford University, wants to make the run-up to a heart-surgery procedure more like the design of an airplane. His team has created a simulator, called SimVascular, that converts magnetic resonance imaging (MRI) data into a computerized geometric model of the patient's blood vessels. The model offers surgeons the chance to test-fly various surgical procedures and other treatments to see which approach is most likely to best fit an individual patient's physiology.

"A patient gets only one surgery. You can't do two and see which is better," says Taylor. Using the model, however, surgeons could perform multiple virtual surgeries and test out ideas without ever touching the patient.

SimVascular, which has been more than a decade in the works, is due to be released on Aug. 31 as open-source software freely available to researchers all over the world. Taylor's team of cardiologists, surgeons, and others is already using the software to conduct basic research on the value of various heart treatments. For one type of serious congenital heart defect, the team has even used the software to design and test an entirely new surgical procedure. In the coming months, Stanford surgeons hope to perform that procedure for the first time.

"It's a very different way of thinking about medicine, infusing engineering and mathematics into the surgical-planning process," Taylor says.

CAPTURING CIRCULATION For several decades, researchers have been modeling the physics of the human circulatory system. In recent years, they've moved away from traditional glass-and-water models toward computer models that use software tools handed down from the aerospace industry to solve fluid mechanics equations. These models have provided compelling evidence that simple fluid-mechanical forces, such as blood pressure and shear stress, underlie most heart disease, from the buildup of fatty plaques in arteries to the vessel-wall weakenings called aneurysms.

While such computer models have proved illuminating, they remain idealized descriptions of a generic circulatory system. Individual circulatory systems vary widely, not only in the locations of plaques and the widths of vessels but also in how various vessels connect with one another.

As a graduate student in the early 1990's, Taylor realized that it should be possible to reconstruct a particular patient's physiology from the three-dimensional images of blood vessels that MRI creates. At first, Taylor planned to use such patient-specific models simply to continue studying the link between fluid mechanics and vascular health.

"But at some point," he says, "I realized that there was a much more important application: to help predict the outcome of a surgery."

Off-the-shelf fluid mechanics software tools were not designed to study blood flow, so Taylor knew that they would be inadequate for his purposes. The human circulatory system is different from a network of pipes, he explains. For instance, blood pulses in bursts rather than flowing smoothly, and blood vessels, unlike pipes, are flexible tubes that expand and contract with each pulse.

To make matters more complicated, the pictures offered by an MRI, unlike the blueprints for a plumbing system, are far from complete. MRI images can show all the vessels larger than 1 millimeter in diameter, but that amounts to just a few hundred of the millions of blood vessels in a human body. To deal with these complexities, Taylor realized that he would have to build his model from scratch.

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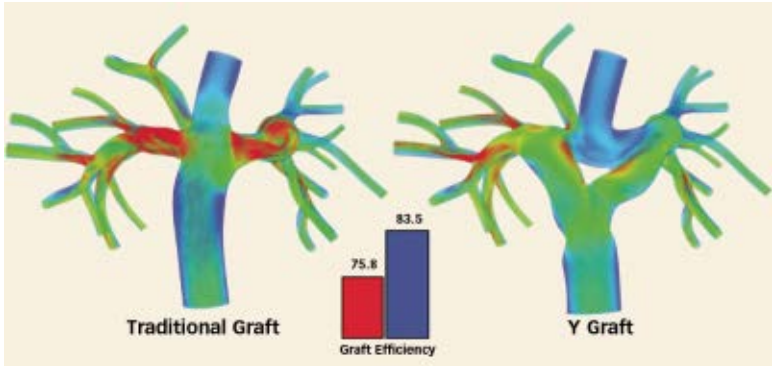
The SimVascular software starts with MRI images. Using image-recognition techniques, it extracts the geometry of the patient's major blood vessels—all those big enough for the MRI to detect. Next, the software divides the geometric model into millions of tiny chunks. Then it chooses a representative point inside each chunk. At each such point, differential equations govern the blood's velocity and pressure as well as the dynamics of the vessel walls.

To make these equations accurate where the model ends and blood flows into vessels too small for the MRI to detect, Taylor's team used existing knowledge about the fractal geometry of the vascular system to estimate the blood pressure and other conditions at these ends. This feature, along with its description of flexible blood vessel walls, sets SimVascular apart from other attempts to model the circulatory system, says Jay Humphrey, a biomedical engineer at Texas A&M University in College Station. Taylor and his team use their system to "prescribe well what is happening at the ends, and that is critically important," says Humphrey.

