SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

MAY 27, 2006 PAGES 321-336 VOL. 169, NO. 21

light sleepers

abusive results

predators are kelp culprits

vaccinating the flock

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destructive impact

ELEMENTS OF YOUTH AGGRESSION

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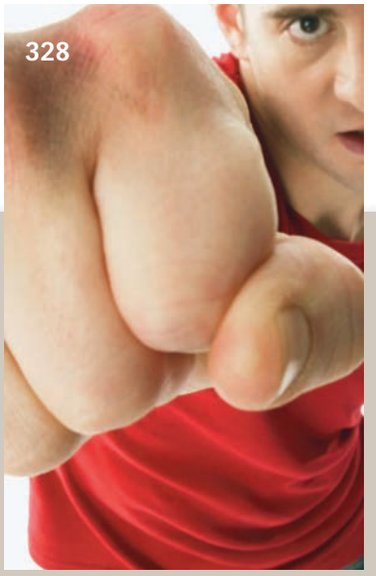

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This Week

Of Note

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Cover New research focuses on interacting factors that encourage young people to become violent. These include a genetically mediated weakening of brain impulse-control areas, wayward family and peer interactions, and coercive school situations. (Corbis) Page 328

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Science News (ISSN 0036-8423) is published weekly on Saturday, except the last week in December, for $54.50 for 1 year or $98.00 for 2 years (foreign postage is $18.00 additional per year) by Science Service, 1719 N Street, N.W., Washington, DC 20036. Preferred periodicals postage paid at Washington, D.C., and an additional mailing office.

POSTMASTER
Send address changes to **Science News**, P.O. Box 1925, Marion, OH 43306. Change of address: Two to four weeks' notice is required—old and new addresses, including zip codes, must be provided.

EDITORIAL, BUSINESS, AND ADVERTISING OFFICES 1719 N St. N.W., Washington, D.C. 20036
202-785-2255; scinews@sciencenews.org.
LETTERS editors@sciencenews.org

SUBSCRIPTION DEPARTMENT P.O. Box 1925, Marion, OH 43306. For new subscriptions and customer service, call 1-800-552-4412.

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Burden of Abuse

Violent partners take mental toll on women

Physical abuse doled out by husbands or male live-in partners contributes substantially to major depression and other mental disorders among women of childbearing age, a long-term study finds. In contrast, men subjected to violent abuse by their female partners show psychiatric disorders no more often than they did before entering those relationships.

"Partner abuse should be assessed routinely during psychiatric evaluations," remarks psychologist Miriam K. Ehrensaft of Columbia University.

The new investigation by Ehrensaft and her colleagues, published in the May *American Journal of Psychiatry*, offers a rare before-and-after look at the mental impact of abusive relationships. It focuses on 449 women and 456 men in New Zealand whose physical and psychological development was tracked from ages 3 to 26.

The researchers evaluated psychiatric interviews done at ages 18 and 26. In separate assessments at age 26, participants reported on any abusive partner relationships—entailing physical injury, medical treatment, or involvement by police and other agencies—from the previous 3 years.

The researchers identified 37 men and 38 women subjected to partner abuse producing physical injuries, such as cuts and broken bones. Abusive incidents occurred with equal frequency in both groups.

People who ended up in abusive relationships displayed higher rates of some mental disorders at age 18 than their peers did. Battered women were more likely to have had depression and marijuana dependence, and battered men had had those problems plus alcohol dependence and anxiety disorders. As suggested by previous studies, childhood abuse frequently foreshadowed a person's abuse by a partner.

At age 26, women in abusive relationships displayed elevated rates of depression, marijuana dependence, and post-traumatic stress disorder, compared with their rates of those disorders at age 18. No such trend appeared for the women not in abusive relationships or for men, regardless of whether they were in abusive relationships.

Since men, who tend to have greater financial resources and less responsibility for child rearing, can often leave abusive relationships more easily than women can, it makes sense that partner abuse weighs more heavily on women's mental health, remarks psychologist Mary P. Koss of the University of Arizona in Tucson.

Still, it's unclear why marijuana but not alcohol problems appeared in New Zealand women subjected to partner abuse, Koss says. An examination of other illicit drug use is also needed, in her view.

Related findings appear in the June *American Journal of Preventive Medicine*. In the United States, women commonly encounter domestic violence, reports a team led by physician Robert S. Thompson and psychologist Amy E. Bonomi, both of the Group Health Cooperative in Seattle.

Depression, physical complaints, and social isolation increase as women experience more partner abuse, these researchers say.

In a random sample of 3,568 women, ages 18 to 64, enrolled in a health maintenance organization, 44 percent reported having experienced abuse by a husband or live-in partner in the preceding 5 years. Abuse typically included physical injury, fear resulting from a partner's anger or threats, or frequent attempts by a partner to control the victim. About one-third of women cited instances of physical injury, and 17 percent reported rapes or forced sexual contact.

The predominantly white, employed women in this study provide a conservative estimate of the prevalence of partner abuse, comments physician James S. Marks of the Robert Wood Johnson Foundation in Princeton, N.J. "This is a national scourge," he says. —B. BOWER

Top-Down Lowdown

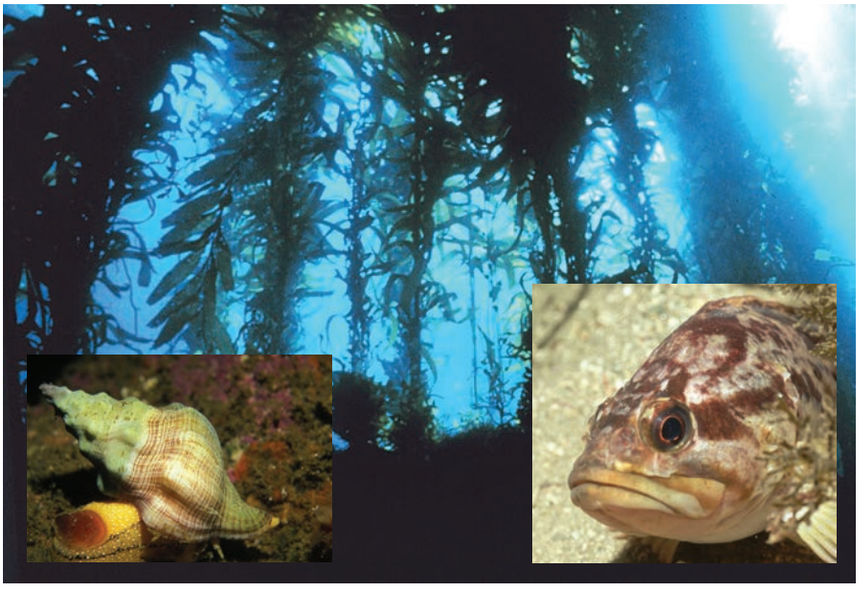
Predators shape coastal ecosystem

The health of southern California kelp forests may depend more on the ecosystem's predator population than on the forest's access to nutrients, researchers report. The finding suggests that fishing practices have a profound impact on these ecosystems.

Kelp forests grow worldwide in shallow coastal areas with mild climates. The brown seaweed called kelp reaches from the ocean floor to the water's surface, usually spanning 10 to 20 meters, says Benjamin S. Halpern of the National Center for Ecological Analysis and Synthesis in Santa Barbara, Calif. Along western U.S. coasts, these ecosystems support up to 1,000 species of fish, plants, and invertebrates, he says.

Ecologists have long debated whether the number of predators—such as fish that feed on smaller creatures—at the top of the ecosystem's food web or the availability of nutrients at the bottom of the web more strongly influences the condition of ecosystems.

Halpern and his colleagues studied kelp forests that surround the Channel Islands, about 25 miles off the coast of Santa Bar-



IN CHARGE **The populations of predators, such as Kellet's whelk (left inset) and kelp rockfish (right inset) in the seaweed forests of the Channel Islands seem to have a stronger impact on the health of the ecosystem than nutrient availability does.**

HALPERN; (LEFT INSET) S. LONHART; (RIGHT INSET) CORBIS

bara. The group analyzed surveys of species' abundance from 16 sites around the Channel Islands National Park. They also examined satellite data from 1999 to 2002 on chlorophyll concentrations—an indirect indication of nutrient levels—in the ocean waters surrounding the islands.

The "top-down" control accounts for 11 to 20 percent of the ecosystem's pattern of species abundance, the team reports in the May 26 *Science*. The predator populations have 7 to 10 times as much influence over the ecosystem as the availability of nutrients does.

