# SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

OCTOBER 18, 2003 PAGES 241-256 VOL. 164, NO. 16


wagering beyond wall street

extinct albatross clue

large cholesterol for health

casino's mental payoff

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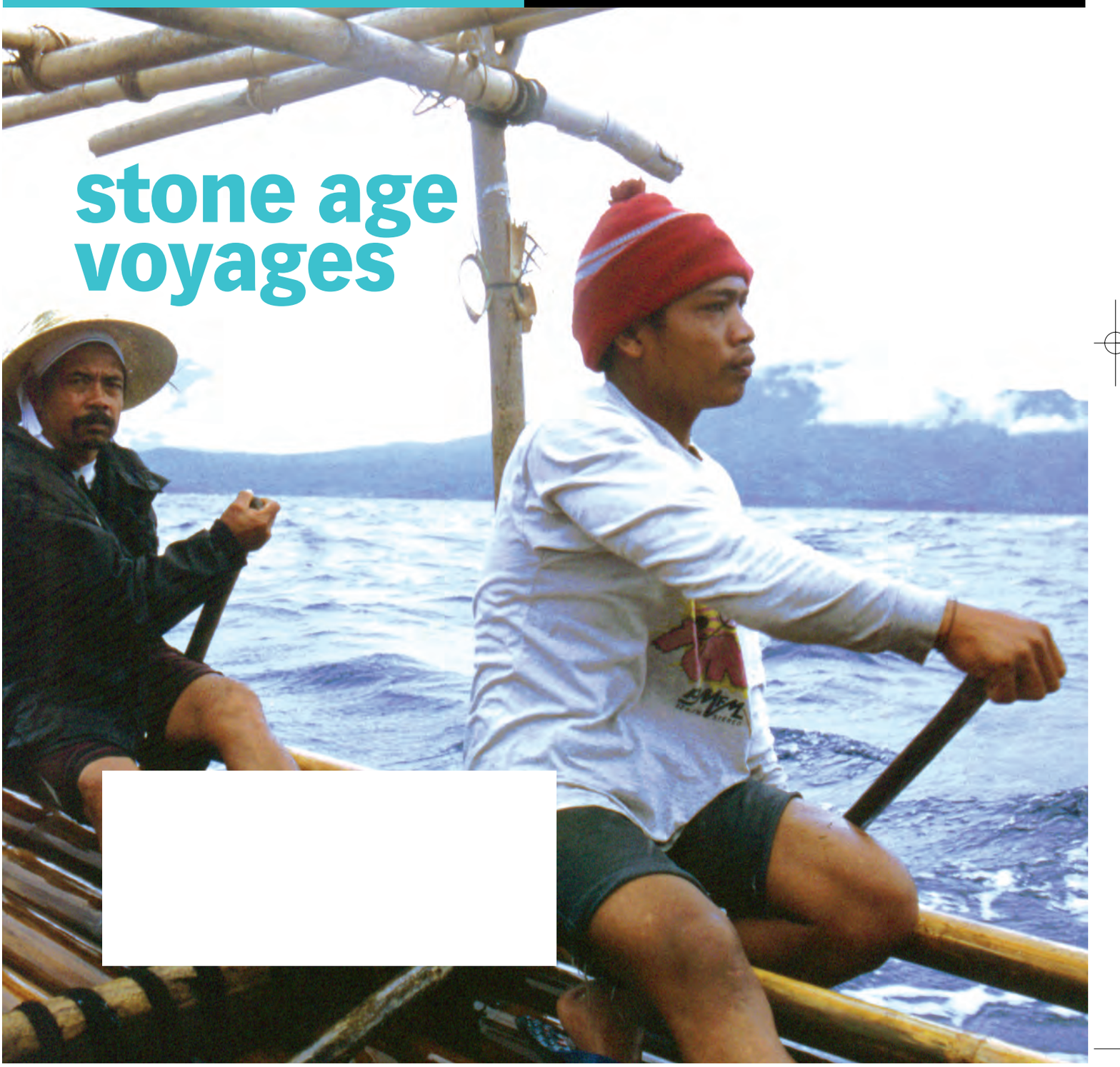

## stone age voyages

THE WEEKLY NEWSMAGAZINE OF SCIENCE

# SCIENCE NEWS

OCTOBER 18, 2003 VOL. 164, NO. 16


## Features



## This Week



## Of Note



## Departments



**Cover** It's tough and sometimes dangerous work to paddle a handmade bamboo raft across the open sea from Bali to the adjacent Indonesian island of Lombok. But such ventures may offer insights into the nautical skills of human ancestors who lived more than 800,000 years ago.
(R.G. Bednarik) Page 248



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# Centenarian Advantage

## Some old folks make cholesterol in big way

**Healthy living undoubtedly plays a role in** longevity. But studies have shown that siblings of centenarians are 8 to 17 times as likely as the average person to see 100. That link suggests that a potent benefit runs in the family's genes.

Researchers now offer an explanation for a portion of this hereditary good fortune. In the Oct. 15 *Journal of the American Medical Association*, physician Nir Barzilai of the Albert Einstein College of Medicine in New York and his colleagues report that Jewish near-centenarians and their offspring are more likely than other people to have large cholesterol particles in their blood, a condition conducive to good health. What's more, the old people and their children are more likely than others to carry a variant form of a gene called *CETP*. This gene encodes the cholestryl ester tranferase protein (CETP), which plays a role in the formation and movement of cholesterol particles in the body.

The researchers enlisted Jews of eastern European descent because the group has a history of longevity and its members tend to marry within the population, creating a genetically homogeneous group.

For the cholesterol investigation, Barzilai's team obtained blood samples from 213 Jewish men and women, average age 98, all of whom had been living independently at age 95. Half were centenarians, and ages ranged from 95 to 107. The researchers also got blood samples from 216 of the group's offspring. For comparison purposes, the scientists obtained blood from 258 other Jews, some of whom were spouses of the offspring. Also, the researchers had blood samples from 589 white, unrelated, non-Jewish people. The average ages in the offspring and comparison groups ranged from 68 to 70 years.

Doctors currently measure blood concentrations of two forms of cholesterol, high-density and low-density lipoprotein (HDL and LDL), to assess risk of heart disease. In the new study, the very old people and their offspring were significantly more likely to have large versions of both HDL and LDL than were people in either control group. The size correlation was independent of the concentrations of HDL and LDL.

Scientists theorize that small LDL particles penetrate vessel walls more easily than large particles do. This heightens the risk of atherosclerotic plaques, Barzilai says.

In Barzilai's recent work, genetic tests revealed that the very old participants and their offspring were three times as likely as the Jewish control group to have a specific variation in their *CETP* gene. Members of the non-Jewish control group weren't tested for this variation.

When the researchers considered the health of members of the offspring and spousal groups, they found that those who showed high blood pressure and heart problems were less likely to have large cholesterol-particles than their healthier counterparts were.

"These findings are striking," says David B. Finkelstein, a molecular biologist at the National Institute on Aging in Bethesda, Md. The work strongly suggests that cholesterol-particle size correlates with health risk, he says. "If I were a drug company reading this, I'd want to [find agents that] modify particle size," he says.

Indeed, the drug company Pfizer, based in New York, is currently testing a CETP inhibitor as a promoter of heart health.

Finkelstein points out that there could be other variant forms of *CETP*—or of other genes—that influence the size of cholesterol particles.

Also, Barzilai notes, genetic variations that appear to impart benefits to a Jewish population might not occur in other ethnic groups. —N. SEPPA

# Your Spiral or Mine?

## Snail gene reverses coil, makes new species

**A snail with a shell spiraling to the right** can't mate readily with a lefty. So, changes in the single gene that controls shell direction have created new snail species, say researchers.

