

SCIENCE NEWS

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stretching nylon
autistic smarts exceed IQ
crayfish bravado
restoring a sense of smell

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tropical risk

SAND, SEA, AND SCHIZOPHRENIA

SCIENCE NEWS

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LETTERS editors@sciencenews.org

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Polymer Breakdown

Reaction offers possible way to recycle nylon

Each year, thousands of tons of nylon end up in landfills. But small-scale experiments may offer big hope for efficient recycling of some types of the material.

Nylon-6, an artificial polymer used in carpets, clothing, and car parts, is made by chemically linking large numbers of molecules derived from a petroleum product called caprolactam. Current processes to break apart, or depolymerize, nylon-6 typically must take place at high temperatures and high pressures. The processes are also relatively inefficient, says Akio Kamimura, an organic chemist at Yamaguchi University in Ube, Japan.

On the other hand, incinerating the polymers in mixed trash can create prodigious amounts of toxic compounds (*SN*: 1/29/00, p. 70). That's why nylon-6 usually ends up in landfills. Each year in the United States alone, carpets containing about 500,000 metric tons of nylon-6 end up at the dump.

Now, Kamimura and his colleague Shigehiro Yamamoto have developed a process that depolymerizes nylon-6 and regenerates caprolactam. The researchers describe their bench-scale experiments, which use common laboratory equipment, in the June 21 *Organic Letters*.

Kamimura and Yamamoto placed chips of nylon-6 and small amounts of a catalyst in various ionic liquids, which consist solely of positively and negatively charged ions (*SN*: 9/8/01, p. 156). At a temperature of 270°C, the depolymerization reaction was inefficient, and the team recovered only 7 percent of the caprolactam contained in the nylon chips, says Kamimura. At tem-

peratures above 330°C, the reaction was more efficient, but only 55 percent of the caprolactam was recovered because some of the substance decomposed in the heat.

At the intermediate temperature of 300°C—low by industrial standards—the yield of caprolactam approached 86 percent, says Kamimura. More important, he notes, at that temperature the ionic liquid didn't become tainted with by-products of the reaction. The researchers were able to reuse their ionic liquid five times without significant drops in caprolactam yield.

The team's approach is novel because it uses ionic liquids under conditions less harsh than those needed for other solvents, says Michael P. Harold, a chemical engineer at the University of Houston. He suggests, however, that several issues may stand in the way of making the process economically feasible. For instance, because ionic liquids are typically quite costly, expanding the process to an industrial scale would require the solvent to endure hundreds of depolymerization cycles.

"Ultimately, the economics [of the process] will dictate the success," says Harold. "If the ionic liquid is very expensive and not sufficiently durable, the concept will not be viable."

QUOTE



Ultimately, the economics [of the process] will dictate the success."

MICHAEL P. HAROLD, University of Houston

John D. Muzzy, a chemical engineer at the Georgia Institute of Technology in Atlanta, and his colleagues are developing a different sort of chemical reaction to unzip nylon-6. In the lab, they've used a liquid catalyst to melt the nylon and cleave its long molecules. The researchers haven't yet published their findings, but Muzzy and his

team estimate that a single facility using this process to recycle nylon-6 would be able to recover about 90 percent of its caprolactam. It could generate more than 4,600 metric tons of an impure solution of caprolactam each year at a cost of about half the current market price. —S. PERKINS

Faker Crayfish

Males keep bluffing but don't get caught

Many males of an Australian crayfish species consistently fake their way through macho confrontations, a new analysis of rivalries indicates, even though evolutionary theory says that such bluffing should be rare.

When two male slender crayfish (*Cherax dispar*) encounter each other, the one waving bigger claws typically sends the smaller-clawed creature fleeing, say Robbie Wilson of the University of Queensland in St. Lucia, Australia, and his colleagues. Yet the researchers' measurements show that the biggest claws don't necessarily deliver the strongest pinch.

That the oversized but feeble claws retain their menace represents "one of the first demonstrations of dishonest weaponry on a widespread scale," says coauthor Michael J. Angilletta Jr. of Indiana State University in Terre Haute.

Slender crayfish, about palm size, stake out homes in streams, and males face off when they encounter each other. "They do this odd little dance," Angilletta says. One, adopting a pose that reminds Angilletta of a knuckle-walking gorilla, plants his claws tip down in the sand, then lets the other male tap them. Then the poser and tapper switch roles. After several posing bouts, one male usually retreats. Only rarely does the encounter escalate into a wrestling match.

The researchers studied various confrontations among 32 males. Angilletta says that his coauthors—from Brazil and England as well as Australia—paired the males in a series of contests arranged to create "the crayfish World Cup."

A detailed analysis showed claw size to be a much stronger predictor of dominance than strength and body condition, the researchers report in an upcoming *American Naturalist*.



SMACKDOWN? Two male slender crayfish of Australia resort to actual wrestling only when they're about the same size. Often, the smaller one simply flees.

To see what a large claw might mean to a challenger, the researchers presented the crayfish with a tweezerlike device that measured grip force. Their claw size correlated with force only “very weakly,” says Angilletta.

Coauthor Rob James of Coventry University in England dissected crayfish muscles to measure their force. He found that a section of male muscle tissue was only half as strong as a same-size sample of female muscle tissue. “What it suggests to us is that males are making crappy muscle,” says Angilletta. The males apparently put a lot of resources into size even if quality suffers.

On the rare occasions when males resorted to wrestling, claw strength did matter, the researchers found. So there ought to be an evolutionary advantage for males calling the bluff of fakers, which would over time reduce the frequency of cheating. “It’s a puzzle,” says Angilletta.

The result contrasts with the findings of a 2006 paper on threat behaviors among collared lizards in the southwestern United States. Male lizards spend time “just sitting there with their mouths open,” says Jerry Husak of Virginia Polytechnic Institute and State University in Blacksburg. The gape reveals mouth muscles, and Husak and his colleagues found that muscle width proved a reliable indicator of bite strength.

Husak notes, though, that evolutionary theory suggests that cheating may arise under certain circumstances. He calls the new crayfish study “a good step forward in our understanding of reliability and deception.” —S. MILIUS

Bad News for Cats

Cat allergen hits all allergic people

For people who have asthma or respiratory problems that are triggered by cats, living with Fluffy is obviously a bad idea. Now, researchers have found evidence suggesting that people who know that they have other allergies may also want to avoid the furry felines.

Scientists who conducted a study across 14 European countries say that people allergic to irritants such as dust mites, mold, and grass had poorer lung function if they were around cats than if they lived felinefree.

“Cats are more of a problem than we

thought,” says lead author Sue Chinn of Imperial College London.

The unexpected result emerged from a broad study of allergy and lung function. The researchers went into the homes of 1,884 randomly selected volunteers and tested mattress-dust samples for allergens from cats and dust mites. Volunteers were also tested to determine whether they were allergic to common triggers such as dust mites, cats, *Cladosporium* mold, and timber grass, a relative of Kentucky bluegrass.

Scientists tested participants for allergies by measuring their blood concentrations of antibodies of a type known as immunoglobulin E (IgE). An allergic reaction occurs when an IgE antibody binds to an otherwise harmless compound and spurs the immune system into action.

To assess how living amid differing amounts of triggers affected participants’ respiratory systems, the scientists had volunteers undergo a lung-function assessment that included a test of how strongly their lungs constricted in response to an irritant.



HIGHLY IRRITATING People allergic to things other than cats possibly should avoid the animals anyway because their presence can make people’s lungs more sensitive to a wide range of allergens.

Surprisingly, Chinn says, people living around cats performed worse on the lung function test even if they weren’t specifically allergic to cats. By contrast, exposure to dust mites made no difference to the test results of people not allergic to the bugs.

The scientists had expected that people’s lungs would constrict only when exposed to the stimulants that trigger their allergies, as happens in people with asthma (*SN: 11/27/04, p. 344*).

Chinn cautions not to give away Fluffy just yet because “the study needs to be replicated before we start getting too excited.” The results appear in the *July American Journal of Respiratory and Critical Care Medicine*.

Dennis Ownby, a physician at the Medical College of Georgia in Augusta, notes that one of the more interesting findings of the study is that exposure to cats affected participants’ breathing more than exposure to house dust mites did.

