

SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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modern stone toolmakers
rock climbing's bio-damage
querying quarks
cannibalism clues

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weeds?

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Cover Hundreds of popular garden imports have turned weedy, and they're overrunning parks and wild lands. Among these rogues are (clockwise from upper left): multiflora rose*, porcelainberry†, Bermuda buttercup‡, butterfly bush*, garlic mustard†, and salt cedar§. (*John Randall; †Sue Salmons; ‡Barry Rice; §John Gaskin) **Page 232**

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

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This Week

Rare Events

Exotic processes probe the heart of matter

Physicists have for the first time unambiguously detected and measured the rates of certain rare reactions among protons, neutrons, and simple atomic nuclei, possibly opening a novel window onto the deepest nature of matter.

At Canada's national TRIUMF cyclotron in Vancouver, British Columbia, researchers have observed unusual particle trajectories following proton-neutron collisions. At the Indiana University Cyclotron Facility in Bloomington, another team has studied never-before-detected fusions of deuterium nuclei, which contain one proton and one neutron. Both teams reported their results April 5 at a meeting of the American Physical Society in Philadelphia.

In both experiments, scientists focused on how the reactions violate so-called charge symmetry, a type of order among subatomic particles, says Edward Stephenson of Indiana University, leader of the experiment conducted there. Charge-symmetry violations have played an important role in shaping the universe.

Because of charge-symmetry violations, protons and neutrons differ in both charge and mass. In the early universe, the mass differences resulted in vast numbers of neutrons, which were not yet stabilized within nuclei, quickly decaying into protons. That process yielded a huge reservoir of protons that contributed to star formation.

The new results promise to yield important information about the up and down quarks that comprise protons and neutrons. Scientists haven't had enough information to determine the masses of these quarks. The new cyclotron data ought to usher scientists closer to finding those values, comments theorist Bira van Kolck of the University of Arizona in Tucson.

Besides settling basic quantitative facts about matter, gauging those masses may grant physicists a glimpse within the quarks themselves to learn what, if anything, lurks there—perhaps more funda-

mental entities known as strings (*SN: 9/22/01, p. 184*), van Kolck adds.

In the experiment at the TRIUMF accelerator, a team lead by Allena K. Opper of Ohio University in Athens beamed neutrons against a tuna-can-size vessel containing protons in the form of liquid hydrogen cooled to 20 kelvins.

Each combination of a neutron and a proton produced both a deuterium nucleus, or deuteron, and a neutral pion particle. As this happened, the researchers observed the directions in which those products shot off from the point of impact. In 17 of every 10,000 events, they observed unusual trajectories emblematic of charge-symmetry breaking, Opper says.

These telling trajectories derived from the quarks' electromagnetic fields and differences in their masses, Opper says. Her team has teased apart the contributions each effect had on the trajectories.

In the Indiana University study, Stephenson's team collided a beam of deuterons into a target of deuterium gas. For the most part, the collisions shattered both projectile and target nuclei into loose protons and neutrons. However, in one of every 10 billion collisions, the deuterons fused to form a helium nucleus and a neutral pion. This marks the first observation of this reaction, which physicists have been looking for since the late 1950s.

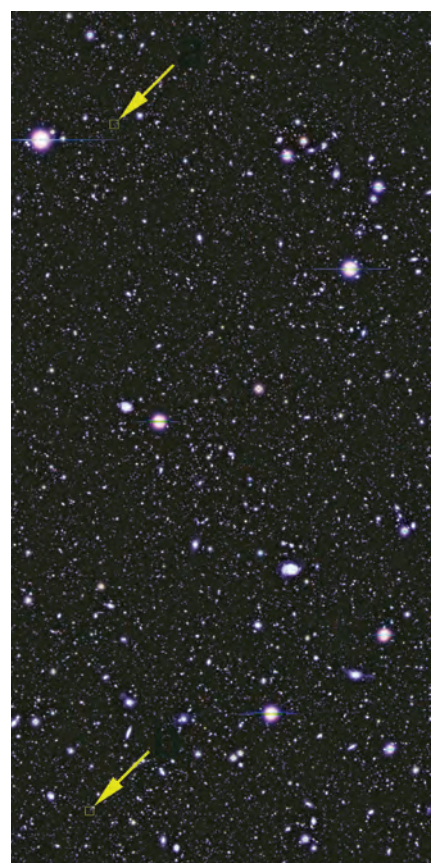
As in the TRIUMF experiment, electromagnetic and mass-difference effects governed the frequency of the exotic fusion reactions. However, the relative strengths with which those factors act are different from those in the charge-symmetry violation spotted by the Opper group. The combined results may thus yield enough information for theorists to pinpoint the up and down quark masses, van Kolck says.

However, the calculations required for these determinations of mass are fabulously difficult. Spurred by the new experimental results, more than a half-dozen theorists including van Kolck have embarked together on an unusual crash program. If things go well, in the next several years, the up and down quarks may finally weigh in, van Kolck says. —P. WEISS

Once Upon a Time in the Cosmos

Using distant galaxies to study the early universe

Peering far back in time, two teams of astronomers say they've found some of the universe's earliest galaxies. The findings suggest that less than a billion years after



GOING THE DISTANCE The most distant galaxy (bottom arrow) and the third most distant galaxy (top arrow) identified so far.

the Big Bang, some galaxies were already minting the equivalent of several suns a year, a prodigious rate of star formation.

The data also hint that the average density of these galaxies is only about one-sixth that of similarly bright star-forming galaxies observed roughly a half-billion years later in cosmic history.

"We are seeing some of the first galaxies to be born," suggests Richard G. McMahon of the University of Cambridge in England, a coauthor of one of the two studies. "A decrease in the density as we go back in time means we are approaching the 'dark ages,' the time when there were no galaxies."

Other researchers say that could be an overstatement. The decline in the number of bright, star-forming galaxies may only indicate that earlier, the cosmos had many more small, faint galaxies that are difficult to detect, notes Charles C. Steidel of the California Institute of Technology in Pasadena. Astronomers generally assume that small galaxies coalesce to build larger ones. Steidel says, "It is nice to see [this assumption] backed up with some real data, over an area of sky larger than [astronomers have recently examined]."

A team of astronomers used the 8-meter Subaru telescope atop Hawaii's Mauna Kea to identify 73 galaxies that might be extraordinarily distant. Spectra of two of these galaxies revealed that one of them is the

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most distant galaxy now known, residing 12.8 billion light-years from Earth. The other galaxy, the third most distant galaxy known, is only slightly closer to Earth, report Yoshiaki Taniguchi of Tohoku University in Sendai, Japan, and his colleagues in the April *Publications of the Astronomical Society of Japan*. The team found that the density of known star-forming galaxies decreases as scientists look at earlier times in cosmic history.

Taniguchi notes that he and his colleagues could identify a large group of distant galaxies because their camera covers an area of the sky the size of the full moon, about 20 times larger than either of the 10-m Keck telescopes on Mauna Kea, the biggest visible-light telescopes on Earth.

The researchers accomplished their feat without the aid of a so-called gravitational lens, an intervening cluster of galaxies whose mass boosts the light of distant objects on its way to earthly observers. The most distant galaxy previously identified, discovered by McMahon and his colleagues using Keck, required such a lens (*SN: 5/27/00, p. 340*). That galaxy now ranks number 2.

In his newest work, McMahon and other colleagues analyzed some of the first images taken with the Hubble Space Telescope's advanced camera for surveys. The scientists identified six galaxies that could be extremely distant, and spectra revealed that one of these candidates is about 12.7 billion light-years away, McMahon's team reports in an upcoming *Monthly Notices of the Royal Astronomical Society*. In agreement with the Subaru team, his group finds a reduced density of star-forming galaxies early in the universe.