Among the 20 species of *Euhadra* snails, an abundant Japanese genus, the shell-spiraling direction has changed from left to right at least three times, forming new species in each case, according to Rei Ueshima of the University of Tokyo. That conclusion comes from analysis of a family tree based on the snails' DNA, say Ueshima and Takahiro Asami of Shinshu University in Matsumoto, Japan. In the Oct. 16 *Nature*, the two scientists describe a case in which different forms of a single gene have driven the formation of species. Asami says this marks the first reported example of single-gene speciation.

The notion that coil reversal in snail shells could have such a dramatic effect has intrigued theorists for some 15 years, comments Menno Schilthuizen of the University of Malaysia Sabah in Kota Kinabalu. "We've seen quite a bit of work, ranging from creative speculation to computer simulation, showing that in theory it's possible," he says. "Ueshima and Asami have done the field of snail speciation a great favor."

UESHIMA; ASAMI

**MATE BARRIERS** **One gene determines which way these three *Euhadra* species coil (top). The lefty is *E. quaesita* (left) and the two righties are *E. aomoriensis* (middle) and *E. senckenbergiana* (right). Matched coils let *E. congenita* mate easily (bottom left), but a mismatch in *Bradybaena similaris* (bottom right) keeps the genitals apart (arrows).**

For most species of snails, shells and body plans curl in only one direction. The *Nature* article presents photos that illustrate the reason for that uniformity: A rare lefty in a right-spiraling species closely related to *Euhadra* writhes heroically but fails to mate with a partner with the majority spiral.

Single-gene speciation doesn't, in theory, take place among just any group of snails, Asami says. Although researchers have shown that for the three other snail groups tested so far, a single gene determines spiral direction, those groups' righties can mate with lefties.

When the Japanese researchers analyzed a DNA family tree of *Euhadra*, however, they found a single lineage that gave rise to three right-shelled and four left-shelled species. The tree indicated that the common ancestor of the seven species was left shelled.

In a particularly dramatic example, the

genome of the lefty *Euhadra quaesita* is almost identical to that of the righty *Euhadra aomoriensis*, the researchers report. However, close examination of the snails reveals subtle morphological differences in shell characteristics.

Ueshima and Asami suggest that because the right-coiling gene is dominant, a speciation shift from a left-coiling *E. quaesita* ancestor to the right-coiling *E. aomoriensis* might have happened multiple times in this lineage. This contrasts with other known animal speciations, in which the emergence of the new species occurs only once. —S. MILIUS

# Fossils of Flyers

## Bones tell why Atlantic albatross disappeared

**OCEANS APART** Albatross still breed on Pacific islands and in Antarctica, but there's evidence that the Laysan albatross colonized Atlantic sites up to 5 million years ago, and short-tailed albatross (inset), as recently as 400,000 years ago.

T. BODEEN, US FISH AND WILDLIFE SERVICE; H. HASEGAWA, TOHO UNIV.

**Two years ago, scientists described 5-mil**lion-year-old albatross fossils representing five different species. The fossils, found in North Carolina, raised a question: If albatross once soared above the Atlantic Ocean, why do they now nest only in scattered locations around Antarctica and the northern Pacific?

New fossil data unearthed in Bermuda indicate that the North Atlantic population of short-tailed albatross died off around 400,000 years ago, when an era of global warming caused the oceans to rise, says Storrs L. Olson of the Smithsonian Institution in Washington, D.C.

The fossilized albatross eggs and skeletons, first identified in 1981, represent the only known breeding colony of the birds in the North Atlantic, he notes. Olson and Paul J. Hearty of James Cook University in Townsville, Australia, present their findings in an upcoming *Proceedings of the National Academy of Science*s.

"Albatross fossils are pretty rare," comments Steven Emslie of the University of North Carolina at Wilmington. "To find a whole colony preserved like this is incredible."

The fossils formed when a storm sealed off the remains of the colony, Olson and Hearty say. By examining the rocky strata around the fossils, they dated them to the middle of the Pleistocene epoch, almost a half-million years ago.

"The last evidence we had [for Atlantic albatross] was 5 million years ago, and here they are breeding away with eggs and everything only 400,000 years ago," says Olson.

The age of the fossils correlates with one of the warmest periods of the past million years, when ice sheets in Greenland and Antarctica melted and raised the sea level at least 20 meters, the scientists observed.

At that point, says Olson, there would have been very little land left on Bermuda. Moreover, in the high waters, coral reefs no longer could protect the islands and their birds' nests from storms and rough seas.

This was a bad turn of events for albatross, which are notoriously picky about real estate. They roost only on islands that are windy enough for their gliding takeoffs and landings yet are free of mammals that would prey on them and of dense vegetation that could hinder their large wings.

In the Atlantic, where such venues were few, albatross died off, Olson suggests. In the Pacific Ocean, however, there were plenty of suitable islands with higher elevations that would not have been swamped in rising seas.

Although different species can share breeding colonies, fossils of only short-tailed albatross were unearthed at the Bermuda site. This implies that when Bermuda flooded, the other species identified in North Carolina had already disappeared from the Atlantic.

The dating of the Bermuda fossils expands scientists' perspective on short-tailed albatross, "suggesting that the distribution and perhaps total abundance of this species were much broader than previously thought," says seabird ecologist Julia Parrish of the University of Washington in Seattle.

Some short-tailed albatross still nest in Japan, but feather collectors in the early 1900s so decimated the birds' numbers that the species remains endangered today. —K. RAMSAYER

# Poor Relations

## Casino windfall reveals poverty's toll on Cherokee kids' behavior

**In a cruel double whammy, poor people** endure material deprivation while experiencing more than their share of mental disorders. Some scientists theorize that this disproportion of mental illness stems from individuals with genetically based psychological ailments drifting into poverty and staying there. Other researchers suspect that the stress of financial hardship undermines emotional health.

An unusual new study boosts the latter view. During the 4 years after their families moved out of poverty thanks to a community-wide economic windfall, Cherokee children in rural North Carolina

exhibited marked declines in behaviors such as delinquency, violence, disobedience, and truancy, according to epidemiologist E. Jane Costello of Duke University Medical School in Durham, N.C., and her coworkers. Mental-health clinicians typically diagnose kids with these problems as having either conduct disorder or oppositional defiant disorder, a penchant to defy authority.

"In families that moved out of poverty, parents were better able to supervise their children, apparently leading to fewer behavioral symptoms," Costello says. "Poverty or any other single factor can't fully explain the development of such symptoms."

The North Carolina study, published in the Oct. 15 *Journal of the American Medical Association*, came about through scientific serendipity. In 1993, Costello's team had begun administering annual psychiatric interviews to 1,420 rural children, ages 9 to 13. About one-quarter of the kids were Cherokees residing on a federal reservation. Most of the rest were white and lived in surrounding areas.

Halfway through the 8-year project, a gambling casino that had opened on the reservation started sharing profits with tribal members. Annual payments to each person reached around $6,000 in 2001.

By the end of the study, casino disbursements had moved 14 percent of the Cherokee families out of poverty. Another 53 percent remained poor, while 32 percent had never been poor.

Before the casino payments began, children in poor families displayed substantially more behavioral problems than did kids in families with incomes above the poverty line. After the payments started, behavioral problems among children in formerly poor families—but not among kids in still-poor families—declined to the level of those in never-poor Cherokee families. Interviews indicated that after moving out of poverty, parents supervised their children's activities more closely.

The windfalls didn't affect kids' anxiety and depression.

Similar findings emerged for the study's white families that, without the benefit of the casino payments, had also moved out of poverty during the same period. In those cases, the researchers note, it's possible that the added income and improved behavior in children reflected parental characteristics such as ambition and ingenuity.

Costello's data document how the relief of poverty helps improve family functioning and children's mental health, remarks psychiatrist Michael Rutter of the Institute of Psychiatry in London in an editorial accompanying the new report.

Ongoing studies of children in foster care who receive subsidies for education and of kids whose parents enter welfare-to-work programs support Costello's findings, adds epidemiologist Ronald C. Kessler of Harvard Medical School in Boston.

