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OMNI

JANUARY 1990

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Dutch artist Braldt Bralds originally created this oil painting for the cover of *The Sand Child*, a novel by Tahar Ben Gelloun. Currently based in the United States, Bralds says the illustration reflects the poetry and metaphor he found in Ben Gelloun's tale of androgyny

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OMNI (ISSN 0149-8711) is published monthly in the United States and Canada by Omni Publications International Ltd., 1965 Broadway New York, NY 10023-5965. Second-class postage paid at New York, NY and at additional mailing offices. POSTMASTER: Send address changes to Omni Magazine, Post Office Box 3041, Harlan, IA 51537-3041. Volume 12, Number 4.

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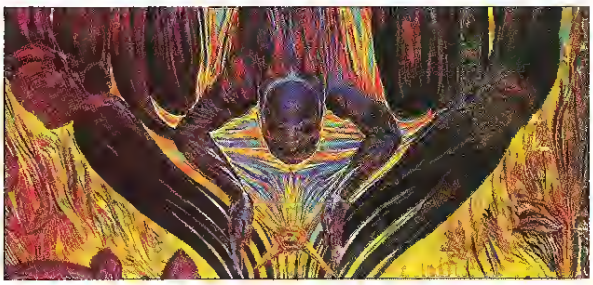

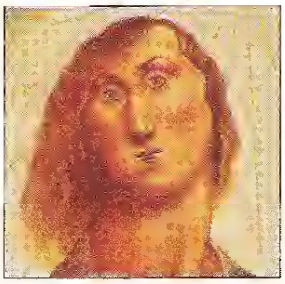

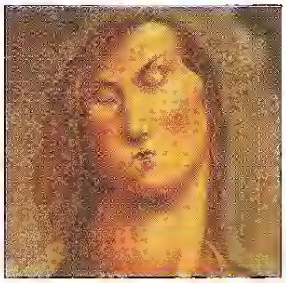

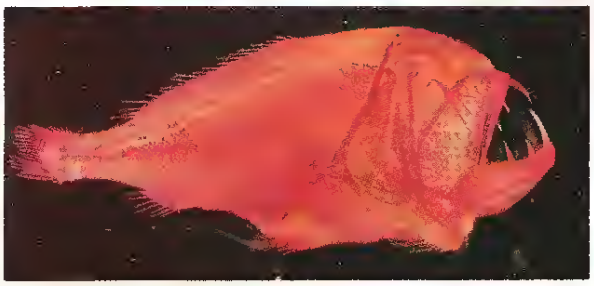

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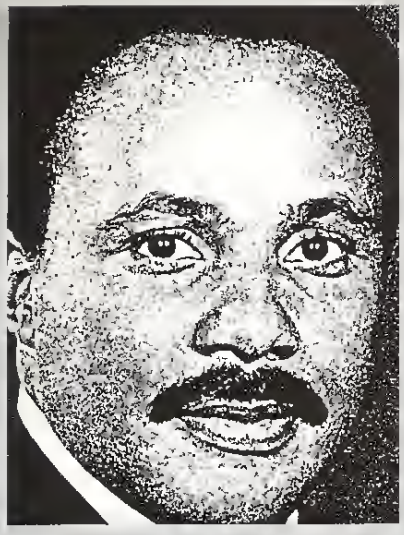

FIRST WORD

By Martin Luther King III

"Dazzling technological advances are revolutionizing the way we live and work. Yet these changes will mean little unless we secure for all the human rights needed to make democracy's promise real."

As we begin the final decade leading up to the millennium, dazzling technological innovations are revolutionizing the way we live and work. Yet these changes will mean little unless we secure for all the civil and human rights needed to make real the promise of democracy.

Despite the accomplishments in the struggle against discrimination we have seen in recent decades, the Eighties brought sharp reversals in civil rights progress. The Department of Justice drastically scaled back enforcement of civil rights legislation. The Supreme Court has all but shredded affirmative action laws that help combat discrimination in employment and education. And Congress drastically cut the federal budget supporting social programs.

A tone of hostility toward civil rights continues to reverberate throughout our society, and incidents of racial and anti-Semitic violence have increased. To stop these drastic reversals in equality, Americans must urge law enforcement agencies to prosecute institutions that continue to discriminate against minorities, women, and the disabled. We must also encourage Congress to support affirmative action and to adopt laws that leave no room for misinterpretation. Just last year, a Supreme Court decision weakened programs that gave minority and women contractors a fair share of economic opportunities.

We must also forge a national consensus in support of basic economic security as a civil right. African-Americans still suffer more than double the unemployment rate of white workers. In the private sector, few women and only one black American head Fortune 500 companies. And today about half of all black children live in poverty.

The key to the abolition of poverty for Americans of all races is full employment, defined as a job at a decent wage for every worker who wants one. We need to encourage government and business to invest in employment training programs that can help secure the right to a job at a living wage for every American. The rights to adequate housing and health care must also be firmly established if we are to assure decent living standards for all Americans. In addition, among industrialized nations only the United States and South Africa have retained capital punishment. Between 1972 and 1988 more than 700 African-Americans received the death penalty for killing whites, and 27 were executed. In the same period only 40 white defendants received the death penalty for killing blacks; none of the 40 convicted have been executed. I look with hope to the time when the United States joins the community of civilized nations that have abolished the death penalty. Freedom from murder by the state should be a civil right for citizens of all races.

We can't afford to assume that mere awareness of the rights and freedoms we hope to achieve will somehow be translated into the political process. We must act out our aspirations. In the Eighties hundreds of thousands marched for their democratic rights through the streets of Beijing, East Berlin, and Warsaw. Yet here in the United States half of the electorate, 90 million eligible voters, failed to vote in the 1988 presidential election, and only 9 million of 25 million eighteen- to twenty-four-year-old Americans vote at all.

A 1984 survey indicated that two thirds of those who didn't vote in the presidential election said that burdensome registration requirements prevented them from voting. Yet automatic voter registration has produced voter turnout rates in excess of 90 percent in other Western democracies. These and other election reforms can help strengthen our democratic rights.

To increase political involvement, civil and human rights activists should begin to coalesce their consumer power. We need to establish a network of selective councils that encourage corporations to embrace affirmative action and eliminate job discrimination, or else these councils might promote consumer boycotts of products and services provided by industries that refused to recognize the civil rights of an individual.

Ultimately our civil rights cannot be separated from those struggling for freedom beyond our borders. As my father, Martin Luther King, Jr., said, "We are all tied together in a single garment of destiny, caught in an inescapable network of mutuality. Whatever affects one directly affects all indirectly. I can never be all that I ought to be until you are all that you ought to be. And you can never be what you ought to be until I am what I ought to be."

A nonviolent movement can achieve the aforementioned human rights and set an example that will be emulated throughout the world. We will win the struggle for hearts and minds, not through our military might but through our moral power. And the dawning of the twenty-first century can herald a golden age of freedom for all people. ∞

Martin Luther King III is a member of the board of commissioners of Fulton County, Georgia.

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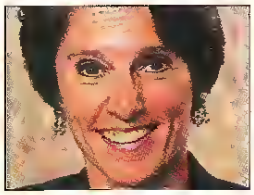
FORMAN


FLEMING

While researching "The Last Laugh?" (page 42), **Judith Hooper** began to believe the world was coming to an end. "I went through a few weeks of paranoia," she says. "But that passed after I looked at the prophecies and realized they didn't mention the things that threaten us today." Hooper and her "Last Laugh" coauthor, former *Omni* editor **Dick Teresi**, are also collaborating on *With the Buddha Wear a Walkman*, a book about mind expansion, to be published by Simon & Schuster.

According to Emory University professor of anthropology **Melvin Konner** ("Under the Influence," page 62), people are often reluctant to ascribe behavior to genetics. "We don't like feeling there are things we can't change," he says. "A trait may be genetic, but that doesn't mean you can't change it and still respect genetics." A collection of Konner's essays, *Why the Reckless Survive and Other Secrets About Human Nature* (Viking, July 1990), will include "Under the Influence."

Oxford zoologist Richard Dawkins's book *The Selfish Gene* profoundly affected the way **Thomas Bass** (Interview, page 58) thought about evolution. "It was one of those turn-your-world-around books," he says. And Dawkins was equally impressed by Bass's *The Eudaemonic Pie* (Houghton Mifflin, 1985), about scientists attempting to "beat the house" in Las Vegas and other casinos. Dawkins recommended it to his own publisher, Longman, which will produce a British edition of the Bass book this spring. And Houghton Mifflin will publish Bass's *Camping with the Prince and Other Tales of Science in Africa* next month.

Having worked in both the government and industrial sectors of the aerospace field for the last 17 years **Brenda Forman** was no stranger to Austrian space czar Johannes Ortner (Space, page 24). But lunching with him in Strasbourg, she says, was a study in contrasts. "Sitting in a sixteenth-century restaurant and drinking French wine, we were talking about Buck Rogers come true, which made the wine taste even better."

New York Daily News reporter **Robert Fleming** (Artificial Intelligence, page 28) was lucky to have even a phone conversation with Bell Labs' Arno Penzias. Having become frustrated in his innumerable attempts to contact the future-technology expert, Fleming was surprised when he finally met Penzias. "This guy has a warmth about him you don't usually find among scientists," says Fleming, who writes pulp crime novels under a pseudonym.

Currently working on a book titled *On the Dinosaur Frontier*, **Don Lessem** (Explorations, page 32) almost didn't make it to the Colville River, where paleontologists are unraveling the history of Alaskan dinosaurs. An early snowstorm disrupted his plans, and he found himself holed up for three days "with angry hunters in a space the size of a doctor's waiting room," he says. Then, once he got to the paleontologists' camp, he had to climb a 100-foot cliff, hike a mile, and descend to the dig site below. Lessem is a frequent contributor to *Smithsonian* magazine and the *Boston Globe*.

The author of *Verging on the Pertinent*, a collection of short stories published by Coffee House Press, **Carol Emshwiller** ("Looking Down," page 66) teaches creative writing at New York University. Her novel *Carmen Dog* (Mercury House) is due out in the spring.

A contributor to such publications as *American Heritage*, *Defense World*, and *Popular Science*, California-based **T. A. Heppenheimer** (Stars, page 22) wrote *The Coming Quake* (Times Books, 1988).

Former art critic **Sherry Baker** (Body, page 26) has specialized in science journalism for the past eight years, writing frequently for *Omni*. "I have no idea how I got into this field," she jokes, "although I sometimes think my life would make a good Antimatter column."

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JANUARY

LETTERS

COMMUNICATIONS

The Powers to Be

In their article "Future Trends" [October 1989] Marvin Cetron and Owen Davies envision a far drearier and more dehumanizing trend in social values than seems warranted. In their anticipated world we see little more than a continuation of twentieth-century lockstep Utopias. I see reason for greater optimism than this. Perhaps in the twenty-first century we will discover that state control is incompatible with life and that our social needs can never be met within institutions. A society that coerces its own members cannibalizes itself.

Butler Shaffer
Los Angeles

Czechered Cab?

Norman Bel Geddes's ideas did not go unnoticed ["The Shaping of Things to Come," October 1989]. In the Fifties Czechoslovakia produced a car similar to the one pictured, called the Tatra. It wasn't well accepted in the West, and only a few buffs bought one. Detroit laid Bel Geddes's designs to rest even though it spent more than $7 billion on them.

Sol Gillin
Ontario

Global Nuclear Defense

Arthur C. Clarke doesn't explain why he thinks nuclear deterrence does not work ["First Word," October 1989]. Is it not obvious that if Iraq and Iran had both had nuclear missiles in 1980, then each would have been afraid to go to war? Clarke is right to say that every dollar spent on the military could be more happily spent on other things, but the same could be said about spending for police. He says military spending is causing the United States to lose its high-tech edge to Korea but doesn't explain how that can be when South Korea also spends a big chunk of its GNP on its military. Meanwhile, Ireland spends very little on its military but has high unemployment and a large flow of well-educated emigrants going to the United States to find jobs.

Douglas Szczygelski
Dayton

Doing the Right Thing

According to "Moral Propaganda" [Continuum, October 1989], opposition to needle-exchange programs is "nothing more than prejudice." It is also puritan fanaticism, nurtured by America's backwoods mentality. The United States is basically a nation of backwoodsmen who were suddenly dragged kicking and screaming into the twentieth century. This explains our barbaric fundamentalism, Prohibition, the Ku Klux Klan, and the witch-hunt against drugs even if it spreads AIDS.

Mark Oller
Houston

Just Say Yes to Respect

Discovering the cellular neurobiological counterpart of addiction is a marvelous achievement ["Addiction and IQ," Mind, October 1989]. What I find troubling is the technological attitude of searching for yet another drug to break the addictive pattern. Biological intelligence has provided humans with an intricate system of checks and balances for survival. Learning how to use this intelligence for optimum functioning would change our drug-dependent, self-alienating society.

Jewel Richman
Oceanside, CA

To Err Is Human

Toronto's Spaced Out Library ["E.T. Phone Toronto," Books, October 1989] has more than 22,000 novels and anthologies, not 2,000 as reported. And the House of Elsewhere (not Elsewhen) is located in Switzerland, not in Scotland.

The correct title for Rick Lovell's painting on the November 1989 cover is *Days Between Stations*.

THE ORACLE AT SHATTUCK

FORUM

By Kevin McKinney

Will the United States have a woman president in the next 60 years? Will we establish contact with intelligent aliens by 2050? Could technological worship replace traditional religion? These are questions answered by Ken Uslabar's eighth-grade earth science classes.