"No one has tested these two factors at the same time," says Halpern. "How healthy a kelp-forest community is depends primarily on which predators and how many of them you have in the community." Overfishing that depletes these predator populations could affect the ecosystem's stability.

"I think this is a very powerful paper in terms of suggesting the strength of top-down influences," says Robert S. Steneck of the University of Maine in Orono. "As we basically fish down global food webs in all these different ecosystems, we will in essence be restructuring communities."

James Estes of the University of California, Santa Cruz agrees that the work is important to fisheries management. "It provides further evidence for the notion that overfishing has a strong effect on the ecosystem. It's not just the [fish] stocks being taken out."

But Michael H. Graham of Moss Landing (Calif.) Marine Laboratories notes that the new study may have underestimated the bottom–up effect. He points out that the 1999–2002 satellite data cover a period without an El Niño or La Niña event, two weather phenomena that can have large impacts on nutrient prevalence in kelp forests. Furthermore, the satellite measures chlorophyll concentrations near, but not in, the kelp forests. —A. CUNNINGHAM

Open Water, Open Mouths

Scuba divers face infection risks

Circling sharks and empty air tanks may haunt scuba divers' imaginations, but ordinary microbes are a far more probable hazard. A new study takes a stab at quantifying the risks that waterborne bacteria and viruses pose to divers.

A LOT TO SWALLOW Swallowing contaminated waters can cause infections in divers.

While scientists regularly measure bacterial concentrations in waters used by beachgoers, they don't test all the sites visited by divers, surfers, and kayakers. What's more, researchers don't know how much of the water these people swallow, says microbiologist and mathematical modeler Jack Schijven of the National Institute of Public Health and the Environment in Bilthoven, the Netherlands.

To begin measuring the microbial risk to divers, Schijven and his institute colleague Ana Maria de Roda Husman provided a questionnaire to 233 professional divers and posted a similar survey online for about 26,000 recreational divers in the Netherlands. Thirty-seven pros—who do underwater-construction or search-and-rescue work, for example—and 483 amateurs responded. They supplied data on illnesses they'd had in the past year, how many dives they'd made in various aquatic environments, and what volume of water they'd swallowed on a typical dive.

The researchers focused on skin, ear, eye, respiratory, or gastrointestinal symptoms, which might have been caused by infections acquired during dives. Most respondents said that they'd had at least one such illness. Diarrhea and ear problems topped the list.

"Only 20 percent of the divers stated that they did not have any complaint at all," Schijven says. "We were really astonished."

The study didn't include a comparison group of nondivers, so it's unclear what portion of the ailments resulted from diving, he cautions.

Other data from the questionnaires suggest that recreational divers face a gastrointestinal infection risk of up to 1.1 percent per marine dive and 1.5 percent per freshwater dive.

The recreational divers tended either to swallow no water or to swallow about the volume of a shot glass. Professional divers, who often wear full face masks, generally swallowed a few drops of water or less. From the survey information and data on pathogen abundance, the researchers estimate in the May *Environmental Health Perspectives* that professionals face the highest risks.

The pros "have to dive in any kind of water, even wastewater," Schijven says.

Overall, divers reported more ear complaints during the summer months than the winter months. That's "a strong hint" that diving is to blame, Schijven says, because the bacterial suspects in such infections prefer warm water. By contrast, gastrointestinal problems, which are caused by pathogens that survive longer in cold water, are most frequent during winter.

The study takes a "great approach" to examining overlooked aspects of divers' health, says Richard E. Moon, a Duke University physician and senior medical consultant for the Durham, N.C.–based Divers Alert Network. "It should raise divers' level of awareness of this potential risk," he adds. However, he says, the results could be biased because people with health complaints may have responded more readily to the survey. —B. HARDER

For the Birds

New vaccines protect chickens from avian flu

By piggybacking components of strains of avian-influenza virus onto an existing poultry vaccine, scientists have created experimental vaccines that can prevent bird flu in chickens, two studies show.

While researchers will need to further test the novel vaccines in large numbers of fowl and against various subtypes of bird flu, the early results suggest that widespread vacci-

PHOTODISC

nation of flocks could stall the spread of bird flu in animals, says molecular virologist Angela Römer-Oberdörfer of the Federal Research Institute for Animal Health in Riems, Germany, who coauthored one of the studies. "Controlling disease in poultry helps to avoid infection of humans," she says.

Previously developed poultry vaccines against influenza aren't widely used in the United States because they interfere with screening tests for ill animals.

Research teams in Germany and the United States each designed a vaccine using a live but attenuated version of a bird pathogen called Newcastle virus. They engineered the virus to produce the version of a protein, called hemagglutinin, that is found on either the bird-flu virus known as H5N1 or the one called H7N7. Each vaccine prompts the immune system to produce antibodies against the hemagglutinin and, therefore, against the virus.

The H5N1 flu has killed or led to the culling of millions of poultry, mostly in Asia. The H7N7 strain led to the deaths of millions of chickens in the Netherlands in 2003.

In a series of experiments, the research groups sprayed an aerosol of the vaccine into chicks' eyes. The animals subsequently fended off infection after exposure to bird-flu virus, the two groups report in the May 23 *Proceedings of the National Academy of Sciences*. In both studies, unvaccinated chickens died within days of exposure.

The hybrid vaccine would probably cost a fraction of a cent per dose, says virologist Peter Palese of Mount Sinai School of Medicine in New York City, who coauthored the U.S. study.

STATS

4 billion

Conservative estimate of number of chickens in China

The studies complement work, reported in the February *Journal of Virology*, that showed similar protection against H5N1 by an injected vaccine engineered from an adenovirus.

"The Newcastle-hybrid vaccine seems to be cost-effective," says Andrea Gambotto of the University of Pittsburgh School of Medicine, a coauthor of the *Journal of Virology* study. Such a vaccine could be applied much the same way that large poultry operations spray flocks with Newcastle vaccine.

These vaccine studies in chickens are proceeding on a track parallel to efforts aimed at creating a bird-flu vaccine for people. So far, the virus has infected and killed only people who'd had direct contact with an infected animal (*SN: 9/10/05, p. 171*).

Gambotto cautions that while the idea of stockpiling a bird-flu vaccine for human use has gained acceptance, the notion of using influenza vaccines in animals remains controversial. Previously developed vaccines trigger antibodies that are indistinguishable from those caused by an infection.

However, by generating a distinctive immune response, the new vaccines might "allow us to differentiate infected birds [from vaccinated birds] in the population," says veterinarian David Swayne of the U.S. Department of Agriculture in Athens, Ga., who coauthored the U.S. study. —N. SEPPA

Big Oil, Tiny Barons

Microbes can unleash trapped petroleum

Supply shortages have pushed oil prices above $70 per barrel, but nearly 380 billion barrels of crude oil—in the United States alone—are stuck in the pores of rocks or on the surfaces of sand grains. A new study proves the feasibility of using specialized microbes to lift trapped oil that's inaccessible to current pumping technologies.

Several decades ago, researchers found that bacteria in the genus *Bacillus* produce detergent molecules as waste. Some preliminary lab and field studies suggested as adding these microbes to oil wells could release significant amounts of trapped oil in the same way as detergent lifts stains out of clothing. However, other work showed that the microbes had no effect, says microbiologist Michael McInerney of the University of Oklahoma in Norman.

McInerney and his team have now conducted a rigorous test of microbial activity both in the lab and in some small oil wells.

The researchers first injected mixtures of cultured *Bacillus* bacteria and nutrients into sandstone or sand-packed columns containing entrapped oil. They found that when the organisms produced a detergent concentration of at least 60 milligrams per liter (mg/l) of culture, the microbes unleash up to 40 percent of the trapped oil.

Last summer, the scientists moved their experiments into five small, nearly spent oil wells located near the town of Oil Center, Okla. The researchers shut off the oil pumps and injected test solutions into the wells. Two of the wells received hundreds of billions of *Bacillus* bacteria, along with carefully measured nutrients including sugars, nitrogen, and other minerals. Two other wells received only the nutrients, and a fifth well got an injection of only water.

After 4 days, McInerney's team turned the pumps back on and took samples of liquid coming from each well. The researchers reported this week at the annual meeting of the American Society for Microbiology in Orlando, Fla., that the two wells that had received the microbes yielded live microbes. Detergent there measured about 90 mg/l, well above the threshold for oil removal shown in the lab. The tests revealed no *Bacillus* bacteria or detergent in the other wells.

McInerney notes that oil flow increased slightly in the presence of the microbes in the early results, but because of mechanical problems with the restarted pumps, the team didn't collect data over a long period.

