02484

OMNI

SEPTEMBER 1989

ENVIRONMENTAL SPECIAL

SAVE THE PLANET

A 16-PAGE ACTIVIST'S PRIMER TO HEALING AN AILING EARTH

KIDS SPEAK OUT ON DRUGS, WAR AND ILLITERACY

$3.50

0 778845 1 09

VOL 11 NO 12 SEPTEMBER 1989

CONTENTS

A photo of Erin Dean blowing a bubble inspired her father, artist Glenn Dean, to create this cover. The painting "reflects the fragility of the earth" and the need to leave a safe and clean planet for today's children Dean says

OMNI (ISSN 0149-9711) is published monthly in the United States and Canada by Omni Publications International Ltd 1965 Broadway New York NY 10023-5965 Second-class postage paid at New York NY and at additional mailing offices POSTMASTER Send address changes to Omni Magazine Post Office Box 3041 Harlan IA 51537-3041 Volume 11 Number 12

FIRST WORD

By Bruce Babbitt

"As populations have skyrocketed and technology has created new hazards, we have gained the power to contaminate not just a river, neighborhood, or city; we have the power to poison the entire planet."

In [illegible] years the population of our planet [illegible] grown by 25 percent. We have invented and released a host of new chemicals. And we are now restructuring the building blocks of life itself—through genetic engineering.

As world population skyrockets and technology creates new hazards, we have gained the power to contaminate not just a lake or river or neighborhood or city; we have the power to poison the entire planet. The burning of fossil fuels creates acid that flows across wilderness boundaries. The radioactive fallout from Chernobyl has saturated the lichen tundras of the far north. And everywhere under the sun life is menaced by ultraviolet radiation streaming through a leaky ozone shield.

There is certainly ample reason to be disheartened, but the darkest hour often comes just before dawn, and I believe we are on the threshold of a new and hopeful international opportunity. The lessening of cold war tensions between the United States and the Soviet Union will provide the opportunity for joint environmental leadership. The European community has already taken a strong lead to eliminate the use of chlorofluorocarbons, which are destroying the ozone layer. Here at home President Bush has made a good start on air quality, although he has yet to provide international leadership.

As capital flows from one country to another and trade increases, the emergence of a new interdependent world economy can be channeled into environmental progress. The countries sharing the benefits of interdependent world growth must also share responsibility for international environmental standards.

In 1958 the nations of the world participated in an International Geophysical Year (IGY). IGY triggered cooperation among scientists for worldwide research. Thirty years later it is time to create another IGY, but this time an International Greenhouse Year. It could show once again that scientists and leaders working together can solve problems on a global scale.

It is also time to award a Nobel prize for environmental science and leadership. For more than eight decades the awarding of Nobel prizes for physics, chemistry and, more recently, economics has focused a great deal of attention on the work of scientists throughout the world whose accomplishments would have otherwise gone unnoticed. A new Nobel prize would bring to the environmental sciences a recognition commensurate with the urgency of the issue.

The most important task, however, is to use our leverage in the international economy to promote environmental responsibility. We have that leverage in at least three areas—trade, aid, and debt. Consider the aid we provide to other countries. Why should the United States subsidize dams that inundate tropical forests and displace indigenous peoples? And why should we sponsor agricultural practices that ruin the land and destroy wildlife? Before such projects are funded environmental concerns should be considered.

The United States can also play an influential role in molding international policy regarding the crushing burden of debt in the Third World. Within the next few years this debt must be reduced, presenting an opportunity for linking economic and environmental reform. As usual, environmental organizations captured the public imagination with a proposal to swap debt for commitments to preserve tropical forests. The next step is to persuade government and the multilateral banks to become involved in debt-for-nature swaps.

The most neglected of our international economic–environmental links are caused by issues related to trade. It is access to American markets that has made possible the rise of trading states and the growth of the new world economy. Yet access to American markets should not be an inducement to destroy the environment.

Some progress in linking economic gains with environmental concerns in trade relationships has been achieved. To instill energy conservation, we passed laws requiring automakers to meet fuel economy standards and apply those standards to both domestic and foreign cars.

More recently the United States halted the import of ivory in response to a 1989 report indicating that the African elephant is in serious danger of extinction. Other countries are doing the same. We should now extend that concept to a ban on imports of timber from endangered rain forests. And we need to go further still, moving against products that themselves are risk-free but that are manufactured by processes threatening the environment.

The times cry out for an international agreement that integrates worldwide economic and environmental policies. Such legislation could provide the first step toward making environmental treaties with sanctions on those countries that fail to comply.

The United States, long the engine of world economic growth, must now become the engine of world environmental progress. For too long we have considered economic and environmental issues in opposition to each other. Our challenge is to link the two together, proving to a skeptical world that we can have both growth and a quality environment and that we are willing to use one to achieve the other.

Bruce Babbitt, former governor of Arizona, was a 1988 presidential candidate.

CONTRIBUTORS

OMNIBUS

SAVE THE PLANET

BECOMING CINDY

LIVERSIDGE

ROBOTHAM

CURRENT AFFAIRS

HELP WANTED

Nearly all astronauts who have gone into space have noticed the same thing. The planet below them is not divided into individual countries but appears as a cohesive, almost lyrical entity. "From where you see it," notes former astronaut Russell Schweickart, "the planet is whole."

In the Seventies our planet was described as a self-contained 'spaceship,' a watery blue gem. Yet spaceship Earth, overburdened with industrial pollution and toxic waste, is a fragile machine that may be on the verge of breakdown. Rain forests continue to be harvested at an alarming rate, breaking delicate ecological chains and leaving barren, wasted land behind. In the meantime malnutrition, polio, tuberculosis—all preventable with modern technologies—still claim millions of lives each year. With the agility and scope of modern communications, the absurd fact remains that many children grow up illiterate. Nuclear war hangs over the present and future generations, cultivating a devil-may-care attitude toward the problems facing every living thing.

We decided to devote this issue to exploring the extent of Earth's problems and offering alternatives to a dubious future. It would take volumes to fully address the state of the world. Instead in "Save the Planet" (page 34), we decided to concentrate on six areas: contaminated drinking water, reforestation, health care delivery, drugs, war and illiteracy. We enlisted contributing editors *Ellen Kunes* and *Cathy Spencer*, writers *Linda Marsa*, *John Cummings*, *A.J.S. Rayl*, and New York *Daily News* reporter *Robert Fleming* for their expertise in each of our topics. Their mission: define the problem, then seek out solutions from sources ranging from political and scientific experts to the world's future leaders, children.

"Most people don't think that they can make a difference," says Spencer, who also passionately researched and assembled "Help Wanted," our special 16-page activist's guide to a better Earth. "We wanted to focus on things everyone can do—without spending a lot of money—to have a positive impact on the environment."

A concern for the environment comes easier to some people than a concern for their fellow man. How would you react to a shelter for the homeless being put in your backyard? "Not in my backyard," a syndrome known by the acronym NIMBY, is a cry increasingly heard from communities throughout the country. And beginning on page 60, writer *Rosemarie Robotham* looks at the reasons why self-interest sometimes overpowers social conscience. Here, too, social scientists offer creative ways to resolve the conflicts of interest.

Mathematician Neil Sloane's world of superspace is so remote from everyday life that the uninitiated cling to him as their guide. Even experts rely on the Bell Labs pioneer for counseling on the digital-communications theories that bring CDs and even satellites to life. And after following Sloane into some formidable terrain in the mountains of upstate New York, writer *Anthony Liversidge* accompanies him into higher dimensions in Interview (page 78).

Using electrical coils, assorted cables, and machine parts, artist Dave Archer paints pictures of a different world. Collected by Schweickart and other astronauts, Archer's spacescapes ("Current Affairs," page 66) challenge the viewer to glimpse what might exist far beyond our own planet.

Author of the novel *The Neon Lotus* (Bantam), science-fiction writer *Marc Laidlaw* conjures up an alternate universe in "His Powdered Wig, His Crown of Thornes." For Laidlaw's idea of what might have been—had America not won the Revolutionary War—turn to page 50. Then, on page 74, *Richard Kadrey* weaves a tale of a woman who sold her dreams in "Becoming Cindy."

A note to those readers who buy *Omni* at the newsstand: The material used to wrap this issue is plastic made with cornstarch and an oxidizing agent to help it break down faster and more efficiently—in a span of two to six years, depending on landfill conditions. This is the most degradable wrapping currently available. We hope someday an even more ecologically sound product will be introduced. OO

OMNI

BOB GUCCIONE,
editor in chief & publisher

KATHY KEETON,
president
OMNI PUBLICATIONS INTERNATIONAL LTD

THE CORPORATION

Bob Guccione (chairman of the board)
Kathy Keeton (vice-chairman)
David J. Myerson (president)
John C. Prebich (executive v.p. and finance)
Antonia J. Guccione (secretary-treasurer)
William S. Maillis (president, marketing and advertising sales)
John Evans (senior v.p., foreign editions)

EDITORIAL

Editor in Chief: Bob Guccione; *Editor, Penthouse:* Joseph Mangino; *Managing Editor:* Steve Fox; *Senior Editors:* Pamela Weintraub, Murray Cox; *Fiction Editors:* Ellen Datlow; *Humor Editor:* Bill Lee; *Staff Writer:* Kathleen Stein; *Assistant Managing Editor:* Don Armstrong; *Associate Editors:* Tim Sworszyn, Kevin McKinney; *Copy Chief:* Ian Ellen; *Literary Rights Manager:* Babette C. Lefrak; *Picture Editor:* Nina Guccione; *Research Editor:* Justine K. Kaplan; *Assistant Editor:* Mary S. Erickson; *Editorial Assistant:* Shira Boodysey; *Senior Editor:* Scot Morris; *Editorial Director, Penthouse Division:* Babette C. Lefrak; *Assistant to Editorial Director:* Robert Mangino; *Contributing Editors:* Ellen Kunes, Bill Lawton, Marion Long, Cathy Spencer

Offices: 1965 Broadway New York, NY 10023-5965. Tel. (212) 496-6100 Telex 237128

ART

Sr. VP/Graphics Dir.: Frank DeVino; *Art Dir.:* Dwayne Flinchum; *Assoc. Art Dir.:* Rena Levy; *Designer:* Cathryn Bongiorno; *Art and Photo Ed.:* Hildegard Kron; *Asst. Photo Ed.:* Alison Blimey; *Art Rights Mgr.:* Gwenn Lewis; *Lumas Special Asst. to Bob Guccione:* Jane Hennon

ADVERTISING AND MARKETING

VP/Assoc. Publisher: Linda Newman; *Adv. Dir.:* Sharon Scott; *Sr. VP, Overseas Sales:* Beverley Waddell; *VP/Dir. Group Adv.:* Nancy Kesten-baum; *Assoc. Adv. Dir.:* Gina Mallon; *Sr. VP/Mid-west and Southern Adv. Dir.:* Peter Goldsmith; *VP, Western Adv. Dir.:* Brian Van-Mols; *New York Adv. Mgr.:* Glenn Smith; *Midwest Adv. Mgr.:* Phil A. Wirtz; *Assoc. Midwest Mgr.:* Ron Keown; *Sr. Category Adv. Mgr.:* Mara Payne; *Assoc. Adv. Mgr., Southern Region:* Harriet Rogers; *New England Mgr.:* Jamie Goody; *Nat. Direct Response Mgr.:* Karine Marie; *Marketing Production Dir.:* Eileen Barbutes Garber; *Adv. Prod. Dir.:* Charlene Smith; *Adv. Prod. Traffic Mgr.:* Mark Williams; *Foreign Editions Mgr.:* Michael Stevens. *Offices:* New York, 1965 Broadway New York, NY 10023-5965. Tel. (212) 496-6100, Telex No. 237128. *Midwest:* 333 N. Michigan Ave. Chicago, IL 60601, Tel. (312) 346-1933, Fax (312) 346-3518. *Detroit:* Wynkoop Hendelt, Albaum Inc., 2685 Lapeer Road, Suite 100 Auburn Hills MI 48057, Tel. (313) 373-1026. *Northeast and Canada:* 1200 Post Road East, Westport CT 06880, Tel. (203) 226-6998. *South:* 1725 K St., N.W. Suite 903, Washington, D.C. 20006, Tel. (202) 728-0320 Fax (202) 728-0399. *West Coast:* 6728 Eton Ave. Canoga Park, CA 91303, Tel. (818) 992-4777. *U.K. & Europe:* Penthouse Clubs Ltd., 11 Whitehorse St., London W1, England. *Japan:* Intergroup Communications, Ltd., Press Jiro Semba, 3F Tigier Bldg., 5-22 Shibakoen 3-Chome, Minato-ku Tokyo 105 Tel. 03-434-2607, Telex J28469 IGLTYO, Fax 434-5970. *Korea:* Kayd Advertising, Inc., Pres. S.H. Hwang, Room 402 Kunshin Annex B/D 251-1 Donwa Dong Mapo-ku, Seoul 121 Tel. 719-6906, 6907, 9813 Telex K 32144 Kayaad, Cable "Kayaad" Seoul, Fax 822-7196616

ADMINISTRATION

C.O.O.: David J. Myerson; *Sr. VP/Administrative Services:* Jeri Winston; *Sr. VP/Production Director:* John Evans; *Sr. VP/Chief Financial Officer:* John Prebich; *Controller:* Patrick Gayle; *VP/Newsstand Circ.:* Marcia Growitz; *VP/Dir., New Magazine Devel.:* Rona Cherry; *Dir. East Reg. Sales:* Chuck Anderson; *Dir. West Reg. Intl. Sales:* Bruce Eldridge; *Newsstand Dist. Mgr.:* Lori Rossi; *VP/Dir. Public Relations:* Marcia Potash; *Publicist:* Dana Hall; *Dir. Sales Promo (Mktg.):* Beverly Greiper; *Research Dir.:* Eli Ball; *Prod. Mgr.:* Tom Stinson; *Asst. Prod. Mgr.:* Nancy Rice; *Dir. Sub. Circ.:* Marcia Schoor; *Traffic Mgr.:* William Hanson

SEPTEMBER

LETTERS

COMMUNICATIONS

Power Shortage

Congratulations on your hydrogen overview ["Road to Power," June 1989]. Given the limits of magazine space, I thought Robert Keating did a good job describing the implications of hydrogen as a fuel. Herewith, a couple of widely ignored recent news items from the evolving hydrogen scene: This spring German carmaker BMW inaugurated its first dedicated liquid-hydrogen engine test stand in Munich. BMW is eyeing a major fleet test of hydrogen cars in several cities. And at the recent Paris Air Show, Messerschmitt-Boelkow-Blohm, the German partner in the European Airbus group, announced a feasibility study for a liquid-hydrogen Airbus that may fly by the mid-Nineties.

Peter Hoffmann
Editor and Publisher
The Hydrogen Letter
Hyattsville, MD

Sea Worldly

I couldn't agree more with the article on Sea World ["Seagate Continuum," June 1989]. My family and I enjoyed a visit to the park, still, we came away discussing our disappointment that it seemed to take no role in educating people about endangered species and so on. We were told a great deal about the animals but not a word about what we are doing to them. We were left with the impression that Sea World was using the animals for financial gain, and this detracted from our enjoyment. I wonder why a place that prides itself on educating people about ocean life does so little to protect it.

Bonnie Sharpless
Belton, MO

Dolphin Love

When my family visited a nature preserve on Florida's Sanibel Island, I was lucky enough to swim with a wild bottle-nosed dolphin. I will never forget the initial thrill and fear of wading into the ocean, wondering if it was a shark, then seeing the familiar rounded melon and feeling completely relaxed. Swimming with that dolphin was one of the most beautiful experiences of my life. Thank you for publishing Justine Kaplan's article "The Day of the Dolphins" [June 1989] and helping to share the magic and beauty of these creatures.

Maggie Fox
Hamilton, Ontario

Gilding Lilly

When the dust of the twentieth century has settled, I expect that John C. Lilly will be regarded with Albert Einstein and Buckminster Fuller as the rarest of creative geniuses. As his biographer, I can see that "The Day of the Dolphins" presents a confusing account of Lilly's pioneering role in dolphin research. To say that skepticism about dolphin work increased in the Sixties and to attribute this change to Lilly is bizarre. The field of dolphin-communication studies did not exist until Lilly created it in the Sixties. The assertion that "nothing he did was subject to measurement" is ridiculous. Lilly has published 5 books and 37 scientific papers about dolphins, containing vast amounts of qualitative data. It is most inappropriate to construct a value-loaded comparison between Lilly and Louis Herman. Herman belongs to a younger generation of scientists who were largely inspired toward dolphin research by Lilly's earlier efforts. Many of Lilly's foresighted observations about dolphin intelligence have recently been confirmed beyond a doubt, including Herman's punctilious demonstration that dolphins learn to respond to a man-made symbolic language.

Francis Jeffrey
Malibu, CA

Justine Kaplan responds: Most of the scientists interviewed for the article acknowledged the importance of Lilly's visionary work early in his career; many agree that their own research was inspired by it. While Lilly's ideas may have been brilliant, his lack of replicable data, coupled with his unorthodox interpretations of test results, caused the field's scientific credibility to suffer.

NAME THAT SPORT

COMPETITION

By Scot Morris

At the time of the 1988 Seoul Olympics I wrote about games that combine two or more sports (Games, September 1988). Examples ranged from windsurfing and rollerblade skating to jogging and wallyball. What's next? I wondered. Downhill hurdles? Synchronized jet skiing? We asked readers to invent original sport variations for *Omni* Competition #47. The result was enough new sport ideas to stock ten Olympiads.

Sometimes the name of the game told all: synchronized diving, toboggan jumping, trampoline volleyball, and roller tennis. Some of the silliest-sounding recreations included La Brea tar pit wrestling, full-contact sumo water ballet, and equestrian tennis.

Many suggestions were made on how to enliven existing sports. Readers who find it boring watching swimmers race in a straight line envisioned elaborate underwater feats. Others provided new ways for divers to enter the pool—pole vaulting in, for example.

For those who want to add a little pizzazz to their golf game, try these techniques: dropping the ball onto the green from a glider, parachuting it in with a model rocket launcher, or speed play, in which the object is to complete the course in the shortest time.

Target shooting could be a thrilling challenge for competitors on horseback, skis, or in midair. (A combination of skydiving and skeet shooting was cleverly named para-shooting.)

Some readers unknowingly "invented" sports that already exist (ski-jump diving into water, for example), while others anticipated upcoming events. Charles W. Brooks of San Francisco suggested human-powered underwater racing, unaware that such a contest was planned. I wrote about the first muscle-powered submarine races in the June 1989 issue of *Omni*.

I reviewed the contest entries along with Ian Arthur and Patti Taylor from Prince Manufacturing Inc. Although judged primarily on originality and practicality, some entries got our attention because of the sheer outrageousness or cleverness of their names.

The grand prize-winner gets a Windjammer cruise for two. Of the five runners-up, the top two receive Prince Response tennis rackets, the third gets a Prince racket, and the fourth and fifth get Prince shoes. All six winners receive copies of *The Next Book of Omni Games*.

GRAND PRIZE

Swimming Steeplechase. Although there were similar variations on water sports, this entry was judged practical enough to warrant the grand prize. Obstacles are either moored in the pool, below the surface, or suspended just above it. Competitors swim through rings and tubes at varying depths, over and under bars, and "porpoise" out of the water over lines of floats. Submitted by Corporal Eric Culp, New York.

RUNNERS-UP

1. **Desert Golf.** Usually golfers try to stay out of the sand, but not in this game. Using a softball and croquet mallet, play is conducted on a desert course. Players gain points by hitting a ball through a wicket or striking an opponent's ball. Sent in by George Reed, Twentynine Palms, CA.

2. **Strategy Ball.** Here's a game that combines basketball, soccer, and chess. Two teams of 16 players line up on a giant chessboard. Behind each team is a soccer goal, and at the sides of the square court are basketball nets. One player gets the ball and passes it to a teammate. On each turn they must make one legal chess move, and the person with the ball must either try to kick it into the soccer goal (six points), shoot a basket (two points), or toss the ball to a teammate. If a shot is unsuccessful or the player holding the ball is captured in a chess move, the opposing team takes over the ball. Invented by Donna Blair, East Rutherford, NJ.

3. **Greek Warrior Hexathlon.** Here are six events in the spirit of the original Olympic Games that would have tested the skill of any Greek soldier: a foot race (marathon or steeplechase), swimming (200 meter freestyle), sword fighting (fencing with sabers), Greco-Roman wrestling, weight lifting, and javelin throw for accuracy. Devised by John Huotari, Zimmerman, MN.

4. **Combo Ball.** This one links rings, jai alai, and volleyball. Rings hang above two sides of a volleyball court. Athletes swing on the rings and, with a jai alai cesta, fling a ball across a net to score on their opponents. Created by Ruth Bernstein, Gary, IN.

5. **Soccarate.** Unlike traditional soccer, players can use their hands but only to tackle one another. Standard soccer goals score ten points; karate takedowns only one. Conceived by Michael Spring, College Park, GA.

HONORABLE MENTIONS

Row of War. Crew teams pull backward against one another in an elemental test of strength and endurance in the water. Created by John Becker, Reno, NV.

Ulcer. A game combining Ultimate Frisbee and soccer. It is played on a 50-yard field with two soccer goals (two points per goal scored) and, at right angles, two Ultimate goals (one point per goal scored). Both a soccer ball and a Frisbee are in simultaneous play during the game. Suggested by Ayn Lynch, Palo Alto, CA.

Balance Fencing. Swordsmanship on a balance beam. Proposed by Lindsay Bates, Covington, GA.

Although the contest's sports were judged on feasibility, we couldn't let **Curling Iron** go by without a mention. In curling, one player slides a stone on ice while another skates ahead of the stone and sweeps the ice with a broom to control the stone's path. Curling Iron is played with steam irons on a Teflon-coated court. The object is to press as many shirts as possible with one toss of a heated iron. A teammate runs in front of the iron and controls its path using a lint brush and a can of spray starch. Contrived by Jay Maille, Union City, CA.

RHINO WARRIOR

EARTH

By Doug Starr

It was a typically soggy day during the Nepali monsoon season when Ramprit Yadav heard about the death. A body had been found in the jungle. Arriving at the scene, he examined the corpse: no wounds, just hardened skin and weathered horn. He dispatched runners to gather some local tribesmen, who agreed with his finding. So did the local army commander. Only after half a dozen witnesses signed affidavits attesting to the condition did Warden Yadav reach his official conclusion: The rhinoceros had died of old age.

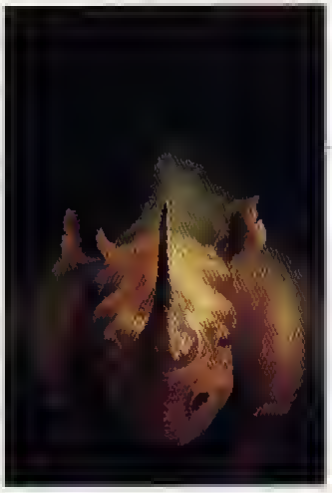
After he removed the animal's horn and hooves—these would go to a storeroom in Katmandu—dozens of tribesmen descended on the dead rhino, hacking and tearing it to pieces. After an hour nothing remained except for some rust-colored stains on the ground.

This ritual, which takes place a few times a year in Nepal, is part of one of the most successful conservation programs in the world. Driven by a lucrative market for the beast's horn and flesh, poachers have hunted the rhino to near extinction in every country of the animal's habitat throughout Africa and Asia. Yet Nepal, one of the poorest countries in the world, has effectively halted the rhino's decline. While the rhinos of Kenya, Uganda, and Zambia have been decimated, Nepal's herd has quadrupled in the last 15 years. It happened, ironically, because the king liked to hunt rhinos.

The beasts lived in relative security in southern Nepal's Terai region, an uninhabited zone of malarial jungle and grassland. The king's parties would load up on quinine, ride into the area, and shoot a dozen or so rhinos. The killings did not threaten the populations, which had plenty of time and space in which to propagate. Then, in the Fifties and Sixties, American-sponsored programs of DDT spraying eliminated malaria from the Terai. Gone was the rhino's natural moat as thousands of impoverished hill people moved to the region and began slashing and burning to make way for farms.

Poachers poured in as well. Yemenite men had long coveted rhino-horn handles for their decorative daggers. The oil cartel made the Yemenites rich enough to buy them. The economic boom in the Orient inflated the demand for powdered rhino horn, traditionally used for cures and aphrodisiacs. By the mid-Eighties the value of rhino parts had skyrocketed to $13,000 a pound.

Nepalis killed rhinos, too. Hindus use rhino horns for a ceremony called Turpa, in which they pour water over a horn fragment as part of a ceremony honoring ancestors. Lacking the horn, they may use the skin or hooves. Even the kneecap of the rhino can serve as a ceremonial cup. Some Nepalis drink rhino urine as an antidote for asthma and digestive disorders or apply it to the skin to disinfect wounds. Women may drink a solution of rhino blood to relieve menstrual cramps, and a rhino-skin bracelet is thought to bring luck. "People believe that if they eat rhino meat they will go to heaven," Malu Mohato, a seventy-five-year-old Tharu tribesman, said through an interpreter. "I don't know why. Maybe because the rhino is so big and powerful."



The king's decree. Horns of plenty.

At six feet in height, with a weight of two tons, the great one-horned rhino is a powerful beast but no match for people's greed. Worldwide, the population of rhinos plummeted from more than 100,000 in the early 1900s to a mere 11,000 today. By the early Seventies Nepal's rhino population numbered fewer than 90. The great beast was on its way to extinction.

Then the king of Nepal stepped in. A sportsman in the Teddy Roosevelt mold, King Mahendra had spent decades hunting rhinos, tigers, and other animals at the royal hunting reserve in the Terai. Alarmed at the rhino's decline, he planned a series of steps to protect the animal. Upon King Mahendra's death in 1972 his son, King Birendra, put the plan into effect.

Birendra declared the rhino protected. He generously converted its largest habitat—his family's hunting reserve—into a national park. To do this, however, he ungenerously evicted some 22,000 squatters. Chitwan National Park, as it's called, now stretches over 360 square miles. And a unit of the army—about 850 men—enforces the royal decree. Stationed at outposts every few miles, they are ordered to shoot poachers on sight. "The general guidelines were to shoot below the waist," says ecologist Sanat Dhunghel. "But it was generally understood that if a poacher was killed, there would be no investigation."

Poachers who survived faced rigorous prosecution. Merely possessing a piece of a rhino meant spending up to five years in one of Nepal's dungeonlike jails, plus paying a $2,000 fine—three and a half years' wages for the average Nepali. Authorities dispensed with certain democratic niceties, such as the right to a trial. The park warden acts as both prosecutor and judge. "We have one of the strictest laws in the world: whether you like it or not," says Dhunghel. "The park closes at sunset. After that the people are scared stiff to go in there.

CONTINUED ON PAGE 92

ISLANDS OF GENIUS

MIND

By Rosemarie Robotham

Two and a half months premature Ellen Boudreaux weighed a scant two pounds. Doctors administered oxygen for 12 days, but her weight fell. The doctors advised Boudreaux's parents not to name the infant, to accept that their daughter would die. But Ellen had other plans. Rallying to the cause of her survival, she went home ten weeks later. But the use of oxygen—a procedure now largely abandoned—had rendered her blind. And there were other handicaps. Boudreaux was late in walking, although when, at four, she did, it was with an uncanny spatial sense. She could, her father says, run through the thickest of woods, instinctively avoiding every tree. She was a hyperactive child, her speech a gibberish of parroted phrases, humming and mumbled words. By adulthood Boudreaux still had not mastered the most basic conversational skills. Her only connected language was in singing the words to hundreds of songs she knew.

Boudreaux, now thirty-two, possesses an extraordinary musical ear. She can sing any song after hearing it once and has memorized whole musicals, playing them back on the piano. Her astonishing memory and musical skill stand in stark contrast to her severe intellectual defects, making Boudreaux a part of that seldom-seen neuropsychological phenomenon portrayed by Dustin Hoffman in the movie *Rain Man*—the idiot savant.

Dr. Darold Treffert, a psychiatrist and director of Wisconsin's Fond du Lac Health Care Center, prefers the term *savant syndrome*. (Almost all of the few hundred cases reported worldwide have occurred in persons with IQs of 40 or above. 25 is the scientific ceiling for the classification of "idiot.") "The savant syndrome," the psychiatrist explains, "is an exceedingly rare condition in which persons with serious mental handicaps have spectacular islands of intelligence, even genius, in a sea of mental disability." These islands of brilliance, given the scope of talents in the human repertoire, are confined to a narrow range of skills: a flair for music or the visual arts, mathematical ability, mechanical wizardry, or mnemonic skills such as calendar calculation (divining instantly the day of the week a particular date will fall on in a given year). The trait that binds these facilities together is superior memory of an idiosyncratic, emotionless, enigmatic sort.

How do savants do what they do? Does the savant's cerebral cortex, where billions of neurons translate outside stimuli into perception, differ from a normal brain's? And what is the role of the primitive subcortical pathways of memory? These questions have absorbed researchers since 1887, when J. Langdon Down first described the condition to the Medical Society of London. In the absence of conclusive findings, theories abound. Among them: Savants are capable of eidetic imagery, an intense visual image that remains imprinted on the brain long after the stimulus has been removed; savants' abilities are inherited; savants experience sensory deprivation and social isolation, which leads to boredom, causing them to adopt bizarre and trivial preoccupations; savants have impaired conceptual ability, producing a reliance on concrete thinking; savants develop their skills through repetition to compensate for their mental defects.

Rain Man. *Tapping ancestral memories?*

Treffert, author of *Extraordinary People*, the most exhaustive study of savantism to date, dismisses these theories as partial explanations. He suggests that the syndrome has its roots in dysfunction of the cerebral cortex, due to pre- or postnatal injury to the brain's left hemisphere, with compensatory "recruitment" of some language and motor skills by the right hemisphere.

Neil Charness, a cognitive psychologist at the University of Waterloo in Ontario, Canada, has used CT scans to study organic brain dysfunction in a profoundly retarded, blind, epileptic thirty-six-year-old man with prodigious musical gifts. In support of Treffert's theory, Charness found a "cystlike structure" in the third and lateral ventricles of the savant's left hemisphere. "It looked," Charness says, "like a large hole in his brain." There was damage to the right hemisphere as well, but nowhere near as extensive as that to the left. Other scientists, using CT scans and autopsy data, have noted similar left-brain defects in other savants.

Cautioning against oversimplification, Treffert points out that while normal brains typically exhibit left-hemisphere dominance, savants tend to be deficient in left-hemisphere functions, the use of language and other logical, conceptual, and abstract skills. The savant's unusual talents are generally associated with the right brain, which governs spatial perception, visualization, mechanical dexterity, and movement.

Such right-brain compensation for left-brain deficits may account for the art of Alonzo Clemons, a thirty-two-year-old sculptor of clay animals. Clemons was born normal, but after a fall at age three, his development slowed markedly. Clemons cannot speak clearly, indicating

CONTINUED ON PAGE 110

HEALING A BROKEN HEART

BODY

By Bill Lawren

A day after he appeared at his local hospital's emergency room—pale, sweating, and complaining of severe pain in his chest, neck, and left arm—an otherwise healthy middle-aged man remains under 24-hour observation. Because his symptoms indicate a possible heart attack, doctors admit him to the coronary intensive care unit. To find out what, if any, damage their patient's cardiac tissue has sustained, they order a routine battery of tests: an electrocardiogram (EKG), an echocardiogram (ultrasound used to visualize internal cardiac structures and function), and a radioactive thallium scan. Thallium scans, however, highlight *normal* tissue, and areas of the heart injured by the obstructed blood flow that precedes a heart attack show up only as vague abnormalities.

When all of the test results fail to yield a conclusive diagnosis, the doctors decide to try a new way of diagnosing heart attacks: using monoclonal antibodies, antibody proteins designed to bind exclusively to a single type of molecule. They swab the patient's arm and give him a shot of Myoscint, a recently developed monoclonal that speeds straight to the heart to bind with myosin, a protein released only by dying heart cells. Because Myoscint is labeled with a radioactive isotope, the doctors use a gamma camera—standard equipment for nuclear imaging—to take a picture of its path through the heart. Just a few hours later they huddle over the test results—a multicolored image of their patient's heart—scrutinizing it for telltale patches of brilliant yellow, the sign of dead cells. In this case a yellow blemish appears at the base of the heart—a definite heart attack, but only a small one.