The *Omni* Delphic Poll (October 1989) asked readers what they expect to see by the year 2050. There were no right or wrong answers. "To spur lively debate," Ken Uslabar had his Shattuck Junior High School students in Neenah, Wisconsin, respond to the poll and then discuss their opinions. "They had a great time thinking about their answers," Uslabar says. "We have a pretty optimistic group of kids here."

Life in the twenty-first century, judging from Uslabar's pupils, will embody exciting new technologies. The majority of the students, for example, say that voice-activated computers will advise us on psychological problems. How will they get around in 2050? Not by electrically powered cars but by easily handled aircraft. Roughly two thirds of the students say that scarcity of resources will make oil and coal more valuable than gold, and that lightning bolts will be captured and stored, becoming a major source of electricity.

Kids, of course, will continue commenting on the bizarre-looking, questionable contents of the cafeteria's food, but they don't think that hunger-satiating, time-released nutrition implants will usurp school meals. Lunch chat will certainly include opinions on the latest 3-D holographic movie, comparisons of mind excursions—dreamlike fantasies stimulated by brain–computer hookups, and fierce debates on the pros and cons of acoustic instruments versus computerized music—which wins among these science students by only a slim margin.

The future trendsetters, however, will probably not be taking their children and grandchildren on vacations to the moon; for 78 percent of them lunar resorts will not be "in." And most of them don't think humans will be traveling to our nearest star, Alpha Centauri. Even so, they do expect to see permanent observation satellites orbiting each planet in our solar system. Mining operations will be established on other planets. And 96 percent are positive that a manned mission will land on Mars.

Here on Earth, with its abundance of mysteries and undiscovered wonders, most of these students don't think every plant and animal species will be identified and cataloged by the year 2050. And of the 24 percent who said Atlantis will be discovered, many had never heard of the legendary land. But Uslabar says they assumed that if we asked about it, then someone should be able to find it. Well, why not? There are certainly others who have spent lifetimes searching for Atlantis.

As for exploration of the earth's interior, it was too early in the school year for Uslabar to determine how much his students already knew about earth science. Even so, 93 percent of them don't believe we'll be able to travel to the earth's molten core. Asked whether technology, land use, and architecture will combine to create a second Eden, more than 80 percent of the respondents say it's unlikely.

If these students are on the mark, doctors are likely to put away their scalpels in favor of noninvasive laser surgery. Slightly more than 50 percent of the students think in vitro correction of genetic disorders will be possible. The likeliest medical development in the next 60 years, according to 96 percent of the students, will be a cure for cancer.

The one thing Uslabar's students all agree will *not* occur: male pregnancy. Every one of the kids found that future alternative simply inconceivable by the year 2050.

As for the initial questions: Madam President *will* be inaugurated, according to 91 percent of tomorrow's voters in Uslabar's earth science classes. But 71 percent say she won't be speaking with E.T. in the Oval Office. And only 24 percent predict the rise of the Techno Worship Church.

Is male pregnancy on the horizon? That's one subject junior high-schoolers aren't ready for.

SHIFTY QUASARS

STARS

By T. A. Heppenheimer

Quasars drift near the edges of the universe, beacons so luminous as to outshine the brightest galaxies. If we could view one at close range we would see a titanic whirlpool formed from hydrogen and other gases, an immense, swirling mass spiraling into a vast black hole. As the gas approaches the hole, it congeals into a disc, spinning at speeds that approach the velocity of light. Gathering energy, the hydrogen flashes with the intensity of a star burst, swirls into the black hole—and vanishes like water down a drain.

This is the explanation of quasars that most of the world's astronomers work with and accept. But Halton "Chip" Arp, long a leading observer at California's Mount Palomar Observatory, takes a different view: Quasars, he says, are not perched on the universe's boundaries, nor do they drain into black holes. In the world according to Arp, quasars are hot material ejected from nearby galaxies, newcomers to the universe rather than discs of gas on their way out the door. Because of this view, Arp has suffered the fate of a heretic. His colleagues have barred him from using their telescopes. Today the sixty-two-year-old Arp is not observing at Mount Palomar—or anywhere else, for that matter. Nor is there any chance in the near future that he'll be allowed to use optical telescopes to continue his work.

While he was in favor, Arp was one of the brightest of the young astronomers who gathered around the California Institute of Technology (Caltech) during the Sixties. Commuting regularly to Palomar and other major observatories, Arp became a star, and as his reputation grew, he set out to challenge his colleagues by presenting them with series of unusual, puzzling photos. Indeed, his *Atlas of Peculiar Galaxies* is a detailed guide to weird objects his telescope plucked from the night sky.

Arp's next step would take him into an astronomical Twilight Zone, a one-way trip resulting in an obsession he could neither avoid nor turn from. As he recalls, "It was a snowy night at Palomar, two or three o'clock in the morning, and I was in the library." While looking at regions surrounding some torn-up galaxies, he realized he was finding quasars nearby. "And that's when the whole thing suddenly became sensationally difficult. Because I realized, looking down this long tunnel into the future, that quasars must be associated with nearby galaxies."

His revelation ran completely counter to the reigning scientific axiom. Quasars weren't on the edges of the universe, they just looked that way. As Arp drew his conclusions, he saw trouble. The source of the trouble was what astronomers call the redshift, the measure of how fast a galaxy or other object is moving in space. Quasars, from the moment of their discovery, had excited astronomers because they had redshifts so large that they evidently were flying outward at velocities close to the speed of light. This seemed to suggest that they were very distant, near the outermost parts of the universe. But now Arp, examining his plates on that wintry night, was finding reason to declare that the large redshift quasars were in fact the companions of nearby, small redshift galaxies. In the astronomical world, it was almost as startling as if he had declared that the world is flat.

But while his photos were suggestive, there was still a problem. If quasars are indeed the children of nearby galaxies, how do you explain their large redshifts? Here Arp had little to say. And this was the key to his downfall, for with no clear theory to connect the mismatched pairs, it was tempting for his colleagues to downplay his ideas. In short, nobody believed him.

By 1983 he had been quasar watching for more than 15 years. Then a

CONTINUED ON PAGE 94

They're luminous, spill into black holes, and got one scientist branded a heretic.

ALPINE BET

SPACE

By Brenda Forman

Johannes Ortner orders our wine in fluent French and directs an endearment, in his native German, to his wife, Martina. Then he turns back to me and continues in slightly accented English to discuss the Austrian Space Agency (ASA), of which he has been the managing director since 1974.

Ortner is almost fifty years old, with thinning brown hair and an almost mournful face, which is transformed by a radiant smile when he talks about space. Thanks in large part to his enthusiasm, persuasive powers, and determination, Austria's space industry has also been transformed—enough so that the country is now a full-fledged member of the European Space Agency (ESA). Ortner has even broader horizons in mind. He is looking for prospective partners beyond ESA to make Austria a valued participant in the increasingly complex international cooperative space projects of the future.

This trend toward international space cooperation is reflected in Ortner's own globe-trotting career. In 1960, just out of college, he assumed the leadership of Sweden's first space project, a sounding rocket launched into a suborbital flight path from Kiruna, a site north of the Arctic Circle.

A new challenge presented itself in 1962, when a group of European nations initiated the studies that led to the formation, in 1965, of the European Space Research Organization (ESRO). The Swedish government sent Ortner as a representative, and he wound up working at the ESRO until it became the ESA.

Austria had been gradually developing its own space program since 1969, when the Austrian Academy of Sciences opened its Institute for Space Research in Graz. The country collaborated in a number of projects with other spacefaring nations: with the Soviet Union on the Venus-bound *Venera 14* probe, the *Vega 1* and *2* probes to Halley's Comet, and most recently the failed *Phobos* mission to Mars, and now with ESA's development of the Ariane 5 rocket and the Hermes spaceplane. Austria has also chaired the United Nations Committee on the Peaceful Uses of Outer Space since its formation 27 years ago.

In 1973 Ortner left ESRO and returned to Austria to establish its space agency and to bring the country into ESA and into space business at the same time. Austrian companies were reluctant to make the big up-front investments, such as for clean rooms and special equipment. "Their first question was always, 'How many can I sell?' " says Ortner. "The answer of course was, 'Maybe an engineering prototype and a couple of flight models.' When they would ask if they would get follow-on contracts, I had to tell them that there were no guarantees."

The breakthrough came when ESA decided to build *Spacelab*—the pressurized experimental module that fits into the bay of the U.S. space shuttle. Austria got the subcontract to build the lab's windows—in engineer-speak, its viewport adapters. The success of the windows has galvanized the Austrian space community. "We have now three times the capacity we need," says Ortner.

Austria: The little country that could

Having overcome the hurdle of developing a space industry, Ortner and ASA turned to developing a manned mission. It began with a Soviet invitation to fly an Austrian cosmonaut on *Mir*—an attractive proposition, since the shuttle was (and still is) booked long into the future. The Soviets will train two Austrian cosmonauts and fly one (the other is a backup) to *Mir* for an eight-day mission. The flight is now planned for November 1991.

As for the long-term future of the ASA, Ortner says, "It's time for Austria to branch out in the world and start building joint ventures beyond ESA with space companies in the United States and elsewhere." To facilitate this expansion of Austrian space business, Ortner himself plans to acquaint U.S. firms with Austria's diverse capabilities by visiting aerospace shows, exhibits, and meetings around the world. At these he will promote his nation's abilities to produce laser communications gear, space software, and electrical power distribution systems and to manufacture satellite structural parts.

Perhaps this plan to travel the earth touting Austria's spacewares is more of the wanderlust that carried him from the Arctic Circle to the ESA launch site in French Guiana. Or maybe it's part of his commitment to space expansion through international cooperation. "The international flotilla to visit Halley's Comet is the only time the world has done that sort of thing so far," he says. But there is a gleam in his brilliant blue eyes when he says it, as if to suggest that it shouldn't be the last. ∞

VIDEO VÉRITÉ

BODY

By Sherry Baker

The woman being operated on is awake and cracking jokes. Although her surgeon will be removing benign growths and scar tissue spread throughout her reproductive tract, he has chosen to use a new technique that allows him to operate without opening his patient's abdomen. He will slip all his instruments through three tiny cuts near the woman's navel and pubic bones. A miniature camera attached to one of the instruments will transmit a view of her organs—magnified up to ten times—to a nearby video monitor. Instead of bending over the woman to peer into her abdomen, the surgeon will manipulate his tools according to the images he sees on the monitor. And some physicians think that this innovative system could revolutionize surgery in the twenty-first century.

At Atlanta's Northside Hospital, the procedure is already an everyday event. Camran Nezhat, director of the city's Fertility and Endocrinology Center, pioneered this surgery and trains doctors to do it in quarterly workshops under Northside's auspices. Called videolaseroscopy, the technique combines lasers with medical telescopes called laparoscopes, tiny cameras and video monitors that ease the stress of delicate surgery for both patient and doctor. Doctors currently use videolaseroscopy primarily for surgery on the female reproductive tract. Yet Nezhat believes surgeons will adopt the technology for a wide variety of operations early in the next century. Within 20 years, he says, even cardiac and stomach surgery that now call for a week's stay in the hospital will be done safely and quickly on an outpatient basis. The advantages for patients are obvious: minimal pain and exterior scarring, less time lost recuperating, and less money spent on hospital expenses. Laser surgeons who now work bent over their laparoscopes will operate accurately and comfortably, standing upright and following their progress on the monitor.

Using videolaseroscopy, Nezhat has treated nearly 4,000 women. He has successfully removed tumors, ovarian cysts, and ectopic pregnancies and reversed infertility due to scar tissue caused by endometriosis, a disease believed to affect up to 10 million American women. In endometriosis, pieces of the uterine lining, which normally develops and sheds over each menstrual cycle, migrate *outside* the uterus. The tissue then spreads through the reproductive tract. Like the uterine lining, the displaced tissue responds to monthly fluctuations in estrogen and progesterone and bleeds during menstruation. The result is intense pain, scar tissue, and infertility.

As the operation begins, Nezhat inserts his instruments and camera through three tiny incisions in his patient's abdomen and manipulates them by coordinating his movements with the images he sees on the screen. Once inside the body, the camera scans its territory. Nezhat eyes the monitor, now filled with a view of his patient's diaphragm. When the surgeon maneuvers the camera, the scene shifts to soft, pastel-colored balloons stippled with blue veins—the patient's bowels—and a glistening white form curled like a snail—her appendix. So far, everything looks normal. Then the lens zooms toward the woman's reproductive organs, revealing the endometriosis responsible for her infertility. One ovary has disappeared under a net of scar tissue where a cyst exploded; other organs are plastered together with spider-weblike adhesions of endometrial tissue. Nezhat touches a foot control, activating the laser. Flickers of light illuminate the monitor as the laser beam zaps the scar tissue, drains the cysts, and vaporizes the endometriosis, leaving healthy tissue intact and blood vessels sealed.

Internal affairs: Faster uterine surgery

In most cases, microsurgeons use a procedure called a laparotomy to open their patients' abdomens. Patients spend up to six hours in surgery, a week in the hospital, and a month or more recuperating at home. Experienced surgeons can do videolaseroscopies in as little as 30 minutes, and the most complicated procedures take three hours. Nezhat's patient will leave the hospital within hours of her surgery and return to work in several days. In two months the thirty-year-old woman will get pregnant for the first time.

"My concept is to keep the abdomen closed and thus prevent contamination with air and exposure to hot, tissue-drying lights," says Nezhat. "We don't even put sutures in. The result is a quick recovery with far fewer new adhesions."