SimVascular uses the differential equations to create a flip-book movie of blood flow through the vascular system. The software divides each second of time into about 10,000 steps, and it uses the differential equations to calculate the forces at each representative point for each fraction of a second. Surgeons and researchers can view the movie and see detailed information about blood pressure, shear stress, and other conditions at each point in the blood vessels.

Creating such a movie involves simultaneously solving about 10 million equations for each time point. It currently takes the Stanford team's supercomputers several days to create a 20-second movie, but Taylor hopes to bring the running time down to a single day or a few hours. Such a speedup would bring the modeling process well within the customary timetable for surgical planning.



SIMULATED SURGERY — For a baby born with only one functioning pumping chamber in the heart, researchers have proposed replacing the traditional cross-shaped surgical repair (left) with a new, Y-shaped graft (right). In this simulation of blood flow through the grafts during moderate exercise, the "Y graft" proves significantly more efficient.

Surgeons could use the completed model to test the effects of existing treatments on a given patient. Even more broadly, they could use the model to test "any procedure you could imagine," Taylor says. Currently, a surgeon with an idea for a new type of surgery might, with luck, have a chance to try it out on a few animals or cadavers. Beyond that, surgeons have few options besides performing the surgery on a living, breathing patient.

"I think we'll make it easier for surgeons to test out wild ideas that might be good ideas," Taylor says.

HALF A HEART Taylor's team has already started testing one novel idea, which the Stanford surgeons may inaugurate within months. They hope that it will improve the quality of life for children born with a particularly serious type of heart defect.

Each year, up to 1,500 babies are born in the United States with, essentially, just half a heart. A normal heart has two pumping chambers. One, the right ventricle, pumps blood to the lungs to receive oxygen, and the other, the left ventricle, pumps the oxygenated blood through the body. In rare cases, however, one of these chambers fails to form properly.

Before birth, this malformation isn't a problem, since a mother oxygenates her baby's blood while it's in the womb. To survive after birth, however, a baby with the defect requires a series of procedures to reroute the heart's plumbing so that a single chamber can do all the pumping needed. After the rerouting, blood that has traveled through the body takes a detour to the lungs before returning to the heart.

For decades, surgeons performing this rerouting have connected the major blood vessels in the shape of a cross. In this procedure, two vertical veins coming from the upper and lower body are connected to two horizontal arteries carrying blood to the left and right lungs. Such a connection, however, isn't very efficient. Blood flowing down to the junction collides head-on with blood flowing up, and the resulting turbulence wastes energy. Wasted energy is a serious matter in these patients, in whom a single pumping chamber has to do the work of two.

"Patients often end up having heart failure by their teenage years and needing a heart transplant," says Alison Marsden, a researcher in Taylor's lab who has been using SimVascular to study the rerouting procedure.

About 10 years ago, some surgeons started doing an "offset" procedure, in which the upper vein still connects at the central junction but the lower vein is shunted to one side, avoiding a head-on collision of blood. This procedure creates its own set of problems, however. It delivers more blood to one lung than to the other, potentially inhibiting growth of the neglected lung.

Together with Stanford pediatric cardiologist Jeffrey Feinstein, Marsden and Taylor came up with a new idea. The surgeon could attach a Y-shaped graft to the bottom vein, then connect the Y's two short arms to the two horizontal arteries. This would create "off-ramps to the highway," Taylor says. "From a fluid mechanics perspective, it made a lot of sense."

The SimVascular software has enabled the team to compare the predicted efficiency of the Y graft with that of the offset graft. Earlier studies had suggested that the offset procedure is 90 percent efficient, which doctors would consider a good outcome. Those studies were limited, however, by the fact that tests of the efficiency of a patient's heart are generally performed while the patient is at rest. It's hard for doctors to predict from that information how the patient will fare during vigorous activity.

"The measurements we make are always on kids lying down, but that's not how they spend their days," Feinstein says.

SimVascular, however, can easily mimic exercise conditions. The simulator simply increases the heart rate and the blood flow leading to the major working muscles, decreases the blood flow to organs such as the stomach and kidneys, and adjusts a few other parameters that typically change during activity.

Marsden's simulations suggested that during exercise, the offset graft's efficiency drops to 65 to 70 percent, while the Y graft's efficiency is 80 percent. During rest, the Y graft runs at 95 percent efficiency, also topping the offset's performance.

When the surgeons collaborating with Taylor and Feinstein saw the numbers, they were eager to try the new procedure, a goal that the team hopes to make possible in the coming months. "The surgeons were willing to try it before we were, because that's how they do things," says Feinstein.