Steidel cautions that because today's telescopes can only detect the brightest distant galaxies, "it is hard to extrapolate what [the new findings] mean about galaxy formation in general."

Other astronomers expect to release new estimates of early galaxy densities and star-formation rates in the next few weeks. —R. COWEN

Costly Sexiness

All that flash puts birds at extra risk

Looking good to wow the opposite sex may be bad for the neighborhood. Distinctive his-and-her plumages raise the chance that a bird species will go extinct locally, accord-

ing to an unusually far-ranging study.

In many bird species, a male's plumage differs from a female's, notes Paul F. Doherty Jr. of Colorado State University in Fort Collins. After analyzing 21 years of birdwatchers' records across the United States, Doherty and his colleagues report that bird species with such gender gaps in their plumage color were 23 percent more likely to disappear from a locale than were



EXPENSIVE LOOK Male cardinal exemplifies birds with flashy plumage in only one gender. Such species seem to take extra risks.

species with unisex plumage. Many local extinctions were temporary, however. Birds of the same species from nearby neighborhoods later recolonized the depleted area, the researchers report in an upcoming *Proceedings of the National Academy of Sciences*.

Biologists take gender-specific plumage as a sign that the demands of winning a mate, instead of just the rigors of daily survival, influence a species' evolution. Theorists as far back as Charles Darwin have mused that this sexual selection imposes hardships, or costs, on animals. Sexy colors, for example, might attract predators or require extra foraging for pigment-rich foods.

Such costs showed up in smaller studies, including ones indicating that birds with sex differences in plumage were more likely than others to disappear on Tahiti and other islands. Another study found that flashy spots attractive to the opposite sex shrink over generations in guppies living with aggressive predators.

Thanks to a volunteer effort called the Breeding Bird Survey, the new study takes an unusually broad look at the cost of sexual selection, says Doherty. For decades, birdwatchers have surveyed the United

States by recording species in breeding season at specified stops along thousands of preset routes. Doherty and his colleagues have used novel methods for analyzing data on animals' presence in particular spaces.

The researchers compared 153 species showing plumage differences between the genders with 185 that have no such color differences, at least not ones that people can see. In data covering 2 decades, the scientists indeed found a significantly greater chance of local disappearances in the species with plumage differences. The pattern of local extinction didn't correlate with the birds' body size, nest type, or preferred breeding habitat, says Doherty.

The general pattern of local extinctions didn't hold across two areas: Southern Texas and a region of the northern prairie, says Doherty. "You can start to make [up] all kinds of stories," he says.

Peter Bennett of the Institute of Zoology in London, who also studies the dynamics of extinction, asks whether the bird species in the survey really made the best test of the idea. People have changed habitats across so much of the United States that these species "have already been through a filter of extinction," he says.

In a commentary in *PNAS*, Nils Stenseth and Glenn-Peter Sætre of the University of Oslo, say that the new results "might have important implications for our understanding of the ecological dynamics and evolution of biotic communities, as well as on how we are to best protect threatened species." —S. MILIUS

At a Snail's Place

Rock climbing cuts mollusk diversity

As rock climbing soars in popularity, some cliff-side snail populations may be crashing, according to new research. While focusing attention on cliff ecosystems, the finding is also instigating debates about tougher climbing regulations.

A cliff's cracks and crevices are home to many small species. On a single saucer-size cliff ledge in Wisconsin, for example, scientists have found evidence of one-quarter of the state's land-snail species, notes ecologist Jeffrey C. Nekola of the University of Wisconsin-Green Bay.

North America's 4 million rock climbers treat cliffs as natural jungle gyms, says cliff ecologist Douglas W. Larson of the University of Guelph in Ontario, Canada. Still, rock climbing is generally considered to have a low environmental impact. Most climbers, after all, leave behind little save chalk dust.

A closer look at the cliff's more humble tenants suggests that climbers are leaving a more lasting trace, Larson says. In earlier studies, he and his colleagues found that plants and lichens growing on the Niagara Escarpment—a 700-kilometer stretch of limestone cliffs in southern Ontario—decline in popular climbing spots compared with unclimbed locations. Now, a team led by Larson and Nekola reports that tiny land snails, some smaller than caraway seeds, also disappear from high-activity spots.

The researchers counted snail shells in soil samples from nooks of climbed and unclimbed faces of the limestone cliffs. Soil collected along established climbing routes harbored one-fifth the number of snail shells found at unclimbed spots, the researchers report in the April *Conservation Biology*. What's more, half of the 40 snail species identified in the unclimbed areas were absent

from soil samples taken from climbing routes. The researchers say that removal and packing of soil by climbers likely spur the declines. The results should open up the possibility of restricting climbers to specific routes, they argue.

"I'm amazed by the size of the effect," says conservation biologist Menno Schilthuizen of the University of Malaysia in Sabah. Snails lost from an area can take a "very long time" to come back, Schilthuizen adds.

"It's another case of a restricted habitat type that doesn't appeal to big, charismatic animals and therefore tends to get missed [by conservationists]," says ecologist Robert R. Dunn of the University of Connecticut in Storrs.

People shouldn't put too much weight on a single study along a single escarpment, says Jason Keith, policy director of The Access Fund, a climbing organization in Boulder, Colo.



SLASHING SNAILS Cliff-dwelling snail species, represented here by their shells, decline on frequently climbed rocks.

The crucial question for management strategy, says conservation ecologist Robert H. Cowie of the University of Hawaii in Honolulu, is to determine how much of the snails' habitat is being severely disturbed. —K. MORGAN

Cannibalism's DNA Trail

Gene may signal ancient prion-disease outbreaks

Cannibalism among prehistoric humans may have left lasting genetic marks, a team of scientists contends. Their controversial argument hinges on a link between specific DNA mutations and a disease that afflicted South Pacific villagers who practiced cannibalism as late as 1950.

Gene variations that protect against prion diseases—deadly neurological illnesses caused by proteins known as prions (*SN: 10/11/97, p. 229*)—frequently occur in modern human populations, say John Collinge of University College London and his colleagues. These variations occur in the gene that encodes a protein that's usually harmless but causes prion disease when it's in a mutant form. The protective variations

Deadly Stowaways

Seeds of cancer in transplant recipients are traced back to donors

An organ transplant gives many people a second chance at life, but the harsh drugs required for staving off immune rejection of the new tissues seem to hike a recipient's risk of cancer. For someone desperately in need of a heart or liver, this drawback represents a gamble worth taking.

Scientists initially considered this boost in cancer risk to be the result of a suppressed immune system no longer capable of checking the proliferation of cancer precursor cells already in transplant recipients. That may be only part of the explanation. In the May *Nature Medicine*, researchers report that the cellular precursors for one type of cancer, Kaposi's sarcoma, can be transmitted in the form of virally infected donor tissue.

Kaposi's sarcoma occurs 200 times more frequently in trans-

plant patients with a suppressed immune system than in the overall population. It usually shows up in the skin but can attack internal organs. Scientists generally acknowledge a virus in the herpes family as the cancer's cause.

The new study establishes that transmission of cancer precursors can occur in a solid-organ transplant, says researcher Mario Luppi of the University of Modena and Reggio Emilia in Modena, Italy. In earlier investigations of leukemia patients who had received bone marrow transplants, other scientists found similar signs of viral transmission, which led to different types of blood cancer.

In the new study, Luppi and his team identified eight people who developed Kaposi's sarcoma within 4 years of getting a kidney transplant. Of the

recipients, six were women who received organs from male cadavers. Scientists found that tumor cells in four of the women contained the telltale Y chromosome that appears only in men, establishing that the troublesome cells hitchhiked in the transplant. Tumor cells in one of the male transplant recipients also carried genetic markers clearly deriving from his donor.