Over the last several years, Nezhat has taught videolaseroscopy to 2,000 physicians from around the world. It takes time—four to five years, he estimates—for the aver-

CONTINUED ON PAGE 56

RESTRAINING ORDERS

ARTIFICIAL INTELLIGENCE

By Robert Fleming

How smart machines will affect our daily lives has troubled scientist Arno Penzias for more than a decade. Will we become dehumanized and lose our survival skills and creativity under the computer's growing influence?

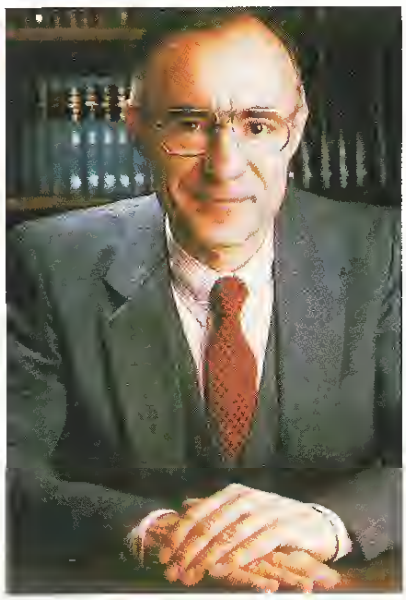
Using insights gained from his work as a leading scientist and researcher for AT&T Bell Labs, the soft-spoken, bespectacled Penzias, fifty-six, says that there could be serious problems ahead in the current information revolution. He advocates a careful reassessment of the role of the computer and other technologies in modern society in order to get the most out of our scientific advances. A major problem: mechanization with the human touch, versus a passionless use of technology concerned only with efficiency and research.

"I think that we can direct technology to get us the best of both worlds," says Penzias, who won the 1978 Nobel prize for discovering cosmic microwave radiation at the fringes of the galaxy, confirming the existence of waves remaining from the fabled Big Bang that gave birth to the universe.

"Decisions made by computers and committees cannot displace the need for thinking and feeling human beings in positions of responsibility," he says. "There are walks of life that seem to offer little more than the gratification of avarice, like playing the stock market. But for many others, work strives to make a meaningful difference in some aspect of the world we live in. Making this difference on a global scale will take the best use of our society's minds and machines."

Penzias warns against humans developing an overreliance on machines in an attempt to meet the demands of contemporary life. He cites the 1987 meltdown of the New York Stock Exchange as an example. "Whenever you rely on something and it breaks down, you're in trouble," Penzias says. "To get around this, you don't rely completely on one system. Humans can deal more easily with the unexpected than computers, which are geared to follow a specific scenario. But in the future, as machines become pictorially oriented and less reliant on symbols, we'll get away from this danger of system failure."

Penzias sees computers and other information systems shrinking in size, while increasing their capacity for analysis and logic. This may eventually help them get around what he now considers their major problem: that smart machines of today require rigid sets of rules to govern their behavior. In his 1989 book *Ideas and Information: Managing in a High Tech World* (W. W. Norton) he compares the rigidly defined terrain of computer logic with the improvisational thinking of Sir Arthur Conan Doyle's Sherlock Holmes. Holmes, in Penzias's view, uses his intelligence to distinguish between the truth and lies presented as fact. This is what separates man from machine, Penzias notes, for no machinery exists today with the human ability for judgment or opinion.



Penzias: Keeping an eye on smart machines

In the future, Penzias says, the development of smarter machines may be linked to the development of human potential. "That potential is often tied to the development of better technology and better tools," he says. "In a world of information, we seem bound to computers, machines that help some to move ahead, others to remain in their accustomed places, and still others to move backward. Technology controls the flow of information and ideas. Sometimes it works fitfully. A properly managed flow of information often separates winning organizations from losing ones. Both technology and people have room for growth."

Since Penzias frequently speaks out on the need for a better application of science and technology to meet the ever-increasing demands of the modern world, he is considered controversial by some, who argue that he doesn't act like a scientist. His response: "Sure there are those who say that I'm controversial, but there are a lot of people who don't believe in technology."

He believes, however, that this will diminish as machines intrude more and more into our daily lives. "Systems will take over the more menial, repetitive tasks," he says. "All of us will be affected in some way. But as time goes on, the fears about machines will lessen. If the technology had remained frozen at its 1970 level, then dehumanization might have taken place. But technology has progressed. As machines improve and become more powerful, they become less ominous. We are finding more ways to make them increasingly useful and productive."

DINO THAWS

EXPLORATIONS

By Don Lessem

There is something peculiar about the dinosaur fossils of Arctic Alaska—and important, for they may allow scientists to re-create dinosaurs 65 million years after the last one perished.

Pick up any animal fossil and you can feel its heft, the weight of the stony minerals that have seeped into the bone. But fossils are not bones turned to rock. Rather, once-living tissue provides the nucleation sites, places within the bone where invading minerals can form crystals. A crystal mineral network then develops in the spaces within the bones, creating a dense fossil.

Minerals, however, did not replace soft tissue in the bones excavated from the banks of Alaska's Colville River west of Prudhoe Bay. "They're as light as balsa wood and look as fresh as yesterday's dog bones," says Canadian paleontologist Phil Currie, who has examined many of the Alaskan fossils.

For more than 65 million years the remains of vegetarian duck-billed dinosaurs and other creatures lay buried in the now-frozen tundra, which was once a coastal swamp with a subtropical-to-temperate climate. For tens of millions of years the bones were entombed in sand and silt. Then with the coming of Alaska's Ice Age, they were placed in deep freeze.

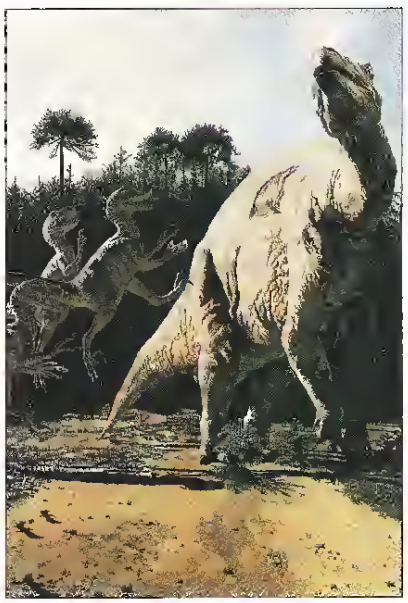
Gordon Curry, a geologist at the University of Glasgow, began examining the long-frozen souvenirs in 1984. Like geologists at the University of Illinois and biochemists at the University of Leiden in the Netherlands, Curry is deeply immersed in molecular paleontology, a new branch of science little known to most paleontologists and geologists.

Until recently, the structure of the earth's organic compounds had been largely a mystery. Death, decay, and fossilization were long thought to destroy the familiar structure of organic material containing proteins, the peptide sequences of amino acids that are the building blocks of life. But, Curry says, "some of the more resistant organic molecules can be incorporated into rocks with only minor changes." These geochemical fossils, or biomarkers, have broken down into their constituent amino acids but are still sufficiently preserved to enable scientists to track molecules to their origins.

Curry says the sequences of molecules that form amino acids differ from species to species and from individual to individual. DNA contains this genetic code, but DNA is locked in soft tissue cells and is seldom preserved in recognizable fossils.

Amino acids, however, are preserved in many fossils and can now be detected in the laboratory in almost incomprehensibly small amounts.

Challenged by an appropriate antibody, fragmented proteins produce a detectable chemical reaction. And in their attempts to investigate proteins that may be present in the Alaskan fossils, Curry and his colleagues are now using osteocalcin, a monoclonal antibody effective on fossils up to 70 million years old.



Is there life in those old bones?

"The fossil molecules could tell us a lot about what group these dinosaurs belonged to," Curry says. "We may be able to sort out the evolutionary pathways."

Curry believes that in a few years he'll be able to determine whether a previously unidentifiable, minuscule fossil fragment came from a duck-billed or some other dinosaur. He may further peg the creature to its nearest biological relatives. And based on hard evidence, he may answer at least some of the vexing questions of dinosaur evolution, such as whether dinosaurs were reptiles or birds. "We might also tie down the rate of evolution, build up data on how quickly they were changing per million years," he says.

"If such information can be recovered from any dinosaur fossils, it seems likely it'll be from the Alaskan bones," Curry says. "They are among the best we've examined: very good quality, well preserved, and overly rich in amino acids."

What particularly excites Curry about the Alaskan bones, however, is that "their structure was porous and the fossils were not remineralized." Therefore, in their deep freeze, the Alaskan bones may have preserved some of their DNA. "We might be able to regenerate a piece of dinosaur, a very small part of molecule but still a dinosaur's," he says.

Although Curry cautions that he's a long way from actually bringing dinosaurs back to life, Phil Currie thinks it might eventually be possible to remake an entire dinosaur—by working in reverse. "You don't have to build up dinosaur DNA," he says. Knowing the sequence of proteins in dinosaur DNA, according to Currie, a firm believer that some dinosaurs were the ancestors of birds, "you could manipulate living bird DNA to re-create their ancestors."

CONTINUUM

A SEVERED SOUL

I opened the front door to my office and faced a woman who could have been beautiful if her expression had not been tinged with sadness. Her features were delicately chiseled, a perfect nose, large blue eyes that stared squarely into mine. Her simple black crepe dress fell to her knees, she carried a matching black silk purse. "Please come in, Mrs. Winthrop," I said. And so we began a voyage together that would last five years. Nancy Winthrop came to me diagnosed as a paranoid schizophrenic. She had been institutionalized on numerous occasions, medicated, and given electroshock therapy. Because of her "history of mental illness," as psychotherapists say, she felt no one would want to have anything to do with her. I was dealing with a woman who believed she lived in real danger, one that might destroy her unless I gave her new strengths in her four weekly visits. Such a state of mind is inherent in those who believe others are out to kill or harm them. Although there is no realistic basis for their fear, those who suffer from paranoia are convinced they are in danger. They believe nobody loves them, everyone hates them, and not a soul wants to help them.

To this day the schizophrenic has been viewed by most people—and by the majority of psychiatrists and other therapists—as subhuman, crazy, animallike, and terrifying. The schizophrenic's speech sometimes does not make sense. He hears voices, if he is catatonic, he will not utter a word. Or he will talk continually about impulses most of us usually repress—sexual or violent feelings and wishes. These include committing incest, manifesting acute dependency, wanting to be the opposite gender, and other forms of what analysts call polymorphous perversity. Contrary to conventional popular and professional belief, I am convinced the person who suffers from schizophrenia is more acutely aware of pain, grief, and trauma to the mind than the average human being. When the schizophrenic experiences grief, it is likely to be more devastating than the grief of most of us.

Every practitioner of psychoanalytic therapy with schizophrenic patients is invariably asked, "Is there a genetic disposition toward schizophrenia?" Most of us who conduct psychotherapy with schizophrenics believe the primary roots of schizophrenia lie in the patient's early life with his mother and father. Those who use as "curative" [illegible] procedures as insulin injections, electroshock [illegible] the schizophrenia to the patient's [illegible].

While everyone is a product of [illegible], I believe that no one will become [illegible] experienced an early environment with [illegible] not only him but each other. I have never [illegible] where there was a consistently loving en[illegible] hood. I have also noticed that when the schizophrenic [illegible] vided with a constant warm environment by the [illegible] petent, caring therapist, he invariably improves.

If schizophrenia were solely a genetic [illegible] be affected by human encounters alone. [illegible] never rule out the fact that all of us are born [illegible] nerabilities that affect our emotional autistic [illegible] ment, energy level, and intelligence—[illegible] react to us and how we experience their [illegible] our emotional life more than anything else. All [illegible] strengths and limitations, whether we are emotionally [illegible] ture, neurotic, or psychotic. We become [illegible] situations we feel are dangerous. We may become [illegible] sensitive and suspicious, deeply afraid of [illegible]. The child, man, or woman labeled schizophrenic [illegible] strengths and limitations. His hypersensitivity and [illegible] are similar to everyone else's, only at times [illegible].

Just as I had to understand Nancy's [illegible] to understand her mental health. There were [illegible] life that had helped her become a capable [illegible] measure of her mental health that she sought [illegible] sis after so many fruitless, painful experiences [illegible].

The schizophrenic patient needs what [illegible] need to grow and develop—understanding, [illegible] love, and empathy. Humane attitudes [illegible] helps the schizophrenic face his conflicts [illegible] a functioning human being able to [illegible].