“For many years, a tremendous amount of work was done on [the study of dust] mites in homes and the risk of asthma on the people living there,” he says. “This study now suggests that mites are not that important.”

The results don’t necessarily indicate a cause-and-effect relationship, Ownby says. “It’s possible that higher [sensitivities to] cat allergens are directly related to something else in the home and [that] we’re just not measuring the primary culprit.” —C. BARRY

Hidden Smarts

Abstract thought trumps IQ scores in autism

There’s more to the intelligence of autistic people than meets the IQ. Unlike most individuals, children and adults diagnosed as autistic often score much higher on a challenging, nonverbal test of abstract reasoning than they do on a standard IQ test, say psychologist Laurent Mottron of Hôpital Rivière-des-Prairies in Montreal and his colleagues.

The same autistic individuals who score near or below the IQ cutoff for “low functioning” or “mental retardation” achieve average or even superior scores on a test that taps a person’s ability to infer rules and to think abstractly about geometric patterns, Mottron’s team reports in the August *Psychological Science*.

“Intelligence has been underestimated in autistics,” Mottron says. Autistic people solve problems and deploy neural resources in unusual ways, which are poorly understood and might contribute to problems with IQ tests, he asserts.

Mottron regards autism as a variant of healthy neural development. For that reason, his group—including study coauthor Michelle Dawson, herself diagnosed as autistic—prefers the term “autistic” to “person with autism.”

The researchers studied 38 autistic children, ages 7 to 16; 13 autistic adults, ages 16 to 43; 24 nonautistic children, ages 6 to 16; and 19 nonautistic adults, ages 19 to 32.

Volunteers completed an age-appropriate IQ test and a Raven’s Progressive Matrices test. The latter test includes 60 items, each consisting of a series of related geometric designs and a choice of six or eight alternative designs, one of which completes the series.

The nonautistic children and adults scored slightly above the population average on both tests.

In contrast, autistic kids and adults scored far higher on the Raven's test than they did on the IQ tests. These youngsters' average IQ was substantially below the population average, but their average score on the Raven's test was in the normal range.

One-third of autistic children qualified as "low functioning" by IQ, but only 5 percent did so by Raven's scores. Moreover, another third of the autistic children achieved "high intelligence" on the Raven's test.

As in previous research, autistic volunteers performed well on an IQ task that required them to reproduce geometric designs using colored blocks.

The new findings confirm prior indications that autistics score poorly on IQ tests despite processing perceptual information well, comments psychologist Uta Frith of University College London. In a 2000 study, Frith's team noted that autistic and non-autistic children made equally rapid and accurate visual judgments, such as discerning which of two lines was longer.

In people with autism, a lack of social insight derails the ability to acquire skills and information from others, a key to IQ success, Frith theorizes. Autistics thus succeed only on self-explanatory tasks, such as the Raven's test.

The Raven's test may measure autistic

intelligence better than an IQ test does, adds psychologist Helen Tager-Flusberg of Boston University. Nonetheless, many autistic children are extremely impaired intellectually, she says.

Researchers generally sell short the unique features of autistic intelligence, Dawson responds. For example, autistics shift flexibly back and forth between focusing on details of a scene or its overall configuration, whereas nonautistics single-mindedly concentrate on the big picture, she says. —B. BOWER

Dropping the Ball

Air pressure helps objects sink into sand

Here's good news if you happen to drop something while you're strolling across a sandy section of Mars: You should be able to find what you dropped more easily than if you had dropped it into desert sands on Earth. And that's not just because of Mars' weaker gravity. Two teams of physicists have shown that a denser atmosphere, such as

Earth's, makes a falling metal ball penetrate much deeper into grainy terrain.

"It's very counterintuitive," says Detlef Lohse of the University of Twente in Enschede, the Netherlands. "You would expect that, once air is there, there would be more friction," slowing down a ball's descent into the sandy bed. Instead, the air's presence makes the sand act more like a liquid than a solid, Lohse says.

Sand is an example of what physicists call a granular material. Neither fish nor fowl, granular materials display features reminiscent of both solids and fluids. For example, gravel can flow smoothly but then abruptly jam.

In their experiment, Lohse and his colleagues looked at how deeply a marble-size steel ball sank when dropped into loose, dry sand. Falling from a height of 15 centimeters in atmospheric pressure, the ball penetrated as much as 13 cm into the sand. But when the team lowered the air pressure to one-fortieth of an atmosphere, the penetration depth shrank to just 4 cm.

The team also estimated how much the ball's impact changed the volume of sand in the bed. In the presence of air at atmospheric pressure, the volume of sand stayed roughly constant. But in an experiment under vacuum, the volume decreased, indi-

Allergy Nanomedicine

Buckyballs dampen response of cells that trigger allergic reactions

Scientists have shown that soccer ball-shaped carbon molecules, commonly called buckyballs, can block allergic responses in both human cells and mice. The findings point to a new way of treating allergies using these nanoscale particles.

In recent years, several labs have begun harnessing the unusual physical and chemical properties of buckyballs to develop new drugs and diagnostic tools (*SN*: 7/13/02, p. 26). A buckyball consists of 60 carbon atoms arranged in a hollow, spherical shape. Scientists can easily modify the molecule's properties by attaching different chemical entities to its surface.

Several studies suggest that buckyballs act as strong antioxidants, or "free radical sponges," says Chris Kepley, an immunologist at Virginia Commonwealth University in Rich-

mond. In other words, they appear to sop up free radicals and other chemical species containing reactive oxygen, which are natural by-products of energy production in cells. Free radicals, which damage cellular structures, may be an important cause of aging and many neurological diseases.

Since studies have also linked allergic responses to increases in reactive oxygen species, Kepley and his colleagues wondered whether buckyballs could quell allergies. The researchers exposed two types of human cells—mast cells and basophils—to water-soluble buckyballs for 24 hours. Both cell types store histamine, the chemical that induces allergic reactions.

When the researchers triggered an allergic response in the buckyball-exposed cells, the cells released significantly less histamine than expected.

In contrast, unexposed cells generated the full allergic response.

Kepley and his colleagues also injected mice with a solution of buckyballs and then triggered an allergic reaction that would normally cause the animals to experience anaphylactic shock. The buckyballs blocked the animals' anaphylactic response by dampening the release of histamine.

The researchers report their results in the July 1 *Journal of Immunology*.

"This is a great proof of principle that these molecules can act as good antioxidants," says Laura Dugan, a geriatric specialist at the University of California, San Diego, whose lab is also testing buckyballs for the treatment of allergies. Dugan says that the new results are in line with her own group's unpublished findings.

"There is an enormous future

for these compounds," she says. "It's a whole new approach to treating a lot of different diseases." For instance, Dugan's lab is testing the possible use of buckyballs against Parkinson's disease and Alzheimer's disease. Kepley plans to investigate the use of buckyballs to prevent arthritis and diabetes.

The next step in the allergy work will be to chemically modify buckyballs so that they target only mast cells or basophils in the body, says Kepley. Although toxicity is a concern with nanoparticles, the buckyballs in his study didn't appear to be toxic to either the cells or the mice. But more tests are needed to ensure the molecules' safety, says Kepley.

His group is collaborating with Luna Innovations, a company in Danville, Va., to turn buckyballs into a new treatment for allergies. —A. GOHO

cating that the sand had compacted.

In an independent experiment, Heinrich Jaeger of the University of Chicago and his colleagues used X rays to image the interior of a sand bed as a steel ball fell in. They, too, found a dramatic difference in how deeply the ball penetrated, depending on air pressure. In a test done under vacuum, the sand surrounding the ball appeared darker, indicating that it had been compacted. No such darkening occurred when the ball fell into sand in the presence of air. Both studies are due to appear in *Physical Review Letters*.

Lohse says that as the ball pushes into the sand, the air provides a layer of lubrication that allows sand particles to flow around the ball. That reduces drag, allowing the ball to sink. Jaeger agrees, adding that the air's presence makes it less likely for sand grains to rub against each other and slow down the ball by dissipating energy. He says that his group's experiments show that in the presence of air, the entire sand bed acts like a liquid.

The new findings may shed light on the formation of lunar and planetary craters by meteorite impacts, the researchers say. The research could also improve models of the behavior of granular materials.