Past work showed that herpesvirus-8 is present in most Kaposi's sarcoma patients and some healthy people, says Julio C. Mendez of the Mayo Clinic in Jacksonville, Fla.

"This suggests that in people with a healthy immune system, the virus is kept continually under immune surveillance" by so-called T cells, a situation equivalent to house arrest, says Patrick S. Moore of the University of Pittsburgh Cancer Insti-

tute. The new study indicates that when virus-infected cells are "seeded" into a recipient who has a suppressed immune system, these cells are suddenly free to proliferate and become cancerous, he says.

To treat those who develop tumors traceable to donor tissue, Luppi proposes using cancer-checking T cells from the donor.

Another approach to reducing cancer risk for transplant recipients would be to stop transmission of virally infected cells before it happens. "Transplant screening for herpesvirus-8 is justified," says Moore, whose lab has developed and patented such technologies. Because in the United States, only 3 percent of people harbor herpesvirus-8, eliminating contaminated organs wouldn't have a major effect on transplant availability, Moore says. —N. SEPPA

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originated around 500,000 years ago and spread via natural selection because they protect against epidemics of prion diseases, Collinge's team contends in an upcoming issue of *Science*.

Prion diseases include Creutzfeldt-Jakob disease in people and mad cow disease. These maladies unfold when prions, presumably from meat consumption, induce their harmless versions to assume the prions' warped shapes and then to clump together. This process leads to brain degeneration and death.

The potential link of protective genes to cannibalism stems from studies of a prion ailment known as kuru, which Fore villagers in Papua New Guinea contracted from 1920 to 1950 as a result of eating human brains and other tissue during funeral rituals. Enough prehistoric cannibalism occurred to have instigated kurulike epidemics in ancient human populations (*SN*: 9/9/00, p. 164), Collinge asserts. "Selection for [the protective genes] has been widespread and began very early in the evolution of modern humans," Collinge says.

A previous study led by Collinge determined that people with one regular copy and one mutated copy of what he calls "the prion-protein gene" were protected against Creutzfeldt-Jakob disease. The scientists did not find anyone with two mutated copies; those with two regular copies were not protected. The mutation consists of a single amino acid substitution at a specific location. Other researchers studying Japanese populations found that a different mutation on the same gene had a comparably protective effect.

Collinge's team studied DNA sections containing the critical gene obtained from more than 2,000 people worldwide. All the groups examined contained a substantial proportion of people with a single copy of one of the two protective mutations. People in Japan and Taiwan exhibited the lowest population rate of the variations, 6 to 8 percent. Fore villagers had the highest rate—55 percent.

These genetic patterns indicate that "balancing selection" took place, Collinge proposes. In this rare phenomenon, also seen with malaria, individuals with different versions of the same gene receive more protection against infectious diseases than those with two copies of the common version do.

A prion disease acquired in prehistoric populations through cannibalism represents the most likely explanation of the high prevalence of people with one

mutated and one regular prion protein gene, in Collinge's view.

Although the new data are suggestive of early cannibalism and kurulike diseases, they're also consistent with the presence of prion diseases that result from eating meat of nonhuman animals, comments anthropologist Henry Harpending of the University of Utah in Salt Lake City. —B. BOWER

Putting Out the Welcome Mat

Chemical guides germ cells to gonads

Even though it only covers a few millimeters, the trip can take several days. In the mouse embryo, cells that spawn sperm or eggs must travel from where they arise to their destination in the developing gonads.

A Japanese research team has now identified a chemical signal that enables these primordial germ cells to hone in on the gonads. The discovery mirrors recent findings in fish embryos, making it likely that the same guidance mechanism works in human embryos, as well.

In mice, the chemical lure for primordial germ cells is a protein known as stromal cell-derived factor-1 (SDF-1), Takashi Nagasawa of Kyoto University in Japan and his colleagues report in an upcoming *Proceedings of the National Academy of Sciences*. They and other researchers had already determined that SDF-1, a chemical signal known as a chemokine, guides the migration of nerve cells in the brain and of cells that form blood vessels.

Hypothesizing that SDF-1 also influences the movement of primordial germ cells, Nagasawa's team studied a mutant strain of mice unable to make the chemokine. Although these mice die as embryos, they live beyond the time when the gonads of normal mice are colonized by primordial germ cells.

Nagasawa and his colleagues found that while the germ cells do migrate through the mutant embryo, fewer than half the normal number of these cells end up in the gonads. The scientists have also found that in normal mice, SDF-1 is produced in a ridge of gonadal cells and that mouse primordial germ cells sport a protein called CXCR4 that detects the chemokine.

Fish versions of SDF-1 and CXCR4 are critical for the migration of primordial germ cells, other researchers reported in the Nov. 27, 2002 *Cell* and the Jan. 16 *Nature*. In zebrafish embryos lacking the key chemokine, for example, the germ cells disperse randomly instead of heading for the gonads.

"In the mouse, SDF-1 appears to be



Liberty's smooth move

Workers briefly lifted Philadelphia's 2,000-pound Liberty Bell off its supports last month, giving the icon a taste of the stresses it will encounter this fall when it moves 300 yards to a new home. Last week, the National Science Foundation reported that two sensors clamped to the bell's famous crack registered displacements near the fracture of just several millionths of a meter. That's good news, says Steven Arms, founder of MicroStrain in Williston, Vt., which originally designed the sensors to measure strain in knee ligaments. If a hairline fracture now extending from the main crack were to grow during the move, he says, "the bell could literally fall apart." Arms plans to monitor the bell's transfer this fall to make sure it isn't jostled any more vigorously than it was during the warm-up lift. — J. GORMAN

required for the execution of the last step when the cells colonize the genital ridge which expresses the chemokine," says Erez Raz of the Max Planck Institute for Biophysical Chemistry in Göttingen, Germany, who led the *Cell* study. "In the case of the zebrafish, the cells appear to depend on the chemokine throughout their migration and not just at the last step."

Although it would be difficult, if not impossible, to confirm that SDF-1 guides the migration of primordial germ cells in a human embryo, Nagasawa says that his group will study whether human primordial germ cells make the chemokine's receptor. Raz suggests that such work could provide insight into rare childhood cancers that may originate from primordial germ cells gone astray. —J. TRAVIS

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CULTIVATING WEEDS

Is your yard a menace to parks and wild lands?

BY JANET RALOFF

In 1985, shortly after buying a heavily shaded home in one of Washington, D.C.'s northern suburbs, I installed 35 liriopie plants (*Liriope muscari*), also known as turf lilies. Gardening books recommend these East Asian, shade-tolerant border plants because the 10-inch clumps of vegetation "don't creep"—that is, invade surrounding areas. And for 15 years, those plants maintained a neat border that separated my lawn from a hill stabilized with English ivy. Four years ago, something changed. A few clumps of two or three spindly liriopie leaves sprouted in the lawn. By last summer, hundreds of clumps were infesting the property—in some cases, up to 50 feet from the liriopie border.

This "is a classic example of invasive ecology," observes Mike Maunder, horticulture director of the Fairchild Tropical Garden in Miami. "Many species will sit absolutely blameless for decades—and then, ping!, they explode all over the place."

As big a nuisance as such episodes pose to gardeners, they risk becoming an ecological nightmare if the botanical invasion doesn't stop at a homeowner's fence line but jumps—as increasing numbers of garden plants do—into forests, parks, and wild lands. More and more people in the United States are gardening, foreign trade in plants is going up, and, as suburban areas expand, the interface between gardens and wild lands is increasing.

In many cases, as with my liriopie, scientists don't understand why such invasiveness develops. However, the more domineering of these plants almost invariably have foreign origins, notes Maunder, who has studied such botanical thugs the world over.