NEW LIGHT ON HEART DISEASE In addition to the Y-graft project, Taylor's team is using SimVascular to investigate a host of other heart ailments and treatments, from studying whether exer-

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cise slows the growth of aortic aneurysms to examining how blood flow in healthy children compares with that in babies born with severe narrowing of the aorta.

Drawing on her background in aerospace engineering, Marsden has been using optimization techniques to identify the best location and angle at which a surgeon should attach a coronary artery bypass graft. Coronary artery bypass is the typical "open-heart surgery" done on people with badly clogged heart arteries causing chest pain and threatening heart attacks.

The process is "similar to the design of an airplane wing, in which you look at how changing the shape affects lift and drag," she says. "Here, we're asking how the shape of the graft affects flow and shear stress," the blood's rubbing forces on vessel walls.

In another study, the team has come up with some findings about treatment options for high blood pressure in the arteries to the lungs, known as pulmonary hypertension. Between 50,000 and 100,000 people in the United States suffer from pulmonary hypertension, and in the most severe cases, it leads to heart failure and death. Beverly Tang, a graduate student in Taylor's lab, has been using SimVascular models of patients with pulmonary hypertension to calculate how their high blood pressure affects shear stress. It's impossible to measure shear stress using typical diagnostic tools. "The software allows us to get information we can't get in the clinic," Feinstein says.

Shear stress plays an important role in vascular health, because the rubbing forces created by rushing blood stimulate the cells lining blood vessels to grow and develop normally. Taylor's group has found that areas of low shear stress in the aorta tend to be where plaques accumulate.

"That's one of the reasons exercise is such a good thing—it increases the flow and the shear stress," Feinstein says.

Tang found that, according to SimVascular simulations, shear stress was almost an order of magnitude lower in the pulmonary-hypertension patients than in healthy individuals. To gauge the effect of this low shear stress, Tang subjected excised vessel-wall cells in the lab to shear stresses typical of those in pulmonary-hypertension patients. The cells became inflamed, and their level of functioning decreased.

The high blood pressure that defines pulmonary hypertension appears to set off "a cascade of complications," Feinstein says. These effects may explain why the disease progresses, which has been a puzzle for medical researchers. Tang's findings suggest that it may be appropriate to treat early cases of pulmonary hypertension more aggressively, using a drug called prostacyclin, which doctors usually reserve for severe cases. Unlike some other therapies, this drug increases blood flow, thereby raising shear stress. Using it in milder pulmonary-hypertension cases than usual, Feinstein suggests, may prevent the cascade that leads to full-blown disease.

> "I think we'll make it easier for surgeons to test out wild ideas that might be good ideas."
>
> — CHARLES TAYLOR, STANFORD UNIVERSITY

"The simulations are giving us a whole new light on this disease," Feinstein says.

With SimVascular's public release on Aug. 31, the software "will start to get used on a much larger number of problems than we're able to handle in-house," Taylor says. While many of those problems are likely to be in the realm of basic research, Taylor hopes some researchers will develop the software into an even more potent tool to help doctors and surgeons decide how to treat specific patients.

"Engineers take it for granted that you'll build a theoretical model and use it to make predictions, but medicine has not developed that way because bodies and diseases are so complex," Taylor says. "But now," he adds, "when I tell physicians about this approach, they say, 'Wow—of course this should be done.'" ■

OF NOTE

BEHAVIOR

Antidepressants trim suicide tries

Two extensive new investigations indicate that depressed people who take antidepressant drugs generally become less likely to attempt suicide.

Gregory E. Simon and James Savarino of Group Health Cooperative, a health maintenance organization in Seattle, analyzed medical and pharmacy records for 109,256 patients who had received depression treatment between 1996 and 2005. Patients' suicide attempts spiked during the month before starting treatment with medication, psychotherapy, or both. The frequency of suicide tries declined substantially during the 6 months after starting any of these treatments.

This pattern applied to teenagers and young adults as well as to older patients, the researchers say.

The researchers hypothesize that, for most patients, starting treatment with medication or psychotherapy diminishes depression symptoms, including thoughts about death and killing oneself. However, Simon suggests that further research needs to determine whether antidepressants aggravate agitation and suicidal thoughts in certain individuals.

A second study, directed by Robert D. Gibbons of the University of Illinois at Chicago, focused on data for 226,866 military veterans diagnosed with depression and then tracked for at least 6 months. Patients treated with fluoxetine (Prozac) or any other antidepressant medication during that period displayed large decreases in the frequency of suicide attempts that did not occur for other patients.