—DR. HERBERT S. STREAN AND LUCY FREEMAN

Excerpted from The Severed Soul: A Psychoanalyst Reveals How to Heal the Mind of a Schizophrenic *by Herbert S. Strean and Lucy Freeman, St. Martin's Press, 1990*

CONTINUUM

Siftin[illegible] celestial [illegible]lable materials

MOONRAKERS

Besides craters and some nifty space hardware, there doesn't seem to be much on the moon right? Wrong, says Brandt Goldsworthy president of Alcoa Goldsworthy The moon, he says, is filled with the materials needed to make fiberglass

A few years ago Goldsworthy had an inspiration "It occurred to me," he recalls, "that if you could make composite fibers from material on the lunar surface, it might be the easiest way to build the structures you'd need to start a lunar colony" In fact, he and his colleagues have already made fiberglasslike material out of "lunar simulant'—rocks mixed to duplicate the chemical composition of moon rocks

The next step is to find a way to produce the heat energy needed to transform moon rocks into fiberglass That's where the aerospace company McDonnell Douglas comes in It has a spare parabolic solar concentrator capable of producing temperatures well above the 3 000°F needed to melt moon rocks, and it has agreed to lend the unit to Goldsworthy Testing to determine whether simulated moon rocks turn into fiberglass when heated will begin sometime this year Says Goldsworthy, 'If this works, we'll be able to build on the moon using materials that are just lying around'—Steve Nadis

THE RIPE STUFF

Some people swear they can spot a ripe watermelon by thumping it Others judge the ripeness of a cantaloupe by poking its bottom But how do you know about honeydews and casabas? 'You don't," says Gerald G Dull of the Agriculture Research Service at the U S Department of Agriculture (USDA) in Athens, Georgia In fact, he says, most people can't accurately tell when any type of melon is ready to eat

The days of guessing, however, may be over Dull and colleagues at USDA have developed a device that uses near-infrared light to analyze fruits and vegetables and register their ripeness 'The more infrared absorbed the sweeter the fruit,' Dull explains Unripe fruit may register only 6 percent sugar content on the meter, ripe fruit will show a sugar level of 9 percent or more Dull says the device should work on any fruit or vegetable in which "sugars or carbohydrates determine ripeness '

Although the meter is only about the size of a bread box (a computer is attached to it) it will have to be made even more compact for commercial use If instrument companies invest in the device, Dull believes that in a year from now, the meter will be in use out in the packinghouses to determine if the melons are ripe for shipping The price? Between $5,000 and $10,000 Further down the road Dull foresees a miniature meter for consumers "A lot of people joke about having one for their pocketbook to make sure the melon they buy in the store is ripe," he says "I dream a lot, and I do believe a pocket meter could eventually be developed"—Jane Bosveld

Technology may do away with the need to squeeze your melons

NUCLEAR POWER

Picture this scenario An enemy jet on a kamikaze mission manages to escape detection, slips past our radar screens, and heads straight for a nuclear power plant Would the walls shielding the nuclear reactor withstand the blow? Walter A von Riesemann, supervisor of the containment-technology division of the Sandia National Laboratories in Albuquerque, New Mexico may have the answer

Von Riesemann—whose intentions were to see what would happen if a misguided plane accidentally crashed into a reactor—took a surplus F-4 jet fighter, mounted it on a rocket-propelled sled, and crashed the whole thing into a million-pound block of reinforced concrete Damage was minimal The wall survived with only a small dent As for the jet, Von Riesemann says, "There were chunks of metal all over the place, but they weren't very big chunks"

At the experiment s conclusion, all parties, including representatives from Tokyo's Muto Institute of Structural Mechanics (which paid for the simulation), were secure in the knowledge that nuclear reactors could withstand such a strike 'We'd previously done some fairly accurate computer analysis, but the computer models couldn't replace the real thing,' says Von Riesemann

—George Nobbe

"No one can be good for long if goodness is not in demand"

—Bertolt Brecht

THE SNAKES OF WRATH

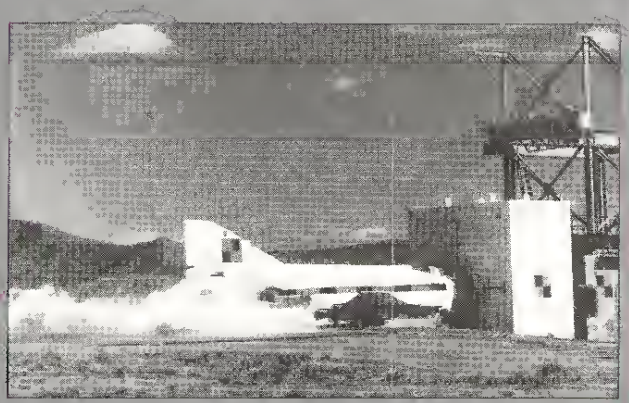
It's like a scene out of Hitchcock's *The Birds*, only this time it's snakes Huge numbers of brown tree snakes have hit the island of Guam like a hurricane They re dropping onto power lines, electrocuting themselves, and causing blackouts They ve eaten the local birds their favorite prey, into near extinction Now their hunger has drawn them closer to civilization—where there are rodents to feed on Consequently, they've bitten a number of people, of whom at least three have needed emergency treatment

Scientists studying the situation are trying to figure out why and how the snakes increased their numbers so dramatically—and whether the population explosion will sustain itself Others are eager to devise strategies for preventing a similar explosion in nearby islands including the Hawaiian islands But still more are trying to discover why the bite of these supposedly nonvenomous snakes has caused such severe reactions in people—similar to, but not the same, chemically speaking, as an allergic response

Unlike cobras and rattlesnakes, which have poisonous fangs right up front, the brown tree snake has long teeth at the back of its mouth Kenneth V Kardong, a zoology professor at Washington State University, has found that the brown tree snake s fangs secrete a toxin, but he says it's "probably there to help the snake digest food, not to poison enemies" Kardong will try to determine whether this toxin poses a widespread threat, given the large number of snakes on the island

—Dava Sobel

A toxic turn Paradise has been lost on the island of Guam ever since mobs of snakes slithered into the ecosystem



Concrete evidence Could a rabid fighter jet bring down the walls of resistance? To find out, an F-4 rams into some opposition

"We are going to have to find ways of organizing ourselves cooperatively, sanely, scientifically, harmonically and in regenerative spontaneity with the rest of humanity around earth We are not going to be able to operate our spaceship earth successfully nor for much longer unless we see it as a whole spaceship and our fate as common It has to be everybody or nobody"

—Buckminster Fuller

"The beneficiaries of incredible change are naturally conservative"

—Hugh MacDiarmid

CONTINUUM

AIRLINER STRESS TEST

It started with a sudden whooshing noise 24,000 feet over Hawaii. Then part of the top section of Aloha Flight 243 tore away, sucking a flight attendant out of the plane. Sixty-nine passengers suffered injuries by the time pilots landed the crippled Boeing 737. An inspection by the National Transportation Safety Board later determined that the April 1988 near disaster was caused by cracks that had spread through the plane's internal frame.

Aeronautical engineers have long known that the stress of repeated landings and takeoffs, as well as fatigue caused by pressurizing and depressurizing, can cause cracks to form in a plane's skin as well as in its internal frame. Until recently ground crews relied primarily on visual inspection to check for cracks. But Physical Acoustics Corporation of Princeton, New Jersey, has now developed a sensing system that pinpoints cracks by listening for the telltale sounds they emit.

Here's how it works. On the ground the inside of a sealed airplane is filled with pressurized air, prompting its skin to bulge slightly. This pressure causes any cracks to pop slightly, and the sounds are detected by about 100 acoustic-detecting sensors placed on the outside of the plane. Then a computer pinpoints the exact locations of the cracks, notes their locations, and alerts ground-based maintenance crews.

These acoustic-emission sensors let us look at a plane from the outside and tell us what's going on inside," says company vice-president Thomas Welch. The device is especially well suited for locating cracks of the "subsurface" variety, invisible to human eyes because they form within the plane's joints, bulkheads, and internal frame stringers, the structural pieces that hold an airplane together.

Welch says the firm hopes to win Federal Aviation Administration approval for the method and plans to refine the system so that it will generate a picture of each plane, complete with color coding to identify cracks. He says the procedure also works for other systems that need to be kept airtight, such as helicopters and railroad cars carrying toxic materials.

—George Nobbe

Sounding off: You can't see cracks in an airplane's frame, but you can hear them before they begin their lethal journey.

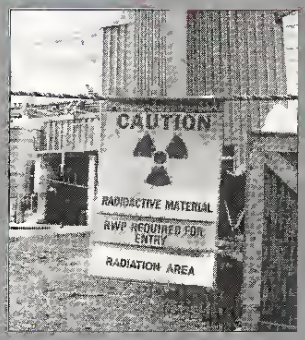
MIRROR IMAGE

Ask any astronomer the nursery rhyme he loathes most and he'll probably recite "Twinkle, twinkle little star." The reason? That blinding starlight obscures the researchers' view of celestial bodies. Now, though, astrophysicists at Johns Hopkins University have developed a novel technique that takes the twinkle out, thus allowing them to glimpse far clearer images of distant suns and planets.

Getting a good look at the stars from the ground is tough because when their light is filtered through Earth's atmosphere, it becomes diffuse, dulling an astronomer's view. To combat that glare Johns Hopkins scientists developed a set of mirrors that can clean up images of stars and other celestial bodies in the Great Up There.

The detwinkler relies on sensors that determine where and how starlight is distorted. A high-speed computer then reshapes a flexible mirror—which is attached to the telescope—to correct the distortion. Johns Hopkins astronomer Samuel Durrance is enthusiastic, saying that with the detwinkler in place "ground-based telescopes can detect fine details one-hundredfold better."

Durrance believes nearly all Earth-based telescopes will be modified in this way in the near future. Testing continues at observatories in Chile, where the dark, clear sky already produces some of the clearest star images on Earth. —Alan Maurer



The picnic raiders have a new hobby. They dig radiation

ANT MISBEHAVIN'

In the late Fifties, when the Idaho National Engineering Laboratory buried its nuclear waste underground it didn't think much about harvester ants—quarter-inch long red ants known to dig as deep as ten feet. Could the ants be dredging up long buried radioactive material and incorporating it into their aboveground anthills? After studying 30 mounds, University of Idaho entomologist James Johnson concludes that the answer is yes.

"The amount of radiation in the mounds is about two to three times higher than levels you would expect to find," Johnson notes. He emphasizes, however, that the anthills contain relatively low levels of radiation. "It doesn't seem to be affecting the ants. They look happy and healthy and are reproducing successfully."

What kind of radioactive materials have the ants brought to the surface? Johnson won't say but notes that "two of the sites have wastes from nuclear reactors. These are old sites that would not pass current burial standards."

Johnson says it's possible that coyotes could dig into the mounds and spread the contamination. But even if an animal does that, most of the dirt stays right there, he says. 'Also, these waste sites are just a couple of acres fenced in within nine hundred forty-three square miles. I don't think that it's going to pose a significant problem.' —Sherry Baker

THE RED ROVER

Man may have been the first explorer to walk around the surface of the moon, but on Mars a robot will be taking the first steps on the surface.

In preparation for the upcoming unmanned mission to Mars, engineers at Martin Marietta have dreamed up what they call a walking beam robot, a contraption with two horizontal metal beams connected in a T shape with the robot's 'body' hanging below the back of the end beam.

The new robot will prowl the Martian surface sporting two arms for picking up rocks and dust samples. Stereoscopic TV cameras perched on the robot's mast will allow earthbound controllers to get a closeup view of the Martian terrain. What really makes the walking beam robot unique, though, is the way it moves. According to Andrew Spiessbach, an engineer who helped design the robot, 'Stability and simplicity were our goals. This machine will have to be pretty autonomous.' Since there won't be any astronauts around to pick up the robot if it stumbles on the rocky Martian terrain, Spiessbach and his designers needed to create a machine that wouldn't fall over.

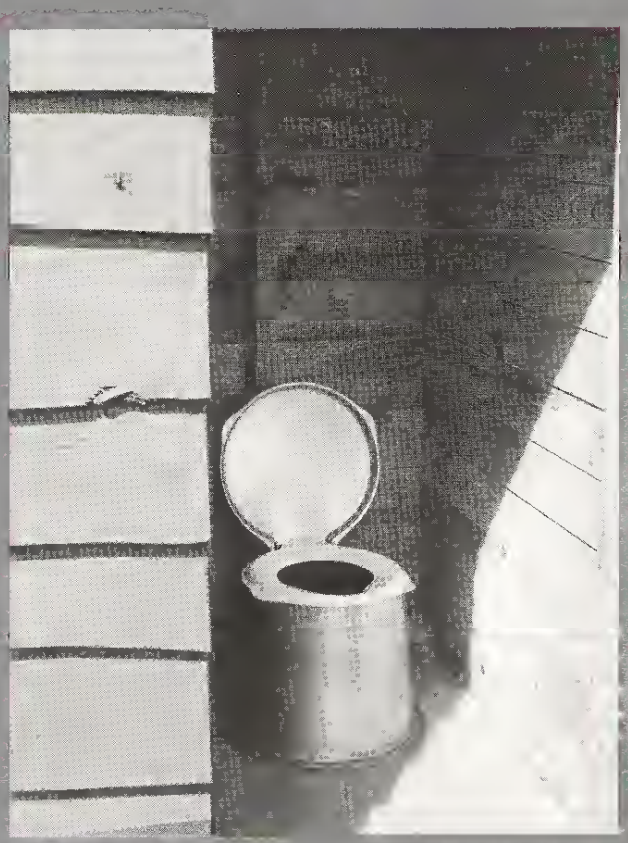
For this reason, the robot moves like a mechanical inchworm. To walk, it places its three front footpads on the ground and then lifts up the remaining four footpads, thus allowing the robot's body to slide forward. Despite its odd gait, the robot can travel at a clip of 300 feet per hour. —Devera Pine

A giant leap for robotkind. A prospector, mapper, and wanderer all wrapped up into one will inch its way around the Martian surface.

