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NUCLEAR RENAISSANCE

REACTORS ARE
BACK AND REACTIONS
ARE GOOD

SACRED ARCHITECTURE
OF THE NEW AGE



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Part of the permanent collection of the Hirshhorn Museum of Modern Art, the photo on this month's cover was shot by New York-based photographer Kent to commemorate the fortieth anniversary of the founding of Hirshhorn.

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FIRST WORD

By Ira Glasser

● *The real question is, Do we really want to give employers the ability to monitor an employee's life-style? As one federal judge put it, "It is George Orwell's Big Brother society come to life."*

On March 8, 1986, the President's Commission on Organized Crime proposed that all employees of the federal government be tested periodically for drugs as a condition of employment. This call was the opening gambit for what was to be a phenomenal increase in workplace drug testing, especially in the private sector. It is estimated that about 80 percent of the nation's largest corporations now subject either job applicants or current employees to urinalysis as a condition of employment.

I believe it is unfair to force millions of American workers who are not even suspected of using drugs to submit to humiliating and intrusive urine tests. More important, it is inconsistent with our basic democratic principles. Bob Stanley, a pitcher for the Boston Red Sox, put it pungently: "I don't take drugs, and I don't believe I have to pee in a bottle to prove it." Stanley was echoing one of the oldest American traditions—that general searches of innocent people are unfair and unreasonable. That's not just common wisdom: It is a basic principle found in the Fourth Amendment of the Bill of Rights.

Besides, urine-screening tests are far from reliable. For instance, eating poppy-seed bagels can produce a positive result for heroin. Using nasal decongestants can be confused with amphetamine use. Anti-inflammatory drugs can show up as marijuana. Even enzymes, naturally produced by the body, can interfere with the accuracy of the urine test.

The laboratories throughout the United States that analyze urine don't have the capacity to absorb millions of these tests on a routine basis without sacrificing quality and reliability. In a recent National Institute on Drug Abuse survey of medical-lab proficiency, 20 percent of the labs mistakenly reported the presence of illegal drugs in drug-free urine samples.

Even if drug tests were 100 percent reliable, I would still strongly oppose routine and indiscriminate drug testing in the workplace without individualized suspicion. First of all, drug tests are commonly a surveillance device for off-the-job activity—what people did the night or weekend before—not a test for job performance. Urine tests detect only inactive remnants of substances called metabolites. These tests are incapable of measuring current impairment or even of telling how much of a particular substance was ingested or when.

In the case of marijuana—used recreationally in the United States by 40 million people—its metabolite, tetrahydrocannabinol, lingers in the body for days and even weeks. An employee can be penalized for testing positive for marijuana that he or she smoked either the weekend or while on vacation. By the time the employee is tested, the active ingredients have long ceased to have any effect on ability to conduct at work. But the real question is, Do we really want to

give employers the ability to monitor or police life-style? As one federal judge put it: "It is George Orwell's Big Brother society come to life."

Urinalysis can also reveal details of one's personal life irrelevant to drug consumption. An employer can determine whether an employee or job applicant is being treated for a heart condition, depression, epilepsy or asthma. The District of Columbia Police Department has been subjecting the urine samples of women job applicants—collected for drug tests—to pregnancy tests without the knowledge or consent of the women. Those who tested positive were not hired immediately but were "deferred" until the completion of their pregnancies. That is more than a probable violation of federal antidiscrimination laws; it is an intrusion into people's private lives.

When employers assume the right to make employees take a drug test, it is not only to detect a medical condition. These tests have sometimes been a pretext for political harassment and firing. The American Civil Liberties Union (ACLU) is currently representing several safety inspectors from a nuclear power plant who after complaining to the Nuclear Regulatory Commission about problems at the plant, were ordered by their employers to submit to drug tests. All were fired for failing the test. There had been no complaints about their performance.

Permitting the employer to mandate urine tests without any evidence that an individual is using drugs in a way that impairs job performance invites the use of such screening to punish or silence employees with grievances.

Labor unions and civil liberties organizations, including the ACLU, have often challenged these tests on behalf of public employees. Most courts have ruled that government employers cannot subject employees to drug tests unless they have "reasonable suspicion" to believe that an individual is using drugs to the detriment of his or her job performance.

In the private sector, however, the situation is very different. Although six states have enacted legislation restricting drug testing in the private workplace, most workers can be tested for using illicit substances at any time, for any reason. Everyone agrees that employers have a right to expect competence in the workplace, but drug tests do not lead to that goal.

The public should be aware that drug tests are ineffective, that urinalysis is an indignity to an individual, and that fundamentally these tests are constitutionally unsound. American workers do not leave their rights to privacy at the office door or factory gate. Drug testing of innocent people without cause has no place in a free society. □

Ira Glasser is executive director of the American Civil Liberties Union.

CONTRIBUTORS

OMNIBUS



SPRIT OVERLOADS



EMERITON



SHEPARD



NUCLEAR REACTIONS



BOUND FOR GLORY



MIXED MARRIAGES

For nearly a decade the nuclear power industry has languished. Few, if any, new reactors have been ordered. The 1979 Three Mile Island debacle and the 1986 Chernobyl disaster moreover have served to increase the public's fear of nuclear power. Indeed, opponents may have expected that such accidents would further dim the prospects of nuclear reactors. Save your eulogies, though. Today nuclear power may be staging the greatest comeback since Richard Nixon's.

In "Nuclear Reactions" (page 40) Joel Davis reports that a core group of true believers pin their hopes and aspirations on a new generation of nuclear reactors. The design of the future, some scientists and engineers are convinced, will be simple, more efficient, and above all safer. And responsibility for that safety is being passed from the operators to the designers. Nuclear power as the ultimate energy source, however, depends on the industry's ability to gain public confidence. The problem is, Which reactor design—an advanced version of what we've had, or one of several radically new systems—will ultimately convert the skeptics? And will the developers be able to get it right the second time around?

While disciples preach the gospel of nuclear energy, a band of New Age architects is delving into the past to create tomorrow's sacred shrines. In "Spirit Dwellings" (page 64) Jamake Highwater, a noted author and the host of the PBS

series *Wolfe Land and Pinball Mind*, re-creates his sojourn to one such temple—Colorado's Uncliffside Mountain Retreat, where the mystical geometry of Pythagoras' figures prominently. Its designers, called sacred architects, believe that shapes, room size, and the proportions of angles affect our thinking and encourage the development of consciousness. It's not enough simply to construct beautiful houses of worship; they explain, pointing out that the builders of Chartres and other great cathedrals also drew on the wisdom of the ancient Greeks.

As children, some of us were taught that our bodies are temples of God. We had to be cognizant of how we used and cared for them. Should they, then, be vessels for a higher purpose? Before answering, read "The Girl Who Loved Animals" (page 100), a story by Bruce McAllister. Then expect the debate to intensify after you finish Lucius Shepard's "Life of Buddha" (page 52). Shepard has received critical acclaim for such works as the Nebula award-winning novella *R & R* and the novel *Life During Wartime* (Bantam Books). Now tucked away in a low-tech Nantucket enclave with no telephone, "according to his agent, Shepard's biographical data includes stints as a janitor in a nuclear facility and a bouncer in a whorehouse in Spain. And you wonder where writers get their ideas."

Where, then, you may ask, does artist Claude Verlinde get his inspiration? We don't know, and were asked to ask. Nor do

we have any inkling of what muse lurks in the mind of Nina Guccione, who spins a tale that weeds her fantasies to Verlinde's in "Mixed Marriages" (page 76). Turn to page 94, and there she is again, examining Egyptian mummies, especially the 3,000-year-old singer Ta-bes, in the pictorial "Bound for Glory."

For past issues, we commissioned artist Ron Embleton to illustrate such subjects as dinosaurs in "Tyrannosaurus Sex: A Love Tale" (February 1988) and moon buggies in "Prix de Lune" (July 1987). Primarily a comic strip artist and painter, the 37-year-old Embleton died suddenly at his home in England in February. For nearly 40 years Embleton created marvellous and painstakingly detailed artwork for comic books like his "Gallant" series—"Gallant Science," "Gallant Adventure," "Gallant Detective," and "Gallant Western." He addressed science fiction in his adaptations of England's television puppet series, including *Sir Gray* and *Captain Scarlet* and the *Mythicons*. Embleton illustrated children's books and also created the adult cartoons "Wicked Wends" and "Sweet Charity." The British newspaper *The Guardian* described his works as "belonging a member of the Royal Institute of Oil Painters," to which Embleton was elected on his thirtieth birthday. Another British paper added, "In the international comic strip world Ron Embleton was a giant maker of his art." It's an opinion shared by many. **DO**

NUKEBUSTERS

FORUM

By Gregg Levoy

Takoma Park, Maryland, a community of 17,000, passed a legally binding nuclear free zone (NFZ) ordinance in 1963, banning the city from investing in or purchasing from any company doing nuclear weapons work. The city then dropped its contracts with Motorola for police radios and with General Motors for police squad cars, choosing instead to purchase from nuclear-free Chrysler. Currently the city treasurer is assessing the banks that hold \$1 million in city funds to see if they're "clean."

City contracting affords everything from office equipment and phone services to computers and light bulbs. It demands shopping around, citizens' review and lots of paperwork to determine who a municipal can do business with. The larger the city, the bigger the task.

The NFZ movement began 30 years ago in Hiroda, Japan. Although some 5,000 NFZs have been created in 24 countries since then, not a single warhead has been dismantled, not a single defense contract has been canceled. Until very recently the 147 nuclear free zones established in the United States—about 20 a year—have had little economic effect on the country's \$300-billion-a-year defense industry, 25 percent of which is nuclear.

"Municipalities are beginning to realize the purse can influence even the arms race," says D. L. Hamilton, program director of Nuclear Free America, a Bethesda-based international clearinghouse for the movement. Hamilton may be right. Today some people in corporate board rooms are listening. The reason NFZ initiatives have failed in every community where they've threatened ending nuclear weapons contractors is that the companies affected have taken the nuclear free zone measures seriously.

Draper Laboratories, a nuclear weapons guidance-system manufacturer and the prime target of a 1983 nuclear free Cambridge, Massachusetts, initiative claimed the ordinance would knock out jobs, basic research, and tax revenues. Draper dropped in nearly a third of the \$300,000 it took to defend the ordinance,

making the opposition campaign—at \$46 per vote—one of electoral history's most expensive. Still, the ordinance lost by only a 60–40 margin.

In a campaign fund-raising letter circulated to defense contractors around the country, Charles Adams, finance-committee chairman of Raytheon, which also opposed the Cambridge initiative, wrote: "Let's make this campaign the last one of its type that we have to battle, rather than the first of many." Cambridge, however, wasn't the last. Expensive and well-publicized defeats followed in Ann Arbor, Michigan, and in Palo Alto and Sonoma County, California.

But the nuclear free initiative was not lost in Marin County, California, last year. The county cleared its public funds portfolio of \$20 million in nuclear weapons investments in Ford, General Motors, General Electric, and Westinghouse—the largest divestment to date. And the county isn't hurting—it earned slightly higher yields after the "clearing."

To Ritchie Lowry, a sociologist at Boston College and president of Good Money

Publications, an "ethical investments" outfit, Marin County's yields aren't surprising. He contends that nonnuclear companies are a better investment. After a decade of tracking the performance of ten nuclear weapons corporations and ten nonnuclear weapons corporations right through the stock market's crash, he found that the nuclear companies rose 860 percent, the nonnuclear companies rose 1,244 percent. "Defense contractors," Lowry says, "get big bucks in the short term but not the long term."

Marion Anderson agrees. Director of Employment Research Associates, an independent consulting firm in Lansing, Michigan, that analyzes the impact of government policies on the economy, she says, "You generate far more jobs—six thousand more per billion dollars—if money is spent in the civilian economy instead of the military."

The \$100 billion military buildup from 1961 to 1966, she claims, cost the nation more than 1.1 million jobs, led up 30 percent of its scientists and engineers produced fewer marketable innovations than civilian research would have, and siphoned \$39 billion in investment capital out of the civilian economy. More defense money is spent on machinery than on personnel and creates products that can't be used by consumers. The money has left the economy for good. "Military spending is a bad buy for cities and for the economy," she says.

But it isn't bad for national security, defense-spending advocates say. And nuclear free cities, they claim, are a threat to national security. When Chicago went nuclear free, Illinois governor James Thompson called it "stupid and un-American." But local officials disagree, pointing to the growing municipal involvement in shaping foreign policy—everything from NFZs to antipartheid legislation and overseas trade offices.

Admittedly the NFZ movement's economic effect is minimal. But the numbers of "free" zones are slowly adding up. If declaring cities nuclear free doesn't reduce the risk of nuclear war, the warring public, details may



Some cities just say no to nuclear weapons.

DIRTY POLITICS

EARTH

By Cathy Spencer

It is a good thing that come November we won't be voting for a President on the basis of his overwhelming concern for the environment. We polled a number of the nation's foremost environmental groups, and none seemed certain that any of the front-runners would be up to tackling the serious ecological issues facing us today. Instead, activists have taken to contemplating an environmental dream candidate.

Here's what he or she would do immediately implement a comprehensive clean air act that would control acid rain, diminish toxic pollutants, and protect the ozone layer; pass federal legislation mandating recycling programs and waste reduction to solve the nation's emerging solid waste crisis; guard our groundwater from toxic wastes; bolster the Environmental Protection Agency's budget and fill it with environmental experts—not political appointees; and preserve our coastlines, national wilderness, agricultural areas, and national parks. That's what the ideal imaginary candidate would do. What have the real contenders who

may or may not be around by the time you read this said or done?

Vice President George Bush has been dubbed "an environmental disaster" by activists in part because he has vowed to support the policies of Ronald Reagan. For the past eight years Reagan has opposed all legislation to control acid rain, vetoed the Clean Water Act, and approved the foudation of the last remaining old-growth forests in the Northwest. Brock Evans, spokesman for the League of Conservation Voters, says, "If we hadn't had a Reagan administration, we wouldn't have had landscapes gutted because strip mining laws were not enforced. We'd be well on our way to controlling acid rain, and there wouldn't be a push to open up the Arctic Wildlife Refuge for oil drilling."

Maybe Bush wouldn't wreak quite as much environmental havoc as Reagan has, though. Bush has diverged (at least in theory) from Reagan's opposition to preserving our parklands. In a speech on June 7, 1987, in Jackson Hole, Wyoming, the Vice President stated, "More can

and should be done to ensure that quality outdoor opportunities continue to exist for our next generation of Americans."

What Bush considers a "quality outdoor opportunity" is not all that clear, however. Senator Robert Dole, says Daniel Berkey of Environmental Action: "Has a terrible record on environment issues. He has been a leader in fighting against any type of environmental legislation." Dole was one of only 13 senators who voted against Superfund, the program to clean up chemical waste sites. He opposed the Clean Air Standards Attainment Act of 1987, which would have required reductions of sulfur dioxide emissions by 12 million tons and of nitrogen oxide by 4 million tons by the year 2000. Dole's campaign aides tell us that even though America must curb acid rain, their candidate doesn't support any of the bills that would help control the problem.

Former TV evangelist Pat Robertson has never had to vote or take a stand on problems of the environment. Apparently there's little room in his platform for environmental issues; he hasn't made any statements concerning the environment. When the League of Conservation Voters submitted a list of questions to him, he refused to respond.

On the brighter side, Governor Michael Dukakis says, "If there is one thing the next President might do, it is to help build a bright and vibrant economic future for this country. But you can't build that economic future without a healthy environment. The two go hand in hand."

Dukakis supports research and development of photovoltaics, a safe and natural process that converts sunlight directly into electricity. In conservation circles, Dukakis is best known for his fight against the Nuclear Regulatory Commission's (NRC) evacuation plan for the Seabrook nuclear power plant, located in New Hampshire, near the Massachusetts border. The governor, in cooperation with the Massachusetts Civil Defense Agency, decided that the topography, meteorology, and demographics of the six Massachusetts communities within the Seabrook "emergency zone" made a safe



Dukakis and Bush: Who will stop the reign of pollutants, pesticides, and toxic wastes?

AN AMERICAN SAMPLER

ARTIFICIAL INTELLIGENCE

By Robert Neumann

At age thirty-four, music programmer John Mahoney has decided to become a part-time private investigator, a "music fingerprinter" who can electronically determine whether one musician has reproduced sounds from another musician's copyrighted recording. Mahoney's business isn't booming—yet—but he may testify in two copyright infringement suits pending in New York, and other cases are undoubtedly on the way.

In his windowless basement studio jammed with state-of-the-art recording equipment that he uses for his own musical compositions, Mahoney demonstrates how digital sampling makes cloning sounds possible. Digital sampling is done using an electronic device called a sampler, which converts sounds into digital recordings that are stored on computer disks. "I can capture any sound in the universe with digital sampling," says Mahoney. "Once I've sampled [digitally recorded] a sound, I can play it later, do whatever I want to it." Indeed, such digital doctoring has given modern musicians the ability to insert almost any sound—even James Brown's voice—into one of their own pieces.

Mahoney shows a floppy disk containing previously sampled sounds into a disk drive and, using the Rolie-Royce of samplers—the Synclavier—he selects trillants from a timbre display on the monitor. When he strikes a key on the Synclavier's piano keyboard, the sound of a deep-bellied drum resounds from massive wall speakers. He can do the same for any note from any instrument. In fact, he can vary the pitch of each note and stretch or shorten the sounds. Mahoney leans back in his chair and clasps his hands behind his head. "I can incorporate any isolated sound into my palette and mix those sounds to make my own creation," he says.

The reproduction of isolated sounds is widely accepted in the music business. Music programmers build large libraries of individual sounds, everything from a note played on an unusual African folk

instrument to one that flies off Phil Collins's snare drum. "Part of what you're hired for are your sounds," says Mahoney, who was one of the first musicians to enter the field of music programming when the Synclavier first became popular in 1985. In building a library, programmers may buy sounds from the musicians who created them or sample sounds from compact disks. But that's where Mahoney draws the line. "You could use this technology to copy a melody or rhythm," he explains, "maybe cut up someone else's horn phrase and fly it into your own composition. I don't do that."

Others do copy longer passages, though, and that's where Mahoney's detective work comes in. When he is asked to fingerprint sounds, he must first identify the two passages to be compared. The suspected passage will usually be something that the aggrieved musician thinks sounds "too familiar." That same musician, though, might not remember where the passage occurs in his own composition. Mahoney has to find it and

determine if it is a likely candidate for sampling. A sound buried among other instruments or voices is extremely difficult, often impossible, to isolate. It just can't be separated from the other sounds. "OUI," says Mahoney. "If the sound is laying out in the open and I find it on the other musician's recording, that's a good indication it was lifted."

Often the samples he examines have other sounds added to them. A horn phrase, for example, might be surrounded by drums. "Then," says Mahoney, "I have to try to filter out what's around the sound. I can get rid of some frequencies, but often they cross over each other, and there's not much you can do."

Once the original and the suspect sounds have been isolated, Mahoney uses the Synclavier to graph the characteristics of each sound. After matching the two starting points and setting the opening patches to match each other, he programs the Synclavier to graph the relative amounts of each frequency that appear in the sounds. If he finds that the two sounds match, it's a clear case of copying.

It looks likely that Mahoney will take the stand for the first time later this year in one of two infringement suits pending against the Beastie Boys in New York. The rap group is currently being sued for copyright infringement for several songs on their album *Licensed to Ill*. The plaintiffs hope that testimony from a music fingerprinter will bolster that of musicologists, who are traditionally called as expert witnesses in copyright infringement cases. If the court accepts music fingerprinting as viable evidence, the door will be open for more suits. But acceptance of music fingerprinting will also mean that the courts will have to grapple with some new and decidedly sticky problems. The sounds Phil Collins gets out of a snare drum are his, or are they? Can a programmer lift one or two of those sounds without infringing on Collins's copyright? In a profession where legal limits have yet to be set, these cases may determine to what extent the recording industry is licensed to sample. **CC**



Are musicians stealing one another's sounds?

NURTURING NASA SPACE

By Lindsey Van Gelder

The minute someone walks into her office at the NASA Ames Research Center, Dr. Yvonne Clearwater goes into hostess mode, offering mugs of fragrant apple-herb tea and slices of home-baked apple pie. She dunks tea bags and jingles spoons as she ponders the next phase in the all-propulsion, get-the-can-into-the-air-and-make-it-land-where-you-want, "manned" space program of the last quarter century.

She herself has a job that would be the envy of any professional, researching and developing architectural and interior design guidelines for the permanent U.S. space station that is scheduled to go into orbit in the Nineties. And Clearwater—along with many of her colleagues in the aerospace field—believes that women are now at a point where they can not only compete as equals but also add a unique perspective.

There are more women in space-related careers today than ever before. Still vastly outnumbered by men (with minority women particularly invisible),

many can tell horror stories of tokenism and outright discrimination. But the industry that popularized the word "manned" as an adjective denoting a human presence is increasingly "womaned." Sally Ride's historic flight as the first American woman in space is the most obvious example, but the 95-member astronaut corps now has 12 women, including the first black female candidate, Mae Jemison.

The number of female scientists and engineers employed full-time by NASA has risen from less than 3 percent in 1974 to nearly 11 percent today. Although salaries for private industry are harder to come by, NASA also reports a more than 9 percent increase in the dollar amount of NASA contracts awarded last year to women-owned businesses.

During the Sixties and early Seventies, when the women now moving into key positions in aerospace were growing up, there were virtually no female role models. In fact, according to Marcia Smith, a Library of Congress aerospace specialist who recently served as execu-

tive director of the National Commission on Space and is a former president of the professional group Women in Aerospace, many of the female science stars of today began as secretaries.

"If you were a woman you had two choices: Type or teach," adds Brenda Forman, a senior policy advisor at a major aerospace manufacturer in Los Angeles.

One of the few women who did come to prominence in the space field before the Eighties was Elene Galloway, who recently received the first Lifetime Achievement award given by Women in Aerospace. Now eighty-one, she has been dubbed the grande dame of space law.

Galloway had taught political science at Swarthmore College in Pennsylvania and was serving at the time of the first Sputnik launch in 1957 as a national defense analyst for what is now the Library of Congress Congressional Research Service. Galloway had just finished a report on guided missiles for the Senate Armed Services Committee when she found herself cast in the role of Sputnik expert. Within weeks of the launch, then-Senator Lyndon Johnson hired her to help prepare hearings on "The Missile/Satellite Situation." When the Senate soon afterward established the Special Committee on Space and Aeronautics, Johnson appointed Galloway as a consultant.

Galloway also helped draft the bill that created NASA in 1958. Johnson next asked her to commence research into the new field of space law, an area she has in the years since become an expert in—from space treaties to the legal ramifications of international cooperation in clearing up space debris.

But one of her major thrusts these days is the integration of space activities with the humanities. "Today our most urgent and unsolved problems involve those of political science—management [especially from the top level] of space activities, organization in the executive branch, and the role of the government in relation to the private sector," she explains. The bottom line, she says, is that "no matter what your discipline is, it's going to be affected by space."

CONTINUED ON PAGE 36



Outnumbered but increasingly "womaned": The battle of the stars reaches new heights

LONG-DISTANCE OPERATORS

BODY

By Richard Wolkowicz

Your hitch as a construction specialist on the ever-growing space station has been uneventful until now. Your appendix, just detonated. The physician on duty in Houston checks you out on the interactive TV and gives you the bad news: Your appendix has to come out—as soon as possible.

The space station has no surgeon, and the next supply shuttle isn't due up for two weeks. Launching an ambulance to bring you down would cost millions. But there's no need to worry—a surgeon on call in Los Angeles is prepared to operate immediately. He instructs medical technicians at your station to ready the robot telesurgeon. (Robots that do telesurgery are equipped with operating arms programmed to mimic the motions made by surgeons on Earth.)

The medics rush you into the station's tiny operating cubicle and give you a quick CT (computed tomography) scan, beaming the 3-D images of your abdomen to a computer on Earth, which digests the data. The L.A. surgeon reviews your scan, confirms the Houston doctor's diagnosis, and tells the medics how ready to go ahead with a classic appendectomy. It's time to give you ether, he says, and they zip a mask over your mouth. The last thing you see is the robot's operating arm, a scalpel glimmering in its gripper as it starts to rise.

When you awake, you have neat stitches just below your right hipbone. A few days rest, and you're back on the job.

"I'm not ready to volunteer for an operation like that, and I doubt that you would be," says Scott Fisher, principal investigator for a project called Virtual Environmental Work Station (VEWS) at the NASA/Ames Research Center in Moffett Field, California. Such telesurgery is an anticipated benefit of the research Fisher shepherds: as decades in the future he says. But the project is only one facet of VEWS. Fisher and his team of ten core researchers, backed by squads of outside contractors, are developing a technology of "virtual environments" that could dramatically change the way surgeons are trained in their craft.

The VEWS project is modeled in part on computerized flight simulators, which offer pilots and aerospace engineers a vicarious version of a given flight experience for training and research purposes. In much the same way, virtual environments will offer surgeons and their students the option to perform an operation on a computerized model of a real or a hypothetical patient before ever cutting into flesh. But while flight simulators provide only graphic data, VEWS users will receive haptic images and vivid sensory stimuli. The technology should have an impact on everything from drawing up architectural blueprints to designing salvage missions in the event of a nuclear accident.

The equipment for virtual environments is minimal. The operator wears a helmet like a bicyclist's, with an electronic box smaller than a paperback book fitted in front of his eyes. Inside the box are two tiny video screens, one for each eye. (Because the screens are so close to the operator's eyes, special optics in the box provide a wraparound, 3-D view that

simulates reality. (Returning to the appendectomy scenario, "reality" would be the actual operating field.) The user must also don electronic gloves. A tracking device on the helmet uses low-frequency magnets to monitor the position of the gloves as well as the direction of the operator's gaze. All this data are fed back into the computer generating the virtual environment.

As astronauts begin moving out into space, medical emergencies will be a problem. Telesurgery provides one possible solution. Consider the appendectomy for which the patient is anesthetized in the space station. The surgeon wearing the helmet is in Los Angeles. Looking through the viewer, he sees a computer-generated image of the patient's abdomen, built up from the CT scan and other data. He also sees the robot's gripper holding a scalpel over the man's flesh. With his hands in the electronic gloves, the surgeon moves the robot's grippers as if they were his own hands. While the surgeon performs a simulated operation on the computer-generated man he sees through the viewer, the robot on the space station performs the actual operation on the flesh-and-blood patient. Telesurgery is decades away because the movements must be precise, says Fisher. "But we've begun working on a training environment for surgeons."

For teaching purposes, a professor—wearing the helmet and the electronic gloves—could perform an operation on a simulated patient while talking his students through the procedure. (The patient can be generated entirely by computer or from videos of real individuals.) Alternatively, the professor could perform an actual operation as video cameras feed his patient's image directly into the computer. In this case, students might not be in the same room—they could even be on different continents. By wearing equipment identical to their instructors, they could watch the operation through his eyes. With the electronic gloves on their hands, they would feel whatever the instructor's hands felt as he made his motions: virtual or actual.



With telesurgery, only the robot needs to scold.



CONTINUUM

WE'RE SORRY, YOUR TIME IS UP

Emergency room, County Hospital, 2008. Two elderly Medicare patients are wheeled in side by side, both in the midst of heart attacks. The doctors know that an expensive drug called TPA could save both patients. But the law intervenes. One of the patients is seventy-nine, while the other has just passed his eightieth birthday: the legal limit for coverage of heroic lifesaving treatments. The slightly younger patient gets the TPA and lives. With no relatives nearby to assume the considerable cost of the drug, the older patient—his right to coverage for lifesaving treatment having legally expired—is allowed, by his physicians, to die.