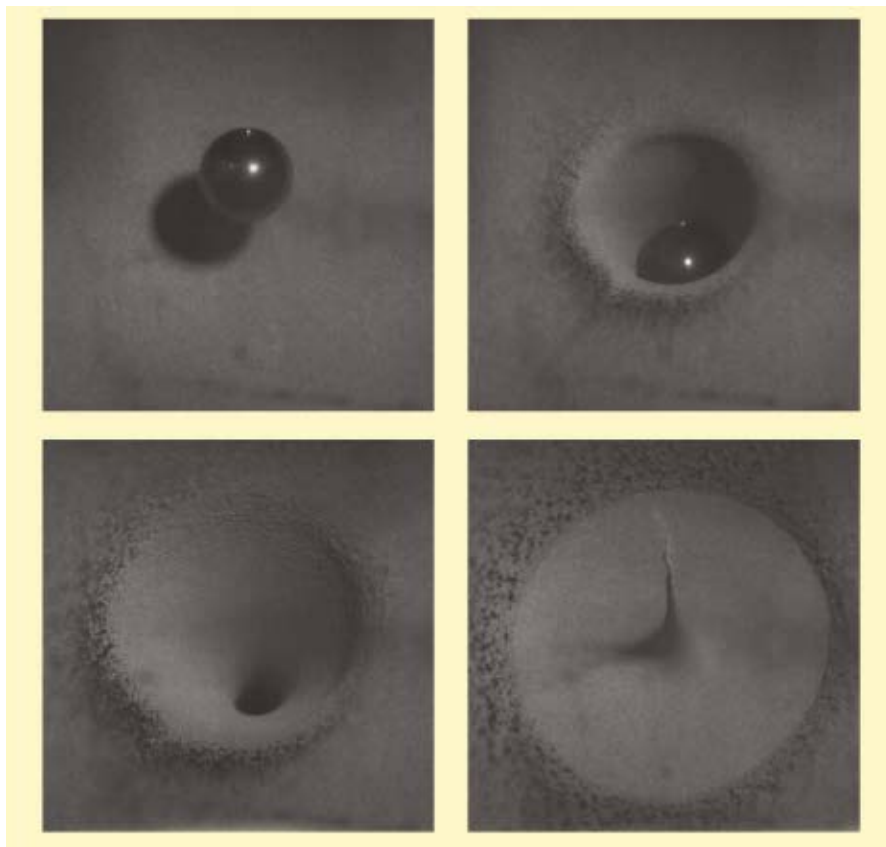
"Careful experiments like these are the only way to go," says Daniel Goldman of the Georgia Institute of Technology in Atlanta. —D. CASTELVECCHI

Spermicide Flip Side

Compound may promote papillomavirus infection

A widely used spermicide may increase a woman's risk of contracting human papillomavirus from a sex partner, a study in mice suggests. On the other hand, a thickening agent in many vaginal lubricants sold commercially impedes the virus' ability to infect female mice via their genital tracts—even in the presence of the spermicide.

It remains to be seen whether the findings will translate to people, cautions study coauthor Jeffrey N. Roberts, a human papillomavirus (HPV) researcher at the National Cancer Institute in Bethesda, Md. But the results "raise the intriguing possibility that you could formulate [the two compounds] as a spermicide that would prevent HPV infection," he says.



SPLASH! Video frames tens of milliseconds apart show sand grains under air at one-fifth of atmospheric pressure engulfing a metal ball. The column of sand in the final image would be much higher if the impact occurred under normal air pressure.

Nonoxynol-9, the most widely used spermicide, has come under scrutiny because its strong detergent properties—which make it lethal to sperm—irritate the lining of the genital tract of some women.

Roberts and his colleagues tested mice to establish whether that damage might facilitate HPV passage.

First, they abraded the genital tracts of some female mice with a tiny brush. A genetically modified version of HPV, applied to the damaged tissue 6 hours later, infected cells lining the tract. The virus' modification made it traceable. Mice with unabraded genital tissue largely resisted infection.

Next, the researchers inserted nonoxynol-9 into the unabraded genital tracts of a second group of mice. Six hours later, they exposed the animals to the modified HPV. Five times as much HPV infected the mice as it did after abrasion, the researchers report in the July *Nature Medicine*.

"Nonoxynol-9 seems to compromise the barrier effect of the cells lining the genital tract while not inactivating the virus in any way," says Roberts.

When nonoxynol-9 and HPV were inserted simultaneously into mice with unabraded genital tracts, no infection occurred. That suggests that "it might take some time" for the detergent properties of nonoxynol-9 to disrupt the layers of cells lining the genital tract, Roberts says.

"The data presented are really very convincing," says immunologist W. Martin Kast of the University of Southern California in Los Angeles. "This leads you to think there is a chance the virus might do something similar in human beings."

The scientists conducted a parallel set of experiments with carrageenan, a seaweed derivative used to thicken vaginal lubricants. It had shown signs of inhibiting HPV in lab tests (*SN*: 7/22/06, p. 62).

In mice, carrageenan fended off HPV infection almost completely after the animals underwent genital-tract abrasion or exposure to nonoxynol-9.

There are more than 100 HPV strains. Some cause genital warts, while others can lead to cervical cancer. A vaccine called Gardasil prevents infection by two wart-causing and two cancer-causing HPV strains (*SN*: 10/15/05, p. 243; 11/20/04, p. 332). Roberts and his colleagues used one of the latter strains, HPV-16, in the current study.

Kast says that researchers need to test whether carrageenan would complement Gardasil. In the new study, carrageenan blocked infection by HPV-16 and showed signs of inhibiting two cancer-causing strains that the vaccine doesn't address.

Meanwhile, the current findings "make the case that carrageenan is a useful compound to add to nonoxynol-9" to offset its detrimental effects, Kast says. —N. SEPPA

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If You Have Questions about Islam and Its History ...

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Islamic Mosque, Nairobi, Kenya

that face them in their new homelands; and how they are grappling with these challenges.

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Dr. Esposito is Editor-in-Chief of *The Oxford Encyclopedia of the Modern Islamic World*, *The Oxford History of Islam*, and *The Oxford Dictionary of Islam*. He has more than 25 books to his credit. An international consultant, he is Professor of Religion and International Affairs and of Islamic Studies at Georgetown University, Washington, DC. He specializes in Islam, political Islam, and the impact of Islamic movements from North Africa to Southeast Asia.

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High schizophrenia rates among Pacific islanders raise cultural questions

BY BRUCE BOWER

The Micronesian islands that form the Republic of Palau, situated about 500 miles east of the Philippines, boast the sun-washed beaches and lush greenery of a tropical paradise. But behind the picture-postcard scenery lurks a disturbing mental-health mystery. For some reason, Palau has one of the highest rates of schizophrenia in the world.

Although researchers routinely assume that this devastating fragmentation of thought and emotion occurs in 1 percent of people everywhere, it afflicts 1.7 percent of the approximately 17,000 Palau residents at some time in their lives. Among Palauan men, schizophrenia's prevalence soars as high as 2.8 percent. Yet in other parts of Micronesia, the schizophrenia rate dips as low as 0.4 percent.

Such variations, which also crop up elsewhere in the world, illustrate the dangers of assuming that an average prevalence rate of 1 percent applies to any particular location. Differences in schizophrenia's prevalence from one place to another reflect the influence of environmental and social forces on a disorder often regarded as the product solely of wayward genes and brains, says anthropologist Roger J. Sullivan of California State University in Sacramento.

Although it has been described and pondered by clinicians for the past century, schizophrenia consists of a grab bag of symptoms in search of an explanation. Major elements of the disorder include hallucinations, delusions, apathy, inability to interact with others, blunted or inappropriate emotions, and distorted thinking. Schizophrenia typically emerges in young adults. Doctors 100 years ago described it as a progressive disease of the brain, but many mid-20th-century clinicians attributed schizophrenia to disturbed family relationships. The pendulum then swung back to a biological and genetic emphasis, where it remains.

Research on Palau conducted by Sullivan and his colleagues underscores how environmental and cultural challenges interact with the numerous genes that studies have linked to schizophrenia. The research also suggests that schizophrenia hits people harder in Palau than it does in many other parts of the world. This finding challenges a widespread assumption—based on an ongoing mental-health study launched by the World Health Organization (WHO) in 1967—that family and social life in developing countries provide buffers against psychosis that aren't available in big cities and developed regions.