'Each instant represents a little universe, irrevocably forgotten in the next instant.'
—Milan Kundera

'The present is not always an unwelcome guest, so long as it doesn't stay too long and cut into our time for remembering.'
—Phillip Lopate

CONTINUUM



[illegible] flushing the old toilet helps [illegible] plumbing [illegible] the technology come as[illegible]

ROYAL FLUSH

Necessity has been called the mother of invention "Necessity" explains seventy-three-year-old shipbuilder Luther H Blount, in the form of plumbing problems aboard his pleasure craft drove him to improve the humble flush toilet Now the technology he devised may soon jump ship and find its way into American homes

During a Caribbean cruise, Blount hit upon a design for a new toilet that uses only one pint of water per flush (Standard [illegible] gulp at least three and a half gallons each time the handle is pulled) Blount will not reveal how his toilet works until his patent applications are approved, but he says the key is an electric pump and a device that shreds and liquefies solid waste

The water-saving potential of Blount's toilet has attracted a lot of attention In the United States 38 percent of the water used domestically is flushed away each year If Blount's toilets were to replace standard models, home water use could be cut by 37 percent annually

Blount's toilets have made waves aboard ships and in his own shipyard in Rhode Island "All I've tried to do is solve my own ship's problem,' he says "But my problem is really everybody s problem —Steve Nadis

SOTTO VOCE

Tired of looking over your shoulder while punching secret numbers into the automatic teller machine or worrying that someone will see the numbers on your credit card and start charging up a storm? To combat plastic money fraud, Bell Communication Research (Bellcore) in New Jersey has developed a system that identifies its owner by recording his own vocal tones

The Bellcore system contains a microchip that digitally records its owner's voice on a card when he utters a special password To make a purchase or to get money from an automatic teller, users slip the card into a voiceprint terminal, then they re asked to repeat their password while the terminal compares the "look of the voice with the digitized print on the card

Codeveloper Tim Feustel says that 99 times out of 100 the card will recognize the voice of an authorized user (The system becomes 98 percent accurate when a person has a cold) If your voice doesn't match the print on the card, you ll be able to punch in a code number to verify your identification

The best news Voiceprints are believed to be as unique as fingerprints, and even the most skilled impersonator will not be able to duplicate the resonance of your voice "The human ear may be fooled,' says Feustel 'but not the machine" Bellcore plans to make the system available to industry within a year

—Jeff Hecht

"It's never too late to do nothing at all"

—Allen Ginsberg

Neither coughs nor colds nor impersonators can fool this machine into thinking you are someone you aren t

Shrimp with a jumbo problem. American shrimp farmers can't help the crustaceans, and marine biologists are confused about what to do. But now chemists are working on the salient solution.

SHRIMP FERTILITY CLINIC

In 1988 Americans consumed more than 500 million pounds of imported shrimp. Fledgling American shrimp farms, hoping to net some of that market, have tried to raise the tasty crustaceans—but with little success. The problem? For some reason, shrimp, which normally breed in the open sea, don't reproduce well in captivity. Currently many shrimp farmers sidestep the problem by clipping off one of the female shrimp's two eyestalks. "Removing that organ," says Texas A&M entomology professor Larry Keeley, "makes the female shrimp become reproductively active."

The trouble is, the one-eyed female shrimp can't seem to stop breeding—which is also a problem. "Each cycle becomes poorer, with the female producing fewer healthy eggs and weaker offspring," says Keeley. "Finally the female becomes so exhausted she stops reproducing."

Keeley and fellow Texas A&M researchers Susan Rankin, James Bradfield, and Timothy Hayes are now developing a shrimp fertility drug. Ultimately they hope to create a chemical that, when added to holding tank water, would eliminate the need to remove the female's eyestalk. Thus, says Keeley, "farmers would be able to extend the female's reproductive life, improving shrimp production."—Sherry Baker

CRIME STINKS

Police in the Dutch city of Rotterdam have added a new weapon to their crime fighting arsenal: an archive of human odors and three dogs specially trained to sniff and identify each one.

"Our bodies are a source of odors," explains Sergeant Jan de Bruin. "When we move, scent molecules are left behind." Just as traditional fingerprints are taken at the crime scene, Rotterdam police collect and preserve "smellprints" to help them identify possible perpetrators. Investigators do this by bombarding the evidence with filtered air, transferring its odor onto an unscented cloth. Back at the station house, crime suspects are routinely "smellprinted"—they're asked to rub their hands on clean cloths which are then sealed inside clean glass jars.

When seeking to solve a particular crime, the sharp-sniffing dogs are brought in to make the collar. First they're given a noseful of the scents found at the scene, which they compare with the odors preserved in the police archive. If none match up, suspects are brought in to participate in an olfactory lineup. Each stands in front of a fan, which blows his odor toward a dog hidden behind a venetian blind. A positive identification is usually accompanied by loud barking and clawing at the screen. "Sometimes," says De Bruin, "it's enough to get a confession from the suspect."—Doron Pely

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"It is highly improbable that the bureaucrat will put his life on the line. It is absolutely impossible that he'll put his job on the line."
—Eduardo Galeano

Canine cops in Holland may have a nose for outlaws.

CONTINUUM

ALIEN PREP

The scenario NASA retrieves a secret, unmanned space probe, and something totally unexpected is found inside it a spindly little creature with a huge chest The alien appears healthy, but NASA scientists know nothing else about it So they contact a famous physiologist to examine the extraterrestrial In a hurriedly constructed isolation chamber at Cape Canaveral, the physiologist begins to sweat He knows nothing about his subject, and if the alien is injured or killed, the government fears, interplanetary warfare may break out

The creature above exists only in a computer program called *Alien,* created by Texas A&M University biologist Pat Patterson and Clemson University biologist Robert Kosinski "The *Alien* scenario ' Patterson says, "is designed to present students with situations that help develop the skills needed to collect and analyze data'

Working with *Alien,* students pretend to be the physiologist, who must figure out which experiments to run and in what order "There aren't any 'right answers to the questions ' says Patterson "But if students don't follow correct procedures, they won't be able to get any answers And if they do drastically wrong procedures—like putting the alien on the treadmill and running him hard at low oxygen levels—they will kill their research subject"

Patterson and Kosinski have also developed a computer scenario called *Seedling* It asks students to view the world from the perspective of a small plant Another scenario, called *Shark,* lets students 'become" a small bonnethead shark looking for food and fleeing from predators off the South Carolina coast "These scenarios allow students to experience the world through the eyes of another organism,' Kosinski says

—Sherry Baker

Open wide and say "Ah" If you haven't learned your alien biology you could start an interplanetary war

THE SIREN'S SONG

How many times has this happened to you? You're driving along and suddenly you hear the plaintive wail of an emergency siren You want to get out of the ambulance's way, but the trouble is you don t know where it's coming from

Enter Max Neuhaus composer, artist and "sound sculptor" Armed with a remote-control synthesizer, Neuhaus has redesigned siren sounds to convey information about the direction and the speed of an approaching or receding emergency vehicle

Neuhaus tailored his siren in the echoey canyons near the Salton Sea in southern California It took him weeks of trial and error to find a sound pattern that the ear could locate "Psychoacoustics is a young field," says Neuhaus of the effects of sound on human perception "I had to work from a very scanty knowledge base"

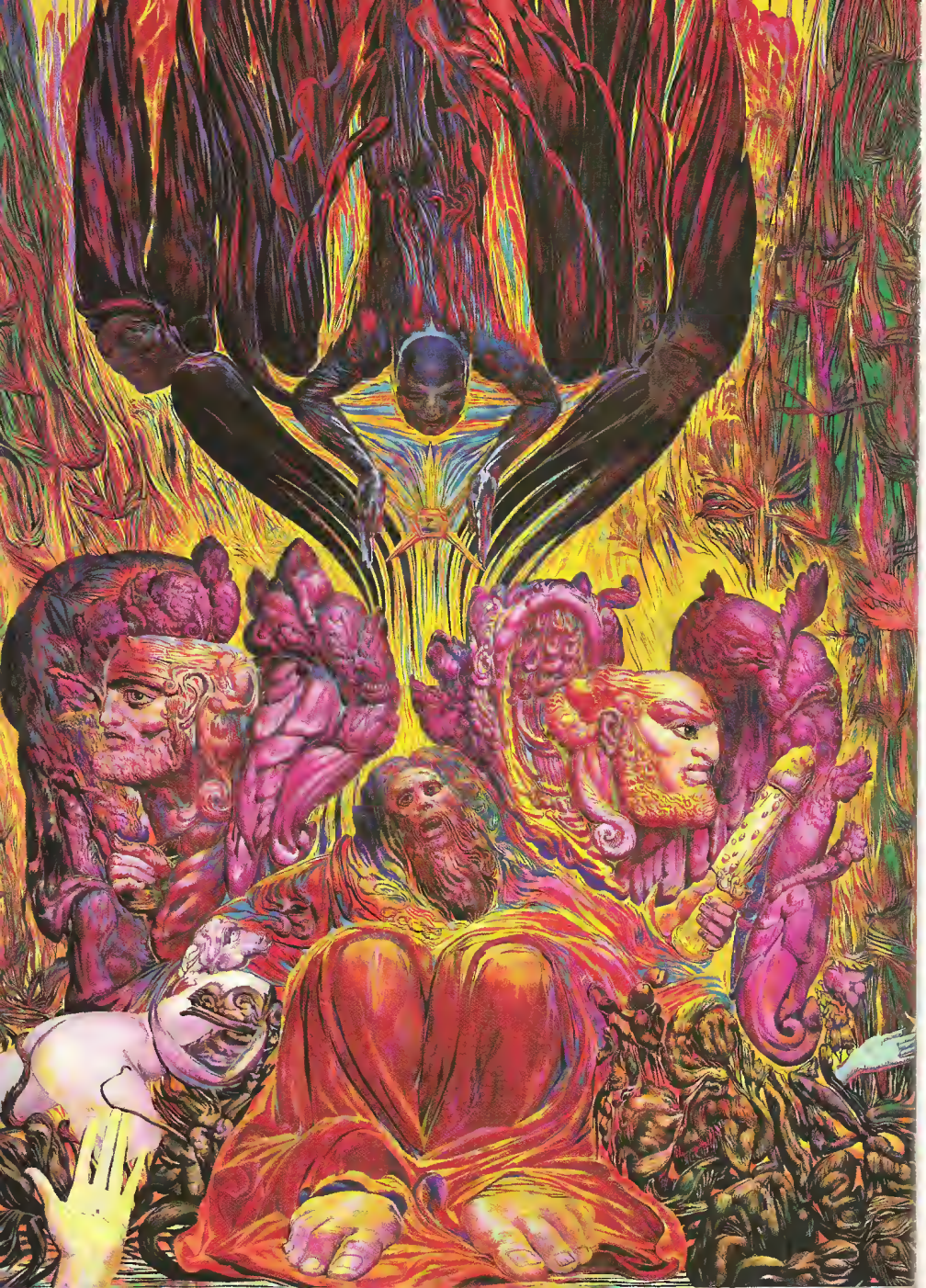
Despite the laborious effort, Neuhaus emerged from the Salton Sea canyons with a solution His new siren fires clipped sonic bursts forward and backward instead of radiating a racket in all directions, the earmark of most emergency sirens used in the United States In addition, the siren's tempo picks up as the vehicle accelerates Its resonant bell-like tone conveys urgency without panicking other drivers

After two tryouts on the side streets of Oakland, the Neuhaus siren won praise from emergency-vehicle drivers But will the public respond to a different-sounding siren? "When I travel to new countries I hear unfamil iar sirens" he says ' But I quickly recognize them as emergency sounds It's an intuitive learning process"

—Gregory T Pope

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

—Henry Wadsworth Longfellow



ARTICLE

The end of the world is at hand, again. Will we survive another wave of woeful prophecies?

THE LAST LAUGH?

BY DICK TERESI AND JUDITH HOOPER

"Apocalyptic thinking is in the air," University of Connecticut psychologist Kenneth Ring says. "As we approach that subjective date, 2000, images stored in the collective unconscious begin to populate our dreams and visions." And nightmares, of course.

There are, we found, a lot of people who think that the world will end soon—around the year 2000, as a matter of fact. Religious fundamentalists find that cryptic verses in the Bible's apocalyptic texts actually refer to a nuclear Armageddon within the next few years. At the same time an astonishing number of people claim to be in contact with UFOs, and the message they are getting from the "space brothers" is that time is running out for our planet. The Hopi prophecies are in vogue, and they tell us that our world is currently teetering on the brink. The Mayan/Aztec calendar points to the year 2012 as the end of this age, an age that began more than 5,000 years ago.

Of course, people thought the world was going to end in A.D. 33, too. And in 999. And in 1013, and in 1844. And in 1914. One of the characteristics of millennial thinking is that the end is always near. There is something different about 2000, however. "Since 1945 it began to be technologically feasible to end life on this planet," muses Michael Grosso, a philosophy professor at Jersey City State College, who contemplates starting a newsletter called *Millennium Watch*. "The prophetic symbols percolating in the collective unconscious of the West are now assuming an objective content they never had before." Now the lamentations of the early prophets are infused with the reality of H-bombs, chlorofluorocarbons, chemical weapons plants, oil spills, holy wars, and mutual assured destruction. "Many people feel that the world is now so hopelessly sinful, or just plain messed up, that there is no possibility that it can survive,"

PAINTINGS BY ERNST FUCHS

"The greenhouse effect will cause the land and oceans to dry up, but not everyone will starve—the chosen will be rescued by the White Light Star Ship."

notes Daniel Cohen, author of *Waiting for the Apocalypse*.

We must admit that while researching this article we sometimes fell into an apocalyptic malaise ourselves. Badly printed religious tracts began to assume a weird kind of logic, and we began noticing eerie coincidences between Ezekiel and the UFO people, the Hopi and Edgar Cayce, Nostradamus, Our Lady of Fatima, the Mayan calendar stone, Jerry Falwell, and the National Academy of Sciences, all of whom agree we're in perilous times.