This scenario and the wrenching morality play that underlies it are the plausible outgrowths of a controversial set of recommendations advanced recently by one of the country's leading medical ethicists. Daniel Callahan, director of the prestigious Hastings Center in Bardonia Manor, New York, and author of *Setting Limits: Medical Goals in an Aging Society* (Simon & Schuster), argues that the only way the government can avoid being overwhelmed by accelerating health costs in the next generation is to ration certain kinds of life-extending medical care—bypass surgery for instance, or organ transplantation, or extended intensive hospital care—to the elderly. And the only equitable standard for that rationing, Callahan insists, is age.

Callahan looks at the numbers—28 percent of today's federal health budget expended on medical care for the elderly, Medicare costs rising 8 percent a year, a continually rising life expectancy—and sees an impending crisis. To head off that crisis and to ensure that the young are not deprived of adequate care in favor of the old, he advocates a top-to-bottom rethinking of our attitudes toward aging, death, and society's moral, legal, and ethical obligations toward its oldest citizens.

The key to Callahan's own thinking and the rationing system he proposes is what he calls the "natural life span." Here he means not biological life expectancy but a "biographical" concept in which society's obligations to an elderly person decrease once that person has accomplished the ordinary scope of possibilities that life affords: living to see one's grandchildren and realizing some of one's personal and professional goals. Beyond that, Callahan maintains, society has no obligation to support one's desires to be immortal or even to be one hundred ten.

But how does society pinpoint the age at which one has lived out one's "natural life span," when natural means something short of death? Callahan leaves that to future debate, suggesting only that the cutoff point be somewhere between the late seventies and early eighties. To those who object that any age standard would be radically unfair in that it would not take individual differences into account—would we deny bypass surgery to a Picasso or kidney dialysis to an Oliver Wendell Holmes?—Callahan has an answer: "In most states people can't drink until they're twenty-one even though there are some fifteen-year-olds who are mature enough to drink and some thirty-year-olds who aren't. And Medicare itself starts at sixty-five. If you're younger than that you're simply not eligible. There are many established precedents," he concludes, "for using age as a legal standard."

Callahan concedes that his ideas have found few supporters. Right now, he says, "people think this is outrageous. If there's any consensus, it's that the idea that we could ever use age as a standard [for rationing] in the near future is basically unthinkable." One who finds it quite thinkable, though, is former Colorado governor Richard Lamm, who created a law in 1984 when he said that "we all have a duty to die" when we grow old. Life-extending care for the elderly, he says now, is a "fiscal black hole into which we can pour this country's entire future. Our octogenarians have the highest life expectancy in the world, and yet we're twentieth in infant mortality. Is this the kind of [medical] policy we want, one that gives the elderly a few more days of pain-racked life yet denies health care to kids?" Lamm is, however, decidedly in the minority.

Perhaps more typical is the response of Dr. Robert Butler, a prominent gerontologist and professor at Mount Sinai Medical School in New York. In Butler's view, Callahan's book is "frightening and disturbing... its perspective 'shallow and philosophically dangerous. It ignores eternal verities like decency to elders and is punitive to those people who can least afford medical care. We're not in a calamity. Butler concludes: "We're still the richest country in the world, and we can well afford to take care of our old people!" —BILL LAWREN

Bill Lawren is a contributing editor of *Crain*, and author of the recently published book *The General and the Bomb* (Doubt/Free).



CONTINUUM

CHERNOBYL ON ICE

The nuclear reactor disaster at Chernobyl announced itself to the world by raising ambient radiation levels as far away as Sweden and Spain. Now comes news that the reactor explosion also left its radioactive signature in the unlikelyst of places: the perpetually frozen snowpack of Arctic Greenland.

Environmental scientist Cliff Davidson of Carnegie Mellon University in Pittsburgh led a group of scientists who were searching the snowpack for evidence of industrial pollutants. Analyses of their samples showed unmistakable traces of two radioactive isotopes of cesium plus thorium 90 at levels of four to eight inches below the snow surface.

The levels of these isotopes in the Greenland snow indicate that the cesium was of very recent origin, and since no aboveground nuclear weapons tests have

been conducted since 1980, this constitutes what University of Chicago geochemist Mark Monaghan calls some "circumstantial" but strong evidence that the source of the radiation was indeed Chernobyl.

Though the finding has told the scientists little new about the disaster itself, it should tell them a great deal about how contaminants in the atmosphere are incorporated in the snow. There's a relationship between what's in the snow and what's in the air, says Davidson. "The radioactive particles from the Chernobyl accident are about the same size as pollutants like sulfates from industrial processes and lead from car exhausts." By studying these particles, scientists hope to learn more about how the atmosphere acts to transport pollutants around the globe.

—Bill Lewers

"Living is more a question of what one spends rather than what one makes."

—Mortel Duchamp

"The only difference between myself and a machine is that I am not dead."

—Salvador Dalí

"Today's robots are very primitive: capable of understanding only a few simple instructions such as 'go left,' 'go right,' and 'build car.'"

—John Sladek

"Pedestrians never seem to realize that they are in threat to the safety of cars."

—Thomas Sowell



Scared of flying? Ever wish you had a parachute onboard? Now a Pennsylvania inventor has come up with a chute for the whole cabin.

EJECTABLE CABIN

Fighter planes have long been fitted with seats that can eject a pilot to safety if the plane is facing an unevitable crash. Now Pennsylvania pilot/inventor Peter Diamond has patented a similar idea for commercial airlines: an entire passenger cabin that could be ejected from a troubled aircraft and float harmlessly to Earth under a cluster of parachutes.

The cabin, explains Diamond, would sit on diagonal rails attached to the inside of a plane's fuselage. If the plane were headed for a certain crash, the pilot and crew would retire to the passenger cabin and hit the eject button. A set of pneumatic arms would thrust the cabin up and away from the rest of the plane (the force of the thrust would keep passengers in their seats), and the parachutes would open. A set of air bags underneath the cabin would inflate automatically to cush-

on the landing.

Diamond cautions that the idea would work best at altitudes above 3,000 feet where the parachutes would have time to open. But even for takeoff and landing crashes, the ejected cabin would at least land on the runway where, he says hopefully, "I don't think it would disintegrate."

Diamond, who has been flying for 55 years (the now sixty-one-year-old got his pilot's license at the age of sixteen), claims the idea came to him decades ago when he was still piloting biplanes, but he patented the concept only recently. Existing airliners, he says, could be retrofitted with the ejectable cabin for about \$2 million. Just cut the top of the plane out, pull out the seats and slide the ejectable compartment right in. "At the writing, Diamond has ap-

proached only Boeing with his invention and has yet to receive a response.

—Bill Lewers



Chernobyl control room. The disaster's impact is far-fung.

ANATOMY OF A YAWN

Ever since 1873, when Charles Darwin noted that baboons yawned more frequently in circumstances involving either passion or a threat, the biochemical and neurological implications of the yawn have fascinated researchers like Ronald Baemlinger of Temple University in Philadelphia.

After studying lions, man drills, Siamese fighting fish and humans, Baemlinger concludes that people yawn for different reasons from other animals. "Right now we're long on hypothesis and

short on data," he says, reporting that his fighting fish yawned six times an hour before combat and never when they were alone; zoo lions yawned in anticipation of dinner; and the mandrills usually yawned seated and hungry but never immediately before bedtime.

Humans often yawn when they are alone or bored and always in situations where they feel safe. "If they think something bad is about to happen, people won't yawn," says Baemlinger, puzzled by the difficulty he had getting his subjects to yawn in the lab.

"Yawning may just be a mechanism to keep us awake," says the Temple professor, who edits a journal called *Aggressive Behavior* in an effort to solve the biological mystery of the yawn. He now plans to take electroencephalograms, monitor heart rates, and give polygraph exams to test his theory that yawning increases the human arousal level. The invariably contagious nature of the yawn also intrigues him.

—George Nobba

KINKY LAMBS

What stands on all fours has a penis and a scrotum, urinates like a male, yet is biologically at least half female? It is one of the new experimental lambs produced at the U.S. Department of Agriculture (USDA) Meat Animal Research Center in Clay Center, Nebraska.

Over the past four years, USDA researcher John Kindt has been treating pregnant sheep with precisely timed injections of the male sex hormone testosterone. At birth, the ensuing lambs were all what Kindt calls pseudo-hemaphrodites: chromosomally female but with a mixed complement of sexual hardware—penises and scroti on the one hand and uteri and ovaries on the other. But what really interested Kindt was that the sexually mixed-up lambs put on weight 10 to 30 percent faster than normal females, yet at the same time they produced meat that was 13 percent leaner.

Kindt can't yet explain



John Kindt holds USDA experimental lamb.

exactly how the testosterone injections acted on the fetuses to produce such dramatic changes, but he suspects that they in some way affected the production of important growth hormones. On a more practical level, he thinks that these experiments will sooner or later spell good news for super market shoppers. "Anything that enhances the efficiency of production gets passed on to the consumer," he says. In this case, Kindt promises, "we'll eventually see cheaper leaner lamb."

—Bill Lawren

"Any sight is a sum of different glimpses."

—Robert Hughes

"Writing free verse is like playing tennis with the fist down."

—Robert Frost

"A national debt, if it is not excessive, will be to us a national blessing."

—Alexander Hamilton



A yawn down (always contagious). If the lion yawns, you yawn before bedtime. And if a lion yawns at you, you could be his next dinner.



CONTINUUM

A BLIMP FOR STAR WARS

To you and me it's a blimp, but Frederick D. Ferguson, president of Magnus Aero Space Corporation, refers more elegantly to his lighter-than-air (LTA) freight aircraft as a Magnusphere.

The helium-filled airship—ten years in the making—looks like something out of *Star Trek* and in fact has the contractual backing of the Defense Department as part of the Strategic Defense Initiative (SDI), or star wars. The SDI people are understandably close mouthed, but it claims Magnusphere can lift three-ton loads to 70,000 feet and maintain its position for a month, making it ideal for hauling aloft such gear as transmitting equipment.

The slightly pressurized Magnusphere flies with the same maneuverability as a helicopter. Spherical in shape, it has a horizontal bar running through the middle



Cats that don't get enough taurine may be developing an degenerative heart disease. Veterinarians recommend giving your cat supplements to raise amino acid, which only help humans as well.

of the craft. Twin engines mounted on the bar slowly rotate the sphere, lifting it by the same aerodynamic principle that sends a golf ball flying. The bar also supports a cargo yoke at the base of the strange craft, which takes on air to maintain its buoyancy after cargo has been unloaded.

Star wars aside, Ferguson says the vehicle's commercial possibilities may be realized before its military uses. At lower altitudes it can lift as much as 400 tons and could haul giant sections of prefabricated buildings, transmission towers, pipelines, offshore oil rig components, twin water or fishing catches—George Nabbbe

CAT NUTRITION

If your cat doesn't get enough of an obscure nutrient called taurine, it's at high risk for a degenerative heart disease called dilated cardiomyopathy, according to scientists at the University of California at Davis.

Give it a regular dose of the amino acid and it will probably be as good as new, according to veterinarian Paul D. Pion, who's studying taurine to find out if it has human applications.

"Taurine is an atypical amino acid," says Pion, who adds, "Nobody is sure what it does." In some animals, the substance aids in the production of digestive bile

helps maintain internal water balance, and ensures healthy eyes. Large concentrations of taurine in the heart may help strengthen a cat's heart muscles, and it has been added to commercial cat food since 1987.

So far, pending ongoing human studies, no one really knows whether the amino acid could help people or, for that matter, how many individuals have taurine deficiencies. "We're hoping for some answers soon," says the veterinarian.

—George Nabbbe

"Whenever I hear the word culture, I reach for my revolver."

—Herbert Góring



Magnosphere: Like a big golf ball filled with helium.

HOW MANY ROACHES?

We hate to break this news to you, but deep down inside, you probably suspected it all along. Remember that roach in the kitchen last night? You had a sinking feeling there were more where it came from. You were right. There are a whole lot more. According to a recent study conducted by the University of Florida and the USDA Agricultural Research Service in Gainesville, Florida, for every cockroach you see there are at least 500 more hiding in your home.

The roach survey was prompted by research into insect growth regulators: synthetic hormones that render cockroaches sterile.

We wanted to know how effective the chemicals were, so we caught roaches in over one thousand apartments and calculated how many of the insects were present," explains Agricultural Research Service entomologist Richard Patterson. "We were surprised at how many we found—an average of thirteen thousand to twenty thousand per home."

Although the apartments surveyed were low-income units in Florida, Patterson emphasizes that the rampant Manhattan high rise is not immune from huge roach colonies. "If just one apartment has a heavy infestation the cockroaches spread out between wallboards and in ceilings. They also live in elevator shafts and move up and down until all the apartments are infested."

Even units regularly treated with pesticides are frequently



For every one of these, there are 500 more hiding.

infested with roaches. Patterson points out. That's not surprising, since the cockroach has survived for 350 million years, and many strains are pesticide resistant. "The insect growth regulators will work on cockroaches. But you have to wait six months to a couple of years until the sterile roaches die of old age," says Patterson. "And I can understand someone with thirteen thousand roaches not wanting to wait for that." —Sherry Baker

BOOYBUILDER'S PSYCHOSIS

A young bodybuilder decided it would be interesting to aim a car into a tree at 40 mph. While driving down the highway, another weight lifter became enraged when he thought a passing driver had cut him off. So he chased down the motorist and smashed his windshield with a copier. According to psychiatrist David L. Katz and Harrison G. Pope Jr.,

of Harvard Medical School, both athletes were suffering from psychiatric symptoms apparently produced by anabolic steroids, a syndrome they have dubbed bodybuilder's psychosis.

Pope and Katz surveyed 45 bodybuilders and football players who all admitted taking steroids to increase muscle mass. They found that about 10 percent experienced psychotic symptoms while using the drugs. Some had hallucinations or paranoid delusions," Pope relates. "Others had manic symptoms, including irritability, hyperactivity, impaired judgment, and uncharacteristically aggressive behavior."

The athletes studied took between 10 and 100 times more steroids than are used in medical studies, which could explain why the medical literature doesn't list many of the known psychiatric effects of steroids.

"Although medical side effects can include liver cancer, they are usually quite

minor—like acne and hair loss. But I believe the psychiatric side effects are much more common and serious than the medical ones," Pope notes. "I suspect a lot of incidents of aggression and unusual behavior in athletes witnessed by physicians and police may be attributable to steroids, but no one recognizes it at the time."

Despite the bizarre manifestations of bodybuilder's psychosis, Pope has good news for its sufferers. "The symptoms go away almost immediately in most cases when steroids are discontinued." —Sherry Baker

"Looking for temporary Edens is a perpetual lure, certainly not confined to seniors who sooner or later discover that the islands of their existence are, in truth, the tops of their desks."

—Alastair Reid

"Eternity is a mere moment, just long enough for a joke."

—Hermann Hesse



Weight training is normally a healthy athletic pursuit, but taking anabolic steroids can lead to dangerous mental problems.



CONTINUUM



Is there a link between sex and risky behavior in teenagers? Yes, according to a San Francisco study which found that risk taking in adolescents was a precursor to becoming sexually active.

RISKY BUSINESS

Adolescents who begin engaging in risky behavior such as using drugs or driving a car fast may be signaling their intention to become sexually active. In a study of San Francisco eleven- to fifteen-year-olds, University of California at San Francisco psychologist Susan Kegellesa and colleagues found this marker was more pronounced among whites than it was in blacks or Asians.

In what Kegellesa terms the study's key finding, white adolescents who were thinking of becoming sexually active "are doing more risk behavior than virgins." This couldn't be measured in black males because they tend to become sexually active prior to the ages measured in the study. A risky-behavior-sex link

among Asians couldn't be determined because they tend to remain virgins longer than whites, says Kegellesa.

To determine the linkage between sexual activity and risky behavior, the students in the study were asked if they had used marijuana, drunk alcohol, ridden in a car when the driver drank or used drugs, driven a car fast, done fancy tricks on a bicycle or skateboard, or taken dares.

Kegellesa says these findings are important for parents to understand because eleven- to fifteen-year-olds have several problems that are age specific. The younger adolescent girls are when they start engaging in sex, the more likely they are to get pregnant. Adolescents also have a high rate of sexually transmitted disease and may not be prepared to avoid contracting VD or AIDS, she says. —Joel Schwarz

DEEP-THROAT STRESS

Posttraumatic stress disorder most often plagues survivors of violent events—like Vietnam veterans who are haunted by flashbacks of the war. But a St. Louis woman claims that watching just 15 minutes of the X-rated film *Deep Throat* in 1980 brought on the syndrome, leaving her disabled.

According to court documents, Olivia Young, a medical supply company representative, attended a business conference at the office of St. Louis University Hospital administrator Richard Stensrud. When the meeting ended, Young claims, Stensrud showed the movie.

The shock of that experience allegedly left Young unable to have sex or even do daily chores. In a lawsuit filed against St. Louis University and Stensrud, she de-

manded \$2 million for "gross, emotional shock and mental distress and loss of employment and job opportunities."

Although a psychiatrist testified that Young was indeed suffering from post-traumatic stress disorder, a jury recently rejected her claims for damages.

Emory University psychiatrist Philip Ninan notes that as the name suggests, posttraumatic stress disorder most often develops after cataclysmic events. "But it is possible that a more normal type of experience, like seeing an X-rated movie, could result in some milder symptoms related to the disorder," he explains.

Ninan adds that problems associated with posttraumatic stress disorder tend to lessen over time. "Unfortunately," he says, "some people spend their energy on getting retribution with lawsuits rather than getting rid of their symptoms."

—Sherry Baker



Deep Throat: Can the movie affect daily household chores?



Animals take it on the lam when a quake is imminent, so one geologist uses the lost-and-found ads as an early-warning guide.

EARTHQUAKES AND CLASSIFIED ADS

Every morning Jim Berkland counts the number of missing cats and dogs listed in the lost-and-found classified sections of three of California's major newspapers. When the numbers go up, it means the state may soon be hit by an earthquake.

For centuries the Chinese have noted that animals can somehow sense when a quake is coming, and part of China's earthquake-warning system is in fact based on observations of animal behavior. Just before a quake strikes, animals become nervous and frightened and often go into hiding. Berkland, chief geologist for California's Santa Clara County, became convinced of the efficacy of the Chinese technique when his own cat ran away from home just before a large earthquake. The cat returned a few months later—just before another quake.

Today he combines the

number of animals advertised as missing, data on peyer and tidal activity, and the position of the sun and moon to detect seismic windows—periods when conditions are most favorable for quakes to occur. These windows extend exactly eight days, usually from one day before to six days after a full or new moon. Seismic windows most favorable for earthquakes are marked by maximum high and low tides, animals leaving their normal habitats, and heavy rain. Berkland claims an 82 percent success rate since 1974 in predicting earthquakes that were strong enough to be felt in the city of San Jose and in Santa Clara County.

Theoretically, says Berkland, animals sense the drastic changes in the earth's magnetic field that are precursors to earthquakes and run away in fear. Not everyone is convinced of Berkland's method, however. Seismologist Leonardo Seeber of the Lamont-Dougherty Geological Ob-

servatory in New York readily concedes that animals respond to quakes. But he adds, "In California you might have a thousand minor quakes a week, and when you have a lot of earthquakes you can find correlations anytime you want to, if you are not sufficiently rigorous." —Joel Schwartz

GLACIAL ICE CUBES

The latest craze at big ceremonial occasions in Japan is "party ice cubes" carved from glacial ice that fell as snow or ran into the fjords of southeastern Alaska thousands of years ago. So popular are the clear bluish cubes that the Japanese will pay as much as \$2.50 for a seven-pound bag.

Tim Diamond, a Northland Service Inc. barge company employee, was well aware of the Japanese craving when he last began harvesting the ice, scooping 4,000 pound icebergs out of the waters of Tracy Arm (near Juneau), loading them on refrigerated barges, and shipping them off to Seattle for processing.

Alaskan environmental activists are predictably out raged. "Bringing a barge with a backhoe on it is totally incompatible with pristine wilderness values," says Don Cornelius, a Petersburg environmentalist. Refracts Diamond, who did agree to stop operating in LeConte Bay, "I'm not breaking any laws. There are a few people in the world who feel we're stealing the crown jewels of Alaska."

So while Diamond waits for

a permit from the Alaska Department of Natural Resources to harvest ice, he continues to make one side trip a week into the Tracy Arm fjord after his regular Seattle-to-Juneau vegetable run is over, collecting about 100 small icebergs per trip.

The Japanese prize the ice for its clarity and color and the crackling pops it emits as it melts. Diamond says he'll have no trouble selling them at least 200 tons a week.

—George Nobbie

"To avert disaster we have not only to teach men to make things but also produce people who have complete mental control over the things they make."

—Prince Chieriki

"In the fight between you and the world, back the world."

—Frank Zappa

"Myths are public dreams. Dreams are private myths."

—Joseph Campbell



Glacial ice melts a nice pot when it melts in a drink.

CONTINUUM

NEW SPACECRAFT MATERIAL: WOOD!

It took NASA thousands of dollars and hundreds of hours to come up with the right materials for spacecraft heat shields: a pliable, heat-resistant substance for the Apollo capsules; low-density silica tiles for the shuttle. Now that the Chinese are getting into the business of space, they have developed their own brand of heat shield: a slab of oak.

The Chinese have reportedly launched nine satellites that use the oak heat shields and they planned to launch another one this spring. The idea isn't as far-fetched as it sounds. Back in the early Seventies NASA tested the heat-shielding properties of mahogany, maple, and balsa wood. One of the problems with a wood shield says Don Curry, a NASA space shuttle subsystem manager, is that the char layer—the carbon layer that forms as the wood burns—is weak. As a result, when the char layer is subjected to pressure, vibration, and the various other stresses of reentry, it's liable to fall off. For the cargo inside the satellite, that's a very bad news. Without the char layer, the remaining wood burns faster. And if the wood isn't thick enough, the shield can literally go up in smoke.

That doesn't mean that you can't use wood as a heat shield. You just have to use it under the right circumstances, says Curry. In launches where the temperatures during reentry are relatively low, wood works

fine. The Air Force has used oak shields in launching some of its ballistic missiles without any problems.

—Devers Pen

"With the exception of man, no being wonders at his own existence."

—Arthur Schopenhauer

"It is a mark of modern ignorance to think that we have become progressively smarter."

—Thomas Goldstein

"The losses which a man regrets most in his life are those which he didn't commit when he had the opportunity."

—Helen Rowland

SUPER HAIR BALL

As a medical emergency it was nothing highly unusual. A thirty-two-year-old Kansas City man was admitted to the Truman Medical Center complaining of stomach pains and internal bleeding. But when surgeons went into his stomach to find the source of his problem, they got the surprise of their lives—they found an eight-centimeter-long, egg-shaped bezoar. That's a hair ball, but this one didn't have a hair in it. In fact, it was as hard as glass and made entirely of polystyrene (what most of us call Styrofoam).

The patient admitted to a fondness for nibbling on polystyrene cups: a new psychological melody that the doctors promptly dubbed polystyrenomania. The patient's confession solved the mystery as to how the



Polystyrenomania: Eating polystyrene cups can be hazardous to your health and can also result in a hard-as-glass hair ball.

strange bezoar got there in the first place. But a greater mystery remained: How could a substance as soft and porous as polystyrene turn into the virtual equivalent of a marble, especially in the powerfully acid environment of the human stomach?

University of Missouri chemist Eckhard Hellmuth set himself to solving that puzzle. He remembered that the dairy industry never stores milk in polystyrene containers because the milk breaks down their ability to withstand stress. Hellmuth now thinks that butterfat in the patient's stomach broke down the bonds among the polystyrene molecules,

and pressure from stomach muscles restructured those bonds to form a glass.

Hellmuth is still testing this notion in the laboratory. In the meantime, he issues a caution to latent polystyrenomanacs: Don't eat Styrofoam, he says. "It can be hazardous to your health."

—Bill Lawton

"Realism has no more to do with reality than anything else."

—Hob Brown

"The large brain, like large government, may not be able to do simple things in a simple way."

—Donald G. Hebb



ARTICLE

Solar power's still a dream; oil's an economic nightmare; coal is just plain dirty. There's lots of uranium available, so what's the problem?



NUCLEAR REACTIONS

BY JOEL DAVIS

It is a foggy, cold morning, and I am in the middle of an evergreen forest on the outskirts of the tiny town of Satsop, 40 miles west of Olympia, Washington. The huge parking lot at the Satsop nuclear power plant is empty, no sign of life. Suddenly two hard hats in a red pickup truck zoom past, breaking the silence. The top of the nearby cooling tower is shrouded in mist, but I can see the rail silos on the containment building of nuclear power plant 3, WPN-3. Steel reinforcing rods poke out of the concrete structure, a grim parody of the

coniferous forest surrounding the site.

I drive up to the guard's trailer. A middle-aged man in uniform sits at his desk drinking a cup of coffee. No, he says, I can't just wander around, but I can talk to the public relations person. When I find the PR man's hideout, the trailer is locked and empty. A note on the door tells a local teacher that the man has gone to lunch and will be back by one-thirty for the fifth grade tour. I look at my watch. It is not even eleven A.M.

In the Sovieties the Washington Public Power Supply System, or WPPSS (ps)

PHOTOGRAPHS BY MICHAEL KENNA

nounced by some as whoops) planned to build two nuclear power plants on this site. When work stopped in 1983 WPN-3 was nearly finished; its companion WPN-5 was abandoned a year later—less than a quarter of the construction completed. Today Sabesp is a multimillion-dollar wasteland, a symbol, some people say, of the death of nuclear power in this country—a failed technology, a modern-day Liarus. The evidence: No nuclear power plant has been ordered since 1976. In fact, between 1960 and 1984 53 nuclear power plants at 31 different sites were canceled. The existing 125 reactors—either operating, being tested, or being constructed—are well below the 236 projected by utility companies in 1975. And after the Three Mile Island (TMI) fiasco and the 1986 Chernobyl disaster, the death wishers claim, the lid on nuclear power's coffin is being nailed shut.

Not everyone agrees, however, that the industry is dead, much less dying. In no way is Sabesp a symbol of technological failure, states Carl Goldstein, vice president of the U.S. Committee for Energy Awareness (USCEA), a private nonprofit association of more than 400 organizations with an interest in energy and electricity issues, especially the use of coal and nuclear energy to supply our electrical needs. Sabesp represents a financial debacle, large price overruns, plummeting of prices, slow growth in demand in the late Seventies, high interest rates, regulatory delays—and yes, some public concern after TMI. Quasi-admirers, emotions assuaged, Goldstein recounts these facts. As of last January, 109 nuclear reactors were operating, another 14 units had received construction permits, and two more were on order—all slated to be in operation by 1997, generating enough electricity to service 20 million people. Already Goldstein notes, 18 percent of electric power in this country is produced by nuclear plants. "That's a lot of electricity hardly the sign of a dying industry."

NATIONAL ENERGY DIET

Like it or not, American society is becoming "electrified": light bulbs, air conditioners, TV sets, stereos, stoves, refrigerators, water heaters, personal computers, marifonies, toasters, toasters, telephones, steel furnaces, drill presses, automated facilities, photocopy machines. Where's the generating power coming from? Our sources of electricity are coal (about 55 percent), nuclear power (18 percent), hydropower (about 11 percent), gas (10 percent) and oil (about 5 percent) (less than 1 percent is supplied by the so-called "renewables"—geothermal, wind, solar and wind).

But the wind doesn't always blow, and the sun doesn't always shine. There aren't that many dams that can be built, and anyway, hydropower needs rain and snow, coal has got its drawbacks—environmental pollution and health hazards of its own—OPEC controls two thirds of it. America's share of global oil produc-

tion—4 percent—requires us to import, and we imported \$41 billion worth of oil in 1987. That's a big dependence on open sea-lanes in the Persian Gulf. That, also, represents more than one third of the nation's trade deficit. But the United States does control one fourth of all the coal and uranium in the world—"enough," says Goldstein, "to last us for hundreds of years."