With minor variations, this scenario has been played out more than a thousand times at 35 hospitals in the United States and Europe. Doctors testing Myoscint say it heralds a new era in the diagnosis and treatment of heart disease—still the number one killer of adults in the United States—and has important implications for heart transplant patients. "It's the only antibody system that works consistently," says Ban-an Khaw, a cardiology researcher at Massachusetts General Hospital who was instrumental in developing the technique. Scientists at Centocor, the Pennsylvania biotechnology company that combined monoclonal antibodies with nuclear imaging technology to create Myoscint, have used similar means to formulate a highly specific test for pinpointing blood clots, which often lead to heart attacks. And they are working on a test that could become the sine qua non of preventive cardiology, a noninvasive procedure showing how much plaque has built up in a patient's blood vessels.

Cambridge University researchers introduced the original monoclonal antibodies in 1975. Biologists Cesar Milstein and William Kohler attracted worldwide attention when they announced their development of a line of long-lived antibody proteins able to bind to specific molecules. After injecting mice with a foreign substance, or antigen, the researchers removed the antibody-producing cells that clung *only* to that antigen from the animals' spleens. Next they fused the specialized spleen cells in culture with a line of continually reproducing cells grown from a mouse tumor. By conferring the self-perpetuating nature of the tumor cells on the spleen cells, Milstein and Kohler created a unique type of hybrid cell, or hybridoma. In the lab they maintained individual colonies of hybridomas, or *clones*, as separate cultures, each producing *only* the type of antibody specific to a single antigen—hence the name *monoclonal antibodies*.

Monoclonals scan the heart for dying cells

The press quickly embraced the new antibody technology, hailing it as a potential cure for a wide variety of diseases, especially cancer. While Milstein and Kohler went on to win the 1984 Nobel prize in medicine for their achievement, it became apparent to the scientific community that the most immediate application for monoclonals would be as powerful tools for making diagnoses. In fact, after a decade of intensive and widespread research that spawned monoclonals capable of diagnosing infections, predicting ovulation, and suppressing rejection episodes in kidney transplant patients, only one form of cancer has yielded to monoclonal treatment—hairy-cell leukemia, an extremely rare form of the disease. Recently, however, several companies have announced that they are ready to begin human trials of monoclonals engineered to destroy specific types of cancer cells, including those that proliferate in lymphoma, melanoma, and colon cancer.

Centocor researchers were already working on lines of monoclonals to treat blood clots and deadly septic-shock infections when the company's development team decided to apply the new technology to diagnosing heart disease. For more than 30 percent of all suspected heart attacks, existing tests such as EKGs and cardiac enzyme counts fail to yield a concrete diagnosis. In collaboration with Khaw and his

colleagues at Massachusetts General, Centocor investigators began to work with myosin, a protein that, under normal circumstances, is found only *inside* the membranes of heart cells. When the cells die during a heart attack, however, those membranes break down, releasing myosin. After developing a monoclonal antibody that bound exclusively to myosin, the researchers tagged it with indium 111, a radioactive isotope, so they could track the escaped protein in patients with heart attack symptoms. They called their new test Myoscint.

Once injected into a patient's bloodstream, Myoscint travels to the heart and binds promptly with the myosin within dying heart cells. The indium 111 literally lights up on the screen of the gamma camera imaging machine, allowing doctors to see precisely where heart cells have died and how much damage has been done to nearby tissue. Harvey Berger, Centocor's senior researcher, says doctors can also use the test results to establish a prognosis for the future. "We've found that the extent of a heart attack as shown on the Myoscint scan is the single most important predictor of subsequent attacks and death," he notes.

Heart transplant patients are already reaping the benefits of Myoscint. When a cardiac patient receives a transplanted heart, as about 1,800 U.S. citizens did in 1987, doctors perform weekly biopsies on the new organ to detect early signs of rejection (the immune system's rebellion against the insult of receiving foreign tissue). The procedure, which some patients suffer as many as 20 times, requires inserting a needle directly into the heart to retrieve a tissue sample. Each biopsy, however, can be used to recognize symptoms of rejection only in that particular area of the heart. Moreover, the immunosuppressive drugs transplant patients take to reduce the risk of rejection often mask the signs of such an episode. In a study published in *Circulation* in 1987, investigators found Myoscint capable of precisely delineating the area of rejection 80 percent of the time.

Heart disease can begin with something as simple as a blood clot lurking in the body's veins, most often in a leg. Doctors treat more than 2 million people each year for clots, which set the stage for strokes and pulmonary embolisms (life-threatening lung obstructions by clots on the move) as well as cardiac disease. Now Berger and his team, in collaboration with Dr. Bo Kudryk of the New York Blood Center, have developed Fibriscint, a test to identify blood clots in the legs *before* they cause trouble. This time the researchers targeted fibrin, a gellike protein that functions as the glue in clot formation. After designing a monoclonal antibody to bind exclusively to fibrin, they tagged it with a radioactive isotope called technetium 99m. When injected into a patient's arm, Fibriscint binds to the fibrin in any clots it finds, illuminating them in yellow on the gamma camera's screen. As with the indium 111 in Myoscint, the dose of radiation that patients receive from the technetium 99m in Fibriscint is smaller than what they would get from a series of chest X rays. The test is painless, and results are available within two hours.

Doctors are now concluding the final phase of clinical trials of Fibriscint, and Centocor officials hope to get FDA approval to market it as a diagnostic product by early 1991. In tests at 75 hospitals here and abroad, Berger says, Fibriscint scored extremely high for accurately imaging clots in patients' legs. Centocor scientists are now working with cardiology researchers at Cedars Sinai Hospital in Los Angeles to refine Fibriscint so that it can image clots in the coronary arteries. Dr. Abass Alavi, director of nuclear medicine at the Hospital of the University of Pennsylvania, believes Fibriscint may eventually be used to determine whether medication has effectively eliminated a clot. "Experimental evidence indicates that Fibriscint can be used to detect clots in the heart as well as the deep veins," he says. "By repeating the test, doctors will be able to see whether they have successfully dissolved the clots."

> *"Myoscint lights up dead cells on the gamma camera screen, allowing doctors to see where cells have died and how much damage has been done to nearby tissue."*

Because of its simplicity and accuracy, Fibriscint should revolutionize the diagnosis of blood clots in the deep veins of the legs. Until now doctors have had to rely on a painful test called X-ray contrast venography, for which they inject a contrast dye into a vein in the patient's foot while he is suspended upside down. Even when it provides a clear picture, venography can't always distinguish between old, healed clots—which need no treatment—and fresh, dangerous ones, which can make their way to a patient's lungs or heart.

Berger is most excited, however, about a series of monoclonal antibodies he and his colleagues have developed to image the atherosclerotic plaque that leads to narrowed arteries, clot formation, and eventually heart attacks. Atherosclerotic plaque, sometimes caused by elevated cholesterol levels or high blood pressure, can close a patient's coronary arteries so completely that virtually no blood gets through, thus setting the stage for a heart attack. An angiogram, the current means of detecting plaque formation, requires threading a tube through the patient's vascular system, a highly invasive procedure that is both difficult and dangerous. A test using monoclonal antibodies, on the other hand, would be no more invasive than a shot in the arm.

Because plaque consists of more than 50 different substances, however, it is a more complex target than either dead heart cells or blood clots. Berger and his colleagues have developed an imaging agent with monoclonal antibodies to two components of plaque. Researchers using the new test, called Capiscint, report promising results in trials with rabbits, and Berger expects clinical trials on people to start before the end of the year. According to Khaw, although Capiscint successfully finds its target plaque, it doesn't make the plaque fully visible on a screen. Even so, he says, these plaque antibodies, or others like them, are "the next frontier" for cardiology imaging. "Heart specialists would love to have a test that can target atherosclerotic plaque before a heart attack occurs," he points out.

Berger believes the test for plaque could become the first practical means of scanning the arteries of high-risk patients—those whose parents had early heart attacks or whose serum cholesterol count tops 400—to assess the amount of plaque buildup before chest pains or other danger signs set in. Based on Capiscint test results, he says, doctors could prescribe changes in diet or drug therapy to short-circuit the process that could ultimately lead to a heart attack. "Cardiologists can begin to think in terms of preventing heart disease instead of just doing end-stage repair," he says.

The development of Myoscint, Fibriscint, and Capiscint should ultimately vindicate the expectations scientists and the media held out for monoclonal antibodies. Dr. Alavi believes that the tests will be widely used and that patients should benefit from both the ease of the procedure and the reduction in cost from that of existing tests. Centocor officials estimate that hospitals will charge approximately $500 for each of the new exams. The risks from the radioactive tags are negligible, and doctors using the tests have recorded no allergic reactions to the antibodies. For a nation plagued by heart disease, the new tests could offer a new lease on life.

ARTIFICIAL INTELLIGENCE

By Paul McCarthy

How does Roseanne Barr or any other professional comedian for that matter set up a joke and deliver a punch line that is unrelated to the situation she has just presented? "What triggers the idea?" asks real estate tycoon and would-be comedian Marsh Fisher. For 13 years Fisher kept pondering that problem and finally concluded that although the setup and the punch line are unrelated, a connecting word link is associated with both. "That's what triggers the punch line," Fisher says, "and that was the breakthrough that led to the development of the computer program *The IdeaFisher*."

In 1977, after cofounding, developing, then selling his interest in the Century-21 Real Estate organization, Fisher retired to Hawaii "to sit on the beach" and write a book explaining how to find associations in order to write good comedy. To find connecting word links on a regular basis, though, Fisher knew he needed oodles of words associated with the setup and punch line.

Twelve years, 250 employees and $3.5 million later the proposed book grew into *The IdeaFisher* with more than 65,000 words and phrases arranged into 28 categories and 373 subcategories and with 675,000 associations and several thousand questions—all of it designed to stir the creative juices. "The program is like an electronic brainstormer," Fisher says. "It makes us better problem solvers and thinkers because we think by association, we categorize like things together."

According to Fisher, our brains don't store *restaurant* under *R* like Ma Bell does but under "food," "lunch," "good times," and a host of other categories.

Query *red*, for instance, in the IdeaBank of words and phrases. Twenty varieties—including people, animals, things, places, verbs, abstractions, and events—leap out. There are also about 600 associations for *red*: *Scarlett O'Hara, lobsters, blood, Red Square, red tape, bullfights*, and *tickled pink*.

There is no secret to the IdeaBank. Fisher says, "We are just organizing the human language in an entirely new, yet natural, way." The bank consists of words culled from dictionaries, words Fisher labels *Time* magazine level. Concepts or whole categories of associations are arranged so that unlikely relationships will jump out.

The IdeaBank, however, is only part of the program. The QuestionBank contains several thousand questions that facilitate problem solving. The two banks can be used independently or in a back-and-forth process in which word associations trigger answers to the questions and the questions prompt the user to plug in new associations.

The questions fall under various headings and are designed to force the user to think very quickly and in a systematic way, about a problem and record his thoughts on the screen. The questions focus the user and allow him to reflect on the thoughts he has just typed out on the screen. Alex Pattakos, public administration and political science professor at Idaho's Boise State University, for instance, tapped into the program when he participated in a Boise task force organized to deal with the problem of teenagers cruising the downtown area. At first members of the task force discussed punitive, get-tough ordinances to stop the cruising. "*The IdeaFisher*, however, forced us to look at the positive side," says Pattakos. "Cruising creates activity downtown, and that could mean a customer base for new small businesses that cater to young people."

Fisher envisions his program as a "living brain." In the future he hopes to work out associations for basic concepts in physics, engineering, law, and medicine. "In my wildest dreams," he says, "I hope the day comes when the processes and techniques for getting new and better ideas will be taught at every grade level and will be just as important to learn as the three R's. Good ideas got us here. Great ideas will determine our future."

Fishing for ideas? This database program will help you make your creative concepts flow

CONTINUUM

BLOWING IN THE WIND

You mean you can t just go to the factory with the biggest smokestacks blowing junk into the air kick in the door tell them you're the Feds and haul them all off to jail like the G men? I asked

'If it was only that easy John Tillman, director of Washington operations for the Office of Air Quality Planning and Standards at the Environmental Protection Agency (EPA) said as he pointed out the window at the Washington DC skyline

See that smokestack off in the distance? See what's coming out? It s steam Harmless He turned back to me 'Everyone thinks they know what pollution is Stuff might look bad but it isn t as harmful as say bad ozone the low level pollutant formed when sunlight is mixed with nitrogen dioxide and hydrocarbons emitted in exhaust from automobiles and industry

It's called bad ozone to distinguish it from the good ozone in the upper atmosphere that shields us from the sun s harmful effects A lot of our job is gathering data so we know our priorities in dealing with the most harmful pollutants first

We still have a long way to go on ozone he admits but a few minutes later points out how far they ve come in ridding the air of lead Being at the EPA for him however isn t just a way of taking a smooth career path Tillman was one of the millions who showed up for Earth Day in April 1970 That year Senator Edmund Muskie from Maine heard the voice of the people and responded as chief sponsor of what became known as the Clean Air Act of 1970 President Nixon fearing a Muskie presidential campaign pitching the senator as the good environment candidate signed the bill into law on December 31 1970 and created the EPA as part of the package The EPA was supposed to implement the cleanup of America by among other things setting national air-quality standards and establishing penalties for violators

The EPA has proved to be anything but gangbusters To date the agency has done little about the more than 200 industrial plants around the country that pose cancer risks at levels at least 1 000 times higher than the federal government considers acceptable And according to a June 1989 *Washington Post* article Although in the mid-80s Congress directed the EPA to limit emissions of such pollutants the agency regulated only seven of the 200 airborne substances considered hazardous

How much this will change is anyone s guess While I was meeting with Tillman President Bush was proposing amendments to the Clean Air Act that call for ' the use of clean-burning alternatives like natural gas and alcohol instead of gasoline in areas that have the worst pollution At an outdoor podium at the Teton Science School near Jackson Wyoming the President asked for reductions in emissions that cause bad ozone As George Bush proclaimed himself the environmental president I realized that had the EPA done its job there wouldn't have been a need for such amendments During the Reagan administration the agency nearly turned its back on clean air by allowing industry all types of exemptions doubling the number of 1982 cars receiving special exemptions from carbon monoxide standards and delaying regulation of nitrogen dioxide and tiny toxic particles emitted by vehicles

Could the agency be bolstered by a strong armed crime stopper like J Edgar Hoover willing to chase down and kick the crap out of our major polluters? So do you guys keep a most wanted file like the FBI? I asked

Tillman shook his head no embarrassed by the thought

Well do you at least have a top ten list of the worst cities?

He handed me a dull looking booklet entitled *National Air Quality and Emissions Trends Report 1987* (the most recent survey conducted) and told me the data were all there

After a few minutes I tallied up a rough score of the worst areas in the United States for air pollution according to the highest quarterly maximum concentrations of pollutants in micrograms per cubic meter St Louis Missouri was number one Birmingham, Alabama, two Gary–Hammond Indiana, three Orange County, New York four Philadelphia five

Don t you think it would do some good to list the Who s Who of worst places to live?' I said pushing Tillman to the mat. That it might inspire the people who live there to clean up the places?

Well we don't like to point fingers he said Not only was that the purpose of creating the EPA—to point fingers—but something had died in him and perhaps in all of us since Earth Day 1970 We had tolerated the EPA's negligence Under the Clean Air Act we were asked as 'citizens to file suit in federal court against the EPA for failure to perform its duties Obviously it s time we marched again —*R EDWARD McNEIL*

CONTINUUM

What do a sperm whale and a jojoba tree have in common? Both are sources of valuable lubricants but one is prohibited by law and the other is prohibitively expensive

SEEDY BUSINESS

The cosmetics defense and aerospace industries all suffered a heavy blow in the early Seventies when the sale of sperm whale oil was banned by the Endangered Species Act Sperm whale oil was valuable as a lubricant in high-temperature high-pressure environments such as engine transmissions and computers

An alternative oil made from the seeds of the jojoba tree is an adequate but expensive substitute

But a recent breakthrough—successfully cloning jojoba trees—has been made at the University of California Riverside (UCR)

Himayat Naqvi leader of the jojoba research team says that only the cosmetics industry could afford the naturally grown oil The oil sells for $35 to $40 a gallon mostly because of low seed yield a problem that commercial jojoba growers have been trying to solve for years UCR scientists are cloning the female jojoba developing a strain that produces more than 4 000 pounds of seed per acre Commercial growers now get no more than 500 pounds

There was so much hype about jojoba in the mid-Seventies that many growers rushed into business with seed they planted from the wild explains Naqvi You can t expect to get a profitable crop from wild seed We test for many generations and select for high uniform yield ' says Naqvi

But it will take up to five years to produce usable seeds '—George Nobbe

BODY MUSIC

Strap on a headband and a couple of armbands close your eyes and start waving your hands around Presto! You're making beautiful music with just the motions of your body That s the promise of Biomuse, an electronic music system being developed by researchers from Stanford University

Biomuse s creators Hugh S Lusted and R Benjamin Knapp, say the device represents a marriage of brain physiology and sophisticated computer electronics Electrodes in the system s head- and armbands will pick up electronic signals from the muscles in the eye arm and hand These signals will be relayed to a black box, which will translate the signals into a musical instrument digital interface (MIDI) code which can drive a synthesizer Thus says Lusted you can listen to your body make music and then learn to manipulate the sound

Lusted believes that Biomuse can also be used to give voice to the audibly handicapped or as a training device for athletes who would then be able to literally 'listen to their bodies as they exercise Lusted also talks of hooking the system up to intelligent animals The body is a symphony of electronic voices say the inventors who think that the Biomuse could retail for $2 000 to $4 000 —Bill Lawren

'Sentimentally I am disposed to harmony but organically I am incapable of a tune'
—Charles Lamb

MICROMACHINES

Metal micromachines too small to see promise to make their importance felt in a variety of fields from medicine (tiny Roto Rooter type devices could be used to clear clogged arteries) to security surveillance (miniature flying robots the size of gnats could patrol areas)

Until now silicon has been the stuff of American micromachine technology A silicon motor about as thick as a human hair and powered by static electricity was recently built at the University of California, Berkeley But metals may be more versatile, according to a team of researchers at the University of Wisconsin in Madison

'Silicon is somewhat brittle points out Henry Guckel professor of electrical and computer engineering, ' and it s only *one* material We re looking to examine the possibilities of the whole family of metals and of metal alloys as well ' Particularly when it comes to building microscopic machines with moving parts he says metals should hold up better and actually prove easier to manufacture

The technology that allows the Wisconsin group to dream in extreme miniature is a new variation on methods for making integrated circuits The major difference in this type of micromachine manufacture according to Denice Denton also a professor of electrical and computer engineering is that the resulting structures are not flat, as integrated circuits are allowing for many variations in form and function

Lilliputian patrol That may not be a fly you hear buzzing in your ear but microscopic machines planned for the future

High energy X rays crucial to the production process come from the university's synchrotron laboratory

German scientists pioneered this approach called deep etch X ray lithography at the Nuclear Research Center in Karlsruhe They have made a metal micromachine useful in nuclear power production, the device separates isotopes of uranium fuel The Wisconsin group is exploring the possibilities of microscopic metal valves pumps and gears

—Dava Sobel

BACKYARD BUZZER

Now there s good news and bad news about tornadoes The good news A University of Mississippi physicist has devised a smoke alarm-size contraption that detects imminent twisters The bad news When Henry Bass s alarm goes off you'd better run like hell it means the tornado is about to enter your backyard

Bass says that tornado warnings are so common in 'tornado alleys' like the Mississippi Delta and portions of the Midwest that most people just ignore the weather service alerts

You can t ignore Bass's alarm It won't sound until a tornado is only a few hundred yards away he says You ll have only about thirty seconds to seek shelter

The device works by detecting the eerie sound produced by twisters We've studied the only nine sound recordings of tornadoes known to exist and the device listens for the acoustic characteristics we've identified Bass explains

The tornado detector which Bass expects to market in about ten years, will cost less than $100 But you'd better have a plan ready if you intend to rely on one of these devices When this thing goes off ' says Bass a tornado is in your backyard —Sherry Baker

The more human beings proceed by plan the more effectively they may hit by accident

—Friedrich Durrenmatt

What would you do with 30 seconds to spare?

CONTINUUM

CREATURE FEATURES

Food pundits have been telling us for some time that we are what we eat. Now biologist Erick Greene of the University of California Davis has discovered that one species of caterpillar literally looks like its meals. Members of the species *Nemoria arizonaria* grow up to resemble either flowers or twigs, depending entirely on what they eat immediately after birth.

In spring, says Greene, oak trees issue hundreds of golden, fuzzy male flowers called catkins. *N. arizonaria* larvae that hatch in the spring eat the catkins, then grow up to look just like them: golden, fuzzy and with rows of dots on their back that look very much like catkins' pollen sacs. In contrast, *N. arizonaria* larvae that hatch in summer, when the catkins have already died out, eat oak leaves and grow up to be greenish-gray and skinny—looking, in other words, just like twigs.

To determine whether diet alone is responsible for the difference, Greene hatched eight groups of *N. arizonaria* in the laboratory and subjected them to different temperatures, day lengths and diets. Sure enough, only diet made any difference in the caterpillars' ultimate appearance.

Greene cannot yet explain why this is so, although he thinks the genes for the two different appearances may be responding to differences in the protein levels of the two food sources. And he says, noting that the development of queen bees is determined entirely by which larvae are fed royal jelly as their first meal, the you-are-what-you-eat phenomenon may be a lot more widespread than had previously been thought. —Bill Lawren

'There are two kinds of people in one's life—people whom one keeps waiting—and the people for whom one waits.'

—S. N. Behrman

ISLAND WIPEOUTS

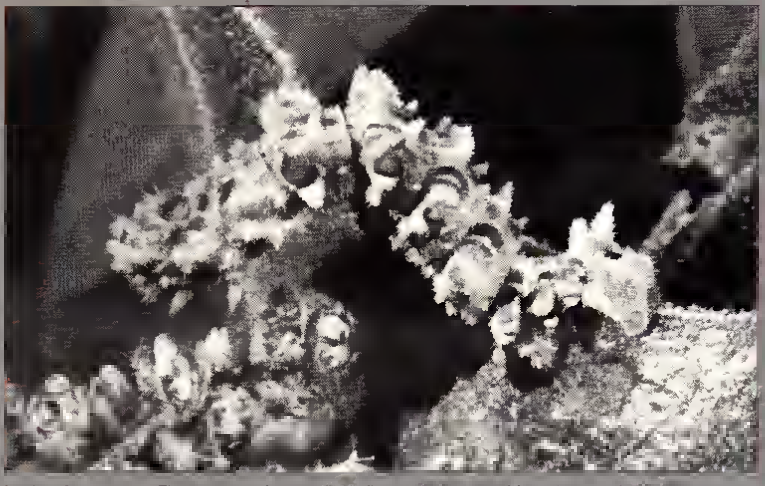
The nation of Tuvalu, a group of nine islands in the South Pacific, gained its independence just ten years ago. But if predictions about the greenhouse effect—a global warming due to a buildup of carbon dioxide in the atmosphere—are accurate, rising sea levels over the next 100 years will wipe the Tuvalu nation off the face of the earth.

The problem, explains British architect James Lewis, who authored a study of Tuvalu's plight for the upcoming Commonwealth Conference in Great Britain, is that all of Tuvalu's atoll islands lie very low—most of them in fact less than two meters above sea level. And their coral composition makes the islands extremely porous, so that a rising sea would flood them not only from the outside in but from the inside out. Rather than construct elaborate and expensive sea defenses which might or might not work, the citizens of this desperately poor country (much of its GNP comes from the sale of postage stamps) simply want out, preferably to Australia or New Zealand.

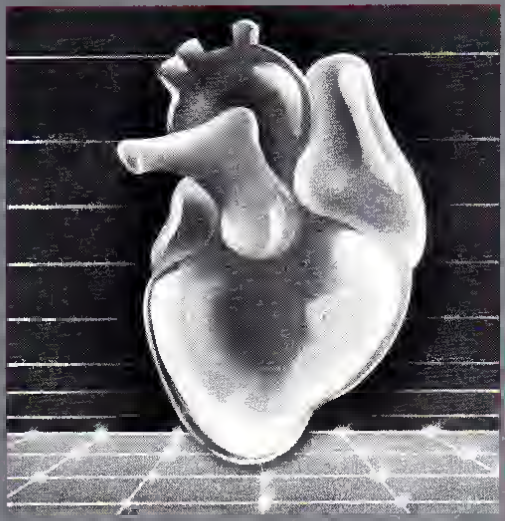
Fine. But Lewis is also worried about the more prosperous and less portable peoples of other low-lying islands—the Seychelles and the Maldives in the Indian Ocean, for example, or even some of Hawaii. In fact, he says, this is a crucial issue 'for *all* islands. Even Hong Kong? Singapore? *Manhattan?* Well, Lewis amends. Those islands are heavily populated, wealthy and very well fortified. They should be able to look after themselves.' —Bill Lawren

'The most dreadful thing of all is that millions of people in the poor countries are going to starve to death before our very eyes, upon our television sets.'

—C. P. Snow



Look before you eat. This species of caterpillar will grow [illegible] ble its first meal [illegible] ast is a choice between fuzzy flowers and shiny twigs, served [illegible] -come basis.



Having [illegible] heart Rejection is always painful, but when [illegible] organ or tissue transplant it can be fatal

PIECE OF MY HEART

Every year 30 000 to 70 000 people need a heart transplant but each year only 1 400 heerts are available A hopeful alternative, says a Purdue University researcher is the building of spare hearts from the patients' own bodies

What surgeons do is construct an extra pumping chamber called an assist ventricle to aid the original two chambers and take the strain off the heart In a typical operation a surgeon might shape conventional graft material into a heart chamber wrap it in muscle from the patient s own body, and connect the whole assembly to the heart Rigged with a special pacemaker the new heart s contractions would coincide with the weakened heart s resting phase The process could re duce the workload of a weakened heart by as much as 40 percent

At Purdue s Hillenbrand Biomedical Engineering Center Dr Stephen Badylak says he has tried the replacement technique on 150 animals and expects to see it perfected for use in humans in about five years

Recently surgeons have performed a related operation called cardiomyoplasty on people The doctors take a section of muscle generally from the patient s back wrap it around the heart and install a pacemaker to keep the muscle beating in synchrony with the heart So far 30 people around the world have undergone this experimental procedure

Both methods avoid the tissue rejection that comes with transplants and the infection and blood clotting generally associated with artificial hearts Badylak says —Henry Wouk

VOLCANIC ICECAPADE

The contrast between fire and ice has provided metaphors for everything from Renaissance visions of hell to an apocalyptic poem by Robert Frost Now astronomers who study closeup photos of the moons of Uranus have a living oozing metaphor to add the apparent existence on those satellites of volcanic processes that are driven not by fire but by an unearthly variety of ice

David G Jankowski and Steven W Squyres of Cornell University looked at detailed photographs taken by *Voyager* 2 of the surface of two of Uranus moons—Ariel and Miranda In both cases they found surface cracks filled with icy deposits resembling thick lava flows The big question is What could have caused these flows to form on satellites that lack the internal heat sources that drive volcanism on our own planet? The answer, says Squyres is ice

"People think of ice as being solid and brittle he explains "If an ice cube falls out of your glass it breaks But ice can flow just as it does in a glacier The problem is that at the supercold temperatures (as low as – 203° C) that prevail on Ariel and Miranda, water ice should stiffen up and lose its ability to flow The fact that it doesn t says Squyres suggests a mixture of water ice with either solid or liquid methane and ammonia This composite ice would have a lower viscosity than ice made of water alone, thus enabling it to flow up from under the satellite's surface "It really is volcanism says Squyres in the sense that something from down below oozes up to the surface It s just that in this case it's ice —Bill Lawren

"Nonsense is good only because common sense is so limited"

—*George Santayana*

"The best of seers is he who guesses well"

—*Euripides*

Do the gods of Uranus demand sacrificial virgins?

CONTINUUM

[illegible] at running [illegible] not own [illegible]

FILL 'ER UP IN ORBIT

If and when NASA ever sends men to Mars they'll need more than just a spaceship and time they'll also need fuel To that end NASA planners are working on an orbiting gas station of sorts—a fuel depot to store liquid oxygen and liquid hydrogen

The depot which would most likely hang out in low Earth orbit would have to hold enough fuel to gas up a spaceship for a three year mission to Mars and back Fueling such a ship in orbit instead of on the earth is necessary because we don't have rockets powerful enough to lift both the ship and its fuel out of the earth's gravity And though researchers already have the technology to build an orbiting fuel station there are still some tricky problems to solve says John Mankins, a NASA program manager

For instance the fuel station will need to be refrigerated when it's in the sun and insulated when it's in the shade The tanks themselves will need baffles in them to minimize sloshing Then there are the problems caused by zero gravity For example in zero gravity you can't weigh a tank to determine how much fuel is in it Worse because liquid floats conventional pumping systems won't work One possible solution says Mankins would be to spin or to accelerate the tank slightly creating an artificial gravity so that the fuel settles to one side of the tank and can be pumped out

As for the fuel itself NASA will probably ship it up from Earth at first Eventually though scientists hope to extract oxygen from lunar soil and process it into liquid oxygen —Devera Pine

---

"Science is a first rate piece of furniture for a man's upper chamber if he has common sense on the ground floor"
—Oliver Wendell Holmes

"I now perceive an immense omission in my Psychology *The deepest principle of human nature is the craving to be appreciated*
—William James

GENETICALLY ENGINEERED PICKLES

Damage caused by carbon dioxide during pickles fermentation process (CO_2 bloats them) has long been the bane of pickle packers who are finally getting some help from scientists at the U S Department of Agriculture's research labs in Raleigh North Carolina These researchers have developed a microorganism that can turn a cucumber into a pickle without producing CO which guarantees the consumer a crisp dill free of gas pockets and mushiness

A team of scientists led by Harry P Fleming spent the last six years chemically mutating selecting and improving strains of *Lactobacillus planatarum* the bacterium that gives pickles their familiar sour flavor Previously picklers injected their 10 000 gallon open-topped vats with nitrogen to drive off the carbon dioxide

Pickle Packers International Inc an industry association now testing the microorganism also hopes to devise closed tanks which would permit the use of less salt as a preservative Dill pickles now spend at least three weeks soaking outdoors in a 4 to 5 percent salt solution Says Fleming The tanks and the bacteria are both parts of the overall picture that could revolutionize the pickle business ' Not that the industry needs help Figures show that Americans eat nine pounds of pickles per capita every year —George Nobbe

The end may be near for bloated mushy pickles

BACTERIAPHONES

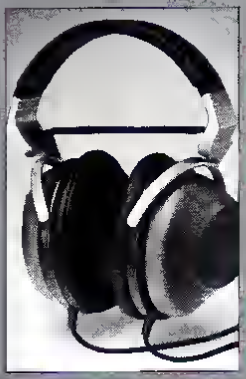
Get ready for the next wave in headphones Sony has just announced the advent of the MDR R10 superphone a headphone so exotic that one of its critical parts is actually manufactured by bacteria.

The headphone's critical part is its diaphragm the little water in the earpiece that vibrates to create the sound we hear In most headphones these diaphragms are made of compressed paper But Sony engineers found a bacterium *Acetobacter aceti* which when fed sugar solutions produces a thin cellulose material 'Its light weight and rigidity make it respond more accurately explains Sony's Jim Pepe

The bacterial diaphragm is not the only unique feature of the MDR-R10 The wood casing in which the diaphragm is mounted comes from the hearts of 200-year old zelkova trees which grow in only two regions of Japan and which won out over 200 other kinds of wood tested by Sony engineers. And as a final touch, the covering for the earpieces comes from Greek sheepskin — the softest most comfortable material available say the Sony people

It all this exotica sounds expensive to you you're right The MDR-R10's sell for $4 000 and are available only by special order through audio retailers These headphones are for the audio phile ' says Pepe They're what people use when they want to hear what things really sound like'

—Bill Lawren



Audiomaniacs: listen to what you've been missing.

'Most people would succeed in small things if they were not troubled by great ambitions '

—Henry Wadsworth Longfellow

People with only the use of their lower limbs can now have greater mobility, thanks to one man's observation of nature.