HOW THE WORLD WILL END: WHAT TO LOOK FORWARD TO

Sixteenth-century French prophet Nostradamus foresaw 1999–2000 as a time of tremendous upheaval, wars, even (possibly) nuclear annihilation. Edgar Cayce, the famous "sleeping prophet" of Virginia Beach, Virginia, saw 1998 as the beginning of a New Age—right after a catastrophic shift of Earth's axis. Jeane Dixon foresees an evil and charismatic Antichrist leading the youth of the world astray in this decade. New Age millennialists focus on the year 2000 as a collective turning point for humanity, a shift into a more ethereal kind of consciousness. There are even a few messiahs around, notably an avatar of "Maitreya the Christ" who lives incognito as a Pakistani in London.

One can't help noticing that an awful lot of people are looking forward to the end of the world. Religious fundamentalists expect to be supernaturally "raptured out" of the coming cataclysm; New Age millennialists try to "heal the planet" with love and good vibrations. Bob Nelson, also known as Mobius Rex, a California radio talk-show host and author of *Prophecy*, a compendium of doomsday predictions across the ages, expects that "less than one third of the world's population will be around by 2020." He adds, "It might be best for this planet and humanity if this civilization collapses as quickly as possible."

Perhaps the world really is going to end. Or perhaps the ancient vocabulary of apocalypse is simply the handiest way to express the anxieties provoked by extraordinarily rapid cultural change. "Beholding the world coming to its end amid storm, earthquake, flood, and fire [is] a typical experience of a prophet whose psyche is registering the emotional impact of the end of an era," says John Perry, author of *The Heart of History*. At any rate, something is going on "in the collective," as they say in California.

HOW THE WORLD WILL END: TECHNICAL CONSIDERATIONS

In the minds of many apocalyptic seers, there's no doubt the world will end in the year 2000 or thereabouts. The only debate is over the method of destruction. There are many "scientific" scenarios. Here's how they stack up in credibility—or lack of same.

POLE SHIFT

Scenario: The earth hurtles through space at 67,000 miles an hour. Think of it. What if you drove your Ford Fairlane that fast down an interstate? And what if you piled too much luggage on your roof rack? Why, you'd topple ace over teacups when you hit the first good curve. That's essentially what pole shift doomsayers predict. Namely, too much ice is piling up on the polar ice caps. This will cause the earth to topple and the poles to shift, maybe in a matter of hours, maybe so much as to switch places. As you can imagine, this would be very, very bad: enormous tidal waves, electrical storms with hurricane winds, tremendous earthquakes and lava flows, even poisonous gases. Not to mention the resultant damage from millions of back issues of *National Geographic* tumbling over in attics all across North America.

Who says? Many psychics have staked their reputations on this ending. Edgar Cayce, Immanuel Velikovsky, and Nostradamus, among others. Plus hints of a pole shift can supposedly be found in the Bible and Native American prophecies, according to John White, author of *Pole Shift*. One of the modern "researchers" White cites as supporting this theory is one Emil Sepic. Mr. Sepic's credentials? "I think I went to second grade in school and after that I don't remember...."

Seriously, now: Some scientists do think a pole shift is at least an outside possibility. "It's a consideration," says Donald Turcotte, chairman of the department of geological sciences at Cornell University. "Pole shift is a well-established principle. It's the same concept as continental drift. Continents shift around the earth, so it's possible that poles might shift toward the equator." Not too many scientists, however, believe the poles will actually change places. But even if this "true polar wander," as geologists call it, does occur, you don't have to worry about tying your house down yet. The poles would move at about the same speed the continents drift now, which really isn't fast enough to knock you off your feet. "It's not going to happen overnight," says Turcotte. "Even

a million years would be rapid in terms of geologic time."

FLOOD

Scenario: Remember Noah? The doomsayers say we'd better start building arks again because we're all going to get very wet thanks to some wicked tsunamis. If you're ordering your Chris Craft now, make sure that there's plenty of room for your new Akita puppy and a mate so that we can repopulate the earth with various species after everything dries out.

Who says? Edgar Cayce predicted a California with coastal cities submerged with the Carolinas and Georgia sinking into the Atlantic.

Seriously, now: Actually, there's a basis for this one. Except that the flooding won't be the result of earthquakes, as Cayce predicted, but of a more recent phenomenon, the greenhouse effect. The burning of fossil fuels causes an increase in carbon dioxide, which in effect turns the atmosphere into a greenhouse. The CO_2 absorbs infrared rays and prevents them from radiating back into space, and we all end up like hothouse tomatoes. A little side effect is that the polar ice caps will melt as the temperature soars upward by as much as 9°C during the next century. Ocean levels could rise seven feet, submerging the Nile Delta, the Louisiana Delta, and the New Jersey wetlands. In other words, another global flood, a la Noah. However James E. Hansen, head of a greenhouse effect study at the NASA/Goddard Institute for Space Studies, says the atmosphere is too complex to predict exactly what will happen. At the present time there's no computer model capable of handling all the variables. Interestingly, while the greenhouse effect is one of the most serious—and bona fide—dangers facing the earth in this century and the next, it was predicted by none of the great seers over the past thousand years.

THE BIG CHILL

Scenario: Those pesky glaciers, which gave us the Great Lakes and terrible weather, will come again. But this time, even if we don't freeze to death, the new ice age will at the very least reduce the acreage available for farming and we'll all starve.

Who says? Ice age aficionados include California doomsday connoisseur and talk-show host Mobius Rex and New Age seer/UFO contactee Earlyne Chaney. Get this: Chaney believes the ice age will be an offshoot of the greenhouse effect. You probably thought that the greenhouse effect meant everything would heat up. Well, so did we, but Chaneian logic goes something like this: Carbon dioxide will keep the heat from escaping. The heat will then vaporize the oceans, and the resultant excess moisture will be carried to the poles, where it will freeze, and the glaciers will grow bigger. Got that? This will all happen, says Chaney, between now and 1999. However, there's hope. Many will die, but some will be rescued by the White Light Star Ship.

Seriously, now: Actually, there is some evidence for a new ice age. No less an authority than physicist George Gamow predicted the return of the glaciers: "We must expect the ice that retreated some ten thousand years ago to come back again." Don't get out your summer snowshoes just yet. Chaney's 1999 deadline may be a bit off. Gamow set the date for this new ice age some 20,000 years from now.

BIG, SCARY THINGS FROM THE SKY

Scenario: A comet or asteroid collides with Earth, and we're all killed or at least seriously shook up. In 1954, for example, a meteorite crashed through the roof of a house in Sylacauga, Alabama, bounced off a radio, and hit a woman on the hip. The next time it will be even worse, warn the doomsayers.

Who says? Jeane Dixon prophesied that a comet would crash into the earth around 1985 (whoops), causing massive tidal waves and flooding. Nostradamus also seemed to be referring to an extraterrestrial object when he predicted that "a great spherical mountain of seven stades [about a mile in diameter] will roll end over end, sinking great nations." Comet disaster was also predicted by Hildegard of Bingen (1098–1179). (Hildegard was a kind of upscale twelfth-century Jeane Dixon. Adviser to three popes and two emperors, she had a pretty good track record, predicting the coming of Protestantism and the fall of the Holy Roman Empire.)

Seriously, now: Ordinarily, we'd poohpooh such alarmism. Unfortunately, this past March a large asteroid passed within half a million miles of Earth, or twice the distance between our planet and the moon. This particular asteroid, a quarter to half a mile or more in diameter and zipping along at 46,000 miles per hour, would have hit Earth with an impact that would have obliterated New York City or Los Angeles. It would have carved out a crater half a mile deep and five miles wide. A water impact, according to NASA's Bevan French, would have created waves several hundred meters high that could have swept over coastal areas.

But how about death by comet, which the seers seem to favor over asteroids or meteorites? Again, this is possible. The comet that exploded over the Siberian forest in 1908 (the so-called Tunguska Event) was estimated by Russian scientists to have been several miles in diameter and to have weighed close to

"It won't be long before the renegade finite equation theorists are brought to justice."

CONTINUED ON PAGE 78

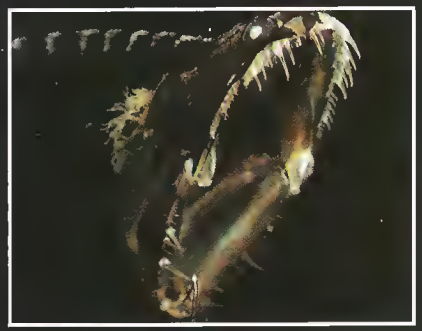
You've got it. These are faces only a mother could love

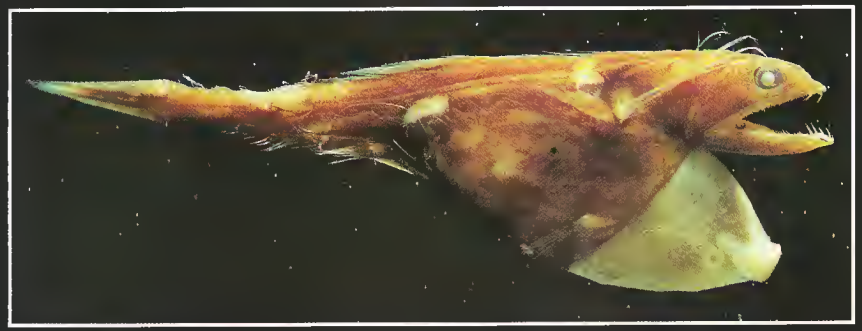
FISH OUT OF WATER

Ladies and gentlemen, welcome to the Ugly Fish Pageant. Arrayed here for your amusement and education are some of the least aesthetically pleasing denizens of the deep. We have scoured the world's waters for fish not found in your local restaurant or pet store. These aquatic apparitions may not be much to look at, but beyond each ugly mug lurks a tale of evolutionary splendor

Take the icefish, a native of the Antarctic and Arctic. It has no red blood cells coursing through its scaly body;

PHOTOGRAPHS BY NORBERT WU





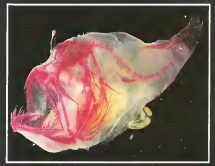
instead, this little fellow circulates a fluid similar to antifreeze.

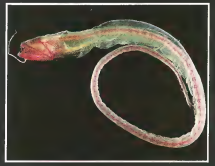
Notice the toothy grins on these bathing beauties. In the deep sea, meals don't swim by often, so fish must be ready for prey of any size. Although these guys can be quite small (some fangtooth species are six inches long), they unhinge their jaws to swallow prey almost as large as themselves.

The enticing viperfish practices a more seductive method of food acquisition. Armed with a bioluminescent dorsal fin, this fish attracts prey—lured by the glow—into its mouth. Other viperfish species use their homemade lanterns for less nefarious purposes and flash an invitation to prospective mates.

But when it comes to mating, the anglerfish wins the Don-

After trawlers dredged up many of these specimens, Wu snapped portraits for the school yearbook. Previous pages: Deep-sea swallower. Clockwise from bottom: Bleck swallower; black dragonfish; icefish; flashlight fish, fangtooth fish. Right: Anglerfish





Juan-of-the-deep award, fins down. Finding a mate a no easy task, so when a male anglerfish discovers a female, he sticks with her until death do them part. Less than a tenth the female's size, the male anglerfish attaches his mouth to her skin, and the pair becomes one—how romantic.

Fertilizing the female's eggs, the male becomes absorbed in his mate's skin until he shrinks away completely. The biomedical community hopes these intriguing liaisons can help uncover the secret to tissue acceptance patterns in human-organ transplants, since the female anglerfish's immune system readily accepts the presence of a foreign body. Now who says beauty is just skin-deep?—Shari Rudavsky

We also toured the fish morgues at various oceanography institutes, looking for appropriate models. Left: The cookie cutter shark.

Clockwise from bottom left: The viperfish with bioluminescent glow, the black dragonfish, the anglerfish, the stargazer, the sea robin.

CONTINUED FROM PAGE 26

age gynecologist to feel sufficiently comfortable with videolaseroscopy to substitute it for conventional surgery.

"It's so meticulous," Nezhat says, "I tell them they must be able to go over a tiny grape held in their fingers and remove its skin with a laser. If they burn themselves, they would have burned their patient." In the future, however, Nezhat believes enough surgeons will become proficient at videolaseroscopy to use it in more than nine out of ten cases that now require laparotomies or hysterectomies.

If Nezhat is right, videolaseroscopy could have an enormous impact on American women. Some people believe the hysterectomy rate in the United States—the greatest of any industrialized country—is unnecessarily high. Surgeons performed hysterectomies on 653,000 women in this country in 1987, according to the American College of Obstetricians and Gynecologists.

Not all surgeons are ready to accept Nezhat's technique as the wave of the future. Robert Franklin, a Houston Laser Institute surgeon who helped bring laser laparoscopy to the United States, believes videolaseroscopy may not be the best approach to treating severe endometriosis. "If you don't destroy the entire lining of an endometrial mass—something that's difficult to do while working off the camera—it's going to come right back. Nezhat is a great technician, but he's doing too many things through the laparoscope." Nezhat points out, however, that small amounts of endometrial tissue can migrate to places a conventional surgeon can't see or would hesitate to operate on, like the ureters or bladder. The normal release of estrogen can then stimulate regrowth.