"This is a proof of principle," McInerney says.

The team's next step, says McInerney, is to measure longer-term oil production from small microbe-treated wells. Then, the researchers will turn to larger wells.

The new study impresses oil field microbiologist Gerrit Voordouw of the University of Calgary. "In this study, they've gone the additional distance in verifying [microbial activity] in the oil wells," he says. Previous studies of oil wells had been "quick and dirty," he adds. —C. BROWNLEE

Lobster Hygiene

Healthy animals quick to spot another's ills

Caribbean spiny lobsters somehow detect and shun potential roommates carrying a virus, even before the infected lobster can pass along the disease, a research team reports.

These lobsters, *Panulirus argus*, often share hiding places. Yet underwater surveys on the Florida coast found most sick lobsters alone in dens, report Mark Butler of Old Dominion University in Norfolk, Va., and his colleagues. Lab tests showed that

BEHRINGER

CRUSTACEAN QUARANTINE **Caribbean spiny lobsters' detection of diseased individuals like this one may explain the low prevalence of a fatal virus.**

healthy lobsters avoid shelters already inhabited by an infected animal, even one in the early stages of illness, he and his colleagues report in the May 25 *Nature*.

This is the first evidence that healthy animals in the wild quarantine infected members of their own species, Butler says.

Although spiny lobsters don't have the big, meaty claws of North Atlantic lobsters, they're the main edible lobster throughout much of the world. The Caribbean spiny species ranges from Bermuda to Brazil.

Unlike the North Atlantic species, the Caribbean spiny lobsters are social. In autumn, certain populations march single file along the ocean bottom for several kilometers to reach deeper water less troubled by winter storms. Lobsters sharing a den join in its defense by poking their long, stiff antennae menacingly at intruders.

"They'll drive the antennae into the flesh of fish—or of researchers," says Butler. Collecting the lobsters is "like trying to grab a porcupine out of a crevice," he notes.

The new study grew out of the curiosity of coauthor Donald Behringer, also of Old Dominion University. In 1999, he noticed that troubled-looking young lobsters, with discolored shells and lethargic attitudes, usually lived alone. The researchers eventually established that these loners carried a virus, which they named PaV1. It's the first virus known to strike lobsters.

The disease caused by PaV1 is most evident in the young. It spreads through physical contact, but the smallest lobsters can catch it from virus-tainted seawater. When scientists put lobsters together in an experiment, more than 60 percent of the lobsters with infected den mates died within 80 days.

In an underwater survey of juveniles, more than 56 percent of the healthy animals shared a hiding place, but only 7 percent of the infected ones did.

In the recent lab tests, infected animals showed no preference between a hideout containing a healthy lobster or a sick one. But uninfected lobsters were choosier. More than 60 percent shied away from a shelter occupied by an animal that had been inoculated with the virus only 4 weeks earlier. That's before researchers could see any symptoms, says Butler.

At 6 weeks after inoculation, infected lobsters were shunned by all the uninfected ones.

That's good timing, says Butler. Lab tests found no virus transmission 6 weeks after inoculation. At 8 weeks, though, PaV1 spreads readily.

These observations may explain why the virus' transmission in the wild is low and isn't affected by lobster density, says Butler.

Ecologist Hamish McCallum of the University of Queensland in St. Lucia, Australia, welcomes the finding as "really interesting" and plausible.

Parasites manipulate their hosts' behavior to favor transmission. "One would therefore imagine the opposite possibility," McCallum says, "that hosts should modify their behavior to decrease transmission." —S. MILIUS

Gripping Tale

Metal oozes in nanotubes' grasp

Chalk up another feat of astounding strength for the hollow threads called carbon nanotubes. When they squeeze in on enclosed crystals of hard metals, those substances collapse into thin shafts, an international team of scientists reports.

The nanotubes exert pressures up to 400,000 atmospheres, or about a tenth of that at the Earth's core, say Florian Banhart of the University of Mainz, Germany, and his colleagues. Their findings appear in the May 26 *Science*.

The nanotubes' newfound capability "opens up a window to directly watch atomic-scale development of pressure-induced phenomena," say Zhongwu Wang and Yusheng Zhao of Los Alamos (N.M.) National Laboratory in a commentary accompanying the report. The fields of materials science, chemistry, condensed-matter physics, geophysics, planetary science, and nanotechnology all stand to benefit, they add.

However, the nanotube-induced pressures don't rival those produced in the diamond anvils used in many high-pressure studies (*SN: 5/14/05, p. 309*), Wang and Zhao note.

To carry out the experiments, Banhart and his coworkers in Mainz and in Finland, Mexico, and the United States first vaporized carbon containing various metals under conditions that would create multiwalled carbon nanotubes. The tubes simultaneously acquired crystalline cores of iron, cobalt, or iron carbide, a compound that hardens steel.

To make the tiny tubes even narrower, the team placed them in the vacuum chamber of an electron microscope at a temperature of 600°C and blasted them with the microscope's high-energy electrons.

The beam knocked some carbon atoms out of the tubes. However, at the high temperature, the remaining carbon atoms were mobile enough to cinch together and establish new bonds. As that repair process narrowed the tubes and tightened their grips, the metal crystals inside collapsed into narrower, more-elongated shapes.

Banhart notes that at room temperature, the beam destroys nanotubes, but he predicts that even at 200°C, bombarded nanotubes would squeeze forcefully.

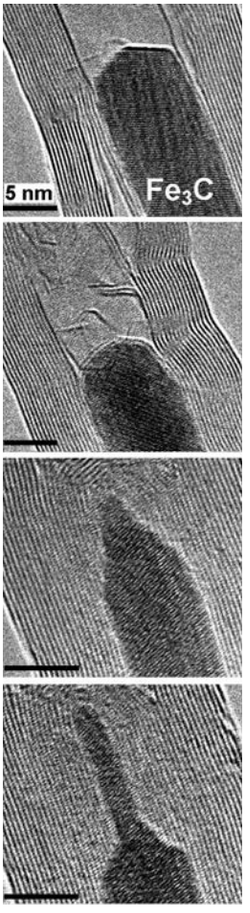
Because the cinching process occurs inside an electron microscope, "we can now study the deformation of nanocrystals," Banhart says. "This has not been accessible to observation before." He and other scientists find nanocrystals of increasing interest because of their extraordinary properties, including their hardness.

In the new experiments, the researchers were surprised to find that the nanocrystals, unlike larger-scale metal crystals, deform without developing any apparent structural flaws. So far, the team can't fully explain that observation, Banhart says.

In 1996, Banhart used electron bombardment of carbon nanostructures to make diamonds. He and Pulickel M. Ajayan, now of Rensselaer Polytechnic Institute in Troy, N.Y., and a coauthor of the new work, forced carbon onions—concentric nanospheres of carbon—to compress their cores (*SN: 8/31/96, p. 139*).

Both sets of experiments have demonstrated a process that could be called "nano-shrink-wrapping," comments David Tomanek of Michigan State University in East Lansing.

He notes that high pressures lower the melting points of metals and make elements mix that ordinarily wouldn't. New materials built from such nano-shrink-wrapped components might have remarkable properties, says Tomanek. —P. WEISS



L. SUN ET AL./SCIENCE

SQUEEZE PLAY **Time-lapse sequence shows a multiwalled carbon nanotube (seen in cross section as two bands of thin lines) compressing into a thin shaft the end of a rod-shaped nanocrystal of iron carbide (black bar labeled Fe_3C).**

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VIOLENT DEVELOPMENTS

Disruptive kids grow into their behavior

BY BRUCE BOWER

Henry was headed for serious trouble. The 15-year-old provoked an endless series of fights at school and frequently bullied girls. Teachers regularly suspended him for his classroom disruptions. Older students taunted Henry in the hallways by calling him a sexual pervert or jeered him for having been held back in kindergarten. At home, his father browbeat and denigrated the boy, while his mother cried and muttered about how sick Henry had become.

Henry liked violent video games. He downloaded information from a Web site on how to make pipe bombs and drew pictures of gory deaths of people who mistreated him. The boy openly expressed jealousy of the attention lavished on the youths in Columbine, Colo., who in 1999 fatally shot 12 of their classmates and a teacher and then committed suicide.

In 2001, Henry's life took a fortunate turn. At his high school principal's insistence, he and his parents sought psychotherapy from Stuart W. Twemlow of the Menninger Clinic in Houston. In individual and family sessions, psychiatrist Twemlow zeroed in on the boy's fury at his parents and his tendency at school to view himself as a passive victim who needed to strike back at evil tormenters.