SPIDER CAR

There's something intriguing about a spiderweb A spider spinning her web supposedly inspired Robert Bruce to try, try again, until he finally led his Scottish troops to victory over the British And Charlotte's web saved Wilbur the pig from the slaughterhouse in the classic children's story

Now here's a twist A Canadian inventor has been inspired by a spider that *doesn't* spin a web Gordon Dowton a movement teacher at the Toronto Dance Theater read about the curious practice of *Tegenaria atrica* a common house spider that eschews webs in favor of jumping in the air to catch insects for dinner What interested Dowton most was that *Tegenaria's* leaps are powered not by muscle but by bodily fluid that's pumped into its legs

Using the spider as a model Dowton has now built a 14-pound aluminum and fiberglass vehicle—powered by hydraulics—that allows paraplegics to roll sideways somersault and even stretch into a near standing position

The vehicle gives the disabled a wider range of movement than a wheelchair can Riders sit low so they can push off with their hands It's like a skateboard, except you sit on it says John Hastings a paraplegic who rides the device for an hour every week

The insectlike chair is custom fitted with a molded seat and small wheels under the buttocks and heel Any pressure against one of two cylinders—one under the rear end the other at the knees—drives motor fluid into the other cylinder If you lean back fluid surges into the lower cylinder which in turn extends your knees Leaning forward flexes the knees instead By relying only on the upper body riders generate a semblance of lower leg movement

Dowton has demonstrated the device at the Ontario Science Centre and at Canadian hospitals He says the spider car helps paraplegics build muscles improve circulation, and better prepare for the day when medical science can regenerate injured spinal cords

—Robert Brody

'The power of accurate observation is commonly called cynicism by those who have not got it

—George Bernard Shaw

CONTINUUM

ROVING EYES

Saying that a robot can see is like saying George Bush can play a funky guitar There are some basic skills there, but neither is ready for the big time While a team of Rochester researchers can do nothing for George they think that they can help the robots

Computer science professors Dana Ballard and Chris Brown have managed to bestow a crude type of depth perception on their Rochester robot, which consists of a cybernetic arm and head hooked up to computers Depth perception in humans relies on stereo vision which requires two eyes But the Rochester robot is a one-eyed monster so it uses an approach called kinetic depth perception Essentially the robot moves its head around rapidly, focusing on an object from different angles This shifting perception shows the changing relationship of the object to its background and thus provides depth perception It's a bargain basement alternative to stereo vision

The Rochester group also claims it's on the way to solving another tricky vision problem called vergence what you do when you visually track something moving toward you Their robot uses a fast-acting computer program that can keep a pair of robot eyes—motor-powered cameras—focused on a moving target

What the Rochester team is hoping for is a machine that can instantly evaluate and respond to what's happening around it They hope to have the robot play reactive "thinking games" like keeping a roomful of balloons aloft by bumping them back into the air with its head

—Henry Wouk

The ships Columbus sailed across the ocean were sleek

'Computers are useless They can only give you answers'

—Pablo Picasso

'A historian is a prophet in reverse'

—Friedrich von Schlegel

COLUMBUS'S SHIPS: SLEEK AND FAST

The three sailing ships that carried Columbus and his crew to the New World in 1492 were not the oversize bulky square-riggers depicted in most history-book illustrations His craft called caravels were small sleek *fast* vessels strong enough to withstand rough weather on the open ocean but shallow and maneuverable enough to explore uncharted coastlines at close range

'Columbus didn't give detailed descriptions of his ships in his journals because he knew what they looked like and his patrons did too says Joe J Simmons a research associate in the Ships of Exploration and Discovery project part of the Institute of Nautical Archaeology at Texas A&M University "There's very little specific information recorded about these vessels In fact we know much more about ancient Egyptian ships than we know about the caravels of only five hundred years ago

Intent on filling some of these gaps in nautical knowledge Simmons along with Tom Oertling and other colleagues studied the wrecks of two Iberian ships from this period that lay buried in the Caribbean Sea near the Bahamas

Only about ten percent of the hull remained of the wreck' reports Oertling But before its keel rotted away it wore a groove in the limestone bottom, so we could measure its length

The overall dimensions of these two ships were roughly 60 to 80 feet long and 18 to 25 feet wide In stereotyped pictures however Columbus's ships are shown to be much larger—100 to 125 feet long 25 to 35 feet wide But that type of tubby-looking vessel the researchers say probably didn't come into play until later when the New World had already been colonized and there were quantities of commercial goods to ferry back and forth —Dava Sobel

KING ARTHUR'S EXCALIBUR

WROUGHT OF STAINLESS STEEL. 24 KARAT GOLD. STERLING SILVER. HAND-SET CRYSTAL CABOCHONS. INSERTED IN CRYSTAL-CLEAR ROCK.

KING ARTHUR. Immortal hero of medieval legend, he was the only one who could free the magical Excalibur from stone. And when the most famous King of chronicle and romance wielded this mighty sword, he became invincible.

Now you may own the authorized re-creation. From Europe, its blade is wrought of tempered steel. Its pommel and crossguard sculptured with Arthur's symbol of power – the dragoo. Ablaze with fiery red crystals, sterling silver and 24 karat gold, Excalibur is to he removed from its crystal-clear rock only by the man destined to possess it. $675.

The magnificent hardwood-framed display – shown smaller than actual size of 51½" high x 16½" wide – is included at no additional charge.

Excalibur shown smaller than actual length of 43"

AN OFFICIAL ISSUE OF THE INTERNATIONAL ARTHURIAN SOCIETY

The International Arthurian Society
c/o The Franklin Mint
Franklin Center, Pennsylvania 19091

Please enter my order for the authorized re-creation of King Arthur's Excalibur sword. Crafted of hand-polished tempered steel and embellished with sterling silver and 24 karat gold electroplate. The custom-designed display is included at no additional cost.

I need send no money now. I will be billed in 10 equal monthly installments of $67.50* each, beginning prior to shipment.

*Plus any state sales tax.

Please mail by September 30, 198

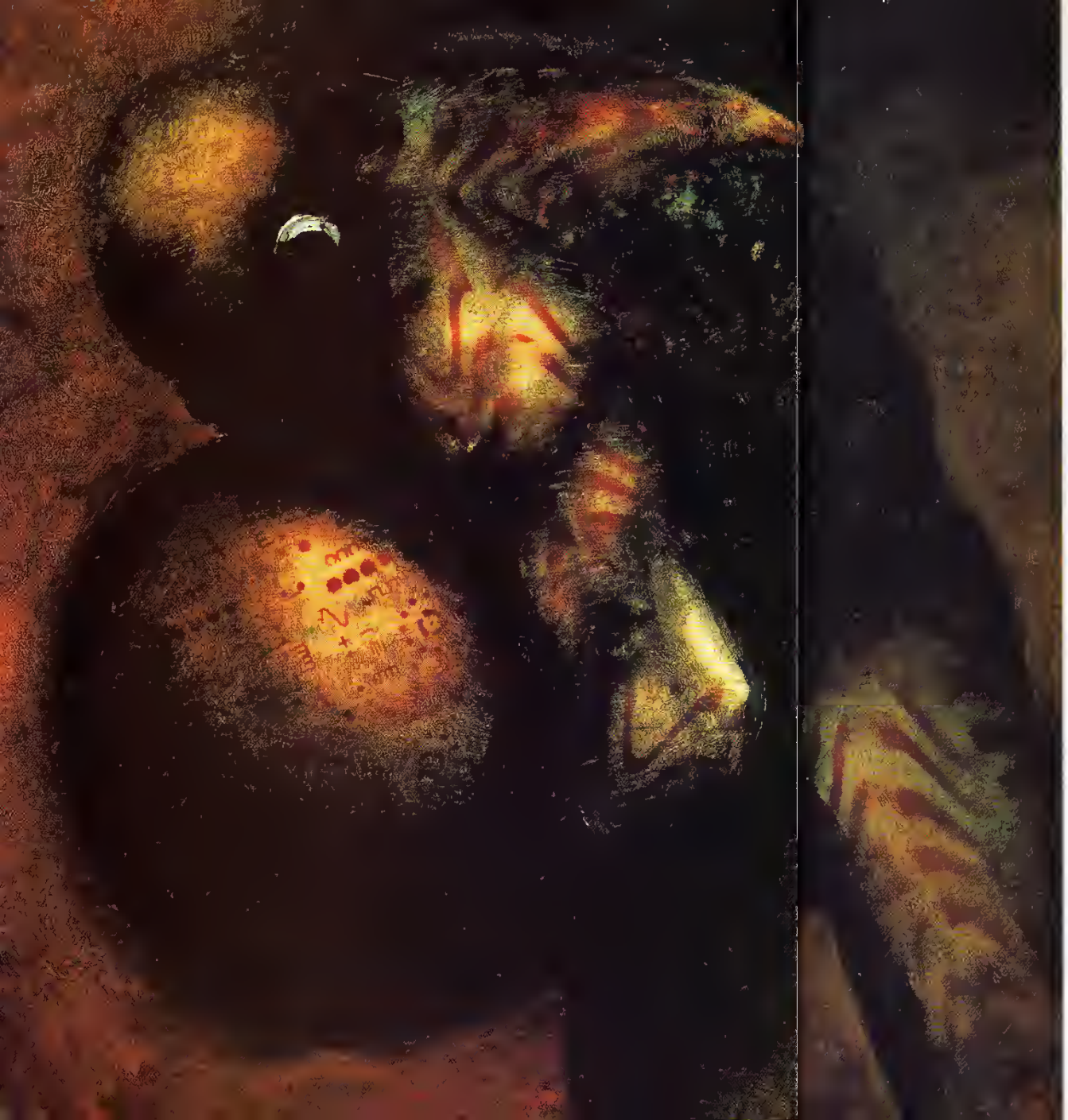
Signature _____
ALL ORDERS ARE SUBJECT TO ACCEPTANCE.

Name _____
PLEASE PRINT CLEARLY

Address _____

City, State Zip _____

05468-23



ARTICLE

Will tomorrow bring a silent spring or a brave new world? Six journalists seek answers to the earth's problems

SAVE THE PLANET

From the vantage point of Earth we look up to see the heavens At night we gaze at the stars new moon, full moon, or no moon at all during the day the sun blasts or browns us, while nimbus or cirrus clouds ease on by But if we're not careful, if we're not thoughtful, if we're not, yes, committed, we may lose our vantage point—this Earth—for millions of years home to us and our fellow species It's time to stop gazing upward and to look around at the planet itself to look at our fellow human beings, at some of their problems and their suffering

The earth's in serious trouble We've polluted the very water we drink and bathe in with human sewage and an endless amount of toxic chemicals We've chopped down forests all over the world—we've even got a name for it, *deforestation*—without any sense of what we're losing And worse, we're becoming nearly illiterate, unable to read technical manuals, high-school textbooks, or billboards on buses, to say nothing about *Don Quixote* or *A Midsummer Night's Dream* Should we be alarmed by the number of people who can't read? Words strung together form sentences, paragraphs and stories—inform us about how other people live feed our dreams introduce us to new concepts soothe our wounds, unmask our preju dices Without those basic tools we won't be able to understand and then solve the plethora of problems facing us as we move into the next century

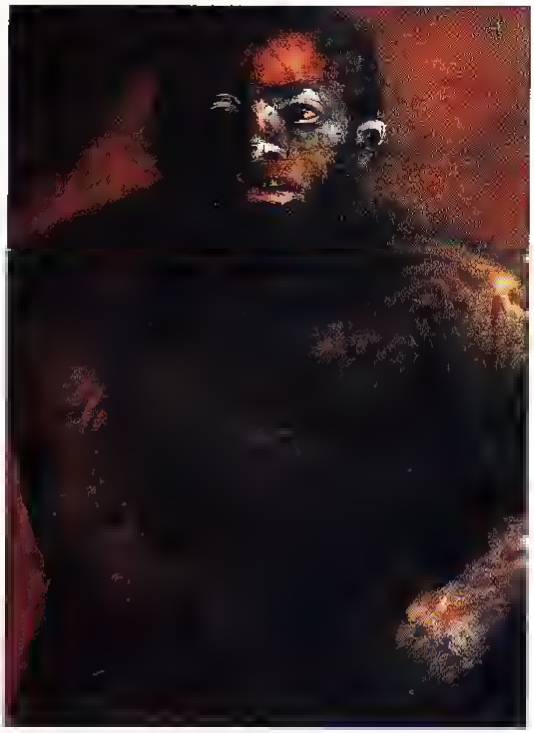
Health care, and its escalating cost, is just one of these problems Some of us can't afford to get sick We've got great medicines grand machines highly trained medical researchers and practitioners—for the benefit of some not all It's time to change that system we say so what's stopping us? Or consider the problem of war In some countries the earth is mined with bombs awaiting an innocent man woman, or child to set them off In too many

PAINTINGS BY MARSHALL ARISMAN

"By the time kids reach tenth grade, four out of five high-school students show no interest in studying science or math."

places people wake up to the sounds of automatic rifles or artillery fire. What are we handing off to our children's children? Maybe the idea of a peaceful world is an illusion, a fantasy of people who just don't understand geopolitics. Perhaps these people read too much.

Lately science has been portrayed as the great villain, spawning death technologies, wreaking havoc with the atmosphere, precipitating ill health. It's partly true. Surely scientists now know that they will never again be able to enjoy the luxury of discovery or the thrill of invention without scrutinizing the consequences of what they've found. But the nonscientist cannot rest easy either, pointing the finger of blame at the community that has furnished us with aerosols, air conditioners, automobiles—with the goods, the life-style we wanted. Many of our ills are self-inflicted, the sins of selfishness, of greed. And that problem has a solution. We can curb our seemingly endless desire for things, or there may come a day when Earth will be no more.



That's not apocalyptic; it's not a scare tactic. That message—save the planet—is everywhere, flashing from the headlines of daily newspapers, on Glad garbage bags, UN studies, the latest reports from Washington, Paris, Tokyo, or Moscow; and blaring from evening news programs and rock concerts. Out of the myriad issues that confront us, our journalists tackled six technological and human dilemmas: the inequity of our health care system; the state of our drinking water; the age-old horror of war; the alarming rates of deforestation and illiteracy; and drug abuse, whether it's on the stock exchange or New York's Lower East Side. Each issue is defined and dissected. Some politicians have their say about what legislation they're proposing to deal with; say, lead in our water. Scientists tell us, among other things, about Project 2061, a national program to eradicate illiteracy. And some kids talk about what they're thinking and what they're doing, whether it's helping their peers in remedial reading programs, attending classes after school to further their own education, or collecting rain from the playground to test it for acidity. Once upon a time, a prophet gave us a metaphor for what a world at peace would be like. Wolves and lambs, calves and lions would live together, and children would lead the strange menagerie. It could be time to take a child's hand and follow.—Murray Cox

TEACH YOUR CHILDREN

To keep this nation competitive as we move into the twenty-first century, we need scientific know-how, and we need it soon. The task: Find 450,000 scientists and engineers in fields as diverse as astrophysics, internal medicine, and biology, and find them over the next 20 years. Mindpower. We once had plenty of it, but now we're staring into a dry well.

The number of twenty-two-year-olds getting undergraduate degrees in science and engineering hasn't changed in 15 years—40 to 50 students out of every 1,000, according to a National Academy of Sciences (NAS) study. NAS predicts that figure will dip by 25 percent by the end of the Nineties. The number of science and engineering students seeking doctoral degrees has fallen 50 percent since the mid-Sixties.

The latest figures on high-school reading levels indicate that 61 percent of seventeen-year-olds can't comprehend their textbooks—whether they're history or biology texts. About half of these students cannot understand basic junior-high math, according to a National Assessment of Educational Progress report released this year. By the time they reach tenth grade, four out of five high-school students show no interest in studying science. And in an international survey financed by the National Science Foundation and the U.S. Department of Education, 24,000 thirteen-year-olds from South Korea, Spain, Ireland, England, Canada, and the United States competed in math and science tests. Korean students topped all the other competitors in math proficiency. Americans scored last in math and well below average in the sciences.

"West Germany, England, and Japan put their children through more rigorous courses in math and the basic sciences," says Dale W. Jorgenson, the director of Harvard University's Program on Technology and Economic Policy. "Kids take more science-related courses in secondary schools. There is less freedom of choice. In the late Sixties, curricula in this country opened up, offering students a greater selection of elective courses. Today we are paying the price for such academic freedom."

To remedy the situation, officials of the American Federation of Teachers (AFT) propose that elementary school teachers take math and science courses to qualify for their licenses. But the proposal will not help immediately, says Albert Shanker,

AFT's president, because new teachers lack adequate math and science credentials. Lewis Branscomb, director of Harvard's Science Technology and Public Policy department, agrees. "We have too many teachers without any training in science, and the number of teachers trained in science is small," he says. "Scientific illiteracy feeds on itself. Unsure teachers with little or no training in science communicate their math and science phobia to students."

In order to stop the frightening trend toward illiteracy, private organizations, Congress, corporations, futurists such as Marvin Cetron, and schoolteachers are supporting the drive to achieve national scientific literacy. In 1985 the American Association for the Advancement of Science (AAAS) kicked off a long-term program called Project 2061. During Phase I they defined the scope of the problem. With Phase II now under way (projected completion time: four years), teams of educators and scientists are creating new curricula, revamping teacher education programs, and designing new testing and teaching materials. School systems in five states—Texas, California, Georgia, Wisconsin, and Pennsylvania—are participating in the project. Two private organizations, the Carnegie Corporation of New York and the Mellon Foundation, provided partial funding for the first phase. IBM has agreed to furnish computers and software for the second phase.

"We're putting the teams together now," says F. James Rutherford, AAAS's chief education officer. Twenty-five people will teach for the next two and a half years at each school. "We're not interested in rote facts but in stressing the importance of thinking and creating ideas," he says. "Students need to understand the basic functions of science and how they relate to society and their lives."

Congressman Douglas Walgren (D-Pennsylvania), head of the House Subcommittee on Science, Research, and Technology, called the AAAS project an "outstanding contribution in helping to close the gap in science education." Members of Congress alarmed about the educational crisis, have proposed several bills to repair our nation's schools. Walgren supports legislation to create a national science scholarship program supervised by the National Science Foundation. Exceptional math, science and engineering students would receive $5,000 a year for four years. Another bill, introduced by Congressman Sherwood Boehlert (R-New York), proposes to give federal scholarships to top science, math, and engineering majors who consent to teach two years in public schools for each year of funding received.

Scholars at the Educational Testing Service claim that academic performance can be improved if teachers and parents demand more from students and show more interest in science and math. Educator and columnist Thomas Sowell says Americans are intellectually lazy. He blasts schools for letting students graduate without understanding long division or such basic laws of the universe as relativity or the concept of matter.

In his forthcoming book, *American Renaissance*, Marvin Cetron suggests several ways to jump-start the sluggish American educational system, including increased school budgets, more teachers, longer school hours, greater use of computers in the classroom, and a standardized core curriculum.

IBM's involvement in Project 2061 is but one example of American corporations' support for the anti-illiteracy campaign. IBM, Citibank, and Pfizer also donate money to tutorial programs. General Electric executives tutor youngsters in Spanish Harlem to prepare them to enter top-notch universities such as MIT and Stanford. Polaroid Corporation pays up to ten of its workers each year to become math and science teachers. Those eligible for the company's Project Bridge receive full salary while attending a year-long teacher certification program at Harvard University or Lesley College in Cambridge, Massachusetts.

Students themselves are taking the initiative to improve their education by attending classes after school and on weekends. At the Science Skills Center in New York City, 8,000 kids between the ages of five and nineteen take classes ranging from biology, robotics, chemistry, and physical science to rocketry, geology, and oceanography. The ten-year-old center cooperates with the city's Board of Education and medical facilities such as Downstate Medical Center. Director Michael Johnson says all of the students in the center's early groups have gone on to college, with half of the graduates majoring in engineering or science. The majority of the students who attend the classes come from the city's financially depressed neighborhoods.

The center teaches us how to use our imagination and how to form new ideas," says Dana Reid, a twelve-year-old sixth grader at PS. 268 who plans to become an engineer. "We learn to be committed. I thought it was going to be difficult, but the experiments make it interesting." Another student, Aaliyah Barclift, a ten-year-old fifth grader at PS. 307, recalls a field trip to the National Science Foundation and George Washington University's labs in Washington, DC. "I was thrilled," says the would-be surgeon. "We talked to the scientists and they told us about microbes. They had a centrifuge in the lab. It was all new for me. It was great."

The same enthusiasm resides in the public school, says Stanley Shapiro, a science and chemistry teacher at Midwood High School in Brooklyn. He teaches three chemistry and three sci-

ence research classes daily Many of the students who enroll in his demanding classes are accepted at prestigious universities after graduation eventually becoming doctors, scientists, medical researchers, and chemists "There is such poor public education in this country, especially in our science classes,' Shapiro says "In Japan, where I've lectured, science and scientists are respected But in this country science has a bad reputation A lot of teachers are afraid of the subject, and so our students are taught to be afraid and distrustful of science"

Children should be turned on to the mysteries of science and the universe in the early school grades Shapiro says The 12 year teaching veteran fosters intellectual curiosity by involving his students in challenging projects Science and chemistry students at Midwood work with scientists and researchers in labs throughout the New York City area Starting as observers, they take on manageable portions of research under the scrutiny of their mentors Once a kid gets in research, everything else seems boring," Shapiro says Twenty Midwood students have won scholarships in the Westinghouse Science Talent Search, the nation's oldest and most prestigious high-school science competition "The appetite for knowledge can't be totally developed in the classroom" Shapiro says 'You must stress independent work and study"

One sixteen year old Midwood High School science whiz won a $7,000 prize in the 1989 Westinghouse competition For his project Andrew Gerber tested the strength of antipsychotic drugs by combining them with iodine With both parents working as physicians in nearby hospitals, Gerber grew up in an environment filled with talk of the latest medical advances and scientific achievements At six he caught the science bug when he received an electric bell and a battery His father was not surprised when Andrew assembled a computer kit four years later 'My major influence was my parents," Gerber says "A lot of kids grow up hostile to science You only hear bad things about science additives in foods chemical spills, and nuclear accidents You never hear the positive side of technological advances There is a built-in bias against science and technology"

The way science is taught in American schools turns students off, Gerber claims "The introduction to science and physics in high school has no practical application right away," he says "Kids are impatient They lose interest People also distrust someone with an analytical mind—such a person is supposedly cold and has no feelings—but value poets, actors, and writers for their creativity Scientists have to be creative as well as disciplined If this country is going to remain powerful it's going to need the best scientists and researchers'

Harvard's Branscomb knows the science education shortage is extremely serious "In this modern, technical world our tools are getting smarter When the tools get smarter we must have people properly trained to master them At this time we aren't doing that And even if we solve the problem of scientific illiteracy we will feel its effects for a long time to come"—Robert Fleming

LIVE AND LET DIE

"Our current system of health care is not fair it's not just and it's not the morally strong system this country deserves," Surgeon General C Everett Koop admonished in a commencement address last May On the eve of his retirement Koop warned that public expectations of medical care are "fast outpacing our ability to pay for them"

The statistics underscore the chilling fact that the United States' health-care system is out of control Rising at two and a half times the inflation rate the nation's medical bill will total a staggering $650 billion this year Yet critics say we're not getting much for our money

"No other country in the world except South Africa tolerates a system in which the state of a family's health is determined by the size of the family's wealth" Senator Edward Kennedy (D-Massachusetts) told the Senate Subcommittee on Health for Families and the Uninsured last June More than 37 million Americans have no health insurance Another 15 million have inadequate coverage One third of American women don't receive prenatal care during the first trimester of pregnancy And some adults living in impoverished rural areas have never even seen a doctor

There is little evidence, moreover that many of the dazzling—and expensive—miracles of modern medicine actually prolong life Americans have four times as many coronary bypass operations (at a cost of more than $7 billion annually) as Western Europeans While 26 nations have better cardiovascular health rates than the United States we rank a dismal fifteenth in life expectancy for males and twentieth in infant mortality 'A baby born in Spain or Greece has a greater chance of survival than one born in the United States' says Richard Lamm, whose views on health care issues ignited a fire storm of controversy during his three-term tenure as governor of Colorado

"Health care is a fiscal black hole in which we pour an unjustifiable amount of resources," Lamm says

Globally the outlook is equally disturbing Although medical care in some Third World countries most notably China has improved practices remain 30 years behind the times Generally, sanitation is horrendous and malnutrition is rampant (The number one cause of infant death in developing countries is dehydration from diarrhea) And whole populations have not received basic immunizations against such preventable diseases as measles, polio and tuberculosis Severe economic setbacks compounded by the AIDS epidemic have drained the meager resources of most African nations 'These governments simply do not have the money to provide everyone with the services they need" explains Michael Reich, associate professor of international health at Harvard's School of Public Health "And the good facilities that do exist are often accessible only to the elite"

Even Great Britain's National Health Service a system of socialized medicine once considered an enlightened model of egalitarian efficiency is beset by crises Waiting lists for cataract joint replacement, and other nonemergency surgery are five years long The lives of critically ill patients are often jeopardized because procedures are delayed repeatedly due to a shortage of nurses (Nurses are so poorly paid they're quitting the profession at a rate of 30,000 a year)

One of the few bright spots in this bleak picture is Canada's government-funded national health insurance system The principal difference between the Canadian and the British systems is hospital ownership In Great Britain hospitals are government owned, which means costs are lower than in Canada because the government controls everything, including doctors' and nurses' salaries The Canadian government controls medical fees and the purchase of high-tech equipment, and each province negotiates its annual health-care budget with its medical and hospital associations, setting a ceiling on total expenditures

According to the nonprofit, Washington-based Employee Benefit Research Institute, Canadians are healthier than Americans, they live longer, and their infant mortality rate is 25 percent lower than the United States But even Canadians, who believe their system is the best in the world, complain of bottlenecks Indeed, delays were at least partly responsible for the deaths of six heart patients in 1988 And as more people take advantage of the insurance, costs are escalating, draining the national coffer "We are beginning to move off the delivery of the highest standard, which was the premise of Canadian Medicare," Canadian Medical Association president John O'Brien-Bell recently said

An endless number of economists, politicians, physicians, and health-care

policymakers have been stymied in their attempts to cut medical costs without sacrificing quality and accessibility. But we are headed for disaster, Koop and other experts warn, if fundamental changes aren't soon made in the practice of medicine.

Former Colorado governor Lamm believes there are plenty of solutions, but he also contends that dire circumstances call for stern, perhaps even Draconian, measures. "Medical expenditures are crippling the economy," he says. "We simply can't provide everyone with all the health care that medicine has developed. We need to set priorities in the allocation of resources." Lamm argues that it makes more sense, for example, to provide prenatal care to pregnant women than for pediatricians to fly sickly newborns to million-dollar neonatal care units. "The price of vaccinating children, providing prenatal care to all pregnant women, and giving everyone basic health care can be offset by reducing high technology medicine," he says. "The inadequacies in one part of the system can be funded by trimming other areas."

Director of the Center for Public Policy in Denver, Lamm proposes a radical restructuring of health care delivery along the lines Canada pioneered. He also advocates closing some hospitals, replacing them with hospices, and regionalizing such high-tech medicine as kidney dialysis, pacemaker implantation, and organ transplantation.

"We're engaged in a wasteful technology race. There are more CAT scanners, for example, in Colorado and Arizona than in all of England," Lamm says. "And high-tech care should be rationed based upon the chances of success rather than rationing care based on the ability to pay. We can no longer pour phenomenal resources into people for whom there will be no happy outcome."

According to pediatrician Barbara Starfield, head of the division of health policy at Johns Hopkins University School of Public Health, computerized data banks to monitor care are also necessary to eliminate administrative waste and the overuse of procedures. "First, there is more accountability with a centralized system," she says. "Second, keeping records on each patient means that we know exactly what treatments, tests, medications, and other care they've already received, so the procedures aren't duplicated, which is so often the case now. And by tracking treatments, we can determine which ones are most effective. This is an area in which we can begin to collaborate internationally and make cross-cultural comparisons."

Alex Romani, an eighteen-year-old senior at North High School in Torrance, California, agrees with the idea of a centralized data bank: "so we can better understand disease. And with it linked to data banks in other countries," he says, "we can all learn from each other." He also looks forward to computerized tools to detect diseases in their very early stages. "If a computer spots chemical changes in our bodies, we can cure ourselves before we show physical signs of illness. And perhaps we will even have monitoring devices we can use at home."

Health care must be redirected toward preventive medicine. "Right now, the focus is on the management of disease rather than its prevention," Starfield says. "That *must* change because it is in the area of prevention that we can make the most dramatic inroads—with the least amount of money—in combating illness."

In Cuba, for example, the government has worked with nurses and doctors to develop programs that focus on prevention rather than high-tech care, providing such services as prenatal care and immunizations. Through Cuba's concept of one doctor for 125 families, ongoing community-based care is provided by a physician who knows the patients and their living conditions and takes personal responsibility for their health care.

> *"Hospitals, of course, don't prevent death. We should institute basic health services, raise the literacy rates of women, the primary caretakers of children, and teach nutrition to children in school."*

And when Costa Rica abolished its military four decades ago, it freed up capital that went not only directly into health care, but also indirectly in the form of sanitation and housing.

Hospitals, of course, don't prevent death. Money diverted to building or improving hospitals and stockpiling high-tech equipment merely reduces the amount of aid that reaches the poor, points out Lawrence Bruce, president of the U.S. Committee for UNICEF (see First Word in *Omni*'s August 1989 issue). Instead, we should institute basic health services; raise the literacy rates of women, who are the primary caretakers of children; and teach nutrition and hygiene to children in schools.

"We also need to recruit people into medicine who are healers and get rid of those who are in it for the money," Alex Romani adds. "Right now, students need top grades to get into medical school and if they're not rich, they end up deeply in debt by the time they're finished. But healing is a special skill, and the best doctors aren't necessarily the ones who got the best grades in school. We need to identify people who would be good doctors and subsidize their education."—Linda Marsa

GO ASK ALICE

You see it in the headlines
You hear it every day
They say they're gonna stop it,
but it doesn't go away . . .
It's propping up the governments
in Colombia and Peru.
Ask any DEA man.
He says there's nothing we can do,
from the office of the President
*right down to me and you.**

When these words to the song "Smuggler's Blues" were written for television's *Miami Vice*, they were meant to convey the frustration of two undercover cops trying to interdict Colombian cocaine. But the words have nearly become an anthem for a frustrated nation pushing solutions that, for the most part, haven't worked yet never change—from cracking down on dealers and users and creating more educational programs to prevent or stop addiction, to bombing Bolivia, invading Colombia, and sealing the U.S.–Mexican border. Now George Bush wants to build more jail cells.

As drug enforcement agents plug the dikes the tide of drugs continues to rise. In 1987 the U.S. Coast Guard and the Customs Service confiscated approximately 30 tons of cocaine, an increase of more than 2,500 percent since 1981. And that amount, drug enforcement officials believe, is only 10 percent of what actually enters the country each year. Despite the so-called war on drugs, cocaine has become increasingly plentiful. Some drug kingpins are now showing up on *Fortune* magazine's list of the wealthiest people in the world. And drug-producing nations are earning roughly $2.5 billion to $3 billion annually—almost double their drug revenues in 1980.

Until recently, cocaine was not a major problem in Europe, where heroin had been the drug of preference. But cocaine use has begun to rise in countries like Switzerland, Spain, Italy, and West Germany, either as a result of drug cartels tapping an undeveloped market or of Europeans following Americans' lead. New York Democratic congressman Charles Rangel, chairman of the House Select Committee on Narcotics Abuse and Control, hopes European governments will learn from our mistakes.

With only 5 percent of the world's population, the United States consumes 50 percent of the planet's drugs (some 600

** Lyrics from "Smuggler's Blues" by Glenn Frey, © 1984, 1985 Red Cloud Music/Night River Publishing. Used by permission of Warner/Chappell Music, Inc. All rights reserved.*

tons), according to 1987 figures. This translates not only into deaths from overdoses but also more than 300 known drug-related murders in Los Angeles alone in 1988. Last winter a federal drug agent was executed as he sat in his car during a sting operation in New York City. And sixty-one-year-old taxi dispatcher Mildred Greene was slain after she agreed to testify in a New York drug case.

Senior economist Peter Reuter of the Rand Corporation, a California-based think tank, says his research and statistical studies show that the policy of interdiction has failed. He doesn't call for its abandonment, however, because recent studies by the National Institutes of Health indicate that high-school seniors have become more aware of the dangers of cocaine and other illegal substances. "Cocaine usage rose from 1978 through the early 1980s," Reuter says, "but the genuinely good news is that it has declined since 1985."

The bad news: Rand studies portend a continuing decline in the number of affluent cocaine users in the Nineties, leaving the drug's consumption increasingly concentrated among the poor and disadvantaged. While the overall number of users may decrease, the demand will remain constant. One reason is that crack, the highly toxic smokable form of cocaine, is less expensive, but greater quantities are needed to maintain the same high as cocaine that is sniffed or injected. "And if cocaine use becomes concentrated in the underclass," Reuter says, "the whole thing will increasingly feed on itself, with more cocaine-related crimes committed by those seeking the money to buy cocaine."

According to eighteen-year-old Linda Costello, adults are misguided in their belief that young people begin using drugs because of peer pressure. "I don't feel peer pressure and I don't think anyone else does," says Costello, who admits that she's been offered marijuana and other drugs on many occasions. When she simply turned them down, she says, no one tried to change her mind.

The Long Island, New York, teenager began seriously thinking and reading about drug addiction after a close friend "hit rock bottom" with his drug abuse. Eventually Costello became involved in fund-raising for a local drug prevention program. "Young people make a choice to use drugs," Costello says. "They often have to hit bottom before they ever make the decision to stop." And parents must precipitate such a crisis, she adds. "They have to clamp down. And if the children don't respond, parents must simply shut the door on them, though that is a hard thing to do."