Still, many social forces encourage aggression and delinquency among children, Rutter says. In Western nations, he notes, childhood-behavior problems and family incomes have increased simultaneously. —B. BOWER

# New Quarktet

## Subatomic oddity hints at pentaparticle family

**Physicists at a European particle accelerator** say they've spotted a never-before-seen elementary particle composed of five of the fundamental constituents known as quarks and antiquarks. In contrast, protons and neutrons contain three quarks, and no particle is known to have four quarks. The new report marks only the second sighting ever of a five-quark particle, the first one having been found last summer by three independent groups working in the United States, Japan, and Russia (*SN: 7/5/03, p. 3*).

**QUOTE**

**"Having discovered another member of this exotic family is very reassuring."**
*MAREK KARLINER*
*Tel Aviv University*

The detection of this second so-called pentaquark bolsters the theoretical hunch that a family of five-quark particles exists, says Gunther M. Roland of the Massachusetts Institute of Technology (MIT), a member of the team that spotted the newest particle. Physicists expect others in the new particle family, like these initial two members, to consist of four quarks and one antiquark.

"This is really the beginning of a new era," Roland says. "I think this will lead to a big program to find further [pentaquarks] and to understand their properties in detail."

"It's all very exciting," says theorist Harry J. Lipkin of the Weizmann Institute in Rehovot, Israel, who is not associated with the team making the claim.

Evidence for about 40 of the new particles turned up in an analysis of millions of proton-proton collisions from 2000 and 2001 at the Super Proton Synchrotron accelerator at the European Organization for Nuclear Research (CERN) near Geneva. The experiment has yet to be replicated.

On Oct. 8, the CERN team posted a report about the new pentaquark on ArXiv, an Internet site where many physics results appear initially (*www.arXiv.org/abs/hep-ex/0310014*).

The discovery of a new family of quark-containing particles may help physicists fill in blanks in their understanding of quark interactions, says theorist Frank Wilczek of MIT. For one thing, it could end what had been a puzzling absence of evidence for particles with groupings containing more than three quarks or antiquarks, which theorists for decades have been expecting to show up in accelerators.

Larger groupings of quarks and antiquarks may have existed in the early universe and may persist today in extremely dense stars, says theorist Marek Karliner of Tel Aviv University. Like recently discovered extrasolar planets that reveal new planetary configurations to astronomers (*SN: 3/15/03, p. 164*), pentaquarks are alerting physicists to possible new subatomic arrangements, he adds.

Some theorists, including Karliner, Lipkin, and Wilczek, propose that pentaquarks may involve two-quark subgroups known as diquarks. These are quark-quark or antiquark-antiquark pairs that have seemed to play only bit roles in quark interactions, Wilczek says. Others theorize that the new findings rule out such arrangements.

"Do not believe any theoretical model at this stage," says Lipkin.

What's most important about the CERN evidence for now, says Karliner, is that it puts to rest gnawing doubts about the initial pentaquark sighting last summer.

"There were slight discrepancies between the experiments [that identified the first pentaquark], and people were worried that something was wrong," Karliner recalls. "Having discovered another member of this exotic family is very reassuring." —P. WEISS

# A Shot at Pain Prevention

## Nerve-healing protein relieves rats' misery

**A chemical that spurs growth of nerve cells** during fetal development may provide a new way to treat severe chronic pain that results from nerve damage, according to a study of rodents.

"Is this a promising candidate for a drug? The answer is, absolutely yes," says Frank Porreca of the University of Arizona Health Sciences Center in Tucson. "It works in multiple models of neuropathic pain."

Neuropathic pain was recognized during the Civil War. From that conflict, physicians for the first time encountered large numbers of patients with bullet wounds that elicited intense, ongoing pain despite seemingly minor tissue damage. The 19th-century neurologist S. Weir Mitchell documented many cases in which pain per-

sisted for years and where even a slight breeze could trigger a severe burning sensation on a patient's skin.

Physicians now know that neuropathic pain derives from nerve damage that never heals properly. The nerves, injured by trauma, diabetes, stroke, or one of many other insults, send pain signals to the brain. The signals may be constant or may occur whenever surrounding tissue is perturbed.

"These neuropathic pains are often very extreme, they're often very long-lasting, and they're often refractory to conventional analgesics, including opiates," such as morphine, says Stephen McMahon of King's College London.

Newer drugs, such as the antiseizure agent gabapentin, sometimes provide modest pain relief but only by dulling the entire nervous system, essentially sedating the patient.

In the past few years, researchers have investigated another treatment strategy: fixing the injured nerves rather than stifling the pain signals. In 2000, McMahon and his colleagues reported promising results after giving rodents a protein called glial-derived neurotrophic factor (GDNF). It and similar chemicals support the growth of the developing nervous system and promote the survival of damaged nerve cells in adult animals. "The [chemicals] are kind of a chicken soup that keeps neurons happy," says McMahon.

**QUOTE**

**"Is this a promising candidate for a drug? The answer is, absolutely yes."**
*FRANK PORRECA University of Arizona Health Sciences Center*

In an upcoming *Nature Medicine*, Porreca and his coauthors report that artemin, a relative of GDNF, also shows promise for treating neuropathic pain. They tested the protein on rats with spinal-nerve damage that makes the animals hypersensitive to touch and heat. In this model of neuropathic pain, periodic injections of artemin largely reversed the animals' hypersensitivity, the researchers found. The protein has also shown similar promise against other forms of neuropathic pain, Porreca says.

The changes in nerve cell shape and biochemistry that underlie neuropathic pain unfold in well-understood ways. "One of [artemin's] characteristics is to reverse a lot of the changes that occur in the nervous system," Porreca says.

Artemin interacts with cell-surface proteins that are found only on sensory nerves, so it may have fewer side effects than do conventional pain medications or even GDNF, Porreca suggests. For the recent experiments, he worked with Biogen, a biotech firm in Cambridge, Mass., which controls the patent rights to artemin and is considering whether to continue developing it into a drug. Most drug companies shy away from protein-based drugs because they have to be injected, McMahon notes. So far, he adds, investigators have had little luck finding smaller molecular mimics of GDNF and artemin that could be taken as oral drugs. —J. TRAVIS

# Nobel Prize in Chemistry Opens Channels

## Research reveals vital function of tiny pores in cell membranes

The 2003 Nobel Prize in Chemistry, awarded Oct. 8, honors two researchers whose pioneering work on channels in cell membranes has elucidated how ions and water molecules get in and out of cells. Such protein-based channels or pores underlie much of physiology, from the firing of nerve cells in the brain to the regulation of water by the kidneys.

Half of the $1.3-million prize goes to Roderick MacKinnon, a Howard Hughes Medical Institute investigator at Rockefeller University in New York. In 1998, MacKinnon became the first scientist to determine the three-dimensional structure of an ion channel. Receiving the other half of the prize is Peter Agre of the Johns Hopkins University Medical Institutions. Agre was named for his discovery in the early 1990s of water channels called aquaporins.

"Everybody in this field who works on channels is elated about this award," says biochemist Christopher Miller of Brandeis University in Waltham, Mass.

Ion channels act like valves that regulate the flow of ions, such as potassium and sodium, across a cell's membrane. Defects in ion channels can result in myriad disorders, such as heart arrhythmia and cystic fibrosis.

Says Kenton Swartz of the National Institute of Neurological Disorders and Stroke in Bethesda, Md., "As we begin to learn how these molecular machines work, we'll be in a better position to design drugs that have very specific kinds of actions that might target one type of channel but not another."

MacKinnon originally set out to discern the molecular structure of ion channels. He was undeterred by numerous failed attempts by other researchers to coax membrane-based proteins into ordered crystals. MacKinnon and his colleagues overcame that obstacle, creating crystals of a bacterium's potassium-channel protein. The researchers then used X-ray crystallography to generate the first high-resolution images of the channel's structure. These data, in turn, enabled the researchers to explain how 100 million potassium ions per second can cross a cell membrane while sodium and other ions are essentially barred (*SN: 3/9/02, p. 152*).