To be sure, most immigrant species remain well behaved—which is good news, since more than a quarter of all plant species now growing in the United States evolved elsewhere. But there are an increasing number of formerly mild-mannered guests that have morphed into bullying weeds.

Of some 300 such rogues in this country, roughly half were deliberately introduced as ornamental garden plants, according to the Federal Interagency Committee for the Management of Noxious and Exotic Weeds. This committee categorizes as weeds many prized and commercially popular garden staples—from European buckthorn (*Rhamnus cathartica*), a Eurasian immigrant planted as specimen trees or dense hedges, to butterfly bush (*Buddleja davidii*), a shrub promoted for its fragrant, bright-colored flowers.

Only about 10 species out of 1,000 new introductions will prove weedy, notes Kayri Havens, conservation-science director of the Chicago Botanic Garden in Glencoe, Ill. However, her team's research shows, it takes only one aggressively invasive species to profoundly disturb the natural ecosystem of a forest, wetland, or prairie.

INNOCENCE AND NEGLIGENCE Rock Creek Park, a federally protected 2,900-acre forest cutting through Washington, D.C., now hosts 238 species of exotic plants—most of them garden escapees, notes Susan E. Salmons of the National Park Service

staff there. Forty-two have proven invasive enough to ride roughshod over native neighbors. The most notorious interlopers are two vines of Asian ancestry: a bittersweet (*Celastrus orbiculatus*) and porcelainberry (*Ampelopsis brevipedunculatus*).

In forests, Salmons observes, bittersweet and porcelainberry "grow to the tops of the tallest trees, where they create a dense, smothering foliage." Within 20 years, the weight of these vines can pull down a tree. Eradicating the problem requires intense vigilance, she notes, since seeds can survive in soil for up to 18 years before germinating.

Birds probably foster most of the vines' dispersal by excreting seeds from berries they ate in someone's yard. However, Salmons cautions, even an errant cutting can start a new plant, so "people must be careful about how they dispose of any clippings."

Yet few homeowners realize that their plant choices and husbandry can lead to environmental havoc a mile or more outside their yard. Contributing to the problem: Nurseries sell some of the most aggressive invaders—usually with little or no warning.

"Many species sit absolutely blameless for decades—and then, ping!, explode all over."

—MIKE MAUNDER

marshland plant were used as a garden ornamental in an arid environment, it wouldn't spread because its seeds wouldn't germinate.

Says Maunder, there has been "a sad gap between the scientific realization of the dangers posed by invasives and communicating those threats [to the public]." Several horticultural organizations are planning public outreach. But until they get the word out, Maunder says, gardeners should start scouting their greenery for signs of plants behaving badly (see <http://www.sciencenews.org/20030412/bob9.asp#Looking>).

INVASIONS' COSTS Invasive foliage has become a serious problem globally. Although attempts to quantify its costs have been spotty, Maunder says \$4 billion annually is a fair estimate for the worldwide devaluation of natural resources and cost of combating the exotics' aggression.

The nonprofit Nature Conservancy owns some 1,500 preserves around the nation, where combating invasive species is a top priority, notes Rice. A survey his organization conducted among its preserve managers showed that the group's staff devotes some 36,000 hours annually in efforts to rout 271 invading species. Volunteers contribute almost that much time again. Assembled teams sometimes just pull up the weeds. Other times they excavate them, burn them, drown them, mow them down, attack them with natural

"I don't like to vilify these plants," says Barry Rice of the Nature Conservancy in Davis, Calif., because most invaders aren't innately bad, they're just inappropriate for where they're growing. For instance, errant wind- or waterborne seeds of the red-bloomed, South American shrub *Sesbania punicea* have established impenetrable thickets in California's Sacramento River delta. However, Rice says, if this

predators, or shower them with herbicides. Says Rice, "We evaluate each problem individually and then just do whatever it takes."

Other scientists are evaluating the invaders' ecological costs.

In woodlands invaded by European buckthorn, Pati Vitt of the Chicago Botanic Garden finds dramatic stunting and compromised reproduction in a rare native wildflower, the dog violet (*Viola conspersa*). Although healthy dog violets sport up to 50 leaves and lots of blooms, "under buckthorn cover, an average plant will produce maybe five or six leaves," Vitt says, and no real flowers.

The problem, she says, is that buckthorns form a dense cover 20 feet above the ground that shrouds the forest floor in almost total darkness. Everything dies, she says, "except poison ivy, a few woodland sedges, and the occasional *Viola*."

Like buckthorn, the Norway maple's dense canopy withholds light from shorter plants. The dense, shallow roots of this European native make it hard for native forest-floor plants to find space, and slurp up more than their share of water, weakening neighboring trees. Also, the maple's huge numbers of wind-blown seeds thrive almost anywhere. Such characteristics make the tree "too big a bully" to responsibly fit into any U.S. landscape, says Ann F. Rhoads of the University of Pennsylvania's Morris Arboretum in Philadelphia.

Two hundred years ago, a Philadelphia gardener imported the Chinese tree of heaven (*Ailanthus altissima*), and Chinese immigrants later introduced it on the West Coast. This species has proven such a successful invader that it continues to establish countless new communities even though it's unlikely many people have intentionally planted it for the better part of a century. One key to its success: It poisons the competition.

Beginning around 1995, several research teams identified the chemical ailanthone from this tree's roots as a toxin that inhibits the germination of other plants. In the Feb. 26 *Journal of Agricultural and Food Chemistry*, a European research team has not only confirmed ailanthone's toxicity to cultivated plants, but also identified four additional poisons in the tree of heaven's roots. Indeed, these agents may hold promise for controlling weeds in crop fields, say Vincenzo de Feo and his colleagues at the Università degli Studi di Salerno in Italy.

By creating novel tinder, even the invasion of "boring" ornamental Eurasian grasses into Arizona's dry lands is creating big problems, Maunder notes. "Parts of the Sonoran Desert that had never burned are now beginning to," he says. It's devastating native cacti, which can survive drought but not fire.

FITNESS OR LUCK Why do some plants turn invasive? The answer could help botanists anticipate which new immigrant will be the next environmental tyrant.

For years, a leading hypothesis has been that the immigrants left behind the pests and predators that had held their numbers in check. A study in the Feb. 6 *Nature* now supports this view.

Charles E. Mitchell and Alison G. Power of Cornell University focused on 473 European plant species that have invaded the U.S. landscape. The plants faced, on average, only 16 percent as many fungal species and 76 percent as many viruses as their kin remaining in Europe did.

Other researchers have found another means by which some nonnative plants increase their invasiveness. They hybridize with

relatives they meet in their new world. John F. Gaskin, now with the U.S. Department of Agriculture's pest-management research unit in Sidney, Mont., and Barbara A. Schaal of Washington University in St. Louis examined desert salt cedar. In the United States, these trees—initially imported from Eurasia to shade arid plots—rank second only to purple loosestrife (*Lythrum salicaria*) as the most invasive nonnative plants.

Physically, many U.S. salt cedars look somewhat different from the two main species initially imported, *Tamarix chinensis* and *Tamarix ramosissima*. The U.S. plants also repel many pests that plagued one or the other of those species in Eurasia. This suggested, Gaskin says, that at least some U.S. salt cedars were novel crosses of the two imported species.

Using DNA fingerprinting techniques, he and Schaal examined 269 salt cedars—both in the United States and overseas. In the Aug. 20, 2002 *Proceedings of the National Academy of Sciences*, they confirmed that the most invasive U.S. specimens were hybrids. Gaskin says that this adaptive crossbreeding couldn't have been anticipated before the trees were imported because their native ranges didn't overlap.