While some parents must battle the drug problem at their own doorsteps, Congressman Rangel believes the war on drugs must be depoliticized. Attitudes stemming from the Cold War and four decades of confrontation and preoccupation with Communism have diverted attention from drugs, which claim more American lives than any conspiracy hatched in Moscow, he says.

Despite the glut of illegal drugs from abroad, Rangel points out angrily, "the State Department never mentions the subject, much less addresses it, because in my opinion, we have been afraid of jeopardizing other supposedly more important purposes of foreign policy. In the official view of the United States, another country can do *anything*, including trafficking in drugs, as long as its government is anticommunist."

Western Hemisphere leaders, including Fidel Castro, must hold a summit meeting to map out a strategy for waging a real war on drugs, Rangel says. In fact, during a meeting with the Harlem congressman last December, Castro pledged his cooperation in the battle against narcotics trafficking, but the State Department has been a stumbling block. In talks on drugs, it wants to bring up other, nonrelated issues, like Cuban armed forces in Nicaragua, that have nothing to do with drugs, Rangel says.

According to psychopharmacologist Ronald Siegel of the University of California at Los Angeles, however, the major obstacle to resolving the drug problem has been the belief that using drugs is unhealthy as well as immoral. Intoxication, Siegel asserts, is "the fourth drive," ranking right after hunger, thirst, and sex—sometimes overshadowing all three—and has been part of the human condition since at least the beginning of recorded history. "Trying to prevent drug use by outlawing it is like trying to treat AIDS by outlawing sex," says the author of *Intoxication: Life in Pursuit of Artificial Paradise* (E. P. Dutton). "Winning the war on drugs by eradicating nonmedical drug use is neither possible nor desirable."

The solution to the drug problem, Siegel believes, is to produce *safe* drugs. "The difference between a medicine and a poison is one of dosage," he says. The coca leaf, used by South American Indians as both a medicine and a stimulant, is extracted to produce the powdery cocaine residue, turning a medicine into a poison. If cigarettes were similarly processed, rather than using the whole tobacco leaf, the white nicotine alkaloid residue would be "instantaneously lethal" when ingested, Siegel says.

According to Siegel, the pharmaceutical industry already spends billions of dollars every year for the research and development of wonder drugs that maximize desired effects and benefits and minimize the risks and dangers. Indeed, he says, chemists have already designed drugs that enhance sensation. One example is 2C-B, which appears to enhance all the senses without distortion.

"I didn't have the heart to break them up!"

Future molecular architects Siegel adds may someday be able to mix and match the desirable properties to create a perfectly safe combination

"This is not a moral surrender in the war on drugs," Siegel says. "The development of safe, man-made intoxicants is an affirmation of one of our most human drives and a challenge for our finest talents." He admits, however, that this is not likely to occur until drugs are depoliticized. —John Cummings

TROUBLED WATER

Picture a landscape dotted with streams and lakes so fetid that no species can survive a swim in them. Drinkable water pours only from plastic bottles. The surgeon general warns that bathing more than once a week in such fluids could be hazardous to your health.

Fifteen-year-old Waseem Ahktar's vision of American life in the year 2000 is pessimistic, which he readily admits. "Maybe these kinds of things will have to happen before people get really concerned about water pollution," the New Jersey high-school sophomore says. What's really frightening, though, is that Waseem's vision could become a reality.

When planet Earth was born, about a million cubic miles of usable fresh water existed—the same amount our world carries today. While fresh water coffers have remained at Year One levels, however, the earth's population, and thus its demand for H_2O, has skyrocketed. In this century alone, the number of people on our planet has increased fivefold, and our water consumption has risen in tandem. Scientists are predicting that the planet's population will triple again within 50 years, which is why we must uncover new freshwater sources to quench the world's growing thirst.

Making matters worse is the way we've taken to treating this most precious natural resource. It has become increasingly difficult to keep our fresh-water supplies free of dangerous contaminants. In developing nations, the greatest fouler of fresh water is sewage. The waterborne diseases spawned by "biological" pollution cause a staggering 80 percent of all child deaths in the Third World. "The poorer the nation," says Mohamed El-Ashry, vice-president of the World Resources Institute in Washington, DC, "the more likely the water will be contaminated by human waste."

Most of us assume that it's rural folk in developing nations who live without benefit of water-treatment plants and sewage systems. But in many of these countries, city sanitation systems can't cope with soaring populations. Cairo's sewage floods the streets. The Jamuna River, which passes by New Delhi, India, picks up 50 million gallons of untreated wastewater every day and delivers this sludgy stuff to the unfortunates living downriver.

Because sanitation systems are more sophisticated in the West, water polluted by waste is less of a health issue. In the United States, much has been done in the last two decades to protect us against biological pollution. Billions of dollars have been provided since the 1972 Clean Water Act to build better sewage-treatment plants and upgrade water-treatment facilities. In June 1989 the Environmental Protection Agency (EPA) required many of the nation's waterworks to either improve or install filtration systems to destroy the microbes known to cause such waterborne maladies as hepatitis A and Legionnaire's disease.

We have put an enormous amount of money into cleansing our water of biological impurities. At the same time, however, we have allowed much of our water supply to become tainted by a growing number of toxic chemicals. To date, more than 700 chemicals have been detected in U.S. drinking water, 129 of which the EPA calls dangerous. These include a hash of poisonous industrial solvents and metals spewed illegally into waterways and waste-treatment facilities by manufacturers. Consider the EPA's latest survey, which revealed that 627 industrial plants and 12 federal installations dumped toxic substances into the nation's waters this year. One was the Rocky Flats nuclear-weapons plant in Colorado (dubbed the most environmentally hazardous site in the nuclear weapons industry by the Department of Energy). Rocky Flats allegedly perpetrated a potentially lethal crime. It is accused of having discharged hazardous chemicals into creeks leading right to Denver's drinking-water supplies. Residents are outraged at the possibility that they might have drunk water containing radioactive contaminants.

> *"Trying to prevent drug use by outlawing it is like trying to treat AIDS by outlawing sex. One solution: Make safe drugs like 2C-B, which appears to enhance the senses without distortion."*

And a 1987 survey showed that industry released 9.7 billion pounds of toxics into streams and rivers. In fact, the EPA says there is chemically polluted surface water in 49 of our 50 states. And it gets worse. Our underground water reserves (known as groundwater), which provide 60 percent of the American population with drinking water, have become contaminated in recent years by seepage from underground chemical-storage tanks and toxic leakage from landfills.

Lest you think your local waterworks will simply filter out these hazardous chemicals, let us enlighten you. No all-purpose chemical cleanser is being employed today. The dirty truth is, our water-treatment plants simply aren't equipped to test and filter these toxics from our drinking water. "No one ever envisaged that our water-treatment plants would be required to clean these kinds of toxic chemicals out of our drinking water," says Ellen Silbergeld, a scientist for the Environmental Defense Fund in Washington, DC. "And the fact is, they don't." The result? All that arsenic, barium, cadmium, mercury, and a host of other pollutants are responsible for health problems ranging from stomach disorders and insomnia to liver and kidney dysfunction, cancer, and birth defects.

There's one more kind of water pollution—lead contamination—that may actually occur in the pipes stretching from water-treatment centers to our homes. Studies reveal that almost one in five Americans drinks water that's full of lead (50 parts per billion). According to the National Academy of Sciences (NAS), that much lead in the water is none too healthy for adults, but it's far more dangerous for children. The symptoms of lead poisoning in adults are pretty unpleasant: anemia, constipation, headaches. But for children nine or younger the effects of drinking lead-rich water can be devastating. The NAS claims that every year some 200,000 American children who drink heavily leaded water experience a loss of brain function equivalent to five IQ points. What's more, the NAS estimates that each year 640,000 fetuses suffer some neurological damage when pregnant women swallow leaded water. In spite of these figures, no lead regulations have been set as yet by Congress.

Representative Henry Waxman (D-California) is currently preparing a bill to control the amount of lead in our drinking water. "Lead contamination of drinking water supplies is an extremely pervasive threat to the nation's health, affecting forty-two million Americans, according to the EPA," Waxman says. He and his staff hope to force the EPA to reduce lead levels in water to 10 parts per billion or less.

Environmentalists believe we must set toxic limits for every suspected pollutant and then test water regularly and carefully. Currently the EPA has regulated only 40 of the hundreds of chemicals known to be contaminating our water.

All of this regulating takes time, which means we must continue to live in fear of what's pouring from our faucets—or switch to drinking bottled water. Silbergeld insists that we shouldn't condone the EPA's turtle-slow approach to regulation. Nor should we allow their "end-of-the-pipe

mentality," she says. "I don't think we should be investing more public money in designing sophisticated treatment plants to remove each of these chemicals. We've got to get rid of pollution at its source."

Senator David Durenberger (R-Minnesota), a leading member of the Senate Environment and Public Works Committee, agrees with Silbergeld, especially when it comes to groundwater pollution. "I think what we need is a national program to prevent the contamination of groundwater supplies," he says. "This law would focus on the principal activities that threaten groundwater quality, like pesticide applications, but also landfills and sewer impoundments and abandoned oil and gas wells. It would require that owners of these facilities take whatever measures are necessary to prevent groundwater contamination." El-Ashry believes the answer to water-pollution woes may be to make industrial waste recycling a more attractive alternative to dumping. "The key to pollution prevention is to recycle all that chemical waste and use it to create more energy. A few American companies—such as 3M Corporation—have already successfully employed a waste-recycling system. In such a closed-loop system, waste isn't simply dumped into a nearby stream or underground well. Instead, chemical waste water is separated and the different chemical compounds are returned to their original form. In this way the chemicals can be used to create new products.

"Designing these new technologies is the only solution for the future," El-Ashry adds. "People aren't going to want to alter their life-styles to reduce waste, so we must be more creative and innovative in the way we handle that waste."

At his most cynical, Waseem Ahktar agrees that it's tough for Americans to change their comfortable living habits. But he also believes that when we truly comprehend the depth of our water troubles, we will be eager to take part in the cleanup. "I know that my friends and I will try to use only environmentally safe products, like replacing cleansers, pesticides, and fertilizers so that we at least won't contribute to water pollution. After all, I don't want my kids to have to worry about this threat the way we have to today."—Ellen Kunes

BUNGLE IN THE JUNGLE

In a humid, densely forested region of the Amazon basin 80 miles north of Manaus, Brazil, scientists work to understand the intricate structure of the tropical rain forest. Cloaked in rain gear and weary from long and tedious hours, they document the changes occurring in the section of forest after the surrounding jungle has been cut and burned to clear the land for agriculture and cattle ranching. The vast expanse of forested Amazonia—approximately 6 million square kilometers—is in danger of extinction.

In Germany the Black Forest is disappearing, dying from the poisons of acid rain. In the United States the timber industry cuts irreplaceable stands of old-growth forest (trees at least 200 years old) from northern California to Washington State at an alarming rate. In some parts of Asia the earth has literally been stripped bare to supply firewood for booming populations. And in recent months dangerously high levels of ozone and acid rain have been discovered for the first time in Central Africa.

These dramatic and sudden losses are not going unnoticed, however. All over the world, government officials, scientists and concerned individuals are demanding change and implementing strategies to protect and replant forests. Due to lack of forest cover, massive flooding has occurred in India, prompting Prime Minister Rajiv Gandhi to declare reforestation a priority in his current development agenda. With the help of the U.S. Agency for International Development, 35 million trees were recently planted across the scorched and barren plains of Haiti. And in the United States environmental organizations purchase foreign debt in exchange for conservation programs—debt-for-nature swaps.

Congressman Bruce Vento (D-Minnesota), who chairs the House Subcommittee on National Parks and Public Lands, is trying to pass legislation to protect the remaining forests in Alaska and the Pacific Northwest as well as the tropical forests of Latin America and the Caribbean. "We need to find ways to protect the forest and, at the same time, support the economy of the region," Vento says.

A tropical rain forest receives 100 inches of rain each year (the eastern United States normally gets 60), light is scarce or diffused, humidity is high, temperatures are constant. If a rain forest is left undisturbed, every tree supports the next tree, every species depends on every other species. Trees depend on birds and animals to disperse their seeds. Otherwise trees do not reproduce and the forest eventually dies out. Such a highly sensitive balance makes the rain forest very vulnerable to even slight change. When a section of the forest is cut or burned, the remaining forest is exposed to elements from which it should be protected.

"A decade ago," says Thomas Lovejoy, assistant secretary for external affairs at the Smithsonian Institution, "no scientific data existed to determine how big a rain forest should be to preserve its health and natural balance." In 1979 Lovejoy decided to find out the minimum size a rain forest needed to sustain its trees, insects, birds, mammals and plants. It has now been calculated that as much as 300,000 hectares, or almost three quar-

ters of a million acres must be preserved to protect the entire ecosystem of a forest. In any section smaller than this, species begin to disappear.

Lovejoy also introduced debt-for-nature swaps. Third World countries bogged down with foreign debts—the total Third World debt is $3.2 trillion—usually slash money allocated for natural resources. Lovejoy proposed to buy the debts in exchange for conservation programs. "The World Wildlife Fund supplies technical assistance and grants to help protect undisturbed natural areas in these countries anyway," says Kathryn Fuller, president of the World Wildlife Fund and the Conservation Foundation. "Debt-for-nature swaps help make the conservation dollars go further."

Swaps ranging from $1 million to $75 million have been negotiated in Ecuador, Costa Rica, the Philippines, and Bolivia by the World Wildlife Fund, the Nature Conservancy, and Conservation International. Other debt exchanges are expected to occur in Africa, Eastern Europe, and Asia. Debt is bought for as little as ten cents on the dollar, or $1 million of debt for $100,000. In exchange a fund is set up to finance protection and management programs that support conservation. Debt-for-nature swaps are however, still frowned upon by some nations. Brazil's president, Jose Sarney, believes the exchanges pave the way for the West to control policy in less fortunate countries. Even though Brazil's foreign debt is $120 billion, Sarney rejects the swaps. "It's a vocal minority," says Rob Bierregaard, a senior scientist for the World Wildlife Fund. "Most people in Brazil realize that these swaps are not an international plot to take over the Amazon."

What the United States demands of Latin American and other Third World countries—preservation of the rain forests—it does not demand of itself. Ironically, our own government is destroying the rain forest in Alaska. "We are saying, 'Do as we say, not as we do,'" says Congressman Vento. The Tongass National Forest, the only remaining rain forest in North America, stretches along the panhandle of southeastern Alaska. Extending over 16.8 million acres, the Tongass is a beautiful, pristine wilderness surrounded by spectacular mountain landscapes. Giant Sitka spruces and Western hemlocks stand proudly, as they have for many centuries. Home to Sitka black-tailed deer and the world's largest population of bald eagles and grizzlies (notably, the Alaskan brown bear), the Tongass is a unique natural wonder.

After World War II, the U.S. Forest Service offered two companies, Ketchikan Pulp Company and Alaska Pulp Corporation, 50-year contracts and cheap lumber prices to harvest the Tongass. Japan bought the bulk of the trees' pulp product. Sixty percent of the pulp was used to make rayon and cellophane. In 1980 the Alaska National Interest Lands Conservation Act (ANILCA) was passed, making 4.5 billion board feet of timber available for cutting in the Tongass each decade. ANILCA also provided $40 million a year, "or whatever sums are necessary," to build roads and take other steps to make timber available.

Today the demand for Alaskan lumber has declined because rayon and cellophane are produced synthetically. Since 1981 the Forest Service has lost approximately $50 million a year, or 98 cents on each dollar. Given those losses the huge old-growth trees—six to eight feet in diameter and 175 feet tall—are worth $2 apiece. Even though the demand for Alaskan timber has dropped, "the agency continues to build roads through pristine stands of forest to make timber accessible that nobody wants," says Vento. "We needlessly destroy irreplaceable forest. Many of the roads are never used." Advocates of the program, however, claim

> *"Sixth, seventh, and eighth graders collect rainwater from the playground, test the precipitation for acidity, and call in the results to the Audubon Society's offices."*

road building is essential to the economy. It creates jobs.

Both Republican senators from Alaska, Ted Stevens and Frank Murkowski, as well as Republican representative Don Young, support ANILCA. They insist the lumber industry in the Tongass supports the local economy. Cutting trees, however, doesn't support an economy based on fishing and recreation. And as the forest is logged, fishing and recreation are affected. The streams, no longer protected by vegetation, are contaminated by surface runoff. And recreational areas are being destroyed.

Some congressmen are out to kill the ANILCA subsidy. The Tongass Timber Reform Act, recently introduced in the House by Representative Bob Mrazek (D-New York), calls for termination of the 50-year contracts with the logging companies and proposes to set aside 23 areas in the Tongass as wilderness, as well as cancel the automatic $40 million funding. As of last April 22, 122 congressmen had cosigned the bill. The Tongass Timber Reform Act and a similar bill introduced in the Senate are slated to reach President Bush's desk later this year.

Congress also faces proposals to curb sulfur dioxide (SO_2) and nitrogen oxide (NO_x) sources of acid rain. In April a bill was introduced to the House calling for the reduction of sulfur dioxide emissions by 10 million tons per year and nitrogen oxide by 4 million tons per year by 1998. (President Bush recently proposed to reduce SO_2 by 10 million tons and NO_x by 2 million tons.) Emissions of these gases would be cut by one third. Sulfur dioxide emitted from coal-burning power plants and nitrogen oxide fumes from a variety of sources, including automobile exhaust, combine with water to form sulfuric and nitric acid in the atmosphere. Acid rain and snow damage forest cover, weakening trees' ability to sustain normal bouts of drought, insect infestation, or disease. Acid rain also disrupts the acidic balance of lakes and rivers and reduces fish populations.

Concerned about the effects of acid rain, the National Audubon Society set up the Acid Rain Monitoring Network in 1987. Three hundred monitoring stations measure acid precipitation throughout the nation. The network has centers in all 50 states. (The Environmental Protection Agency also monitors acidity in the rainfall nationwide. Because the agency does a complete chemical analysis, however, it takes two to three years before the results are known.)

Audubon, on the other hand, releases its data every month to Congress and local news organizations, keeping people aware of acid rain's continuing effects in their own backyard. Audubon Society members, families, and school groups run the acid rain test sites. At the Poughkeepsie Day School in New York, for instance, sixth, seventh, and eighth graders collect rainwater from the playground each month, test the precipitation for acidity with litmus paper, and call in the results to an answering machine at Audubon's headquarters in New York City.

Startled by a video on acid rain shown in class, Jason Berry, an eighth grader, said, "The trees were turning yellow and the needles were falling off the branches." Cami Townsend, another eighth grader, said she didn't know about acid rain before her school got involved in the network. "My parents didn't know any more than I did, but since my class started testing rain, my parents are more aware of it." And Nicky Rudikoff, a sixth grader at Poughkeepsie, said, "We need to improve education so the next generation learns how to handle acid rain better than people do today."—Cathy Spencer

WAR — HHUUUUH
WHAT IS IT GOOD FOR?

With a world arsenal of more than 50,000 nuclear weapons holding the future hostage, nations continue to endorse war as a foreign-policy tool. They view the development and sale of weap-

CONTINUED ON PAGE 72

FICTION

HIS POWDER'D WIG, HIS CROWN OF THORNES

BY MARC LAIDLAW

Grant Innes first saw the icon in the Indian ghettos of London but thought nothing of it. There were so many gewgaws of native "art" being thrust in his face by faddishly war-painted Cherokees that this was just another nuisance to avoid, like the huge radios blaring obnoxious "Choctawk" percussions and the high-pitched warbling of Tommy Hawkes and the effeminate Turquoise Boys; like the young Mohawk ruddies practicing skateboard stunts for sluttish cockney girls whose kohled black eyes and slack blue lips betrayed more interest in the dregs of the bottles those boys carried than in the boys themselves. Of course, it was not pleasure or curiosity that brought him into the squalid district, among the baggy green canvas

PAINTING BY DONALD ROLLER WILSON

street-teepees and graffitoed storefronts. Business alone could bring him here. He had paid a fair sum for the name and number of a Mr. Cloud, dealer in Navaho jewelry whose samples had proved of excellent quality and would fetch the highest prices, not only in Europe but in the Colonies as well. Astute dealers knew that the rage for turquoise had nearly run its course; thank God, following the popularity of the lurid blue stone, the simplicity of black-patterned silver would be a welcome relief indeed. Grant had hardly been able to tolerate the sight of so much garish rock as he'd been forced to stock in order to suit his customers, he was looking forward to this next trend. He'd already laid the ground for several showcase presentations in Paris; five major glossies were bidding for rights to photograph his collector's pieces: antique sand-cast *najas* and squash-blossom necklaces, for a special fashion portfolio.

Here in the slums, dodging extruded plastic kachina dolls and machine-woven blankets, his tine-tuned eye was offended by virtually everything he saw. It was trash for tourists. Oh, it had its spurts of cheap popularity, like the warbonnets which all the cyclists had worn last summer, but such moments were fleeting as pop hits, thank God. Only true quality could ever transcend the dizzying gyres of public favor. Fine art, precious stones, pure metal—these were investments that would never lose their value.

So much garbage ultimately had the effect of blinding him to his environment, avoidance became a mental as well as a physical trick. He was dreaming of silver crescents gleaming against ivory skin when he realized that he must have passed the street he sought. He stopped in his tracks, suddenly aware of the hawkers' cries, the pulse of hide drums and synthesizers. He spun about searching for a number on any of the shops.

"Lost, guv?" said a tall brave with gold teeth, his bare chest ritually scarified. He carried a tall pole strung with a dozen gruesome rubber scalps, along with several barrister's wigs. They gave the brave the appearance of a costume merchant, except for one morbid detail: Each of the white wigs was spattered with blood—red dye, rather, liberally dripped among the coarse white strands.

"You *look* lost."

"Looking for a shop," Grant muttered, tumbling Mr. Cloud's card from his pocket.

"No, I mean really lost. Out of balance. *Koyaanisqatsi*, guv. Like the whole world."

"I'm looking for a shop," Grant repeated firmly.

"That all then? A shop? What about the things you really lost? Things we've all lost, I'm talking about. Here."

He patted his bony hip, which was wrapped in a black leather loincloth. Something dangled from his belt, a doll-like object on a string, a charm of some sort. Grant looked over the brave's head and saw the number he sought, just above a doorway. The damn ruddy was in his way. As he tried to slip past, avoiding contact with the rubbery scalps and bloodied wigs, the brave unclipped the charm from his belt and thrust it into Grant's face.

Grant recoiled, nearly stumbling backward in the street. It was an awful little mannequin, face pinched and soft, its agonized expression carved from a withered apple.

"Here—here's where we lost it," the brave said, thrusting the doll up to Grant's cheek, as if he would have it kiss or nip him with its rice-grain teeth. Its limbs were made of jerked beef, spread-eagled on wooden crossbars, hands and feet fixed in place with tour tiny nails. It was a savage Christ—an obscenity.

> *"Something dangled from his belt, a doll-like object on a string, a charm of some sort. As Grant tried to slip past, the brave unclipped the charm and thrust it at him."*

"He gave His life for you," the brave said. "Not just for one people, but for everyone. Eternal freedom, that was His promise."

"I'm late for my appointment," Grant said, unable to hide his disgust.

"Late and lost," the brave said. "But you'll never catch up—the time slipped past. And you'll never find your way unless you follow Him."

"Just get out of my way!"

He shoved the brave aside, knocking the hideous little idol out of the Indian's grasp. Fearing reprisal, he forced an apologetic expression as he turned back from the hard-won doorway. But the brave wasn't watching him. He crouched over the filthy street, retrieving his little martyr. Lifting it to his lips, he kissed it gently.

"I'm sorry," Grant said.

The brave glanced up at Grant and grinned fiercely, baring his gold teeth; then he bit deep into the dried brown torso of the Christ and tore away a ragged strip of jerky.

Nauseated, Grant hammered on the door. It opened abruptly, and he almost fell into the arms of Mr. Cloud.

He next saw the image the following summer, in the District of Cornwallis. Despite the fact that Grant specialized in provincial art, most of his visits to the Colonies had been for business purposes and had exposed him to no more glorious surroundings than the interiors of banks and mercantile offices, with an occasional jaunt into the Six Nations to meet with the creators of the fine pieces that were his trade. Sales were brisk, his artisans had been convinced to ply their craft with gold as well as silver, supplanting turquoise and onyx with diamonds and other precious stones; the trend toward high-fashion American jewelry had already surpassed his highest expectations. Before the inevitable decline and a panicked search for the next sure thing, he decided to accept the offer of an old colonial acquaintance who had long extended an open invitation to a tour of great American monuments in the capital city.

Arnoldsburg, DC, was sweltering in a humid haze, worsened by exhaust fumes from the taxis that seemed the city's main occupants. Eyes burning, lungs fighting against collapse, he and his guide crawled from taxi after taxi and plunged into cool marble corridors reeking of urine and crowded with black youths selling or buying opiates.

It was hard not to mock the great figures of American history, thus surrounded by the ironic fruits of their victories. The huge seated figure of Burgoyne looked mildly bemused by the addicts sleeping between his feet; the bronze brothers Richard and William Howe stood back-to-back, embattled in a waist-high mob, as though taking their last stand against colonial lilliputians.

Grant's host, David Mickelson, was a transplanted Irishman. He had first visited America as a physician with the Irish Royal Army, and after his term expired had signed on for a stint in the Royal American Army. He had since opened a successful dermatological practice in Arnoldsburg. He was a collector of native American art, which had led him to deal with Grant Innes. Mickelson had excellent taste in metalwork, but Grant had often chided him for his love of these marble monstrosities.

"But these are heroes, Grant. Imagine where England would be without these men. An island with few resources and limited room for expansion? How could we have kept up the sort of healthy growth we've had since the Industrial Revolution? And without these men to secure this realm for us, how could we have held on to it? America is so vast—really, you have no concept of it. These warriors laid the way for peace and proper management, steering a narrow course between Spain and France. Without such fine ambassadors to put down the early rebellion and ease the cosettling of the Six Nations, America might still be at war. Instead its resources belong to the Crown.

This story is from What Might Have Been Volume II: Alternate Heroes *(Bantam), appearing in early 1990.*

This is our treasure house Grant, and these are the keepers of that treasure"

'Treasure ' Grant repeated with an idle nudge at the body of an old squaw who lay unconscious on the steps of the Howe Monument.

'Come with me, then," Mickelson said "One more sight and then we'll go wherever you like"

They boarded another taxi, which progressed by stops and starts through the iron river of traffic A broad, enormous dome appeared above the cars.

"Ah,' said Grant "I know what that is '

They disembarked at the edge of a huge circular plaza The dome that capped the plaza was supported by a hundred white columns They went into the lidded shadow into darkness and for a moment Grant was blinded

'Watch out old boy,' Mickelson said 'Here's the rail Grab on Wouldn't want to stumble in here"

Grant's hand closed on polished metal When he felt steady again he opened his eyes and found himself staring into a deep pit The walls of the shaft were perfectly smooth, round as a bullet hole drilled deep into the earth He felt a cold wind coming out of it, and then the grip of vertigo

"The depths of valor, the inexhaustible well of the human spirit.' Mickelson was saying. "Makes you dizzy with pride, doesn't it?"

'I'm ... feeling sick " Grant turned and hurried toward daylight

Out in the sunshine again, his sweat gone cold, he leaned against a marble podium and gradually caught his breath When his mind had cleared somewhat he looked up and saw that the podium was engraved with the name of the hero whose accomplishments the shaft commemorated His noble bust surmounted the slab

BENEDICT ARNOLD
FIRST AMERICAN PRESIDENT GENERAL
APPOINTED BY KING GEORGE III
AS REWARD FOR HIS VALIANT ROLE
IN SUPPRESSING THE PROVINCIAL
REVOLT OF 1776–79

David Mickelson caught up with him

'Feeling all right, Granf?"

'Better I—I think I'd like to get back to my rooms It's this heaf

"Surely I'll hail a cab you just hold on here for a minute"

As Granf watched Mickelson hurry away his eyes strayed over the circular plaza, where the usual hawkers had laid out the usual souvenirs Habit more than curiosity drove him out among the ragged blankets his eyes swiftly picking through the merchandise and discarding it all as garbage.

Well, most of it This might turn out to be another fortunate venture after all His eye had been caught by a display of absolutely brilliant designs done in copper and brass He had never seen anything quite like them Serpents, eagles, patterns of stars The metal was all wrong, but the artist had undoubtedly chosen them by virtue of their cheapness and could easily be convinced to work in gold He looked up at the proprietor of these wares and saw a young Indian woman, bent on her knees, threading colored beads on a string

Who made these?" he said, softening the excitement he felt into a semblance of mild curiosity

She gazed up at him "My husband '

Really? I like them very much Does he have a distributor?

She didn't seem to know what he meanf

"That is ... does anyone else sell these pieces?

She shook her head 'This is all he makes, right here When he makes more, I sell those

In the disfance he heard Mickelson

Grant recoiled, nearly stumbling backward in the street It was an awful little mannequin, face pinched and soft, its agonized expression carved from a withered apple.

shouting his name The dermatologist came running over the marble plaza 'Grant I've got you a cab!

Grant gestured as if to brush him away. 'I'll meet you later, David, all right? Something's come up

"What have you found?" Mickelson tried to look past him at the blanket, but Grant spun him around in the direction of the taxis—perhaps a bit too roughly Mickelson stopped for a moment, readjusted his clothes, then stalked away peevishly toward the cars So be it

Smiling, Granf turned back to the woman His words died on his tongue when he saw what she was doing with beads she'd been stringing

She had formed them into a noose, a bright rainbow noose, and slipped this over the head of a tiny brown doll

He knew that doll knew its tough leathered flesh and pierced limbs, the apple cheeks and teeth of rice

The cross from which she'd taken it lay discarded on the blanket, next to the jewelry fhaf suddenly seemed of secondary importance

While he stood fhere unspeaking, unmoving, she lifted the dangling doll to her lips and daintily, baring crooked teeth, tore off a piece of the leg

"What ... what ...

He found himself unable to ask what he wished to ask Instead, fixed by her gaze, he stammered, "What do you want for all of these?'

She finished chewing before answering "All?

"Yes I ... I'd like to buy all of them In fact I'd like to buy more than this I'd like fo commission a piece, if I mighf

The squaw swallowed.

'My husband creates what is within the soul He makes dreams into metal He would have to see your dreams"

"My dreams? Well, yes I'll tell him exactly what I want Could I meet him to discuss this?"

The squaw shrugged She patiently unlooped the noose from the shriveled image, spread it back onto its cross and pinned the three remaining limbs into place, then tucked it away in a bag at her belt Finally rising, she rolled up the blanket with all the bangles and bracelets inside it and tucked the parcel under her arm 'Come with me," she said

He followed her without another word, feeling as though he were moving down an incline losing his balance with every step, barely managing fo throw himself in her direction She was his guide through the steaming city, through the crowds of ragged cloth, skins ruddy and dark He pulled off his customary jacket loosened his tie, and struggled after her She seemed to dwindle in the distance, he was losing her, losing himself, stretching into a fhin strand of beads, beads of sweat, sweat that dripped through the gutters of Amoldsburg and offered only brine to the thirsty

But when she once looked back and saw him faltering, she put out her hand and he was standing right beside her, near a metal door She put her hand upon it and opened the way

It was cool inside and dark excepf for the tremulous light of candles that lined a descending stairway He followed, thinking of catacombs, the massed and desiccated ranks of the dead he had seen beneath old missions in Spanish Florida There was a dusfy smell, and far off the sound of hammering She opened another door and the sound was suddenly close at hand

They had entered a workshop A man sat at a metal table cluttered with coils of wire, metal snips, hand torches The woman stepped out and closed the door on them

"Good afternoon," Granf said "I ... I'm a great admirer of your work

The man turned slowly the stool creaking under his weighf, though he was not a big man His skin was very dark, like his close-cropped hair His face was soft as though made of chamois pouches, but his eyes were hard He beckoned

"Come here" the man said. "You like my stuff? What is it that you like?"

Grant approached the workbench with a feeling of awe. Samples of the man's work lay scattered about, but these were not done in copper or brass. They were silver, most of them, and gleamed like moonlight.

"The style," he said. "The ... substance."

"How about this?" The Indian fingered a large eagle with spreading wings.

"It's beautiful—almost alive."

"It's a sign of freedom." He laid it down. "What about this one?"

He handed Grant a small rectangular plaque inscribed with an unusual but somehow familiar design. A number of horizontal stripes, with a square inset in the lower right corner, and in that square a wreath of thirteen stars.

"It's beautiful," Grant said. "You do superior work."

"That's not what I mean. Do you know the symbol?"

"I ... I think I've seen it somewhere before. An old Indian design, isn't it?"