"We have to get past the idea that schizophrenia is necessarily milder outside of urban settings and start asking about stressors in any society that influence this condition," Sullivan says.

Moreover, new Palau findings—published in the April *Current Anthropology* along with comments from six researchers—contribute to growing evidence that schizophrenia especially targets two groups: men and recent immigrants to various countries.

"Schizophrenia is not the egalitarian disorder that we once thought it was," remarks psychiatrist John J. McGrath of the University of Queensland in Australia.

CULTURE CLUBBED Sullivan knows that he's looking at schizophrenia in a counterintuitive, controversial way. He says that his evidence suggests that traditional, small-scale societies aggravate schizophrenia more than modern, industrialized ones do. In a major city, a person who hears hectoring voices and feels controlled by space aliens can retreat from the stress of social life into anonymity and solitude. But "in a small-scale setting, you can't choose not to participate in social interactions, even if you have schizophrenia," Sullivan says.

In 1995 and 1998, he and his coworkers studied a total of 49 men and 21 women receiving outpatient treatment for chronic schizophrenia or for a mix of schizophrenia and depression at Palau's main hospital. Volunteers averaged 39 years of age and had experienced schizophrenia symptoms for more than a decade. Physicians had prescribed antipsychotic medication to most of them.

Schizophrenia is the same illness in Palau as it is in the United States and other developed countries, the researchers hold. In standard psychiatric interviews, Palauan patients reported much

the same array of symptoms as 240 individuals hospitalized for schizophrenia in New York City did around the same time in a separate study.

"We have to get past the idea that schizophrenia is necessarily milder outside of urban settings."

— ROGER J. SULLIVAN,
CALIFORNIA STATE
UNIVERSITY IN
SACRAMENTO

A common biological marker of schizophrenia also characterizes many of the Palauan patients, according to Sullivan's team. About 55 percent of the islanders display disturbed eye tracking of objects moving through their visual fields. Several previous studies had found that a comparable proportion of patients with schizophrenia living in developed countries, as well as many of their immediate relatives without the disorder, share this genetically influenced trait.

Some researchers suspect that excessive consumption of alcohol and other drugs among individuals with schizophrenia on Palau exacerbates the condition. Yet, in the new study those who engaged in such behavior actually displayed milder symptoms. Consider betel nut, a stimulant chewed by millions of people from eastern Africa to the Pacific. Among the Palauan patients, the 40 frequent betel nut chewers suffered from milder hallucinations and delusions than did the 30 others who never or rarely chewed the substance. Brain-altering chemicals in betel nuts may quell hallucinations and delusions, the researchers propose in the April *American Journal of Psychiatry*.

Traditional social practices in Palau ease the experience of schizophrenia for young women and worsen it for young men, the scientists suggest. Signs of schizophrenia first appear as members of both sexes face the stressful task of moving from childhood dependency into adult roles. However, a Palauan woman with the disorder will usually receive support and protection from her family and clan. If necessary, she will continue to live at her family's house.

In contrast, a mentally ill man on Palau typically receives scant family and clan support. He has few job options and little ability to fulfill customary obligations to repay family members for their prior assistance. As an undesirable marriage partner, he misses out on traditional transfers of family wealth to married men.

In other words, young Palauan men with schizophrenia are cultural outcasts. Their society places unattainable expectations on them and provides constant reminders of their failures. The combination of stress and rejection twists their schizophrenia into a much knottier disorder than it would otherwise become, Sullivan asserts.

He plans to explore this proposal in a 1-year study of symptom progression, social support, and social activities among Palauans with schizophrenia.

DISPUTED DISORDER Opinions vary widely about the implications of the new schizophrenia evidence from Palau. Perhaps that's not surprising, given the disorder's controversial history.

Francis X. Hezel, director of an organization called Micronesian Seminar that conducts research and provides pastoral care in Micronesia, welcomes a focus on the high rate of male schizophrenia in Palau. Sullivan's report "is a summons to take seriously once again environmental factors that seem to have long been sidelined, if not ignored, in general schizophrenia studies," Hezel says.

Still, much remains unknown about how culture and biology foster schizophrenia, remarks psychiatrist Robert Barrett of the University of Adelaide in Australia. Researchers need to examine the role of "that universal cultural commodity, stigma," which may occur with special intensity in small, island populations, Barrett says. The possibility that a distinctive genetic profile contributes to schizophrenia on Palau also deserves scrutiny, he adds.

But psychiatrist Marina Myles-Worsley of the State University of New York Upstate Medical University in Syracuse rejects the new report's implication that schizophrenia inflicts especially devastating effects on inhabitants of developing nations such as Palau. Sullivan's team failed to study the many Palauans with schizophrenia who cope without medication or any other formal treatment, Myles-Worsley asserts.

In this close-knit island society, schizophrenia sufferers and their families may tolerate the disorder better and experience less distress than their counterparts in developed countries do, the New York investigator suggests. Palauan women with schizophrenia may often go untreated and uncounted in prevalence studies, she adds, because they don't engage in drug abuse, criminal acts, or other behaviors that occasion treatment referrals for men.

In a 1999 study, Myles-Worsley and her colleagues identified 160 Palauans with strictly defined schizophrenia. Most either had never been prescribed antipsychotic medication or had taken medication for a few months, giving it up as soon as their symptoms had improved. Of 62 Palauan teenagers with schizophrenia or related disorders described by Myles-Worsley's group in a 2006 publication, only three males had received treatment with antipsychotic drugs.

The latest data from the international WHO investigation still indicate that people with schizophrenia generally suffer milder symptoms and function better in developing countries than they do in developed nations, says anthropologist Kim Hopper of Columbia University. Those findings appear in a 2007 book edited by Hopper and his colleagues and titled *Recovery from Schizophrenia: An International Perspective* (Oxford University Press).

However, much of the positive outlook for schizophrenia in the developing world comes from evidence gathered in India, Hopper

notes. In that country, families respond to the stigma surrounding mental illness by making extraordinary efforts to support ill individuals and participate in their treatment.

Often forgotten is the fact that, even in Western countries, a majority of people with schizophrenia show remarkable improvement over several decades if provided with social and job programs.

"Specific local characteristics in a community affect the course and outcome of schizophrenia," Hopper says. "'Developed' versus 'developing' countries are lousy categories to use in thinking about this issue."

BAD MOVES Migration presents serious challenges to mental health, especially for Africans and other dark-skinned people moving into largely white areas of western Europe, according to psychologist Elizabeth Cantor-Graae of Lund University in Malmö, Sweden, and psychiatrist Jean-Paul Selten of Utrecht University in the Netherlands. Selten says that neither psychiatrists nor politicians nor immigrants themselves want to face the implications of "the silent epidemic of psychotic disorders among immigrants from non-Western countries in western Europe."

Cantor-Graae and Selten combined and analyzed results from 18 studies, published between 1977 and 2003, of new schizophrenia cases among first- and second-generation immigrants. One investigation took place in Australia; the rest focused on Denmark, the Netherlands, the United Kingdom, and Sweden.

First-generation arrivals to these countries develop schizophrenia at more than twice the rate observed in native-born groups, the researchers reported in 2005. Schizophrenia affects an even greater proportion of second-generation immigrants, Cantor-Graae and Selten say.

Black immigrants from developing countries displayed especially elevated rates of new cases of schizophrenia. Being a dark-skinned immigrant to a primarily white nation is second only to having family members already diagnosed with the disease as a risk factor for schizophrenia, the researchers conclude.

They suggest that the experience of "social defeat" among immigrants promotes severe mental illness. Social defeat arises when an individual is forced into a menial position as an outsider, unable to attain the social rewards of a dominant group. Although scientists have studied this phenomenon in rodents and monkeys, they know little about how it works among people.

Palauan men with schizophrenia who fall short of their culture's expectations may become mired in social defeat, suggests Hopper. Intriguingly, half the patients studied by Sullivan's team lived away from Palau for some period of time as young adults and then returned. Their initial episodes of schizophrenia frequently occurred abroad, raising the possibility that immigration experiences contributed to the disease.