Since 1973 overall demand for electricity has increased about 40 percent and based on North American Electric Reliability Council projections, will be using 34 percent more electricity by the year 2000. We're not to the dismay of the antinuclear people, changing our life-styles fast enough to curb the intense process of electrification. To the believers it's perfectly clear: Go nuclear—electricity is crucial to maintaining our industrial strength, our international competitiveness, and our national security. "But as long as the public believes there is no energy problem, the development of nuclear as well as other energy sources

As of last January, 109 nuclear reactors were operating, another 14 units had received their construction permits, and two more were on order—all slated to be in operation by 1997.

will not move further," says Harold Finger, president of the USCEA. "This country has little existing capacity for future electrical generation outside of old oil-burning plants. When the crunch comes, we'll be forced back to burning oil, as I've never learned the difficult lessons from the oil embargoes of the Seventies."

INTERNATIONALE

Finger and others like him—the engineers and executives of the companies that build nuclear reactors—do acknowledge that there is a hiatus in nuclear power development in this country. But overseas orders for our reactors are increasing—a vote of confidence for the industry in general and for America's standard light-water reactor (LWR), such as the one at Three Mile Island. As with the boiler in a coal-, oil-, or gas-burning power plant, an LWR produces steam to drive a turbine, which turns an electric generator.

Countries like Italy, Spain and Japan are working in varying degrees with American reactor companies. Great Britain is building an advanced US-style LWR. The Soviets, even before the accident at Cher-

nobyl, chose the American LWR. South Korea is ordering two updated LWRs from an American manufacturer, and ironically the Japanese, the first ones to experience the destructive power of the atom, will build several advanced LWRs developed here. Then there is the famously successful nuclear program in France, which provides more than 70 percent of the country's electricity—almost entirely from LWRs.

From Belgium to Bulgaria, Argentina to Brazil, Turkey, Thailand, and Taiwan, the word appears to be going nuclear. Five hundred ninety plants in 41 countries outside the United States are in various stages of development. 285 plants are operating, 131 are under construction, 9 are on order, and 105 are in some form stage of planning. Seventy percent of these reactors are variations on America's standard LWR.

A HOUSE DIVIDED

Very few people in the industry dispute the fact that business on the home front is bleak. What they disagree on is the reactor design of the future—the dream machine that is simple, small, efficient and, most important, safe enough to convince the American public, once again, to vote nuclear. The inside debate over which model to go with is intense.

John Graham, the Washington, DC, representative for the American Nuclear Society, describes the division in religious terms. "The old-time-religion people—company executives and some engineers—control the nuclear lobby." They believe the United States soon will need more reactors. When that happens, their answer is an advanced version of the light-water reactor. A smaller group of old-timers claims that while the LWR has been proved and is safe, we need smaller reactors with more passive safety features. Example: emergency coolant tanks placed above the reactor core so gravity and not electrical pumps would send the coolant pouring into the core in case of an emergency. No human intervention necessary.

The new-religion people—many of them university professors and laboratory researchers—believe Americans will never accept light-water reactors again. Three Mile Island was a light water reactor they point out, and look what happened. Graham's new-religion people include Alvin Weinberg, the former director of the Oak Ridge National Laboratory, research metallurgist and author Ronald Ruess, and Alan Schriesheim, director of the Argonne National Laboratory. They give speeches and write articles with titles such as "A Second Nuclear Era?" and "Nuclear Power: The Second Coming" and "After Chernobyl—A Powerful Vision."

They place their hopes in the newest designs. Called "inherently safe" reactors, these use laws of nature and simple principles of physics to preclude the possibility of a nuclear meltdown. Something brand new they say, something inherently safe, needs to be sold to an anxious public.



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if the nuclear Lazarus is to rise again.

According to the old-timers, some engineers claim too much for their designs. All reactors use laws of nature and simple principles of physics," says Goldstein. "It is important to understand that inherently safe does not mean perfectly safe. No nuclear process or nuclear facility is perfectly safe. It is not correct to label some reactors as inherently safe and others as not inherently safe." They all, however, hope that one of these models will provide the industry with as longed-for malaise.

YANKEE DOODLE DANDY

The standard American LWR is based in part on the design of the highly successful reactors that power America's nuclear submarines. The two main versions pressurized water reactors (PWRs) and boiling-water reactors (BWRs). In any nuclear power plant, no matter what type of reactor it has, heat is produced by the fissioning of uranium atoms. The atomic nucleus contains two kinds of particles: protons, with a positive electrical charge, and neutrons, which are electrically neutral. If the uranium nucleus is bombarded by neutrons, it splits into two smaller nuclei. That process is called fission. A fissioning uranium nucleus releases several neutrons of its own, which cause other nuclei to fission, releasing more neutrons—and so on. The result, called a chain reaction, produces vast amounts of energy.

PWRs and BWRs use the heat generated by nuclear fission to power generators. In a PWR, water under pressure of 2,000 pounds per square inch flows through the core where it is heated. It then goes to a steam generator and heats a second closed loop of water. A BWR operates in a similar fashion except that the water in the primary loop is under less pressure. The water turns to steam and is piped directly to the turbines. In both types, control rods are inserted into the core to shut down the fission reaction. In both, the core is bathed in a liquid coolant. If the core should suddenly lose its coolant, operators release water from emergency tanks to flood the reactor and cool it down. Light-water reactor cores are designed so that if the water in the core region begins to turn to steam or is lost, the neutrons scatter. It is then impossible to sustain a nuclear chain reaction, and the reactor shuts down.

Even though LWRs are protected by "active" components—pumps, valves, diesel generators—they are vulnerable to similar problems: electrical failures that prevent emergency generators or emergency cooling pumps from working; human error (pumps get turned on or off when they shouldn't be, and valves can be placed in incorrect positions); and erroneous computer commands. The result: the Three Mile Island near disaster and other serious incidents, such as the cable fire at the Blowfish Ferry reactor in Alabama in 1975. Workers were trying to locate the source of an air leak in the cable room next

to the reactor—with candles. Five accidentally broke out, destroying electrical cables connected to the reactor and disabling many of the safety systems. (The reactor at Chernobyl—the only one of its kind—was a hybrid, a graphite-moderator design that used light water.)

NEW AMERICAN STANDARD

Light-water reactor engineers believe future LWRs should have more-passive safety systems—using natural physical laws such as gravity—to keep accidents from occurring. Karl Stahkopf is an old-timer. He directs the advanced light-water reactor (ALWR) programs for the Electric Power Research Institute (EPRI), based in Palo Alto, California. A research-and-development organization, it is supported by utility companies. They dictate the types of reactor designs to develop and the design requirements—simplicity, safety, and an improved man-machine interface are the watchwords at EPRI. While EPRI is working

❗ I never thought
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Teller, but he
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to defeat a
sufficiently great fool." ❗

on three fundamentally different reactor designs, Stahkopf says his organization has placed top priority on a national program to create passively safe ALWRs for the Nineties and the twenty-first century.

Future ALWRs, according to Stahkopf, would be smaller than current models, with fewer parts to break down. For example, a typical 1,000-megawatt nuclear plant with an LWR has 30,000 to 40,000 valves. Many of these valves are complex subassemblies requiring a motor, controls, remote read-outs, and other equipment. Many of these systems could be eliminated, Stahkopf contends, because simpler systems are being developed. New ALWRs would be assembled from shop-fabricated modular components, making them cheaper for utility companies to buy. Instead of pumps for emergency cooling water, ALWRs would use gravity: larger supplies of emergency cooling water would be available; larger heat-transfer surfaces would conduct heat from the core more quickly; and the power density of fission cores would be decreased and easier to control.

Westinghouse, in conjunction with Burns and Roe, an architectural and engineering

firm that designs nuclear power plants, is also developing a safer ALWR. It's called the AP-600. "We've proved that this reactor is technically feasible and economically competitive with coal and oil," says Joseph Sudol, project manager for the reactor at Burns and Roe. By the mid-Nineties Westinghouse and Burns and Roe expect to start building these reactors—and they think they'll have buyers. "We had expressions of interest," Sudol says.

DESIGNER REACTORS

The design of the present LWRs and ALWRs may not be those of the future. Three other types of reactors that proponents claim to be "inherently safe" go by the names of integral fast reactor (IFR), high-temperature gas-cooled reactor (HTGR), and process-oriented ultimate safe reactor (POUS).

As a prototype, the IFR has been around for years, although there are no commercial IFRs in this country. The volatile components of the integral fast reactor are immersed in a coolant of liquid sodium metal. Because the coolant is a metal, it draws heat away from a hot core more effectively. A second sodium loop carries heat from the core to the steam generator. Even if the reactor pumps fail, the sodium will still carry away the heat by natural convection. The IFR uses fuel rods made of a metallic alloy (uranium and plutonium in a wrapping of zirconium) that expands if the temperature in the reactor goes too high, stopping the fission reaction. The standard reactor uses ceramic oxide fuels that retain more heat than metallic fuels and do not easily expand when heated.

Proponents of the IFR brag about its "inherent safety." One IFR design is being perfected at the Argonne National Laboratory in Idaho Falls, Idaho. In 1986, researchers tested several times the reactor's ability to shut itself down in a major accident. After conducting a "loss-of-flow test," a simulated total electrical blackout, Yoon Ching, general manager of the Argonne IFR program, concluded, "Spectacular successes." As reported in many newspapers, including *The New York Times* and the *Los Angeles Times*, as well as by the Associated Press and United Press International, testers cut power to the reactor's sodium pumps and even disconnected all emergency electrical power, preventing the reactor's control rods from dropping into the core.

The temperature of the sodium coolant rose rapidly, Chang explains, causing the core of the reactor to expand, shutting down the fission reaction—all without operator action. Simple physics," says Chang. As the reactor core and its fuel rods expanded from the heat, the uranium elements moved away from one another; the nuclear chain reaction was gradually reduced and halted. The test, Chang says, successfully simulated what would happen in a commercial IFR reactor. Rockwell International and General Electric have al-

ready developed two commercial designs for inherently safe, sodium-cooled reactors. "Some utility leaders have a vision for the future," Cheng says. "To maintain the nuclear option in the long run, we need to develop this new generation of reactors."

Robert Pollard believes the scientists at Argonne claim too much for their "spectacular" experiments, which tested a loss of coolant flow but not a loss of the actual coolant itself—what Pollard calls the "worst-case scenario." As spokesman and nuclear safety engineer with the Union of Concerned Scientists, an organization opposed to the use of nuclear energy and weaponry, Pollard has called for a phaseout of all U.S. nuclear power plants. According to Pollard, Argonne's IFR design is being touted as safe, but it's not any safer than the reactor at Three Mile Island.

BALLS OF FIRE

A safer alternative to the "inherently safe" IFR is the high-temperature gas-cooled reactor. So claims Richard Dean, senior president of reactor programs for General Atomics in San Diego (formerly called GA Technologies). In this design the coolant helium gas is pumped down through the core and then to a steam generator. The fuel uranium sealed in layers of pyrolytic carbon and silicon carbide. The one-millimeter balls are molded into graphite rods which are then inserted into a hexagonal graphite box. A total of 660 boxes is inserted into the reactor to form the core. When it is time to refuel, the individual boxes are removed and replaced. The advantage of using graphite the researchers claim, is that it withstands intense heat, the exact type of heat buildup that occurs if the reactor's cooling systems fail. As fuel heats up, its properties change and fission stops. As an added safety measure, balls made of boron can be dropped into the core. Because boron absorbs neutrons, it kills the chain reaction. Heat produced in the core after a shutdown radiates to the reactor vessel and is carried away by natural air convection.

The modular HTGR design we're working on is the only inherently safe reactor that can take a loss of coolant accident—a LOCA—and not result in fuel failure," says Dean. "Our graphite micro-spheres can take a LOCA. We have no metal components in the core because metals cannot withstand high temperatures for very long. Graphite can, and so radioactive fission products cannot escape. (Water reacts with graph-

resulting in a meltdown.) If an HTGR is running at full power and the control rods are suddenly withdrawn, our reactor shuts down. Liquid metal reactors, however, are very sensitive to that kind of accident. Light-water reactor advocates note that LWRs also shut down when the control rods are withdrawn."

Three HTGR reactors are in operation: one at Fort St. Vrain in Colorado and two (called AVR) in West Germany. (A small commercial HTGR ran at the Peach Bottom nuclear facility on the Susquehanna River about 40 miles from Philadelphia between 1968 and 1974.) While the Colorado reactor has been plagued by design and performance problems, the AVR design in West Germany has been running since 1968. The fuel in the German AVR is uranium, which is sealed inside small graphite balls. Some 300,000 spheres lie on the bottom of the reactor. New fuel spheres are fed into the core from the top; spent ones are removed from the bottom. In 1971 the Germans ran a loss-of-cooling test on the AVR identical to the one that Argonne did with its IFR in 1986. Dean says, "The AVR shut itself down fast."

Internationally there is strong interest in HTGRs. The Chinese have included the reactor in their nuclear power program. Italy is considering HTGRs. Spain, Japan, and Bangladesh are working with General Atomics, the Soviet Union, which has its own HTGR program, has recently expressed interest in the West German AVR design. "We hope," says Dean, "to complete a

comprehensive plan this year for developing the next generation of HTGRs."

BLINDLY INTO THE BREACH

None of these designs are as futuristic as the process inherent ultimate safe reactor, branch of the Swedish company ASEA-ATOM. Touted as "inherently safe" by its designers, the PLUS light water reactor would be completely submerged in a pool of cool water laced with boron. The

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le. In the Chernobyl hybrid reactor, such a reaction created steam containing radioactive elements. The steam was released into the atmosphere after the explosion. In the HTGR design, however, the coolant is helium gas and not water.)

Dean anticipates another potential disaster: withdrawing the control rods from the reactor core. In many conventional reactors, if the control rods are taken out, the result could be a runaway chain reaction

reactor core enclosed inside the containment vessel would have its own supply of boron-free warm water. The two water supplies would not mix, and no mechanical valves would separate them because PIUS would rely on the principle of thermal layering. The higher-density boric acid water would stay below the warmer, lower-density core water; the density difference and the height of the reactor vessel would cause a pressure difference of about six pounds per square inch. Unless other energy was supplied, the boric acid water would flow into the core through pumps. If the pumps stopped, the boric acid water would surge into the core, absorb neutrons, and stop the fission reaction. No human intervention would be needed.

Should a PIUS reactor fail for any reason—electrical blackout, operator error, terrorist attack, conventional war—it would automatically shut itself off and cool itself down. A PIUS reactor would cool for a week by natural convection before more water would need to be added. And that could be done by a fire engine hookup to a simple hydrant-type connection. It would take only a few minutes.

PIUS has won praise from Alvin Weinberg, one of the new-energy people. Short of a direct hit by a nuclear warhead, PIUS ought to be invulnerable to acts of sabotage and war. Weinberg wrote in the *Bulletin of The Atomic Scientists* in 1985:

What's more, he added, PIUS appears to have as close to a zero probability of a disabling accident as I can imagine.

Engineers agree that PIUS is an elegant design, but that's all—only a design. It's still on the drawing boards. Not even a prototype has been constructed, and one must be constructed to demonstrate its claims. I think there have been some small-scale lab tests of the hydraulics, says Francis Paté, chief nuclear engineer at Burris and Roe. "But we don't have the body of research, including full-scale tests that would demonstrate the validity of the principle behind PIUS," EPRI's Stahlkopf adds. "We've done an in-depth study of the PIUS design. The thought is noble, but so far it isn't an efficient power-producing system that's also economical." The old-timers are simply not convinced.

COME AGAIN?

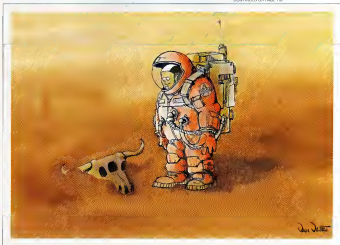
Is a Second Coming possible for the nuclear power industry? Some people fervently hope not. No reactor, they say, can be made safe enough. "I never thought I'd end up quoting Edward Teller," laughs well-known antinuclear activist Amory Lovins, "but he did get it right when he said 'There's no system foolproof enough to defeat a sufficiently great fool.' It's hardly surprising that Lovins is unimpressed by claims that nuclear reactors can be made inherently safe. When you claim you have an

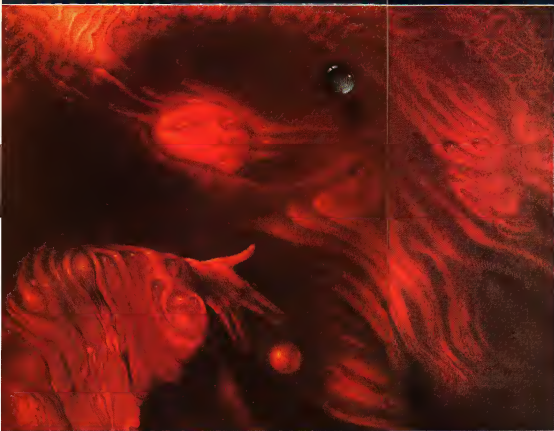
inherently safe design, you're transferring the requirement for perfection from the operators to the designers," he says. "If the designers were angels or robots, I'd feel better about the likelihood of success. But designers are as fallible as anyone else."

Ultimately, whether or not the nuclear power industry makes a comeback will probably not depend on which reactor design becomes the industry standard. The average person on the street doesn't know the difference between a light-water reactor and a gas-cooled reactor. But the average person's opinion is very important to the future of nuclear power, which raises difficult questions: Does the average person even care? What is the public's perception of nuclear power today? Is nuclear power good or bad?

According to an October 1987 Gallup poll, 77 percent of Americans believe nuclear energy is important in meeting the country's future electricity needs, and 75 percent believe that the nations need for nuclear energy will increase in the years ahead. The Gallup results are consistent with recent findings by Cambridge Reports, Inc., another major national polling organization. In August 1987 Cambridge Reports found 79 percent of Americans express the view that nuclear energy will be important in meeting future U.S. electricity needs. When Americans, however, were asked, "If a new power plant were

CONTINUED ON PAGE 18





FICTION

If you wish hard enough for the thing you want most in the world, you just might get it—and change your whole life

LIFE OF BUDDHA

BY LUCIUS SHEPARD

Whenver the cops scheduled a raid on the shooting gallery to collect their protection money, old cotton-headed Pete Mason, who ran the place, would give Buddha the day off. Buddha rarely said a word to anyone, and Pete had learned that cops were offended by silence. If you didn't scream and run when they busted in, if like Buddha you just sat there and stared at them, they figured you were concealing a superior attitude, and they then tended to get up on your head.

They had beaten Buddha half to death a couple of times for this very reason, and while Buddha hadn't complained (he never complained about anything), Pete did not want to risk losing such a faithful employee. So on the night prior to the September raid, Pete went downstairs to where Buddha was napping on a stained mattress by the front door and said, "Why don't you hang out over at Taboo's place tomorrow? Police is coming round to do they thing."

Buddha shook himself out of his nod and said, "Believe to him already, Johnny Wardell, I got to over sometime make a bag, but he say to come ahead anyway." He was a squat black man in his late thirties, his head stone bald, with sleepy, heavy-lidded eyes and the beginnings of jowls; he was wearing chinos riddled with blood from his last fix, and a too-small gray T-shirt that showed every tuck and bulge of his round belly and womanly breasts. Sitting there, he looked like a Buddha carved from ebony that somebody had outstayed with Salvation Army clothes, and that was why Pete had given him the name. His real name was Richard Darnon, but he wouldn't respond to it anymore. Buddha asked him just fine. "Beats me why Taboo wants do business with Johnny Wardell," Pete said, hitching his pants up over his ample stomach.

PAINTING BY BOB VENOSA

"Sooner or later Wardell he be gettin' crazy all over a lappet like Taboo—y'know?"

Buddha grunted, scratched the tracks on his wrist, and gazed out the window beside the front door. He knew Pete was trying to draw him into a conversation, and he had no intention of letting himself be drawn. It wasn't that he disliked Pete; he liked him as much as anyone. He simply had no opinions he wanted to share; he had cultivated the lack of opinion, and he had found that the more he talked, the more opinions came to mind.

"You tell Taboo from me," Pete went on, "I been livin' in Detroit more'n a sody years, and I done business wit' a lotta bad dogs, but I ain't never met one meaner than Wardell. You tell him he better watch his behavior, y'understan'?"

"Awright."

"Well . . ." Pete turned and with a laborious gait, dragging his bad leg, mounted the stairs. "You come on up, round two and get your goodnightin'. Ill out ya out a spoon of China White."

"Precious!" said Buddha.

As soon as Pete was out of sight, Buddha lay down and stared at the faking grayish-white paint of the ceiling. He picked a sliver of paint from the wall and crumbled it between his fingers. Then he ran the back of his hand along the worn nap of the runner that covered the hallway floor. All as if to reassure himself of the familiar surroundings. He had spent the best part of fifteen years as Pete's watchdog, lying on the same mattress, staring at that same dried-up paint, confessing that same runner. Before taking up residence on the mattress, he had been a young man with a future. Everybody had said, "That Richard Danson, he's gon be headlines, he's gon be Live at Five, he's gon be People magazine." Not that he had started out different from his peers. He'd been into a little dealing, a little numbers, a little of whatever would pay him for doing nothing. But he'd been smarter than most and had kept his record clean, and when he told people he had his eye on the political arena, nobody laughed. They could see he had the stuff to make it. The trouble was, though, he had been so full of himself, so taken with his smarts and his fine clothes and his wit with the ladies, he had destroyed the only two people who had cared about him. Destroyed them without noticing. Worned his name into an early grave, driven his wife to suicide. For a while after they had died, he had gone on as always, but then he'd come up against guilt.

He hadn't known then what that word *guilt* meant, but he had since learned its meaning to the bone. Guilt started out as a minor irritation, no worse than a case of heartburn and grew into a pain with claws that tore out your guts and hollowed your heart. Guilt made you sweat for no reason, jump at the least noise loud behind you in every dark place. Guilt kept you from sleeping, and when you did manage to drop off, it sent you dreams about your

dreams so strong they began to invade your waking moments. Guilt was a monster against which the only defense was oblivion. Once he had discovered that truth, he had sought oblivion with the fervor of a converted sinner.

He had tried to kill himself but had not been able to muster the necessary courage and instead had turned to drugs. To heroin and the mattress in the shopping gallery. And there he had discovered another truth: that the life was in itself a kind of oblivion, that it was carving him slow and simple, emptying him of dreams and memories. And of guilt.

The porch steps creaked under someone's weight. Buddha peered out the window just as a knock sounded at the door. It was Marlene, one of the hookers who worked out of Dally's Show Bar down the block, a pretty cocoa-skinned girl carrying an overnight bag, her breasts pushed up by a tight bra.

Her pimp—a long-haired white kid—was

**“Guilt started out
as an irritation no worse than
heartburn and
grew into a pain with claws
that tore out your
guts and hollowed your heart
— Guilt was a monster;
the only defense was oblivion.”**

standing on a lower step. Buddha opened the door and they brushed past him. "Pete round?" Marlene asked.

Buddha peered up the stairs and shut the door. The white kid grinned, whispered to Marlene, and she laughed. "John think you look like you could use some love," she said. "What say you come on up, and I'll give you a sweet ride for free?" She chuckled him under the chin. "How that sound, Buddha?"

He remained silent, denying desire and humiliation, practicing being the nothing she perceived. He had become perfect at ignoring ridicule, but desire was still a problem. The pimp under stooges of her breasts gleamed with sweat and looked full of juice. She turned away, apparently ashamed of having teased him.

"Take it easy now, Buddha," she said with studied indifference, and handed the white kid up the stairs.

Buddha plucked at a frayed thread on the mattress. He knew the history of its every stain as every no. Knew them so thoroughly that the knowledge was no longer something he could say. It was part of him, and he was part of it. He and the

mattress had become a unity of place and purpose. He wished he could risk going to sleep, but it was Friday night, and there would be too many customers, too many interruptions. He fixed his gaze on the tarnished brass doorknob, let it blur until it became a greenish-gold sun spinning within a misty corona. Watched it whirl around and around, growing brighter and brighter. Correspondingly his thoughts spun and brightened, becoming less thoughts than reflections of the incessant light. And thus, did Buddha pass the middle hours of the night.

At two o'clock Buddha double-bolted the door and went upstairs for his goodnighter. He walked slowly along the corridor, scuffing the threadbare carpet. Its pattern eroded into grimy darkness and worm trails of murky gold. Laughter and terry music came from behind closed doors, seeming to strain the stillness of the cooking odors that pervaded the house. A group of customers had gathered by Pete's door, and Buddha stopped beside them. Somebody else wandered up, asked what was happening, and was told that Pete was having trouble getting a vein. Marlene was going to bat him up in the neck. Pete's raspy voice droned from the room, saying, "Derrin! Hurry up, woman!"

Getting a vein was a frequent problem for Pete, the big veins in his arms were burned out, and the rest weren't much better. Buddha peered over shoulders into the room. Pete was lying in bed on sheets so dirty they appeared to have a design of dark clouds. His heavily brown skin was suffused by a chalky pallor. Three young men—one of them Marlene's pimp—were gathered around him, murmuring comments. On the night table a lamp with a ruffled shade cast a buffery yellow light, giving shadows to the strips of knoleum peeling up from the floor.

Marlene came out of the bathroom, wearing an emerald-green robe. When she leaned over Pete, the halves of the robe fell apart, and her breasts hung free, catching a shine from the lamp. The needle in her hand showed a sparkle on its tip. She swabbed Pete's neck with a clump of cotton and held the needle poised an inch or two away.

The heaviness of the light, the tableau of figures around the bed, Marlene's gleaming skin, the wrong-looking shadows on the floor, too sharp to be real. Taken all together, these things had the same richness and artful composition, the same important stillness, as an old painting that Buddha had once seen in the Museum of Art. He liked the idea that such beauty could exist in this ramshackle house, that the sad souls therein could become even this much of a unity. But he rejected his pleasure in the sight, as was his habit with almost every pleasure.

Pete groaned and twisted about. "Stop that shit!" Marlene snapped. "Want me to bleed you dry?"

Other people closed in around the bed blocking Buddha's view. Pete's voice dropped to a whisper instructing Marlene. Then people began moving away from the bed revealing Pete lying on his back holding a bloody Kleenex to the side of his neck. Buddha spotted his goodnight on the dresser: a needle resting on a mirror beside a tiny heap of white powder.

"How you don't?" Pete asked weakly as Buddha walked in.

He returned a diffident wave, went over to the dresser and inspected the powder. It looked like a nice dose. He tilted the mirror and headed off downstairs to cook up.

"Goddamn!" said Pete. "Fifteen years I been taken care of you. Fendin your Jones buyin' your supper. Think we'd have a relationship by now. He tone grew even more resolute. I should never have gave you that damn name! Got you thinkin you respectable, when all you is a goner!"

Nodding on his mattress in the moonlit dark, feeling the rosy glow of the fish in his heart, the pure flotation of Chino White in his flesh, Buddha experienced little fish dreams, bizarre images that materialized and faded so quickly he was unable to categorize them. After these had passed he lay down, covered himself with a blanket, and concentrated upon his dream of Africa, the one pleasure he allowed himself to nourish. His conception of Africa bore no relation to the ethnic revival of the

Sixties: to Ainos and dashikis, except that otherwise he might have had no cognizance of the Dark Continent. Buddha's African kingdom was a fantasy derived from images in old movies, color layouts in National Geographic, from drugs and drugged visions of Nirvana as a theme park. He was not always able to summon the dream, but that night he felt disconnected from all his crimes and passionate failures, stateless and empty and thus worthy of the guardian blues. He closed his eyes, then squeezed his eyelids tight until golden pinpoints flowered in the blackness. These pinpoints expanded and opened into Africa.