Then there are some immigrant species that appear to be well behaved, but in fact are time bombs, notes Daniel Simberloff of the University of Tennessee in Knoxville. In the book *Strangers in Paradise* (1997, Island Press), he relates how nurseries imported 60 species of ornamental figs to Florida, where landscapers for decades employed them without a problem.

Growers propagated the plants by hand, since to reproduce naturally, each species needed a particular pollinating wasp—none of which was in the United States. About 20 years ago, however, the

first fig wasp—the only pollinator of *Ficus microcarpa*—arrived from Asia. At once, Simberloff tells *Science News*, this laurel fig turned aggressively invasive.

CODES OF CONDUCT Sixteen months ago, invasive-plant experts convened at the Missouri Botanical Garden in St. Louis and drafted a policy statement. This St. Louis Declaration asks nurseries and botanical gardens to implement a voluntary code of conduct that would have them introduce cultivars in a manner that would limit unintended harm; work toward national standards to prevent and manage plant invasions; foster research; and inform the public about risks associated with garden species.

At about the same time, several major growers and botanical gardens began testing new plants for aggressiveness before they get into garden centers, the Nature Conservancy's John Randall observes.

For instance, Wayne Mezitt, chairman of Weston Nurseries in Hopkinton, Mass., and president of the Washington, D.C.-based American Nursery and Landscape Association, is spearheading the development of criteria for Massachusetts growers to use in assessing invasiveness. Tests of the criteria and reviews of existing data that were developed elsewhere have already led his nursery to stop selling some plants and to offer shoppers guidance on other cultivars that might prove problematic.

He sees a big role for research, not only in helping identify plants' invasive potential, but also perhaps in genetically modifying traits that make some species so invasive.

For now, Maunder says, gardeners must begin recognizing "that what they plant can have far-reaching impacts." ■



FRIEND AND FOE — The dainty dog violet (left) thrives in woodlands, unless shrouded by the dense buckthorn trees (right).

THE STONE MASTERS

Toolmakers at work and children at play
reflect ancient technology

BY BRUCE BOWER

In the Indonesian island village of Langda, located on Irian Jaya near its border with Papua New Guinea, a half-dozen men sit in an open space, chipping fragments out of rocks. It's not rocket science, but it's a veritable rock science still practiced by a handful of groups around the world. The men are making double-edged stone blades for adzes, scythe-like tools with wooden handles that the Langda have traditionally used to clear land and to work wood. Several of the men show great dexterity in shaping stones into implements, a process known as stone or flint knapping. Each man holds a grapefruit-size stone in his right hand that he uses as a hammer to strike a rock braced against a piece of driftwood with his left hand.

Deitrich Stout, an anthropology graduate student at Indiana University in Bloomington, sits among the men. To him, the situation is the next best thing to traveling back in time to witness what otherwise would be a lost art.

The men's work is going well. One craftsman proclaims his joy by crying out the name of a mythical figure revered as the provider of adze-worthy stone. A second man smiles and describes the stone strips, or flakes, that he's pounding from a blade as "peeling off like sweet potato skin." A third experienced adze maker talks excitedly of wanting to slice flakes off "every stone in the river."

Their duties encompass more than knapping stones. The skilled workers pause periodically to monitor and advise apprentices gamely pounding at their own potential blades. "Work more slowly," they might say. Or they might offer advice on proper knapping technique and posture or outline strategies for shaping a particular stone.

To Stout, the opportunity to observe interactions between the master stone workers of Langda and their apprentices may help him and other scientists recognize the handiwork of experts and apprentices on stone artifacts dating back thousands and perhaps even millions of years. And it could provide a window on the way ancient technological skills passed from generation to generation.

"Stone tools provide hard evidence of skilled performance that will be invaluable for determining when and how the social learning of tool making emerged," Stout says.

His research, published in the December 2002 *Current Anthropology*, appears at a time of ferment in investigations of both ancient and modern toolmakers. Some archaeologists now see a surprising amount of technical aptitude and regional variability in the earliest known examples of stone-tool fabrication and use. These observations challenge the traditional notion that knapping practices evolved slowly and uniformly, steadily increasing in complexity as time passed.

What's more, psychologists who study how children develop motor abilities (*SN: 3/20/99, p. 184*) have been weighing in on ancient tool use. They're finding that toddlers learn to use toy tools on their own by exploiting well-practiced hand and arm actions from infancy combined with the added freedom of hand movement that comes

with standing upright. If 1-year-olds can walk their way toward simple types of tool use, then founding members of the human evolutionary family—who adopted a two-legged stride perhaps 8 million years ago—could have done so as well, these researchers suggest.



KNAP TIME — Langda adze makers, here fashioning stone blades, conduct their work in groups consisting of experts and novices.

ROCK ON In the fall of 1999, a group of five expert and five apprentice Langda adze makers welcomed Stout into their fold. They were flattered that an outsider wanted to observe a craft that they regard with great pride.

The process begins with a trek down a steep valley to a river, where seasoned workers select promising boulders.

They strike small chunks from the best candidates to look for a uniform grain under the surface and other signs of internal strength. When they uncover the best boulders, the stone workers crack them open using a set of hammering stones, sometimes also relying on the heat of a fire to weaken the boulders.

This yields large hunks that then need to be reduced to stones suitable for carrying back to their village for knapping. There, after flaking a stone into the general shape of a blade, the nearly complete tool is ground against a sandstone slab for an hour or more. Then, it's ready to be bound to an adze handle's socket with rattan strips.

As Stout observed this sequence, he realized that the experts—who had passed through apprenticeships of 5 to 10 years—made a different breed of adze blades than novices did. Experts removed long, thin flakes from a budding blade, yielding a smooth surface and a shape that looked much the same from one product to the next. These craftsmen fashioned large, long blades that gracefully tapered to a point. Most of their blades extended 8 inches or more.

D. STOUT

In contrast, apprentices scooped out short, thick flakes from stones, leading to a scalloped finish. They also skipped certain knapping procedures that were too difficult for them. These aspiring craftsmen ended up with fairly short, wide blades, most no longer than 6 inches. Points were unevenly shaped and varied greatly from piece to piece.

The main reasons for these differences boiled down to execution and experience, Stout says. Experts first homed in on the best ridges jutting out from a stone from which to strike flakes and then wielded their hammers with remarkable precision and deftness.

This is not just a job to the craftsmen. They see it as a social bond with their environment in which they nurture an ongoing relationship with living stones, Stout notes. In traditional societies, practical knowledge about plants, thunderstorms, and other features of the natural world commonly includes an assumption that these objects and events are alive (*SN: 6/5/99, p. 360*). For instance, knappers take care not to anger pieces of stone through practices deemed to be improper or careless, such as failing to place finished blades parallel on the ground, with sharp points facing away from the worker. Langda adze makers also emphasize their social links to dead and mythical ancestors who they say handed down their craft through the generations.

Like Langda stone workers, Stone Age toolmakers may also have consisted of experts and apprentices, Stout says. For instance, it must have required years of practice to become adept at making the teardrop-shaped hand axes of the so-called Acheulian tradition, which flourished around 500,000 years ago.

Communities of expert practitioners and apprentices represent, in Stout's view, "a distinctive cultural mode of skill acquisition that has emerged over the course of human evolution."

The trick to supporting this view, says archaeologist John A.J. Gowlett of the University of Liverpool in England, will be to work backward from the realm of Langda tool makers and other modern artisans into the world of Stone Age tool specialists.

BEAD CRAFTERS Stout's observations of the Langda adze makers resonate with the findings of a team of French archaeologists and motion researchers who have studied stone-bead knappers in Khambhat, a region of northern India.