Henry's feelings of rage abated as he grasped that his father struggled with his own deep-seated problems. Henry began taking martial arts training, as suggested by Twemlow, and attending a new school that had a healthier social environment. His grades improved. He started dating.

Henry's story highlights a theme that is attracting increasing scientific attention: Like all children, chronic troublemakers and hell-raisers respond to a shifting mix of social and biological influences as they grow. Some developmental roads arc relentlessly toward brutality and tragedy. Others, like Henry's, plunge into a dark place before heading into the light of adjustment.

Developmentally minded researchers are now beginning to map out violence-prone paths in hopes of creating better family and school interventions. New evidence indicates that a gene variant inherited by some people influences brain development in ways that foster impulsive violence, but only in combination with environmental hardships. Other studies explore how family and peer interactions build on a child's makeup to promote delinquency. Separate work examines ways to counteract the malign effects of bullying rituals and other types of coercion in schools.

"Violence is such a complicated issue," Twemlow says. "There's always a set of preconditions to violent behavior and never just one cause."

T-R-O-U-B-L-E — New research examines the mix of biological, psychological, and social influences that foster violent and aggressive behavior in young people.

ISTOCKPHOTO

SIGNATURE BRAINS Andreas Meyer-Lindenberg says that he knows what a genetic risk for impulsive violence looks like in the brain. Ironically, he and his colleagues at the National Institute of Mental Health in Bethesda, Md., traced a portrait of rash aggression in the brains of placid people free of emotional problems, brain disorders, substance abuse, and arrest records.

Meyer-Lindenberg, a neuroscientist, directed studies of 142 white adults who had inherited one of two common versions of a gene that triggers production of an enzyme called monoamine oxydase A (MAOA). That enzyme controls the supply of an important brain chemical. One of the gene variants yields weak MAOA activity in the brain, resulting in elevated concentrations of serotonin. Too much of that chemical messenger upsets the regulation of emotions and impulses.

The other gene variant sparks intense MAOA activity, leading to serotonin concentrations at the low end of the normal range.

Several teams have already reported that children who endure severe abuse and also possess the weak-MAOA gene variant commit violent and delinquent acts later in life far more often than do abused kids who carry the strong-MAOA gene variant (*SN: 8/3/02, p. 68*).

In Meyer-Lindenberg's study, the 57 men and women with the MAOA-light gene displayed a set of neural characteristics that appear to weaken a person's ability to hold emotions and aggressive urges in check. Brain scans of these participants revealed unusually small inner-brain structures involved in emotion regulation. This effect was stronger in the 27 men than in the 30 women.

The same men and women displayed intense activity in two emotion-related structures, the amygdala and the hippocampus, when they looked at emotional facial expressions and recalled emotional experiences; they had sparse activity in impulse-control parts of the frontal brain during a computer task that required self-control.

In contrast, volunteers with the strong-MAOA gene displayed less intense responses to emotional input and more activity related to impulse control. These brain responses indicate greater control of emotions and impulses, the scientists report in the April 18 *Proceedings of the National Academy of Sciences*.

Noting that each of the study participants was law-abiding, the Meyer-Lindenberg team proposes that the weak-MAOA gene variant contributes only slightly to the brew of ingredients that fosters impulsive violence.

Meyer-Lindenberg's finding of genetically influenced brain differences "gives rise to the possibility that [the weak-MAOA variant] contributes to a vulnerable neural signature that could turn nasty given adverse environmental circumstances," remarks neuroscientist Essi Viding of University College, London.

MAOA-gene–mediated brain disparities in nonviolent people "provide clear evidence against genetic determinism of violent behavior," adds psychologist Terrie Moffitt of the Institute of Psychiatry in London. In 2002, Moffitt and her colleagues first reported elevated rates of violence and lawbreaking among people with the weak-MAOA gene who had been abused as children.

Child-development researchers are also exploring the interplay of individual and environmental factors. Consider the work of psychologist Kenneth A. Dodge of Duke University in Durham, N.C. He directs a study of psychological and academic adjustment in 585 boys and girls from three midwestern communities. Participants have been tracked from ages 4 to 21, so far.

Dodge's study focuses on reward sensitivity, a measure of a person's need for immediate positive feedback. Impulsiveness contributes to this trait. Less than half of the participants were considered high in reward sensitivity.

But an interesting twist emerges at age 21, Dodge says. By this age, those young people who grew up with emotionally cold, punitive parents frequently had turned to violence, crime, and substance abuse if, as 16-year-olds, they also exhibited high reward sensitivity. This pattern was especially strong among boys.

The researchers scored teenagers on reward sensitivity according to how they gambled in a laboratory task. Those deemed high in reward sensitivity lost a small pot of money in a card rigged by the experimenters so that a string of initial wins gave way to a series of losses. "For these kids, the rush of winning exceeds the pain of losing," Dodge says.

In contrast, the teens who opted out of the card game while they still had some money left were categorized as low in reward sensitivity. These kids showed considerable resilience in the face of harsh parenting and usually didn't have behavioral problems.

DYNAMIC DELINQUENTS For the past 25 years, psychologist Gerald R. Patterson of the Oregon Social Learning Center in Eugene and his colleagues have noticed that some parents and children bring out the worst in each other. Their daily interactions consist of the parents demanding compliance with some rule or request, the child refusing to comply, and the parents eventually giving in. Long-term studies indicate that these coercive interactions foster aggression in young and old alike.

Such interactions are best understood as dynamic systems that tend toward stable patterns but that can change in response to pressure applied at key times, contend Patterson and psychologist Isabela Granic of the University of Toronto. Dynamic-systems principles have already been used to examine how children learn to reach, walk, and otherwise control their bodies (*SN: 3/20/99, p. 184*). In the January *Psychological Review*, Granic and Patterson described recent insights into the development of violent and delinquent behavior gleaned from long-term tracking of child-parent interactions.

The research reveals that coercive relations in families with violent children come in two varieties: mutual hostility and permissiveness. Granic directed a study of children deemed to have serious problems with self-control, some of whom were sometimes withdrawn or depressed.

Each of the 33 children and his or her mother came to a research lab and discussed a family problem for 4 minutes. Then, a knock on the door signaled that they had 2 minutes to wrap up and "end on a good note." The deadline was designed to push each pair into its routine style of confronting stress.

At that point, hostility typically escalated between mothers and those kids whom the researchers had identified as generally behaving in impulsive ways. In contrast, mothers of kids who sometimes lost control but at other times withdrew or seemed depressed usually kept peace by acceding to a final barrage of demands and whines to agree with the child's position.

Both patterns represented interactions that had become hard-to-break, aggression-promoting habits, the researchers contend.

Within their peer groups, some adolescent boys amplify their delinquent tendencies through fevered, one-on-one exchanges. Granic and Thomas J. Dishion of the University of Oregon in Eugene found that, during videotaped talks between 14-year-old best friends, some excitedly exchanged stories of increasingly deviant misadventures in a kind of antisocial one-upmanship, while others discussed any misdeeds briefly, if at all. Boys who engaged in the fevered escalating exchanges displayed the highest rates of arrests, school expulsions, and other delinquent activity 3 years later.

> "For these kids, the rush of winning exceeds the pain of losing."
>
> — KENNETH A. DODGE, DUKE UNIVERSITY

Other studies find that children's early behavior troubles often reflect rigid interactions at home, as exemplified by a mother and a child expressing only one type of emotion when discussing problems. That correlation held even when the single emotion was affection.

Children from rigid parent-child relationships become markedly more aggressive at transitional points in their development, such as entry into day care or the onset of puberty, Granic says. Evidence from dynamic-systems research suggests that programs offering basic parenting skills work best when administered while participants' children are in such developmental transitions, she adds.

BULLY BE GONE Coercive interactions occur not just in families but also in schools and other institutions, Twemlow contends. As Henry's case illustrates, a three-way tango of bully, victim, and one or more bystanders can begin at home and continue at a child's school, where students, teachers, and administrators join the destructive dance.

Henry's move to a school that actively discourages bullying had a huge impact on him, Twemlow says.

The psychiatrist and his colleagues at the Menninger Clinic have devised a series of interventions that they call the Peaceful Schools Project. Project activities aim to develop students' capacity to perceive and reflect on their emotional reactions and those of others. This skill makes it possible for them to negotiate solutions rather than to fall back on violent rituals.