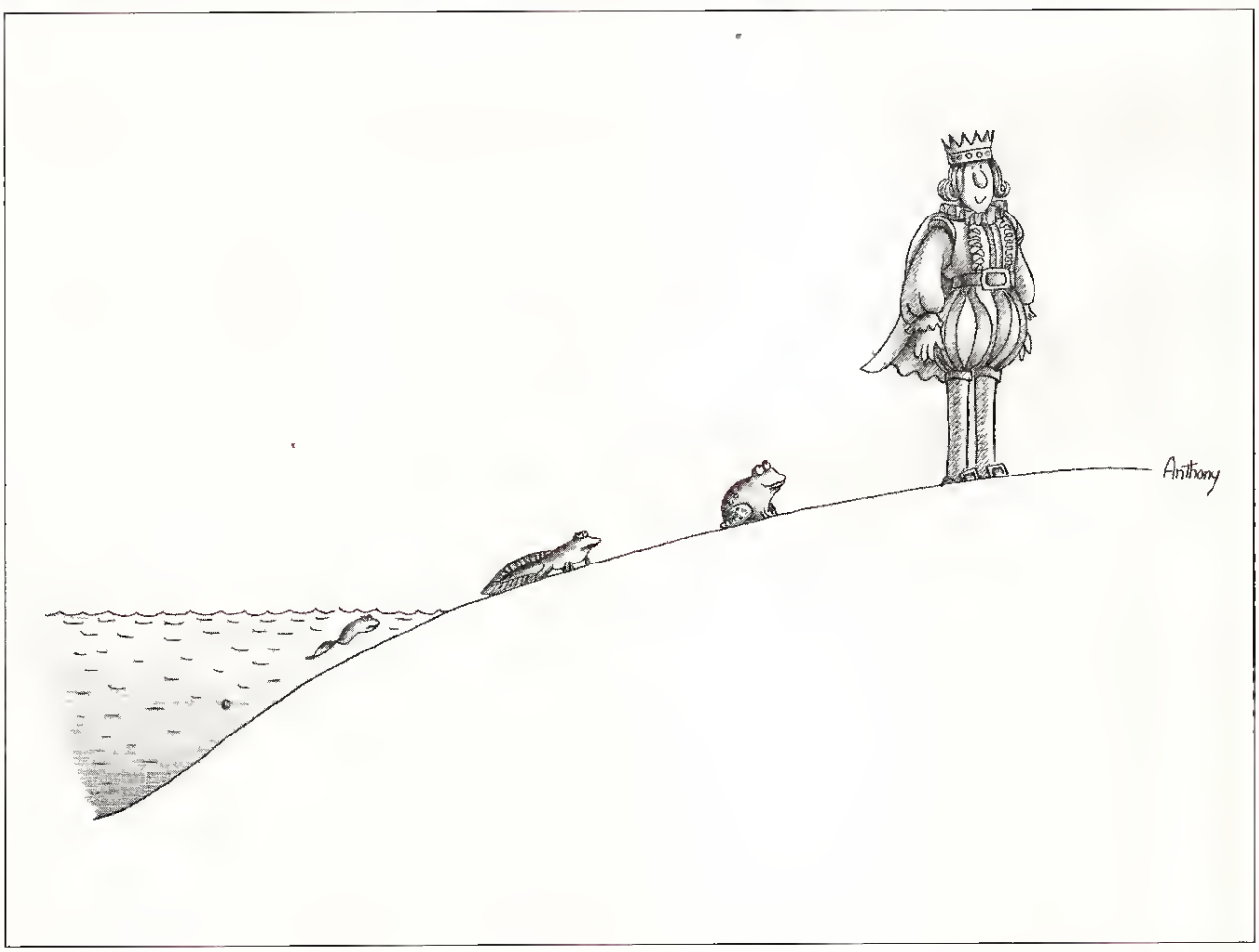
Nezhat has done animal studies to back up his assertion that the rate of new adhesions in his endometriosis patients treated with videolaseroscopy is lower than that of laparotomy patients. To further convince skeptics, he now broadcasts difficult videolaseroscopies live, via satellite, to doctors across the United States. "Many doctors think it is impossible until they see for themselves what we are already doing," he says. "Five years ago, I said that you could do almost anything through videolaseroscopy and I was laughed at. Now doctors come from all over the world to study with me."

Some physicians become converts to the technique after taking Nezhat's training course. Dr. Martin Motew, a fertility specialist and professor of medicine at Northwestern University Medical School, says he enrolled with doubts. "Now I think it could supplant most microsurgery techniques—if not all."

In Marietta, Georgia, gynecologist William Saye already uses videolaseroscopy for appendectomies and gallbladder surgery. "There is a beauty to this kind of surgery," he says. "If my appendix had to come out, there's no question as to how I'd have it done." In the next 18 months, he says, surgeons will adapt more and more procedures to videolaseroscopy as researchers develop better lasers and refine the tools and cameras presently in use.

And at UCLA Medical School, general surgeon Jonathan Sackier is researching other applications for the technology. "In the twenty-first century, the combination of video and laparoscopy will replace the scalpel for most abdominal surgery," he says, "although to predict at this point that these procedures will replace other kinds of surgery would be science fiction."

Nezhat contends that videolaseroscopy will also be widely used for cardiac and vascular operations. "Medical cameras are now being developed that will see better than the human eye, and doctors will *have* to learn to work from the camera. Videolaseroscopy is the future of surgery."



For the Oxford zoologist who takes a gene's-eye view of life, humans are just temporary survival machines, robots blindly programmed for someone else's benefit. Whose? The genes themselves, of course

INTERVIEW

RICHARD DAWKINS

Nothing in his scientific training or his 20 years experience with computers prepared Richard Dawkins for what emerged on his screen one night. The Oxford zoologist had designed a program called *The Blind Watchmaker*, which simulated the process of evolution by means of electronic "gene mutations," of quasibiological forms he called biomorphs. "I began to breed generation after generation of biomorphs from whichever child looked most like an insect," he recalls. "As I watched these exquisite spiderlike creatures emerging before my eyes, I distinctly heard the triumphal opening chords of *Also sprach Zarathustra* in my mind. That night 'my' insects swarmed behind my eyelids as I tried to sleep."

Ever since he published *The Selfish Gene* in 1976, Dawkins has presented a gene's-eye view of the world and its workings. "Humans are nothing but temporary survival machines, robot vehicles blindly programmed for someone else's benefit," he says. The true rul-

PHOTOGRAPH BY STEPHEN HYDE

ers of this world are the bits of DNA that make up our genes. Dawkins compares these genes to successful Chicago gangsters. Having survived for millions of years, they are the only immortal part of the body, and the secret to their success is "ruthless selfishness."

Thousands of *The Selfish Gene*'s quarter of a million readers have written to tell Dawkins that the book changed their lives. It made them understand for the first time that genes are the building blocks on which evolution works, the key to understanding animal behavior, the stuff of life itself.

In his second book Dawkins carried his "fundamental law of gene selfishness" a step further. *The Extended Phenotype*, published in 1982, shows how genes manipulate not only the bodies in which they happen to be sitting but also those of other organisms. Parasites hijack their hosts' tissue. Male mice subjugate females by emitting pheromones that drive them into heat. One can even say that "sneezing genes"—commonly known as viruses—have mastered the knack of replicating by getting themselves passed from nose to nose. Competing gangs of genes, claims Dawkins, "are running arms races in evolutionary time," the stakes being reproductive immortality or extinction.

Lest Dawkins be mistaken for a genetic determinist, *The Selfish Gene* ends with a call to "rebel against the tyranny of the selfish replicators" that are our genes. Dawkins posits another unit of evolution, a nongenetic replicator, the *meme*. Memes are ideas, bits of consciousness, beliefs capable of evolving, combining, and flowing down the generations. Our ability to choose between replicating genes or memes is what distinguishes humans from other animals.

If humans have broken free from the genes that program them, then such a change could happen again. Only this time, Dawkins says, it will be conscious machines—computers—that take over from humans to replicate their own forms of life. These and other speculations on the evolution of complex systems are the subject of his third book, *The Blind Watchmaker* (1986).

Dawkins does most of his thinking these days sitting in front of a Mac II computer, running his *Blind Watchmaker* program. Biomorphs, he feels, are a uniquely powerful and flexible tool for exploring his current "heretical" speculations on embryology and the origins and development of life itself. His method involves "switching back and forth between real life and the computer." And his interview with writer Thomas Bass followed the same format. Their conversation was interspersed with sessions on the computer touring biomorphland.

The son of an agronomist in the British colonial service, Dawkins was born in 1941 in Nairobi, Kenya. After inheriting a farm in Oxfordshire, his parents returned to England to raise dairy cattle. Growing up within 20 miles of Oxford and eventually going to school and teaching there, Dawkins took his father's interest in natural history and gave it a theoretical spin. This, combined with a brilliant prose style, has made him a best-selling author and recognized master at explaining the evolutionary process.

Apart from two years spent teaching at the University of California, Berkeley, Dawkins's entire professional life—as an undergraduate and graduate student in zoology, as a research assistant to Nobel prize-winning ethologist Nikolaas Tinbergen, and as a university lecturer in animal behavior, a post he has held since 1970—has revolved around Oxford University.

The twice-divorced father of a four-year-old daughter, Dawkins lives alone on the top floor of a house with windows overlooking the medieval towers of Oxford. Interviewer Bass visited him in this airy attic, where his office chair is positioned in front of a cockpit of video displays and computer keyboards.

"The human body has within it a privileged subset of cells: the very genes contained in our sperm and eggs. These are the only parts of the body that actually have immortality."

***Omni*:** How did you develop your gene's-eye view of the world?

Dawkins: It's inherent in Darwinism. The body has within it a sequestered, privileged subset of cells, the genes contained in our sperm and eggs, the only parts of the body that have immortality. The German biologist August Weismann, at the turn of the century, first verbalized this separation between what he called the germ line and the body. I've just carried this implicit line of thought to its logical conclusion and turned it into a radical metaphor that caught people's imagination. Perhaps it's not a metaphor; in some sense it's the literal truth. For my purpose, we could have said what's important about genes long before DNA was discovered. Genes go on in the form of exact copies of themselves for millions of years. So the body is only a temporary survival machine, a vehicle for the genes that ride inside it. The fate of genes in their quest for immortality is bound up in the short-term success of the body they inhabit, or the long succession of bodies they inhabit because they go from body to body. Successful genes are those that make a long succession of bodies good at passing them on—which means good at surviving and reproducing.

***Omni*:** Why do you call genes selfish?

Dawkins: Genes always take whatever steps are necessary to survive. If an animal is caring for its young, this may be altruistic behavior at the level of the ordinary organism. But genes are controlling this behavior, and the genes in this case have been copied in the body of the offspring being cared for. *All* examples of apparent altruism at the individual level are the result of selfishness at the gene level.

***Omni*:** When did you begin thinking that genes ran the world?

Dawkins: I was doing postdoctoral studies with Nikolaas Tinbergen in 1966, when he asked me to give some lectures. This got me thinking about why animals behave the way they do. The best way of conveying these ideas was to talk about genes as being in control of life. The rhetoric of immortal genes leaping down the generations, jumping from one throwaway survival machine to another—it's all in my Oxford lecture notes. It was unconventional imagery to get across essentially orthodox ideas.

***Omni*:** Was that what you hoped to do in *The Selfish Gene*?

Dawkins: When I started writing it in 1972, *The Selfish Gene* was an attempt to get rid of the group-selection view. This outright wrong idea had obtained a grip over the popular presentation of science. Time after time I'd see excellent natural history programs on television marred by this false assumption that individuals act for the good of the species, the good of the ecosystem, or for the good of the world! This was an error that needed exploding, and the best way to demonstrate what's wrong with it, I felt, was to explain evolution from the point of view of the gene.

***Omni*:** Overnight *The Selfish Gene* became part of our daily reality.

Dawkins: Perhaps that's because it brings home to people the truth about why they exist, something they previously took for granted. No one had given them such a ruthless, starkly mechanistic, almost pointless answer. "You are for nothing. You are here to propagate your selfish genes. There is no higher purpose to life." One man said he didn't sleep for three nights after reading *The Selfish Gene*. He felt that the whole of his life had become empty, and the universe no longer had a point. Another way of putting it is of people losing religious faith. People now felt they understood what it was all about, where previously they had been fobbed off with religious,

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ARTICLE

UNDER THE INFLUENCE

BY MELVIN KONNER

We speak of a timid soul, a troubled soul, a hearty soul, an inward one, a temperate soul, a vengeful, a generous, a venturesome one. These and countless other phrases using words like *soul, spirit,* or *character*—

Who am I? is the most basic question we ask. Education and environment don't count, geneticists say. We are who we are when we're born

PAINTINGS BY ANITA KUNZ

and much more so, words like *personality*—are now being shaken by a biological revolution. Ancient and medieval ideas about our constitutional predisposition to certain character types (choleric, or quick to anger, for example, or phlegmatic and unemotional) are rising again, in altered form, with data to back them up.

Sartre's dictum "Man is nothing more than what he makes of himself" has fallen, at least in many scientific circles, into the realm of wishful thinking. Accumulating scientific evidence suggests we are not solely our own creations. Our genetic inheritance plays at least as large a role in determining our personalities as the way we were raised or the education we received. Biology may not be destiny, but it contributes to it more than we may like to think.

Studies of the genetic makeup of emotionally disturbed individuals, along with long-term studies of twins and families, have laid the foundation for these new theories of personality. But this revisionist research is new—most of the findings were gathered during the past decade—and the repercussions are only beginning to be felt.

Should the research be taken to heart, we will need to do nothing less than reformulate our ideas that deal with the development of the psyche and the treatment of its disorders—and perhaps, ultimately, of free will itself.