He was blowing like wind across a tawny plain, a plain familiar from many such crossings. Tall grasses swayed with his passage, antelope alerted up and the gassy smell of lions was in the air. The grasslands evolved into a veld dotted with sour coated ponds and crooked trees with scant, pale foliage. Black stick figures kept from cover and menaced him with spears, guarding a village peopled by stoyleless and long legged women who wore one-eyed white masks and whose shadows danced when they walked. Smoke plumed from wart-shaped thatched huts and turned into music, voices spoke from cooking fires. Beyond the village stood green mountains that rose into the clouds and there among the orchids and ferns were the secret kingdoms of the gorillas.

And beyond the mountains lay a vast blue lake, its far reaches lapped by shifting veils of mist in whose folds miragelike images materialized and faded.

Buddha had never penetrated the inside. There was something ominous about their unstable borders, and the ghostly whiteness they enclosed. At the center of the lake a fish floated halfway between the surface and the bottom, like the single thought of a liquid brain. Knowing that he must soon face the stresses of the outside world, Buddha needed the solace offered by the fish he sank beneath the waters until he came face-to-face with it, floating a few inches away.

The fish resembled a carp and measured three feet from its head to its tail, its overlapping scales were a muddy brown, and its face was the mask of a lugubrious god, with huge golden eyes and a fleshy, downturned mouth. It seemed to be regarding Buddha sadly, registering him as another of life's disappointments, a subject with which it was quite familiar for its swollen belly encaged all the evil and heartache in the world, both in principle and reality. Buddha gazed into its eyes, and the pupils expanded into black funnels that connected with his own pupils, opening channels along which torrents of grief and fear began to flow. The deaths of his wife and mother were nothing compared with the hallucinatory terrors that now confronted him: demons with mouths large enough to swallow planets; gates composed of a trillion dying breaths; armies of dead men and women and children. Their bodies maimed by an infinity of malleic usage. Had he witnessed these visions while awake, he would have been overwhelmed, but protected by the confines of the dream, he withstood them and was made strong.

And before long he fell asleep in the midst of this infinite torment contained within the belly of the fish in his dream, contained in turn within his skull, within the tinseltickie frame house, within the gun-shot-ejected spiritual realm of the Desert ghetto, whose agonies became a fleeing instance of disasters—the fluttering of an eyelid, the twitching of a nerve—within the dreamed-of peace of Buddha's sleep.

The shooting gallery was located in the Jefferson-Chalmers district, the section of the ghetto most affected by the '67 riots. Hundreds of gutted houses still stood as memorials to that event, and between them—where once had stood other houses—lay vacant lots overgrown with weeds and stunted trees of heaven. The following afternoon as he walked past the lot adjoining the shooting gallery, Buddha was struck by the sight of a chained sofa set among weeds at the center of the lot, and obeying an impulse he walked over to it and sat down. It was the first day of fall weather. The air was crisp, the full moon pinned like a discolored carrier of bone to a cloudless blue sky in front of the sofa was a pile of ashes over which somebody



And what leads you to believe that you're Vincent Van Gogh?

had placed a grill half a dozen sootied cars were scattered around it. Buddha studied the ashes, the grill, the cars, mesmerized by the pattern they formed. Sirens squealed in the distance, a melodic clanging seemed to be issuing from beyond the sky, and Buddha felt himself entranced. The fearless king of a ruined world in which all desire had faded.

He had been sitting for perhaps an hour when a teenage boy with a freshly complexion like Peter came running along the sidewalk. Dressed in jeans and a sweat-shirt and lugging an immense ghetto blaster. The boy looked behind him, then sprinted across the lot toward Buddha and lunged himself down behind the sofa. "You still in 'em here," he said breathlessly. "Till out ya?" Hewiggled a switchblade in front of Buddha's face. Buddha just kept staring at the lopped brick chimneys and vacated premises. A dragonfly wobbled up from the leaves and vanished into the sun dapple of a piece of broken mirror carried against the ash heap.

Less than a minute later two black men ran past the lot. Spotting Buddha, one shouted: "See a kid come this way?" Buddha made no reply.

"Tell 'em I headed toward Case," the kid whispered urgently, but Buddha maintained his silence, his look of concern.

"Where me?" the man shouted. "Did a kid come this way?"

"Tell em!" the boy whispered. Buddha said nothing.

The two men conferred and after a second ran back in the direction from which they had come. "Damn blood! You take some chances!" said the boy, and when Buddha gave no response he added, "They come back, you just sit there like you done. Maybe they think you a dummy." He switched on the ghetto blaster and rap music leaked out, the volume too low for the words to be audible.

Buddha looked at the boy, and the boy grinned: his nervousness evident despite the mask of confidence.

"Ain't this a fine box?" he said. "Fools leave it settin on they stoop; they deserve to get it took." He squirmed as if trying to scry out Buddha's hidden meaning. "Can I you talk, man?"

"Notin to say," Buddha answered.

"That's cool. Too much bubble in the air anyhow."

The boy reminded Buddha of his younger self and this disquieted him. He had the urge to offer advice, and he knew advice would be useless. The boy's fate was spelled out by the anger lying dormant in the set of his mouth. Buddha pined him, but pity—like love, like hate—was a violation of his policy of noninvolvement, an impediment of the emptiness to which he aspired. He got to his feet and headed for the sidewalk.

"Ho!" yelled the boy. "You tell them motherfuckers where I'm at! I'll kill ya ass!"

Buddha kept walking.

"I mean it, man! And as if in defiance

as if he needed some help to verbalize it, the boy turned up the ghetto blaster and a gassed voice blared, "Don't listen to the shuck and jive from Chairman Channel Twenty-five."

Buddha picked up his pace, and soon the voice merged in with the faint sounds of traffic, distant shouts, other musics absorbed into the troubled sea from which it had surfaced.

From the shooting gallery to Taboo's apartment should have been about a twenty-minute walk, but that day—still troubled by his encounter with the boy—Buddha cut the time in half. He had learned that it was impossible to avoid involvement on his day off, impossible not to confront his past, and in Taboo he had found a means of making the experience tolerable, letting it be the exception that proved the rule. When he had first met Taboo seven years before, Taboo's name had been Yancy; he had been eighteen, married to a

●At the center
of the lake, a fish floated
halfway between
the surface and the bottom,
like a single
thought of a liquid brain.
Its face was the
mask of a lugubrious god.●

pretty girl, and holding down a steady job at Pontiac Motors.

Three years later, when he had next run into him, Taboo had come out of the closet, was working as a psychic healer, curing neighborhood ladies of various minor complaints, and through hormone legalments had developed a small yet shapely pair of breasts, whose existence he hid from the world beneath loose-fitting clothes.

Buddha had caught a glimpse of Taboo's breasts by accident, having once entered his bathroom while he was washing up, and after this chance revelation Taboo had fixed upon him as a confidant, a circumstance that Buddha had welcomed—though he did not welcome Taboo's sexual advances. He derived sexual benefits from the relationship. For one thing, Taboo's specialty was curing warts, and Buddha had a problem with warts on his hands (one such had given him an excuse to visit that day), for another, Taboo—who dealt on the side—always had drugs on hand. But the most important benefit was that Taboo provided Buddha with an opportunity to show kindness to someone who brought to mind his dead wife. In their

solitary moments together Taboo would don a wig and a dress, transforming himself into the semblance of a beautiful young woman, and Buddha, would try to persuade him to follow his inner directives and proceed with the final stage of his sex change. He would argue long and hard, claiming that Taboo's magical powers would mature once he'd completed the transformation, telling Taboo stories of how wonderful his new life would be. But Taboo was deathly afraid of the surgeon's knife, and no matter how forcibly Buddha argued, he refused to pay heed. Buddha knew there had to be an answer to Taboo's problem, and sometimes he felt that answer was staring him in the face. But if never would come clear. He had the notion, though, that sooner or later the time would be right for answers.

It was a beautiful spring day in Taboo's living room. The walls were painted to resemble a blue sky dappled with fluffy white clouds, and the floor was carpeted with artificial grass. In Taboo's bedroom where he did his healing, it was a mystical night: The walls were figured with cabalistic signs and stars and a crescent moon, and the corner table was ebony, and the chairs upholstered in black velvet. Black drapes hid the windows, a black satin quilt covered the bed. Muted radiance shone from the ceiling onto the corner table, and after he had fixed it, was there that Buddha sat, soaking his wart in a crystal bowl filled with herb-steeped water, while Taboo sat beside him and muttered charms.

Taboo was fit in drag because he was waiting for Johnny Wardell to show, but even so he exhibited a feminine beauty. The soft lighting applied sensual gleams to his chocolate skin and enhanced the delicacy of his high cheekbones and generous mouth and almond-shaped eyes. When he leaned forward to inspect Buddha's wart, the tips of his breasts dimpled the fabric of his beauty shirt. Buddha could make out his magic, a disturbance like feet hake in the air around him.

"There, darlin'," said Taboo. "All gone. Your hand back the way it showed to be."

Buddha peered into the bowl. At the bottom rested a wrinkled black thing like a nail. Taboo lifted his hand from the water and chafed it with a towel. Where the wart had been was now only smooth skin. Buddha touched the place; it felt hot and smelled bitter from the herbs.

"Wash, Johnny, it hurry up," said Taboo. "I bought a new dress I wanna try on for ya."

"Whym? you try it on now? If the buzzer goes, you can pretend you ain't at home."

"Cause I just have to deal wit' him later and no tellin' what kinda mood Johnny be in then."

Buddha had no need to ask Taboo why he had to deal with Johnny Wardell, all Taboo's reason for asking himself among the bed dogs was similar to Buddha's reason for retreating from life. He felt guilty for the way he was, and this risk was his self-inflicted punishment.

ARTICLE

*Even geometry can become mystical when
the formulas are correct*

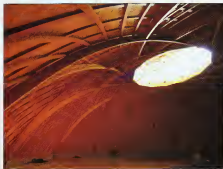
SPIRIT DWELLINGS

BY JAMAKE HIGHWATER

The highway disappears into the furthest horizon of the San Luis Valley in Colorado. It is a narrow black road that cuts an unrelenting straight line through a flat, brown, uninhabited world of stinging grasses and leafless shrubs. The long drive from Denver to the tiny town of Creskone (population 66), hidden away in the southwestern tip of the state, is starting to get to me. I have the uncomfortable feeling that I have been summoned to the end of the world. There has not been another automobile or truck for more than an hour. Twice, as I



● it seems as if the chapel's ceiling of intertwined ribs is a gigantic amplifier of the ancient stillness that comes from the earth itself ●



speed past ramshackle barns lost among a few trees far from the highway I see what looks like one or two people. Otherwise I am utterly alone on this endless road searching for some sign of the lavish settlement called Boca Grande to which I have been invited. Surely I think, this can't be the location of the Lindisfarne Mountain Retreat, William Irwin Thompson's sanctuary for philosophical meditation.

Just as I am sure that my journey is some kind of senseless joke, I slam on the brakes in amazement. At the edge of this deserted highway an ultramodern structure stands incongruously in the midst of the desolation. A sign reads *BACA GRANDE VISITORS CENTER*. But from the dust on the windshield, I suspect it has not had a visitor in a very long time. As I get back into the car, I ponder whether to call it a day and turn back toward civilization when I notice a road sign pointing into the air. Peering into the great vacant distance where the sign indicates I step on the gas and turn down an asphalt lane that



branches off the highway and meanders across the wide valley toward the Sangre de Cristo Mountains, those great humps of earth that tower into Crestone Peak on one side and Kit Carson Peak on the other.

By now it is dusk. At this altitude (8,000 feet) the night comes down so suddenly that it seems to devour the sun. Soon I will be alone in an entirely lightless world, miles from anything and anyone. I am feeling deeply troubled by this thought and by an illogical fear of the landscape itself when I once again stop the car in amazement. The lean, rocky mountains that rise before me are gradually turning a rich bloodred. My fears turn to wonderment. What had seemed a forbidding place is now a world of natural power. I speed toward the bleeding mountains until I am almost in their foothills. Then yet another surprise confronts me in the



last light of day. An artificial lake appears on my left, surrounded by a highly manicured golf course, then low modern bungalows and a resort hotel, and finally the Boca Grande settlement.

Like a dreamer disappointed to awaken into a simpler reality than his dream, I know that I have arrived at my destination.

The Ute Indians regard the San Luis Valley as the center of the world. Thompson tells me the next day as he shows me around the Lindisfarne settlement. As head of Lindisfarne, an international organization dedicated to spiritual transformation and other New Age concerns, Thompson had looked for several years for the right place for the society's meditation center. "The valley was perfect," he explains. "It has always been a holy place. The medicine men of the Ute tribe believe that it was here that time began."

From our position on the gentle slope where Lindisfarne is located, we peer over the magical, wide valley in silence. The sun burns down on the flatlands, casting deep shadows upon the naked upheaval of stone that forms the surrounding mountains, so high above us that they are capped with snow even in August.

Thompson guides me to his work in progress—the Lindisfarne Chapel. As we walk into a circular structure of rock and wood, it seems as if the chapels domed

The greatest structures of the ancient world were built using principles of sacred architecture. The pyramids (preceding pages), the Parthenon (top right), and Stonehenge (bottom right) are three examples. Today a small group of architects still calls on those principles in their work. The recently constructed chapel at the Lindisfarne Mountain Retreat in Colorado (top left and center) is one example. © 1991

coiling of interwoven ribs and timber is a gigantic amplifier of the ancient wisdom that comes from the earth itself. I feel the same mixture of delight and fear that I had felt in the Paleolithic caves of Spain or in central Anatolia's underground cities of Cappadocia or at Chartres Cathedral in France. There the massive buttresses support a snake interlacing of stone, not wooden, ribs. Indeed, throughout the Lindisfarne retreat—a series of handsome structures built of natural materials—the combination of earth and architecture results in an intense mood of sacredness.

Thompson's round, bearded face is transformed by a leish smile as he realizes my amazement. "The chapel is rather special," he murmurs into the deep silence. "I find it like that masculine Air Force Academy Chapel in Colorado Springs, which expresses the spirit of technology and the desire to soar above the earth. The sacred is seen here as immanent in nature and not in a condition of escape from it."

Though still under construction, the form of the chapel is vividly clear. It is somehow much larger in mind than in reality: a mere 60 feet in diameter and 18 feet in height nestling into the ground just below the surface, surrounded by a rich landscape. The timbers of the roof and ceiling are interwoven like a basket. "I wanted the chapel to be spiritual but not religious, sacred but not sacerdotal [relating to the priesthood]," Thompson explains. "To build a chapel that is not a church is a paradox. I needed some help."

Help came from several experts in sacred architecture, a tradition that draws on the principles of ancient geometry in the design of spaces. The pyramids, the Parthenon, and almost all the Renaissance and Gothic cathedrals of Europe were designed using the philosophy of sacred architecture formulated by the "mystic mathematicians" of antiquity. The Greek philosopher Pythagoras is probably the best known of these early theorists. Like thinkers in other cultures before him, Pythagoras saw an underlying unity or harmony in the universe and attributed it to basic, unchanging forms and numbers. These perfect forms, he believed, could be made visible through mathematical formulas and geometric renderings. In turn, those calculations could be applied to such concrete forms as buildings and works of art. As Robert Lawlor, one of today's chiefs of sacred architecture, explains:

"Geometry is a way by which the essential creative mystery is rendered visible. The passage from the unmanifest, pure formal idea to the here-below—the world that spins out from that original divine stroke—can be mapped out by geometry."

The geometry through which the ideal world can be represented is anything but simple. Indeed, to the untutored it may seem like some sort of geometric numbers game in which squares become circles, spirals evolve from triangles and hexagons, proportions, and numbers are inter-

woven to represent spiritual concepts like the Holy Trinity or cosmic fire. The numerology associated with sacred architecture is equally mystical. Odd numbers are considered masculine, even numbers, feminine. The number 1 is associated with a vertical line and connotes the phallus, fire, and ascending spiritual rays. The number 2 is found in a horizontal line and is associated with water, matter, and earth. To gather these active and passive principles are envisioned in the numbers 3 and 4 and are symbolized in the triangle and the square. The triangle is also associated with the Trinity of God as well as with the most mystical of all architectural shapes, the pyramid. The square represents terrestrial life and the base of the pyramid. Seven is the most sacred number because it represents the principles of life itself: the sum of 3 (male) and 4 (female).

The philosophy behind sacred architecture had an immense impact on some of the leading artists and architects of the turn

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of this century. Many groups emerged, such as the Theosophical Society of Helena Blavatsky and the Anthroposophical Society of Rudolf Steiner, which combined religious teachings with geometry and numerology. In the past few years sacred architecture has emerged as a popular topic, especially among New Age groups. Workshops and lectures have drawn many artists and craftspeople. Michele Zackheim, for example, has created an unusual transportable "temple" utilizing principles of sacred geometry. Her Tent of Meeting, which will be in San Francisco in June and July, is a huge (40 feet by 25 feet) Bedouin-like structure with interior walls lavishly painted with some 250 vignettes taken from religion and folklore. "The tent," she explains, "tends to simplify whatever concept a person has of God. It's a combination of color and light; it moves and seems almost alive. A lot of people think of it as a sacred place."

Sculptor David Barr also incorporates some concepts of sacred architecture in his art. One of his works is a model of the earth that encloses a huge geometric form called a tetrahedron. Its four equally

spaced points pierce the globe's surface at Easter Island, South Africa, Greenland, and New Guinea. The project might have ended with the model, but Barr believes art should be "manifest" and applied his model to the actual earth as if an invisible tetrahedron spanned the inside of the earth with its four outer corners just barely protruding from the ground. He and his assistants traveled to the four selected points to implant small marble projections.

"When I look at the ancient world, at all the stone segments and sites like Stonehenge," says Barr, "I see the works of people who believed that the earth and cosmos are sacred. They were plugging into that with everything they made. That's what I'm trying to do."

This renewed interest in sacred architecture has supplied Thompson with any number of interested workers to help him build the Lindisfarne chapel. Architect Michael Barron, for instance, first came to Lindisfarne to attend a lecture on sacred architecture, then stayed on to work on the chapel. "The ceiling sort of built itself," he says as he climbs to the margin of the dome and embraces one of the massive beams that rise in a majestic curve to the highest point of the ceiling. His gesture is filled with pleasure and reverence.

Lawlor had urged Thompson to forgo ornamentation in the chapel. "No decoration, only proportion," he said. "I liked that," Thompson explains, "because I realized that the principles of sacred geometry lie above and behind all temples, from Islamic mosques to Shinto shrines and Gothic cathedrals. If the geometry were true and correct, then anyone entering our chapel—his mother, what their religion—would feel the sacred calling of the place and wish to sit in silence. It is the geometry at the heart of sacred architecture that gives life and purpose to the chapel."

I have been hearing a great deal about sacred architecture, and frankly, I have been a bit disturbed by the tone of self-righteousness that surrounds many of the discussions. At the Graduate School of Architecture at Columbia University, where I teach, people are very critical of what they call "the cult of sacred architects." To find out more about these architects, I contacted Keith Critchlow, perhaps today's best-known architect of the sacred.

Critchlow, who designed Lindisfarne chapel, gives frequent lectures both in the United States and in Europe. Interestingly, he came to sacred architecture not through science and formal mathematics but through studies in art. A graduate of the Royal College of Art in London, where he is now supervising doctoral candidates, Critchlow is the vice-chairman of the Research into Lost Knowledge Organization Trust, which according to its literature, studies standing stones and other Neolithic structures.

Critchlow like other sacred architects past and present, firmly believes that there are architectural principles that transcend

different cultural expressions. These are based on elemental and primordial factors and demonstrate how structure on the physical level is integral with structure on the metaphysical level.

I was beginning to see that it was this overriding belief in transcendent forms that makes people uneasy. Even adherents of sacred architecture have sometimes found the theory too inflexible. Stage designer Rachel Fletcher, a former student of Critchlow for instance, was at Lindesfarne when Thompson decided to build the chapel. But now she regards the ideal forms of sacred architecture as metaphors rather than as representations of fixed, eternal truths. "I study geometry because I want to get a better grasp of a knowable world of ordered relationships," she says. "The fact—and the wonder—is that every pursuit leads inevitably and mysteriously not to the known but to the unknown. This ambiguity and otherworldliness, she believes, may be what saves geometry from the threat of fundamentalism and fascism—human inclinations that seek in every shadow of every idealized philosophy."

Thompson has also had problems with the sometimes-rigid ideological stance of many sacred architects. A few of the geometers have gotten into a kind of crypto-fascism that makes me politically uneasy," he explains. "You can't just come up with some cultish symbolism of numbers and call it the absolute and only truth. It's like a private code known only by an elite, and everybody else is wrong. That's fascist. It can turn into some sort of Boy's Club of the Mysteries of the Sacred Geometry for Theonians Initiated. That doesn't work for me. It's just too Walt Whitmanesque for that kind of attitude."

I also had the opportunity to discuss sacred architecture with James Hillman, one of today's leading Jungian analysts. Hillman understands the power architecture has to influence people's feelings. "Geometry is as good a god as any other," he says. "but to claim it is the one and only true-god is quite another matter. As I see it, the tendency of sacred geometers is to separate the sacred from the secular, which just makes things worse. The eye must not be forced into Euclidean geometry. This just abstracts one's feelings and tends to create dissociation, which is already at the heart of our emotional problems."

There is little doubt, however, that structures based on principles of sacred architecture do for whatever reasons move people. Michael Baron reports that people who enter the Lindesfarne chapel for the first time have occasionally cried. They find it touches something very tender inside them, he explains. "Others don't say a word; they sense the sacredness of the place. They may not be sure what's going on, but they are affected by it."

This uncertainty about why a building touches us may stem from our evolutionary past. Human beings after all are not really house makers. We're nomads who

tend to use available spaces for shelter. We seem to have come to architecture rather late unlike many species—ants and bees, for instance—that are builders by nature. We had to learn how to be builders, and were not yet sure how to instill our structures with meaning. Indeed we may be better at recognizing the sacred in a rock than at fabricating structures that produce an atmosphere of sacredness. Perhaps that is why we revert to systems of mathematics and geometry in our efforts to construct our holy places.

The meaning we see in the world is probably more a reflection of ourselves than of some fixed and final truth. As Loren Eiseley put it in his book *The Firmament of Time*, "Man's quest for certainty is, in the last analysis, a quest for meaning. But the meaning lies buried within himself, rather than in the void he has vainly searched for portents since antiquity."

Eiseley's theme of an interior quest for meaning is externalized as a vision of architectural space by the British scholar John Michell. "The marks people make on the ground reflect the philosophy of the time," he explains. "The groves and temples of Arcadia, the radiating avenues of the imperial center, the neatly ordered municipal garden, and the spoils and affluence of ci-

vilizational rapacity are each the product of a certain cosmology, a certain view of the nature of the universe and its relationship to men. On the face of the landscape can be seen the affects of the former sacred view of the earth and of the contrasting view now prevailing."

All of the structures built by humankind are expressions of who we are, for all reflect the mentality of the people who produced them. Each of us projects upon the world the ideal—the model paradise—that embodies our vision of ourselves and the cosmos. That vision changes from time to time and from place to place. If it is not eternal, it is nonetheless significant as a metaphor of our minds. Accordingly the temple is sacred because we envision it to be sacred. But is that sacredness found in nature, or is it something we bestow upon the world as an act of faith and imagination? Perhaps we will never know.

Editors' Note: Since Jamaike Highwater wrote this piece, Thompson has left the Lindesfarne Mountain Retreat to work on other projects. The chapel has been completed, however, and is currently being used as a meditation center for students of the Dharma Fungus Zen Center, based in Santa Fe, New Mexico. ☐



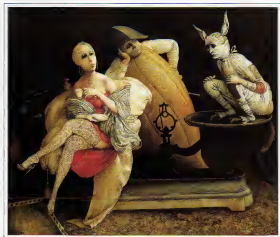
"Prisehold you don't notice here!"



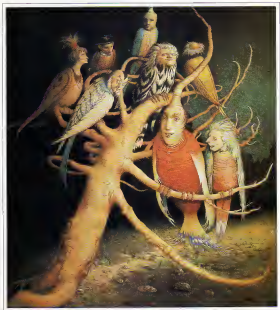
For most people, fairy tales
are just make-believe. But not to those of us
who live in your fantasies

MIXED MARRIAGES

PAINTINGS BY CLAUDE VERLINDE



I married a jackass. This may sound like a remark you'd expect from half the robot's seasoned brides, but in my case, it's a fact. Like many cultures, Uplasia had arranged marriages (don't think this cozy coupling was my doing). Not that Jack wasn't a dashing beast: it's just that my heart was bound to a young man of Banbury descent. Although of little substance, he was honest through and through. My ever elegant and unimpeachable mother announced the marriage decision would be based on logic—she'd weigh what each family had to offer. Little Twit, my younger brother, did his best to emulate my prospective mate, donning the large ears and long tail. Mother sat in for me



In her knowing way Mother concluded the offering would likely resemble our side of the family. It was scientific and settled. As for the rest of the relatives, they were more than pleased. Having few roots and a less-than-impressive family tree, they flew at the opportunity to branch out into an established pack. As celebrations are rarely held here—it's hard with such diverse diets—no one missed the wedding feast, even those who were collarlessly uninvited like Uncle Osean. It was a lovely, if not stark, ceremony. Jack was happy as a lark, I would have been happier to dispose him for the animal he really was, rather than disposing myself, but there was no bucking tradition here.





Bastful days followed, as
 did the inevitable birth of an heir. Although the Gounds, on my father's side,
 did their best in the delivery room, the indiscretions of my gardening
 days were unearthed. Rather than put poor Jack through the torment of
 knowing his son would be a vegetable all his life, I fled. To my sheer
 delight, I met a wonderful man with whom I moved in. My future mother-in-law,
 being well-bred, doesn't feel that it is kinder to live together, so she
 sheepishly asked if she could shop for his wedding coat. She desperately
 wanted him wed, as she holds him responsible for the flock's
 unmanageable increase. But I feel she's only crying wolf! —Nina Guccione

DO



When he tried to prove quantum mechanics isn't as odd as it seems, this unlikely guru ended up twisting reality another turn into the weird zone where particles light-years apart may communicate instantaneously

INTERVIEW

JOHN
BELL

More than 25 years ago, John Bell had a chance to hit off the great Danish physicist Niels Bohr, one of the founding fathers of quantum mechanics. "It was the inauguration of CERN," Bell recalls. "I went up in a hotel lift with him. I didn't have the nerve to say, 'I think your Copenhagen interpretation is lousy.' Besides, the lift ride wasn't very long. Now, if the lift had gotten stuck between floors, that would have made my day!" In which way, I don't know. "Bell roars.

Bell has a curious position in the pantheon of particle physicists. At CERN, the monstrous European physics laboratory outside Geneva where he works, his colleagues consider him a shrewd puzzle solver. He's a fellow who slowly but surely helps to advance the field by patiently unraveling the threads of any concrete problems left after more speculative minds have forged recklessly ahead. But there is another set of peo-

ple—necromancers mostly—who look upon him as an intellectual saint for his work exploring the meaning of quantum mechanics, the theory that describes the world of the atom. To them, he is something of a quantum guru.