The Indian grinned. Gold teeth again, bridging the distance between London and Arnoldsburg, reminding him of the jerked beef martyr, the savage Christ.

"Not an Indian sign," he said. "A sign for all people."

"Really? Well, I'd like to bring it to all people. I'm a dealer in fine jewelry. I could get a very large audience for these pieces. I could make you a very rich man."

"Rich?" The Indian set the plaque aside. "Plenty of Indians are rich. The tribes have all the land and factories they want—as much as you have. But we lack what you also lack: freedom. What is wealth when we have no freedom?"

"Freedom?"

"It's a dim concept to you, isn't it? But not to me." He put his hand over his heart. "I hold it here, safe with the memory of how we lost it. A precious thing, a cup of holy water that must never be spilled until it can be swallowed in a single draft. I carry the cup carefully, but there's enough for all. If you wish to drink, it can be arranged."

"I don't think you understand," Grant said, recovering some part of himself that had begun to drift off through the mystical fog in which the Indians always veiled themselves. He must do something concrete to counteract so much vagueness. "What I'm speaking of is a business venture. A partnership."

"I hear your words. But I see something deeper in you. Something that sleeps in all men. They come here seeking what is lost, looking for freedom and a cause. But all they find are the things that went wrong. Why are you so out of balance, eh? You stumble and crawl, but you always end up here with that same empty look in your eyes. I've seen you before. A dozen just like you."

"I'm an art dealer," Grant said. "Not a ... a pilgrim. If you can show me more work like this, I'd be grateful. Otherwise, I'm sorry for wasting your time and I'll be on my way."

Suddenly he was anxious to get away, and this seemed a reasonable excuse. But the jeweler now seemed ready to accommodate him.

"Art, then," he said. "All right. I will show you the thing that speaks to you, and perhaps then you will understand. Art is also a way to the soul."

He slipped down from the stool and moved toward the door, obviously intending for Grant to follow.

"I'll show you more than this," the Indian said. "I'll show you inspiration."

After another dizzying walk, they entered a derelict museum in a district that stank of danger. Grant felt safe only because of his companion. He was obviously a stranger here, in these oppressive alleys. Even inside the place, which seemed less a museum than a warehouse, he sensed that he was being watched. It was crowded by silent mobs, many of them children, almost all of them Negro or Indian. Some sat

> *"The painting was caked with grease, darkened by time, but even through the grime he could see that it was an imitation of Da Vinci's* Last Supper *but strangely altered."*

in circles on the cement floors, talking quietly among themselves, as though taking instruction. Pawnee, Chickasaw, Blackfoot, Cheyenne, Comanche ... Arnoldsburg was a popular site for tourists, but these didn't have the look of the ruddy middle-class traveler; these were lower-class ruddies, as taffered as the people in the street. Some had apparently crossed the continent on foot to come here. Grant felt as if he had entered a church.

"Now you shall see," said the jeweler. "This is the art of the patriots. The forefathers. The hidden ones."

He stopped near a huge canvas that leaned against a steel beam. The painting was caked with grease, darkened by time, but even through the grime Grant could see that it was the work of genius. An imitation of Da Vinci's *Last Supper*, but strangely altered.

The guests at Christ's table wore not biblical attire but that of the eighteenth century. It was no windowed building that sheltered them but a tent whose walls gave the impression of a strong wind beating from without. The thirteen were at supper, men in military outfits, and in their midst a figure of mild yet radiant demeanor, humble in a powdered wig; a mere crust of bread on his plate. Grant did not recognize him, this figure in Christ's place, but the man in Judas's place was recognizable enough from the numerous busts and portraits occurring in Arnoldsburg. That was Benedict Arnold.

The Indian pointed at several of the figures, giving them names. "Henry Knox, Nathanael Greene, Light-Horse Harry Lee, Lafayette, General Rochambeau ..."

"Who painted this?"

"It was the work of Benjamin Franklin," said his guide. "Painted not long after the betrayal at West Point, but secretly, in sadness, when the full extent of our tragedy became all too apparent. After West Point the patriots continued to fight. But this man, this one man, was the glue that held the soldiers together. After his death, the army had many commanders, but none could win the trust of all men. The revolution collapsed and our chance for freedom slipped away. Franklin died without finishing it, his heart broken."

"But that man in the middle ...?"

The Indian led him to another painting. This was much more recent, judging from the lack of accumulated soot and grease. Several children stood gazing at it, accompanied by a darkie woman who was trying to get them to analyze the meaning of what was essentially a simple image.

"What is this?" she asked.

Several hands went up. "The cherry tree!" chimed a few voices.

"That's right, the cherry tree. Who can tell us the story of the cherry tree?"

One little girl pushed forward. "He chopped it down, and when He saw what He had done, He said, 'I cannot let it die.' So He planted the piece. He cut off and it grew into a new tree, and the trunk of the old tree grew, too, because it was magic."

"Very good. Now, that's a fable, of course. Do you know what it really means? What the cherry tree represents?"

Grant felt like one of her charges, waiting for some explanation, innocent.

"It's an English cherry," the teacher hinted.

Hands went up. "The tree! I know, I know! It's England."

"That's right," she encouraged. "And the piece he transplanted?"

"America!"

"Very good. And do you remember what happened next? It isn't shown in this painting, but it was very sad, Tinsha?"

"When His father saw what He had done, he was very scared, he was afraid his son was a devil or something, so he tore up the little tree by the roots. He tore up America."

"And you know who the father really is, don't you?"

"The ... King?" said Tinsha.

Grant and his guide went on to another painting, this one showing a man in a powdered wig and a ragged uniform walking across a river in midwinter—not stepping on the floes but moving carefully between

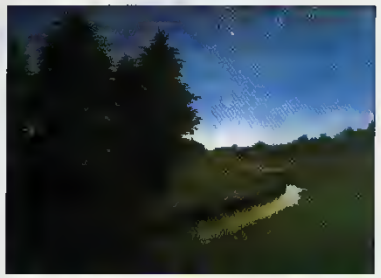
CONTINUED ON PAGE 103

ARTICLE

America: Shelter your homeless, dispose of toxic waste, take care of AIDS victims, build cheaper energy plants, but please,

NOT IN MY BACKYARD

BY ROSEMARIE ROBOTHAM



"Good fences," said the poet Robert Frost, "make good neighbors." It might have been true in America once, but good fences are no longer sufficient to reassure a nation bedeviled by a deepening cycle of social and economic ills. Tricky moral dilemmas confound us at every turn: where to put AIDS patients, where to conduct medical research or dispose of tons of toxic waste, where to construct sprawling new airports.

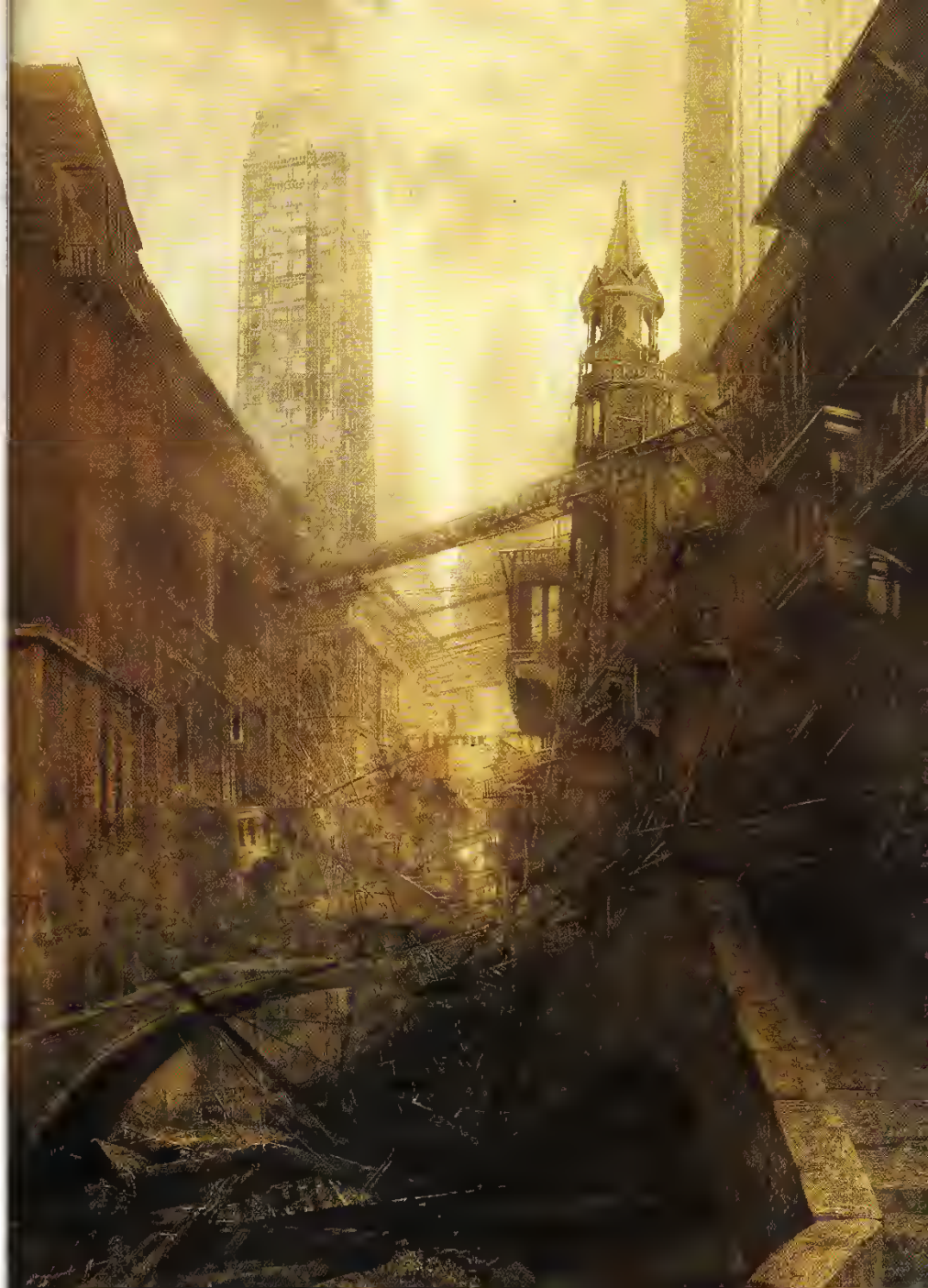
The answer is always in someone's backyard. But more and more, amid a dizzying whirl of threats to individual security, Americans are coming together in protest. "Not in *my* backyard!" they fervently declare.

NIMBY. What is it? How did it come about, and what does it say about us as a nation? NIMBYs can rise up in response to two distinct types of dilemmas: social (housing for AIDS patients, the homeless, prisoners) and technological (toxic waste, nuclear plants). Within the last 20 years NIMBYs have become more prevalent, the inevitable result of economic fluctuations caused by cuts in federal funding for state and city programs, foreign investments and buyouts, wholesale loss of jobs in the steel and automotive industries. Factory emissions have severely compromised the environment, and the mood of the nation has grown conservative. Even the most socially conscious of individuals may hesitate to accept another group when it means that group will be moving next door. "Let's face it," says Willard Gaylin, a psychiatrist and director of the Hastings Center for Ethics in Briarcliff, New York, "we all would love to live where there is no traffic, no pollution in the air, where there is nothing smelly or unattractive, no drugs or violence, no disenfranchised people, where the birds sing in the morning, and where the sun sets through a clear sky. And we're going to fight for as much of it as possible in that selfish, autonomous way that is characteristic of our culture."

What has become of social conscience, our concern for the collective good? Perhaps it has always been elusive. "It is easy to love the poor and the disabled in the abstract, to donate small amounts to causes," says Sheldon Blackman, director of research, program development, and evaluation at St. Vincent's North Richmond Community Health Center in Staten Island, New York. "But it is difficult to welcome such people into our neighborhood."

The reasons that NIMBYs come about are almost as numerous as the incidents themselves. Nationwide, NIMBY organizations are cropping up at a rate of several per week. Some are responses to political decisions. In New York, for instance, where prisons are already crammed 12 percent over capacity, Staten Island residents are up in arms over plans to lo-

PAINTINGS BY ROLAND CAT



cate a city jail in this borough of 400,000 people. Other NIMBY actions seek to protect the environment. In Fannett, Texas, Phyllis Sterling organized her own NIMBY group to fight the construction of a truck stop by a waste-hauling company across the street from her supply store. In Atlanta residents of an inner-city community are protesting plans to build a $210 million stadium and parking deck that will wipe out their neighborhood and force several churches to move.

Even in Berkeley, California, cradle of social consciousness in the Sixties, cries of "NIMBY" are being heard. One community of former radicals and old-line liberals—of older black families and white yuppies—successfully opposed a drop-in center for the mentally ill in a neighborhood storefront.

The term *NIMBY* was first coined in the Sixties, when Americans were protesting the burying of ballistic missiles in the nation's rural backyards. It was a time when communities learned the art of grassroots organization as individuals were politicized by the civil rights, feminist, and antiwar movements. Those years seem, in retrospect, an idealistic time, as yet unsullied by the narcissism of the me generation. Social programs and communal responsibility were in. There seemed to be a greater willingness on the part of individuals to sacrifice personal comforts for the collective good. The idea verbalized so often today—"I have a right to protect my little plot of land"—was not common parlance. And NIMBY didn't become a broad national phenomenon until the late Seventies.

In 1978, in a small suburb of Niagara Falls, New York, a housewife named Lois Marie Gibbs made the connection between a chemical dump in her neighborhood and frequent illnesses suffered by her family. When a state health board ruled that summer that pregnant women and young children should leave Love Canal because of the dump, Gibbs and her neighbors, feeling frightened and betrayed, took to the streets. Eventually the community won federal aid for a complete evacuation of the area, and Love Canal became an enduring symbol of the dangers of modern industry and of the potent goals that can be achieved when a quiet, working-class neighborhood marshals its outrage.

When Ronald Reagan became president there were intimations that NIMBY had come of age. During his eight-year tenure the purses of municipalities were pinched. Reagan minimized the federal government's role in policy-making, passing the hot potato to local government just as pressure on the cities—with the advent of crack and AIDS and the rise in joblessness—was becoming increasingly pernicious. In 1988 federal funding to cities for job training, housing, soup kitchens, and food pantries fell by more than half, a national total of $44 billion in aid abruptly cut back. Cities are hard-pressed to pick up the slack. Psychiatric wards have been closed and mental patients wander the streets, swelling the ranks of the homeless, straining the capacities of churches and shelters, creating one more troublesome equation for the national conscience.

One might argue that if America's social conscience is weak, it's the fault of the federal government. New Deal politics, some have said, with its extensive federal intervention at every aspect of American life, destroyed the cooperative pioneer spirit of Americans, absolving us of moral responsibility toward our fellow citizens. "The social character of Americans," social commentator Lance Morrow wrote, "has atrophied like a limb that has spent too long in a cast."

George Bush has promised a more responsive government, one that values kindness, a gentlemanly social conscience, and a moral commitment to solving society's ills. In the next breath, however, he concurs that welfare and other poverty programs foster an undesirable dependence on government.

Bush's rhetoric sets up anew the perennial conflict at the heart of the American value system: generosity versus self-reliance. The President wants to serve both masters. As yet he has served neither. It remains to be seen whether the current administration will offer more than, in the words of one columnist, "Reagan-omics with a human face."

In the international sphere, particularly with regard to Latin America, this administration shows all the signs of embracing the NIMBY posture held by the last one. "Not in my backyard," said first Reagan and now Bush of the Soviet presence in Central America. Our government refuses to accept the right of those nations close to our borders—in our continental backyard—to choose for themselves the political forces that govern their lives. The perception, even fear, is that those forces could adversely affect the political fabric of American life and, in the future, undermine our ability to choose for ourselves. It is the same principle, but in macrocosm, that drives NIMBY actions in American neighborhoods.

The NIMBY movement draws together strange bedfellows—people of diverse social, political, and ethnic backgrounds. As recently as 1984 a study commissioned by the California Waste Management Board found that NIMBY agitators typically live in the Northeast or California. NIMBY sentiment, however, is likely to crop up in any large urban center particularly in cities with populations of 250,000 or more. NIMBY advocates tend to be young or just entering middle age. They are college-educated housewives and professionals, and most of them are middle-income Democrats. Ac-

"Reflexes excellent."

cording to the study, Southern and Midwestern Republican farm families with a high-school education or less are least apt to question communitywide projects located in their backyards.

Many who live in the middle of the country believe that the 1984 report has been used as a guide in choosing locations for undesirable government and corporate projects. As a result even this essentially passivist group has, in the last two years taken up NIMBY activism.

Perhaps no projected land use causes more impassioned marshaling of NIMBY forces than social programs. When federal, state or local officials propose to locate court-mandated low income units that will house minorities or plan to open a treatment facility for AIDS patients, people react fiercely, revealing the ugliest of issues that plague our lives: bigotry. Certainly the march toward desegregation—most recently fought in the white, middle-class neighborhoods of Yonkers, New York over the construction of housing for minorities—has had overtones of simple bigotry. But there is also a powerful economic concern. Residents fear that if poor people or other unfortunates move in, property values will fall precipitously. Because so many people subscribe to that belief, this is often exactly what happens.

Richard Taub, an urban sociologist specializing in economic development at the University of Chicago, suggests that this is why NIMBY demonstrations are seen in middle-class and working-class neighborhoods among people who must struggle to preserve a fragile economic security. Affluent neighborhoods are less apt to become venues for strident NIMBY protests, as residents of these communities are more able to pick up the phone and speak with influential associates. Middle- and working-class communities do not have this recourse, so they take the most effective paths available to them: relentless agitation within their neighborhoods and an increasingly savvy use of the media, particularly at zoning meetings and other public forums.

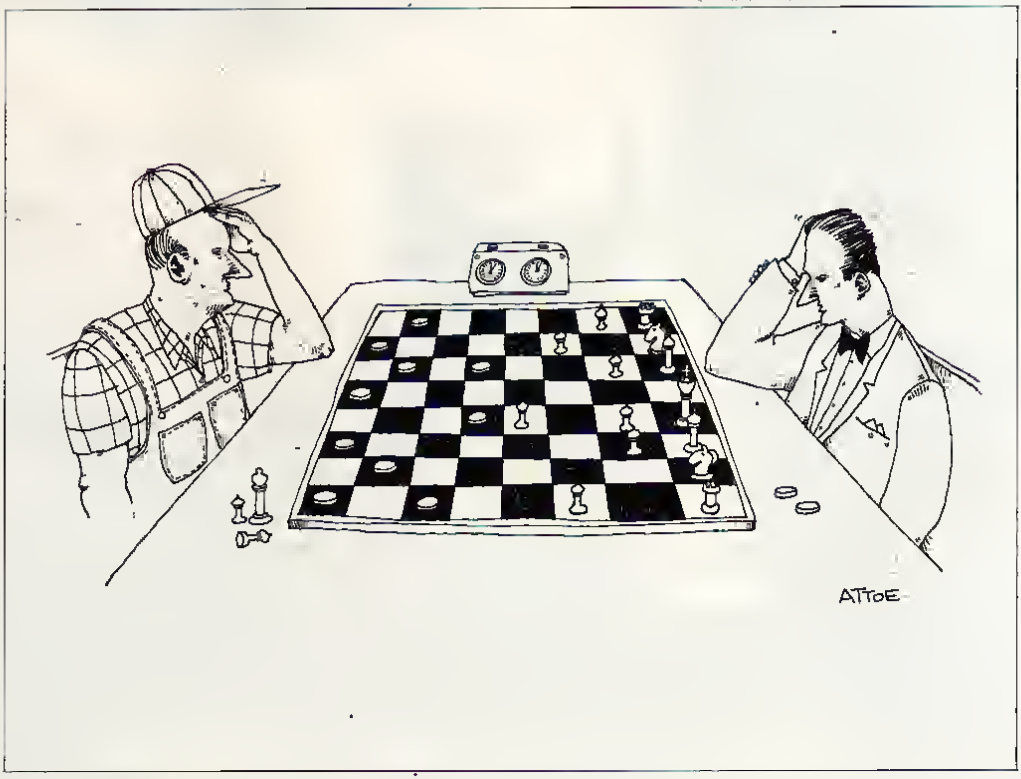
On Good Friday a year and a half ago Wanaque, New Jersey, was the site of a passionate protest. In this middle-class community residents demonstrated against the opening of a facility for AIDS patients. Even the mayor, Angelo Cutillo, got involved, leading some 100 demonstrators in circles around an A&P parking lot, across from a nursing home that had agreed to take in 120 AIDS patients. The protesters cared little that the transfer of the patients from Newark hospitals, where daily care cost some $750 per patient, would save the state $48,000 a day in treatment costs. Nor were they swayed by compassion for the frail and dying.

"These AIDS people come from a degenerate society," declared civic association leader Ken Higgins. "I'm talking about sex and degenerates passing drug needles in Newark. They don't want them in Newark. Well, don't put them in our backyard. We believe in NIMBY too!"

Echoing Love Canal, Three Mile Island, and Bhopal, technological NIMBYs also occur regularly. And perhaps it is easier to sympathize with this type of demonstration against the forces of big business. Such cases recall the biblical image of David and Goliath.

The fears are crushingly legitimate. Incinerator smoke carries dioxin, which causes cancer in laboratory animals and is produced by the burning of such mundane household items as wood polish, cleaners, plastics, even the ink of discarded newspapers. Incinerator technology itself is still in its infancy, and federal guidelines on safety and pollution control have not yet been drafted. The costs of waste-disposal plants are exorbitant, ranging as high as $300 million per incinerator. Opponents worry that the huge capital outlay will undermine less costly long-term alternatives such as recycling and packaging reforms. Some fear that the mammoth structures will have no economic alternative but to become "regional incineration centers," with the communities nearest to the plants bear-

CONTINUED ON PAGE 92



CURRENT AFFAIRS

In a vast warehouse cluttered with electrical coils, cables, and machine parts, hardly the typical picture of an artist's studio, Dave Archer gets ready for his day's work. Donning earplugs, he steps into oversize, insulated boots, arms himself with a nine-foot "lightning brush," and zaps more than 1 million volts of electricity onto heavy-duty glass slathered with paint. As he tames the sizzling bolt, the paint erupts and ozone fills the air, a primordial scene signaling the dawn of another creation.

In this manner the forty-eight-year-old artist from San Rafael, California, forges an iridescent spacescape, complets with brilliant planets, streaking comets, and cratered moons that nearly come alive upon close inspection. His experiments are explorations. "I'm beseeching the viewers to enter the cosmos and get a glimpse of what might exist," he says. According to former astronaut Russell Schweickart, Archer may not be far off. In a letter written to the artist, Schweickart

PAINTINGS BY DAVE ARCHER

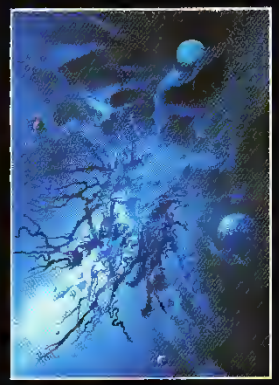
notes, "I believe we are slowly getting the big picture, somehow you seem to have gotten there before most."

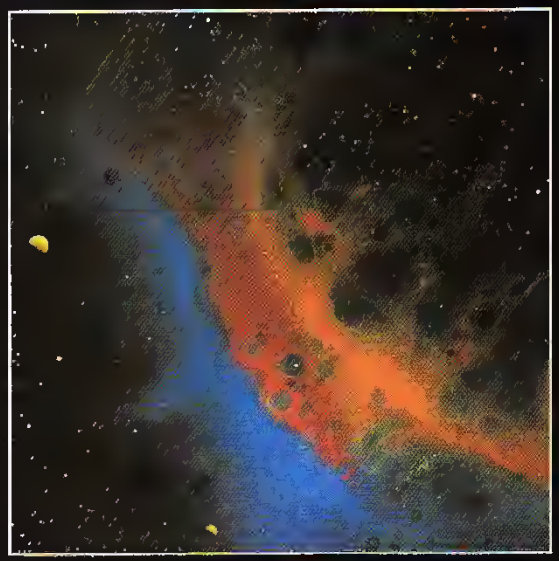
Archer has been using electricity to paint on glass for more than two decades. The Tesla coil, the mainstay of the process, was developed in the 1890's by Nikola Tesla as a means of broadcasting radio signals at very high frequencies. Tesla used the coils in his quest to prove that electricity could be transmitted without wires, but he succeeded instead in generating man-made bolts of lightning.

For Archer the lightning is enough. After spreading paint manually on triple-strength glass, he unleashes the power of a large Tesla coil, and electricity streams through the dual rods of his "brush." The paint bubbles, steams, and disperses, forming the cosmic clouds that typify his work. Methyl alcohol, which ignites and vaporizes the paint, is added to change pigment and consistency. Archer then becomes a more traditional artist, using grease pencils, brushes, and a paletta knife to introduce planets, craters, and other elements of the cosmos.

Archer conceived the technique of electric painting during an intensive three-year study of painting on glass with a fellow artist. "Years ago my cousin introduced me to Tesla coils when he built a small spark-generating device in the garage. I decided to try the coils in glass painting and was amazed at the results," Archer recalls.

Harnessing electricity to create images of the cosmos fascinates Archer, who has forged more than 1,000 such paintings, many of which have been exhibited around the world and sold to private collectors with both artistic and scientific interests. Archer's work captures his enthusiasm for his technique. "The electricity streams out of my wand like a dancing spirit, a spirit of life





and of death as one is drawn into the beauty and repelled by the danger," he says. Although the coil generates 1.5 million volts of electricity, the amperage of the spark is low enough to rule out anything worse than a bad skin burn. But because the technique can be extremely dangerous if not done properly, strict guidelines must be followed, such as wearing insulated boots at certain stages of the process.

Archer, who sells enough paintings to support himself, does not think he'll tire of his technique or his subject anytime soon: "To me all paintings are space paintings. The space the artist deals with is within the borders of the paper, the canvas, or the glass. I happen to be doing space in my own space." But, adds Archer, "I approach my work as an artist, not as a scientist."—Amy McDonald

THE PLANET

CONTINUED FROM PAGE 49

ons as healthy for the economy. They premise defense and national security programs on the idea that nuclear war can be fought and won.

When Soviet president Mikhail S. Gorbachev and former U.S. president Ronald Reagan signed the Intermediate Range Nuclear Forces (INF) Treaty in December of 1987, it signaled to the rest of the world an effort toward peaceful coexistence between the superpowers. Yet during the six months between the leaders' agreement and Congress's ratification of the treaty, both the United States and the Soviet Union built more nuclear weapons than will be destroyed in the three years stipulated in the document. Within the next decade, moreover, 60 countries—including Libya, India, Pakistan, and South Africa—will have the technological know-how to build nuclear weapons. And with the odds of nuclear war steadily increasing, the survival of humanity—indeed, the whole planet—is at stake.

If nuclear war broke out between the United States and the USSR, it would result in the immediate deaths of hundreds of millions of people. Radioactive fallout would eventually kill many more. Scientists predict the ozone layer would be completely destroyed, allowing the onslaught of the sun's deadly ultraviolet rays. In the worst-case scenario, the sun's light would be blocked by radioactive clouds, creating a "nuclear winter" that would destroy *all* life on the planet.

But nuclear holocaust wouldn't necessarily begin with an actual declaration of war. An "error" could produce the same effect. In 1979, for example, a faulty computer chip in the North American early warning system "detected" a massive Soviet nuclear attack. In August of 1984 Soviet Pacific fleet headquarters flashed an alert to ships at sea, ordering them to prepare to engage U.S. forces in combat. Both were false alarms.

Missiles equipped with computer guidance systems that launch on warning can reach their destinations in minutes—intercontinental missiles in less than 30, submarine missiles in less than 10, according to Frank von Hippel, professor of public and international affairs at Princeton University and chairman of the research arm of the Federation of American Scientists. "The elimination of launch-on-warning systems is a first step in reducing the potential for nuclear war," Von Hippel says. "I would also eliminate nuclear weapons designed to attack each other, weapons that justify launch on warning. Such measures would remove the hair trigger on the doomsday machine and then we can shrink the arsenal by ninety percent."

The United States and the Soviet Union must agree to stop supplying weapons to the Third World, Von Hippel adds. "A more cooperative approach between them may be able to throttle back the tremendous flow of conventional weaponry to the Middle East, for example. In the long run, that would be in the interests of Middle Eastern countries as well as the rest of the world."

"Interestingly," says the University of Pittsburgh's Thomas Saaty, a professor of decision theory who worked in the U.S. Arms Control and Disarmament Agency, "ever since the beginning of civilization, prophecies have predicted that a major war would be sparked in that part of the world. And our destiny, at least for now, is tied to the Middle East. That is why we must concern ourselves with what is going on there. And we need to understand their religions in order to understand the way they think."

It seems obvious that a buildup of arms does little to ensure a strong defense when the motivations of entire nations remain unclear. The Pentagon, however, has seduced every president, with the exception of Eisenhower, into believing that national security and strength are based on the magnitude and character of military hardware. Eisenhower, a career military man, launched the interstate highway system and initiated education programs with the idea that a country's infrastructure is vital to any total defense. "He believed that health, housing, and a strong economy are also fundamental to a strong national security program and that our arsenal, in and of itself, cannot compensate for our deficiencies in any of these other areas," says Oregon Republican senator Mark Hatfield. "Eisenhower once said that 'every ship launched and every missile fired is a theft from every child who is cold and not clothed, hungry and not fed.' That is where we have failed in our priorities today. America is more concerned about friendly political regimes—even if it means the destruction of a community or a whole country like Vietnam or El Salvador."

In El Salvador and other countries, even in the United States, the infrastructure is the very area that is suffering. "With teachers, health-care workers, farm people—the kind of army that builds and sustains life—the political, economical, and psychological attitudes would be transformed," says Hatfield, the father of the nuclear freeze movement and a cosponsor of the recently reintroduced Senate bill to prevent the development, testing, and deployment of all weapons in space. "Seeing the results, no one would continue investing in something that produces nothing. Instead of terrorism and war, international justice and stability would be enhanced."

Many peace activists, however, believe that to eliminate nuclear weapons, we must eliminate the institution of war. Moving toward a more global form of government would be a first step. But discussions of global reorganization have always been caught between two extremes: at one end, a kind of anarchy in which every country can do more or less what it wants, and at the other, some centralized, powerful world government.

Von Hippel argues for something in between a specialized, cooperative organization similar, for example, to the International Atomic Energy Agency, which has gotten more than 100 countries to agree not to develop nuclear weapons. Another model of cooperation is the United Nations environmental program, which has been influential in organizing the international ozone convention, a forum where nations work out means of cutting back the production and release of freon and other chemicals that are depleting the stratosphere's ozone.

"During the INF treaty negotiations, Reagan told Gorbachev that it would be easy for us to agree if the Martians landed," Von Hippel says. "But the Martians are already here—not in the form of little green men from the red planet but in the state of the environment, the economy, education, and health issues. These moral equivalents of war can, in fact, substitute for war."

Indeed, in the words of thirteen-year-old actor Lukas Haas (*Witness*, *The Ryan White Story*), "If we keep on making these things that are destroying the world, if we keep on testing nuclear missiles and smogging up the place, we'll never be able to return the world to the way it was."

Active in the peace movement since his appearance in *Testament*, a 1983 film about post-nuclear-war life, Haas has addressed audiences at schools and other gatherings to voice his views on nuclear war. "I think about war all the time, and I think it's a pretty crazy idea," he says. "It's like my dad coming home and wrecking the place and then telling me to clean it up. I try to convince people that we are the ones who will have to deal with it. If countries keep trying, they can work things out. And if they can't, their presidents should get into a boxing match or something because we had nothing to do with it. We don't vote on whether we should go to war, and we haven't done anything to be blasted from the sky."

"I'm not scared for my own well-being," Haas continues. "I don't care if I die or not. I'm scared about humanity dying."

—A.J.S. Rayl

FICTION

Selling your own memories is profitable—but dangerous

BECOMING CINDY

BY

fitting her own crown. Through the window she could see the taillights of jets silently taking off and landing at the airport across the freeway. When she turned her head the trick was smiling at her, revealing a gold incisor inset with a small diamond. Cindy pressed a button on the DreamWalk unit in the headboard and settled against the man's shoulder as the simulation settled over her senses like a slickly edited dream.

She wasn't surprised that he chose a porn scenario and was amused by its lame attempt at a travelogue structure. The scene was tedious but fairly tame—a clattering train ride north out of Bangkok, a nude swim in a forest lake, then straight sex in the Khmer ruins at Pimai. Cindy felt the trick's hands moving across her breasts, mirroring the simulation. In response she reached down and stroked his penis, idly following the sexual blueprint of the dreamwalk. She wondered distractedly whose memories the producers had purchased for the scene. The strongest sensations were touch and smell (damp soil of the surrounding rain forest, patches of dry grass that tickled her spine), feelings she had come to associate with the memories of women.