Again, the pattern held for all ages, including vets younger than 25 or older than 65.

Both new studies appear in the July *American Journal of Psychiatry*. —B.B.

MICROBIOLOGY

Old viruses have new tricks

Only a few years ago, biologists stumbled upon the fact that cells use RNA snippets called microRNAs as tools to control the activity of genes. Now it appears that some viruses also carry codes for microRNAs that can control the genes of invaded cells.

Once inside a host cell, a virus tricks the cell into producing these microRNAs, which then shut down genes that protect against infection by that virus.

"This [discovery] is fabulous, because it opens up a whole new avenue for making antiviral drugs," says research team member Mark Prichard of the University of

OF NOTE

Alabama at Birmingham. Drugs that block the viral microRNAs could reactivate the cells' own defenses against the virus, Prichard says. "There are a lot of viruses that this strategy might work for," he says.

The researchers scanned the genome of cytomegalovirus and found a microRNA that targets a gene called *major histocompatibility complex class I–related chain B* (*MICB*). The protein produced by this gene enables immune system cells called natural killers to fight viral infections.

Prichard and his colleagues then exposed lab-grown human cells to the virus and to a viral mutant that lacked the microRNA code. Only the original virus caused a reduction in *MICB* activity, the researchers report in the July 20 *Science*. —P.B.

EARTH SCIENCE

Erosion accelerates along Alaskan coast

Rates of erosion along Alaska's northern coast have more than doubled in recent decades, overhead views suggest.

Mud-rich permafrost cliffs standing 3 to 4 meters tall constitute much of the shore that runs from Barrow, Alaska, to the Canadian border. In some spots, the coast has moved inland more than 900 m during the past 50 years, says John C. Mars, a geologist with the U.S. Geological Survey in Reston, Va. He and USGS colleague David W. Houseknecht compared an aerial survey conducted in 1955 with more-recent satellite images to gauge erosion along the Arctic Ocean coastline.

ALL FALL DOWN Erosion of the permafrost cliffs along Alaska's Arctic coast (note slumping blocks at center) has more than doubled.

Between 1955 and 1985, about half a square kilometer of land fell into the sea each year along a 130-km-long subsection of the coast, says Mars. Between 1985 and 2005, however, the average annual rate of erosion there more than doubled to 1.08 km^2.

Causes of the recent boost in erosion aren't clear from this study, the researchers note in the July *Geology*. A warming climate in the past few decades could have rendered the permafrost cliffs more susceptible to erosion, and a decrease in the Arctic Ocean's summer-ice coverage may have increased wave action along the shore. —S.P.

PLANETARY SCIENCE

Saturn's retinue: 60 and counting

Astronomers have discovered yet another satellite of Saturn, bringing to 60 the number of moons around the ringed planet. The Cassini spacecraft spied the roughly 2-kilometer-wide body in images taken May 30.

Residing 197,700 km from Saturn, the moon orbits between Methone and Pallene, two 4-km-wide moons that were discovered by the craft soon after its arrival in July 2004. The grouping of these three objects suggests that they might be either the leftovers of a collision or a collection of icy objects that failed to coalesce into a larger moon, says Cassini scientist Carl Murray of Queen Mary, University of London.

After spotting the newest moon, temporarily known as S/2007 S4, astronomers searched through old images and found that Cassini had recorded the moon on several occasions over the past 3 years.

The moon, along with Methone, orbits Saturn in lockstep with a larger satellite, Mimas. Methone and S/2007 S4 probably didn't initially have the orbits that they do now but fell under the influence of Mimas as gravitational tides exerted by Saturn caused the two small bodies to drift toward the large satellite, says Murray.

NASA is considering extending Cassini's mission, scheduled to end in the summer of 2008. If the mission continues, Cassini's orbit will take it within 7,300 km of S/2007 S4 at the end of 2009, enabling the craft to better study the moon's composition and size. NASA released details on the newly detected body July 19. —R.C.

BIOMEDICINE

Perception is longevity

Mice engineered to have brains less sensitive to insulin live 18 percent longer than normal mice, new research shows.

The finding could help explain the link between low concentrations of insulin in the blood and greater longevity in centenarians and in some lab animals on calorie-restricted diets.

In the new study, mice ate high-calorie diets and so had high blood insulin. However, the researchers tricked some animals' brains into sensing less insulin. The engineered mice had just one copy of a gene called *IRS2* in their brain cells instead of the normal two, explains Morris F. White of Harvard Medical School in Boston. The single gene copy produced less of a protein that's critical to the function of insulin receptors.