Despite such clues, researchers have yet to identify any environmental measure that can claim major responsibility for fluctuations in schizophrenia rates, cautions psychiatrist Assen Jablensky of the University of Western Australia in Crawley, who headed the WHO international schizophrenia study.

Schizophrenia may well encompass many diseases, each with its own mix of causes, he notes. If so, efforts to pin down the ailment's population rates must await discovery of gene variations that prompt its different forms, Jablensky says.

Until then, high schizophrenia rates in Palau will remain a troubling enigma in paradise. ■



RESTORING SCENTS

Faulty sniffers may get help

BY JANET RALOFF

Betty (not her real name) remembers the day 9 years ago when she fully experienced an orange. As she split the fruit's skin, the sections, citrus scents sprayed into the air and the 51-year-old woman experienced a sensory epiphany: "Whoa! This is an orange. My God, this is what an orange smells like."

Even now, she says, recalling that day "makes me tear up because that orange was the very first thing I smelled." Ever.

"There are probably around 25 million people in this country who have some olfactory problem," observes Barry Davis, who directs the taste and smell program at the National Institute on Deafness and Other Communication Disorders in Bethesda, Md.

Few people lack all sense of smell. Among these, Davis notes, only a tiny share were either born that way, as Betty was, or lost olfaction so early that they can't recall being able to smell.

More common is a gradual diminution of olfaction among seniors, notes Beverly J. Cowart, a sensory psychologist at the Monell Chemical Senses Center in Philadelphia. By age 70, she says, "some degree of smell loss will be close to universal."

Smell loss can also follow head trauma, arise as a complication of respiratory or brain disease, or signal pollutant poisoning of nasal cells.

Many research programs are not only probing what

underlies loss of the sense of smell, but also investigating ways to restore it. Strategies to achieve that goal include drug therapy, sniff training, and even reseeded the nasal lining with stem cells.

Prodding the research is recognition that good olfaction can be a lifesaver, enabling people to detect gas leaks or pick up putrid warnings from spoiled food.

But for Betty, the main benefit has been an improved quality of life. She's building an inventory of identifiable scents—from the fragrances of new-mown grass and roses, to the odor of a cat box. "I love that I can smell them all," she gushes. "Well, maybe not the cat box."

TASTE VERSUS FLAVOR Jason Feifer, an associate editor at *Boston* magazine, can't smell a thing. However, he wasn't aware of this sensory deprivation until he was in college and a girlfriend began constantly asking for his opinions on foods. It didn't take long for him to realize that she was responding to cues that he couldn't even vaguely detect.

"There are probably around 25 million people in this country who have some olfactory problem."

— BARRY DAVIS,
NATIONAL INSTITUTE ON
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"My taste buds work fine," Feifer points out. "So I can detect sweet, salty, sour, and bitter." Add in color, texture, and mouth feel—such as the smoothness of high-fat fare—and he could easily explain why he preferred some foods over others.

But blindfolded, he says, "I can't tell the difference between mint and peanut butter-cup ice creams." Fruits are sweet to Feifer, but with eyes closed, he can only guess their identity on the basis of texture and acidity.

He now suspects that when he can see what he's eating, "my mind fills in some level of sensation that helps me differentiate between foods."

"In fact, what most people call taste is really flavor," a combination of the taste buds' input with tactile impressions and scents, explains neurologist Robert I. Henkin, director of the Taste and Smell Clinic in Washington, D.C. Eliminate scents, Henkin says, and cherry, mint, and butterscotch candies all taste the same.

SMELL KILLERS Feifer divulged a scary anecdote about the seriousness of his sensory deficit in the Nov. 1, 2005, *Washington Post*. While he was in the kitchen, his girlfriend called to him from another room to ask whether something was burning. "I said no," Feifer recalls, and when his girlfriend asked if he was sure, he replied emphatically, "Yes, ma'am."

In fact, a malfunctioning electric grill just inches away from him had begun spewing stinky, black smoke.

The episode prompted Feifer to get a thorough checkup at the taste and smell clinic of the University of Connecticut in Farmington. The good news: He got a clean bill of health—no brain tumor,



serious congenital disease, or other detectable source of smell loss. But those negative findings also implied that he could expect no cure.

A host of conditions can trigger smell loss. Indeed, the olfactory system is fairly vulnerable, as it's the only one of the human senses involving nerves from the brain that make contact with the outside world—on the inside the nose.

Those thin, spaghetti-like nerves run from the nose through an opening in a skull segment called the cribriform plate. Head trauma can sever the nerves, or if an injury shatters the plate, its aperture may close as the bone mends.

Severed olfactory nerves have the capacity to regenerate. If they reconnect to the brain, smell can return, notes James E. Schwob of the Tufts University School of Medicine in Boston. But if their conduit through the cribriform plate closes, smell loss will be irreversible.

Other major reasons for smell loss are respiratory infections and allergies. In rare cases, Schwob says, germs can move up the nerve and into the olfactory bulb, a relay station through which nerve signals enter the brain. If germs damage that bulb, scent data may not reach the tissues able to interpret them.

But the most common causes of smell loss in middle age, says Davis, are chronic inflammation of the nose due to infections and obstructions by growths called polyps. The latter can be surgically removed to restore smell. Steroids, which turn off inflammation, may also bring a rapid return of smell.

However, Davis notes, "sometimes chronic nose infections lead to permanent damage." In those cases, scent receptors in the nasal lining may disappear. Local stem cells should replenish those receptor nerves—except that the stem cells may also disappear. When this happens, he says, "there's no hope" of smell restoration—at least not yet.

SMELL FACTORS Despite the generally grim prognosis for many smell-deprived individuals, there are emerging glimmers that some long-time sufferers will, like Betty, be cured.

Olfactory cells in the nasal lining, or epithelium, don't proliferate by dividing. Instead, individual cells live for a while, then die on command, Henkin explains. Signaling agents such as tumor-necrosis factors (TNFs) give nasal olfactory cells the death sentence. Other signaling compounds known as growth factors then tell stem cells to wake up and divide, creating what will become new scent-sensing cells.

In May, at the Experimental Biology meeting in Washington, D.C., Henkin described his studies of these life-or-death signals in 273 patients, most with profound smell loss or no smell at all. He found that the amounts of two pivotal signal-messenger compounds, cyclic-AMP and cyclic-GMP, in nasal mucus correlated with the ability to smell. The poorer an individual's olfaction, the lower the concentrations of these messenger molecules.

He also reported that the worse an individual's sense of smell, the greater the ratio of death-signaling agents to growth factors in that person's mucus.

For more than a decade, Henkin has been treating a small group of smell-deprived patients with a prescription form of theophylline, a caffeinelike stimulant that's abundant in tea. Doctors typically prescribe theophylline for asthma, but Henkin reasoned that it might help his patients because the drug inhibits the breakdown of cyclic-AMP and cyclic-GMP. He also stumbled upon an additional benefit—the drug substantially ratchets down concentrations of death factors in nasal mucus.

At the Washington meeting, Henkin reported new data on 25 patients treated with theophylline. It didn't help everyone, but Betty and 13 other patients responded.

Among such responders, growth-factor concentrations in nasal mucus skyrocketed. In some cases, concentrations had started at 0.5 percent of normal values. After treatment, concentrations "didn't quite reach normal, but got close to it," Henkin told *Science News*. Death-factor concentrations also fell to near-normal values.

Henkin cautions that it can take a long time before patients see

Beyond the Nose

Smell studies may offer nonolfactory benefits

Smell loss may be an early diagnostic symptom of Alzheimer's disease, new data indicate. Ten years ago, scientists at Rush University Medical Center in Chicago recruited more than 1,000 area seniors, all about 80 years old, into the hospital's Memory and Aging Project. At enrollment, the volunteers took scratch-and-sniff tests of their ability to recognize such familiar odors as turpentine, soap, and lemon.

After the recruits die, Robert S. Wilson and his colleagues at Rush compare data from those smell-recognition tests with autopsy analyses of cell-fiber tangles in the brain—one hallmark of Alzheimer's disease.

Data from the first 129 individuals show that the more trouble a person had identifying smells accurately, the greater the number of tangles that showed up in the brain's olfactory area. This link was strong even in people "with no cognitive impairment" when the smell testing took place, Wilson told *Science News*, suggesting "that problems in smell ability may be a very early sign of [Alzheimer's] disease." His team's findings appeared in the January *Journal of Neurology, Neurosurgery, and Psychiatry*.