Then something happened.

Cindy's stomach spasmed. She groaned as a wave of nausea moved through her, merging with the sensations of the dreamwalk. She pulled off the interface crown and rolled to her feet, making it to the bathroom just before she vomited. She rinsed out her mouth and dressed quickly, her hands shaking. At the door she turned to apologize to the trick. He was on his back, still lost in the simulation—his face split in a smile, his hands caressing empty air.

Cindy let herself out.

For several weeks Cindy had been unable to concentrate. Speed had not helped, neither had vasopressin. She kept forgetting her tricks' names, what they did, where they were from. On two occasions she had missed appointments altogether. Cutter had threatened to let her go. It wasn't just tricks she couldn't remember anymore; it was anything beyond the previous few hours. She slipped into periodic fugue states, mobile comas, and would find herself riding subways she couldn't remember boarding, or sitting by a closed café in the rain.

Cindy had been selling off memories to various DreamWalk houses for months with no ill effects. It had seemed an amusing and lucrative sideline. If you're selling the body, why not sell the brain? But she seemed to have hit some kind of neural limit, a place where the minimum psychic energy required to maintain the person called Cindy was no longer available. And last night at the Hilton—running headlong into a memory that she had suddenly recognized as her own—had been too much. For the first time she wondered what other people saw when they lived her memories. What they felt when they wore her body.

When she had arrived home the previous night three Valiums failed to put her to sleep, and she fell back on an old family cure: Quaaludes and tequila. When she woke, late in the afternoon, Cindy found that Cutter had left several messages for her to call him, the last ending with the promise that if she ever fucked up again he was going to break her sweet neck.

Cindy logged onto the household computer and dialed her bank, requesting a printout of all the deposits made to her account during the last six months. Over coffee she scanned the pages of printout, finding in the deposit dates and dollar amounts not only the state of her finances but a strange kind of autobiography of prostitution, detailing her life in acts of trade and commerce. Cindy used a purple pen to circle the names of DreamWalk production houses that had made deposits to her account. There were more than she'd expected.

> *"It was like dying. It was like walking from one dream to find herself in another, a Chinese puzzle box of dreams. She kept jumping from simulation to simulation, seeking herself."*

After breakfast she walked to a big DreamWalk outlet near Broadway and Fourteenth and began buying chips. She read the simulation descriptions on the backs of the first few chips she picked up, hoping one might sound familiar. It finally occurred to her that as she had sold off each memory, the sense of having lost it would have vanished, too. In a way it made things simpler. She happily filled a bag with a dozen chips from each company on her list. The bill was high—nearly a quarter of her savings. Out on the street she smiled, giddy and excited, feeling as if she were about to be reunited with a long-lost relative.

Candy-colored neon buzzed quietly in shop windows as she walked along Broadway. Evening was just coming on. Cindy was deep into Soho and nightfall when she realized she could not remember where she was going or where she lived. Afraid to stop, afraid even to speak to anyone, she kept on walking. During the night she caught glimpses of herself in the chrome ornaments of shopping displays and shattered car windshields, finding these pliant images of her face more comforting and familiar than the more physically accurate reflections she ran across. Around dawn she sat on a bench near the water and began to cry. A policeman checked her identification number and drove her home.

Cindy sat on the rug in the living room with the chips spread around her like pieces of a monochromatic puzzle. Settling back against the couch, she put a chip in the player and thumbed it on. It was a simulated glider flight up the California coast, the Pacific glittering endlessly off to the left, gray whales breaching in the distance. The first six dreamwalks Cindy took were useless travelogues, battle simulations, and sex scenes. During the eighth, however, she felt a familiar tightening in her stomach. This time she was not afraid and rode the simulation out before entering it in a notebook. That night Cindy found two more memories she recognized.

In the morning she accessed the DreamWalk shop on the computer and opened an account. Her first order was for two more playback units, a switch box, and patch cords. Before logging off Cindy checked her bank balance. It was lower than it had been in years.

When the equipment arrived, she patched all three DreamWalk players through the switch box and loaded a chip into each player. She kept her hand on the switch box as the first simulation came on. Minutes later she pressed a button on the box and was jolted from a dugout in the Rio Negro to a free-fall simulation. Pressed the button again and found herself on a roller coaster in the Moscow Disneyland. Pressed it again and was back on the river. The third time she almost fainted, disoriented by switching bodies and perspectives, all the jumbled sensory data. She switched again. And again. It was like dying, it was like waking from one dream to find herself in another, a Chinese puzzle box of dreams. She loaded in new chips.

Cindy kept jumping from simulation to simulation, looking for herself, but soon, too, was riding a high compounded of hysteria and sensory displacement: feeling, as she left one body for another, moving from one sex to the other, the layers of the person called Cindy peeling away until there was nothing left but raw bones and overloaded nerves.

She came to on the floor of the apartment building lobby, unsure of how she had gotten there. Back upstairs she found her apartment door open and all three DreamWalk players still going. Chips were scattered all over the floor. An LED on the message machine was blinking. It was Cutter giving her the name and address of her next trick. She turned him off before the message had completed. Her

CONTINUED ON PAGE 90

The intrepid climber on the rock face is equally daring in the alien world of superspace—where dimensions number not just 3 but 8, 24, 10,000, even billions. His math makes possible CDs, modems, and deep-space communications

INTERVIEW

NEIL SLOANE

Paralyzed halfway up a 200-foot vertical cliff in the Shawangunks, New York State's rock-climbing Mecca, with no way down or up, I bargain with God that I will give up interviewing forever if only I can make it to the ground safely. High above my head Neil J. A. Sloane, expert rock climber and star mathematician at Bell Labs, AT&T's elite research center, encourages me. "Come on, Anthony," he calls, his mischievous grin just visible over the cliff top. "Stop malingering! You can make it." With a giant leap of imagination, I decide he may be right and, after a few minutes of straining and heaving, join him to gaze at the green carpet of treetops far below.

Being led by Sloane up sheer granite is rather like following him into the limitless reaches of his math—except that on the rocks he likes to wear dazzling, multicolored spandex tights. Swift and nimble as a cat burglar as he stalks up a smooth rock face, Sloane maps the alien world of superspace, where dimensions number not just the familiar 3 but 8, 24, 10,000, even billions. So remote from everyday life is this mental galaxy that the uninitiated can only cling to it dizzily, blindly putting their trust in him as a guide. That Sloane's far-out math be useful is not something Bell Labs, a haven for free-ranging geniuses, insists upon. Astronomers do, however, depend on his work to penetrate the atmosphere to the far reaches of the universe. From CDs and modems to satellites, the whole global apparatus of digital communications depends on Sloane and a few other top coding theorists.

The accuracy of electronic messages hinges on error-correcting codes. Chips add the codes' extra bits to the impulses before they are sent off. The codes let signals survive even the worst noise interference intact. What is sent is exactly what is

PHOTOGRAPHS BY TODD JAMES

"Like most rock climbers I took up climbing because I was afraid of heights—just as people go into psychoanalysis and become shrinks because they're crazy. You take up climbing to overcome your fear of it."

received Claude Shannon, also of Bell, first demonstrated the potential of such codes in 1948. Since then, increasingly powerful examples have been invented. Sloane, with colleague F. J. MacWilliams, wrote the book on them—*The Theory of Error-Correcting Codes*—in 1977. Today Sloane is considered the leading authority on algebraic coding theory.

Codes lead into Sloane's dreamlike terrain, the math of sphere packing. In its simplest form, this seemingly whimsical study might ask innocently enough: How many oranges can you cram into a crate? But solutions mathematicians have learned are not easy to prove. In 1694 Sir Isaac Newton himself pondered how many oranges can touch or kiss one orange at once. Even now the finest mathematical minds have failed to confirm what any greengrocer demonstrates every day: the densest method of packing oranges in three dimensions. But Sloane has tearlessly pursued the kissing dilemma into higher dimensions. He and colleague Andrew Odlyzko were the first to prove that only 240 spheres can kiss 1 sphere in 8 dimensions; that 196,560 can touch in 24 dimensions.

These mind-boggling results may seem facets of a mathematical never-never land, but they're very important to Bell Labs engineers. Packing imaginary spheres more tightly translates into better codes that cram information more efficiently along cables or across space. Densely packed spheres are the mathematical way of representing how to send the waveforms of a coded message as quickly as possible while keeping them well separated to avoid error. The more dimensions involved in sphere packing, the more accurate the transmission. Codes can easily involve 100,000 dimensions. Some of Sloane's math explores spaces of more dimensions than the number of atoms in the universe.

Sloane thinks a lot about regular packing arrangements known as lattices. Nature lines up the atoms in diamonds and in other crystals in orderly lattices. In many multidimensional spaces, no one yet knows whether lattice or nonlattice arrangements are the densest possible. Sloane is working to find out. Meanwhile, the E8 lattice is the densest lattice in eight dimensions, a number favored by engineers. The practical result, if AT&T wants to produce it, could be a superfast 19,000-baud [signaling speed of bits per second] telephone modem. A competitor, Codex, already makes a similar modem based on a rival eight-dimensional coding scheme.

Such esoteric abstractions constantly fuel Sloane's mental furnace, which stops only for sleep. One friend says he used to divide all his tasks into categories A, B, and C. C tasks were things he'd do when absolutely too exhausted to think. Family legend has it that he juggled toys with his feet as an infant out of boredom.

Sloane's family comes from Beaumaris, Wales, where his paternal grandfather, after losing a foot to gangrene in the Boxer Rebellion in China, became mayor and made a fortune as a racing bookie. "He was known as The Todder," Sloane recalls. "And as legend has it, he was the most powerful man in North Wales. The Reverend Somebody-or-other wrote a scurrilous book about him called *Sarne*. But Grandfather took the reverend to court for libel and got all the copies burned. I've never been able to find one, not even in the British Museum." Sloane's other grandfather wrote an arithmetical guide to cotton spinning.

In 1948, when Sloane was nine, his family migrated to Melbourne, Australia, where he won scholarships and eventually a graduate fellowship at Cornell. Bell recruited him 20 years ago because of his prowess as a coding theorist.

Married to a writer, rug maker, and fellow rock climber, Susanna Cuyler (author of *One Who Goes Everywhere: The Ubiquarian's Dictionary*), Sloane seems always on the move, driving and talking at breakneck speed, sketching his ideas with breathless rapidity. His office at Bell is a grand mess of papers, books, and machines. The computer terminal is armed with MACSYMA and other advanced programs. (Sloane imagines that if an amateur pianist got to play the organ at St. Patrick's Cathedral in New York City and with one finger produced an overwhelming quantity of sound, he might feel the way a mathematician does when he first uses MACSYMA.) There is a model of the diamond's latticed structure and a pile of crank mail. ("Dear Dr. Sloane: You are a mathematician, and I am the discoverer of antizero.") With his wiry body, schoolboy grin, and nervous enthusiasm, Sloane seems to have discovered the secret of eternal youth.

—Anthony Liversidge

Omni: Why did you start rock climbing?

Sloane: Like most rock climbers I took up climbing because I was afraid of heights—just as people go into psychoanalysis and become shrinks because they are crazy. You take up climbing to overcome your fear of it. After seventeen years, heights don't bother me much.

Omni: Do you see any relationship between rock climbing and mathematics?

Sloane: No, they are totally orthogonal [at right angles]. Rock climbing is strength, balance, and courage. You have a rope, but usually it's going downward if you're the leader. You attach the rope every so often to pitons stuck in the rock. You try to make sure that if you fall there's enough protection to hold you. Of course things can break, rock can fall apart. Climbing combines athleticism with sunshine.

Omni: Do you risk your life climbing?

Sloane: Only in England and Wales are some routes potentially fatal. In a few places, like the sea cliffs in Anglesey, you

have to climb without putting in protection. If you fall you can die. In the United States climbs are graded according to difficulty, from 5.1 to 5.14—the hardest. In England they have an E rating that, roughly speaking, tells you how dangerous the climb is. On an E8 route, if you fall, you die. The hardest I've done is an E5. I'm willing to do some pretty scary things, but I'm nowhere in the same class as people who do E8's. I've been up twenty-five feet with no protection, legs shaking. But those weren't death routes. Maybe hospital routes. But you wouldn't crater [go through the ground].

Omni: What were you thinking about as you climbed today?

Sloane: Group theory, groups generated by reflections, like holding up two mirrors against each other generates a two-dimensional group. I am working in *n* dimensions—groups generated by *n* reflections in *n* mirrors, seeing what you see in them. It's not very interesting when you get an infinite number of reflections, but in some cases you get a finite group, and these are called reflection groups.

Omni: What are the "deep holes" you've recently been exploring?

Sloane: A lot of things I'm interested in somehow relate to these deep holes between spheres in a certain lattice. It turns out they have a wonderful mathematical structure. There are an infinite number of them. If you think of yourself as sitting at this hole or gap between the spheres, you can look at the pattern of spheres around you and it's like a constellation of stars in the sky. These constellations have some wonderful properties. It's sort of magic.

Omni: You wrote in *Scientific American* that higher dimensions are not really spatial. Yet you use words like *spheres, touching, sliding into gaps and holes*. How do you visualize this seemingly impossible geometry?

Sloane: They are spaces! Perfectly ordinary geometrical spaces that just happen to have more than three dimensions. You can think spatially if you wish. You might find it very confusing, but there's no harm in it. It's like one of those astronomers who, from a terminal in Germany, controls what a telescope in Chile is looking at. He can rotate the telescope, point it, make some measurements. Then the photons are translated into numbers and sent over a wire. It's exactly the same for me. I'm looking at multidimensional space, but all I'm really getting is stuff on my screen. Like the astronomer, I'm missing a lot. But also like him I take essential measurements. He measures the spectrum of a star, I plot spheres in twenty-four dimensions.

It's probably not possible to think in twenty-four dimensions as such. I have some idea, however, of what happens when you fiddle around in twenty-four dimensions. It's really the same geometry you need in two or three dimensions. You still describe geometrical objects by points and lines, coordinates and equations. How do you tell in two dimensions if you have a proper packing of circles? You can draw pictures and see if they overlap. In twenty-four dimensions a circle is described by an equation.

Omni: Can space be described by slicing it?

Sloane: Yes. In three dimensions, if you take a slice through a plane, you get two dimensions. If you intersect that with another slice you get one dimension. If you intersect three planes, you get a single point of zero dimensions. You can also go the other way, building up space in layers. This is a very powerful technique. You can think of four-dimensional space as a stack of three-dimensional spaces. Just as you can think of three-dimensional space as made up of layers of two-dimensional spaces. You can keep on going like that to dimensions five, six . . .

Omni: Most people have trouble imagining more than three perpendicular lines.

Sloane: Draw them on paper. Paper is two-dimensional, and you can draw three dimensions on it if you flatten them. Do the same with a four-dimensional picture. On paper something like the letter Y is a projection of three perpendicular lines in three dimensions. An X or some other thing with four lines meeting at a point, is a projection of four perpendicular lines. The lines can in fact be all at right angles, even if there are twenty-four of them.

Omni: Can you also draw a four-dimensional cube?

Sloane: In two dimensions. It's very hard to draw it in three dimensions because I don't have three-dimensional paper. In four dimensions a cube has sixteen vertices, or corners. You draw a three-dimensional cube, which has eight corners, then draw another three-dimensional cube a few inches from it. Now join up the corresponding vertices of the two cubes with lines. You've got a four-dimensional cube. It's a graphic representation that is not totally accurate because it distorts things. If you want a five-dimensional cube, take that entire thing and slide it in different directions and join up the vertices again. You have thirty-two vertices now.

Omni: Would a four-dimensional sphere look like a sausage then?

Sloane: No, it still looks like a sphere. Let's go back to two and three dimensions. If you have a circle, how do you get a billiard ball from it? You pick the circle up, gradually shrinking it. Imagine a rubber band in the shape of a circle sitting on a piece of paper. You pick it up and gradually shrink it to a point, and it becomes a hemisphere above the paper. Do the same thing on the underside and you have a sphere. You do exactly the same thing in going from three to four dimensions to make a four-dimensional sphere.

Omni: Is it true that Newton and the Scot-

"Don't worry. I'm a stunt man."

tish mathematician David Gregory tangled with the problem of the maximum number of spheres you could pack in three dimensions?

Sloane. Yes. Gregory did the obvious calculation, dividing the surface by the area taken up by one ball, and came up with a number a bit bigger than thirteen. They discussed it and Newton may have said you probably can't get thirteen. It's hard to read Gregory's notebook, of which I have a copy, written in old Latin. But there is no suggestion they disagreed. The story that Newton had a firm opinion [no more than 12] and Gregory disagreed sounds wrong, doesn't it? They probably left it open.

Omni. An enlightened person such as Newton probably couldn't commit himself to something that wasn't proven.

Sloane. Oh, I don't know about that. If you think about a problem enough, you say, 'Well, I admit it's pretty obvious that it's such and such, and I'm willing to bet it is.' Certainly Gregory thought about it a lot, so perhaps Newton did, too.

Omni. Couldn't they have decided the question quickly by experimenting with real oranges?

Sloane. No, it's very hard to do this. Say you have fourteen billiard balls. One in the middle you try to hold and put thirteen around it. After you put twelve in place, there is a lot of space left over—more than enough to get another ball in if only they could be forced closer together. There are a lot of ways of trying to do it. You are not forced to make any one move. There are infinitely many different arrangements of twelve. But you can't get thirteen to kiss. That is a theorem, a true fact. What is *not* proved is that there isn't a denser packing, a way of filling space with more oranges than the so-called face-centered lattice, the standard grocer's pyramid.

Omni. But if you have a tabletop and pack it firmly with one level of oranges, then another layer firmly packed into the recesses provided, why isn't that the densest packing possible?

Sloane. Because you do not have to start off on a plane. You could begin with any arrangement you want and add new spheres according to any rule you can think of. You don't try to fill up space all at once but do it gradually. You might start off with one orange and then add a second, third, fourth, each time in such a way that you minimize the volume, using what is called the greedy algorithm. Each time you make the greediest choice, that locally maximizes the density. Then you get a very irregular packing. To begin with it is denser than the fruit stand packing, so it starts off well. But when you get up past eight or nine spheres, the density falls off.

Omni. Why did you write that all physicists know a sphere's maximum density in three dimensions is .7405—even though mathematicians can't prove it?

Sloane. That's what [British mathemati-

CONTINUED ON PAGE 96

THE VIEW FROM THE TOP IS ALWAYS BETTER

One of the big rewards in life is owning a top-of-the-line big screen. The extraordinary new 55" Big Screen TV from Hitachi.

Our newest big screen is a TV that's truly in a class by itself. With an engineering-breakthrough high-performance optical system. A picture whose brightness, color accuracy, sharpness and realism are unsurpassed. An oversized picture, packed into a real wood veneer cabinet that's much more compact than any other comparably sized TV. A big screen TV that fits nicely into any sized room.

The exclusive CT-5582K HPX High Performance eXtraordinaire 55" Big Screen TV also features Hitachi's theatrical quality surround sound and an intelligent remote control that enables you to combine all your infrared remote controls in one convenient hand unit.

When you're ready for a big screen TV you can really live with, you're ready for Hitachi.

HITACHI

A World Leader in Technolog

We Make Entertainment Come Alive!

John Lear has flown 160 different types of aircraft but never a flying saucer, and he's jealous of those who have

ANTI MATTER

UFO UPDATE

John Lear loves to fly A captain for a major charter airline he s flown airliners seaplanes fighters gliders gyroplanes and helicopters 160 different types of aircraft all told including the Learjet designed by his father William P Lear Sr But he has never flown a flying saucer and he says he's jealous of those who have

Lear believes that since 1947 the U S government has recovered at least 30 flying saucers belonging to alien civilizations And he claims some of these have been test-flown by U S government personnel from Groom Lake Nevada under a secret program called Project Redlight What s more he declares the United States government currently has at least 30 frozen alien bodies representing three different alien civilizations in storage at Wright Patterson Air Force Base Homestead Air Force Base and CIA headquarters in Langley, Virginia

But no all the aliens the government deals with are dead The U S government has been in business with little gray extraterrestrials for about twenty years says Lear who gets his information from published UFO literature personal contacts in the intelligence community and government documents both genuine and alleged In fact, he says by the early Seventies the United States had made a deal with these creatures In exchange for technology we promised to ignore their abduction of humans and mutilation of cattle

The government says Lear was led to believe that these activities were simply part of an ongoing effort to monitor our developing civilization This was not the case Instead he says, the aliens whose digestive systems have atrophied [illegible] hormones and enzymes and feed themselves by applying a solution of this material directly on their skin

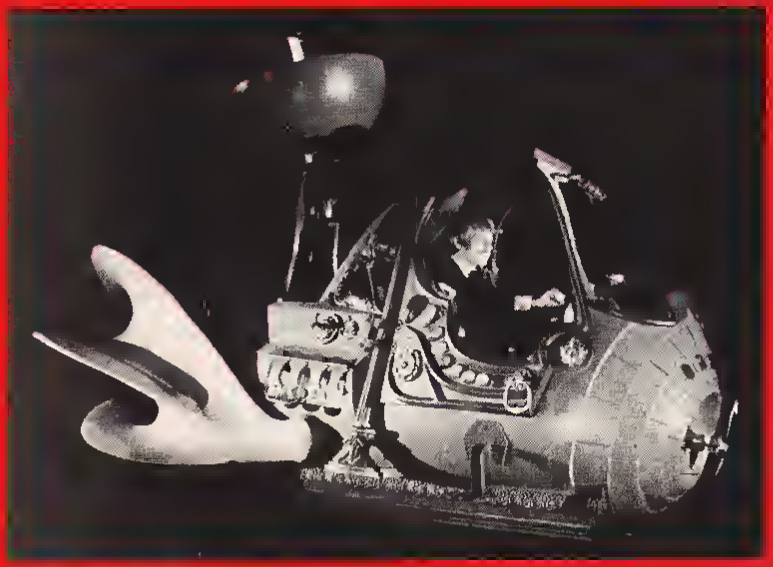
The human and animal body parts are processed in huge underground alien bases on Earth says Lear New Mexico the "Land of Enchantment, is thought by some of Lear s intelligence sources to be the home of three of these bases located near Dulce Datil and Sunspot Witnesses adds Lear report seeing hundreds of huge vats with human body parts floating in an amber fluid "We are in deep serious trouble," says Lear and the public needs to know about it now

These bold statements have made Lear an extremely controversial figure in the UFO field 'I don t wish to repudiate his claims ' says Leonard Stringfield who has spent decades researching reports of UFO crashes and retrievals 'But I would rather be cautious and refer to these sorts of things as rumor rather than fact

Walt Andrus international director of the Mutual UFO Network comments Some people say it s way-out material But it might be true Who knows?"

He s a very colorful character " says Jim Moseley editor of *Saucer Smear*, who has capitalized to some degree on his father s name I don t happen to believe a word of what he says but it s a lot of fun '

As for Lear he says he saw U S government personnel test an alien spacecraft 'last March It was his first personal encounter with the alien force —*PATRICK HUYGHE*



TIME-TRAVELING ROBOTS

Information beamed to us from 200 years in the future? Visits back in time to see what our ancestors looked like? Sounds like the stuff of science fiction? Maybe so but physicist Nick Herbert explains in *Faster than Light* (New American Library) how r theory at least time travel could one day make these scenarios real

Einstein Herbert notes first suggested that time travel is possible by way of a fourth dimension which could be entered by going faster than light Although Einstein then slammed the door on time travel by saying nothing could go faster than light scientists now suspect faster than light speeds may be possible Because of the enormous amount of energy that would be needed to send an object back in time at the speed of light Herbert believes that faster than-light signaling—using a kind of time telegraph—will probably be a reality long before faster-than-light travel My guess is that information like a radio wave or even disembodied consciousness will be the first to go back in time" he says

Herbert notes other avenues for time travel as well Einstein's general theory of relativity for instance states that if you twist four dimensional space-time enough you can actually go backward in time And wormholes—the minuscule holes that today's cosmologists say may be shortcuts through space—might be pried open then used for moving in and out of time continuums

Herbert points out that an advanced civilization for example might build tiny robots that could sense when a wormhole opened up A catheterlike machine would then pop open the wormhole and make it big enough for the robots to maneuver into it and through time

—Sherry Baker

I have seen the future and it doesn't work

—Robert Fulford

The past is a work of art free of irrelevancies and loose ends

—Max Beerbohm

[illegible] view

Skeptics and believers had a field day when the journal *BBC Wildlife* published a photograph of the Abominable Snowman in its September 1986 issue The photograph had been taken by one Tony Wooldridge on a trip to India's Garhwal Himalayas Before he encountered the creature, Wooldridge said, he had come upon a series of strange tracks in the snow (See Abominable Photograph Antimatter, August 1988)

The solution to the mystery however has recently come o light The object Wooldridge saw and photographed was a rock!

The truth came out not long ago when Wooldridge returned to take photographs at the scene He sent his pictures to University College in London where photo experts David Stevens and Ernest Wickens analyzed the pics Their finding? The mysterious figure was a configuration of rock partially covered with snow

Nobody has tried to challenge the report issued by Stevens and Wickens This new evidence is obviously very disappointing ' comments Wooldridge I appear to have jumped to a false conclusion which has taken nearly two years to sort out. '

But the English traveler isn't completely daunted by the results Referring to his original experiences in the Garhwal Himalayas he states Whatever made the footprints and grove in the avalanche debris remains a mystery —D Scott Rogo

UNDER THE INFLUENCE

Can normal subjects use their minds to influence random numbers appearing on a computer screen?

To find out, psychologist William Vitulli of the University of South Alabama asked one test group to use concentration to raise the numbers as they appeared. A second group was asked to lower the numbers, and a third group was asked to do nothing at all.

Reporting his results in *Psychological Reports*, Vitulli found that the values remained the same in all three groups, suggesting that psychokinesis or PK was not at work. In the same paper, however, he added that if the groups were divided according to different guidelines, he could ferret out evidence suggesting that PK was afoot. First of all, for some subjects the numbers had been flashed on the computer screen every second, while for others the numbers appeared every three seconds. And the one-second subjects, it turned out, had significantly higher scores than the three-second subjects. Finally, each subject saw the numbers flash on the screen in three sets of 25. As it turned out, scores varied significantly from one block of 25 to the next.

Is this evidence of PK? In the case of the one- and the three-second intervals, Vitulli says, the computer program could have been faulty and bumped the numbers up, although it is not supposed to do that. As for the differences between the blocks, he finds them "difficult to explain." And he says, "I wouldn't want to throw out the PK hypothesis."

Yet James Alcock, a psychologist at York University in Toronto, is surprised that Vitulli would report differences that he didn't set out to find and had no theoretical reason to expect. He thinks that Vitulli should rerun the study and focus on the one-second/three-second interval. If he gets the same thing, "there's a mystery to investigate." —Paul McCarthy

SOVIET HANDYMEN

It was billed as the biggest event in the state of Georgia since Jimmy Carter was elected President. A large contingent of scientists from the Soviet Union was to attend the Seventh International Conference on Psychotronics Research at West Georgia College in Carrollton. Researchers from around the world, including Mexico, Italy, Norway, Canada, and Poland, came hoping to hear the Soviets reveal the secrets of their work in psychotronics, a field of applied parapsychology that takes the existence of psychic powers for granted.

But of the nearly two dozen Soviets expected, including three members of the Soviet Academy of Sciences in Moscow, only six showed up. None were from the Soviet academy. "I don't know the official reason," says Carl Schleicher, the conference coordinator. "We had raised the money for them to come, and their visas had been issued by the State Department. So a high-level decision must have been made by the Soviets to let certain people come but not others."

Nearly all of the Soviets who *did* attend came from the Youth's Medical Center at the City Hospital in Moscow. Their presentation centered on what Veronica Irina, a Soviet researcher, calls "manosonics." This new science, she said with a smile, is a great Soviet secret. Manosonics is essentially a highly ritualized technique of controlled breathing and hand and finger exercises developed to enable its practitioners to heal with their hands.

The Soviets had hoped to train a number of American physicians in manosonics but, to their great disappointment, found no doctors in the audience. Equally disappointed was Marcello Truzzi, a sociologist at Eastern Michigan University. "Where are the data? Where are the controls?" he says. "What surprised me is not that they let these Russians out, but that they are readily letting them back in."

—Patrick Huyghe

It is the mark of an educated mind to be able to entertain a thought without accepting it.

Aristotle

BIGFOOT FRAMED

Michael Dennett a member of the Committee for the Scientific Investigation of Claims of the Paranormal (CSICOP) says he has studied Bigfoot probably more than any other skeptic His most recent foray into the ape-man arena included a public lecture entitled ' In Search of Famous Monsters delivered at the California Institute of Technology this past winter Dennett insists that he went out of his way to cover both sides of the Sasquatch controversy But Rich Grumley director of the Lancaster-based California BigFoot Organization says that the lecture was "an attempt to cram a negative unscientific viewpoint down people s throats '

Physicist Al Seckel executive director of the Southern California Skeptics group which sponsored the event says he offered Bigfoot proponent Jon Erik Beckjord 20 minutes to present his case following Dennett s lecture 'We had the hall for only a certain length of time and I had to cut him short when he ran overtime Seckel says If that makes the Bigfoot believers mad then I m sorry

Bigfoot advocates were offended to say the least After the lecture Seckel received a letter in which he was compared to Hitler Says Seckel of his critics Frankly some of their wires aren t crossed right The letter speaks for itself

As for Beckjord (who theorizes that Bigfoot is an interdimensional being) he s glad he was asked to participate in the lecture Nonetheless he contends Dennett showed the worst pictures and stacked the deck against Bigfoot He made over thirty factual errors saying that there have been no significant hair or blood analyses done on Bigfoot When we tried to present the correct facts and eyewitnesses they pulled the plug

Dennett points out that he discussed 20 types of evidence proponents say support Bigfoot and then gave 20 skeptical responses For example on the pro side I talked about the footprints that have been found Then explained that there is no consistency to them Some have six toes some have four some are small some are eighteen inches long And the ones with ridges were supposedly found by a man who has confessed to taking other Bigfoot prints

Rich Grumley who claims that he sighted a 17-foot-tall Bigfoot in the California woods circa 1973 thinks there s [illegible] way t[illegible] settle the controversy These creatures migrate and we know the path they take If people donate money for gas and vehicles we can go after them and prove what they are once and for all

But Dennett isn t expecting the hairy creatures to be captured anyt me soon Says Dennett There s more evidence for Santa Claus

Sherry Baker

Men should stop fighting among themselves and start fighting insects

—Luther Burbank

UFO'S FRAMED

The notion that pictures are worth a thousand words doesn t apply to UFOs For one thing b ight smudges of light against a dark background don t allow experts to pin a size on the so-called objects For another the obscure images might be a few inches or tens of miles from the lens But now some experts say the photos taken by the controversial Mr Ed of Gulf Breeze Florida (UFO Update August 1988) are an exception

Since last November, Mr Ed has taken dozens of Polaroid shots and a videotape of UFOs Some of these photos were taken by special cameras provided or suggested by such UFO investigators as Maryland physicist Bruce Maccabee an expert in optics Particularly revealing of Maccabee are a pair of frames from a set of stereo photographs taken by dual Polaroid Sun cameras Maccabee s analysis measures [illegible] e ylindrical UFO in the photographs to be more than 20 feet wide A second object was judged to be smaller about two and a half feet long

'This small object could indicate that there are six-inch aliens or that ten foo aliens have remotely piloted vehicles says Maccabee anticipating jokes about 'tight quarters But he believes that the probability of a hoax is smaller than the probability that i real'

Skeptic Phil Klass who examined the most suspicious of the photographs rather than the best believes otherwise m convinced that the photos are ninety percent authentic and ten percent hoax he says 'The authentic parts are the trees the bushes and the light pole The hoax part is the U [illegible]

—Patrick Huyghe

My eyes are so stuck to the point of view that am looking at that I believe they are going to bleed

—Paul Cezanne

BECOMING CINDY

CONTINUED FROM PAGE 76

notebook was lying on a coffee table near the sofa. During the night she had recorded close to two dozen memories.

In the afternoon more chips arrived, and another DreamWalk player. Cindy slipped on the interface crown and began body hopping, finding it easier each time to adjust to the sensory jolts. In the end it felt like being with a trick, the peculiar displaced sensation that came over her when she temporarily left her body while having sex with some strange man or woman in an airport hotel. The faces in the simulations melted into a singular metaface that Cindy, suddenly aware that she had no face other than the one she constructed for each new trick, recognized as her own. She continued to note those memories she knew were hers, but she also recorded ones she was not sure of and sometimes ones she just liked.