Led by Blandine Bril of the School of Higher Studies in Social Sciences in Paris and Valentine Roux of the National Center of Scientific Research in Nanterre, the scientists studied 12 craftsmen: 6 had trained for 7 to 10 years at traditional bead-making centers and 6 had trained for 2 to 3 years at less demanding workshops that have recently emerged to fill the international demand for high-quality stone jewelry.

Bead knapping uses two tools—a sharp-pointed iron bar sticking up from the ground in front of the artisan and a hammer made from a cylindrical buffalo horn attached to a thin wooden stick. A small piece of stone is pressed against the bar's point and then struck from above with the hammer. The force of the blow drives

the point into the rock, detaching a flake.

With this technique, craftsmen remove pieces of stone in set sequences that vary according to the shapes of the beads they want to make.

Comparison of these bead makers and the Langda knappers showed many similarities. The highly trained bead makers produced longer, larger beads than did their lesser-trained peers. Experts carried out delicate knapping operations that the others didn't perform, apparently because the latter lacked the skill to do so.

Bead makers with the most training were far more successful than the others at fashioning the barrel-shaped beads prized in the region. Moreover, when the researchers provided the bead makers with glass, a substance with which they had not previously worked, only the experts successfully knapped it.

Measurements of hammer acceleration and trajectory showed that the experts fine-tuned and adapted their strokes based on a bead's raw material and the size of the flake they wanted to detach.

These data from modern bead makers yield insights into stone beads found among the remains of India's ancient Harrapan culture. Harrapan society reached its peak around 4,500 to 4,200 years ago. Most Harrapan beads are small and irregularly shaped. However, several hundred long, barrel-shaped beads, which resemble those made by the present-day Khambhat bead makers, have also been unearthed.

"Harrapan long beads were made by highly skilled craftsmen who developed specialized skills for a very limited demand, although their products were quite valuable," Bril says. A small number of proficient Harrapan craftsmen—perhaps only one or two—must have produced all the barrel-shaped beads, she and Roux surmise.

During that era, researchers have found, the use of the potter's wheel and other techniques requiring complex skills and years of apprenticeship were also spreading through Harrapan society.

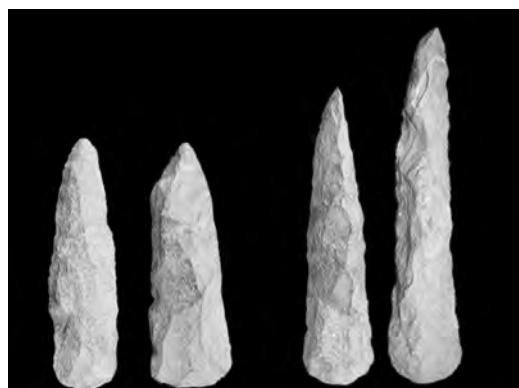
INNOVATIVE ACTS Despite such findings, scientists have much to learn about prehistoric toolmaking, remarks archaeologist Sophie De Beaune of Jean Moulin University in Paris.

Just as studies of modern-day stone workers may give scientists an edge in understanding ancient toolmakers, so might investigations of tool use in animals and infant humans.

Consider that extended apprenticeships in tool use might well have emerged

in ancient apes before appearing in members of the human evolutionary family. In groups of modern chimpanzees that crack nuts with a stone hammer and an anvil, juvenile animals spend several years learning the technique from experienced adults. The juveniles primarily imitate adults' tool use rather than the adults' providing direct guidance to novices. Still, chimps pass through a "kind of apprenticeship" in which they learn to execute the hand and arm movements needed for cracking nuts, De Beaune holds.

Her evolutionary scenario fits into the growing conviction that as early as 8 million years ago, human ancestors must have used



SHARP CONTRASTS — Two adze blades made by experts (right) are larger, narrower, and exhibit more consistent shapes than a pair done by novices (left).



CHIP AWAY — An expert bead maker in Khambhat, India, works at his craft.

unmodified stones as tools. Later, groups began chipping edges on stones and leaving them behind in communal workspaces, which scientists have excavated, Melissa A. Panger of George Washington University in Washington, D.C., and her colleagues suggested last year in *Evolutionary Anthropology* (2002, vol. 11, issue 6). Those artifacts date to no earlier than about 2.5 million years ago.

Intriguingly, several 2.5-million-to-2.3-million-year-old African sites have yielded stone artifacts that exhibit signs of sophisticated knapping techniques and tool-making styles adapted to local rock characteristics, according to Erella Hovers of the Hebrew University in Jerusalem. Hovers takes this as evidence that early tool-makers responded to whatever material they had to work with, rather than making do with a generic approach.

De Beaune agrees. She also suspects that the first anatomically modern humans, who lived at least 200,000 years ago, had all the manual capabilities of people today. In a revolving process of innovation, ancient groups made tools for specific tasks with available materials, invented novel uses for those tools, and then created more intricate implements to meet their new needs more efficiently, De Beaune proposes.

Infants do something similar as they grow, says psychologist Jeffrey J. Lockman of Tulane University in New Orleans. Babies' routine efforts to explore the world set up their later tool use, in his view. That counters the stance of many researchers who hold that childhood tool use emerges during the second year of life from an insight

that certain objects can provide a means to an end.

The banging or pounding of objects provides a telling example. Lockman finds that by 7 months of age, infants who previously pounded all sorts of items show a preference for banging pairs of hard cubes—either singly against a hard surface or together—rather than soft cubes. By 8 to 10 months of age, babies begin to choose hard mallets over soft ones, picking them up by the handles before pounding away. However, only after age 1 year do they deliberately seek out tools to pound with.

Childhood tool use blossoms with the emergence of stable hand preferences and an upright posture, says Daniela Corbetta of Purdue University in West Lafayette, Ind. Before they start to crawl, infants learn on their own to use both hands in systematic ways to open toy boxes or complete other tasks, Corbetta finds. This behavior disappears when the same infants begin crawling and reappears after they've been walking for a few months. Right- or left-handedness then develops, with the dominant hand achieving better fine motor skills and greater strength.

"Efficient stone knapping can only emerge as the result of developing both an upright posture and stable hand-use preferences," Corbetta proposes. This practice may thus be unique to members of the human evolutionary family, all of whom have possessed a two-legged gait.

Still, for our stone-tool-inclined ancestors, it wasn't enough to walk the walk. They had to learn how to sock the rock. ■



PRECIOUS PRODUCTS — A skilled artisan's beads look like this before being chipped and polished into their final form.

V. ROUX

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OF NOTE

IMMUNOLOGY

Microbicide thwarts AIDS virus in monkey test

Experimental medicines containing human-derived antibodies to HIV are partially effective in stopping transmission of the virus, according to tests in rhesus macaque monkeys. The new study, in the March *Nature Medicine*, suggests that such microbicides might help protect women who are exposed to the AIDS virus through infected sex partners.

Ronald S. Veazey of Tulane University Health Sciences Center in Covington, La., and his colleagues put the microbicial antibodies into the vaginas of 12 monkeys and inert preparations into those of 13 others. Within 2 hours, the scientists delivered a virus that combines parts of HIV and simian immunodeficiency virus into each animal's vagina. The team found that only 3 of 12 monkeys primed with the antibodies became infected whereas 12 of 13 monkeys getting inert gels did. Another monkey, which received the microbicide 6 hours before the virus, wasn't protected.

The results support the idea that an engineered microbicide can stop infections, but scientists need to test more such compounds to find better candidates to try on people, say the researchers. —N.S.

ENVIRONMENT

Mapping watersheds invites comparisons

Computerized maps of environmental features for 154 of the largest river watersheds around the globe will soon be available to the public, free of charge. A group of research and conservation groups unveiled a draft of the interactive database at the Third World Water Forum in Japan last month. When completed, the database will be accessible through the Internet and on compact disks.