MacKinnon later identified the structure of a channel that regulates the flow of chlorine ions. More recently, he uncovered the mechanism by which an ion channel opens and closes in response to a voltage across the membrane.

Agre's discovery of the long-sought water-regulating channel was equally groundbreaking, says Miller. Aquaporins are critical for getting water into and out of cells. In the kidney, for instance, aquaporins are constantly pumping water from the organ's many urine ducts back into cells, preventing dehydration. This process explains how the human body can generate 45 gallons of dilute urinary fluid daily and yet excrete only about one quart of urine.

Agre discovered the first aquaporin while searching for a protein on the surface of red blood cells that triggers immune responses. Instead, he found a mysterious, smaller protein. Agre and his colleagues isolated the protein and inserted the corresponding gene into frogs' eggs. Immersed in distilled water, the eggs swelled and exploded, indicating that the protein controls the cellular flow of water.

Agre and others have since identified the structure of the water channel. Agre has also shown that defects in the genes encoding aquaporins cause many kidney disorders, as well as cataracts. —A. GOHO

# ERECTUS AHOY

## Prehistoric seafaring floats into view

BY BRUCE BOWER

As the sun edged above the horizon on Jan. 31, 2000, a dozen men boarded a bamboo raft off the east coast of the Indonesian island of Bali. Each gripped a wooden paddle and, in unison, deftly stroked the nearly 40-foot-long craft into the open sea. Their destination: the Stone Age, by way of a roughly 18-mile crossing to the neighboring island of Lombok. Project director Robert G. Bednarik, one of the assembled paddlers, knew that a challenging trip lay ahead, even discounting any time travel. Local fishing crews had told him of the Lombok Strait's fiendishly shifting currents, vicious whirlpools, and unexpected waves far from shore. No matter—Bednarik knew of no other way to demonstrate that *Homo erectus*, humanity's evolutionary precursor and perhaps a direct ancestor of *Homo sapiens*, was the world's first seafarer.

Such a possibility falls far outside mainstream ideas about the origins of sea travel. Many researchers theorize that Southeast Asian *H. sapiens* built and navigated the first sea vessels between 60,000 and 40,000 years ago, ultimately piloting them to the open spaces of Australia. However, archaeologists have found precious few remains of prehistoric rafts and boats. The oldest such finds, including wooden canoes and paddles, come from northern Europe and date to at most 9,000 years ago.

Nonetheless, Bednarik says, it's apparent that *H. erectus*—which may have survived in Java until 30,000 years ago—launched the first age of ocean journeys between 900,000 and 800,000 years ago. On Flores, an island separated from Bali by ocean waters and the islands of Lombok and Sumbawa, other scientists have dated stone tools at more than 800,000 years old (*SN: 3/14/98, p. 164*). Although a land bridge connected Bali to mainland Asia at that time, it's unlikely such walkways existed between the other islands, in Bednarik's view.

If hardy teams of *H. erectus* reached Flores by sea, their mode of transportation remains unknown. Some scientists suspect that small numbers of Stone Age folk accidentally drifted as far as Flores after climbing onto thick mats of vegetation that sometimes form near the Southeast Asian coast.

That speculation doesn't float, contends Bednarik. Only a craft propelled by its occupants could negotiate the treacherous straits separating one Indonesian island from the next. To back up that claim, he launched a project in 1996 to determine what Stone Age groups would have had to do, at a minimum, to reach Flores and its neighboring islands. A lot of hard work, a handful of sea excursions, and a few close calls later, he and his comrades thrust their newest and most improved bamboo raft, dubbed Nale Tasih 4, into the Lombok Strait.

Nearly 12 hours later, after covering a distance of 30 miles, they completed their journey—just barely.

Through it all, Nale Tasih 4 held up well. Bednarik and a team of Indonesian boat makers and craftsmen built the raft out of natural materials, using sharpened stone tools comparable to those wielded by *H. erectus*. Despite the simplicity of such implements, prehistoric island colonizers must have possessed a broad range of knowledge and skills to assemble rafts on a par with Nale Tasih 4, Bednarik holds.

Ancient seafaring, he adds, coincided with other cultural advances usually attributed by scientists to *H. sapiens*, such as communicating with a spoken language and creating the carved and painted symbols that we now call art.

"A quantum leap in cognition and technology occurred around 900,000 years ago," Bednarik says. "All the traits that fundamentally define modern humans were first developed by *Homo erectus*."

**CANE CROSSING —** Craftsman Abdeslam El Kasmi and scientist Robert Bednarik assemble part of a cane raft on the Moroccan coast of the Strait of Gibraltar.

BEDNARIK

**ISLAND HOPPING** The millennial voyage of Nale Tasih 4 started out swimmingly. After a couple of hours, the vessel reached deep sea, where it floated two-thirds of a mile above the ocean floor. A stubborn current began to muscle against the raft as 5-foot waves peeled off choppy waters.

Furious paddling produced little headway as the current's strength increased. Around noon, an exhausted Balinese paddler collapsed. Responding to a call radioed by Bednarik, a support ship picked up the man and dropped off a replacement.

The going stayed rough throughout the afternoon. Crewmembers couldn't keep the raft from drifting northward in the unrelenting current. Several of them fought off light-headedness brought on by fatigue. It looked as if the crossing might fail.

Then, the wind shifted and the sea calmed. A course correction and final push by the bedraggled paddlers brought Nale Tasih 4 to one of the Gillies Islands, just off Lombok's west coast, shortly after 6 p.m.

Bednarik cherishes such skin-of-the-teeth crossings. As director of the International Institute of Replicative Archaeology in South Caulfield, Australia, he is working to establish the minimum conditions necessary for *H. erectus* to have hopped from one

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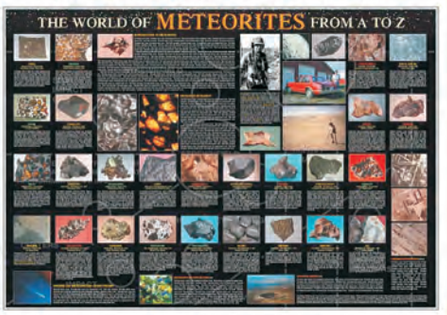
## World of Meteorites: A to Z - Poster




### World of Meteorites: A to Z - Poster

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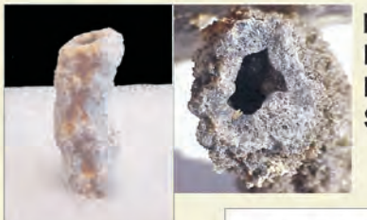

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island to another. Ancient vessels may not have looked like Nale Tasih 4, but they had to have been technological marvels for their time, if the Lombok Strait crossing is any guide.

Bednarik's technological explorations began in August 1997, when he directed 7 months of work on Nale Tasih 1, a 70-foot-long, 15-ton bamboo raft. It included two sails of woven palm leaves rigged on A-frame masts.

Bednarik hoped to sail the craft from the Indonesian island of Timor to Australia, recreating the crossing that presumably occurred as many as 60,000 years ago. However, sea trials indicated that the raft was too heavy to maneuver across the Timor Sea.

That experience resulted in Nale Tasih 2, a 58-foot-long, 2.8-ton bamboo raft rigged with a single palm-leaf sail. In December 1998, a crew guided this vessel from Timor to Australia, taking 13 days to travel nearly 600 miles. Two hollow mangrove tree trunks held fresh water for the travelers. Meals consisted of fish caught with bone harpoons and cooked over a small hearth, as well as rations of palm sugar and fruit.

The trip was no picnic, though. At times, Nale Tasih 2 braved tropical storms that whipped up 16-foot waves. The craft suffered extensive damage during these tempests, including a smashed rudder and a shredded sail. The five-man crew used stone tools to repair the damage at sea.

That mission accomplished, Bednarik turned to a simpler, oar-driven crossing from Bali to Flores that he contends happened as many as 750,000 years before the original Timor-to-Australia voyage. In March 1999, six oarsmen directed Nale Tasih 3 eastward from Bali into the Lombok Strait. The expedition was cut short after 6 hours of rowing, when the crew realized that currents had pulled them too far north to reach Lombok's west coast.