Redheaded, bald, bearded Bell has always been troubled by quantum mechanics. Born in Belfast, Northern Ireland, in 1928, he first encountered quantum theory while at the local technical college and found it strange, indeed. "Quantum mechanics seemed to say that the entire of the subatomic world—electrons, photons, and the like—cannot be pinpointed. They exist in a haze of random possibilities until 'actualized' in particular circumstances, as when a scientist performs a concrete experiment on them. Does that mean that the properties of matter are, in effect, created by human beings? That was indeed a suggestion of Bohr's Copenhagen interpretation. It was vanity

PHOTOGRAPH BY PETER MENZEL

challenged by Einstein, who argued that future physicists would discover presently unknown factors. These "hidden variables" would eliminate the randomness and uncertainty of quantum mechanics and allow physicists to measure the behavior of subatomic particles as if they were billiard balls. Others argued that no such return to determinism (the old belief in certainty) was possible. At the lowest levels of matter, they said, things don't really exist until you look at them.

Bell graduated from college in 1949, began work as an accelerator physicist, and in 1960 wound up at CERN. Continuing to harbor reservations about the Copenhagen interpretation, he ultimately set out to refute it. To his surprise, his conclusions suggested that quantum mechanics is even stranger than anyone suspected. In two brilliant papers, the first published in 1960, he proved what is known as Bell's theorem. Roughly, Bell's theorem says that when two particles are emitted in opposite directions and the properties of one of them are "actualized" by being measured, the properties of the other will be found to be correlated or linked when it, too, is measured—no matter how far apart the particles are. It's as if there were some kind of instantaneous communication between them. Bell's theorem mathematically eliminated the possibility that a "hidden variable" could explain this connection. Somehow the particles are linked, even if there are light-years between them.

Bell's theorem has acquired near-religious status among certain popular authors who feel it proves the ability of subatomic particles to "think," the basic "wholeness" of the universe, faster-than-light communication, and a host of other mystical tooboo—what the late great physicist Richard Feynman called "the cargo cults of science." Experiments proving Bell's theorem, wrote Michael Talbot recently in *Beyond the Quantum*, constitute "the final proof that reality as we know it does not exist at the subatomic level." Bell himself has been summoned to dine with the Dalai Lama and to address the students and faculty at Maharishi University of Management, a self-described "cold-blooded" physicist who likes nothing better than to talk about particle accelerators with his physicist wife, Mary.

We first asked Bell over the telephone whether he himself felt he had demonstrated that "reality doesn't exist." He responded by warning us that he is an impatient, irascible sort who tolerates no nonsense. He did, however, agree to speak with us, jitting down the appointment. We were lured in by his *Pocket Diary for Physicists*, which lists the birthdays of famous scientists. In the flesh, we found him to be a soft-spoken man who talked extremely patiently to us for several hours.

—Charles Mann and Robert Crease

Bell: I was interested in philosophy first. But then I got frustrated with it because each generation of philosophers seemed to overturn the generation before. That was how I got into physics, because it was not so far from philosophy, and there was an accumulation of knowledge.

Q: Well, haven't each generation of physicists overturned the previous one?

Bell: No. I think it's true there are scientific revolutions—big changes at a few points. But it's very seldom that anything is scrapped. We still have Newton's equations, although Einstein's conception of space has replaced Newton's. We still have Maxwell's equations, although quantum field theory has replaced classical field theory. Things still fall the way Galileo said it all builds up.

When I came to learn quantum mechanics, which I did very soon after I went to the university, I was disabused with the expectations I found. This wave function—one never knew whether it was something real

*When we get
down to things beyond our
immediate
experience, the concept of
"out there"
and "really there" and so
on begins
to lose its relevance.*

or some kind of bookkeeping operation.

Q: What's a wave function?

Bell: If you do any careful experiment with electrons, there comes a point when you see that they are not behaving according to classical mechanics. The electrons seem to be influenced by some kind of wave, so they can show interference patterns. Not any one electron but many electrons arriving on a photographic plate build up an interference pattern. So somehow you have particles—because you see a series of little spots on your plate—and a wave which directs them in some way. The relation between this wave and the particles has never really been clearly understood. One knows the mathematics of the wave, and one has the rules for translating the amplitude of the wave into a probability distribution for particles (a kind of mathematical "map" charting the places where a particle might land), but physicists have not agreed on whether the wave is really there.

Q: Now quantum mechanics explains these particles in terms of waves, and nobody is sure if it is real in any ordinary sense. Well, are these real objects out there at all?

Bell: I believe there is something out there. But the philosophy that has grown up with quantum mechanics, the Copenhagen interpretation, calls this reality into question. It says we're not entitled to assume something is out there. Perhaps we are entitled to on the gross scale. I am entitled to assume that you're out there, but I am not entitled to assume that you are made of electrons that are out there. Somehow when we get down to these things beyond our immediate experience, the concept of being "out there" and "really there" and so on begins to lose its relevance.

Q: Why don't we have an adequate mathematical description of these things?

Bell: To call it a description of things is already to imply the things. Ordinary quantum mechanics doesn't sort out the difference between "description" and "thing." It is only description. Einstein was always asking, "What are the things described?" Think of insurance actuarial tables—you'll find curves identifying the probable age at death of a person who is a given age now. But in order to make that meaningful, you need the concepts of people and death. If you had only the curve you'd ask, "What is the probability of?" And the answer to this question is missing in ordinary quantum mechanics—until you come to the gross level, where it's the probability of the result of an experiment. So you can talk about experimental equipment in this way. But the electrons, and so on—these you are not allowed to speak about. You can't talk of them.

Q: These waves are like literary characters that don't exist apart from the words that describe them but nonetheless have a certain reality for us.

Bell: That's a good analogy. And it's as if the book nevertheless had consequences at certain places. Here are these fictitious characters, but at some point the characters cease to be fictitious.

Q: What is the Copenhagen interpretation? Can you describe it?

Bell: The Copenhagen interpretation is a very ambiguous term. Some people use it just to mean the sort of practical quantum mechanics that you can do—like you can ride a bicycle without really knowing what you're doing. It's the rules for using quantum mechanics and the experience that we have in using it. There are big things like laboratory instruments, and there are little things like electrons. The big things we can treat classically, but the little things like electrons have dynamics governed by waves. And there is such a difference in scale between the little ones and the big ones that I don't matter much where you draw the boundary. The rules of pragmatic quantum mechanics, which are absolutely marvelous, work extremely well. And you could say these also came from Copenhagen, at least in part. Niels Bohr, the genius of Copenhagen, was one of the key people who clarified these rules.

Then there's another side to the Copenhagen interpretation, which is a philoso-

Q: From your student days, were you always interested in physics?

re: *Conte*

phy of the whole thing. It tries to be very deep and tell you that these ambiguities, which you worry about, are somehow irreducible. It says the ambiguities are in the nature of things. We, the observers, are also part of nature. It's impossible for us to have any sharp conception of what is going on, because we, the observers, are involved. And so there is this philosophy, which was designed to reassure people to the middle: 'You shouldn't strive for clarity—that's naive. Muddle is sophisticated.' I have heard distinguished people say that this philosophy was important to them as physicists. It allowed them to feel somehow that these things were understood and that nothing could be done except what they were doing. Then they got on with their work. Einstein called it the 'tranquilizing philosophy' from Copenhagen, on which the true believer can find a soft pillow on which to rest his head. Let him be there!

Orin: As a student, you weren't reassured by the Copenhagen interpretation?

Bel: When I found the professors repeating what I saw written in the textbooks, I got angry and said it was nonsense. My professors were actually very tolerant, because I persisted them a great deal. But from time to time I could see that they were at the end of their patience.

Orin: Part of the problem is that there's a quantum world where this strange wacky stuff happens, and you have an ordinary world where ordinary unwacky stuff hap-

pens—and you don't know where to draw the line between them. Is it like knowing that there are the colors blue and green but not knowing at what point blue stops and green starts?

Bel: The present situation is that we have a set of equations for blue and another for green. At the boundary you can pick and it's either blue or green to a very good approximation, and it doesn't make much difference. The world where we are obliged to use quantum mechanics is very, very remote from us. And somewhere between here and there is this change in language. So far in practice it doesn't matter where we change the language, roughly speaking, from particles to waves. And that's why you can get along in practice without deciding it. But it's still a problem theoretically, such a puzzle. You work as if there were two separate worlds, a blue world and a green world, blue equations and green equations. It can't be right.

Orin: When you went to the university quantum mechanics was less than twenty years old. Newtonian mechanics, which said everything in the universe was definite and predictable, was replaced by quantum mechanics, which said on the subatomic level many things were random, and the laws could only be statistical. Were physicists still dismayed?

Bel: When quantum mechanics was invented, everybody must have asked: 'Can we imagine a more complete theory in

which the predictions would not be of a statistical character?' Einstein and [Nobel laureate] Louis de Broglie were certainly among the first to press this question. But the orthodox line quickly became: No, there is no possibility of finding a more complete description than that given by quantum theory. Nature is inherently statistical, so the statistical aspect of quantum mechanics is not provisional or temporary.

Then in 1932 [mathematician] John von Neumann gave a 'rigorous' mathematical proof stating that you couldn't find a non-statistical theory that would give the same predictions as quantum mechanics. That Von Neumann proof itself is one that must someday be the subject of a Ph.D. thesis for a history student. Its reception was quite remarkable. The literature is full of respectful references to 'the brilliant proof of Von Neumann' but I do not believe it could have been read at that time by more than two or three people.

Orin: Why is that?

Bel: The physicists didn't want to be bothered with the idea that maybe quantum theory is only provisional. A horn of plenty had been spilled before them, and every physicist could find something to apply quantum mechanics to. They were pleased to think that this great mathematician had shown it was so. Yet the Von Neumann proof, if you actually come to grips with it, falls apart in your hands! There is nothing to it. It's not just flawed; it's silly. If you look at the assumptions made, it does not hold up for a moment. It's the work of a mathematician, and he makes assumptions that have a mathematical symmetry to them. When you translate them into terms of physical disposition, they're nonsense. You may quote me on that. The proof of Von Neumann is not merely false but foolish!

Orin: Didn't Einstein point out the deficiency in the orthodox view?

Bel: Einstein was convinced that something must be behind the statistical quantum mechanics that would not be statistical in origin. In 1935 Einstein, Boris Podolsky and Nathan Rosen then produced their famous argument, which was an extremely powerful one. It said that because quantum correlations exist between distant objects, and in certain circumstances perfect correlations between such objects, you could not believe that there was independent chance in what the objects were doing.

Orin: We don't get it. Suppose we take a coin and slice it in half along the edge. We seal each half in different envelopes. We take one, you take the other, and we travel to opposite sides of the earth. We open our envelope, and it's heads. We know yours is tails. What's so strange about that?

Bel: There is no mystery because the head and the tail were there all along from the beginning. But suppose you didn't believe each bit was either heads or tails until the moment you looked at it. And then it just chose at whim, at hazard, by chance, to be heads or tails. How could you believe



that the other one would coordinate its response? The head and the tail that are "there before you look" are simply not included in the quantum description. It tells you about the results of your observations, beforehand, there is just a wave function, which has neither head nor tail. And Einstein objected to that. He said to make sense of this situation we must believe that the head and the tail are there from the beginning and are just revealed when we look. So he took like you, a commonsense attitude to this. You see Einstein took the view that quantum mechanics is incomplete. It doesn't tell you the whole story. And for me, Einstein's was a compelling argument.

Again, part of that philosophical story I would like to see is why it did not impress the Copenhagen people—especially Bohr. But in the end it turns out that these other people were, in a way right, because what I am notorious for, the so-called Bell's theorem, is just for showing that Einstein's explanation doesn't work. Einstein's explanation works so long as you have perfect correlations, which means measuring the same component of spin on the two sides [spin is a measure of a property similar but not identical to the rotation of a particle on its axis]. But as soon as you are measuring in a nonparallel direction, you get results that cannot be explained by Einstein's idea that the answers existed before the experiment.

Omni: Didn't anybody react to Einstein? Podolsky and Rosen?

Bell: In 1952 David Bohm gave a fully worked out hidden-variable account of quantum mechanics in which everything was deterministic and definite. The kind of ignorance was of the trivial kind. Nature knows, but I don't know. That was a big thing for me. It told me that Von Neumann was wrong, because Bohm had done what Von Neumann had shown to be impossible. Bohm's paper wasn't rigorous. It didn't have big displays of axioms, theorems, or lemmas [corollaries]. But one could see immediately that what he was saying was right. My reservation about his work and that of others in the physics community was that it was nonlocal, that what you do here [he points] has immediate consequences in remote places [pointing out window]. And that was extremely odd.

Omni: What does locality mean?

Bell: It is the idea that what you do has consequences only nearby and that any consequences at a distant place will be weaker and will arrive there only after the time permitted by the velocity of light. Locality is the idea that consequences propagate continuously that they don't leap over distances. And so the question immediately posed itself: is that inevitable? Can you find another way of relating Von Neumann that does not have this feature of nonlocality?

Omni: Bohm's paper was written when you were a second graduate. Yet despite your doubts about the Copenhagen interpretation you didn't write anything on it until twelve years later. Had the problem just

dropped out of your mind?

Bell: It was never completely out of my mind. I always knew that it was waiting for me. So when I went to the Stanford Linear Accelerator Center at the end of 1963, arriving in California the day after President Kennedy's assassination—4 was a very odd experience to find everybody crushed. The quantum problems were very much in my mind. And that's where I wrote the papers that subsequently became notorious. First of all, I wrote a paper refuting all the proofs known to me of impossibility theorems for hidden variables. While doing that I saw that the problem of locality was vital. So that paper ended with this question: if you make locality a condition, can you then make a good proof of the impossibility of hidden variables?

The second paper answered that question. I tried to imagine what hidden variables there might be that would avoid the nonlocality of Bohm and nevertheless account for the quantum correlation. And I

*•The theorem says
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It implies that Einstein's
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found that I couldn't do it. Something always went wrong. And then I began to suspect maybe it was impossible.

Omni: So is this the place that not only Bohm but everybody has to pay?

Bell: That's right. Then when I suspected the impossibility and I made a phase transition in my mind, I started looking for the proof of impossibility. And I found it.

Omni: What you expected when you started wading into this more than twenty years ago and what actually came out were very different things.

Bell: That's true. Yet I'm not so sure what I felt then. I certainly was indignant with the positions that I saw and with arguments that I saw. I felt a great desire to knock them down. Whether I expected to come out with an Einsteinian interpretation of quantum mechanics is not clear to me. What I succeeded in doing was showing that such an interpretation as I sought was not possible. It wasn't possible even for the arguments that I now regard as good arguments (chuckle), as distinct from the bad arguments like Von Neumann's that I had seen before. What I really wanted was a clear argument, rather than to justify any particu-

lar conception of the world. From what I know of my own character, which is somewhat stubborn, I am often more concerned with the conduct of the debate and its logic than with the actual truth.

Omni: But don't you think logical debate is the way to truth?

Bell: You need both sorts of people in the world—people who don't care about the logic but only about the truth and who must win; it is, and people who are concerned about the logic. The great physicists combine the two concerns, but most of us are lucky to contribute on one side. The whole activity is cooperative in the end.

Omni: What did this second paper, the one containing Bell's theorem, tell us?

Bell: The theorem tells you that maybe there must be something happening faster than light, although it pains me even to say that much. The theorem certainly implies that Einstein's concept of space and time, neatly divided up into separate regions by light velocity is not tenable. But then to say that there's something going faster than light is to say more than I know. If anything goes faster than light, then I could imagine that if you were losing a coin, I might be able to make it do an extra turn [without, so to speak, touching it]. But you would never know I had that power, because you wouldn't know whether it was coming down heads or tails, anyway. And I wouldn't know that I had that power.

Omni: Because you'd see only the final result, which would be heads or tails, you couldn't see what it would have been had you not exercised that power.

Bell: Exactly! And it's only in the analysis of this question of "what would have been" that the theorem obliges you to introduce such funny connectors. The calculations that we do in quantum mechanics make certain predictions for whether the detectors in an experiment both say yes or both no, or disagree. And it is those predictions that are incompatible with any mechanism that does not go faster than light.

Omni: How were these papers received?

Bell: There was not great reaction at first. I suppose that anybody who read it just thought, Well, that's an interesting puzzle. And then in 1962 people proved a more practical form of the result and proposed an experiment. Then people started doing the experiments. The results confirmed ordinary quantum mechanics and therefore disconfirmed Einstein's hopes. Then there was more and more publicity.

Omni: What importance does all of this have for physicists?

Bell: It's a hard question, even an embarrassing question. Quite a lot of physicists are content with the fact that quantum mechanics is something that works, yet which is by no means worked out. All the developments we see around here are based on that, and it's doing just fine. So my theorem is a marginal sort of thing.

Omni: Is there some big problem hidden in these quantum riddles?

Bell: Yes. For me the big question is the

role of Lorentz invariance, which in some obscure way tells you that something can't go faster than light. During the nineteenth century people became convinced that light, like sound, was a wave motion. Just as sound waves move in air, light has to move in a medium, which had come to be called the ether. Now, as you move through the air, the velocity of sound relative to you changes. It will come more quickly toward you from a distant source as you move toward the source and so on. The trouble was that with light this was found not to be the case.

If you think of the earth as moving around the sun, then it's moving in different directions at different times and at different velocities. So if you measure the velocity of light passing through your laboratory, sometimes the other should be running against your motion and other times with your motion, and you should see different velocities of light relative to your laboratory position. Well, people didn't. They found that the velocity always seemed the same relative to the laboratory. To explain that, Irish physicist George FitzGerald invented the idea that moving bodies actually contract. Next Irish physicist Joseph Larmor invented the idea that moving clocks go slower. He said that when you think you're measuring the velocity of light, you're fooled by your clocks having changed their rates. These things happen in just such a way as to make you think light is still moving with the usual velocity.

Then Einstein came along and questioned this "conspiracy" to make things unobservable. If this unobservability [of light] is systematic, it must be really an expression of some deep truth, he said. And the deep truth is that all laws of nature are such that you cannot detect uniform motion in any laboratory. That idea has come to be called Lorentz invariance, because [the great Dutch physicist] Hendrik Lorentz was one of Einstein's predecessors in working out this idea. And that imposes certain restrictions on the equations of theoretical physics.

This principle of Lorentz invariance was speculative when Lorentz formulated it around about 1900. But now it has been so solidly built into physical theory that it is extremely difficult to consider giving it up. The idea that somehow nature has no preferred velocity and no preferred inertial reference system (such as ether) has paid off enormously. But this idea presents one of the biggest difficulties in formulating quantum mechanics in a sensible way, because when you look at these funny paradoxes of Einstein, Podolsky and Rosen, they seem to imply that something goes faster than light. But Lorentz invariance is very embarrassed by anything going faster than the speed of light, because that would seem to say that you should be able to measure the simultaneity of distant events more precisely than you can using light. Yet somehow the fact that light is the quickest measurement available is built into the

theory of relativity. Now it's not as simple as that, and that's just the kind of thing I would like to investigate. What restrictions on velocities—and velocities of what—are really imposed by Lorentz invariance? **Ques:** People have found in this connection between distant events a sort of scientific affirmation of Zen Buddhist thought in which every part of the universe is related to every other within the whole.

Bel: The idea that there is a relation to Eastern mysticism comes already from Bohr and maybe before. Bohr's coat of arms, which he chose himself, has the yin-yang symbol embodied in it. He thought that the ambiguities we face in physics are related to the ambiguities that Eastern mystics have faced—the union of the observer and the universe and so on. That theme was taken up in particular by Erilip Capra. His book *The Tao of Physics* has sold many copies, but I have no responsibility for that. I got into the picture, and people found I had deepened the mystery.

**“The Dalai Lama
said that if physics was
committed to a
once-only universe, then
‘the Buddhists
would have to study their
scriptures
There’s room for maneuver.”**

I think that's true, because my result destroyed the possibility that the world could be Einsteinesque. But it must be something more complicated than that. There is some kind of hidden connection.

So the ecological people, Green people, people who feel that ordinary science is cold and materialistic and hostile—they loved my result. It brought back a warmth togetherness. I have some sympathy with that. I cannot write like that because I don't see it like that. But still, I'm usually on the same side as those people in other things, like conservation and soft science and whole meal bread and all those things. I even feel quite warm toward those people.

Ques: But you don't see it that way.
Bel: No, because I don't have that mystical insight. I am essentially an agnostic about religious and spiritual matters. When people give answers to these questions, I think it's awful thinking. I don't feel hostile toward these people, but I just don't share their enthusiasm at finding answers to questions that seem to me unanswerable. I admit that there are questions that science cannot answer—that science cannot even ask. But I myself don't have answers

to those questions. When I hear people saying we've finally answered it and the answer is Buddhism or Taoism or something else, I just have to say that when I look at those things I don't find the answer. Even so, if other people find the answers there, I'm not going to campaign against them. That's their business. They are doing no great harm. There are ideologies that are much more vicious than Buddhism.

Ques: This movement to link physics and mysticism—do you think it's bad?

Bel: I don't think it's evil, but I don't think it's right. In my opinion physics has not progressed far enough to link up with psychology or theology or sociology. What we deal with in physics are the very simplest questions. We simplify situations to the limit in the hope of finding that the laws of simple things can be built up into the laws of complicated things. The kinds of problems we address ourselves to in physics are just too remote from anything of spiritual concern to be relevant. I don't think Bohr's theorem moves you nearer to God.

Ques: Are people simply picking up the poetic resonances of these ideas?

Bel: Yes! Now, poetry—that's the correct way to see it. Poetry isn't addressed to solving the problems of physics. It is addressed to touching human emotions. If it has a message, it's not on the intellectual level. So as poetry I can appreciate Capra and others. But as physics, I don't appreciate them at all. Now the test for a physicist of whether those people have something to contribute would be to ask them not to interfere with what we have done already but to tell us what is going to happen next. If they can tell us the mass of the Higgs boson [a theoretical new particle], and if we find it, there we are all going to learn their philosophies. [Laughs] Well, off go and sit at the feet of Maharshi if he tells us where the Higgs boson is to be found.

I have the feeling that these things do not come from genuine mystics but from amateur mystics, people who find this romantic possibility opening and see some parallel with physics. People who have devoted their lives to mysticism are not doing this. They make the judgment that they don't know enough about physics. Physics is technical. You can't learn it too well by reading popular books. But my feeling is that those guys feel they are onto something much bigger than physics. They are not going to worry about whether there are three quarks or six.

Ques: Why is it that mystic physics books sell so well?

Bel: People are looking for comfort, and if somebody offers it to them, they try hard to believe it. Those ideas really mean that we live in a less hostile world, with the possibility of coupling to the heart of things. It's comforting to think that not only are priests and mystics saying this, but now we have the physicists with their machines verifying it. The idea that people are back in the middle is very comforting, so it's easy to seize upon. You'd have to be a masoch-



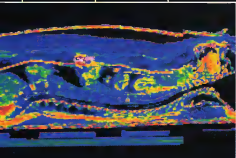
BOUND FOR GLORY

BY NINA GUCCIONE



AT FAR LEFT IS THE
CARTONNAGE OF
NEFSAMETERHEPERA,
A THEBAN PRIEST
(GEMPE, CIRCA 1800
B.C.). CARTONNAGE
WAS CONSTRUCTED
TO BEAUTIFY THE
MUMMY. NEAR LEFT:
X-RAY TAKEN OF
A MUMMY'S SKULL.

It's no easy task to woo your spirit back after death, so you'd better make sure you look your best. Resurrection and immortality were central to the Egyptians' religious beliefs. But to ensure that the body would rise again, all the pertinent elements present during life had to accompany the body in death—organs, name, and spirit. The elaborate funerary customs were restricted to the society's elite, wealthy, or royal.



In the past, mummies had to be examined by unwrapping the yards of encasing linen. Once unwrapped, it was impossible to put the mummy back together.

Medical technology finally caught up with a 3,000-year-old mummy—Ta-Res, an Egyptian singer. At the Museum of Fine Arts in Boston, restorers cleaned and prepared Ta-Res before transporting her to the hospital where she would undergo X rays in a CT (computed tomography) scanner. Unlike conventional X rays, a CT scan can produce images of soft tissue, which is left by embalming



TOP: PREPARING FOR TA-RES'S HOSPITAL VISIT. FAR LEFT: X RAY OF TA-RES'S SPINE. NEAR LEFT: HER RESIN-THICK HAIR AND NOTCHED NOSE. RIGHT: AN X RAY OF HER TORSO. BELOW: PHOTO OF AN EGYPTIAN MUMMY CIRCA 1850 B.C.



The preserving process took about 70 days. The body was pit and the internal organs removed, except for the heart. The viscera were then cleaned and put back into the body. The heart, believed to be the source of all life and thought, had an amulet placed over it to protect it from ever lying against itself. The brain was pulled out by a hook through the nose and discarded. Ta-Res was prepared in this way and still had a few ailments left inside to ward off evil. X rays revealed a bad back and a small head tumor but not the cause of her death. ☐



Even artists are affected by what's happening in space, not only in terms of subject matter but in terms of all kinds of new materials that can be used." Galloway says. And designer Mary Edwards is living proof of Galloway's theory. Edwards actually grew up with the space program: Her father, an electrical engineer, was part of the team that sent the first monkey into orbit. But she was drawn to the visual arts, not the sciences. After studying art all over the world, she eventually became a textile designer and is now president of a rug- and tapestry-design firm bearing her name in San Francisco.

In 1985 Edwards happened to attend a lecture given by Yvonne Clearwater, who had begun her career advising former California governor Jerry Brown on how to build institutional office buildings that wouldn't corrode the human spirit with their sterility. She later became a specialist on the psychological effects confinement could have on humans isolated in such places as submarines, offshore rigs, and remote regions like Antarctica.

In 1984 Clearwater joined the newly created Space Human Factors Office at the NASA/Mcme Research Center. Looking for assistants who shared her belief in humane design, she chose Edwards to join a collaborative color team composed of psychologists, physiologists, and engineers to transform ideas about the effects of different colors, fabric textures, and lighting on people confined to a spacecraft for months or years on end.

Their research has involved large doses of scientific testing—such as measuring people's nervous-system reactions to different environments—and a dollop of intuition. Because space-station passengers will be both private citizens and astronauts, Edwards reasons, "We're potential users: what would we want?"

The answers are in a mock-up module in a laboratory near Clearwater's NASA office. Each passenger's private space is the size of a large telephone booth. The interior walls are dark on the bottom and light at the top—like the earth and the sky. There is a console for playing tapes and videos, a phone to speak to loved ones on Earth, a bulletin board for photographs, and a long mirror so people can remember what they look like.

Some of the team's findings about on-board art are being tested by scientists stationed in Antarctica. Clearwater and her ten investigators asked research subjects to choose among hundreds of photographs in nine categories, from animals to automobiles. The overwhelming favorite was landscapes "without" without buildings, with foreground detail. They had a physiologically calming effect on the viewers, Clearwater says.

In the public areas of the space station

Clearwater and Edwards would like to see an international art gallery. "There are fairly boring tunnels that go from one module to another," says Edwards. She would like to see posters of things like the running of the bulls in Pamplona, Spain; colorful tulips blooming in Holland; and San Francisco's Golden Gate Bridge.

Because there's no gravity in space, space-station passengers will have to sleep vertically. Edwards and Clearwater have designed a plush, glittery sleeping bag with an ocean-blue outside and a rainbow-hued interior. The bottom line, says Clearwater, "is that we think the farther we send people from everything that's familiar to them, the more responsibility we have not for replacing those surroundings but for giving them links. Artwork, communications with home, choices—all those things enhance people's humanness, rather than depriving them of it in the machine-dominated setting."

When the hardware for the space station

◆in the past
there's been this he-man,
we-can-live-in
anything attitude. Women tend
to care more about
quality-of-life issues that could
come up in space,
like relaxation and art. ◆

laboratory is constructed by the Boeing Aerospace Corporation, one of the systems engineers will be twenty-eight-year-old Marcia Baer-Peckham. Her job at Boeing's Huntsville, Alabama, headquarters involves figuring out how the people work as part of the whole—such as evaluating power requirements of particular payloads or whether the space station needs certain types of microscopes or blood-sampling equipment as part of its onboard hardware.