Practical classroom changes get the ball rolling. For instance, counselors work with teachers to develop discipline plans in which all children in a class talk to problem students and work out agreements to keep the class running smoothly. Project officials identify children and adults who have the social skills to serve as mentors, discouraging hallway bullying and playground confrontations. Students learn simple self-defense techniques in special physical education periods.

Violent behavior, bullying episodes, and classroom disruptions declined substantially in nine Midwestern middle schools that participated in the Peaceful Schools Project for 2 years, Twemlow and his colleagues reported in the fall 2005 *Bulletin of the Menninger Clinic.*

The project isn't designed to erase competition and ambition from schools, Twemlow notes. The objective is to imbue kids with enough emotional literacy to foster resilience, even as family, neighborhood, and cultural sources continue to throw them violent curveballs.

That's a longstanding theme of successful psychotherapy as well. "In the end, the goal is finding out the truth about yourself so that you can better control yourself," Twemlow says. ■

LIGHT IMPACTS

Hue and timing determine whether rays are beneficial or detrimental

BY JANET RALOFF

The second of a two-part series on electric lighting and its impacts

Erin Chesky was a sleep-troubled teen, typical of many. Despite going to bed early each night, this honor roll student struggled to doze off—sometimes lying awake until 3 a.m. Each morning, she fought equally hard to wake up at 5:30, in time to eat breakfast and catch the school bus. Forever tired, "I was like a zombie," she recalls.

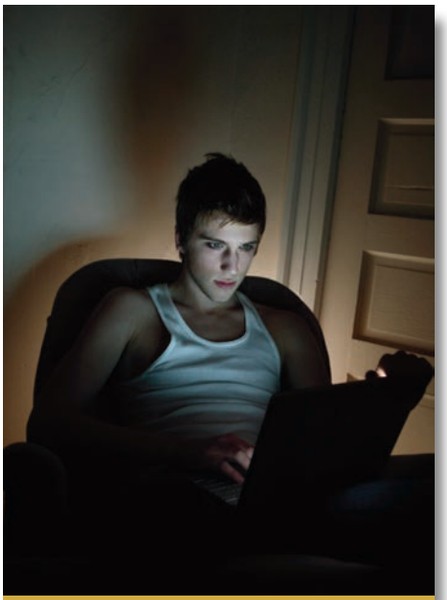
Last fall, a sleep specialist examined the 17-year-old from Colonie, N.Y. He diagnosed her with delayed sleep-phase syndrome, a condition in which the body's internal clock fails to synchronize appropriately with Earth's day-night cycle, which changes a few minutes each day.

From birth, Erin and her siblings were night owls. When Erin turned 15 however, her biological clock really got off-kilter, triggering insomnia that threatened her schoolwork. Her mom recognized the affliction; it had struck her at the same age.

For such teens, adhering to class schedules can be "like swimming upstream," says psychologist Paul Glovinsky of the Capital Region Sleep and Wake Disorders Center at St. Peter's Hospital in Albany, N.Y. Some teens fail to make it to school on time, or at all, 30 or more days a year.

Within 4 months, Glovinsky got Erin in sync with her school's schedule. The high school junior now easily falls asleep by 11 p.m. Glovinsky's trick: entraining Erin's biological clock. Each morning, a special lamp delivers a half-hour of intense fluorescent light as she eats breakfast or reads.

Mariana G. Figueiro of Rensselaer Polytechnic Institute's Lighting Research Center in nearby Troy, N.Y., uses colored light at night to aid elderly institutionalized patients. An early evening treatment from some 50 blue light-emitting diodes (LEDs) coaxes a person's fractured sleep into solid, nightlong slumber. Elsewhere, researchers are experimenting with color-tuned light to perk up the body, improve visual acuity, and even reduce depression. Such techniques all stem from an emerging realization that for the body, light's role extends well beyond vision.



DROWSY—NOT! — The bluish light emitted by computer screens may be sabotaging sleep schedules in teens who work late into the night. The hue might signal the biological clock that it's morning.

ISTOCKPHOTO

MOODY BLUES Because sunlight is a broad mix of colors, the human eye perceives it as white. Lamps used in past attempts to adjust people's internal clocks have emitted a broad composite of colors that also appeared white.

However, suspecting that the biological clock preferentially responds to select elements of the spectrum, George C. Brainard and his team at Thomas Jefferson University in Philadelphia launched a 5-year effort to find the most-effective hues. The project tested 72 people and encompassed more than 600 person-nights of observation.

Results, published 5 years ago, showed that the biological clock is most responsive to a narrow band of wavelengths from 466 to 477 nanometers (nm), which are close to the blue of a clear sky.

"It's not something we would have predicted," Brainard notes, since these wavelengths aren't ones to which the eye's vision receptors—rods and cones—are most sensitive. The receptors called blue cones have a maximum sensitivity of about 430 nm.

Brainard says that an explanation for the biological clock's blue sensitivity soon emerged in "a landmark paper that stunned the world."

Four years ago, retinal neuroscientist David M. Berson and his colleagues at Brown University in Providence, R.I., described a new class of light receptors in the human eye. These receptors' sensitivity peaked at 480 nm. They are located in a minute share of ganglion cells, the information-processing units that send signals to various parts of the brain. Moreover, these cells appeared to be the most important source of information for brain area, the superchiasmatic nucleus, which is "the biological equivalent to the clock chip on your computer," Berson says.

He says that what prompted his search was a series of animal experiments by others that had shown that blind rodents lacking functional rods and cones still maintain their 24-hour, light-synchronized circadian cycles. Remove eyes, however, and the animals' clocks drift out of synch with the daily rhythm of light and darkness. Something other than rods and cones must be responsible for the rhythm, Berson and others decided.

To Figueiro, the ganglion-cell discovery confirmed that "our eyes are effectively blue-sky detectors."

Soon after Berson's finding, Figueiro and others began testing how well blue light can reset people's circadian clocks. Over the past 3 years, for instance, Figueiro has worked with eight Alzheimer's patients who tended to fall asleep around 7 p.m. Their body clocks were running amok—probably, she says, because these shut-ins didn't encounter blue skies or other light that was bright enough to prevent circadian drift.

Exposure to red light around suppertime for 2 hours each day for 10 successive days had no effect on the patients' disordered

sleep. However, Figueiro found, a similar exposure to blue-LED light prompted the study participants to fall asleep later and then sleep longer and better than they had before the treatment.

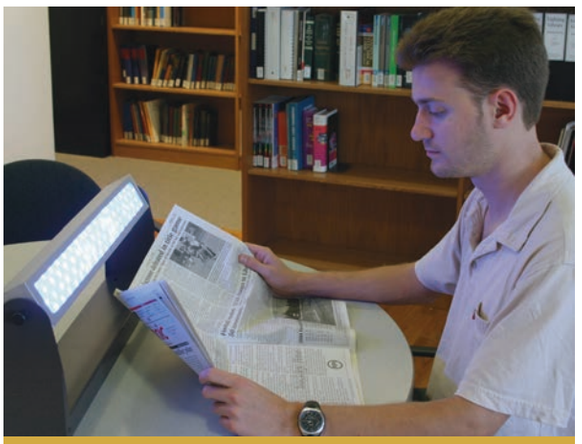
Brainard's team has also investigated blue-light therapy. The researchers tested 24 people with winter depression, also known as seasonal-affective disorder (SAD). Half were given light boxes lit by red LEDs, and the rest had boxes lit by blue LEDs. Early every morning for a month in winter, each volunteer sat directly in front of one of the light boxes for 45 minutes.

In the March 15 *Biological Psychiatry*, the scientists report that people who got blue-light treatment experienced almost a 60 percent reduction in SAD symptoms compared with a 40 percent reduction in people receiving red light. Moreover, the blue light's intensity, 400 lux, which is comparable to the light reflected from a well-lit desktop, yielded symptom reductions comparable to those seen in other studies using glaring, 10,000-lux white light.

MELLOW YELLOW Ganglion cells aren't the only source of information for the biological clock, says Mark S. Rea, a biophysicist at the Rensselaer lighting center. His team has shown that color-signaling cones can mute the ganglion cells' impact on the biological clock, as measured by changes in the hormone melatonin.

Secreted by the brain, melatonin not only helps trigger and maintain sleep but also plays a role in regulating the body's internal clock (*SN: 5/13/95, p. 300*). Dusk and darkness normally trigger melatonin production, whereas bright light can suppress it.

Rea's team exposed four men to mercury-vapor lamps in two hour-long sessions at various times between 11 p.m. and 4 a.m. In white-light sessions, the intensity was either 450 or 1,050 lux and always included both blue and yellow wavelengths. In other sessions, filters removed all but 7.5 or 15 lux of blue light. The scientists monitored the volunteers' blood-melatonin concentrations throughout the evening test periods.