In the early stages of Alzheimer's, nerve connections between the nose and brain may work fine, Wilson says. The problem may lie in the inability of brain tissue riddled with tangles to make sense of odor signals.

A new tool developed by Robert A. Frank and his colleagues of the University of Cincinnati may help researchers such as Wilson continue their smell analyses in people with Alzheimer's, other dementias, Parkinson's disease, or olfactory loss alone. Frank's team devised canisters that open when people stick their noses into them and inhale. The more quickly a person notices an odor, the smaller the sniff he or she takes. Computers monitor each inhalation's length and intensity, thereby gauging ability to smell in people who may not be able to speak or even think clearly, says Frank.

Wilson adds that smell testing may one day help identify patients with Alzheimer's and other neurological conditions before dementia or other crippling symptoms set in—a time when therapy can be most effective. —J.R.

a difference. Betty can attest to that. Every 3 months after her daily theophylline treatment began, she performed a battery of sniff tests. Henkin offered her three scents, one after another, then asked which smell was different from the other two. "I'd have no clue," Betty says. "So, I'd just guess."

Over the course of a year, her guesses became increasingly accurate, Henkin told her. "But I had to trust him on that," she says, because she could not consciously tell that she was smelling anything at all.

Then came the day she smelled that orange. With continuing drug therapy, her olfaction has steadily improved, but her threshold for detecting odors remains high. She still can't smell coffee brewing in an adjoining room.

SNIFFS AND MORE Nancy E. Rawson of the Monell Center has been investigating a few other treatments. One that looked quite promising—vitamin A therapy—has turned disappointing.

Vitamin A has anti-inflammatory and skin-regenerating ben-

efits. After learning that doctors would occasionally prescribe it to treat smell loss, Rawson and her team launched a pilot study in animals. A day after severing the olfactory nerves of mice, the researchers began administering vitamin A. To their amazement, it halved the animals' smell-recovery time, when compared with recovery periods in untreated animals.

In repeated experiments since that first trial in 1999, the "findings hold up quite robustly," Rawson says.

Several physicians who read the studies wanted to try vitamin A on their patients. Because excess vitamin A can be toxic, especially to a fetus, the Monell group recommended prescribing beta-carotene, the orange pigment in carrots. The body converts beta-carotene into vitamin A but shuts down the process before an excess builds up.

The treatment didn't work. Cowart now suspects that far higher vitamin A doses may be needed—ones higher than the body will make from beta-carotene.

For now, Monell scientists have changed tack and are teaming with Thomas Hummel's unit at the University of Dresden Medical School's Smell and Taste Clinic in Germany to investigate sniff training. Patients with smell deficiencies sniff from each of several canisters of scented chemicals daily. Although some people initially smell nothing, each volunteer is told the source of the scent—lemon, for example—and asked to think about it as he or she takes in whiffs for 5 to 10 seconds.

In one preliminary trial in Germany, 47 people with partial or total smell loss took part in this sniff training; another 15 with similar smell problems did not. At the end of a 3-month program, "using highly sophisticated tools, we could measure an improvement of more than 15 percent" in the ability of people in the trained group to detect and identify scents, Hummel says. "In addition, this group was able to recognize odors that it hadn't before."

The treatment may train the brain to pick out scent signals

from what had been olfactory noise, Rawson speculates.

Or, Hummel says, it might be that the strong scents he used also helped stimulate the regeneration of nasal sensory cells. In test-tube studies, such cells grow better when exposed to scents.

Tufts scientists are among several groups exploring a far more ambitious therapy: growing nasal-epithelium stem cells in the lab so that they can be grafted into noses devoid of them. In animals, Schwob says, "we have taken [nasal stem] cells from one animal, engrafted them into another, and they'll divide, differentiate, and make new neurons." Moreover, he says, those new nerves make connections to the brain.

Working the same trick with human-olfactory stem cells has proved challenging, however. Recognizing such cells in a donor's nasal tissue is not easy, Schwob says, and the stem cells don't grow well in the lab.

Indeed, Henkin says that there's much to learn about the environment that the cells of faulty sniffers need in order to regenerate. But the payoff for success, he says, is watching patients come alive to the scents around them.

In particular, Betty says, "I've learned how wonderful foods can smell and taste." It's something that her husband no doubt appreciates: He's a chef.

Of course, there can be one weighty side effect of gaining smell. "When I first was beginning to smell things, I became ravenous," Betty says. "I don't know if food tasted better or the new scents just stimulated my appetite. But I [temporarily] gained 30 pounds over the first couple years." ■

"Problems in smell ability may be a very early sign of [Alzheimer's] disease."

— ROBERT S. WILSON,
RUSH UNIVERSITY
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BEHAVIOR

Blind people excel at serial recall

Blindness from birth fosters a superior ability to learn and remember ordered sequences of information, a new study indicates.

Blind people recall much longer word sequences than sighted individuals do, report Noa Raz of the Hebrew University in Jerusalem and his colleagues. The researchers propose that the advantage stems from blind people constantly practicing serial-memory strategies in daily life. For instance, a sightless person gets from one place to another by remembering and noting specific nonvisual cues along a particular route.

The researchers studied 19 adults who had been born blind and 19 adults with normal vision. Each volunteer heard a list of 20 words and was instructed to recall the words and their original order. This procedure was repeated four times to promote learning of the list.

In various sessions, blind individuals recalled 20 to 35 percent more words from the list than sighted people did. That advantage more than doubled for correctly remembering sequences of 2 or more words, and nearly quadrupled for recalling sequences of 11 or more words, the investigators report in the July 3 *Current Biology*.

Blind participants displayed better memories than did their sighted counterparts for all words, not just the first and last ones in the list. In the scientists' view, this suggests that the memory success of the blind relies on thinking of the list as a word chain and on forming meaningful associations between adjacent words. —B.B.

OCEANOGRAPHY

Icebergs can be biological hot spots

Material scraped off land by glaciers and carried to sea by icebergs nourishes life in frigid Antarctic waters.

Late in 2005, oceanographers conducted separate biological surveys near two large icebergs in the South Atlantic. One, an ice mass about 2 kilometers long and 0.5 km

wide, drifted more than 120 km in 8 days, says Kenneth L. Smith Jr., an oceanographer at the Monterey Bay Aquarium Research Institute in Moss Landing, Calif. Currents carried the other iceberg—30.8 square kilometers in area—about 531 km during an 18-day period.

Smith and his colleagues assayed the ocean around each iceberg from about 20 meters to 9 km away. Phytoplankton, the organisms at the base of the ocean's food chain, were about five times as abundant near the bergs as they were in distant waters, the scientists report online and in an upcoming *Science*. Populations of aquatic predators were similarly enhanced in waters near the bergs, Smith notes. The data suggest that the zone of increased biological productivity extended about 3.7 km from each iceberg.

Chemical analyses of water samples suggest that the near-berg population booms were fueled by nutrients, such as iron, that dissolved into the sea as each iceberg melted and released bits of soil and rock.

Satellite images of the region at the time of the surveys showed 89 icebergs that each covered more than 0.1 km². Even though the bergs together occupied less than 0.5 percent of the ocean's surface, the thriving ecosystems around them covered about 39 percent of the sea, the team estimates. —S.P.

BIOMEDICINE

Linking stress and senility

Studies have suggested that emotional stress can increase a person's risk of developing Alzheimer's disease. Now, scientists have found a gene that may explain the connection.

Paul E. Sawchenko of the Salk Institute for Biological Studies in La Jolla, Calif., and his colleagues turned their attention to a gene called *type 1 corticotropin-releasing factor receptor (CRFR1)*, because it's widely involved in the brain's responses to stress.

Scientists had shown that mice subjected to extreme stress—whether by forced swimming in cold water, starvation, or heat—develop clumps of insoluble proteins called neurofibrillary tangles in their neurons. Such tangles form, along with plaques, in the brains of Alzheimer's patients.

"We wanted to know if emotional stressors that are much milder and more like

the ones people experience every day would have the same effect," says Sawchenko.