A driving force behind the project was international interest in freshwater biodiversity, notes Daniel B. Tunstall, director of information programs with the World

Resources Institute in Washington, D.C., a codeveloper of the new database. Research by several organizations, including the U.N. Convention on Biodiversity, has shown that "freshwater species of fish and invertebrates are more threatened [with extinction] than any other," he says.

The new project maps the number of known fish species within a watershed—the area drained by a river system—and the share of those species that are found only in its waters.

Other mapped features include human-population density, types of land cover, and major cities.

Tunstall expects policy makers around the globe to use the maps and data to study the natural benefits of river systems, such as flood control, recharging groundwater, supporting biodiversity, and supplying drinking water. —J.R.

ASTRONOMY

All-sky survey makes Internet debut

Last month, an atlas of some 5 million images from the celestial map known as the Two Micron All-Sky Survey (2MASS) became available online (<http://www.ipac.caltech.edu/2mass/gallery>). It's the most detailed high-resolution survey of the entire sky so far (*SN*: 2/23/02, p. 122).

Researchers conducted the survey at infrared wavelengths, using identical 1.3-meter telescopes in the northern and southern hemispheres. Because infrared light emitted by stars and galaxies penetrates dust more easily than their visible light does, infrared telescopes are more likely to reveal objects hidden behind dust.

The images add to the storehouse of astronomical data already online, which scientists hope will become part of a national

virtual observatory. With such a resource, which includes analytical tools for finding patterns within the raw data, astronomers could make discoveries without leaving their offices.

For example, notes Michael Skrutskie of the University of Virginia in Charlottesville, with 2MASS, "we can, in effect, step outside our galaxy and see it in detail, as it would appear from above." The sur-

vey, he adds, also enables astronomers to discern details in the distribution of galaxies outside the Milky Way. —R.C.

BIOMEDICINE

Weight-loss pill carries risks

An analysis of past research on ephedra, an over-the-counter dietary supplement, indicates that the pill leads to modest weight loss but poses significant dangers to health. Those include psychiatric problems and a wide range of physical harm, such as damage to the heart and stomach. The analysis also suggests that ephedra doesn't enhance athletic performance, says Paul G. Shekelle of the Southern California Evidence-based Practice Center-RAND in Santa Monica, Calif.

The studies indicate that ephedra use should be restricted, says Shekelle, who conducted the analysis with several colleagues. "The existing evidence about harm is strong enough to say it outweighs any chance of benefit," he says. The Food and Drug Administration is currently reviewing the study, which appears in the March 26 *Journal of the American Medical Association (JAMA)*. The Department of Health and Human Services commissioned Shekelle and his colleagues to examine the scientific literature on ephedra and ephedrine, the chemical presumed to be the herbal supplement's active ingredient.

The analysts reviewed 20 studies that gauged the effectiveness of ephedra or products containing ephedrine. The collective message of the studies is that the supplement multiplies various health risks 2.2- to 3.6-fold. Specific problems include depression, anxiety, insomnia, sweating, vomiting, heartburn, nausea, and heart-beat irregularities.

The scientists also found 15,951 cases in which either a doctor or a user of

ephedra or ephedrine reported a medical problem to a manufacturer or the FDA. Of these, 283 were severe, including 5 deaths, 5 heart attacks, 4 seizures, 11 strokes, and 8 psychiatric disturbances.

Shekelle and his colleagues have provided "the best scientific evidence yet" that ephedra poses health risks, says physician Phil B. Fontanarosa, executive deputy editor of *JAMA*. —N.S.



SEEING RED Sky-survey image of the spiral galaxy NGC 891, seen edge-on in the infrared.

MEETINGS

American Chemical Society
New Orleans
March 23 – 27

NATURAL PRODUCTS

Catnip repels pest

Catnip may be the cat's meow, but the plant's oil repels roaches and mosquitoes (*SN*: 9/8/01, p. 148). Now, the entomologist who discovered this insect-harassing power of catnip, Chris Peterson of the U.S. Department of Agriculture's Forest Service in Starkville, Miss., has found that the oil also repels termites.

Peterson challenged termites to a test of whether they could burrow through sand that he'd treated with catnip oil. Below 100 parts per million by weight, the oil wasn't an effective barrier. At 250 ppm, the oil discouraged termites from plowing through the sand. Above 500 ppm, the oil was deadly.

A natural product such as catnip oil may be less toxic to people and the environment than current termite repellents, says Peterson. Catnip oil by itself may not work well, he says, since it breaks down quickly. In the future, however, the oil's lifetime may be extended through special formulations. Peterson notes that catnip oil must still be tested for safety and effectiveness in realistic settings. Simply planting catnip in a yard probably would not stave off termites, he adds. —J.G.



LINE IN THE SAND Termites burrow readily through untreated sand (top) but not through sand treated with catnip oil (bottom).

ANALYTICAL CHEMISTRY

Nuclear-waste monitoring gets close to the source

Some forms of nuclear radiation—such as the beta-emission from radioactive technetium-99—are particularly difficult to detect underground, partly because the radiation doesn't travel very far. A new prototype instrument may make this and other elements easier to trace in groundwater.

Technitium-99 is produced during nuclear-reactor operation and nuclear-weapons production. It has a half-life of 212,000 years, and once it finds its way into groundwater it moves quickly, says analytical chemist Oleg Egorov of the Pacific Northwest National Laboratory in Richland, Wash. For these reasons, this isotope needs to be carefully monitored in places

such as the Hanford Site, near Richland, where nuclear weapon materials were produced from the 1940s to the 1980s.

Currently, researchers take groundwater samples from Hanford wells to a lab for a tedious analysis. If the water could be monitored by small detectors left inside the wells, analyses would be cheaper and quicker. Also, the containers now used to transport the well-water samples have to be treated as hazardous waste themselves, an issue that would disappear with in-well monitoring, says Egorov. "Our goal is something that you can take into the field and leave there," he says.

Egorov and his coworkers have taken a step in that direction by building a prototype detector that monitors technitium-99 concentrations. The apparatus is roughly 1 meter long and contains a column packed with an absorbent material and so-called scintillation beads. When water tainted with technetium-99 passes through the column, the isotope gets trapped by the absorbent material. Then the emitted beta-particles—high-speed electrons—hit the scintillation beads, which respond by emitting light that's picked up by sensors at either end of the column. The data can be transmitted to a computer as far as several miles away, says Egorov.

The researchers have proven the detector's effectiveness in laboratory tests. They now plan to make their system more rugged so they can deploy it in a Hanford well by the end of next year. —J.G.

FOOD CHEMISTRY

Matcha green tea packs the antioxidants

Some nutritionists have suggested that matcha, the green tea prepared during Japanese tea ceremonies, might offer more health benefits than the green tea most people drink in the United States. Until now, however, there was little scientific evidence to support this hunch.

For years, studies have indicated that

the antioxidants in green tea offer protection against diseases, including cancer, and even fight dental cavities. One of the most beneficial of these antioxidants is called epigallocatechin gallate. At the University of Colorado at Colorado Springs, sophomore Christopher R. Anderton and chemistry professor David J. Weiss used the chemical separation technique known as micellar electrokinetic chromatography to analyze matcha and a green tea commonly available in U.S. markets.

The researchers found that samples of matcha had 200 times the concentration of epigallocatechin gallate in the common U.S. tea.

Although most green teas are prepared in the familiar way—by steeping leaves in water—matcha is prepared by mixing hot water with powdered leaves. This is probably why matcha contains so much epigallocatechin gallate, says Weiss. If other green teas were also prepared from powdered leaves, he says, they might offer tea drinkers more of the beneficial compound. —J.G.