LITE THERAPY — A regimen of light can reset a person's biological clock when it's out of sync, but the white, high-intensity glare of the typical light box can cause discomfort. Since the human biological clock is especially sensitive to blue hues, researchers are developing light boxes equipped with blue, low-intensity LED lights, as shown here.

The high-lux, white-light mercury lamp suppressed the nighttime melatonin by 50 percent. So did the 15-lux blue light—despite its low intensity. The low-lux white light didn't perform nearly as well as those or even the 7.5-lux blue light, which reduced nighttime melatonin by more than 30 percent. The researchers reported their findings in the October 2005 *Neuroendocrinology Letters*.

The results suggest that yellow light can blunt the body clock's response to blue light, Figueiro says. When both blue and yellow are present, equal intensities of the two cancel each other. Only if there's an excess of blue will the cones signal light's presence to the biological clock.

Yellow-light therapy might be especially helpful in teens, whose body clocks tend to run late. Most people naturally wake about 2 hours after their core body temperature reaches its daily minimum, typically around 5 a.m. However, Figueiro notes, in teens with much-delayed internal clocks, body temperatures may not bottom out until 9 a.m. If intense blue light, such as that present in sunlight, arrives before this time, it may further delay their clock and natural waking time.

Wearing yellow goggles that block out blue hues might enable such teens to reach class on time. They might also want to wear yellow glasses late at night while doing homework at computer screens. Figueiro says that those screens are rich in blue emissions and so suggest the presence of morning when a person's biological clock should be registering that it's time to sleep.

Former General Electric Co. lighting scientist Richard Hansler, now at John Carroll University in Cleveland, has teamed with academic colleagues to develop such blue-canceling glasses. In tests, the researchers demonstrated that no blue light passes through the glasses' lenses.

Glovinsky and others have begun prescribing such yellow glasses to enable sleep-disorder patients to better control when they encounter blue light.

SPECTRAL CAFFEINE? Bright white light can perk up drowsy people. Steven W. Lockley of Harvard Medical School in Boston and his colleagues decided to test whether specific colors within that light are particularly arousing.

They recruited 16 men and women to spend 9 days in an environment lacking sunlight and its daily time cues. For the first 2 days, the researchers kept the lighting bright for 20 hours a day and totally dark for 4 hours. For the rest of the days, the light was kept dim—less than 2 lux—except for occasional periods of total darkness lasting up to 4 hours a day and, on the sixth day, jolts of intense, colored light.

On that day, the volunteers—by then quite sleepy—encountered 6.5 hours of pure-blue or pure-green bright light during the middle of the night. During that time, tests measured such features as alertness, brain wave patterns, and blood concentrations of hormones.

Compared with people receiving green light, those getting the same intensity of blue light became more alert and less drowsy—4.0 versus 6.5 on a 9-point sleepiness scale. Blue light also triggered brain waves suggesting that the volunteers were more awake.

"[W]e have demonstrated that short-wavelength [blue] light is more effective at stimulating subjective and objective correlates of alertness and performance," Lockley's team concluded in the February *Sleep*.

The researchers argue that if the findings are confirmed, lighting with a strong blue component might improve safety or performance among people who need to maintain sustained vigilance—from long-distance drivers to air-traffic controllers and airport-security inspectors.

Blue hues also heighten visual acuity. Physicist Sam M. Berman of Lawrence Berkeley (Calif.) National Laboratory and his colleagues investigated the phenomenon in 27 fourth and fifth graders in Michigan schools. An optometrist assessed how well each student could read an eye chart under three conditions: bright blue-white fluorescent light, bright reddish-white fluorescent light, and the blue-white light at half its initial intensity.

In the January *Lighting Research & Technology*, Berman's group reported that 24 of the students performed significantly better under the higher-intensity bluish light than under the reddish-white light. However, the kids' performance was indistinguishable between the low-intensity blue-white light and full-strength reddish light. Berman says that schools should consider installing fluorescent lights that emit more blue.

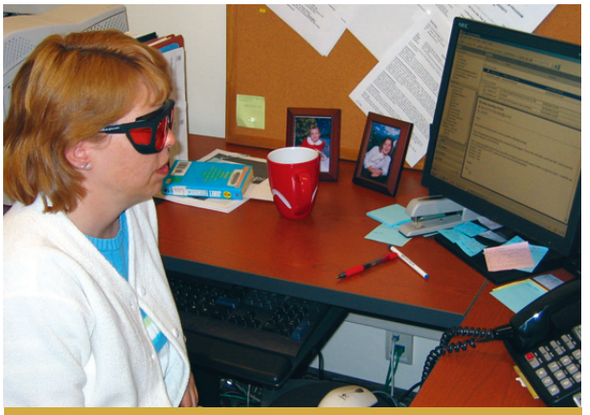
The Department of Energy (DOE) has a related field experiment under way in three California buildings. After surveying

LIGHTING RESEARCH CENTER/RENSSELAER POLYTECHNIC INST.

individuals' perception of their office lighting's quality, crews substituted the commonly used reddish-white fluorescents with lower-lux, bluer-toned ones.

People reported no drop in satisfaction with their office lighting, notes James R. Brodrick, a DOE lighting-research manager in Washington, D.C. Prompting the study, he says, were analyses indicating that "the human retina responds to the slightly bluer light in such a way that the iris closes down a tidbit, improving visual acuity." This contraction increases the distance over which features remain crisp, comparable to stopping down the lens on a camera.

Furthermore, an unpublished study spearheaded by neuroscientist Paul Gamlin of the University of Alabama at Birmingham demonstrates that the eyes' blue-sensitive ganglion cells that relay light signals to the biological clock drive this pupil constriction in rhesus monkeys—and presumably people.



BLUE BLOCKERS — Yellow-orange glasses, seen here, or similarly colored filters for computer and television screens can block blue emissions that at night may inappropriately reset the body's internal clock.

HANSLER/JOHN CARROLL UNIV.

COLOR SHIFTING Sunlight tends to change over the course of the day from spectra with a strong blue component to illumination dominated by reddish-gold tones. Many of Earth's inhabitants, including people, have adapted biologically, reading spectral changes as important cues for when it's time to work or slumber.

With the advent of electric lighting, people created synthetic daylight. However, artificial lighting's color, intensity, or timing may confuse biological systems. In an attempt to make lighting more natural, comfortable, and healthful, lighting manufacturers have been investigating what they now call dynamic lighting.

For instance, Philips Lighting in Eindhoven, the Netherlands, has developed a computer-controlled system that pairs fluorescent tubes that have different spectral outputs. One tube produces light that's rich in blue wavelengths, while the other has stronger red and yellow outputs. Nevertheless, both tubes "are basically experienced as white light," explains Luc Schlangen, a lighting scientist with the company.

In the morning, to perk people up, the lamp increases the blue tube's contribution to room lighting. As lunchtime nears, controls dim both tubes to save energy but now make output of the second, warmer-toned fluorescent dominant. After lunch, the blue's contribution again rises briefly to counter afternoon sleepiness, eventually shifting as outdoor daylight wanes, to dimmer, redder lighting. The controls are adaptable, so that customers can personalize the pattern of when and how the spectra vary.

Systems using these lights have already been installed in many facilities throughout Europe, including some hospitals, insurance companies, a town hall, and traffic-control center.

Studies are planned, Schlangen says, to evaluate the extent to which such spectrally adaptive lighting—developed in response to the findings of Berman, Brainard, Figueiro, and others—might contribute to wellbeing under real-world conditions. ■

OF NOTE

BIOTECHNOLOGY

Directing tubular traffic

Researchers have shown that they can combine a biological motor and an electric field to steer individual protein tubes along tiny channels of a glass chip.

Within living cells, a two-headed protein called kinesin acts as a biological motor, hauling cargo. Fueled by chemical energy, the protein uses the two heads to "walk" along microtubules, which form an inner scaffold in cells.

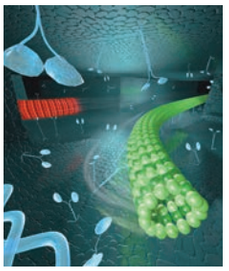
Researchers at Delft University of Technology in the Netherlands put a version of this transport mechanism onto the chips. Instead of having kinesin move around, the scientists anchored the molecules so that their heads would propel free microtubules through the channels, explains biophysicist Cees Dekker.