Moving deeper into the levels of the simulations, she no longer needed food. She no longer needed sleep. Cindy saw herself everywhere and nowhere, brain sliced and diced and spread across microscopic layers of silicon on a few dozen master chips that reproduced thousands of copies of themselves. She had entered a place of no time, tricking forever on DreamWalk players scattered around the world. Cindy the forever fuck, Cindy the chip, the trick, ubiquitous as death.

When Cindy awoke she had the feeling that she'd been out for days. One of the chairs from the kitchen had been pulled up even with her head. An ashtray on the floor was overflowing with crushed Gitanes. Cutter had been there. She knew that meant she had missed another trick and was out, not only from Cutter's stable but probably from anybody's.

When Cindy sat up and saw the broken chips around her she was neither surprised nor frightened. *Digital seppuku*, she thought, and laughed, scattering the chip fragments with her hands, realizing how pointless a gesture it had been to destroy them. *Can't kill what's already dead*, she told herself. The notebook lay by her feet. As she read through its laundry list of experiences she realized just how stupid she'd been, thinking she could reconstruct herself by dreamwalking with her memories. The things she had originally taken for her memories, she now knew, had all been fakes—scenes based on her experiences but edited for a mass market. And even if they had been real, the DreamWalk players offered only the simulations of memories, not the memories themselves.

Cindy went into the bathroom and cleaned the cuts on her hands, letting cold water run over her swollen palms. In the living room she accessed her bank account. *Not much left of either of us*, she thought when she read the balance. As she stood, Cindy caught a glimpse of her face in the computer monitor and thought back to that night at the Hilton. The dreamwalk had ended in Pimai. There was a temple to Siva there, she remembered. That was what had startled her. The Khmer architects had carved the face of the goddess into the building itself, so that the individual stones that made up the walls were still visible. Cindy considered the block face of the goddess as she swept the broken chips into a pile. It was not a beautiful face, she recalled, but it held genuine grace. As she carried the broken chips to the disposal in the kitchen she wondered idly if her face might be in the mass of silicon somewhere. She knew it didn't matter and dropped the chips down the chute.

After eating some breakfast, Cindy walked to the East River and watched the traffic across the Manhattan Bridge. The wind was cool off the water, but the sun warmed her. She touched her cheek once, half expecting to feel creases where stones met. Grace was not bad, she thought. She could live with grace. DO

BACKYARD

CONTINUED FROM PAGE 64

ing a disproportionate share of environmental ruin and health hazards.

NIMBY activists fight fierce battles to keep their backyards free of both technological plants and centers for the "wretched of the earth." Psychologically, NIMBY reactions such as rage, insecurity or bigotry reflect a deep sense of fear. Misfortune can beset anyone.

Frank Popper, chairman of the urban studies department at Rutgers University, is writing a book on the subject of NIMBY, or LULU—locally unwanted land use—as he dubbed the phenomenon before the term *NIMBY* became nationally known. In Popper's view the NIMBY syndrome will only get worse as the decade draws to a close. Already the nation is paralyzed, he says. No nuclear power plant has been undertaken since 1978, despite numerous tries; no large, free-standing hazardous-waste dump has been sited anywhere in the United States since 1980; and no large metropolitan airport, since the early Sixties (Denver, after an extensive campaign to draw public support, seemed to have settled on a location for its new airport, only to discover that the region's two largest carriers, Continental and United Airlines, refused to move from the existing airport, apparently unwilling to risk the competition that expanded air-traffic facilities would bring. This wrangling has yet to be resolved.) "The lack of locations for new prisons has caused so much overcrowding," Popper continues, "that some cities—New York, Chicago, Pittsburgh—have had to release prisoners."

Sociologist Taub suggests several obvious and practical ways to circumvent NIMBY deadlock. "Give the community some assurance that efforts will be made to maintain property values through appropriate intervention. Give them a sense that other communities are also sharing the burden." Taub proposes a lottery system to decide the sites of undesirable projects. "Literally put all the possible locales into a drum and draw one out." The community that is chosen should then be offered what Taub describes as "countervailing incentives." If, for example a community is to become host to a factory, then offer that community a new school, road improvements, renovation of its housing stock, or some other reciprocal project that assures the community of its continued stability.

In a similar vein some have suggested that properties located next to unwanted but necessary projects be given tax abatements. Popper contends that such incentives may still be insufficient to encourage communities to shoulder the burden of LULUs. He proposes a regional point system to ensure that particular communities—usually those that are poorer and have the least political clout—do not become NIMBY dumps. A hazardous-waste facility might be worth 100 points, a group home 30, a highway 50. "Three halfway houses might equal a factory," Popper says. "Each neighborhood could decide the point values and take its equal share of points."

Popper does not discount the importance of continued research to find technological solutions to NIMBY challenges. Bioengineering firms may be able to develop bacteria to neutralize hazardous waste. In addition, alternative energy sources—solar, geothermal, wind, and water—could minimize our need for nuclear power and other polluting sources like coal. Even social NIMBYs may be solved in imaginative ways. Incarcerating nonviolent prisoners at home and monitoring them with computers and electronic bracelets may eventually help to reduce overcrowding in jails.

Two creative solutions, moreover, are under way. Instead of siting a detoxification center, one New York City neighborhood set up a unit that moves around town. And in New Jersey the Environmental Protection Agency runs a mobile hazardous-waste center that goes to the origin of the material and processes the waste in a dumpsterlike vehicle.

Creative possibilities abound, but experts agree that ultimately the most effective measure is also the simplest public education. Don't sneak a group home or halfway house into an unsuspecting neighborhood. Instead, bring the neighbors in at the planning stage, hear and if possible, accommodate their concerns. Allow them to interview the facility's directors, introduce them to neighbors of other group homes to allay their fears. "We must educate people to what are true dangers and what are not," says psychiatrist Gaylin. "There is too much talk about rights and not enough about duties and obligations. It's time we redressed that imbalance." In the wake of sane dialogue, America may yet reclaim its tattered social ideals. ∞

CREDITS

Page 10 clockwise from left, Marshall Truman, Étienne Sandorfi, Randy Mayor, Mark Ferri, Alan Waxler, Dave Archer; **page 17,** Jerry LoFaro/American Artists; **page 18,** *Rain Man*/Gamma-Liaison; **page 20,** Clayton Anderson; **page 24,** Michael D. Radencich; **page 26,** Richard Ellis/Photo Researchers; **page 27 top,** Steag; **page 27 bottom,** U.S. Department of Commerce/National Oceanic and Atmospheric Administration; **page 28,** Billy Goodman/Department of Avian Sciences/University of California, Davis; **page 29 top,** Carol Gillot; **page 29 bottom,** Gamma-Liaison; **page 30 top,** Tim White; **page 30 bottom,** Christi Armstrong/Photo Researchers; **page 31 top,** P. Newman; **page 31 bottom,** Sony; **page 32,** Mary Evans Picture Library/Photo Researchers; **page 67,** Jim Garretson; **page 85,** Romas/Mendola; **page 86,** Movie Still Archives; **page 87 top,** George Holton/Photo Researchers; **page 87 bottom,** Penny Singer; **page 88,** Cliff Feulner; **pages 106–107 clockwise from top left,** Sony, Franklin Computer, JVC Company, HWH Enterprises, Casio, Kinyo Company; **pages 112–113,** Gary Lillen; **page 114,** The Software Toolworks; "Help Wanted," **page 1,** Glen Wexler; **pages 2–3,** Don Snyder; **page 4,** Comstock; **page 5,** Fergie; **pages 6–7,** Unifoto; **page 8 bottom,** Chris Collins; **pages 8–9 top,** Robert Arnold; **page 10,** Michel Tcherevkoff; **page 11,** Charlie Yapp; **page 12,** Michel Tcherevkoff/Image Bank; **page 13,** Marvin Mattleson; **page 14 bottom,** Gene Coleman; **pages 14–15 top,** Charles Sholinor; **page 16,** Mike Mitchell

EARTH

CONTINUED FROM PAGE 17

because of the soldiers. We wanted to make it very hard for poachers."

At the same time the government set up incentives to preserve rhinos. To reduce the temptation to kill the animals, it allows villagers to divide the carcasses of those that die naturally—after they sign the warden's report. With so many witnesses for every dead rhino, Nepal avoids situations like Kenya's, in which wardens sometimes collude with poachers.

Since the royal decree, people have found that rhinos are more valuable alive. The rhinos, and the park that shelters them, have become sources of income, even pride. Wildlife attracts tourists to the park. About 26,000 visit Chitwan each year. Most stay at locally run guesthouses, which boost the local economy. For example, the children of Malu Mohato opened a lodge that brings in three times the income Mohato earned as a farmer. Other money comes in through local Peace Corps-trained guides who take visitors on nature walks and on rhino-viewing safaris. By allowing villagers to enter the park for two weeks a year and cut thousands of dollars worth of elephant grass, which they use for thatch, officials elicit the support of the villagers.

The measures have paid off. Rangers have arrested about 25 poachers in the last 15 years, and rhino poaching has dropped to near zero. The population has increased from its low point of less than 90 to upwards of 400 today, representing the world's densest population of rhinos. The herd is so healthy that biologists have airlifted 13 rhinos to a second park.

By no means is the Nepali system perfect. The burgeoning rhino populations strain at the park's boundaries, making destructive forays onto neighboring farms. The government has yet to come up with a system of reimbursement for the damages, so villagers spear the animals to drive them away. Finally, although park officials don't admit it, the royal family still goes hunting in the park every year or so, bagging at least one of the endangered rhinos per trip.

"It's a small price to pay for the support from the royal family, without which nothing gets done here," says Bruce Jefferies, a Nepal-based technical adviser for the United Nations Food and Agriculture Organization. "If that's a cop-out, so be it." According to Daniel Taylor-Ide, director of the Woodlands Institute, a Virginia-based agency involved in conservation projects in Nepal, Nepal is a great case study of what can happen when there's interest at the top. "The African countries pay a lot of lip service to conservation," he says. "But in Nepal, once the royal family got involved, word got out that you don't mess around with wildlife conservation." ∞

NEWS FROM THE CUTTING EDGE OF SOVIET SCIENCE!

SCIENCE IN THE USSR

The bimonthly magazine of science and technology – now available in the United States in this special limited-time offer.

Medicine. Computers. Technology. The Environment. There's a wealth of crucial research being done in the Soviet Union today. Mysteries being investigated. Problems being solved. Discoveries being made.

SCIENCE IN THE USSR brings you the panorama of Soviet science and technology – six times each year, in full-color magazine format. Published in English by the prestigious USSR Academy of Sciences. *SCIENCE IN THE USSR* is now available to U.S. readers, for a limited time, only in this offer.

To order, return the coupon on this page, or the card attached, with your payment.

SCIENCE IN THE USSR

☐ Yes Enter my subscription to SCIENCE IN THE USSR immediately I'll receive a full year – six bimonthly issues – for just $30

Name_____

Address_____

City_____

State_____ Zip_____

☐ My check or money order, payable to OMNI, is enclosed

I'd prefer to pay by credit card. ☐ VISA ☐ MasterCard

Card no _____ Exp_____

Signature_____

Clip and mail to:
OMNI/
SCIENCE IN THE USSR
1965 Broadway, New York, NY 10023

H50C9

FIRST LIGHT

STARS

By Steve Nadis

"We're like space paleontologists, searching for the equivalent of dinosaur bones in the early moments of the universe," says George Smoot, an astrophysicist at the University of California, Berkeley. Smoot is one of three principal investigators for NASA's upcoming mission, the launch of the Cosmic Background Explorer (COBE) satellite in November. COBE, along with two dozen scientists, will try to solve one of cosmology's biggest puzzles: how stars, galaxies, clusters and superclusters were formed—by looking back to an era before these structures existed.

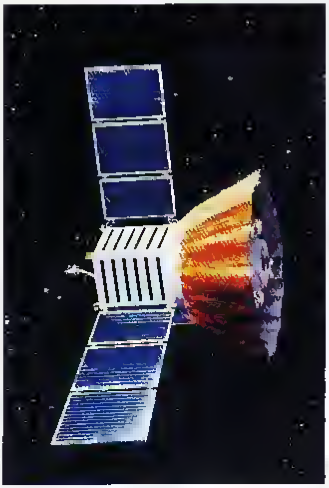
To do this vital detective work, COBE will focus on the most ancient phenomenon astronomers have ever observed: the haze of microwave radiation permeating all of space. Discovered in 1964 by Arno Penzias and Robert Wilson, this cosmic background radiation consists of particles of light, or photons, given off by the Big Bang that were "frozen" by the universe's expansion.

In the universe's early, hot phase—the time when matter became electrically charged—Big Bang photons were scattered violently by free electrons. Scientists theorize that some 300,000 years after that primeval blast, electrons stopped interacting with photons. "At that time matter and radiation went their separate ways," explains Stephan Meyer, an MIT physicist and COBE collaborator. "Left behind was an imprint of what the universe looked like just after the Big Bang." "The cosmic background radiation has been fundamentally unaffected since then," says Meyer. "It's essentially a fossil."

To a large extent this background has remained unstudied because it has been blocked from sight by water vapor in the atmosphere, making it difficult to measure from Earth. COBE will overcome this problem by flying above the atmosphere. The oft-delayed satellite, designed more than a decade ago, will be lofted by a Delta rocket to an orbit 559 miles up. It will carry three instruments that will observe the entire sky twice during its one-year mission.

One of these instruments is the far infrared absolute spectrophotometer, a trumpet-shaped device that will determine how much background radiation is actually out there. A second instrument, the diffuse infrared background experiment (DIRBE), will try to detect the faint collective glow from the first stars and galaxies. "There's a weak infrared background filling the universe, just as there is a microwave background," says COBE deputy project scientist Nancy Boggess. Scientists hope that DIRBE will shed light on a fundamental mystery: the order in which the galaxies and stars were formed. "We still don't know which came first, stars or galaxies," says Boggess.

The third instrument, the differential microwave radiometer (DMR), will examine big chunks of the sky to see whether the microwave background looks the same from all vantage points. Cosmologists have had difficulty explaining the apparent smoothness of the background. The universe itself is not entirely homogeneous. It has large-scale structures, or lumps, interspersed within giant empty spaces. Astronomers expect these areas to have differing temperatures—either hot spots or cool spots—imprinted in the microwave background itself. (The receiver acts as a thermometer for radiation. The more power received from a given area, the hotter it is.) By measuring the pattern of cosmic radiation spread across today's sky, Smoot says, "you are measuring what the surface of the universe looked like at the time of the last scattering [of photons by free electrons] some three hundred thousand years after the Big Bang."



COBE. Will it illuminate the Big Bang?

These measurements will reveal whether the universe is expanding uniformly. If it is expanding faster in one direction than in others, the background radiation in that area will appear to be cooler. The universe is already known to be highly spherical. DMR will yield even more refined estimates of the universe's overall geometry. DMR will also give us better measurements of how the earth and our galaxy move through the heavens. And it will help determine whether the universe is rotating.

COBE will probably be unable to map the cosmic background entirely on its own. Scientists say its explorations must be supplemented by measurements taken by large ground-based telescopes, balloon experiments, and sounding rockets, which can probe the cosmic background in much smaller chunks. But ultimately scientists hope that COBE will even give them a hand in gauging the validity of the well-loved Big Bang theory. "COBE could verify the theory of galaxy formation and large-scale structure formation," says Silk.

David Wilkinson, chairman of Princeton University's department of physics and one of COBE's original designers, believes results from COBE may call the whole Big Bang picture into question. "The Big Bang theory has been successful so far, but COBE will give us a much better, brighter look. We have to be prepared for surprises."

CONTINUED FROM PAGE 83

cian] C Ambrose Rogers said It's a joke but also a tact Buckminster Fuller believed it He put forward some piece of garbage in his book *Synergetics* claiming it to be a proof Several physicists believe it too Why I don't know There is no proof Perhaps it s like the four-color theorem which for a long time everybody believed was true that you can color any map with four colors without adjacent countries ever having the same color This was proved about fifteen years ago but until that time as far as anyone knew it was quite possible that there was some huge map that required more than four colors Yet if you asked even a mathematician in the Sixties, he'd have said it was probably true

Omni: What is a lattice?

Sloane: A periodic arrangement of points in space like a crystal You can think of lattices as regularly spaced points going on forever in all directions In sphere packing the lattice points are the centers of the spheres If you don't have spheres but funny shapes, you probably won't have a lattice Lattices are very regular structures Most packings are not lattices In fact, I discovered some nonlattice packings in ten and eleven dimensions that have the wonderful property of being denser than any known packing

Omni: Who discovered E8, the best packing in eight dimensions?

Sloane: It was first published in 1877 by two Russians looking at it algebraically, not as a sphere packing Later it was established to be the densest lattice packing in eight dimensions Finally Andrew Odlyzko and I proved E8 had the highest kissing number possible in eight dimensions for lattice or nonlattice packing That's our famous theorem which we proved eleven years ago

Eiichi Bannai [a Japanese mathematician] and I were also able to prove that no matter how you arrange two hundred forty oranges around an orange in eight dimensions, you end up with the one that occurs in the E8 lattice The same is true in twenty four dimensions There you end up in the Leech lattice This was discovered in 1966 by John Leech at the University of Stirling in Scotland

Omni: Why do you say that the Leech lattice is a "miracle"?

Sloane: It's an astonishingly dense packing very much denser than any other Also there are a lot of absolutely fantastic "coincidences" connected with the Leech lattice In fact there is a whole subbranch of mathematics called Moonshine that is now explaining these "miracles"

Omni: Currently you are studying lattices in low dimensions Why?

Sloane: My friend John Conway of Princeton University and I are interested in packings that when you perturb them a bit the density goes down Obviously if you have something that you can jiggle and make *better*, then that's not optimal Those that when jiggled only get worse are called extreme lattices These are a relatively small set contained inside a slightly larger set of so called perfect lattices So our goal is to find all the perfect lattices in seven dimensions And after that in eight and nine

Omni: You've said you wished you had a machine to make all the traffic lights green for you as you drive

Sloane: It's one of my dreams Traffic lights should be much smarter One should never have to wait at a red light when there's no traffic on the cross street Another thing that would be nice to have a special driver's license So the police stop you for going fast look at the license and say "Oh, sorry," and let you continue Because you are a good driver

Omni: So you admit you drive fast?

Sloane: Admit it? I'm *proud* of it Surely

> *"If you think of yourself as sitting at this gap between the spheres, you can look at the pattern of spheres around you and it's like a constellation of stars."*

all intelligent persons observe that they do everything faster than ordinary people when it's advantageous to do so Haven't you noticed that you have this property, too? Just as there should be different levels of driver's licenses, so there should be different levels of voting Some people's votes should count for ten units and so on That's [British novelist] Nevil Shute's idea If you went to a university, you get more etc

Omni: That's not very democratic

Sloane: It's not incompatible with democracy It's saying that some people are worth more than others as they are, it's clear Children don't vote Neither can felons It's not true that all people are regarded as equal even in the United States I'm just carrying it a bit further

Omni: Would we then get more intelligent presidents?

Sloane: Could we get less intelligent presidents? Anyhow, it's nothing to be ashamed of acknowledging that some people may be slower I don't think slower people should be allowed to have so many children Children of the intelligent should be subsidized and others should be discouraged Maybe pay them for not having children There should be a penalty for having a child I think abortion should be legal not just up to six months but up to the age of thirteen!

Omni: Would a drug that increased intelligence be good? Would you take it?

Sloane: Sure I think intelligence is very important Definitely a great idea Do you know of such a drug?

Omni: Would you take it if it would enable you to solve Fermat's last theorem?

Sloane: Oh, I would take it in any case That kind of drug is a wonderful idea

Omni: Do you find that you are motivated by the idea of gaining fame for solving a major problem?

Sloane: Not really myself, but it certainly is a powerful driving force in number theory research One example is a difficult problem left unsolved by the famous Indian Srinivasa Ramanujan that was finally settled in the Seventies The Ramanujan hypothesis has to do with how many spheres are in the Leech lattice Think of twenty-four-dimensional space as filled up with oranges If you focus on the one orange at the origin, then there are a hundred ninety-six thousand five hundred sixty oranges that touch that one. Then the next layer of oranges to touch that set—the next shell of the lattice—has about sixteen million oranges in it. The Ramanujan hypothesis tells you how fast these numbers grow how many spheres there are in each shell It's as if you're looking out and you see all the other points like stars in the sky surrounding you The Ramanujan hypothesis tells you how many stars there are at each distance from you It gives a very accurate estimate for the numbers out a long way in twenty-four-dimensional space

Ramanujan made this conjecture about 1910, although the Leech lattice wasn't discovered until 1966 It was treated with respect People said "Boy that's a hard problem Anyone who can solve that must be pretty clever" After sixty years Belgian mathematician Pierre Deligne solved it using some pretty high-powered algebra And he got very famous

Omni: You'd win similar renown, wouldn't you by proving the densest packing number in three dimensions?

Sloane: That would make you moderately famous though you probably wouldn't gain as much renown as Deligne If you were clever about it that would impress people But if you did it through sheer hard work, as I'm afraid it's going to be proved, people will say "Yes, he did it but look at the terrible method he used It's not enough to solve a hard problem you have to do it nicely I'm not working on it at the moment I'm more interested in proving the E8 is the optimal packing—lattice or nonlattice It's easier

Omni: What does sphere packing have to do with communications?

Sloane: People always say "Why on Earth does Bell Labs let you work on problems

in high-dimensional space? They can't possibly have any use. In fact they're central to communications. The sphere packing problem is really the same thing as Claude Shannon's problem of designing signals for a noisy channel. Sphere packing comes in because of what's called the sampling theorem. If you want to represent an electrical signal you could measure its voltage every hundredth of a second. If it's not changing too quickly these 'sample values' contain all the information in the signal.

Suppose you have a signal described by a hundred samples. Well, you can represent all one hundred sample values with a single point in a hundred-dimensional world. Once the signals become points the packing problem is that of designing error-correcting codes. To design a signaling system where the signals aren't too much alike, you have to put the points in space so they are not too close together. The connection between sphere packing and communications is that both want to pack as many things in as possible. In the one case it's oranges in the other it's signals or binary vectors, which are code words.

Nowadays your computer is connected to a modem. When you type something into the computer it gets transmitted over the telephone line as a signal produced by the modem. These signals are quite complicated waveforms, but you can think of them as points in space: single dots in some spatial dimension designed so that they're well separated. A good sphere packing in whatever dimension it is is one where these points are not too close.

Omni: Were you first interested in packing because of its key relation to coding?

Sloane: Yes. It was always one of several related questions having *superficially* to do with geometry but *in fact* to do with the most fundamental questions in communications. The connection was known even before Shannon. All the people who thought deeply about communications in the Thirties and Forties saw it. Shannon made it explicit. But there were a lot of different kinds of codes you could use to implement Shannon's original ideas. Take the Reed–Solomon code, invented in 1959 by Irving Reed and Gus Solomon. Very popular now, these codes are used everywhere on compact discs and on all the spacecraft. My contribution is to make a lot of theoretical advances, clarifying things. One is always trying to find better codes. I found an awful lot of codes that are better than any previously known. But the earlier ones tend to be the short and nice ones and the ones people tend to use. My codes require more complicated circuitry and so forth.

Omni: How many dimensions are involved in coding a compact disc?

Sloane: About seven thousand one hundred sixty-eight. The Reed–Solomon code picks out points, actually all vertices of a cube in seven thousand one hundred sixty-eight dimensions. These points are such a long way from each other that the code can correct any errors. It's a nice property, and one reason why Reed–Solomon codes are so clever.

Omni: So you can work in as many dimensions as you want?

Sloane: As many as you want. Speech is continuous, so if you take a longer chunk of it you represent it by a point in a higher dimensional space. A common engineering principle is that to transmit speech you should sample it eight thousand times a second. A second's worth of speech then will give you eight thousand samples, or a point in eight thousand dimensions. But there's no reason to take one second's worth. You could chop it up into milliseconds. It depends on what you want to do with the speech, deal with it theoretically, do some practical coding scheme, or recognize someone's voice, a voiceprint, or whatever. The higher the dimension, the cleverer you can be.

Omni: So if Motorola only has an eight-dimensional code and you are busy with codes in twenty-four and seventy-two dimensions, are yours better?

Sloane: It depends whether you are a theoretician or an engineer, whether you want to wring every last decibel out of the system or are content with something that does pretty well. Eight dimensions does pretty well, and going up to seventy-two does better still, but it's much more complicated to work in.

Eight dimensions seem to me to be about the last point where good lattices are easy to work in. The E8 lattice is very simple in eight dimensions. The Leech lattice in twenty-four dimensions is quite a bit more complicated. It may be just my ignorance. Maybe when one understands the Leech lattice better one will see that it's as easy to use as E8. Various algorithms in eight dimensions allow you to use the E8 lattice effectively. We have patents on one or two of them, no doubt Motorola has a patent that covers what *they* use. If you want to work in eight dimensions, I think Robert Calderbank and I have the best possible code. E8 appears in both my worlds—extreme rock-climbing grade, extremely dense packing.

Omni: Who has influenced you?

Sloane: Elwyn Berlekamp, whose work I came across when I began studying coding theory and with whom I later worked when I came to Bell. I particularly admired his philosophy when tackling intractable problems: "Go as far as a reasonable person would, then a lot farther." I also admire the Belgian mathematician Philip Delsarte, who invented a whole

branch of coding theory in his thesis. He had an idea and invented a whole theory to support it. He made up a one-hundred-twenty-page thesis that was totally original. I've always kept that as one of my models. If you have a problem and it's not at all obvious what to do, you invent a theory to handle it. By the end, maybe we'll be closer to solving the problem. If not, you've still learned a great deal, the subject has progressed.

Omni: What's the top number of dimensions you've dealt with so far?

Sloane: I've constructed packings up to ten to the power of fifteen thousand. You can get packings in high dimensions, as high as you want. I haven't gone as far as the infinite-dimensional world of Hilbert space [mathematically the most commonly used infinite-dimensional space]. It has a continuum of uncountable dimensions. Indeed, one could ask how you pack spheres in Hilbert space. I haven't had reason to deal with that.

Omni: What's the best way to send information so that it can't be intercepted?

Sloane: So that a spy can't understand it? The best way is to toss a coin each time. For each bit, you toss a coin and if it's heads you add zero, and tails one. This is unpredictable and totally random. If the person at the other end in California, say, has the same string of heads and tails and knows what the coin-tossing pattern is, he can recover the message. No one else can. It is the only unbreakable cipher. The standard way to do it in the army is to have a team of draftees tossing coins. They write down the zeros for heads and ones for tails, and they make two copies. One copy they give to you to send the message. The other goes by courier to the receiver. You throw both notes away once used. Anyone who listens to it gains zero information. For example, take the message "The enemy will attack at dawn." First you write it in binary, in zeros and ones. A becomes zero zero zero zero one, B becomes zero zero zero zero one zero, and so on. Then you encode this by adding the random sequence you got from heads and tails, and transmit it. The person at the other end has the same sequences of random zeros and ones, and he recovers the clear text.

Omni: What do you think of Conway last year offering ten thousand dollars for a solution to a problem that looked fiendishly difficult and having it solved in a week by Colin Mallows, a colleague at Bell Labs?

Sloane: Superficially the problem looked very difficult but in fact had an easy solution. This almost never happens. It was bold of Colin to attack it directly. He did some moderately obvious things, noticed a pattern, and then cleverly figured out how to generalize this pattern to explain the sequence. Conway was unlucky. I helped Colin run his program on the Cray. It only took a few minutes. He got the exact number and Conway sent him a check for a thousand dollars.

Omni: Why not the ten thousand?

Sloane: Is any math problem worth ten thousand dollars? It's very rare that anyone offers ten thousand. One thousand seemed right.

Omni: You once had an idea where you program real individuals' faces and bodies and set them to interacting in a self-generating video theater.

Sloane: Several versions of it are possible. One could be a video game where you put in a dollar or two and it tells you what's going to happen. It has a sophisticated computer chip inside. First it takes a picture of your face and then shows you in different settings. It could play in all kinds of ways: ten, twenty, fifty years. The further into the future it takes you, the more it costs. These cheaper kinds in railway stations will be random and take only a few snaps of your face.

The more sophisticated version will be more accurate because it will ask you all kinds of questions, take in more data. Then you'll look inside and see yourself in various scenes in the future, your face aging as the years go by. If there is a blank, you have died. It will be like a soothsayer, except totally convincing.

It's so powerful because seeing someone with your face doing something is very convincing. This is still just a video game. Obviously you could make it more sophisticated. Criminals convicted for assault and robbery might be required to watch a program showing them the evil of their ways, a kind of Hogarth's *Drunkard's Downfall*. The judge requires you to watch it several hours a day. It might show the horrible things that could happen to you in jail and after you get out.

Omni: You could rev it up by using a supercomputer so you could see what will happen to others, too.

Sloane: Yes. The two-person version. You could have the comic version with the dog, girlfriend or baby, but with all of you in it. One version would be actual prediction. Another would do it randomly, making a best guess. Or it might ask, "What's your sign?" That's the version for the idiots who believe in astrology. "Okay, buddy, you are a Taurus. Welcome to Madame So-and-so's computer."

Omni: If you could wave a wand and double the intelligence of every person on the planet, would you?

Sloane: Of course. It's probably the only thing that can save the earth from destruction in the next five hundred years. It is stupidity that has polluted the oceans and so on. If people were smarter they wouldn't have. A more intelligent person is less likely to be greedy. Intelligent people have a better chance of predicting the consequences of their actions, taking a longer view. Stupid people think of the moment and are incapable of trying to predict the outcome of their actions.

Omni: What are your long-term plans?

Sloane: I have a little green notebook full of my favorite problems—about forty of them. They cover a wide range, from error-correcting codes to computer science. Some have to do with extending works others have done to eight dimensions. I often hear of someone working on some nice problem in two dimensions and say to myself, *Hmmm. I bet that would be really interesting in eight.*

Omni: Superstring physicists think the space we live in may not really be three-dimensional but twenty-four- or twenty-six-dimensional. Are they on the right track because their math works out well?

Sloane: That doesn't mean it's true. But if they can give a sufficiently plausible reason for the world not being three- but say eight-dimensional, then they're quite clever. One of their ideas is the garden-hose argument. That's pretty nice. How many dimensions does the garden hose have? If you look at it from a hundred feet away, it makes a straight line, as if it's one dimensional. But if you examine the hose closely you realize it has three dimensions, although two are small. Similarly, you can have twenty-six dimensions in all, and twenty-three of them could be tiny. We're too far away to see them, just as, standing at a distance, we're too far away

to see the garden hose's other dimensions. The mathematics works out better when you assume the extra dimensions.

It's a wonderful thing they're trying to do, to find some explanation for the universe. You have to admire people who imagine the world in twenty-six dimensions. I'm no physicist, so I'm not trying to understand the fundamental equations that govern our existence. They're talking about this garden hose curved space. My twenty-four-dimensional space is nice. It's flat. All twenty-four coordinates are as good as one another, a kind of democratic coordinate system. No particular dimension is singled out as time. It is an ordinary, twenty-four-dimensional Euclidean space, not hyperbolic Lorentzian space, not a curved space like you have on the surface of an apple.

Omni: Isn't it a complete abstraction?

Sloane: Everything is an abstraction in that sense. When you talk about a dog, that's an abstract notion.

Omni: But you can get bitten.

Sloane: To tell someone what bit you, you have to use the abstract term *dog*.

Omni: You can experience a dog as an example of the abstraction. But you can't experience the additional dimensions.

Sloane: I don't see why not. I can write down the coordinates for them. I've been stuck, had some very unpleasant experiences. I've been *bitten* by those extra coordinates. I remember working in fourteen dimensions and having a lot of trouble with the fourteenth. There was a story by [Argentinian author Jorge Luis] Borges called "Funes, the Memorious" about a boy in South America with a prodigious memory who could remember every single thing that ever happened to him. But he was unable to identify a dog at a particular time: say, three o'clock on Sunday afternoon, as being the same dog at five on the same afternoon. He would think of these as being two different things, because the abstract notion of dog was missing. When you talk about six, that's an abstract notion. Twenty-four dimensions is just another abstract notion.

Omni: When do you relax, apart from sleeping?

Sloane: When was the last time? Doesn't happen a lot. Probably should more.

Omni: Do you get impatient with ordinary mortals for not thinking enough?

Sloane: Sure, doesn't everybody? One wonders how some people survive.

Omni: Are you afraid of losing your math powers with age?

Sloane: The approach of age is a terrifying thing. Everyone must feel that. One slows down, isn't as smart as one was. The thing is to get better organized as you get older, learn shortcuts and tricks. You try to make up for the loss of brain cells by being cunning. Compared with how brilliant children are, grown-ups just can't compare. Clearly children can learn languages and grown-ups can't. Their brains have hardened. Like a piece of cheese that's grown a thick skin on it, it's harder to penetrate.