To create mild stress, the scientists physically restrained mice in tubes for 30 minutes each day. After 2 weeks, the mice had developed the protein tangles in their brain cells. Mice that hadn't been restrained developed no tangles.

However, mice engineered to lack *CRFR1* didn't develop tangles even after being restrained, the scientists report in the June 13 *Journal of Neuroscience*.

Several pharmaceutical companies are developing antianxiety drugs that block the protein made by *CRFR1*, and Sawchenko suggests that researchers might investigate these drugs for use in Alzheimer's patients. —P.B.



BIOLOGY AHOY! Icebergs near Antarctica anchor thriving ecosystems, thanks to nutrients released by melting ice.

PHYSICS

Pas de deux for a three-scoop particle

Two experiments running simultaneously at the Fermi National Accelerator Laboratory in Batavia, Ill., have observed a new particle called the cascade baryon. It is one of the most massive examples yet of a baryon—a class of particles made of three quarks held together by the strong nuclear force—and the first to contain one quark from each of the three known families, or generations, of these elementary particles.

Protons and neutrons are made of up and down quarks, the two first-generation quarks. Strange and charm quarks constitute the second generation, while the top and bottom varieties make up the third. Physicists had long conjectured that a down quark could combine with a strange and a bottom quark to form the three-generation cascade baryon.

On June 13, the scientists running DZero, one of two detectors at Fermilab's Tevatron accelerator, announced that they had detected characteristic showers of particles from the decay of cascade baryons. The baryons formed in proton-antiproton collisions and lived no more than a trillionth of a second. A week later, physicists at CDF, the Tevatron's other detector, reported their own sighting of the baryon.

DZero spokesperson Dmitri Denisov says that measuring the lifetime and other properties of the cascade and other heavy baryons will help physicists refine their models of the strong nuclear force.

Recent improvements that have enabled the Tevatron to smash together protons and antiprotons in unprecedented numbers made possible the creation of the cascade baryon, he adds. —D.C.

BIOCHEMISTRY

Enzyme is target in parasite

The flatworm that causes the tropical disease schistosomiasis has a newly discovered Achilles' heel that drugmakers might be able to exploit.

The target is an enzyme called thioredoxin glutathione reductase (TGR). Biochemist David L. Williams of Illinois State University in Normal, and his colleagues identified the enzyme in the *Schistosoma mansoni* worm in earlier research.

To test TGR's importance to the parasites, the researchers grew larvae in the lab and inserted fragments of RNA that would stop the enzyme's production. The procedure killed the larvae, the researchers report in the June *PLoS Medicine*.

Next, the scientists tested two old schistosomiasis drugs—including an antimony-based compound—that are no longer prescribed because of their side effects. Both drugs neutralized TGR in lab-dish tests.

A third drug, a gold-based medication called auranofin, also neutralized the enzyme. In an additional test in mice infected with *S. mansoni*, auranofin killed nearly two-thirds of the worms.

The researchers are exploring other compounds that might attack TGR with the aim to find one that is "less toxic than antimony and less expensive than gold," Williams says.

S. mansoni lives in tropical waters and infects people through their skin. At present, the sole treatment for schistosomiasis is a drug called praziquantel, which proved to have no effect on TGR. —N.S.

BEHAVIOR

Oldest siblings show slight IQ advantage

For more than a century, researchers have argued about whether first-born children tend to surpass their later-born siblings in intelligence. A large study now indicates that eldest sons indeed score slightly higher on IQ tests than boys with older siblings do.

This IQ effect reflects how participants

were raised, not absolute birth order, say Petter Kristensen of the National Institute of Occupational Health and Tor Bjerkedal of the Norwegian Armed Forces Medical Services, both in Oslo. Later-born sons who became the eldest after an older sibling died in childhood displayed an IQ advantage comparable to that seen in firstborns.

Kristensen and Bjerkedal analyzed data from compulsory military examinations of 241,310 Norwegian men, ages 18 and 19, conducted from 1985 to 2004. The average IQ for all men, regardless of birth order, fell within the normal range. However, the average IQ for those who grew up as the eldest child—either as a first-born or because of older-sibling deaths—exceeded that of men with older siblings by 2.3 points, the researchers report in the June 22 *Science*.

Even that modest difference can substantially influence academic and professional achievement, argues Frank J. Sulloway of the University of California, Berkeley in an editorial published with the new study. —B.B.

PHYSICS

Smallest laser minds the gap

The smallest, most efficient laser yet, a nanoscale device that consumes just 1 microwatt of power, could one day be a component of faster computers.

Toshihiko Baba of Yokohama National University in Japan and his colleagues constructed the tiny laser out of a photonic crystal—a material with internal microstructure that controls the behavior of selected wavelengths of light. In nature, photonic crystals are responsible for the iridescent surfaces of some butterfly wings.

The team shone light from an ordinary laser onto a several-micron-wide slab of semiconductor material pierced with tiny, round holes in a hexagonal pattern. Scattering of light by the holes led to interference among the waves that made the normally translucent slab reflective.

However, the scientists introduced an irregularity by spacing just two holes farther apart than the regular pattern would dictate. This small change modified how light scattered off the slab and caused light of a single wavelength to bounce back and forth between the two displaced holes, which were just a half-micron apart. By effectively trapping light in a tiny space, the photonic material acted as a laser. The results appear in the June 11 *Optics Express*.

Baba says that high-precision fabrication

techniques enabled him and his colleagues to produce a nanolaser one-fifth the size of any that existed before. The smaller laser also operates at lower power and with higher efficiency.

Using tiny laser beams to transmit information between electronic chips could speed up computers with multiple processors, says Tomoyuki Yoshie of Duke University in Durham, N.C. —D.C.

BIOMEDICINE

Antibiotics in infancy tied to asthma

Children given multiple doses of antibiotics before their first birthdays have a heightened risk of asthma later, a study shows.

Researchers analyzed the medical records of 13,116 children born in Manitoba in 1995. Roughly 6 percent of the group developed asthma by age 7.

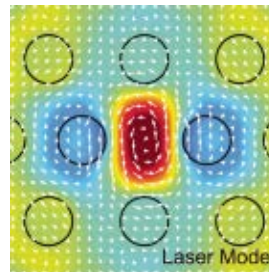
Kids getting more than four courses of antibiotics during the first year of life were 1.5 times as likely to develop asthma by age 7 as kids getting no such drugs, the researchers report in the June *Chest*.

In a further analysis, the scientists took into account the reasons for the prescriptions. "Respiratory-tract infections might be an early indication of asthma, sometimes associated with colds and wheezing," says study coauthor Anita L. Kozyrskyj, an epidemiologist at the University of Manitoba in Winnipeg. To isolate the effect of antibiotics, she and her team separately analyzed the smaller group of children that received the drugs for reasons other than respiratory and ear infections.

These infants received antibiotics mainly for skin and urinary-tract infections. But even among such infants who got only one or more courses of antibiotics, the asthma risk was nearly doubled by age 7 compared with that in kids not getting any drugs.

Because asthma is a chronic overreaction of the immune system, Kozyrskyj offers two possible explanations for the findings.

First, early exposure to toxins made by microbes might help an infant's immune system develop normally (*SN*: 8/26/00, p. 134; 8/14/99, p. 108), and antibiotics administered during the first year of life would reduce that exposure. Another possibility is that a child's intestines need to harbor friendly bacteria, or microflora, for that child to develop a sound immune system. "Taking antibiotics may suppress these good bacteria," Kozyrskyj says. —N.S.



HOLE STORY Light trapped between two holes in a semiconductor slab forms the heart of a new nanolaser.