He and his colleagues designed the glass chips with 800-nanometer-deep channels in different traffic patterns, anchored kinesin molecules within the channels, and pumped in a solution of microtubules.

The team started by applying an electric field to a channel on a simply designed chip. When a microtubule entered this channel from a perpendicular path, the negatively charged microtubule turned toward the positive end of the electric field.

In another experiment in more-complex chips, the researchers steered a single microtubule into one of two fork arms.

Then, the researchers put both green- and red-fluorescently labeled microtubules into a channel. As these microtubules approached a fork, the researchers sorted them by color into one or the other arm by switching the polarity of the electric field, they report in the May 12 *Science*. —A.C.



DELFT UNIV. OF TECHNOLOGY, TREMANI

GOING MY WAY? This artist's rendering shows light-blue kinesin molecules using their two heads to propel red- and green-labeled microtubules through microchannels.

CHEMISTRY

Leaking lead

A disinfectant used by U.S. water utilities dissolves lead in laboratory experiments. The finding bolsters the notion that the disinfectant, called monochloramine, may be responsible for increased lead in some drinking-water supplies.

Utilities have traditionally disinfected drinking water with chlorine. However, the chemical can react with organic compounds in water, generating by-products that include suspected cancer-causing agents. So, some utilities have switched to monochloramine, a compound of chlorine, nitrogen, and hydrogen.

But with the swap came reports of higher concentrations of lead in some water supplies. For example, Washington, D.C.'s water contained lead levels as high as 48,000 parts per billion (ppb) in 2003, 3 years after the city began using monochloramine. The Environmental Protection Agency limits lead in drinking water to 15 ppb. Sources of lead contamination include corroding pipes and solder.

To investigate monochloramine's effect, Jay A. Switzer of the University of Missouri–Rolla and his colleagues measured changes to the mass of lead film after treatment.

A 112-microgram film exposed to a monochloramine solution for 20 hours lost 96 percent of its mass. "The film just about completely dissolves," says Switzer. A similar film immersed in chlorine for the same amount of time dropped only 4 percent of its mass, the researchers report in the May 15 *Environmental Science & Technology*. —A.C.

PHYSICS

A well-spun egg also jumps

Physicists have demonstrated that spinning a hard-boiled egg horizontally makes it jump into the air.

Scientists already knew that a fast-spinning egg spontaneously stands on its end. Random jitters during that process could amplify into leaps, researchers had theorized.

In some high-speed video images, hand-twirled eggs seemed to jump. But, no one knew whether those jumps were real or resulted from inadvertent upward propulsion from a spinner's hand, notes Yutaka Shimomura of Keio University in Yokohama, Japan.

In new tests, he and his colleagues spun egg-shaped pieces of aluminum at initial rates of up to 2,500 revolutions per minute in a machine custom-built to impart strictly horizontal spins. By means of optical, acoustic, and electronic measurements, the team detected that the mock eggs leaped a fraction of a millimeter off the surface for up to a few hundredths of a second. During spins of actual hard-boiled eggs at 1,800 rpm, the researchers saw gaps momentarily appear beneath the eggs.

The team's findings, reported in an upcoming *Proceedings of the Royal Society: A*, illuminate how tiny fluctuations in physical systems can lead to unexpected effects, Shimomura says. —P.W.

PLANETARY SCIENCE

The sands of Titan

Although the surface of Saturn's moon Titan is cold enough to freeze methane, it has sand dunes like those in the Arabian Desert, radar images taken by the Cassini spacecraft reveal. But instead of being made of ordinary sand, Titan's dunes are probably grains of frozen organic compounds, water ice, or a mixture of both, Ralph Lorenz of the University of Arizona in Tucson and his colleagues report in the May 5 *Science*.

The parallel, 100-meter-high dunes stretch for hundreds of kilometers at the equator of Titan, whose atmosphere is rich in methane. The team proposes that the grains that make up the dunes might have formed when rare but intense methane rain drove ice particles out of the moon's frozen rocks. Alternatively, the sand could be organic material produced by sunlight-driven reactions involving methane and other compounds.

Once the grains were created, winds driven by Saturn's gravity could have sculpted them into dunes, says Lorenz. In that process, the planet's gravity would raise tides in the moon's thick atmosphere. Combined with wind generated by Titan's rotation, the tide-driven breeze would average 0.5 meter per second, the researchers calculate.

Although gentle by terrestrial standards, such a breeze would be strong enough to push grains along Titan's surface and carry dark sediment from the moon's higher latitudes to the equator, Lorenz says. —R.C.

BIOMEDICINE

Many people don't see well

Vision screening of a broad sample of people in the United States ages 12 and older finds that 6.4 percent of them have substandard vision. That extrapolates to

roughly 14 million people nationwide, National Institutes of Health (NIH) researchers report in the May 10 *Journal of the American Medical Association*.

Using mobile testing facilities throughout the country, scientists randomly offered people free vision tests. Some participants wore glasses or contact lenses; some didn't. Overall, 13,265 people completed the test.

Participants "failed" the exam if they had vision of 20/50 or worse in both eyes, whether or not they took the exam using corrective lenses. Of those who flunked, 83 percent could achieve good visual acuity by getting lenses for the first time or by replacing an out-of-date prescription, says study coauthor Mary Frances Cotch, an epidemiologist at NIH in Bethesda. Md.

Minorities, teenagers, and people without health insurance were more likely than others to have poor sight that wasn't being corrected, the researchers report.

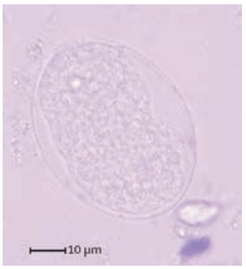
"We recommend that health care professionals talk to their patients about eye health and encourage people to return for periodic eye exams," Cotch says. —N.S.

PARASITOLOGY

Hookworms hitched rides with nomads

Horseback-riding herders known as Scythians or Scythes once traveled far and wide across Eurasia. Their dead have the parasites to prove it.

A man and a woman who were buried separately about 2,300 years ago and recently excavated in Berel, Kazakhstan, were infected with hookworms during their lifetimes, researchers have determined. Hookworms weren't then and still aren't typically found in the steppes of central Asia.



FEEDING THE WORMS Researchers found hookworm eggs in the remains of two nomads buried in Central Asia 2,300 years ago.

"This finding demonstrated that Scythes, a nomadic people, roamed across large areas," says parasitologist Jean-François Magnaval of Paul Sabatier University in Toulouse, France. Hookworm transmission requires a warm and wet climate, he adds, but the closest such weather to the graves is at the Caspian Sea, about 1,200 kilometers away.

Archaeologists suspected that Scythians buried at Berel had traveled extensively because their graves contained artifacts from as far as 1,500 km away.

The rectums of the two Scythians from Berel contained hookworm eggs, the researchers report in the May 6 *Lancet*. The peripatetic pair may have become infected while visiting a seaside settlement or campsite. There, they could have had contact with mud or wastewater that contained human feces, the primary mode of transmission for hookworm infections, Magnaval says. Untreated hookworm infections can persist for at least 10 years. —B.H.

ZOOLOGY

True-pal lizards may show odd gene

Willing to stand between the neighborhood bully and your pal next door?

California lizards doing just that may have a genetic quirk that scientists have been looking for since the 1960s but hardly ever found.

BULLY BOY The large, aggressive, orange-marked lizard relentlessly harasses his neighbors.

The search for the genetic phenomenon began as theorists wondered why altruism doesn't just self-sacrifice itself out of existence, explains Andrew G. McAdam of Michigan State University in East Lansing.

One explanation proposed a powerful gene that lets carriers recognize each other and pushes them to do favors for others of their species who happen to carry the gene. For example, men sporting green beards might do good deeds for other green-bearded men, even if they're not brothers or even cousins.

Scientists have occasionally reported signs of what they began calling the greenbeard gene in fire ants and a few other species (*SN: 8/8/98, p. 86*). However, "there's not been a lot of evidence for it," says McAdam.

Now, he and his colleagues propose a new case: the true pals among side-blotched lizards.

The new results come from Barry Sinervo of the University of California, Santa Cruz. Males with blue throats tend to stake territories next to a blue pal. If one of the bigger, more aggressive males—often with orange markings—moves in, he harasses the nearest blue male relentlessly. Yet the blue harrassee stands his ground, even though he'd get more opportunities to mate if he abandoned the fight. His steadfastness keeps the bully away from the second blue lizard, which can then mate without interference.

Sinervo's study shows that the pairs of blue-marked lizard neighbors typically aren't close kin. Yet a genetic analysis shows three chromosome regions might contain an elusive greenbeard gene, the researchers propose in the May 9 *Proceedings of the National Academy of Sciences*. —S.M.