Baer-Peckham agrees with Clearwater that "typical" male attitudes can be a plus in designing a habitat. In the past there's been a lot of the he-man, we-can-live-in-anything attitude, as if it's perfectly normal to live without a shower for two months," she notes. "Women tend to care more about the quality-of-life issues that could come up in space, like relaxation, communication with our families, and art."

Baer-Peckham's husband, David, also works on Boeing's space station project, although in a different unit. "Sometimes it's stressful waving at each other across air ports," she says.

It seems one of the more difficult places

for women to succeed is within the large private-sector aerospace companies. Clearwater, who worked in private industry before coming to NASA, remembers being criticized by a superior for "enjoying my work too much." There's a glass ceiling in there for women. "You can stand under it and look up through it at the guys at the top, but you can't get past it," she says.

Dee Ann Davis, head of marketing and Washington operations for a small company that hopes to build a private space marketplace, adds: "In the big companies the hierarchy is set. Most of the guys are older, and they're not used to perceiving women in the role of equals."

Davis's Nevada-based company, Third Millennium, Inc., wants to have its Space Van ready for service in 1993. Lighter and less than half the length of the conventional shuttle, the reusable shuttle will slash out costs and the line businesses have to wait to send payloads into space.

But most of these visions, from a new, long-range civilian space program to the establishment of bases on Mars and the moon, are still just a wish list. Many women like their male colleagues are wondering what has ahead for the American space program in these economically shaky, post-Challenger times.

"It's make-or-break time," says Brenda Forman. "The gap the Soviets opened up is widening by the day. And while the Japanese are currently behind the Europeans, if you look at the curve of Japanese space spending, it's climbing precipitously."

Although the recent go-ahead given to the long-delayed Jupiter mission is good news, plenty of careers have been run off course by American space priorities—or the lack of them. And whether women can transform the space industry or whether they will simply fit into the old-boy network is unclear. Indeed, some women worry that the only way they can get ahead and stay ahead is to adopt stereotypically male priorities. Like women in law, medicine, and the business world, they are finding that the demands of a male-dominated, workaholic industry may not be compatible with the pull of motherhood.

Forman says she cannot see both having a child and continuing a career in the space industry. "I think child rearing is one of the hardest jobs there is, and I couldn't bring myself to make that sacrifice. I'm just grateful that I belong to the first generation of women who could really make the choice not to have children."

"The good news," says Marcia Smith, "is that we [American women] are doing a lot better than anyone else. When I was in Brighton, England [for the 1987 conference of the International Astronautical Federation], meeting with the Brits and the Japanese and the Soviets, I was back to being the only woman in the room. I used to be much more critical of the way Americans treat women, but in this country it's been a while since I've been the only woman in the room. ◆◆

FICTION

THE GIRL WHO LOVED ANIMALS

BY BRUCE McALLISTER

*If only you had the power to
save an endangered
species, how far would you go?*

They had her on the seventeenth floor in their new hi security unit on Figueras and weren't going to let her up. Captain Merdola, the one who thinks I'm the ugliest woman he's ever laid eyes on and somehow managed to take it personally, was up there with her and no one else was allowed. Or so this young lieutenant with a fresh academy tattoo on his left thumb tries to tell me. I get up real close so the kid can hear me over the screaming media crowd in the lobby and see this infamous face of mine, and I tell him I don't think Chief Strachan will like getting a call at 6200 hours just because some desk cadet can't tell a privileged soc worker from a media rep and how good friends really shouldn't bother each other at that time of the day anyway, am I right? It's a lie, sure, but he looks worried, and I remember why I haven't had anything done about the lack I was born with. He gives me two escorts—a sleek young sweater with an inked Ruger and a lady in fatigues who is almost as tall as

PAINTING BY ARMODIO



I am—and up we go. They're efficient kids. They think me in the elevator.

Mendoza wasn't with her. Two PD medics with side arms were. The girl was sitting on a sensor cot in the middle of their new glass observation room—closed-air, antibellishac Plex, and the steel—and was a mess. The video footage, which four million people had seen of her, hadn't been peeled off at all.

Their hi-sac floor cost them thirty-three million dollars. I told myself I took them three years of legislation to get, and had everything you'd ever want to keep your witness or assassin or jihad dignitary alive—OCTV, microwave eyes, pressure mats, blast doors, laser blinds, eight different kinds of gas, and, of course, Vulcan sensors from the hospital three floors up.

I knew that Mendoza would have preferred someone more exciting than a twenty-year-old girl with a V-Rating of nine point six and something strange growing inside her, but he was going to have to settle for this chaste thing.

I asked the medics to let me in. They told me to talk into their wall grid so the new computer could hear me. The computer said something like "Yeah, she's okay," and they opened the door and looked me again.

I asked them to leave, citing Welfare & Institutions Statute Thirty-eight. They wouldn't, citing hi-sac orders under Penal Code Section A. I told them to go find Mendoza and tell him I wanted privacy for the official interview.

Very nicely they said that neither of them could leave and that if I kept asking I could be held for obstruction, despite the same statutes cooperation clause. That sounded right to me. I smiled and got to work.

Her name was Lesly Torner. She was beauty one, not twenty. According to Records, she'd been born in the East Valley, been abused as a child by both sets of parents and as the old story goes, hooked up with a man who would oblige her the same way. What had kept County out of her life, I knew, was the fact that early on, someone in WSI had set her up with an easy spouse-abuse complaint and felony restraining-order option that needed only a phone call to trigger. But she'd never exercised it, though the older bruises said she should have.

She was pale and underweight and wouldn't have looked very good even without the contusions, the bloody nose and the belly, and the shivering. The bloody clothes didn't help either. Neither did the wares and contact gel they had all over her for their beautiful new cot.

But there was a fragility to her—princess-in-the-fairy-tale kind—that almost made her pretty.

She flinched when I said hello, just as if I'd hit her. I wondered which had been worse—the beating or the media. HWD done it in a park and had been screaming all her when Mendoza's frost arrived, and so.

Two uniforms had picked up a couple of C's by calling it in to the network.

She was going to get hit with a beautiful posttraumatic stress disorder sometime down the road even if things didn't get worse for her—which they would. The press wanted her badly. She was bloody, shivering, and very ugly.

"Has the fetus been checked?" I asked the side arms. If they were going to listen, they could help.

The shorter one said yes; a portable sonogram from County, and the baby looked okay.

I turned back to the girl. She was looking up at me from the cot, looking hopeful and I couldn't for the life of me imagine what she thought I could do for her.

"I'm your new VR advocate, Lesly."

She nodded, keeping her hands in her lap like a good girl.

"I'm going to ask you some questions, if that's all right. The more I know the more help I can be, Lesly. But you know that."

I should have gone to the hotel, but the apartment was closer. I didn't look at the bedroom door, which is locked from the outside. Some days it's easier not to think about what's in there.

don't you," I grinned.

She nodded again and smiled, but the lip hurt.

I identified myself, badge and department and appellation, then read her rights under Protective Services provisions, as amended—what we in the trade call the Nihil Harsh Act. What you get and what you don't.

First question, Lesly. Why'd you do it? I asked it as gently as I could, flicking the hand recorder on. It was the law.

I wondered if she knew what a law was.

Her IQ was eighty-four, congenital and she was a Collins psychotype, class three dependent. She'd had six years of school and had once worked for five months for a custodial service in Monterey Park. Her Vulnerability Rating, all factors factored was a whopping nine point six. It was the taping that had gotten her a felony restraint complaint option on the mental bond, and County had assumed that was enough to protect her from him.

As far as the provisions on low-IQ cases went, the husband had been fined, she had a second-degree dependency on him, and

an abortion in event of rape by another was standard. As far as County was concerned, she was protected, and society had exonerated proper conscience. I really couldn't blame her. Last VR advocate I'd have assumed the same.

And missed one thing.

"I like animals a lot," she said, and it made her smile. In the middle of a glass room, two armed medics beside her, the media screaming downstairs to get at her, her husband somewhere wishing he'd killed her, it was the one thing that could make her smile.

She told me about a kitten she'd once had at the housing project on Cienfuegos. She'd named it Lesly and had kept it alive "all by herself." I was her job, she said. Like her mother and father had jobs. Her second stepfather—or was it her mother's brother? I couldn't tell, and it didn't matter—had taken it away one day, but she'd had it for a month or two.

When she started living with the man who'd eventually beat her up in a park for the ten o'clock news, he let her have a little dog. He would have killed it out of jealousy in the end, but it died because she didn't know about shots. He wouldn't have paid for them anyway, and she seemed to know that. He hadn't been like that when they first met. It sounded like neurotransmitter blocks, MPH3 metabolism. The new bromine that was on the streets would do it, all the lortanyl analogs would, too. There were a dozen substitutes on the street that would. You saw it all the time.

She told me how she'd slept with the kitten and the little dog and, when she didn't have them anymore, with the two or three toys she'd had so long that most of their fur was worn off. How she could smell the kitten for months in her room just as if it were still there. How the dog had died in the shower. How her husband had gotten mad at her and taken the thing away. But you could tell she was glad when the body wasn't there in the shower anymore.

"This man was watching me in the park," she said. "He always watched me."

"Why were you in the park, Lesly?" She looked at me out of the corner of her eyes and gave me a smile, the conspiratorial kind. There's more than one squirrel in those trees. Maybe a whole family. I like to watch them.

I was surprised there were any animals at all in the park. You don't see them any more, except for the domesticates.

Did you talk to his man?

She seemed to know what I was asking. She said, "I wasn't scared of him. He smiled a lot. She laughed at something and we all jumped." I knew he wanted to talk to me so I pretended there was a squirrel over by him and I fed it. He said, Did I like animals and how I could make a lot of money and help the animals of the world.

It wasn't important. A dollar A thousand. But I had to ask.

"How much money did he tell you?"

Nine thousand dollars. That's how much I'm going to get, and I'll be able to see it when it's born, and sold it.

She told me how they entered her—how they did it gently while she watched, the instrument clean and bright.

The fertilized egg would affix to the wall of her uterus; they'd told her, and together they would make a placenta. What the fetus needed nutritionally would pass through the placental barrier, and her body wouldn't reject it.

Her eyes looked worried now. She was remembering things—a beeing men in uniforms with guns, a man with a microphone pushed against her belly. Had her husband hit her there? *No, no. How many times?* I wondered.

Will the baby be okay? she asked, and I realized I'd never seen eyes so colorless, a face so trusting.

That's what the doctors say," I said, looking up at the side arms, putting it on there.

Nine thousand. More than a man like her husband would ever see stacked in his life, but he'd beaten her anyway. Lousy that she could get it in her own way when he'd failed again and again. Lousy that she'd managed to get it with the one thing he thought he owned...her body.

Paranoid schizophrenics are that way
I ought to know. I married one

I'm thinking of the mess we've made of

4. Lousy I'm thinking of the three hundred thousand grown children of the walking wounded of an old war in Asia who walk the same way.

I'm thinking of the four hundred thousand wallflowers: our living dead. I'm thinking of the 200s, the ones we don't have anymore, and what they must have been like: what little girls like Lissy Turner must have done there on summer days.

I'm thinking of a father who went to war, came back, but was never the same again of a mother who somehow carried us all, of how cars and smog and cement can make a childhood and leave you thinking you can change it all.

I wasn't sure but I could guess. The man in the park was a body broker for pheromone-rich and neuroactive, and behind him somewhere was a species restriction group that somehow had the money. He'd gotten a hefty three hundred percent when most the investment was already thirty-six grand. He'd spent some of his twenty-seven paying off a few WASI people in the biggest countries, gotten a couple dozen names on high VR searches, watched the best bets himself, and finally made his selection.

The group behind him didn't know how such things worked or didn't particularly care: they simply wanted consenting women of childbearing age, good health, no substance abuse, no wallflowers, no

suicidal inclinations, and the broker's reputation was good, and he did his job.

Somewhere he'd missed the husband. As I found out later, she was one of ten Surrogates for human babies were a dime a dozen, had been for years. This was something else.

In a nation of two hundred eighty million, Lussy Turner was one of ten—but in her heart of hearts she was the only one. Because a man who said he loved animals had talked to her in a park once. Because he'd said she would get a lot of money—money that ought to make a husband who was never happy happy. Because she would get to see it when it was born and not to visit it whenever it was kept.

The odd thing was, I could understand how she felt.

I called Antikali at three a.m., got her mad but at least awake, and got her to agree we should try to get the girl out that same night—out of that room, away from the press and into a County unit for a complete legal check. Antikali is the kind of boss you only get in heaven. She lied but Men does stonewalled her under PC Twenty-two, the Jorgenson clause—he was getting all the publicity he and his new unit needed with the press screaming downstairs—and we gave up at five, and I went home for a couple hours of sleep before the next work began.

I know that sitting here in the middle of all that glass with two armed medics was almost as bad as the press, but what could I do. Lousy, what could I do?

I should have gone to the hotel room that night, but the apartment was closer. I slept on the sofa. I didn't look at the bedroom door, which is always locked from the outside. The nurse has a key. Some days it's easier not to think about what's in there. Some days it's harder.

I thought about daughters

We got her checked again this time at County Medical and the word came back okay. Echymotic bruises with some placental bleeding, but the fetal signs were fine. I went ahead and asked whether the fetus was a threat to the mother in any case, and they laughed. No more than any human child would be, they said. All you're doing is borrowing the womb, they said.

"Sure," this cocky young resident says to me, "it's low-tech all the way." I had a lot of homework to do. I realized

Security at the hospital reported a visit by a man who was not her husband, and they didn't let him through. The same man called me an hour later. He was all smiles and wore a suit.

I told him we'd have to abort if County under the Victims' Rights Act decided was best or the girl wanted it. He pointed out with a smile that the thing she was carrying was worth a lot of money to the people he represented, and they could make her life more comfortable, and we ought to protect the girl's interests.



• They come in threes, often arriving or departing in black Cadillacs or other large, dark-colored sedans •

ANTI-MATTER

On March 11, 1966, a group of three men in black suits and ties, wearing dark sunglasses, arrived at the home of Albert K. Bender, a founder and director of the International Flying Saucer Bureau (MIB). Such sightings date back to at least 1953 when Bender, a CIA-registered faculty clerk at Albert K. Bender, claimed he had been visited by three men dressed in black suits.

According to Bender, the MIB not only revealed the secret of flying saucers, but they also intimidated him and up to six other people. Bender, a former CIA employee, claimed he had been visited by three men dressed in black suits.

And in the last issue of the group's newsletter, Bender cryptically warned: "Those engaged in saucer work to proceed be very cautious."

Bender may well have been an eccentric, but his case was hardly unique. Many UFO investigators claim that MIB plague them to this day. "The curious thing," says Peter Rosevear, a biologist who has studied the phenomenon, "is that MIB sometimes show up before the witness has had a chance to report a UFO sighting. They often have intimate information about the person; that only he or a family member would normally have access to. And they customarily identify themselves as military intelligence officers."

Rosevear, now an assistant professor of human biology at The United School in New York City, became fascinated by MIB stories and the people who told them in the early 1970s while researching a book on UFOs at the University of Pennsylvania. His studies revealed a series of bizarre, if contradictory, patterns.

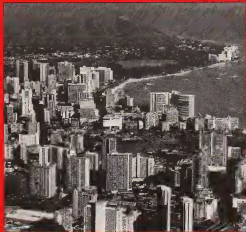


UFO UPDATE

Casual conversation about UFOs told him didn't much care whether they were real physical flying craft or not, but that I found stories about them interesting," said Rosevear's source. "Well, I thought the guy was going to come unglued! He became highly agitated. Flying saucers are the most important fact of the century," he shouted, "and you're not interested?"

Not everyone within the UFO community accepts the existence of men in black. "We tried everything I know in the last thirty years to get them interested in me without a ribbon," says James Mosley, who publishes the interview and anecdotal broadsheet *Saucer Saucer*.

Despite Mosley's lack of a personal encounter, Rosevear considers the chance of confronting the MIB with the individual's degree of UFO involvement. He advises, however, not to let it happen to you. "Keep a sense of humor about yourself. Don't get upset or take them too seriously. In other words, don't feed the phenomenon." DENNIS STACY



MONSTER RATS

According to the Tehran newspaper *Kayhan*, Iran has developed a big—as in monster-size—rodent problem. Environmentalists in that country recently reported that giant rats weighing an average of 26 pounds are killing and devouring cats. Some of the creatures, the newspaper states, have unusually long hind legs and hop like kangaroos.

William Jackson, professor of biological sciences at Bowling Green State University in Bowling Green, Ohio, suspects the Iranian rodents may be similar to the giant rats known as cane cutters, which are frequently used for food in West Africa. But reports of the rodents' cannibalistic appetites and occasional hopping remain puzzling, Jackson adds. "The giant rats in Africa are vegetarians, after all," and the fact that these huge Iranian rats are supposedly devouring cats suggests aggressive behavior in a range.

—Steven Baker

WISDOM OF THE ISLANDS

I maybe Hawaii, but Garth Pendragon, local parapsychologist and parapsychology instructor, doesn't have much aloha spirit for Kur Butler and his band of Honolulu Skeptics. Pendragon is suing for \$1.5 million.

It's not just Butler, though. Pendragon's suit also names the University of Hawaii, the Hawaii Skeptics Organization, without skeptical professors at the University of Hawaii, the Committee

for Skeptical Investigation of Claims of the Paranormal (CSICOP), magazine *James R. H. I.* and Ray Kurtz, head of CSICOP. Before Pendragon gets a cent, he'll have to prove the skeptics and the university conspired to deprive him of his right to teach his hundred parapsychology courses, and that in the process he was defamed. According to Butler, the skeptics don't know an objective course in parapsychology. What used them were co-ops that reported

to teach psychic skills.

With respect to the case, Pendragon thinks a debate would be an excuse to declaring open season on parapsychology and parapsychical practitioners every where. Butler, on the other hand, feels a loss for the defendants would have a chilling effect on skeptics throughout the country.

It is probably safe to say that neither side will be having much fun in the sun between now and the June trial.

Paul McCarthy





IMAGINE IMAGINARILY

Some experts think you're born with the power to have out-of-body experiences (OBEs). But Rex Stanford, a psychology professor at Saint John's University in Jamaica, New York, believes that some people could be conditioned to have them.

Stanford bases his opinion on a recent survey in which several college students filled out a questionnaire dealing with childhood experiences and were asked whether they'd ever left their bodies. They were specifically asked how much time they had spent reading and how often they had played imaginary games by themselves or with imaginary playmates. They were also asked about early attachment to dolls or stuffed animals and about how they had dealt with punishment.

The New York researcher found that his results followed a pattern: Children who spent considerable time reading and playing with imaginary playmates tended

to report out-of-body experiences later in life. To Stanford, these results suggest that far from being a total separation of the mind from the body, OBEs could result from the use of fantasy.

The findings of this study suggest that the OBE is not OBEs, although not all fantasy-prone individuals report OBEs.

Indeed, notes Keith Henry, director of the Institute for Advanced Psychology in San Francisco, who says he



can induce such experiences at will. If a child is sensitive and has a rich inner life, Henry points out, "he's going to have magical experiences. But that doesn't mean that he out of body experiences is necessarily magical. His sensitivity might lead him to have both fantasy experiences and very real OBEs." —D. Scott Rogo

"Out of her own body she turned silver thread light."

Paula Gunn Allen

IMAGINE BLUE EYES

"No one can change the color of my eyes thanks to fitted contact lenses. But psycho-
Jan Craddock of Atlanta insists she's found something else that makes her brown eyes blue—ESP."

Eleven years ago, according to Craddock, she began to hear the voices of spirit guides. "I was considering becoming a professional psychic, and I thought it was a shame that I didn't have blue eyes because all my psychic teacher had clear piercing blue eyes," she recalls. Then the voices said: "Well, give you blue eyes."

Within a week, Craddock says, her eyes began to look blue—only it wasn't her eyes that changed color but her eyeballs. She claims that medical exams showed no physical abnormalities.

Don and Ann Chandler of Carrollton, Georgia, who have had psychic readings performed by Craddock, say they've observed her chameleonlike eyeballs. "We definitely noticed it," notes

Ann Chandler. The whites developed a blue cast.

Craddock points out that the blue color comes and goes: "With one eye some times appearing more blue than the other. They get bluer when I'm in an altered psychic state," she says.

Not everyone is convinced that Craddock's colorful eyeballs have anything to do with alleged supernatural talents, however. "If a person had a drizzle of blood to the optic nerve," notes Atlanta ophthalmologist Thomas



Schlemmerhorn. "It could give the eyeballs a bluish cast. Also, if someone holds his breath for one or two minutes that could turn the eyeball color more blue."

Sherry Baker

The artist solicits the spectator's optic nerve. By methodically organizing his colors, he engages and disturbs his visual system.
—editors of *Positives*

Color got me

Paul Klee

BEASTS OF EXMOOR

The Kildare Hotel, located in western England's Exmoor region, offers more than the traditional bed-and-breakfast. Now tourists can take advantage of a four-day beast-and-breakfast deal. For \$200, you get full board and a guided tour of the Black moors and hills where the mysterious Beast of Exmoor is said to roam.

Described as a huge black cat, the Beast gained local notoriety when press reports blamed a 1983 killing of more than 100 sheep on the creature. Over the past year, sightings of the elusive beast have increased, witness claims. "I kept over an eight-foot tall hedge and propped within 20 feet of a car. Naturally Trevor Beer, who conducts guided tours of the Beast's alleged haunts, recently had a close encounter with the creature and snapped several color pictures of a large, puma-like cat as it hunted rabbits on a hillside.

Beer points out that the North Devon and Somerset counties of England, where the Beast of Exmoor is said to roam, have long been said to be haunted by supernatural creatures that haunt the moors. But he claims the Beast of Exmoor is a flesh and blood creature—or creature. "I think that over the years big cats have escaped from circuses and exotic pet situations," he explains. "And now we have a local breeding population in the British Isles."

Loren Coleman is a crypto-

zoologist who has investigated unexplained sightings of large cats in the United States and another theory.

There may be a relic population of Ice Age leopards that somehow survive in a few parts of the world. The female cats would be very dark like the descriptions of the Beast of Exmoor.

Whenever they came from Beer hopes the cats are protected. "I'm volunteering to give these tours because I want to attract sympathy for the cats. I don't think they are responsible for the sheep killings. I think packs of roving dogs are to blame," he says. "These cats are just living in the wild, perfectly fine, doing no one any harm." —Sherry Baker

I am convinced that beings from another planet have singled out Telen as a special subject."

George Rothrich
astrophysicist

ALIEN CRAVES

That the rumors are bad and not a odd. But that the British royal family is related to Vlad the Impaler, the original Dracula, is strange. Making such line delinquent. Mark Chorvinsky, magazine, filmmaker and editor of the new publication *Strange Magazine*, has compiled a list of the ten strangest events of the past year.

The list pushes most of the right buttons. For parapsychologists, there is the year's major ghost case, the haunting reported at Magdalen College in Oxford, England,



Japan took several nations including one for a Labor Ministry report probing ten deaths caused by robots and another for a seer who said he heard the voice of God on a bullet train predicting Japan's next prime minister, Noboru Takeshita.

But the winner of Chorvinsky's "Hard to Believe" award is Patsy Annandale, the little published claim by Oak Roberts that he has raised a baby from the dead.

To come up with this list, top-ten compilation (complete list available from Box 2296, Rockville, MD 20851), Chorvinsky and his staff of experts on unusual phenomena searched through thousands of cases, choosing only those items that were particularly controversial, deliriously mysterious, or, as surrealists would say, disquietingly strange.

Not so strangely, the list's year runs from October to October and is released at

Halloween. "I think there is a bit of psychopoeia about the strange," says Chorvinsky, except on this date. But his *Strange Magazine*, with its stories of death rays, real-life blob, and state-of-the-art techniques for hunting lake monsters, promises to be a year-round haven for the inexplicable. I enjoy mystery, says Chorvinsky, admits. "Otherwise, why would I be a professional magician?" Patrick Hagghe

She had on those damn takers that point all over the place. But you lost sort of sorry for her."

J. D. Seinger

In which the yo-yo string is revealed as a state of mind. Thomas Pynchon

I've been trying for some time to develop a life-style that doesn't require my presence.

Garry Trudeau

BUDDHA

CONTINUED FROM PAGE 42

Taboo pulled out a packet of white powder and a drinking straw and told Buddha to look a few lines, to put a shine on his high. Buddha did as he suggested. A luxuriant warmth spread through his head and chest, and little sparkles danced in the air, vanishing like snowflakes. He started getting drowsy. Taboo steered him to the bed, then curled up beside him, his arm around Buddha's waist.

"I love you so much, Buddha," he said. "Don't know what I'd do without you to talk to. I swear I don't." His soft breasts nudged against Buddha's arm, his fingers toyed with Buddha's belt buckle, and despite himself, Buddha experienced the beginnings of arousal. But he felt no love coming from Taboo, only a flux of lust and anxiety. Love was unmistakable—a warm pressure as steady as a beam from a flashlight—and Taboo was too unformed, too confused, to be its source.

"New man," Buddha said, pushing Taboo's hand away.

"I just wanna love you."

In Taboo's eyes Buddha could read the sweet, fucked-up sadness of a woman born wrong, but though he was sympathetic, he forced himself to be stern. "Don't mess with me!"

The buzzer sounded.

"Damn!" Taboo sat up, tucked in his shirt.

He walked over to the table, picked up the white powder and the drinking straw, and brought them over to Buddha. "You do a little bit more of this here bad boy. But don't you be runnin' it. I don't want you fallin' out on me." He went out into the living room, closing the door behind him.

There seemed to be a curious weight inside Buddha's head, less an ache than a sense of something askew, and to rid himself of it he did most of the remaining heroin. It was enough to set him dreaming, though not of Alice. Those dreams were ugly, featuring shrieks and thuds and nasty smears of laughter, and once somebody said, "The man got his! Dig it! The man's a fuckin' woman!"

Gradually he arrived at the realization that the dreams were real, that something bad was happening, and he struggled back to full consciousness. He got to his feet, swayed, staggered forward, and threw open the door to the living room.

Taboo was naked and spread-eagled face-down over some pillow, his rump in the air, and Johnny Wardell—a young leather-clad blond with a hawkish face—was holding his arms. Another man, darker and heavier than Wardell, was kneeling between Taboo's legs and was just zipping up his trousers.

For a split second nobody moved. Framed by the vivid green grass and blue sky and incandescent clouds, the scene had a surreal biblical quality, like a hideous act

perpetrated in some unspoiled corner of the Garden of Eden, and Buddha was transfixed by it. What he saw was vile, but he saw, too, that it was an accurate statement of the world's worth, of its grotesque beauty, and he felt dizzied as if he were watching through a peephole whose far end was a thousand miles away.

"Look! here!" said Wardell, a mean grin slicing across his face. "The he already done got himself a man. C'mon, bro! We saved ya a piece!"

Long-buried emotions were kindled in Buddha's heart: Rage, love, fear. Then on-set too swift and powerful for him to reject. "Get your hand off him," he said, pitching his voice deep and full of menace.

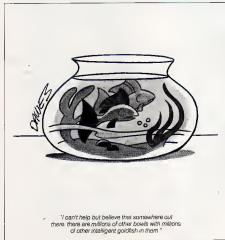
Wardell's lean face went slack, and his grin seemed to deepen as if the lustful expression engraved on his skull were showing through the skin, as if he perceived in Buddha an object of desire infinitely more gratifying than Taboo.