Books

A selection of new and notable books of scientific interest

VACCINATED

PAUL A. OFFIT

Maurice Hilleman is relatively unknown, but he was responsible for 9 of the 14 vaccines routinely administered to children today, Offit writes. These vaccines have rendered once-devastating diseases such as mumps and rubella virtually impotent. Offit, a physician, profiles Hilleman and his life-saving work as a scientist for Merck Pharmaceuticals. The author also chronicles the history of vaccine research before and since Hilleman's work. Included are the tales of Edward Jenner, the first person to inoculate people with cowpox to fight smallpox; Louis Pasteur, the physician who first developed a vaccine from a human virus; and others. Offit explains how Hilleman made his first vaccines for mumps and measles, his attempt to make a vaccine for the common cold, and his work with collaborators at Merck to create interferon, which is now used to treat some cancers. Offit also addresses the current controversy regarding vaccines' possible connection to autism. Finally, the author offers thoughts on why Hilleman's life-saving achievements never made him famous. *Smithsonian Books, 2007, 254 p., b&w photos, hardcover, \$26.95.*

ATLANTIC COAST BEACHES: A Guide to Ripples, Dunes, and Other Natural Features of the Seashore

WILLIAM J. NEAL, ORRIN H. PILKEY, AND JOSEPH T. KELLEY

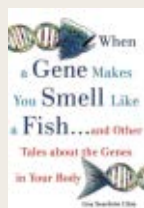
The beach offers more than a place to soak up sun and collect seashells, these three geologists write. They reveal less-recognized attributes of beaches from Maine to Florida. The authors detail the varieties of beaches—including barrier island shorelines, spits, and tombolos. The authors explain the anatomy of a beach and explain how a changing sea level and weather conditions can affect it over time. They explain various wave formations, types of sand, beach shapes, and features such as sand ripples and sea foam. Finally, they look at what past and present beach-preservation efforts are doing to the beaches of the Atlantic coast and suggest new ways to conserve beaches for future generations. *Mountain Press, 2007, 250 p., b&w photos, paperback, \$20.00.*

WHEN A GENE MAKES YOU SMELL LIKE A FISH ... and Other Tales about the Genes in Your Body

LISA SEACHRIST CHIU

Trimethylaminuria, otherwise known as fish-odor syndrome, is a devastating condition whose origin, until recently, remained unknown. Sufferers emit a foul smell that no degree of hygiene can remove. The disease's mystery was solved when scientists discovered that mutations in a gene known as *FMO3*

prevent the body from breaking down a smelly substance found in foods high in protein, writes journalist Chiu. She highlights other unique conditions with recently discovered genetic origins, such as a type



of cerebral palsy found disproportionately among the Amish and a condition that makes certain animals and people abnormally sensitive to the sun. Chiu focuses not only on odd genetic effects but also on the many less-dramatic traits attributable to genes, such as right- or left-handedness. In telling these stories, the author explains how genetic information controls human traits. *Oxford, 2007, 219 p., b&w illus., paperback, \$15.95.*

INCLUSION: The Politics of Difference in Medical Research

STEVEN EPSTEIN

Until the mid-1980s, few medical researchers paid heed to sexual and cultural differences when designing clinical trials. They based their investigations on a one-size-fits-all approach, assuming that an experimental treatment that worked for the adult white male would work equally well for anyone. Epstein, a professor of sociology, examines the political and scientific ramifications of inclusionary research practices in the United States. He outlines the notion of the "standard human" and describes how researchers historically have chosen their test subjects. He looks at the controversy surrounding reforms, including charges that acknowledging differences implies biological and social inferiority, and describes the possible impact of targeted research on the development of more-effective treatments for women and members of minority groups. *Univ. Chicago Press, 2007, 413 p., hardcover, \$29.00.*

UNKNOWN QUANTITY: A Real and Imaginary History of Algebra

JOHN DERBYSHIRE

For mathematicians, the invention of algebra made it possible to think symbolically. Author Derbyshire, a mathematician, traces the history of algebra and reveals how its early concepts led to later forms of abstract mathematic thought. Algebra has its roots in ancient Babylonia and Egypt and in the work of Diophantus, a Greek who became known as the father of algebra. The author recounts the contributions to algebra made by Muslim scholars as well as the identification of the general solution to cubic and quadratic equations during the Middle Ages and the Renaissance. The mid-17th century saw the development of Isaac Newton's theorem and the fundamental theorem of algebra. Finally, Derbyshire introduces famous 19th- and 20th-century mathematicians and the development of complex numbers, vector spaces, group theory, and topology. Although much of the information he presents is complex, the author includes math primers that help the nonmathematician with the more difficult concepts in the book. *Plume, 2007, 374 p., b&w plates, paperback, \$16.00.*

LETTERS

Hex sine?

The NASA researchers baffled by the hexagonal shape in Saturn's soupy atmosphere at its northern pole ("A hexagon on the ringed planet," *SN: 4/28/07, p. 269*) should read "As waters part, polygons appear" (*SN: 6/3/06, p. 348*). It is worth investigating whether there is a similar phenomenon—I still suspect some sort of standing sine wave effect—at work in both cases.

ELLERY FRAHM, MINNEAPOLIS, MINN.

Snore and more

I was surprised that the findings on the brain's processing of information and discerning of relationships would come as a surprise ("Sleep on It: Time delay plus slumber equals memory boost," *SN: 4/28/07, p. 260*). I have long been aware of, and have even come to count on, the fact that a surprising degree of insight and clarity often comes in the morning after having fallen asleep the night before wrestling with a complex mathematics or physics problem. I am certain that many, if not most, mathematicians, physicists, and others dealing with difficult problems are equally aware of this phenomenon.

WARREN F. DAVIS, NEWTON, MASS.

Oliver Sacks, in his book *Uncle Tungsten* (2001, Knopf), mentions that the arrangement of the elements in the periodic table came to Dmitri Mendeleev in a dream. Although I certainly do not consider myself in the same league with Mendeleev, I remember occasionally waking up in the wee hours of the morning with the solution to a computer-programming problem (not always correct) that had been bugging me.

BILL BORNSTEIN, MOUNT SINAI, N.Y.

Safety first

A concern I have for a new route algorithm ("Lost in transportation," *SN: 5/5/07, p. 285*) to replace algorithms that "may overlook shorter routes for the sake of following major highways" is exemplified by the fact that here in southern Oregon, every winter, people get lost and occasionally die taking the "shorter routes" as suggested by car-navigation systems or online trip plotters. I prefer to know first that the route is safe, second that it's shortest.

ED FISHER, CORVALLIS, ORE.

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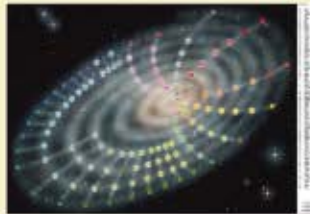
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Chemical Galaxy: A New Vision of the Periodic Table of the Elements



Chemical Galaxy poster is a unique creation in the world of periodic table charts. Developed by Philip Stewart, Oxford University, this table was created in a spiral design. It uses a starry pathway to link the elements and to express the astronomical reach of chemistry. Comes with a two-sided information sheet. Size: 26" H X 38" W Laminated, Order #JPT-2221, Cost \$28.95

The Periodic Table of the Elements - Poster



The Periodic Table of the Elements - Poster

This periodic table poster has the regular information, a picture of Dimitri Mendeleev and a legend denoting atomic number, electron configuration, atomic weight, atomic symbol and whether the element is radioactive or not. This poster has the typical color designations according to alkali metals, alkaline earth metals, transition metals, etc. A well-designed graph on the bottom portion shows when the element was discovered and the percentage of certain types of elements found in the atmosphere, biosphere, hydrosphere, and lithosphere. Size: 26.5" X 38.5", Laminated Order#JPT-3103, Cost: \$15.95; 2 for \$30, Order #JPT-3103-2



Global Warming - Poster

This interesting global warming poster illustrates the consequences of global warming, heat waves, and periods of unusually warm weather. It depicts the emerging knowledge from all parts of the world. Size: 36" X 24", laminated; Order #JPT-warming, Cost: \$16.95

Famous Scientists - Poster



Famous Scientists Poster - 54 of some of the world's premier scientists are shown in photographs on this 24" W X 36" L laminated poster. The poster lists their name under each picture as well as their nationality, life span and field of study. A time line at the bottom of the poster shows the seven sciences with their major branches. Order #JPT-2000, Cost: \$15.95, 2 for \$30, order #JPT-2017-2

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Deluxe Dinosaur Panorama Poster



The Deluxe Dinosaur Panorama poster - A colossal wall poster that embodies the elegance and power of dinosaurs. Painted by Haruo Takino. Size: 64.375" L X 22.75" H and comes laminated. Order #JPT-dinopan cost: \$38.00



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Puzzle size: 39" W X 14" H
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#JPT-1000 Cost \$21.95,
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World Minerals, Rocks, and Gems Collection

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The Atom - Poster

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