Omni: You'd hire a twenty-year-old mathematician before a forty-year-old?

Sloane: Depends on what I wanted the person to do. Twenty-year-olds may be very smart, but what do they know about number theory or algebraic geometry?

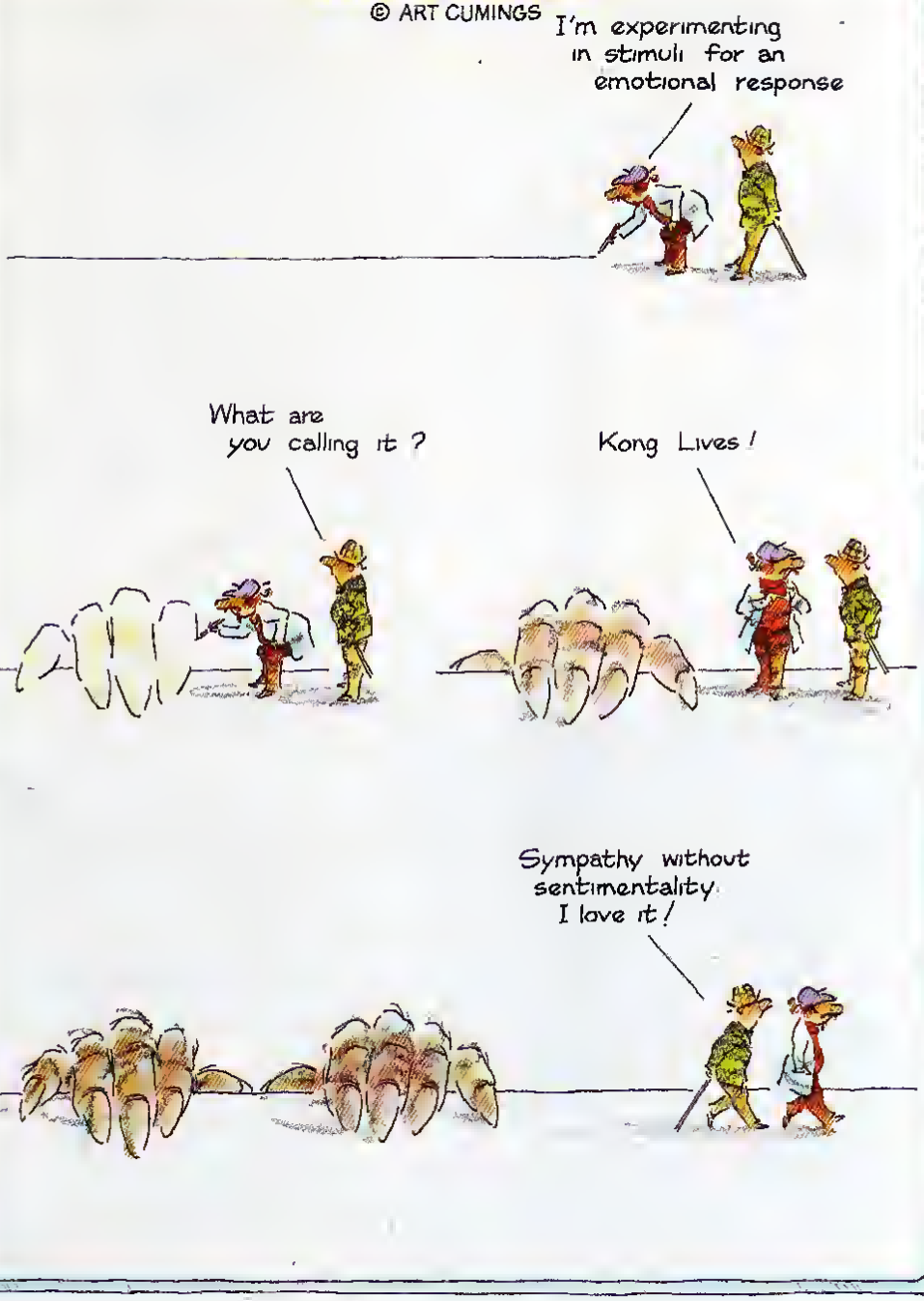
Omni: Do you expect to continue producing good new ideas?

Sloane: Of course. My notebooks are full of a lifetime supply of good ideas saved up in advance. I fill up a notebook about every two months. I haven't slowed down yet. I don't expect to, but I'm aware of the possibility. Some do. I see it every day in some of my colleagues who are on the verge of retirement. They move more slowly, think more slowly, reply more slowly. Blink their eyes more slowly.

Omni: So they should retire?

Sloane: I don't say that. Just that one notices there's been a change over the years. Mathematicians don't do much harm. I don't see why they shouldn't go on doing what they do forever, so long as they're alive. If they want to do mathematics, encourage them. You accumulate knowledge, and mathematicians are generally very smart people. ∞

The Artist



POWDER'D WIG

CONTINUED FROM PAGE 56

them, on the breast of the frigid water. With him came a band of barefoot men lightly touching hands, the first of them resting his fingers on the cape of their leader. The men stared at the water as if they could not believe their eyes, but there was only confidence in the face of their commander—that and a serene humility.

"This is the work of Sully, a great underground artist,' said the jeweler.

"These . . . these are priceless.'

The Indian shrugged. "If they were lost tomorrow, we would still carry them with us. It is the feelings they draw from our hearts that are truly beyond price. He came for all men, you see. If you accept Him, if you open your heart to Him, then His death will not have been in vain.'

"Washington," Grant said, the name finally coming to him. An insignificant figure of the American Wars, an arch-traitor whose name was a mere footnote in the histories that Grant had read. Arnold had defeated him, hadn't he? Was that what had happened at West Point? The memories were vague and unreal, textbook memories.

The jeweler nodded. 'Yes. George Washington," he repeated. 'He was leading us to freedom, but He was betrayed and held out as an example. In Philadelphia He was publicly tortured to dispirit the rebels, then hung by His neck after His death, and his corpse toured through the Colonies. And that is our sin, the penance which we must pay until every soul has been brought back into balance.'

"Your sin?"

The Indian nodded, drawing from the pouch at his waist another of the shriveled icons. Christ—no Washington—on the cross.

"We aided the British in that war. Cherokee and Iroquois, others of the Six Nations. We thought the British would save us from the Colonists, we didn't know that they had different ways of enslavement. My ancestors were master torturers. When Washington was captured, it fell to them—to us—to do the bloodiest work.'

His hands tightened on the figure of flesh, the splintered wood dug into his palm.

'We nailed Him to the bars of a cross, borrowing an idea that pleased us greatly from your own religion."

The brown hand shook. The image rose to the golden mouth.

'First, we scalped Him. The powdered hair was slung from a warrior's belt. His flesh was pierced with thorns and knives. And then we flayed Him alive."

"Flayed . . . '

Grant winced as golden teeth ripped a shred of jerky and tore it away.

"Alive . . . ?"

"He died bravely. He was more than a man. He was our deliverer, savior of all men, white, red, and black. And we murdered Him. We pushed the world off balance."

'What is this place?' Grant asked. "It's more than a museum, isn't it? It's also some kind of school."

"It is a holy place. His spirit lives here, in the heart of the city named for the man who betrayed Him. He died to the world two hundred years ago, but He still lives in us. He is champion of the downtrodden, liberator of the enslaved." The jeweler's voice was cool, despite the fervor of his theme. "You see . . . I have looked beyond the walls of fire that surround this world. I have looked into the world that should have been, that would have been if He had lived.

I saw a land of the free, a land of life, liberty, and happiness, where the red men lived in harmony with the white. Our plains bore fruit instead of factories. And the holy cause, that of the republic, spread from the hands of the Great Man. The King was dethroned, and England, too, made free. The bell of liberty woke the world, the four winds carried the cause.' The jeweler bowed his head. 'That is how it would have been. This I have seen in dreams."

Grant looked around him at the paintings, covered with grime but carefully attended, the people, also grimy, but with an air of reverence. It was a shame to waste them here, on these people. He imagined the paintings hanging in a well-lit gallery, the patina of ages carefully washed away. He saw crowds of people in fine clothes, decked in his gold jewelry, each willing to pay a small fortune for admission. With the proper sponsorship a world tour could be brought off. He would be a wealthy man, not merely a survivor at the end of such a tour. The Indian watched him, nodding. "I know what you're thinking. You think it would be good to tell the world of these things, to spread the cause. You think you can carry the message to all humanity, instead of letting it die here in the dark. But I tell you . . . it thrives here. Those who are oppressed, those who are broken and weary of spirit, they alone are the caretakers of liberty."

Grant smiled inwardly: there was a bitter taste in his mouth.

"I think you underestimate the worth of all this,' he said. 'You do it a disservice to hide it from the eyes of the world. I think everyone can gain something from it."

"Yes?' The Indian looked thoughtful.

He led Grant toward a table where several old books lay open, their pages swollen with humidity, spines cracking, and paper flaking away.

'Perhaps you are right,' he said, turning the pages of one book entitled *The Undying Patriot*, edited by a Parson Weems. "It may be as Doctor Franklin says."

Grant bent over the page and read. 'Let no man forget His death. Let not the

memory of our great Chief and Commander fade from the thoughts of the common people who stand to gain the most from its faithful preservation For once these dreams have faded there is no promise that they may again return In this age and the next strive to hold true to the honor'd principals for which He fought for which he was nailed to the rude crucifix and his flesh stript away Forget not His sacrifice, His powder'd wig and crown of thornes Forget not that a promise broken can never be repair'd"

"I think you are right" said the jeweler "How can we take it upon ourselves to hide this glory away? It belongs to the world, and the world shall have it"

He turned to Grant and clasped his hands His eyes were afire with a patriotic light "He brought you to me, I see that now This is a great moment I thank you brother, for what you will do"

"It's only my duty,' Grant said

Yes Duty

And now he stood in the sweltering shadows outside the warehouse the secret museum watching the loading of several large vans The paintings were wrapped tightly in canvas so that none could see them

He stifled an urge to rush up to the loading men and tear away the cloth to look just once more on the noble face But the police were thick around the entrance

"Careful Grant," said David Mickelson at his elbow

News of the find had spread throughout the city and a crowd had gathered in which Grant was just one more curious observer He supposed that it was best this way, although he would rather have had his own people moving the paintings The police were being unwontedly rough with the works but there wasn't anything he could do about that.

Things had gotten a little out of hand

'Hard to believe it's been sitting under our noses all this time," said Mickelson "You say you actually got a good look at it?'

Grant nodded abstractedly 'Fairly good Of course it was dark in there"

'Even so ... what a catch eh? There have been rumors of this stuff for years, and you stumble right into it Amazing idea you had, though organizing a tour As if anyone would pay to see that stuff aside from ruddies and radicals Even if it weren't completely restricted"

"What what do you think they'll do with it?' Grant asked

"Same as they do with other contraband I'd imagine Burn it"

"Burn it,' he repeated numbly

Grant felt a restriction of the easy flow of traffic suddenly the crowd mainly black and Indian threatened to change into something considerably more passionate than a group of disinterested onlookers The police loosened their riot gear as the mob began to shout insults

'Fall back Grant," Mickelson said

Grant started to move away through the crowd but a familiar face caught his attention It was the Indian the jeweler, he stood near a corner of the museum, his pouchy face unreadable Somehow through all the confusion among the hundred or so faces now mounting in number, his eyes locked onto Grant's

Grant stiffened The last of the vans shut its doors and rushed away The police did not loiter in the area He had good reason to feel vulnerable

The jeweler stared at him Stared without moving Then he brought up a withered brown object and set it to his lips Grant could see him bite, tear, and chew

"What is it, Grant? We should be going now don't you think? There's still time to take in a real museum or perhaps the American Palace"

Grant didn't move Watching the Indian he put his thumb to his mouth and caught a bit of cuticle between his teeth He felt as if he were dreaming Slowly, he tore off a thin strip of skin, ripping it back almost down to the knuckle The pain was excruciating, but it didn't seem to wake him He chewed it swallowed

"Grant? Is anything wrong?"

He tore off another

STAR TECH

ACCESSING THE FUTURE

SILICON FEST

A number of strong trends emerged at this year's crowded Summer Consumer Electronics Show in Chicago. Two of the main themes: electronic books (such as the Bible) and electronics disguised as other items (such as bears or model cars). *Omni* contributor Margo Costello reports on a few of her favorites.

TINYCAM

As the world's smallest and lightest full-feature video camcorder, the CCD-TR5 (left) is another milestone in miniaturization from Sony. At less than two pounds, the 8mm video moviemaker can fit into a small tote bag or coat pocket. Price: $1,500. Contact: Sony, Park Ridge, NJ; (201) 930-SONY.

TAPE TRANSPORT

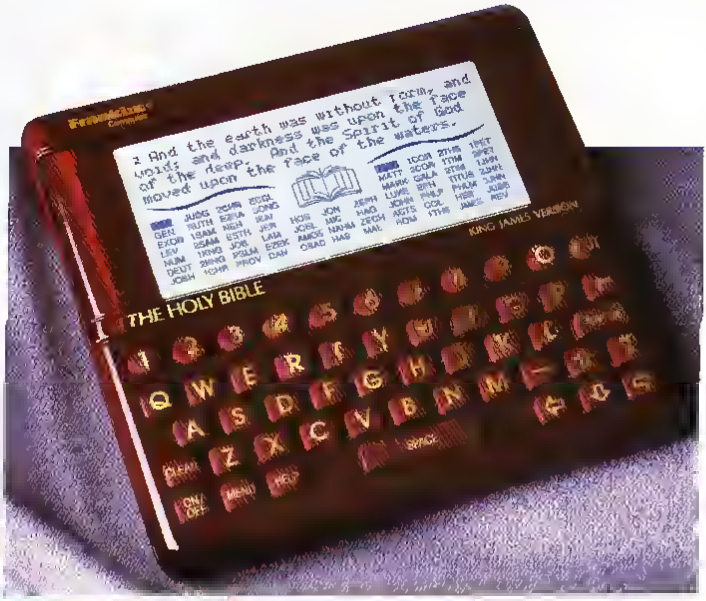
Touch the front grille of the model automobiles (left) and their hoods pop open to reveal a tape rewinder for VHS cassettes. Headlights glow while device is in use. Price: $44.95. Contact: Kinyo Company, South El Monte, CA; (600) 362-2828.

CELESTIAL TIME

Casio's Cosmo-Phase watch (below) presents a moving display of the planets' rotations, calculates solar eclipses and Halley's comet flybys. Price: $49.95. Contact: Casio, Dover, NJ; (201) 361-5400.

DIGITIZING THE WORD

Transcend Gutenberg's movable type with the world's first electronic hand-held Holy Bible (right). The reader *enters key phrases or* words to locate any psalm and the entire passage is displayed in seconds. Available in either the King James or Revised Standard Version, this palm-size marvel is smaller and lighter than most printed Bibles. Price: $299. Contact: Franklin Computer, Mount Holly, NJ; (609) 261-4800.



SIGHT 'N' SOUND

The XL-G512BK compact disk player (above) displays liner notes on a TV while playing audio through a stereo. The secret: A decoder reads notes stored on some CDs. Price: $500. Contact: JVC Company of America, Elmwood Park, NJ; (201) 794-3900.

SMOKEY'S SMOKEY

The Security Bear (left) is an auto alarm disguised as a cuddly teddy. Placed inside a vehicle and activated, the bear roars at a deafening 110 decibels if the car door is opened. Price: $79.95. Contact: Rabbit Systems, Santa Monica, CA; (213) 393-9830.

mind

CONTINUED FROM PAGE 18

damage to left brain cells. Yet accompanying this disability is a rich artistic perception, a full-blown talent for sculpting that would be remarkable in a normal person. Like Boudreaux Clemons has never been formally trained. His genius, which under different circumstances might have languished untapped in the right regions of his brain, may have been activated by right brain "recruitment" of neural cells after his fall.

Left brain injury in savants is most often prenatal and is commonly coupled with autism. One in ten autistics demonstrates savant skills, and 50 percent of all savants exhibit clinical symptoms of early infantile autism. Savants, like autistics, are frequently premature, their brains incompletely formed at birth. Treffert cites embryonic brain studies by Albert Galaburda and Norman Geschwind. The Harvard neuroscientists reported that the brain's right hemisphere completes development first, leaving the left brain vulnerable to a gamut of prenatal hazards. Between the tenth and eighteenth weeks of fetal life, the formation of neurons throughout the brain accelerates; there is a fierce competition among neurons to link up with other neurons and sensory cells. Before birth neurons that have failed to make connections die off.

"If left-brain injury occurs before this mass extinction and during the period of stepped-up neuron production, when a vast reservoir of free cells is available," Treffert explains, "a substantial left-to-right defection of neurons can occur." Some researchers, including Treffert, believe that a similar migration can be sparked by testosterone circulating at high levels in the brain of the male fetus during the formation of the testes. Testosterone, for reasons still unclear, may slow down cortical growth and impair the manufacture of neurons and their ability to make connections. The result is a shift in neurons to the already formed right hemisphere, ensuring its dominance. While the idea of right-brain takeover of left-brain tasks is not entirely new, the testosterone hypothesis is the first to account for the fact that 85 percent of all savants are male.

Another clue to savants' neurological distinctiveness is the manner in which their superior memories express themselves. Savants accomplish feats of brilliance as if by rote: no emotion shades the performance, and there is little cognitive awareness. Instead, the outpouring of memory seems automatic, subject to specific stimuli rather than will.

Treffert has identified three strands of memory potential in the normal brain. The first he calls "ancestral" memory, or genetically transmitted knowledge that is stored in our brains at birth. This memory might include skills and talents passed along family lines as predispositions to artistic, mnemonic, or other types of mental abilities. Exclusive of training or environmental exposure, ancestral memory is innate. Prodigiously-talented savants such as Boudreaux and Clemons may be able to access this mysterious pool. The second strand of memory is "cognitive–associative." It allows the sorting and storage of experiences according to content and emotional tone. Finally, there is 'habit' memory, which is noncognitive and reflexive (a simple example is riding a bicycle). Habit memory resembles the peculiar 'memory without consciousness' displayed by the savant.

Beneath the cortex lie several interconnected structures that instruct these strands of memory. The hippocampus facilitates cognitive memory. It acts as a neurological way station, transferring information from the five senses to the cortex for long-term storage and eventual recall. The amygdala, located at one end of the hippocampus, registers the emotional shading of experiences and files memories according to content. The thalamus (also adjacent to the hippocampus) joins the reticular formation, a network of neuronal clusters that make far-flung connections throughout the brain, to control attentiveness and process sensory information. Collectively these structures compose the primary circuit of memory in the normal brain.

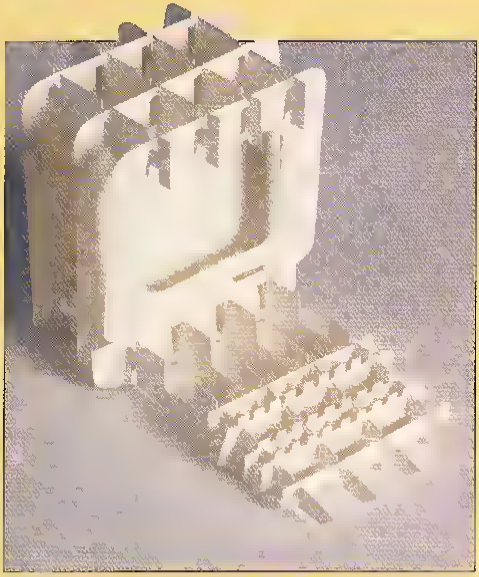
Savants seem to use a different circuit, one governed by the basal ganglia. Like the hippocampus, the ganglia send information to the cortex for long-term storage, but the information is never subject to intellectual interpretation or associative thought. This is "habit" memory. Treffert theorizes that in savants impairment of the normal memory circuits—coupled with left-hemisphere defects—causes this alternate pathway to become the primary route by which information is processed. He suggests that access to ancestral memory may account for the differences between savants whose abilities are remarkable only in contrast to their handicaps and those whose gifts approach unqualified genius.

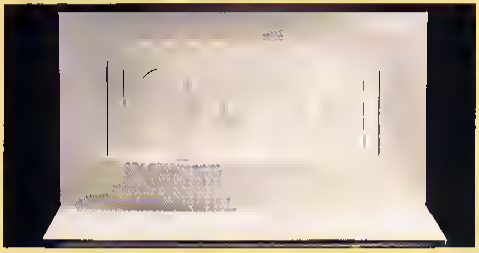
Treffert admits that his alternate-pathway hypothesis is speculative, but if testing proves him correct, intriguing possibilities arise. "Suppose we understood these pathways of memory and could harness them," he says. Suppose we could supplement normal cognitive memory with habit recall or tap into ancestral memories. With newer brain-mapping techniques, such as PET (positron emission tomography) scans, eventually we may be able to do that. As yet there have been no PET scans of savants, but such studies may provide a unique marker in the quest to understand the mechanisms by which the brain stores and retrieves information.

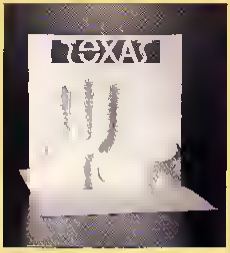
Readers greeted this competition with a handful of winning cards

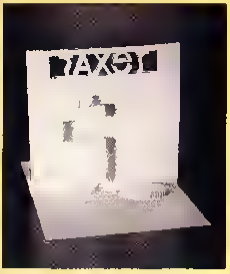
GAMES

By Scot Morris









This month we present the results of two *Omni* competitions previously launched in this column. The winners of our search for new hybrid sports (Competition #47, September 1988) are reported in Competition on page 16. The finalists in our Omnigami contest (Competition #48, December 1988) are shown here.

Traditional origami allows only paper *folding*—no cutting—to create the medium's three-dimensional forms. Masahiro Chatani, a professor of architecture at the Tokyo Institute of Technology, has invented a new type of paper play with fewer restrictions. Under Chatani's format a heavy paper card is cut along several lines, then carefully folded upward in some places and downward in others. When the finished card is folded in half, it lies flat and can slip into an envelope. The artist's structure appears when the card is unfolded halfway to a 90° angle.

As most of Chatani's works have been models of real or fanciful buildings, he has dubbed his paper creations origamic architecture. I didn't think that name appropriately defined the creative variations, so I termed the new art form Omnigami.

In *Omni* readers' adoption of this medium, their talent shone through brilliantly, as always. I was impressed by the quality of the entries and the amount of time it must have taken to give them such a professional look. I sent photographs of the best ones to Chatani for his comments before making the final choices.

The grand prize winner receives a Psion Organiser II, a computer daily diary with calendar appointment reminders and address and phone books (value $179.95). Four runners-up each receive $50. A copy of *The Next*

Book of Omni Games and a collection of eight precut Chatani greeting cards with envelopes (value $24) will also be sent to the winner and runners-up.

GRAND PRIZE-WINNER

Robert Lamarche of Malibu, California, created the abstract ocean waves on a blue background and won first prize. Although quite unconventional with its many holes (islands of paper that were cut out), the piece is striking in its overall effect. Chatani calls Lamarche's piece "a very beautiful, exciting, and complicated work which dances with a rather professional technique."

RUNNERS-UP

1. The pyramid scene complete with full moon and palm trees, was the work of Chris Bird of Stamford, Connecticut.

2. G. E. Belland of Midland, Michigan, created the miniature paper computer. Although it is composed of several separate pieces of paper, the pieces fit together so neatly that the card folds flat.

3. Intricate, Escher-inspired stairs and walkways make up *Stagia Perspectiva* by James Carroll of Griffin, Georgia.

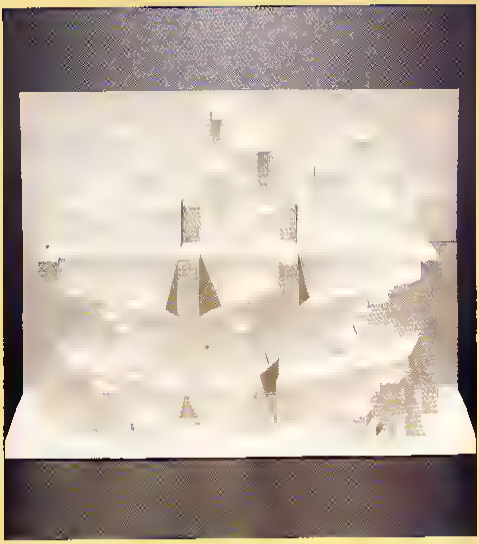
4. Lefty Fontenrose of Hacienda Heights, California, constructed an Omnigami ambigram. On one side of the card is a delicately folded cactus-and-skull scene set below the transparent word TEXAS. On the other side there's a dollar sign and a coin (complete with raised portrait), and the word above now reads TAXES. Fontenrose calls the piece *Bush Ambush*.

An honorable mention goes to Dan Riley of Bellevue, Washington, for his ballet scene. Riley's *Nut cracker* is complete with figures cut from the base of the card and pushed up through slits in the stage.

Readers interested in acquiring books or greeting cards by Chatani can purchase them from Gallery 91, 91 Grand Street, New York, NY 10013.

CORRECTION

In the July 1989 issue, the time shown on the 360° Omniclock is 8:20, not 4:40, as printed. DO



GAMES

Video games. They're just for kids. Right?

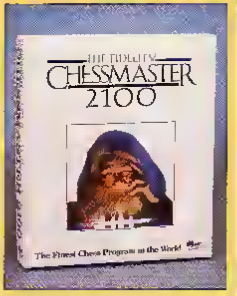
The fly-and-die arm-and-shoot quarter gobblers at the local mall are targeted at overly aggressive adolescents with something to prove and the energy to do it. For them, avoiding defeat at the hands of a punishing game programmer (disguised as a video creature) is a challenge.

Perhaps you have purchased a computerized role-playing game and are intrigued by its sword-and-sorcery or space western plot. The trouble is, you know that with any luck you'll reach the end of the game only after 40 to 100 hours. So much for eating, sleeping, playing with the kids, mowing the lawn or going to work.

As the technology becomes more advanced, interactive electronic entertainment will assume an increasingly important place in our leisure time. At present, however, adults curious about computer and video games find most of them too difficult and too lengthy. Who needs the humiliation? Who has the time? All we want is a little leisure activity that is more involving than television and less defeatist than a day in the boardroom.

But there *are* video games that an adult can play for a few minutes of diversion and then put aside: games that are an excellent aid to relaxation at the end of a tough workday.

A favorite electronic tonic for tension is Activision's *Shanghai* (available for most computer and video game systems). It ingeniously combines elements of old-fashioned solitaire with the exotic color of mah-jongg tiles. Simply find and remove identical pieces on the edges of a pyramid of tiles. The goal: Clear the entire stack. You can play at your own pace or compete against the computer or another opponent. Like the best of computer and video games, the permissive pace of *Shanghai* creates its own lulling atmosphere and can provide a soothing break for the harried adult.



In Spectrum HoloByte's *Tetris* building blocks of various shapes drift down the screen. Stack them from the bottom up, leaving no holes in the subsequent wall of blocks. You can rotate the blocks and move them across the screen using cursor keys or a joystick. In the best video game tradition, the speed of the blocks' descent increases as the game progresses, intensifying the challenge. Unlike many games, *Tetris* (available for most computer and video game systems) has a nonthreatening appeal that pulls you back for more.

Chess, of course, is an obvious choice in the adult video/computer game world, although an uninterrupted game may require more time than you might want to invest. Fortunately, most computer chess games have a "save game" feature, which allows you to return later on and pick up where you left off. Interplay Productions' *Battle Chess* (Amiga and IBM) and Software Toolworks' *Chessmaster 2100* (for most computers) are just two of the many excellent computer chess games.

And what could be more appropriate for adults than gambling? Micro-Illusions' coyly titled "Micro Vice Series" includes two excellent programs: *BlackJack Academy* and *Craps Academy* (for several computer systems). Not only are these games excellent simulations of the real thing, they provide realistic training in rules, odds, card counting, and money management for prospective Las Vegas or Atlantic City visitors.

For those who want to cool down with a full-fledged arcade game, my personal favorite is currently Taito's delightful *Bubble Bobble*, an arcade smash that has translated brilliantly to several computer and video game systems. One or two players control bubble-blowing dragons, using the soap-film globes to entrap "meanies" and pop them out of existence. *Bubble Bobble* has a wide variety of meanies, mazes, and special point-earning treats. Yes, it is silly. But *Bubble Bobble* can turn defeat into a temptation to play just one more game.

There are other games, and there are many adults secretly playing them. So, adult video game fanatics, tell us what games you use to relax. Tell us why you enjoy them, and offer your peers some game-playing tips. Send your confessions to Video Games, c/o *Omni*, 1965 Broadway, New York, NY 10023-5965. We'll pay $25 for each one we print.

—Bob Lindstrom

LAST WORD

By Terry Runte

"In many areas you can walk for hours and never see the light of day, the average temperature has dropped by 10°, plant life is dying off, and, perhaps most alarming of all, no one can get a tan."

In the early Eighties nobody really got worked up over environmental issues. It just wasn't cool. And if you think you're different, try and remember the last time you celebrated Earth Day. But that's all going to change in the next couple of years. The New Hip Environmental Movement will deal with all the problems that have resulted from the excesses of the New Hip Eighties life-style. So why don't you sit back, pop open a wine cooler, put on a Sting album, and read about all the horrible but hip environmental havoc you've caused. You don't have to do anything about it, just try and feel a little guilty. Guilt is hip.

THE NOISE VACUUM

Some pretty tough noise pollution laws were passed in the early Seventies. As a result motorcycles are now quieter than sewing machines, cars are altogether silent, and construction workers are allowed to use their jackhammers only on soft things. Add to that the fact that virtually everyone wanders around wearing a Walkman to avoid having to talk with one another, and you get the number-one noise problem of the Eighties. There is no noise. Take off your headphones the next time you're in downtown New York or Chicago during lunch hour and you'll see just how serious this problem has become: as thousands of yuppies mill about like pigeons in absolute silence. It doesn't hurt anything, but it's real eerie.

PLAQUE ATTACK

Yeah, sure these new plaque-preventing toothpastes may seem like a good idea, but just think for a minute. Maybe nature puts plaque on our teeth for a reason. Maybe plaque is really dangerous stuff that belongs on our teeth where we can keep an eye on it. These new toothpastes remove plaque from billions of teeth and release it into the waterways, where it will settle and harden, eventually filling our sewers and rivers with a hard cement that only dental hygienists can remove using those little scraping hooks. The federal cost of hiring qualified hygienists to remove plaque will triple the budget deficit.

THE FUN-HOUSE EFFECT

Mirrors have become a common motif of interior design. After all, today's hipsters look great and feel good, and want to look at themselves as often as possible. The problem is that light becomes trapped in these literal houses of mirror, bouncing from the mirrored wall to the mirrored ceiling, down to the mirrored table (unless, of course, it's covered with cocaine), and back up to the ceiling. All the while more light is being pumped into the room, creating an invisible clutter of something scientists have termed "used" or "dirty" light. What side effects does this dirty light have on the people who live with it? Some people believe that this sensory overload may cause a type of aesthetic blindness that makes things look better than they really are and may explain why so many people use too much hair mousse, wear fluorescent colored clothing, and tolerate Oprah Winfrey.

THE TRAMPOLINE EFFECT

We know the earth's crust is a thin hardened layer floating on a molten sea, sort of like the skin of a water balloon. Yet every year about a million really trendy people fly from Chicago to Cancun at exactly the same time. As they leave Chicago, the earth's surface relaxes slightly, then depresses in Cancun when everybody lands in those big planes. The resulting ripple takes about a year to reach Chicago, just as all the trendies get ready to leave for Cancun again, doubling the ripple effect. At this rate, in 8 trillion years we will be bouncing around as if we were on a trampoline.

THE WAYFARER EXPLOSION

All the concern over ultraviolet rays damaging our corneas has caused an unforeseen litter problem that threatens to clutter our city streets and overwhelm our landfill sites—the proliferation of millions of nonbiodegradable sunglasses. The typical urban dweller buys a pair of Ray-Bans (or the cheap "Saturday night special" imitations) once every 48 hours—and then promptly loses them. The resulting glut of stylish shades has prompted cleanup programs across the nation, and several states have passed strict laws making those safety straps that hang around your neck mandatory.

THE SOLAR SHORTAGE

All across California solar-powered homes are springing up in response to... Hey, you can never run out of sunlight! Wrong! These houses require a tremendous amount of energy to heat the pools, refrigerate the yogurt, and run the air conditioners and Jacuzzis. All these solar panels are attracting the rays away from the rest of the country. In many areas you can walk for hours and never see the light of day, and the average ground temperature has dropped 10°. Plant life is dying off, and perhaps most alarming of all, no one can get a decent tan anymore.

Terry Runté is a freelance writer who won't even sweat without first filling out an environmental impact report.