Wardell nodded at the man kneeling between Taboo's legs, and the man lunged himself at Buddha, pulling a knife and swinging it in a vicious arc. Buddha caught the man's wrist, and the man's violence was transmitted through his flesh, searing fury in his heart. He squeezed the man's wrist-bones until they ground together, and the knife fell to the floor. Then he pinned the man against the wall and began smashing his head against it, avoiding the fingers that clawed at his eyes. He heard himself yelling, heard bone splinter.

The man's eyes went unblinking, and he grew heavy in Buddha's grasp. He slumped down, the back of his head leaving a glimmering red track across a puffy cloud. Buddha knew he was dead, but before he could absorb the fact, something struck him in the back, a laser punch that landed with the stunning impact of a bullet, and he dropped like a stone.

The pain was luminous. He imagined it lighting him up inside with the precise articulation of an X-ray. Other blows rained upon him, but he felt only the effects of that first one. He made out Wardell looming over him, a slim, leathery giant delivering kick after kick. Blackness flittered at the edges of his vision. Then a scream—a sound like a silver splinter driven into Buddha's brain—and there was Taboo, something bright in his hand, something that flashed downward into Wardell's chest as he turned. He flashed down again. Wardell stumbled back, looking puzzled, touching a red stain on the shirtfront, and then appeared to slide away into the blackness at the corner of Buddha's left eye. Buddha lay gasping for breath. The last kick had landed in the pit of his stomach. After a second he vision began to clear, and he saw Taboo standing above Wardell's body, the other man's knife in his hand.

With his sleek breasts and male genitalia and the bloody knife, he seemed a creature out of a myth. He knelt beside Buddha. "You alright?" he asked. "Buddha? You alright?"



"I can't help but believe that somewhere out there, there are millions of other bowls with millions of other intelligent goldfish in them."

Buddha managed a nod. Taboo's eyes reminded him of the eyes of the fish in his dream—a swarm with terror—and his magic was heavy with it in an intensity that Buddha had never seen it.

"I never wanted to kill anybody," said Taboo tremulously. "That's the last thing I wanted to do." He glanced at the two corpses, and his lips quivered. Buddha looked at them, too.

Sprawled in oddly graceful attitudes on the green grass amid a calligraphy of blood, they appeared to be spelling out some kind of cryptic message. Buddha thought if he kept staring at them, their meaning would come clear.

"Oh, God!" said Taboo. "They gon be comin' for me, they gon put me in jail! I can't live in jail! What am I gon do?"

And to his astonishment, looking back and forth between the corpses and Taboo's magical aura, Buddha found he could answer that question.

The answer was, he realized, also the solution to the problem of his life: it was a measure of redemption, one he could have arrived at by no other process than that of his fifteen-year retreat.

His conviction had demanded an empty world in which to tread and had demanded as well an apprehension of magical principle. That had been supplied by his dream of Africa. And having apprehended the full measure of this principle, he further realized he had misunderstood the nature of Taboo's powers. He had assumed that they had been weakened by the wrongness of his birth and would mature once he went under the knife, but he now saw they were in themselves a way of effecting the transformation with a superior result; that they had needed this moment of violence and desperation to attain sufficient strength. Buddha felt himself filling with calm, as if the knowledge had breached an internal reservoir that had dammed calamity up.

"You need a disguise," he said. "And you got the perfect disguise right at your fingertips." He proceeded to explain.

"You crazy Buddha!" said Taboo. "No way I can do that."

"You ain't got no choice."

"You crazy!" Taboo repeated, backing away. "Crazy!"

"C'mon back here!"

Now man! I gotta get away. I gotta. Taboo backed into the door, fell for the knob—and eyes wide, panic-stricken—wrenched it open. His mouth opened as if he were going to say something else, but instead he turned and bolted down the hall.

The pain in Buddha's back was throbbing, spreading a sick weakness all through his flesh, and he passed out for a few seconds.

When he regained consciousness, he saw Taboo standing in the doorway, looking insubstantial due to the heavy wash of magic around him. In fact, the whole room had an underwater lucidity, everything



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wavering, like a dream fading in from the material. "See?" said Buddha. "Where you got go, man? You barely able to make it here!"

"I don't know, I'll maybe I'll..." Taboo's voice, too, had the qualities of something out of a dream, distant and having a faint echo.

"Shoo!" Buddha reached out to Taboo. "Gimme a hand up."

Taboo helped him to his feet and into the bedroom and lowered him onto the bed. Buddha let go as if he might sink lower into the black satin coverlet.

"Show me that new dress you bought," he said. Taboo went to the closet, pulled out a hanger, and held the dress against his body to display its effect. It was white silk, low-cut, with a scalloping of sequins all over.

"Aw, man," said Buddha. "Yeah, that's your dress. You got knockin' the boys eyes out wearin' that... if they could ever see it. If you'd just do what's right, you'd be lookin' beautiful for Detroit. You'd need to get someplace south, place where the moon shines bright as the sun. 'Cause that's what kinda beautiful you got to be. Moon beautiful. Miami, maybe. That'd suit ya. Get you a big white car, drive down by them fancy hotels, and let all them fancy people have a look at ya. And they gon' lay down and beg to get next to you, man."

As Buddha talked, conjuring the feminine future with greater seductiveness and invention than ever before, the heat haze of Taboo's magic grew still more visible, taking on the eerie, misapprehensive aspect of the mists beyond the lake in Buddha's Africa, and after Buddha had finished, Taboo sat on the edge of the bed, holding the dress across his lap. "I'm scared," he said. "What if it don't work?"

"You always been scared," said Buddha. "You been scared's what got them two men dead out there. Time for that to stop. You know you got the power. So go on!"

"I can't!"

"You ain't got no choice!" Buddha pulled Taboo's head down gently and kissed him openmouthed, breathing into him a calming breath. "Do it," he said. "Do it now."

Hesitantly Taboo came to his feet. "Don't you go nowhere now. You wait for me."

"You know I will."

"Alright." Taboo took a few steps toward the bathroom then stopped. "Buddha, I don't..."

"Go on!"

Taboo lowered his head, walked slowly into the bathroom, and closed the door.

Buddha heard the tub filling, heard the splashing as Taboo climbed into it. Then heard him begin to mutter his charms. He needed to sleep to fix, but he kept awake as long as he could, trying to help Taboo with the effort of his will. He could feel the vibrations of the magic working through the bathroom door. Finally he gave in to the pressures of exhaustion and the throbbing in his back and drifted off to sleep, the pain followed him into the blackness of sleep.

glowing like the core of his being. He woke sometime later to hear Taboo calling his name and spotted him in the darkest corner of the room—a shadow outlined by painted stars.

"Taboo?"

"It don't feel right, Buddha." Taboo's voice had acquired a husky timbre.

"Where, man?"

Taboo came a step closer, and though Buddha was still unable to see him, he could smell the heat and bitterness of the herbs.

"It worked, didn't it? Buddha asked. "It musta worked."

"I think... But I feel so peculiar."

"You just ain't used to it is all. Now c'mon!"

Taboo moved still closer, and Buddha made out a naked young woman standing a few feet away. Slim and sexy, with shoulder-length black hair and high, small breasts and a pubic triangle that showed no sign of ever having been male.

● *Black drapes hid the windows, a black satin quilt covered the bed. Buddha sat soaking his wart in a crystal bowl filled with herb-steeped water, while Taboo sat beside him, muttering charms.* ●

The air around Taboo was still and dark. No apples, no heat haze. The magic had all been used.

"I told ya," said Buddha. "You beautiful."

"I am!... I just ordinary." But Taboo sounded pleased.

"Ordinary as angels," Buddha said. "That's how ordinary you are."

Taboo smiled. It was faltering at first, that smile, but it grew wider when Buddha repeated the compliment, the smile of a woman gradually becoming confident of her feminine powers. She lay down beside Buddha and fingered his belt buckle. "I love you, Buddha," she said. "Make me feel right!"

Love was a steady flow from her, as tangible as a perfume, and Buddha felt it seeping into him, coloring his calm emptiness. On instant he started to reject the emotion, but then he realized he had one more duty to fulfill, the most taxing and compensating duty of all. He reached down and touched the place between Taboo's legs. Taboo stiffened and pushed her hips against his finger.

"Make me feel right," she said again. Buddha tried to turn onto his side, but

the pain in his back flared. He winced and lay motionless. "Don't know if I can. I'm hurtin' pretty bad."

"I'll help you," she said, her fingers working at his buckle, his zipper. "You won't have to do nothin', Buddha. You just let it happen now."

But Buddha knew he couldn't just let it happen, know he had to return Taboo's love in order to persuade her of her rightness, her desirability. As she moaned, him, a shadow woman lifting and writhing against the false night of the ceiling stars, strangely weightless, he pinned his dead wife's features to her darkened face, remembered her ways, her secrets. All the love and lust he had fought so long to deny came boiling up from nowhere, annihilating his calm. He dug his fingers into the plump flesh of her hips, wedging himself deep, he plunged and grunted, ignoring the pain in his back, immersed again in the salty richness of desire, in the small turbulence of this most alluring of human involvements. And when she cried out, a mournful note that played away to a whisper, like the sound a spirit makes falling through eternity, he felt the profound satisfaction of a musician who by his dominance and skill has brought forth a perfect tone from chaos. But afterward as she struggled close to him, telling him of her pleasure, her excitement, he felt only despair, fearing that the empty product of his years of ascetic employment had been wasted in a single night.

"Come with me, Buddha," she said. "Come with me to Miami. We can get us a house on the beach and..."

"Lemme be!" he said, his despair increasing because he wanted to go with her, to live high in Miami and share her self-discovery, her elation. Only the pain in his back—intensifying with every passing minute—dissuaded him, and it took all his willpower to convince her of his resolve, to insist that she leave without him, for Taboo and his dead wife had fused into a single entity in his mind, and the thought of losing her again was a pain equal to the one inflicted by Johnny Wardell.

At last, subsided in hand, she stood in the doorway, the temptation of the world in a white silk dress, and said "Buddha, please, wait!"

"Damn it!" he said. "You got what you want. Now get on outta here!"

"Don't be so harsh wit me, Buddha. You know I love you."

Buddha let his labored breathing be the answer.

"I'll come see ya after a while," she said. "I'll bring you a piece of Miami."

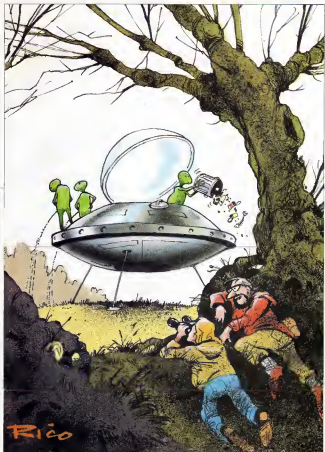
"Don't bother." Buddha?

"Yeah."

"In the bathroom, Buddha... I just couldn't touch it."

"I take care of it."

She half-turned, glanced back. "I'll always love you, Buddha." The door swung shut behind her, but the resonance of her



I guess this blows the 'concerned observation of emergent intelligences' theory!

love kept beaming through the wood, strong and contaminating.
"Go get yourself a big white car," he murmured.

He waited until he heard the front door close, then struggled up from the bed clamping his hand over his liver to muffle the pain. He stayed on the verge of peeing out, but after a moment he felt steadier, although he remained disoriented by unaccustomed emotion. However, the sight of the pitiful human fragment lying in the herb-scented water of the bathtub served to diminish even that. He scooped it up in a drinking glass and finished it down the toilet. Then he lay back on the bed again. Closed his eyes for a minute... at least he thought it was just a minute. But he couldn't shake the notion that he'd been asleep for a long, long time.

Buddha had to stop and rest half a dozen times on the way back to the shooting gallery, overcome by pain, by emotions, mostly by emotions. They were all around him as well as inside.

The shadows of the ruined houses were the ghosts of his loves and hates, the rustlings in the weeds were long-dead memories with red eyes and claws just waiting for a chance to leap out and snatch him, the moon—lopsided and orange and bloated—was the emblem of his forsaken ambitions shining on him anew. By loving Taboo he had wasted fifteen years of effort and opened himself to all the indulgent anarcho of his past, and he wished to God now he'd never done it. Then remembering how dreamlike everything had seemed, he had the thought that maybe it hadn't happened, that it had been a hallucination brought on by the liver punch. But recalling how it had felt to make love, the womanly tenor of Taboo's moves, he decided it had to have been real. And real or not, he had lived it; he was suffering for it.

When he reached the shooting gallery he sat cross-legged on his mattress, heavy with despair. His back ached something fierce. Pete was angry with him for being late, but on seeing his discomfort he limped upstairs and brought down a needle and helped him fix. "What happened to ya?" he asked, and Buddha said it wasn't nothing, just a muscle spasm.

"Don't gimme that shit," said Pete. "You get hit by a goddamn car, and you bettell me it ain't but nothing." He shook his head ruefully. "Well, to hell wit' ya! I'm sick of worryin' bout ya!"

Buddha began to feel drowsy and secure there on his mattress, and he thought if he could rid himself of the love that Taboo had imparted to him, things might be better than before. Cleaner, simpler. But he couldn't think how to manage it. Then he saw the opportunity that the old man presented, the need for affection he embodied, his hollow heart.

Pete turned to go back up the stairs and Buddha said, "Hey, Pete?"

"Yeah, what?"

"I love you, man," said Buddha, and sent his love in a focused beam of such strength that he shivered as it went out of him.

Pete looked at him, perplexed. His expression changed to one of pleasure, then to annoyance. "You love me? Huh? Man, you been hangin' out with that faggot too much, that's what you been doin'!" He clumped a couple of steps higher and stopped. "Don't bother comin' upstairs for your goddamn fix," he said in gentler tones. "I send it down wit' somebody."

"Precise it," said Buddha.

He watched Pete round the corner of the stairwell, then lay down on the mattress. He was so free of desire and human connections that the instant he closed his eyes, golden pinpricks bloomed behind his lids, opened into Africa and he was flying across the grasslands faster than over, flying on the wings of the pain that beat like a sick heart in his back. The antelope did not run away but slaved at him with wet, dark eyes, and the stick figures of those who guarded the village stalked him with their spears. The shadows of the masked women danced with the abandon of black flames, and in one of the huts a bearded old man was relating the story of a beautiful young woman who had driven a white car south to Miami and had lived wild for a time, had inspired a thousand men to greater wildness, had married and... Buddha flew onward, not wanting to hear the end of the story, knowing that the quality of the beginning was what counted, because all stories ended the same. He was satisfied that Taboo's beginning had been worthwhile. He soared low above the green mountains, low enough to hear the peaceful chants of the gorillas booming through the hidden valleys, and soon was speeding above the lake where the solitary fish swam a slow and decorative circle, arrowing toward the mats on its far side, toward those hallucinatory borders that he previously had neither the necessary courage nor clarity to cross.

From behind him sounded a distant pounding that he recognized to be someone knocking on the door of the shooting gallery, summoning him to his duty. For an instant he had an urge to turn back, to rebuke the world of the senses, of bluesy-souled hookers and weed white kids and punks who came around looking to trade a night's muscle work for a fix. And that urge intensified when he heard Pete shouting, "Hey, Buddha! Ain't you gon' answer the goddamn door?" But before he could act upon his impulse, he penetrated the mats and felt himself irresistibly drawn by their mysterious central whiteness, and he knew that when old Pete came downstairs, still shouting his angry question, the only answer he would receive would be an almost imperceptible pulse in the air like the vibration of a gong whose clangor had just faded beneath the threshold of hearing, the pure signal struck from oblivion, the fanfare announcing Buddha's dominion over the final country of his mind. **DD**

NUCLEAR

CONTINUED FROM PAGE 48

needed to supply electricity in your area, would you favor a nuclear power plant, oppose a nuclear power plant, or reserve judgment until you had more information?" 30 percent of Gallup's interviewees opposed construction, and 50 percent said they would reserve judgment. Thirty-three percent of the subjects polled by Cambridge Reports opposed construction and 48 percent reserved judgment.

The American Nuclear Society's John Graham likes to speak of the importance of perception. "Perceived is the key word," he says earnestly. "It's not reality that the nuclear community is fighting but the public's perception of what is real." Lovins thinks the success of "inherently safe" reactor programs depends on how much political muscle the industry will be able to exert. Lovins's scenario: The nuclear industry will come back to the public and the financiers saying, "Let us get it right the second time around so people won't have to worry about reactor safety." Lovins hopes an aware public will retort, "Why didn't you get it right the first time?"

BY THE RIVERSIDE

It's raining. Bad weather seems to follow me around when I visit nuclear power plants. In north of Portland, Oregon, touring the Trojan nuclear power plant, a 1,100-megawatt Westinghouse pressurized water reactor that uses the Columbia River as coolant. Owned by Portland General Electric Company (PGE) and Eugene Water & Electric, Trojan produces about a fifth of the electricity used in Oregon and has been online since 1976. Trojan is an impressive machine: the height of standard light-water reactor technology. It is one of a kind for Oregon because the state passed a law prohibiting further construction of nuclear plants until the federal government licenses a nuclear-waste repository.

That puts us somewhere into the early part of the next century," a PGE spokesman says. "That's a real problem," he adds. "When you look that far into the future, it's hard to say if the use of fission for producing electricity is even going to be a valid concern." Startling thought: The future of nuclear power could be advanced light-water reactors, or pebble-bed gas-cooled reactors, or PHWR reactors immersed in argon-filled pools of boric acid water, or integral fast reactors cooled with liquid sodium.

Given the recent newspaper reports stating that researchers have successfully ignited a nuclear fusion reaction in the Nevada desert, the dream of nuclear fusion may become real by the next century. Or solar-power satellites. Or geothermal plants. Or wind generation farms. Or Arroyo Lovins's dream of ultraefficient construction techniques and religiously practiced energy conservation. **DD**

The Artist

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What's the hardest
part of painting
a floor?

Cleaning up
when
I finish



Especially
the spots!

INTERVIEW

CONTINUED FROM PAGE 52

is or a sadist to insist that we are really not very important or are just incidental to the whole thing, although that actually is often my own impression.

Omni: It doesn't all fit together.

Bel: I guess not. But it doesn't hurt me a lot, because I find I can live with the idea that there can be different departments of knowledge and that you don't have to make them all fit in one. I have actually discussed that more than I would have, because the Dalai Lama visited CERN once, and I was a member of the dinner party.

The dinner was a bit frustrating because it was clear that the Buddhists knew little about Western science, and the scientists little about Buddhism. It was clear that the Buddhists were absolutely inward-looking. They were not trying to explain the mass of the electron or anything like that. They had their own tradition, and insofar as it has any bridge to Western science, it would be to psychology, because it is a discipline of personal salvation. Personal spiritual expansion. There wasn't much communication, as I say, but the people were all friendly toward one another.

We sat at a long table on one side were ten Buddhists, many in their saffron robes, including the Dalai Lama and his interpreter. Opposite them were ten physicists, the director general, the chief of the theory division, other important people, and myself—because they thought Bell's theorem might have something to do with Buddhism. The Dalai Lama, through his interpreter, said more or less that there could not be a conflict between Buddhism and science because both were looking for truth. I pressed him on the eternal recurrence. The Buddhists, he said, believe in metempsychosis on a personal level and on the scale of the universe—things repeat endlessly. The conception in physics at the moment, I told him, is that things begin with a bang, and it happens only once. That's just a fashion—physicists could change their line easily. I asked the Dalai Lama whether Buddhists

also could change their line. He said that if it became clear that physics was permanently committed to a once-only universe, then [imitating the sage], the Buddhists would have to study their scriptures very carefully, there is usually room for maneuver! [Laughs uproariously.]

Omni: That must have been one of the odier spoils of your brand of physics.

Bel: The European branch of Mahesh University is here in Switzerland, in a little place called Seelisberg, overlooking Lake Lucerne. A number of people were invited to the meeting on religion, physics, quantum mechanics, consciousness, and so on. We all made little speeches, and Mahesh gave his comments. He was sur-

Bel: My attitude is all very cold-blooded. I said you can make analogies between quantum mechanics and consciousness but that these are no more than analogies. That these was received politely. They all nodded their heads and said nothing.

Omni: What do you think about spending your time with all of these people?

Bel: Mostly it's just good fun for me. Scientists should try to communicate with nonscientists; it's a proper activity. What my colleagues think about it, I can only guess. To me they are polite. Ah, I suspect they think it is not absolutely kosher that it's not real science—that it's show business. I suspect that my reputation is damaged in their eyes by this side of my life.

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in an oak barrel,
you're very, very sociable
once you get out.

**WILD
TURKEY**

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ILLUSTRATION BY JIMMYE W. HARRIS FOR THE NEW YORK TIMES MAGAZINE

It's a terrible tragedy that we are all so limited. Each of us has the ability to make some little contribution in a field in a lifetime of training and effort, and other people are doing that in other fields, and there is really so much that each of us does not participate in. Sometimes I'm just depressed by that. There's so little that I know about—everything except physics and even except a small corner of physics. So I think it's natural and reasonable and right that at least in a nontechnical way we try to find out about what is happening elsewhere in the world. When people come to ask me what's happening in my world, I try to tell them—and I learn a bit about their world.

Omni: Yet you've said the incompleteness of quantum mechanics is a hard

problem to do something major with—that people destroy their careers looking on it. **Bel:** But that's true of all big problems. Take the problem of free will. Nobody has the idea it's unimportant or trivial. But would you advise a person to make his career thinking about free will?

Omni: Do you think there are still big problems open in physics today?

Bel: Yes. And this particular question of locality is still open, in my opinion. I think we have not found a way of digesting this situation. We have the formulas of quantum mechanics, and they work extremely well, but I have not digested them. There certainly remains something to be said some illumination to be found. **OO**

TINY DANCERS

MIND

By Bibi Wein

At the age of five Wolfgang Amadeus Mozart, proficient on both the harpsichord and the violin, was composing minuets. At the age of seven, following an unprecedented European tour that included a performance at the imperial court in Vienna, he published four violin sonatas and two symphonies. Was Mozart's profound musical talent due, at least in part, to the fact that his father Leopold was a well-known violinist and composer and exposed his son to intensive musical stimuli from the day he was born?

If musical talent is inherited, no one has been able to prove it. But recent evidence suggests that a child's early environment may determine—perhaps even prenatally—the extent to which musical potential is realized.

Peter F. Oswald, a professor of psychiatry at San Francisco's Langley Porter Psychiatric Institute, believes the brain mechanism for musical development may be activated when the baby is still in the womb. That environment, he says, is naturally musical. The inside of the body—the central nervous system, for example—is rhythmic. The embryo feels the external sounds and rhythms of the mother: the pounding of her heart, her breathing, even the beat of her walk.

It's not surprising, then, that newborns too, respond to sound and rhythm. Studies show that within 24 hours of birth, an infant can distinguish between his mother's voice and other sounds. In one of the most dramatic of these studies, Anthony DeCasper, a psychologist at the University of North Carolina at Greensboro, tested newborns with a nonnutritive nipple attached to a tape recorder. Sucking one way would bring forth the mother's voice. Sucking another way would elicit someone else's voice. The babies were quickly conditioned to suck the way that produced the voice of their own mother. Oswald and others believe this evidence suggests that the recognition of acoustical patterns, a form of learning probably begins sometime before birth.

For nearly eight years, Donald Shetter, professor of education at the University of

Rochester's Eastman School of Music and chairman of the cluster program on musical development and cognition, has been providing fetuses with musical stimuli. Recorded music with a single melodic line is played for the fetus through high-fidelity stereo earphones placed directly on the mother's abdomen.

We tend to use orchestral music that's not too complex so that repeated patterns will be absolutely clear, says Shetter. What we think the baby may use as a basis for further learning is the rhythmic and melodic pattern. More than half the mothers in this study, Shetter points out, report rhythmic movement of the fetal limbs in response to the pulse of the music.

For several dozen Rochester children, 30 of whom were subjects of his experiments while they were still in the womb, a monthly visit to Shetter has become routine. The hoary-headed Shetter, known around town as Eastman's grandpa, was the first to experiment with genuine music as opposed to electronic clicks and beeps and is the only one to date who

tracks musical development from fetal stages to early childhood.

Shetter evaluates the musical response of newborns by looking at attention span and body movements. Later he measures the child's ability to imitate rhythms and vocal sounds and to manipulate such sound-making objects as small bells.

The sessions in Shetter's classroom—a music lab of tiny xylophones, drums and musical toys—are videotaped for later analysis. Some of the children, he says, can imitate a two- or three-note melody within eight months of birth.

By the age of two, 80 percent of the children will play the baby piano or synthesizer with one finger at a time, as opposed to banging several random keys at once. The children, he says, pick out different melodies and try them at different places on the piano, much the way a composer does. "It's not unusual for them to sing them," he says. And the more exceptional children will replicate them on another instrument.

One of the most striking observations Shetter has made has more to do with speech than with music. "We've seen the development of highly organized and remarkably articulate speech in the experimental group," he says.

There is much speculation, however, and little hard data to prove a connection between music and language. Neurologists recognize that spoken language has a musical component. But what the neurological mechanisms are that connect them is unknown.

I think Shetter's studies are fascinating and certainly warrant larger longitudinal studies," says Frank Wilson, an author and assistant clinical professor of neurology at the University of California at San Francisco. Musical experiences, he says, do affect a child's socialization and development of self-perception. "A child may recognize individuals and begin to imitate sounds very early," he adds. "But I don't know that you can guarantee a child will speak more clearly or a choir in the Philadelphia Orchestra or be admitted to MIT more readily because of early musical exposure." □



Rhythmic talent may be prenatally determined.

ANIMALS

CONTINUED FROM PAGE 104

I told him what I thought of him, and he laughed. "You've got it all wrong, Doctor."

I let it pass. He knows I'm an MPS VR noPh.D., noM.D. He probably even knows I got the degree under duress, years later, because Antalcu said we needed all the paper we could get if the department was going to survive. I know what he's doing, and he knows I know.

"The people I represent are caring people, Doctor. Their cause is a good one. They're not what you're accustomed to working with, and they've retained me simply as a program consultant, a resource locator. It's all aboveboard, Doctor, completely legal, I assure you. But I really don't need to tell you any of this, do I?"

No, you don't.

I added that, legal or not, if he tried to see her again I would have him for harassment under the D.A.'s cooperation clause.

He laughed, and I knew then he had a law degree from one of the local universities. The suit was right. I could imagine him in it at the park that day.

You may be able to pull that with the ropes and \$150's you work with on the street, Doctor, but I know the law. I'll make you a deal: I'll stay away for the next three months, as long as you look after the girl's best interests, how's that?

I know there was more, so I waited.

My people will go on paying for weekly visits up to the eighth month, then daily throughout term, the clinic to be designated by them. They want ultrasound, CVS, and antibiotic/antibot treatments, and the diet and abstinence programs the girl's already agreed to. All you have to do is get her to her appointments, and we pay for it. Save the county some money.

I waited.

His voice changed as I'd known it would. The way they do in the courtrooms. I'd heard it change like that a hundred times before, years of it, both sides of the aisle. "If County can't oblige," he said, "we'll just have to try Forty A, right?"

I told him to take a flying something.

Maybe I didn't know the law, but I knew Forty A. In certain places it's known simply as Fucker-Forty. Under it—the state's own legislation—he'd be able to sue the county and this VR, advocate in particular for loss of livelihood—his, and hers—and probably win after appeals.

This was the last thing Antalcu or any of us needed.

The guy was still smiling.

You've kept that face for a reason, Doctor. What do young girls think of it?

I hung up on him.

With Antalcu's help, I got her into the Huntington on Normality, a maternal unit for redneck Ward B types. Some of the

other women had seen her on the news, two evenings before, some hadn't. It didn't matter, I thought. It was about as good a place for her to hide as possible. I told myself I was wrong. Everything's on computer these days, and some information is as cheap as a needle.