**SEA FARE —** During a crossing of the Timor Sea to Australia on a bamboo raft, a crew member cooks a tuna he has just harpooned.

BEDNARIK

That set the stage for Nale Tasih 4's grueling demonstration of how *H. erectus* could have conquered a short but taxing stretch of ocean.

Our Stone Age ancestors were certainly smart enough to have traversed a nautical obstacle course such as the Lombok Strait, Bednarik contended in the April *Cambridge Archaeological Journal*. Findings by researchers working in Asia and Africa suggest that rock art, decorative beads, engraved stones, and hunting spears all originated at least several hundred thousand years before the appearance of *H. sapiens*. Such accomplishments would require that individuals speak to one another and assign abstract meanings to various objects and symbols, in Bednarik's opinion.

He suspects that genetic and cultural evolution played out slowly among human ancestors over the past 2 million years. Groups that moved across Africa and Asia interbred to some extent and passed cultural innovations back and forth. In this continental melting pot, a hazy biological boundary separated *H. erectus* from *H. sapiens*. About 1 million years ago, Stone Age Asians probably congregated near coasts, and their fishing rafts were eventually adapted for sea travel. Remains of these shore inhabitants would have since become submerged and so are unavailable to archaeologists.

In contrast, many scientists maintain that *H. sapiens* alone developed language and symbolic thought, after having evolved in Africa between 200,000 and 150,000 years ago (*SN: 6/14/03, p. 371*). Interbreeding and cultural exchanges played no role in modern humanity's rise, this camp argues.

**MAKING WAVES** Bednarik has no qualms about paddling against the academic mainstream. Over the past 30 years, he's become a self-taught authority on Stone Age rock art. He's written hundreds of scientific articles and now edits three journals, all without having attended a university or earned an academic degree.

His equally unconventional raft project, reminiscent of Thor Heyerdahl's 1947 voyage from Peru to Polynesia on a balsa raft, has its supporters.

"Maybe Bednarik is right," remarks archaeologist Michael J. Morwood of the University of New England in Armidale, Australia. Morwood directs ongoing excavations on Flores.

Only watercraft navigators and especially hardy, swimming creatures reached the island in the thick of the Stone Age, Morwood says. Dating of stone-tool-bearing sediment indicates that *H. erectus* occupied the island 840,000 years ago, in his view. At that time, fossil discoveries show that rodents and now-extinct elephants also lived there. Modern versions of these animals are renowned as long-distance swimmers.

"[Stone Age] seafaring appears to have been possible," says anthropologist Tim Bromage of Hunter College, City University of New York. Southeast Asian bamboo that grows in stalks as thick as 12 inches across provides a versatile material for building rafts with the aid of simple stone tools, he notes.

While *H. erectus* possessed enough smarts to construct rafts and navigate them to nearby islands, Bednarik errs in assuming that the ancient species gradually evolved into modern humanity, maintains anthropologist Russell L. Ciochon of the University of Iowa in Iowa City. Instead, *H. erectus* evolved in Asia and died out there, while today's people originated in Africa around 200,000 years ago, Ciochon says.

Some scientists, however, don't think any part of Bednarik's theory holds water. Stone Age folk 800,000 years ago didn't make long-range plans, talk to one another, or form cultural groups, so they couldn't have organized efforts to build rafts and row to islands, contends archaeologist Iain Davidson of the University of New England in Australia.

For instance, the singular, unchanging appearance of stone tools from disparate regions throughout most of the Stone Age betrays an absence of cultural traditions in making and using such vital implements, Davidson says. Moreover, there's virtually no evidence of our 800,000-year-old ancestors having practiced group efforts of any kind, he adds. A small number of *H. erectus* individuals may accidentally have reached Flores, perhaps by floating on mats of vegetation, in Davidson's opinion.

"It seems premature to rule out the use of natural rafts of vegetation in colonization [of Flores]," remarks archaeologist Matthew Spriggs of Australian National University in Canberra. "May [Bednarik's] experiments continue."

The next phase of Bednarik's rafting experiments has moved to Europe. Proposals that *H. erectus* intentionally traveled to Mediterranean islands and entered Europe from Africa via the Strait of Gibraltar have attracted considerable controversy (*SN: 1/4/97, p. 12*).

Bednarik is now directing the construction of rafts made out of cane that grows near the Mediterranean Sea. His team will attempt crossings from the coasts of Greece and Italy to the island of Sardinia, as well as across the Strait of Gibraltar, a channel of water at the Mediterranean's mouth that separates Europe from Africa.

For now, academic squabbling worries Bednarik far less than the challenge of navigating a raft through the Strait of Gibraltar's strenuous currents. "Armchair archaeologists, who think that sea crossings are a piece of cake, really ought to try doing this on drifting vegetation," he says. ■

# BEST GUESS

## Economists explore betting markets as prediction tools

BY ERICA KLARREICH

During a highly charged week in Washington, D.C., last July, a research project sponsored by the Department of Defense sparked a furious outcry from prominent politicians and was then hastily axed by the Pentagon. The project, known as the Policy Analysis Market (PAM), was to have been a market in which participants could wager on Middle East events, say, the gross domestic product of Syria in coming years or the political instability of Iran. The project's developers, however, had made a public relations faux pas. On their Web site, they invited participants to suggest additional topics for markets and speculated that those suggestions might include terrorist attacks and political assassinations. Critics labeled the project a "terrorism futures market" and denounced it as morally repugnant and grotesque.

Within the week, John Poindexter, the official heading the office sponsoring the project, had announced his resignation, and the department had cut off funds not just for the PAM project, but also for all of its research into markets as prediction tools.

On the face of it, having people bet on disasters sounds downright appalling. However, the core idea of the project rests on solid scientific foundations. Studies over a 20-year period have amassed a wealth of evidence that under the right circumstances, carefully designed markets can be among the most effective prediction tools.

Economists have found, for instance, that orange juice futures predict the weather in Florida better than conventional weather forecasts do. And on the day the space shuttle Challenger exploded in 1986, Wall Street traders correctly guessed within minutes of first hearing the news which of the four main suppliers had provided the faulty part, whereas a blue-ribbon panel of experts took months to come to the same conclusion.

Markets, such as the New York Stock Exchange, distill the collective wisdom of millions of individuals into a single statistic, and they do so with amazing efficiency. In contrast to other information-gathering institutions, such as committees and polls, markets require participants to put hard dollars behind their opinions. What's more, markets reward the people who are right, not those who lie convincingly or are loudest or most aggressive or who have the longest string of titles after their name.

"In a market environment, people who don't know anything will lose on average and will take the hint and go away," says Robin Hanson, an economist at George Mason University in Fairfax, Va. and a consultant for Net Exchange, the San Diego company that was to have run PAM.

Some markets have been engineered for the express purpose of providing forecasts on matters beyond the price of commodities. The Hollywood Stock Exchange, a Web-based virtual market that makes predictions about Hollywood stars and movies, correctly guessed 35 of last year's 40 Oscar nominees in the main categories. For more than a decade, an academic project called the Iowa Electronic Markets has predicted the outcomes of presidential races better than 75 percent of the polls do. And in a recent trial, a market specially designed to predict sales of Hewlett-Packard products performed better than the company's internal sales forecasts did.

Some economists hold that such markets could be used to assess potential consequences of policy decisions by a government, corporation, or other institution. "Different people know different things about the consequences of social policies, and to make good decisions, we have to pull all that information together," Hanson says. "The market technology has enormous potential to help us address the most important questions we think about."

**MARKET WIND TUNNELS** To get a sense of how future-predicting markets operate, consider the Iowa Electronic Markets, which is based at the University of Iowa in Iowa City. Suppose two candidates, A and B, are facing off. Anyone can enter the market by putting some money into the pool; for each dollar an investor puts in, he or she receives two contracts, one of which will pay $1 if candidate A wins, and one of which will pay $1 if candidate B wins.