The engineered mice, unable to properly regulate insulin, were more overweight and developed a worse diabeteslike condition than the normal mice did. However, brains of the altered mice sensed only a fraction of true insulin levels, which somehow enabled the animals to be healthier and live longer than the other overfed mice, the team concludes in the July 20 *Science*.

"This points to the brain as the place where reduced insulin signaling increases life span," White says. He adds that the next step is to study how the brain responds to a perception of low insulin and why that response increases longevity. —P.B.

SCIENCE & SOCIETY

Universities seek armchair astronomers

Nonscientists and researchers alike have a chance to see something no one else ever has—a few of the million far-off galaxies that the Sloan Digital Sky Survey has recently photographed. The price of admission: People viewing the new images online must do a little work for the astronomers in charge, classifying individual galaxies as either spiral armed or elliptical collections of stars.

On July 11, Oxford (England) University, the University of Portsmouth in England, and Johns Hopkins University in Baltimore jointly launched Galaxy Zoo. This Web site (*http://www.galaxyzoo.org*) describes how to differentiate between the two galaxy shapes, then lets visitors view previously unstudied images from the Sloan survey.

This is "no gimmick but a project where we need the public to be able to get at the science," says Oxford astrophysicist Chris Lintott. Computers can't match the human brain in classifying galaxy shapes, but there aren't enough astronomers in the project to do the job, he says.

Once the online helpers have sorted the galaxies—and in the case of spirals, determined whether their arms swing clockwise or counterclockwise—the researchers will be able to characterize the properties of like-type galaxies, such as their sizes, the ages of their stars, and whether they host active black holes.

In just 10 days, Galaxy Zoo registered more than 80,000 volunteers. "It's simply amazing," Lintott says. During one peak period, "we were getting 70,000 galaxy classifications an hour." —J.R.

G. CLOW/U.S. GEOLOGICAL SURVEY

Books

A selection of new and notable books of scientific interest

CHASING KANGAROOS: A Continent, a Scientist, and a Search for the World's Most Extraordinary Creature

TIM FLANNERY

In this personal narrative, Flannery pays homage to the kangaroo—the symbol of his beloved country, Australia. Though many of his compatriots view kangaroos as pests because of their abundance and occasionally destructive tendencies, Flannery celebrates the creatures, noting their unique style of locomotion and their ability to adapt to a variety of environments. The author reveals that his fascination with the animals began in 1975 during a motorcycle trip around the country. He describes the first sightings of kangaroos by shipwrecked English explorers, attempts by scientists to identify the kangaroos' origins, and his field work searching for fossils in the Australian outback. Flannery also documents the plight of Australia's people, especially the Aborigines. Finally, he describes the ongoing efforts of conservationists to protect the kangaroo against game hunters. ***Grove Press, 2007, 258 p., b&w illustrations and color plates, hardcover, $24.00.***

GUT FEELINGS: The Intelligence of the Unconscious

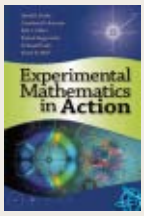
GERD GIGERENZER

In his current best-selling book, *Blink*, Malcolm Gladwell highlights research done by Gerd Gigerenzer on the role of intuition in decision making. Now, in his own book, Gigerenzer, director of the Center for Adaptive Behavior and Cognition at the Max Planck Institute for Human Development, describes in greater detail the remarkable ability of the human subconscious mind to make snap decisions that are often more productive than are decisions based on careful deliberation and logic. In essence, Gigerenzer suggests, less is more. He demonstrates how intuition, combined with basic rules of thumb, capitalizes on the brain's capacity for filling in missing information. This so-called adaptive toolbox of abilities makes split-second decisions possible. He debunks the idea that women are more intuitive than men. He emphasizes that it often pays to make decisions based on one good reason as opposed to many. ***Viking, 2007, 280 p., b&w images, hardcover, $25.95.***

EXPERIMENTAL MATHEMATICS IN ACTION

DAVID H. BAILEY, JONATHAN M. BORWEIN, NEIL J. CALKIN, ET AL.