BIOMEDICINE

Prescription stimulants are big on campus

Nearly 1 in 10 students at a New England college admits to using prescription stimulants without authorization, a new study finds.

Scientists distributed questionnaires to undergraduate students at the private college and collected 347 completed forms. More than half of the responders reported they knew someone who sold prescription stimulants illegally.

Physicians prescribe stimulants for many children and adults with attention-deficit hyperactivity disorder (ADHD). Companies market the drugs under such names as Ritalin, Concerta, and Adderall.

While recreational drug abuse is an old problem on college campuses, modern students appear to take stimulants obtained illicitly to help them stay awake, study, and lose weight, the researchers report in the May *Archives of Pediatrics and Adolescent Medicine*.

Study coauthor Diane R. Blake, a pediatrician at the University of Massachusetts Medical School in Worcester, says the students probably underreported taking the pills. "Even though the survey was anonymous, they may not be comfortable reporting their own use," she says. Nearly three-fourths of the students said that they know another student taking stimulants without a prescription.

In one sense, ADHD medicine "is the NoDoz of the 2000s," says Blake, referring to the caffeine-laden pills used by generations of late-night crammers.

But the data also suggest that some students taking others' prescription stimulants might have a legitimate need for the medications, she says. In her practice, Blake encounters many adolescents who appear to have undiagnosed ADHD. "They hit college and start working extra hard to compensate for it," she says. Some young people taking passed-along stimulants may be self-medicating for ADHD, she says. —N.S.

LANCET, S. MILLS

Books

A selection of new and notable books of scientific interest

FRONTIERS PAST AND FUTURE: Science Fiction and the American West

CARL ABBOTT

Other scholars have pointed out connections between the literature of the Wild West and science fiction, but Abbott takes that idea to new depths. In this book, he considers the genesis of fictional accounts of future homesteading, mining, lawlessness, and other Western-based themes. The author, a professor of urban planning and a science fiction consumer, discusses how science fiction from such notable authors as Robert Heinlein, Ray Bradbury, William Gibson, and Ursula LeGuin are informed by their knowledge of modern frontierism. The author draws comparisons between historical events and the plots of novels and short stories. Invaders arriving by flying saucers mirror marauders of Western lore. Planets altered to be hospitable to people reflect the change brought to the Western deserts by irrigation. Abbott's premise is that the way writers remember the past shapes how they envision the future. ***University Press of Kansas, 2006, 230 p., hardcover, $29.95.***

DRY: Life without Water

EHSAN MASOOD AND DANIEL SCHAFFER, EDITORS

As many as 1 billon people live in places where there is hardly enough water to survive. The cultures there can be rich or poor, but many are among the oldest in the world. They survive because people have developed ingenious ways to capture water from their environments. For instance, the highland people of the Atacama Desert in northern Chile set up boat-sail–size nets to collect water droplets from the fog that comes in off the ocean. The 10-or-so liters that each square meter collects a day is enough for a village's drinking, cooking, and washing. The Masai people in Africa rely on strict conservation of the limited water they have, while people in India and Pakistan build small dams by their homes to collect rainwater. Each chapter tells such a story, as written by people ranging from science writers to researchers to advocates for developing nations. The authors and photographers transform this academic material into a lively presentation. ***Harvard Univ. Press, 2006, 192 p., color photographs, hardcover, $29.95.***

ANOTHER DAY IN THE FRONTAL LOBE: A Brain Surgeon Exposes Life on the Inside

KATRINA FIRLIK

A neurosurgeon needs extensive knowledge of the brain, nerves of steel, and a good dose of arrogance, writes Firlik, who is among the 5 percent of all practicing U.S. neurosurgeons who are women. She offers a personal glimpse into her career, which she says is that of a part-time scientist and part-time mechanic. The author describes her earliest forays into a child's version of medical research, including an experiment on inducing strokes in gerbils. Later, she faced the culture of neurosurgery and then endured the routine of life as a perpetually sleep-deprived surgery resident. She recounts her education in the technical aspects of surgery, such as incision types, as well as the emotional turmoil she underwent the first time she delivered news of a brain tumor to a patient. Firlik offers her philosophy on the nature of intelligence and comments on the ethical dilemmas neurosurgeons face. She also predicts the future of neuroscience, including what she calls "brain lifts" that will offer cognitive enhancements. ***Random House, 2006, 288 p., hardcover, $24.95.***

OCEANS: An Illustrated Reference

DORRIK STOW

Today, water covers more than 70 percent of the planet, yet much about the ocean's depths remains unknown. Stow offers an illustrated guide to our current knowledge about the ocean and its role in sustaining Earth's climate and life. A detailed introduction outlines the role that oceans have played in human society, as the barriers and then the means to massive migrations. The seas have also been critical inspirations for culture and folklore. Stowe, a professor of ocean and earth science in England, outlines the history of ocean science and explains modern oceanographic techniques. The book's first section, "Ocean Systems," describes physical characteristics, including plate tectonics and the various changes that oceans have undergone over hundreds of millions of years. The second portion of the book includes maps of the four major oceans and provides data on each one. The third section focuses on ocean life. Finally, the book describes people's impact on Earth's oceans. Each section includes a list of key terms. ***Univ. Chicago Press, 2006, 256 p., color plates, hardcover, $55.00.***

THE ZOMBIE CURSE: A Doctor's 25-Year Journey into the Heart of the AIDS Epidemic in Haiti

ARTHUR M. FOURNIER AND DAVID HERLIHY

While working in Miami's Jackson Memorial Hospital in 1979, Fournier encountered a patient stricken with a mysterious ailment that would, several years later, be recognized as AIDS. As the number of sick and dying increased, Fournier recounts searching in vain for an explanation as to why these men, women, and children, all Haitian immigrants, were being struck down. With Herlihy, Fournier describes his subsequent work fighting this new disease, which he and his colleagues finally recognized as the same one affecting many U.S. homosexuals, and his developing respect for and dedication toward the Haitian people. Fournier describes his frustration over how the epidemic stigmatized a people that was already struggling to succeed in the face of poverty and prejudice. Ultimately, his efforts took him to Haiti, where he searched for answers and possible treatments among a population that, counterproductively, viewed AIDS as a zombie curse. ***Nat. Academy Press, 2006, 324 p., b&w photos, hardcover, $27.95.***

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LETTERS

Dig it or don't

I am rather surprised at all the attention this find is getting ("Out of the Shadows: Not all early mammals were shy and retiring," *SN: 3/18/06, p. 173*). Some would think that these mammals caused the downfall of the dinosaurs, but the fossil record suggests a very different scenario. There is no evidence of possum-to-coyote–size mammals for the 70-odd million years that the dinosaurs ruled the planet. The only mammals able to remain uneaten were no larger than a rat, almost too small to be noticed.

DAN PETERSON, FORT CAMPBELL, KY.

The article mentions that "researchers analyzed the ... skeleton of a chipmunk-size creature that lived 150 million years ago.... The ... limb bones suggest that the creature spent a lot of time digging." Finally, paleontologists have discovered their own direct ancestor.

BOB KANEFSKY, MOUNTAIN VIEW, CALIF.

Threes, the easy way

I refer to your article "Pigging Out Healthfully: Engineered pork has more omega-3s" (*SN: 4/1/06, p. 196*). Changing the diet of pigs, cows, chickens, etc., to include more omega-3 fatty acids would be a healthy alternative to genetic engineering and wouldn't require government approval. In particular, the weed purslane is higher in omega-3s than any other vegetable and is also edible by humans, although it is not generally available in markets. In addition to improving the quality of meat, purslane feed could produce healthier butter and eggs. And eggs, unlike fish, are plentiful, cheap, and free of pollutants.

HARRIET PEARLMAN, METUCHEN, N.J.

The researchers seem to be unaware that grass-finished beef has two to six times the concentration of omega-3s that grain-finished beef has. Eggs from chickens allowed to forage for part of their food average four times the omega-3s found in factory-produced eggs. There are more easily implemented methods of making animal products healthier than genetic engineering.

VIRGINIA BROCK, ROCK ISLAND, ILL.

These points about omega-3s in meat and eggs are valid, but changing an animal's feed, even by providing it more foraging space, significantly increases the price of meat, milk, and eggs, say the authors of this study. One of their study objectives was to avoid higher prices. —C. BROWNLEE

SO MANY GREAT TOPICS, ONE GREAT SCIENCE WEEKLY

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