> Carefully designed markets can be among the most effective prediction tools

Once contracts are in circulation, participants can buy and sell them to each other at a trading Web site. If the going rate for a candidate A contract is 53 cents, for instance, then the market as a whole thinks candidate A has a 53 percent chance of winning. Once the election results come out, participants cash in their winning contracts from the pool—the more contracts of the winner they have, the more money they make.

In addition to these winner-take-all markets, the Iowa project runs markets in which participants can bet on what share of the vote each candidate will receive.

The research that led to future-predicting markets stems from the 1960s and 1970s, when Vernon Smith and Charles Plott, now of George Mason University and the California Institute of Technology in Pasadena, respectively, began using laboratory experiments to study different market designs. In the early 1980s, Plott and Shyam Sunder, now of Yale University, tested how well markets aggregate information by designing a set of virtual markets in which they carefully controlled what information each trader had.

In one experiment, Plott and Sunder permitted about a dozen study participants to trade a security, telling them only that it was worth one of three possible amounts—say, $1, $3, or $8—depending on which number was picked by chance. Plott and Sunder then gave two of the participants inside information by telling them which amount had been selected. Traders couldn't communicate with each other; they could only buy and sell on the market.

"The question was, Would the market as a whole learn what the informed people knew?" Plott says. "It turned out that it would happen lightning fast and very accurately. Everyone would watch the

movements of the market price, and within seconds, everyone was acting as if they were insiders."

In another experiment, Plott and Sunder gave the inside traders less-complete information. For instance, if the outcome of the random pick were $3, they would tell some traders that it was not $1, and others that it was not $8. In these cases, the market sometimes failed to figure out the true value of the security.

However, if Plott and Sunder created separate securities for each of the three possible outcomes of the random pick instead of using one security worth three possible amounts, the market in which some traders had incomplete tips succeeded in aggregating the information.

The studies established that, at least in these simple cases, markets indeed can pull together strands of information and that different setups affect how well they do so.

This type of experiment gave researchers a "wind tunnel" in which to test different market designs, says John Ledyard, a Caltech economist who chairs the board of Net Exchange. "With experiments, we're starting to zero in on what really works," he says.

**GOOD VALUE —** Markets such as the New York Stock Exchange often do an excellent job of predicting the future as it relates to the exchange of goods. Now, economists are designing markets whose express purpose is to forecast events.

## MARKET LOGIC

Armed with Plott and Sunder's insights, researchers in the late 1980s started designing real-world markets whose primary purpose was to aggregate information and predict the future. The Iowa Electronic Markets provided evidence that so-called idea-futures markets could provide a valuable service.

Why the Iowa markets worked so well was at first a mystery. "We know our traders are biased and mistake-prone, but somehow the markets manage to work," says Thomas Rietz, one of the University of Iowa professors who direct the market.

Market participants, recruited at a Web site and the University of Iowa's business school, are far from a representative sample of voters. By an overwhelming margin, they are young, well-educated, high-income, Republican males. What's more, they tend to be unreasonably optimistic about their preferred candidate's chances, and they trade accordingly.

On closer inspection, however, the Iowa team has found that traders fall into two categories. Most participants hold on to their shares, trading rarely and then tending to accept someone else's price. About 15 percent of traders, however, trade frequently and post offers rather than accept other people's offers. These "marginal" traders are less biased than the other traders are, the researchers report.

"The people who drive the markets—and therefore the predictions—are trading with their heads, not their hearts," says Robert Forsythe, another member of the Iowa team.

The other 85 percent of traders do perform an important function. To put it bluntly, they're the suckers willing to trade with the better-informed participants. "You need some amount of unintelligent money in the pool," says Justin Wolfers, an economist at Stanford University. "That's the honey that draws in intelligent traders."

The Iowa markets typically have hundreds or even thousands of traders. Economists generally expect these so-called thick markets to form better predictions than do thin markets, which have fewer traders. Their reasoning goes like this: The more traders there are, the more information is potentially available, and the more opportunities there are for trading.

However, Plott and Kay-Yut Chen of Hewlett-Packard Laboratories have demonstrated that under the right circumstances, even thin markets can make accurate predictions. In their experiments, markets consisting of about a dozen Hewlett-Packard employees predicted future sales better than the company's usual methods of market analysis did.

Plott and Chen made up for the small number of participants by the care with which they selected them. They chose people across a wide range of the company's departments, to maximize the different sources of information available to the market. They also included some uninformed speculators, both to provide liquidity to the market and to provide watchful eyes against illogical market behavior.

To illustrate that idea, consider the example of an election market with candidates A and B. Perhaps one informed trader believes candidate A has a 90 percent chance of winning, and so bids shares of A up to 90 cents. Meanwhile, another trader pushes B's shares up to 90 cents. This set of prices is illogical, because if one candidate's chances of winning are 90 percent, then the other's chances should be 10 percent. If A and B are both selling for 90 cents, speculators have a golden opportunity: They can buy a packet consisting of one share each of A and B from the pool for $1 and immediately sell the shares on the market for $1.80. Speculators will pounce and, in the process of trading, will push the prices down to a more reasonable level.

"It's useful to have people around noticing inconsistencies and making money by making the market consistent," Plott says.

## BUBBLE-PROOF MARKETS

Of course, one potential objection to idea markets is that markets have been known to make bad predictions, some of them whoppers. During the dot-com boom, for instance, the stock market drastically overestimated the immediate promise of the information-technology industry. Many economists view the Internet boom as a bubble, in which speculators buy stock not because they think it will be valuable in the long run but because they expect to sell it quickly for a profit.

"Maybe I buy Amazon stock at $100 because I think you'll buy it next week for $110, and then you buy it from me because you think you'll be able to sell it for $120, and so on," Wolfers says. "Eventually, the whole thing collapses."

Idea futures may be less prone to bubbles because they usually terminate on a specified date. "If the security is about whether the Raiders will win the Superbowl, we all know it will be resolved on a particular date," Wolfers says. "No one wants to be left holding the baby on that date."

Another potential objection to idea futures markets is that some participants might try to affect prices for reasons other than profit, such as to promote a particular candidate in an election market. However, the Iowa Electronic Markets suggest that this won't be

a big problem. Attempts to manipulate those markets have failed miserably, Rietz says.

For instance, in the 2000 presidential market, several people opened accounts on the same day, and each invested $500—the maximum allowed—in Patrick Buchanan shares. Buchanan prices briefly spiked, but well-informed traders then seized the opportunity to profit off the manipulative traders and by the end of the day, the effect of the investments had virtually vanished.

In an experiment in the same market, economists Koleman Strumpf of the University of North Carolina at Chapel Hill and Timothy Groseclose of Stanford University made random purchases. "The market would typically undo what we had done in a few hours," Strumpf says. "People weren't being fooled by our crazy investments."

**THE POLICY-ANALYSIS MARKET** Many questions remain about idea markets. Hanson and Ledyard are tackling two of them: What types of predictions can a market make successfully? and Which market designs work best?

Hanson and Ledyard have come up with a new structure that, they say, performed better in studies with volunteer traders than previous designs did at squeezing the most information out of a small number of participants. The design incorporates two new elements.

With the first element, called conditional bidding, participants can bet on outcomes that emerge from complicated combinations of circumstances, such as, "What are George W. Bush's chances of being reelected if Howard Dean loses the Democratic primary?"

The other new element, called the market maker, provides an automated bidder that is always available to trade with anyone who comes to the market. That enables the market to remain liquid even when there are few participants. The tricky part, Hanson says, was ensuring that the automated market maker didn't lose tremendous amounts of money.

The next step would have been to test their market structure in a real-world application. Unfortunately, Hanson and Ledyard didn't do a good job of predicting the future themselves. Their proposed test bed was the ill-fated Policy Analysis Market.