I got a call the next morning from the unit, saying a man had gotten in and tried to kill her, and she was gone.

I'm thinking of the ones I've lost, Lissy. The tenth-generation maggot casings on the one in Koratown, the dog locked for days. The one named Conseq, the one I went with to the morgue, where they cut up babies, looking for hers. The skinny one I thought I'd saved, the way I was supposed to, but hers lying in a pool of O-positive in a room covered with the beautiful pink dust they used for prints.

On the ones when I was a kid, East L.A., Fontana, the drugs taking them like some big machine, the snipings that always killed the ones that had nothing to do with it—the chubby ones, the ones who liked to read—the real who took Karenina and weren't gentle, the uncle who killed his own nephews and blamed it on coyotes, which weren't there anymore, hadn't been for years.

I'm thinking of the ones I've lost, Lissy.

I looked for her all day, glad to be out of the apartment, glad to be away from a phone that might ring with a sick lawyer's face on it.

When I went back to the apartment that night to pick up another change of clothes for the hotel room, she was sitting cross-legged by the door.

Lissy? I said, wondering how she'd gotten the address.

I'm sorry," she said.

She had her hand on her belly, holding it not out of pain but as if it were the most comforting thing in the world.

"He wants to kill me. He says that anybody who has an animal growing in her is a devil and is got to die. He fell down the stairs. I didn't push him, I didn't."

She was crying, and the only thing I could think to do was get down and put my arms around her and try not to cry myself.

I know, I know, I said. The symptoms were like Parkinson's, I remembered. You tripped easily.

I wasn't thinking clearly. I hadn't had more than two or three hours of sleep for three nights running, and all I could think of was getting us both inside, away from the steps, the world.

Maybe it was fatigue. Or maybe something else. I should have gotten her to a hospital. I should have called Mendoza for an escort back to his unit. What I did was get her some clothes from the bedroom, keep my eyes on the rug while I was in there, and lock the door again when I came out. She didn't ask why neither of us were going to sleep in the bedroom. She didn't



ask about the lock. She just held her belly, and smiled like some Madonna.

I took two Delmanes from the medicine cabinet, thinking they might be enough to get the pictures of what was in that room out of my head.

I don't know whether they did or not. Lissy was beside me, her shoulder pressing against me, as I got the fulon and the sofa ready.

Her stomach growled, and we laughed. I said, "Who's growling? Whose growling?" and we laughed again. I asked her if she was hungry and if she could eat sandwiches. She laughed again, and I got her a fresh one from the kitchen.

She took the fulon, lying on her side to keep the weight off. I took the sofa because of my long legs.

I felt something beside me in the dark. She kissed me, said "Goodnight," and I heard her nightgown whisper back into the darkness. I held it in for a while and then couldn't anymore. It didn't last long. Delman's a knockout.

The next day I took her to the designated clinic and waited outside for her. She was happy. The big amnio needle they stuck her with didn't bother her. She said, "She lived how much bigger her breasts were," she said, like a mother's should be. She didn't mind being careful about what she ate and drank. She even liked the strange V of hair growing on her abdomen, because—because it was hairy, she said, just like the thing inside her. She liked how she felt, and she wanted to know if I could see it, the glow, the one expectant mothers are supposed to have. I told her I could.

In the thinking of a ten-year-old, the one that used to tag along with me on the median train every Saturday when I went in for casebooks while most mothers had their faces changed, or played, or mothered. We talked a lot back then, and I miss it. She wasn't going to need a lot of work on that face, I knew—maybe the ears, just a little. If she was picky. She'd gotten her father's genes. But she talked like me—like a kid from East L.A.—tough, with a smile, and I thought she was going to end up a D.A. or a showy defense type or at least an exotic. That's how stupid we got. In four years she was into molecular opiates and trillones, and whose butt was that? The top brokers roll over two billion a year in this city alone, the local cap not a twelfth of that, their street dealers a fourth, and God knows what the guys in the labs bring home to their families.

It's six years later, and I hear her letting herself in on something. She's fumbling and stumbling at the front door. I get up, dreading it. What I see tells me that the drugs are nothing, nothing at all. She's running with a strange group of kids, a lot of them older. This new thing's a fed. I tell myself it's like not having your face fixed—like not getting the nasal ramification modified, the mandibular thrust attended to—when you

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could do it easily anytime, and cheaply, just because you want to make a point and it's fun to goose the ones who need goosing. That's all she's really doing: you tell yourself.

You've seen her a couple of times like this, but you still don't recognize her. She's heavy around the chest and shoulders, which makes her breasts seem a lot smaller. Her face is heavy; her eyes are puffy almost closed. She walks with a limp because something hurts down low. Her shoulders are bare and they've got tattoos now, the new metallic kind, glittery and painful. She's wearing expensive pants, but they're dirty.

So you have a daughter now who's not a daughter, or she's both boy and girl. The operation cost four grand, and you don't want to think how she got the money. Everyone's doing it, you tell yourself. But the operation doesn't take. She gets an infection, and the thing stops being fun, and six months later she's got the neurological response to some of the issues the doctors have slapped on her, and pain in the others. It costs money to reverse. She doesn't have it. She spends it on other things, she says.

She wants money for the operation, she says, standing in front of you. You owe it to her, she says.

You try to find the ten-year-old in those eyes, and you can't.

Did you ever?

The call came through at six, and I knew it was County.

A full jacket—ward status, medical action, all of it—had been put through. The fetus would be aborted—for the mother's safety—to prevent further exploitation by private interests and physical endangerment by spouse.

Had Antabou been there, she'd have told me how County had already gotten back from the board of supervisors, state W&I, and the attorney general's office over a VR like this slipping through and getting this much press. They wanted it over, done with. If the fetus were aborted, County's position would be clear—to state, the facts, and the religious groups that were starting to assemble bloody murder.

It would be an abortion no one would ever complain about.

The husband was down at County holding with a pretty fibrecast on his left hip, but they weren't taking any chances. Word on two interstate compromises to kill the ten women had reached the D.A. and they were, they said, taking it seriously. I was, I said, glad to hear it.

Mendoza said he liked sassy women as much as the next guy, but he wanted her back in custody, and the new D.A. was screaming jurisdiction, too. Everyone wanted a piece of the ten o'clock news before the cameras lost interest and rolled on.

Society wasn't ready for it. The tabloid fears were there. You could be on infomazines, you could have an operation to be

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both a boy and a girl for the thrill of it, you could be a wallpaper, but a mother like this, no, not yet.

I should have told someone but didn't. I took her to the zoo instead. We stood in front of the cages watching the holograms of the big cats, the tropical birds, the grass eaters of Africa—the ones that are gone. She wasn't interested in the real ones, she said—the pigeons, sparrows, coyotes, the cute hardy ones that will outlive us all. She never came here as a child, she said, and I believe it. A boyfriend at her one and only job took her once, and later, because she asked her to, so did a woman who warned the same thing from her.

We watched the lions, the tigers, the white bears. We watched the long-legged wolf, the sharp seals, the mees. We watched the tapes stop and repeat, stop and repeat, and then she said, "Let's go," pulled at my hand, and we moved on to the most important cage of all.

There, the hologram walked back and forth looking out at us, looking through us, its red sagittal crest and furrowed brow so convincing. Alive, its name had been Mark Anthony, the plaque said; it had weighed two hundred kilos. It had lived to believe it wasn't one of the two whose child was growing inside her, but she seemed to know this and it didn't matter.

They all did the same way, she said to me. "That's what counts, Jo. Anhed depression. I remembered tasting. Pal-

chef, hem-hemages, onchosis, renal failure.

Somewhere in the nation the remaining fertilized ova were sitting frozen in a lab, as they had for thirty years. A few dozen had been removed, thawed, encouraged to divide to sixteen cells, and finally implanted that day, seven months ago. Ten had taken. As they should have, naturally, since that was me. Sure, it could've been done back then—the cocky young resident with neuroborination written all over him had said, "All you'd have needed was an egg and a little plastic tube. And, of course—I didn't like the way he smiled—a woman who was willing."

I stopped her. I asked her if she knew what The Arks were, and she said no. I started to tell her about the intensive-care zoos where, for twenty years, the best and brightest of them, ten thousand species in all, had been kept while two hundred thousand others disappeared—the toxics, the new diseases, the land-use policies of a new world taking them one by one—how The Arks hadn't worked, how two thirds of the macrokingdom were gone now, and how the thing she carried inside her was one of them and one of the best.

She wasn't listening. She didn't need to hear it, and I knew the man in the suit had gotten his yes without having to say these things. The idea of having it inside her horns for a little while, had been enough.

She told me what she was going to buy with the money. She asked me whether I



*It's from home... Dear Alfred, hope you are having a nice voyage. Pity your ship
had to leave so soon, you missed the parade and fireworks.*

BODY

CONTINUED FROM PAGE 26

In 1987, Fisher and his team began working with Dr. Joseph Rosen, a Stanford University plastic surgeon, to develop medical uses for virtual environments. They are currently refining their first project: a computerized, three-dimensional human head with full skeletal details for use in teaching anatomy. The constructs for the head are now being stored on a database, and Rosen has estimated that it should be available to students next year. He is already designing another version of the head to enable plastic surgeons to create computer models of candidates for surgical reconstruction. If a surgeon needs to take bone or tissue from elsewhere in the body to replace a damaged or deformed area on the face, for instance, he may identify eight possible sites for harvesting the material he needs. Using the virtual environment, he can try each site in turn to see which works best—a method he could never use on a real patient.

Because the VIEWS project is less than a year old, Fisher says he can't predict precisely when medical students around the country will begin training with virtual environments. "It will probably be within the decade," he adds.

Telesurgery, on the other hand, is ex-

pected to take considerably longer to implement. "Any use of telesurgery in space is very far off—maybe one hundred years, maybe fifty years, but not twenty years," says Dr. William DeCampi, a surgeon at Stanford University Medical Center who is also an anthropologist and a member of the presidential Life Sciences Strategic Planning Study Committee as well as a member of NASA's new Space Station Science Advisory Subcommittee.

DeCampi believes that one medical use for virtual environments—as yet unexplored—might be in the rehabilitation of patients with neurological damage from stroke or illness. These patients must relearn such simple motor tasks as picking up dropped pencils. If they could use the virtual environment system with its electronic gloves, says DeCampi, it would accelerate the process of retraining their nervous systems. It would work like this: A physical therapist would be stationed at the controls. A patient would put his hands in the gloves. When the physical therapist released or contracted the muscles in his hand, the patient would "feel" those sensations. Fisher has talked with rehabilitation specialists about the possibility of using virtual environments to assess the movements a handicapped person can and cannot make within a particular setting—such as his apartment—as a step toward prescribing appropriate therapy.

DeCampi foresees a variety of ways in which virtual environments could be put to use to train medical students. One possibility he envisions is a series of "fantastic voyages." Wearing helmets, students could journey through veins and arteries, traversing neurons in a single bound, leaping synapses in the company of neurotransmitters, watching white blood cells engulf invaders in the bloodstream. The opportunities for studying the inner workings of the human body would be unparalleled.

"You could simulate a CT scan, place a tumor in the virtual environment, and have a medical student interpret it," DeCampi suggests. As a variation on this idea, he suggests creating a (virtual) trauma patient. Students could then analyze the patient's wounds, breathing patterns, EKG readings, and other data, making quick decisions just as they would in a true emergency situation. The student could interact with the patient, going through the motions of appropriate treatment, and the systems would give him the results of his actions, says DeCampi.

DeCampi and Fisher both stress their feeling that virtual environment training will greatly enhance the education future generations of medical students receive. "They will definitely play a key role in medical teaching," DeCampi asserts. And if better training makes better doctors of the students, all of society should benefit. □



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COMPUTER FISHING

For fishermen who spend half their time unsetting lines, Ryohi, a Japanese company, has built computer circuitry into a battery-powered fishing reel (at right). The petasium, lithium oxide, and graphite reel (\$299 to \$500) monitors the speed of the fisherman's cast, triggering a magnetic brake that eliminates reeling backlash.

—George Nishio

SUPERANTENNA

A new FM antenna from Perce of Wilmington, Delaware, uses a gelatin arsenide field-effect transistor to improve signal strength while holding signal noise. Perce president Steven E. Rosenthal says his Li-A model (left) "boosts signal strength on an audible sixty-four hours, well beyond the range of all other heated FM antennas." Price: \$59.95.

—George Nishio



EYE TYPER

The EyeTyper (right) lets those who can't speak "type" messages simply by looking at letters on an electronic keyboard. The letters then appear on a 40-character, alpha-numeric display screen, while a voice synthesizer

speaks the message. The EyeTyper can control home appliances, and it even works as a personal computer. Sentient Systems Technology of Pittsburgh is the manufacturer, and the EyeTyper costs \$3,495. —981 Lawrence



LEVITATING GLOBE

This six-inch world globe (right) floats in this air. Pacific Levitation of Vancouver, British Columbia, uses a position sensor and an electromagnetic to create the levitation effect. The novelty item will sell for \$109.99, and the company is also working on a floating deck set.

—George Nishio



BIKE RADIO

Some 28 states outlaw bicycling with headphones because they impair the cyclist's ability to hear traffic sounds that could warn of impending danger. One firm has now solved that problem with a bike stereo system consisting of a headset with two small speakers that latch on to the handlebars. The cyclist adds his own Walkman. The Tune-Tite (right) is made by Nevi Inc. of San Diego and sells for \$24.95. For louder sound an advanced version, Tune-Tite Two (\$24.95) has a booster amplifier powered by two AAA batteries. —Roger Field

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If you love yachting but hate getting seasick, try the 72-foot Chukness from SNAITH Ocean Systems in San Diego. It won't pitch or roll in heavy seas because the deck rides on four submerged hulls, each stabilized by a computerized gyroscope.

Chukness (right) endures at more than 20 knots in 6-foot seas, and its decks remain dry even in 11-foot waves. With appointments fit for a king, the price is \$2,999,999, down one dollar from last year.

—Shi Mengling



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EARTH

CONTINUED FROM PAGE 15

evacuation plan impossible. Without Dukakis's approval of an evacuation plan, under NRC regulations, Seabrook could not operate. On December 8, 1987, however, the NRC voted to amend the criteria governing off-site emergency planning when state or local governments decline to participate, thereby doing away with Dukakis's yes or no. The state of Massachusetts is expected to contest that ruling.

The Reverend Jesse Jackson is passionate in his support of the protection of our environment. He supports the Clean Air Act and believes that in order to reduce the hazards of radioactive waste, we should phase out nuclear power "to prevent nuclear accidents such as Three Mile Island and Chernobyl." By developing renewable forms of energy, Jackson states, we can cut down on the burning of fossil fuels, one of the major causes of acid rain. Although Jackson gets very good marks from environmentalists, he has no legislative record of accomplishment.

Senator Albert Gore says experts is probably the strongest candidate when it comes to environmental concerns. He chaired the investigative hearing that uncovered the hazardous-waste practices at New York State's Love Canal in 1978. He is also a principal author of Superfund.

In 1982 Gore was among the key legislators who uncovered corrupt practices at the Environmental Protection Agency (EPA). EPA administrator Anne Burford resigned under pressure after having been held in contempt of Congress for refusing to turn over documents subpoenaed by a congressional subcommittee. Gore also cited Rita Lavelle, manager of EPA's hazardous waste programs, for contempt of Congress for refusing to testify. Lavelle was indicted for and convicted of perjury and obstruction of justice.

Senator Paul Simon has never been an environmental mover and shaker, say activists. Still, Simon submitted a bill to the Senate in 1987 that would require half of all the gasoline sold in this country to contain a 10 percent ethanol blend—a corn-based, clean-burning form of energy. Right now only about 7 percent of our gasoline contains an ethanol blend—although every new car sold in this country is already equipped to burn such a blend in gasoline. Simon claims that in addition to expanding our oil supplies and making us less dependent on Middle East oil, ethanol gas will help curb air pollution. Environmentalists contend, however, that ethanol may further deplete the ozone layer.

Simon insists that high-sulfur coal must still be used as a source of energy, even though it has been shown to contribute to acid rain. His solution is to support research that will find ways to cut dangerous high-sulfur emissions produced from burning coal. □

Quizzical eccentricities
Are you as mad as a great inventor?

GAMES

By Scott Morris

The light bulb, the telephone and the phonograph are such ordinary parts of our lives that we take them for granted. Their creators, however, took nothing for granted. Eccentric individuals with peculiar visions of the world, they entertained ideas that others considered radical or just plain crazy. concludes Bryan Matimore, a new products consultant in Stamford, Connecticut.

Great success comes only to those willing to risk great failure," says Matimore, who has studied inventors' lives for a creative-thinking seminar he conducts.

Devising a multiple-choice test concerning inventors, Matimore mixed their truly bizarre ideas with a few of his own. He gave Quiz's edited version to members of the Inventors Association of Connecticut (IAC) and to a group of gifted seventh graders. One point was awarded for each correct answer, with a maximum score of 12 points. The scores among IAC members ranged from 0 to 8, with an average score of 3.9. The students did better. The average was 4.4, with a low of 3 and a high of 6. What surprised us was the frequency with which the correct answer turned out to be the one considered least likely.

If you have the courage to risk failure, try this quiz. Mark +1 beside your first choice as the answer to each question and -1 beside the one you think is most probably false. Then total your results. Give yourself one point for each correct answer, subtract a point every time



GOODYEAR



FRANKLIN



DA VINCI



EDISON



EINSTEIN



TESLA



BELL



EASTMAN

your "false" choice turns out to be the right answer.

Of 34 IAC members who were asked to score their choices for each question in the same way, only 14 registered positive totals. The average was just a little better than -1. The best score was +6 (the worst -7). If you score lower, don't be ashamed. Perhaps your thinking is so eccentric, so far beyond the ordinary you might have what it takes to be one of those crazy inventors... yourself!

GREAT ECCENTRICITIES

1. As part of his grooming regimen, Henry Ford would a) add pinches of sand to his toothpaste to increase its abrasive, tartar removing qualities b) dye his hair with rusty water c) keep the balls of his feet soft by applying a coating of

his own saliva to them nightly

2. Thomas Edison proposed to his second wife by a) recording the marriage proposal on his newly invented phonograph and playing it for her during a candlelit dinner b) tapping out the proposal in Morse code from his hand to hers c) making a movie of himself proposing on bended knee

3. Because he thought it would benefit his health, Ben Franklin would a) walk barefoot through the mud, believing it helped pragmatic thinking b) drink water only from a glass container that had been left out in the sun for hours c) take "air baths" by sitting naked in front of an open window and inhaling deeply
4. Nikola Tesla, who invented the alternating current (AC) motor, once tried to invent a device that

- a) diagnosed people's health by electronically reading their auras b) elicited memories when applied to various parts of the head c) photographed thoughts on the retina of the eye

5. George Eastman, inventor of the Kodak camera a) was a supporter of the 13-month calendar b) took a photograph of himself every day from age thirty-one to seventy-two c) invented a camera that when swallowed by cows took pictures of each of their four stomachs

6. As a health precaution, Alexander Graham Bell a) covered his ear with gauze every time he used the telephone b) covered the windows in his home to block out the harmful rays of the full moon c) drank his own urine
7. Edison was convinced



- a) the Germans were using a thought ray during World War I to control President Woodrow Wilson's mind
b) there were submicroscopic entities, or "little people" living in his brain
c) he would someday invent a pair of electronic goggles to see into the future
d) vulcanized rubber

8. Vulcanized rubber inventor, Charles Goodyear
a) considered making rubberized water beds for the ill
b) proposed that newspapers be printed on rubber
c) forswore rubber periscope rubber carpets, rubber blackboards, and even rubber bank notes
d) all of the above

9. Milken Gail Borden
a) had her tomb built in the shape of a condensed milk can
b) tried to sell condensed cow's blood as an ingredient in a salad dressing
c) yielded a public pool with

- milk to promote the idea that milk baths were good for the skin

10. Charles Hall, who invented a practical way to produce aluminum, theorized
a) a daily diet of seaweed could cure asthma
b) aluminum eyeglass frames would enable the wearer to better predict the weather
c) tobacco had snuffed out creative impulses during the previous 200 years
d) all of the above

11. Alexander Graham Bell
a) tried to get his dog to talk by teaching it to growl as he manipulated its mouth
b) charted the vibrations of his own voice on a piece of smoked glass by talking into a mounted ear with a piece of hay stuck in it
c) recommended that aspirin inventors reflect a small ant measure its velocity of transmission
d) all of the above

12. Hating unnecessary suffering, Rudolf Diesel once invented
a) an ammonia bomb that would confuse the enemy instead of killing him
b) an adhesive web fence as an alternative to barbed wire
c) a bag casting mud plov to trap soldiers in the mud instead of shooting them

- Answers appear below

CROSSWORD RESULTS

The entries for last November's *Omnigraffiti* H-I Crossword Puzzle poured in. After each was reviewed, the grand prize, and three first prize winners were randomly selected from an impressive 24 perfect scorers. The fact that the clue for number 120 across was incorrectly labeled 116 had little effect on our readers' ability to complete the puzzle (left), based on information in our grand prize, the sixth

edition of the *McGraw-Hill Encyclopedia of Science and Technology*.

Our grand prize goes to Donnell Tinklenberg of Santa Rosa, California. Our three first prize winners—Roger J. Donberger of Salinas, Michigan; John and Amy Pearson of Austin, Texas; and Willem Sales of Marion, Illinois—each receive the *McGraw-Hill Concise Encyclopedia of Science and Technology*, worth \$90.50.

We originally announced there would be five runner-up prizes, but we think anyone getting a perfect score deserves to be rewarded. So each of the following receives \$25. Sheila Bishop, Youngstown, Ohio; David Casmatek, Belgrade, Montana; Cynthia Desatinsky, Friday Harbor, Washington; Walter Dragan, Bristol, Wisconsin; Suzy Lewis Ewell, Colorado Springs; David Fowler, Gailburg, Maryland; Cindy Garlicks, Bridge water, Virginia; Rita Garlicks, Hallsburg, Virginia; Terry Garlicks, Bridgewater, Virginia; Maude Kerby, McClinton, Virginia; James Maci, Donald, Illinois; Maryland Glen Martin, Eau Claire, Wisconsin; Thomas Reynolds, Tampa; Don Rickenbaugh, Energy, Illinois; Michael Roe, Sebastopol, California; Eric Tentarek, Andover, Massachusetts; Ann Thomas, Ames, Iowa; Keith Thomas, Rapid City, South Dakota; Jo Yacovich, Naperville, Illinois; Richard Youngblood, St. Louis, Missouri.

ECCENTRIC ANSWERS
1 b, 2 b, 3 c, 4 c, 5 a, 6 b, 7 b, 8 b, 9 a, 10 c, 11 d, 12 a



LAST WORD

By Kathy Thornock

During the infamous Spanish Inquisition, vegetable vigilantes proclaimed all Veg-O-Matic manufacturers guilty of crimes against agronomy. They were sliced, diced, and jukenned by their inventions.

Brutalness. Cory McIntosh crouches behind a stack of pallets in Shred Number 6 of the Goo-Goo apple-picking plant. He clutches his rifle close to his body as his eyes search the building for a hiding place. McIntosh can hear the enemy. He knows that they feel none of the fear he is experiencing. For them, this is just another routine extermination.

"We always get our men." That's the motto. McIntosh thinks gloomily. Well, at least they chose an appropriate place for it to end—right here where I started.

McIntosh still remembers that day, 20 years ago, when his father, Jonathan McIntosh, unbolted the door to Shred Number 6 and drove his Heister in to get a bin of Granny Smiths.

He never returned. They found him that evening—cored, peeled, and impaled on his forkbills. He had been smothered with brown sugar and rotenone. McIntosh grimaces in anger as he recalls the headlines: KALU APRIL SAUCE THE BORS. Within hours, hundreds of sensationalized reporters had swarmed into town, probing for disgusting sensations of the "Boxed Rebellion."

McIntosh hated them all, but most of all he hated the scientists. "It's their fault," he mutters. "They just had to 'improve nature. For Some improvement.'"

The warehouse is quiet, but outside he can hear the apple commanders directing their troops. He hears the familiar crunch, crunch as they roll into attack formation. "There is no way I stand a chance against the entire Apple Corps," he groans. "I'm doomed."

Scientists had known that botanical engineering would alter plant life, but they had no idea that their experiments would result in the extinction of human life. At first everything went fine. Experiments in crossbreeding and gene splicing were successful. Then Green revolutionaries of the Eighties began experimenting with electroporation—the insertion of new DNA into plant cells. They created strong new superplants that were resistant to frost, heat, bugs, and herbicides.

Soon scientists were altering antisocial vegetation. Cactus DNA, inserted into corn kernels, was supposed to produce plants that wouldn't need irrigation. Unfortunately, Dr. I. M. Sporen poked his finger and got blood on the electrogun just before delivering the transfusion. The result, commando corn.

Scientists knew they had a problem when making ears began shucking themselves. Soon, however, their pranksters turned to lunacy. Without warning, maize militants seized the Corn Palace in Mitchell, South Dakota, and declared themselves the independent nation of Hominy. One particularly unruly band of oversize kernels established the Plant Liberation Organization (PLO), headed by an unkempt, worried stalk of bald corn named YesSir An'bu-Fat.

McIntosh knows that the apple guerillas

pursuing him were trained at PLO terrorist camps. If only he had acted sooner, McIntosh thinks furiously.

By the time people began to get worried, commando corn contracted the viral virus IDES (Immunity to destructive environmental stimuli). Scientists aren't certain what causes IDES, although initial studies indicate there may be a correlation between IDES and long-term exposure to the time used in tortilla factories. Within months an epidemic of IDES had spread throughout the plant kingdom.

A shoot interrupts McIntosh's musings. "Come on out, McIntosh. We know you're in there," McIntosh recognizes the voice of Mr. Green Genes, the ferocious leader of the Rambo Reds.

"You'll have to come in and get me machiaca," he shouts.

"It will be easier on you if you come peacefully. I'd rather not do to you what we did to Juice Newton."

McIntosh finches. "Barbarians."

His mind fills with gruesome pictures of the brutal Concord Grape Riots of 1990, in which bunches of meat-city street grapes killed, mutilated, and gang-graped thousands of Napa Valley residents.

Throughout the nation, menegade herbage weakened havoc (which is messy and smells bad). It was rumored that fruit lions, genius of human appendages routinely located battlegrounds, searching for arms and legs, which they stuffed into giant Ziploc bags.

Some people were particularly at risk from vegetable vigilantes. During the Spanish Inquisition, Veg O-Matic manufacturers were proclaimed guilty of crimes against agronomy and were sliced, diced, and jukenned by their own inventions. In California, rampaging Indian corn ambushed and scalloped Spuds MacKenzie, and gourmet herbal chefs popularized such exotic human entrées as Julie Child Plumble and Jane Fondaie. Even in San Francisco's usually peaceful Chinatown, bean sprouts starved vegetarians in communal works.

Despite his own predicament, McIntosh feels sorry for the vegetarians. Since the emergence of superplants, they were hunted by vegetables hungry for savings. In Asia the entire brown rice population thrived on vegetarians smothered in soy sauce.

"You'll never take me alive!" he declares. Suddenly he detects the sound of approaching helicopters. Above the noise, a voice calls out: "Stop! Stop! We have the ransom! Do not attack the warehouse."

Peeking from a crack in the door, McIntosh sees a man stepping out of the helicopter with two huge Ziploc bags. Despite the swirling dust, McIntosh recognizes Kernel Oliver North. Has come to swap arms for hostages. □

Kathy Thornock lives in Wenatchee, Washington, which has a sign welcoming visitors to the apple capital of the world.