DRUG DELIVERY

Contacts could dispense drugs

Eye medication usually comes in drops. That's not good, says Anuj Chauhan. Only about 5 percent of the medicine treats the eye. The rest drains into the body, where it can reach the bloodstream and cause complications. Better, Chauhan says, would be a more controlled way of getting medicines into the eye.

That's why he and his coworkers at the University of Florida in Gainesville have created contact lens materials designed to continuously dispense drugs. To make sample lenses, the researchers first prepared 50-nanometer-wide spheres containing the anesthetic lidocaine. They added these nanoparticles to a common contact lens polymer called poly-2-hydroxyethyl methacrylate.

The team made test lenses that were a little bigger and thicker than normal contacts. Despite the nanoparticles, the lenses retained their transparency. When placed in a beaker of water, the lenses leached their loads of anesthetic for 8 to 10 days.

The researchers now plan to test their particles with timolol, a glaucoma drug usually delivered in eye drops, and the antibiotic ciprofloxacin. They also hope to tune the lens material so it releases drug molecules uniformly over time. If all goes well, drug-releasing contacts may be on the market in about a decade, Chauhan says. —J.G.

PETERSON/USDA FOREST SERVICE

Books

A selection of new and notable books of scientific interest

CONSIDER THE LEAF: Foliage in Garden Design

JUDY GLATTSTEIN

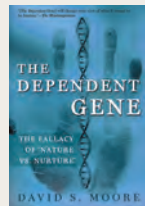
After the flowers, then what? How do you keep a garden interesting? Foliage, declares Glattstein. She encourages gardeners to plant with an emphasis on leaf form, texture, and color that will maintain the garden's vibrancy throughout the growing season, if not the whole year. Moreover, she reports, foliage plants are often easier to maintain than bloomers. Glattstein instructs gardeners on how to select intriguing plant combinations based on leaf shape and color. **Timber Pr, 2003, 227 p., color plates, hardcover, \$24.95.**



THE DEPENDENT GENE: The Fallacy of "Nature vs. Nurture"

DAVID S. MOORE

According to the author, it's wrong to consider just nurture or just nature when evaluating human traits. Moore, a psychologist, argues that "all traits—from 'biological' ones such as hair color and height to complex 'psychological' ones like intelligence—are caused by dependent interactions of genes and environments." Furthermore, Moore argues against the perception that some traits are more heavily influenced by genes than others are. He contends that it isn't possible to "parcel causation of traits in this way." The author surveys the latest research in the field to show how interactions between genes and the environment occur at every stage of biological and psychological development—from a single fertilized egg to a full-grown adult. Originally published in hardcover in 2001. **Owl Bks, 2003, 312 p., paperback, \$16.00.**



THE NATURE OF SCIENCE: An A-Z Guide to the Laws and Principles Governing Our Universe

JAMES TREFIL

This handy reference gives quick and concise overviews of important scientific concepts. Essays of no more than three pages succinctly provide historical background, as well as descriptive text, about ideas ranging from atomic theory to Zeno's paradox. More mundane, yet still provocative, topics are included, such as how airplanes fly and how polarized sunglasses work. Each entry stands on its own but is grouped with others by subject. Graphs and photographs are well placed and useful. **HM, 2003, 433 p., color/b&w photos/illus., hardcover, \$35.00.**

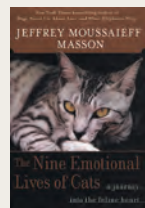


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THE NINE EMOTIONAL LIVES OF CATS: A Journey into the Feline Heart

JEFFREY MOUSSAIEFF MASON

Cats have a reputation as being indifferent and aloof creatures that don't exhibit much of an emotional life. Mason believes this is a bad rap because cats are almost pure emotion. Several years ago, this psychoanalyst explored the minds of dogs in a book called *Dogs Never Lie About Love*. Now, he does the same for felines by focusing on nine emotions that best suit them: narcissism, love, contentment, attachment, jealousy, fear, playfulness, curiosity, and anger. He reflects on his personal interactions with his own five cats as he describes the inner nature of these creatures and their interactions with people. **Ballantine, 2002, 259 p., hardcover, \$24.95.**



SILENT WITNESS: How Forensic Anthropology Is Used to Solve the World's Toughest Crimes

ROXANA FERLLINI

In 29 case studies, Ferllini explains the methods that she and other forensic anthropologists use to identify corpses and recreate death scenes. Sometimes this task is daunting. In the case of the missing body of South American leftist Che Guevara, it took years just to find the burial site. Then, Guevara's remains had to be sorted and identified among those of comrades buried with him. Sometimes even less evidence is available. Ferllini explains how bone fragments at the sites of airplane crashes and explosions are pieced together and identified. She also illustrates how facial reconstruction can identify a person who has been missing a long time. Hundreds of color images reveal some startling details of forensic anthropologists' work. **Firefly, 2002, 192 p., color photos/illus., paperback, \$24.95.**



SYNC: The Emerging Science of Spontaneous Order

STEVEN STROGATZ

It is in the very nature of the universe for its elements to be in sync. The moon spins in perfect resonance with its orbit around Earth. The pendulums on clocks alongside one another swing together. Such spontaneous order has fascinated individuals from Albert Einstein to Richard Feynman. Today, mathematicians such as Strogatz are probing the details of chaos and complexity theories to better understand how systems can synchronize themselves. This new science of synchrony centers on the study of coupled oscillators—entities that automatically cycle and have some physical or chemical influence on one another—such as fireflies flashing in unison. Strogatz considers how this develops and what happens when spontaneous order breaks down. In the process, he explains how synchrony affects fads and riots and why traffic jams occur for no apparent reason. **Theia, 2003, 338 p., b&w illus., hardcover, \$24.95.**



LETTERS

Devil of a question

I scuba dive, and I've noticed that when the current is brisk through some coral formations, small swirls behave exactly as dust devils ("Dust devils produce magnetic fields," *SN*: 2/8/03, p. 94). Would the researchers predict that any magnetic phenomena could be produced by silt in salt water?

LINDSEY RANDAL POTTS,
SAN ANTONIO, TEXAS

Probably not, says William M. Farrell of NASA. Any charges that might build up on the particles of silt would be pulled away almost immediately by the water molecules surrounding them. —S. PERKINS

Driven to distraction

I wish the testing described in "Cell phones distract drivers, hands down" (*SN*: 2/8/03, p. 94) had used airline pilots, policemen, and other people who are accustomed to operating their machines while carrying on a conversation. Cell phones are new, and perhaps all that is needed is time for drivers to train themselves in multitasking.

MIKE KUZARA, WYARNO, WYO.

Shortly after reading the article, I received a phone call from a friend. While talking, I realized that I was vaguely imagining her surroundings. I think the answer to why carrying on a conversation on a cell phone while driving is apparently far more distracting than a conversation with a passenger has to do with being present in the moment: The cell phone conversation draws some part of one's attention to another place, time, and experience.

CAROL BOWLES-TYNDAL,
COLORADO SPRINGS, COLO.

MS and G?

"Essence of G" (*SN*: 2/8/03, p. 92) refers to "the current theory that high intelligence arises from the coating of brain cells with especially large amounts of the fatty substance called myelin." As a person with multiple sclerosis, anything about myelin interests me greatly, yet I have never heard of this.

MARION LEEDS CARROLL,
ARLINGTON, MASS.

For more, see Daniele Posthuma's chapter in Behavioral Genetics in the Postgenome Era (2003, Robert Plomin et al., eds., American Psychology Assoc.). —B. BOWER

Correction "At last, a bird that nails killer chicks" (*SN*: 3/29/03, p. 206) misspells the genus name for Horsfield's bronze-cuckoo. It should have been *Chrysococcyx basalis*.