Despite opponents' claims, PAM was never intended to predict terrorist attacks, Hanson says. For that role, it probably would be self-defeating because terrorists themselves could monitor such a market and switch their tactics accordingly. Rather, Hanson says, the original focus was to be on the social, economic, and political future of Middle Eastern countries.

> "With experiments, we're starting to zero in on what really works."
>
> —JOHN LEDYARD

Hanson, Ledyard, and the people at Net Exchange were aware that the project might spark controversy. Even so, they didn't expect what actually happened: Senators held a press conference denouncing the project, and the Defense Department, the very next day, summarily canceled all funding. "The science was irrelevant in the flap in Washington," Ledyard says.

The uproar turned all research on idea markets into political poison. The Defense Department canceled not only PAM but also projects using markets to predict how large a severe acute respiratory syndrome outbreak is likely to be next year and how soon engineers will reach certain technological milestones in building next-generation vehicles.

Researchers in the field are philosophical about the abrupt reversal of their fortunes. It is probable, they say, that private funding will pick up the slack, because many corporations are interested in the potential of idea markets.

Perhaps the next market should focus on the question, "Do idea futures have a strong future?" According to the insiders, at least, the answer appears to be a resounding yes. ■

# OF NOTE

PALEONTOLOGY

## Reptile remains fill in fossil record

The fossil remains of a sphenodontian, an ancient, lizardlike reptile, are helping span a 120-million-year data gap between its ancestors and today's tuatara, which are the sole survivors of a once prominent group.

Sphenodontians evolved around the same time that dinosaurs did, about 235 million years ago. Sphenodontians flourished until 120 million years ago, when they disappeared from the fossil record known until now, says Fernando E. Novas, a paleontologist at the Argentine Museum of Natural History in Buenos Aires. Many scientists thought that sphenodontians declined in response to competition from lizards, their supposed ecological successors. However, the newly discovered 90-million-year-old fossils—unearthed in northwestern Patagonia and described in the Oct. 9 *Nature*—suggest that sphenodontians thrived for much longer than previously had been suspected.

Adult members of the newly described species dominated their ecosystem and measured up to 1 meter in length, making them the largest known land-dwelling sphenodontians of any era. Today, only scattered populations of two species of tuatara—each measuring about 65 centimeters long—live on remote islands of New Zealand (*SN: 11/8/97, p. 300*). —S.P.

NUTRITION

## Do Arctic diets protect prostates?

Prostate cancer's prevalence and its increase with age tend to be consistent from country to country. A new study finds one major exception to this cancer's high prevalence in older men: Arctic Inuit populations.

Assessments of cancer in Inuit groups in Alaska, Canada, and Greenland had hinted that prostate cancer's incidence among the Inuit is unusually low. To rule out the possibility that the men had undiagnosed cancer, Eric Dewailly of Laval University in Sainte-Foy, Quebec, and his coworkers decided to examine prostates from a cross-section of male Greenlanders who died around 60 years of age from a range of causes, including cancer, heart disease, and violence.

The prostate from only 1 of 61 men appeared cancerous. Among 27 others examined more closely, just 10 showed any cellular abnormality, and none was cancerous, the researchers report in the September *Cancer Epidemiology, Biomarkers & Prevention*. Some 30 percent U.S. men, by contrast, have undiagnosed prostate cancer by age 60.

Several studies have pointed to selenium and omega-3 fatty acids, such as those in fish oil, as nutrients that might protect against prostate cancer. Owing to diets

# OF NOTE

rich in fish and marine mammals, especially whales, Inuit men typically consume more of these nutrients than does any other population on Earth, Dewailly notes. Indeed, the lone prostate cancer that the researchers found was in a 73-year-old whose body fat contained only half of the omega-3 fatty acids concentration typical of the other Inuit men. —J.R.

ASTRONOMY

## To the moon, European style

At the end of September, the European Space Agency launched its first mission to the moon. The probe's main goal is to test new technologies, including an ion-propulsion system. Such a system exerts a tiny but steady thrust that will slowly propel the craft, known as SMART (Small Missions for Advanced Research in Technology)-1, to a January 2005 lunar rendezvous.

**LUNAR SMARTS** Depiction of SMART-1 near the moon.

Touring the moon in a highly elliptical polar orbit, SMART-1's visible-light and near-infrared camera will study the moon's topography. At longer infrared wavelengths, a spectrometer will map the minerals on the moon's surface and look for evidence confirming that water ice resides within permanently shadowed lunar craters. On the poles, such craters never receive direct sunlight, but light scattered from crater rims may illuminate the ice and provide enough photons for the spectrometer to analyze. Data from two earlier U.S. missions have already hinted that frozen water lies at the bottoms of these dark craters (*SN: 10/10/98, p. 239*).

An X-ray spectrometer on the new probe is expected to produce the first X-ray map of the entire lunar surface, providing new clues about the moon's origin. —R.C.

IMMUNOLOGY

## Danger, danger, cry injured cells

Lending support to a controversial theory of how the immune system works, researchers have found that injured or dying cells release uric acid, which then stimulates the activity of key immune cells.

Biologists have long described the immune system as something that distinguishes self from nonself, attacking invaders such as infectious microbes but not the body's own tissues. Some investigators have argued that this paradigm is flawed—after all, the human body safely provides a home for many microbes (*SN: 5/31/03, p. 344*)—and have proposed alternative theories. For example, Polly Matzinger, an immunologist at the National Institutes of Health in Bethesda, Md., suggests that the immune system reacts to microbes only after infected or injured cells have released danger signals.

Uric acid may be one of those signals, Kenneth L. Rock of University of Massachusetts Medical School in Worcester and his colleagues report in the Oct. 2 *Nature*. They show that cells damaged by heat, chemicals, or radiation increase production of this compound and that it stimulates the activity of the cells that launch an immune response.

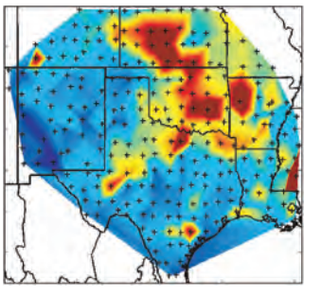
The scientists found that the chemical stimulates the immune system only when it reaches concentrations high enough to form tiny crystals. Rock and his colleagues suggest that uric acid could be added to vaccines to boost a body's response to an immunization. —J.T.

EARTH SCIENCE

## Smog chemicals found even in rural western plains

Analyses of the atmosphere over the south-central United States show that emissions from the region's oil and natural gas industries contribute to air pollution—even over remote Kansas cornfields—that can surpass the noxious mix found in urban areas.

In April 2002, researchers collected air samples in a 1,600-kilometer-wide region roughly centered on Oklahoma City. The samples showed high concentrations of methane, ethane, butane, and propane, gases in a class of hydrocarbons called alkanes. Tests also showed prodigious quantities of alkyl nitrates, which typically form when alkanes react with nitrogen oxides in the atmosphere. Such reactions also create ozone, says Donald R. Blake, an atmospheric scientist at the University of California, Irvine.



**DON'T INHALE, TOTO** Methane in parts of Kansas and nearby states in April 2002 exceeded 2 parts per million (red), partly because of emissions from oil and gas refineries.

Peak concentrations of propyl nitrate and butyl nitrate in south-central Kansas were 51 and 68 parts per trillion, respectively. Those measurements are more than twice the amounts tallied in New York City and five times those rung up in Houston during similar studies in 1999, says Blake. Methane, which is a planet-warming greenhouse gas, showed up in some spots at concentrations of more than 3 parts per million, about 50 percent higher than normal. Blake's team reported its results in the Oct. 14 *Proceedings of the National Academy of Sciences*.

Pollutant concentrations roughly correlated with locations of the oil and natural gas refineries in the region. The smog chemicals showed up in Kansas primarily because the state was downwind of these alkane sources at the time of the measurements, says Blake. —S.P.

BIOMEDICINE

## Magnets, my foot!

People in the United States spend roughly $500 million every year on wearable magnets for treating aches and pains. The devices are advertised as increasing blood flow and altering nerve signals.