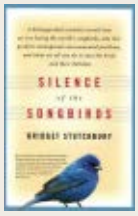
Based on a short course taught by the authors, this book describes the shift in the way in which mathematics has been practiced over the past 20 years—a shift that moved from theory to computation. The authors credit the increase in computer-computation software for this change. No longer are proofs the basis of mathematics, they claim. The rest of the book is devoted to specific mathematical concepts, including algorithms for experimental mathematics, such as high-precision arithmetic and prime number computations, exploration and discovery in inverse scattering, random vectors, and factoring integers, and visual computation that includes chaos games and visualization of DNA strands. Each chapter ends with exercises that challenge readers to apply the principles described. ***AK Peters, 2007, 322 p., b&w images, hardcover, $49.00.***



SILENCE OF THE SONGBIRDS

BRIDGET STUTCHBURY

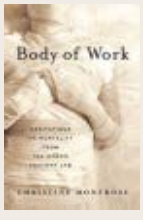
According to some estimates, the skies are missing up to half the songbirds that lived just 40 years ago. That disappearance means that people have fewer bird songs to enjoy, and more important, it spells potential disaster for the world's ecosystems and the human population. Stutchbury, a professor of biology, examines the reasons behind the birds' disappearance, elaborates on the consequences of fewer songbirds, and outlines some of the things that people can do to stem the tide of bird extinction. She documents how birds such as the once-numerous passenger pigeon went extinct in an evolutionary blink of an eye because of deforestation, how eagles suffered as a result of the use of DDT and other pesticides, and how the disappearance of migrant birds is affecting ecological diversity in the rainforests. Some of the measures she proposes for saving songbirds include drinking shade-grown coffee from plantations that provide birds' habitats, reevaluating the use of tall communications towers, and simply keeping household pets indoors. ***Walker, 2007, 256 p., b&w illus., hardcover, $24.95.***



BODY OF WORK: Meditations on Mortality from the Human Anatomy Lab

CHRISTINE MONTROSS

The author, a physician, finds her inspiration for this book in the dissection of a human cadaver, a rite of passage for all first-year medical students. For Montross, the act of cutting into once-living human flesh was fraught with mixed emotions. Her desire to become technically adept was at times contrary to her desire to respect the humanity of the cadaver. Montross chronicles her day-to-day experiences in the anatomy lab as she marvels at the human form, section by section. In researching the history of dissection, she travels to Padua, Italy, where the procedure was first carried out in anatomical theaters. She recognizes that the discomfort that she feels when examining a dead body or responding to the personal concerns of living patients is natural and that she must face such reactions head-on. Montross presents a poetic take on a gruesome, but necessary, procedure. ***Penguin Press, 2007, 295 p., b&w illus., hardcover, $24.95.***



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LETTERS

Gyro Q & A

Doesn't "Spinning into Control" (*SN: 05/19/07, p. 312*) on flywheels leave out a significant aspect: the gyroscope effects of a rotating large mass? Wouldn't it be a benefit for moving installations (stabilization) and a problem for immobile installations?

LEE HUKILL, PALO ALTO, CALIF.

In the article, the flywheels depicted appear to have vertical axles. I presume that this prevents inertial forces from being a problem when a vehicle using one of these systems changes direction. It would seem that such forces could be a real problem for a vehicle with a flywheel installed horizontally when it attempted to turn.

PERRY F. CRABILL JR., WINCHESTER, VA.

Gas on gas?

In view of the extreme importance of atmospheric carbon dioxide, I would have expected the momentous conclusion that southern oceans aren't absorbing the expected increased amount of CO_2, as well as the assertion that nutrient-enriched water absorbs CO_2 less effectively than leaner water does, to be confirmed by field observations. As presented, "Biological Hot Spots: Ocean eddies may not always lock away carbon" (*SN: 5/19/07, p. 307*) appears to represent nothing more than speculation.

FREDRIC M. BLUM, MERION, PA.

Maybe it's about sex

As I read "When female chimps become baby killers" (*SN: 5/26/07, p. 333*), I wondered if the sex of the killed infant was determined. In a troop characterized as having a disproportionate number of females, could it be that the chimps are selectively killing females in an attempt to balance sexes in the group?

ELIZA GOUVERNEUR, PRINCETON, N.J.

A hole and the head

"Migraines in men linked to heart attack risks" (*SN: 5/26/07, p. 333*) states that although men who suffer from migraines are more likely to experience heart attacks, scientists have failed to find a biological mechanism linking them. Such a link seems to be suggested in an earlier *Science News* article, "A Gasping Heart" (*SN: 4/7/07, p. 218*), which states that a patent foramen ovale is linked to migraines and that that heart defect, combined with sleep apnea, can cause oxygen desaturation, which can be a factor in cardiovascular disease.

WILLIAM A. STEPHENS, EARLYSVILLE, VA.

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