A new study finds that, at least for one condition, shoe inserts containing magnets don't work any better than similar inserts without magnets. The problem examined was bottom-of-the-foot pain—a symptom of plantar fasciitis, an inflammation of the tough connective tissue that links the ball of the foot with the heel. Scientists at the Mayo Clinic in Rochester, Minn., report the findings in the Sept. 17 *Journal of the American Medical Association*.

The researchers recruited 101 people with sharp foot pain and gave 57 of the volunteers fitted, cushioned insoles containing magnets. The other 44 volunteers got similar insoles fitted with nonmagnetized metal.

After 8 weeks, about one-third of the volunteers in both groups reported a decrease in their pain, says Mark H. Winemiller, one of the study investigators. Some of these gains could result from the insoles' cushioning, but it's difficult to rule out a placebo effect, he says.

While this study didn't address pain in other areas of the body—such as the wrists—the data suggest that people marketing magnets for pain relief may have a tougher sell from now on, he says. —N.S.

EUROPEAN SPACE AGENCY; BLAKE ET AL.

# Books

A selection of new and notable books of scientific interest

### DICTIONARY OF BIRDS OF THE UNITED STATES

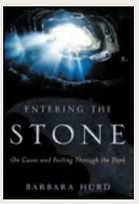
**JOEL ELLIS HOLLOWAY**

The more than 900 entries include the resident birds of all 50 states. This dictionary is touted as the only one to trace the derivation of scientific bird names back to the original Greek. Other language sources for bird names are also revealed in concise entries that include the etymologies and meanings of scientific and common names. The entries detail physical characteristics only as they relate to each bird's name. ***Timber, 2003, 244 p., b&w illus., hardcover, $19.95.***


### ENTERING THE STONE: On Caves and Feeling through the Dark

**BARBARA HURD**

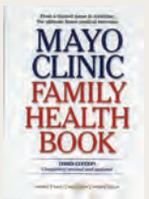
Claustrophobic readers may wince at Hurd's descriptions of spelunking, but they'll find the author's journeys a rare opportunity to explore the wild caves of the world. Hurd documents the life forms that thrive in this unusual ecosystem, from bats to blind cavefish. Along the way, she meets many cave-dwelling and cave-visiting folk, who round out her account of the history and lore of these spaces decorated with stalactites and stalagmites. Hurd also uses caves as a metaphor for the tight spots we people get ourselves into and the ways in which we cope with difficult situations. ***HM, 2003, 170 p., hardcover, $23.00.***




### MAYO CLINIC FAMILY HEALTH BOOK Third Edition

**SCOTT LITIN, ED.**

Completely revised and updated, this encyclopedia surveys all aspects of human health, from infancy to old age. With a strong emphasis on preventive care, initial sections discuss elements of good health, including nutrition and fitness, how the body changes over the course of a lifetime, and the common ailments that strike it. New material assesses various symptoms and helps readers understand and address them. The book's largest portion focuses on 1,000 diseases and disorders and specifies symptoms, causes, treatments, and preventive measures. First aid and emergency treatments are detailed, as are routine testing procedures one might encounter for any one of a hundred conditions. This volume is richly illustrated—including some useful although unsightly color photos of conditions such as ringworm. There is also a visual guide to anatomy and the systems of the body. ***HarpC, 2003, 1,448 p., color plates/b&w photos/illus., hardcover, $49.95.***




### THE PRISM AND THE PENDULUM: The Ten Most Beautiful Experiments in Science

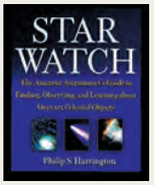
**ROBERT P. CREASE**

Few people outside science refer to experiments as beautiful, but scientists use the word to describe those rare events that "crystallize a new insight and reshape how we perceive things," says Crease. A beautiful experiment is characterized by three elements—depth, efficiency, and definitiveness. Crease, a science historian, polled physicists on the most beautiful experiments in history. Accounts of the top 10 are here. Among them are Galileo's experiment with inclined planes that established a mathematical formula for accelerated motion, Isaac Newton's unraveling of the nature of light and color, and Thomas Young's two-slit experiment that revealed the wavelike character of light. ***RH, 2003, 244 p., b&w photos/illus., hardcover, $23.95.***


### STAR WATCH: The Amateur Astronomer's Guide to Finding, Observing, and Learning about Over 125 Celestial Objects

**PHILIP S. HARRINGTON**

Early chapters in this guide familiarize novice astronomers with terminology and examine Earth's closest neighbor, the moon. Then, Harrington begins a tour of objects in Earth's four seasonal skies, including the sun, the planets, and deep-space objects such as vast star clusters, nebulae, and distant galaxies. The book describes how to locate and observe each of 125 objects in the sky and includes photos and illustrations of most of them. For each object, Harrington provides a full description, size, distance from Earth, structure, and the latest scientific findings. All the profiled objects can be viewed with a 6-inch telescope. ***Wiley, 2003, 301 p., b&w photos/illus., paperback, $16.95.***




### TILT: A Skewed History of the Tower of Pisa

**NICHOLAS SHRADY**

During its 800-year history, Pisa's iconic campanile has been surrounded by mystery and lore. Shrady peels away that mystique as he dissects the structure itself and its role in history. For instance, Galileo was said to have performed experiments testing acceleration by throwing objects off the tower. During World War II, the building was a suspected Italian army hideout. Now, the structure is askew by more than 4 meters. Shrady considers its design and construction, as well as reasons for its tilt. Details of the recent effort to stabilize the tower are also included. Moreover, Shrady examines how this landmark has captured our imagination, making it one of the world's most famous tourist attractions. In a whimsical tribute to the Tower of Pisa, the book itself has been cut at an angle so as to tip sideways on the bookshelf. ***S&S, 2003, 161 p., b&w photos/illus., hardcover, $21.95.***


**HOW TO ORDER** To order these books, please contact your favorite bookstore. *Science News* regrets that at this time it can't provide books by mail.

# LETTERS

## This way out

I passed out three different times from temporary heart stoppages before I got my pacemaker, and I remember dreaming twice. Since I am not religious, my dreams weren't similar to reported "near-death experiences" ("Near death events take arresting turn," *SN: 8/16/03, p. 109*) but it doesn't surprise me that a religious person who thought she were dying would dream of going to heaven.

**DONALD DOZER**, CHARDON, OHIO

## Pained expressions

"Switching Off Pain: Modeling relief on the action of marijuana" (*SN: 8/16/03, p. 99*) notes tetrahydrocannabinol's (THC's) side effects of "sedation, giddiness, and paranoia" and then states that a new drug, AM1241, alleviates pain "without the side effects" of the marijuana ingredient. Yet the article also says there are concerns about AM1241 "undermining the immune system." Marijuana has been shown to be an effective treatment for a wide range of diseases, and its side effects pale in comparison to those of many other leading drugs.

**DOUG GREENE**, CAZADERO, CALIF.

We have a puritanical approach to pain control. A readily available natural substance is deemed unacceptable because it induces euphoria. On the other hand, running 5 or 10 miles to achieve the same state of mind is lauded. Giddiness is acceptable only if you work hard for it. Here we stand, afraid to deploy a pain reliever for fear it might drive people to listen to Pink Floyd.

**AL PERGANDE**, ORLANDO, FLA.

"Switching Off Pain" states that one of the side effects of THC is paranoia. It seems much more likely that the paranoia is a side effect of legislation that makes possession or usage of marijuana illegal.

**BRIAN ZIEGLER**, ELGIN, ILL.

**Corrections** *In "The Body Electric," (*SN: 9/20/03, p. 187*), the embryos pictured on page 187 are of chickens, not frogs. "Letting the Dog Genome Out" (*SN: 9/27/03, p. 197*), misspelled the name of researcher Claire M. Fraser of the Institute of Genomic Research. In "Galileo's Demise" (*SN: 9/27/03, p. 196*), Jupiter's moon Amalthea was misspelled.*

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*—Neil A. Armstrong*


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