Consider Jim Lewis and Jim Springer, separated at birth and brought together at age forty. Both had taken law enforcement training. Both had blueprinting, drafting, and carpentry as hobbies. Lewis had been married three times, Springer twice. Both first wives were named Linda, both second wives, Betty. Each named his first son James Allan. Each had a dog named Toy. Of their first meeting, Lewis said, "It was like looking in a mirror." The first twins studied at the University of Minnesota, they were found to have similar IQs, personality scores, electroencephalograms, electrocardiograms, fingerprints, and handwriting. As Springer put it, "All the tests we took looked like one person had taken them twice."

These are chilling statements for anyone who cares about human individuality. "What am I?" is one of the most basic human questions, and the answer provided by meeting another person who is in effect a flesh-and-blood mirror image can at best be unsettling.

Beyond anecdotes like that of the Springer twins, there are the results of the University of Minnesota Twin Study, published in the *Journal of Personality and Social Psychology* in June 1988. A team of investigators, including Auke Tellegen and David Lykken, administered a well-validated personality questionnaire to 402 pairs of twins. Two hundred sixty-one pairs were identical—monozygotic, or one-egg—twins, sharing the same genes; of these, 44 pairs were reared apart. One hundred forty-one were nonidentical—dizygotic, or two-egg—twins, sharing no more genes than ordinary siblings; of these, 27 sets were reared apart.

Sophisticated statistical methods were used to measure the factors that influence personality—genes, shared family environment, and nonshared individual environment. Subjects responded to questions charting their feelings of well-being, attitudes toward achievement, social closeness, alienation, aggression, and even traditionalism.

Investigators then categorized each subject as exhibiting one of three personality types: positive emotionality, or active, pleasurable, effective interactions with surroundings; negative emotionality, or involvement in life in a negative way, with frequent stress, anxiety, and anger; and constraint, or restrained, cautious, deferential, and conventional attitudes and behavior—avoiding danger or impulsive thrill seeking. These three factors were then analyzed, using twin similarities and differences. Positive emotionality had a 40 percent genetic contribution, negative emotionality 55 percent, and constraint 58 percent.

To the skeptical eye of a behavioral scientist, especially one who may not have followed the behavior genetics of the Eighties, the results are stunning. About 50 percent of measured personality diversity can be attributed to genetic diversity. This is already a much larger proportion than the Zeitgeist of late-twentieth-century America—with our commitment to human potential, formative parenting, and psychotherapy—would lead us to expect. While this would seem to imply that the remaining 50 percent is explained by environmental effects, that's an oversimplification. In fact, at least 15 percent of that remainder is measurement error, inflating the estimate of the environmental contribution. In other words, a clear majority of the accurately measured variation is genetic. The match between identical twins reared apart is remarkably similar to that of identical twins reared together. And the match between nonidentical twins of either rearing condition is much less impressive.

The inclusion of all four types of twins also made it possible to estimate just where the environmental influences came from, after the role of the genes was accounted for. The majority of the nongenetic part comes from environmental effects specific to the individual, not from effects shared by children living in the same family. That is, they could be experiences with different friends or different schooling or distinct family influences—parental favoritism toward one sibling, for example; but they would be less likely to be things like a weak father, an ungenerous mother, a late bedtime, or a prohibition of television, all of which would be experienced more or less equally by all siblings.

These two conclusions—that the main explanation for personality differences is genetic, and that the family en-

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FICTION

LOOKING DOWN

BY CAROL EMSHWILLER

Those with
heavy thighs, flat faces, funny little teeth all in a row.
We fly down and knock them over with
nothing more than the rush of our air. Not even
touch them. And they, yearning after us,
try to invent ways to get themselves up into our sky
while we squawk by laughing. We could save
them when they fall, but we never do. We let them drop
down in their imitation wings, gliders,
and such, and they always do drop. We know what
birds mean to them: fire and smoke
on the one hand; air on the other. Or should I say
sky—limitless sky. A bird—particularly birds
such as we—a bird is better than a mountaintop.
Better than a tower, and they do build towers
Lightning strikes them. Burns them up. Wind blows
them down. Their broken towers lie all across
the land. Only the newest ones still stand or those
few that are built of stone.

PAINTINGS BY GERVASIO GALLARDO

Also we are omens, both for good and evil depending on the circumstances. We have heard them wailing when the sky darkens with us as though we were the storm, yet it is only us at our fall gathering or our spring dancing.

They dance, too, and sing. Paint themselves imitations of our colors. Line their skinny arms with fallen feathers and flap about. And always they bow down to us when we sit, as we sometimes do to dry, in rows along their roofs or perch on their tower tops. They leave flowers for us. Not that we care anything about flowers. You can't eat a flower. They leave bowls of milk, too. Birds don't drink milk. They leave it also for the snakes. Cats come for it.

There are others they bow to. The snakes, of course, and even the cats sometimes. I've stolen and eaten both the family snake and the family cat, which shows which of us are lesser. I haven't done this before, but I had to. (I have even drunk the milk.) The fall gathering has come and gone. I had thought to follow soon—to get well and follow. Not stay until the leaves fell.

Snow will come. I've not seen that nor ever wanted to. The milk will freeze. The tower where I rest is rickety, sways in the wind as though it were a tree yet is not a tree, therefore will fall. But perhaps I'll not last that long anyway.

I coasted here—no, I fell, having been twisted in a wind devil I'd not avoided in time—fell, torn and broken, hid out until too hungry, climbed down from the tower by hand, one step at a time as *they* would do. The cat, the snake, my last good meal. Now only milk. I feel dizzy. I wonder, once I climb down for it, whether I'll be able to climb back up. Such a thing, for one of us to have come to this low point.

Ah, but this evening I see that the milk bowl is set away from the tower and near to the shack. It's a trap. I know that. They want, no doubt, to catch the one who's eaten their cat and snake. If they manage to do that, they'll have one of us in their power, which has not happened before. They've tried but never succeeded. The flock saw to it that those of us caught in their tree nets were never taken alive.

They bring the milk at twilight. The creatures, such as I, that drink it come out after dark, but I have a terrible thirst and it's the milk I want more than any stray cat or snake or small bird. I climb down almost as soon as the milk is put out. I crawl to the shack on knees and elbows. I see one of the half-people watching me from the window, but I'm past caring. When I lean to drink, *she* comes out and stands in the doorway quietly as if she thought she might startle me and that then I would flap away, which is impossible. I don't care. I'm thinking: *Let it all happen the way it must, there are no brothers or sisters left here to see to it that it is otherwise.*

After I drink, she bows down to me, calls me, "Lord of Summer, Flight, and Trinity, having incorporated snake and cat whole," she says, "without chewing, therefore having become a sacred three." I raise myself from the bowl, knowing I've milk dripping from my mouth yet, even so, thinking to loom over her displaying myself in all my splendor, but I have a dizzy spell. Can't fall now, I tell myself, and then I do.

Some of us have fallen from great heights, wounded or sick (as, but for the tower, I also would have done). Some of us have fallen out of cliff nests, too bold when too young, or have been pushed out by a larger sibling. Some of us have caught a downdraft when near the ground. But who would have thought one of us would fall from a half-standing position, and who'd have thought that I would be the one to do it?

"I'm still shaking with fever and still thirsty. Then she comes and holds the bowl to my mouth. I would have bitten her, but I lack the energy."

I wake in a musty, dark place void of wind, void of sky. A rack has been made for me to hold my wing in tension, up and to the side behind me. A throne has already been carved and decorated for me. (Or had they been carving at it ever since I'd glided to their tower? Or perhaps they'd always had it, waiting for one of us to be taken alive.) I had been strapped into it. An offering had been set before me: dried yellow flowers and a good goat broth. There was a fire in the fireplace. Also a sweetish smell from something smoldering in a flat dish.

I have not ever been in such a place, where there's just barely enough room for me to be arranged, as though on display, along one wall—the longest wall. I hang there against it. The rack on one side holds my wing so extended that I myself and my throne are almost in the corner. Around my neck there is a heavy chain or perhaps a necklace of some sort, too short for me to see. On my head there's an uncomfortable circle of metal. I suppose it's some sort of crown, as though I needed anything more than my topknot.

I'm still shaking with fever and still thirsty, but I can't reach the broth. Then *she* comes from behind a curtain and holds the bowl to my mouth. I would have bitten her, but I haven't the energy. She also gives me water . . . a great lot of water, and I can finally drink as I've been wanting to. Then she calls and three of the half-men come in.

"He groans, he sighs," she tells them. "It is meaning that the times will be harsh, the winter cold and early." At first I wonder why she says this, and then I think that there are strange things happening and that rather than protest that I meant no such things, I will keep silent and beware. "To-

night," she says, "or tomorrow, the first snow will be coming, he says. The tower *will* fall, having served a good purpose."

"Lucky for him," one of the half-men says, "that we have rescued him in time."

"The gods are lucky," she says. "This one has come to us with a purpose. Do not doubt it."

That night the winds and the snow come just as she said I said they would. The windows in front of me glow with a strange white light. I can see the flakes blowing sideways. And the tower does fall. I have dozed, and I heard the crashing of it as if in my dream and had thought that I still lay out on it and had come down with it as it fell. I strain at the bounds and the rack, and it's my own squawking that wakes me. One arm comes loose. I'm very weak, but it does come loose, and I think that they don't know my strength at all—what it takes to fly south or even cling to rocks by toes and fingers. They've no idea. I will be able to escape whenever I feel like it.

My crown has fallen. In the glow of the coals and the glow from the windows, I can see it lying upside down in front of me, glints of glassy blue stones and gold—that gold they always like so much, though I have better in one single breast feather. Rather nice, I suppose, if one must settle for less than myself, but I know my topknot is nicer. I have seen myself, and many times, not only in pools, but in the little mirrors we often steal from the doors of their hovels. I know how magnificent I am, though perhaps not quite so much so here in their dim room.

She comes, having heard my squawking, I suppose, but by then I have settled myself so that she'll not see me in some undignified way nor see that one arm is loose. She has again brought me a drink. This time a tisane. I recognize it: valerian with chamomile. We have used the same. Also something fermented in it. Her little teeth don't look quite so funny to me anymore, nor her odd, white, edible hand. Edible. We've not done that. We've let them be, most of us, that is (after all, they have a culture of a sort, however crippled they and it may be), though there have been young ones of us, just fledged, who've carried off smaller ones of theirs, but mostly we have an unspoken rule that we let them be, partly just to see what they do next, and if they ever *would* find a way to get themselves into our sky. We'd like to see the day of that and sometimes speak of it and laugh.

And their women! What use have we for them? Though we've never minded showing off our colors to them. No need for crowns, yet *she* picks it up and puts it back on my head, carefully so as not to crimp my topknot. I could sleep better without that crown, and I have a flash of rage. Beware, I think, of the anger of the gods, but the pale hand, the row of teeth, the broth, the soothing drink, all mix . . . all begin to seem an equation of needs met with the creature who brings the comfort. Also I can see there are qualities I'd not known about before and that I might better take advantage of, especially in my present state, and sights I'd not seen that please me, as the brightness of snow at night.

In the morning the sun is out, and all the half-people come to see the fallen tower and the captured god. *She* pulls the curtains wide, lights many lamps and hooks shiny reflectors behind them, puts up mirrors to mirror the sun. Guards come and stand by my side. They wear imitation topknots rather like my own, held on by a strap around their heads, but they droop and flop, nor do they have any sheen.

I know, on the other hand, that the lights shining on me make me glow, but I don't have the energy to puff myself up to my magnificence, nor can I, anyway, achieve full brilliance sitting down like this with scissor tail dangling out of sight behind me, and who knows what state it's in. I've had no chance nor energy to attend to it, nor a brother or sister to help me.

Cushions are set out for the half-people, large ones for knees and small ones for foreheads. Then the half-people are allowed to file in. They are warned neither to touch nor to tempt the god, nor to ask about the future, and to seek only one favor. They stand and look at me for several minutes, obviously, even in my present state, awed by me. Then they bow down. The lights and the sun in the mirrors shine into my eyes from behind them so that they can see me, but I can't see them except as silhouettes. They kiss my feet though they've been told not to. Some kiss my every toe. They ask their favors . . . small favors, even so small as to be for one more little bag of oats. "All I ask is that I be chosen to sing at Solstice." "All I ask is that they buy my spoons . . ."

I keep silent. Had I spoken, it would have been to ask, on my own behalf, that the lights not shine into my eyes, and that I should not be kissed anymore on knee or toes.

I can make a clacking noise louder than their axes in the hills or their hammers as they build their towers. In here it would vibrate from wall to wall. At the same time that I do that, I can warble out a loony, laughing cry. To laugh again would feel good, and it would drive them all away for sure, but I also want that I should continue to be looked after, sheltered until Spring and fed good goat parts.

So it goes on and on into the afternoon, I keeping silent.

"They sing, "If on joyful wing," and, "Sometimes a light surprises," and I think yes, sometimes a light does surprise as the midnight light of snow."

CONTINUED ON PAGE 82

"Under reduced repression and censorship, a vigorous UFO culture has recently blossomed across the USSR."

ANTI MATTER

UFO UPDATE

Thirty years ago the Soviets gave the world a new word for "space traveler" *kosmonavt*, Anglicized as *cosmonaut*. They are now trying to do it again with the word *enlonavt*, only this time the travelers are not human. The enlonauts (or UFOnauts, as we would say) are aliens from space. And they've landed in the USSR.

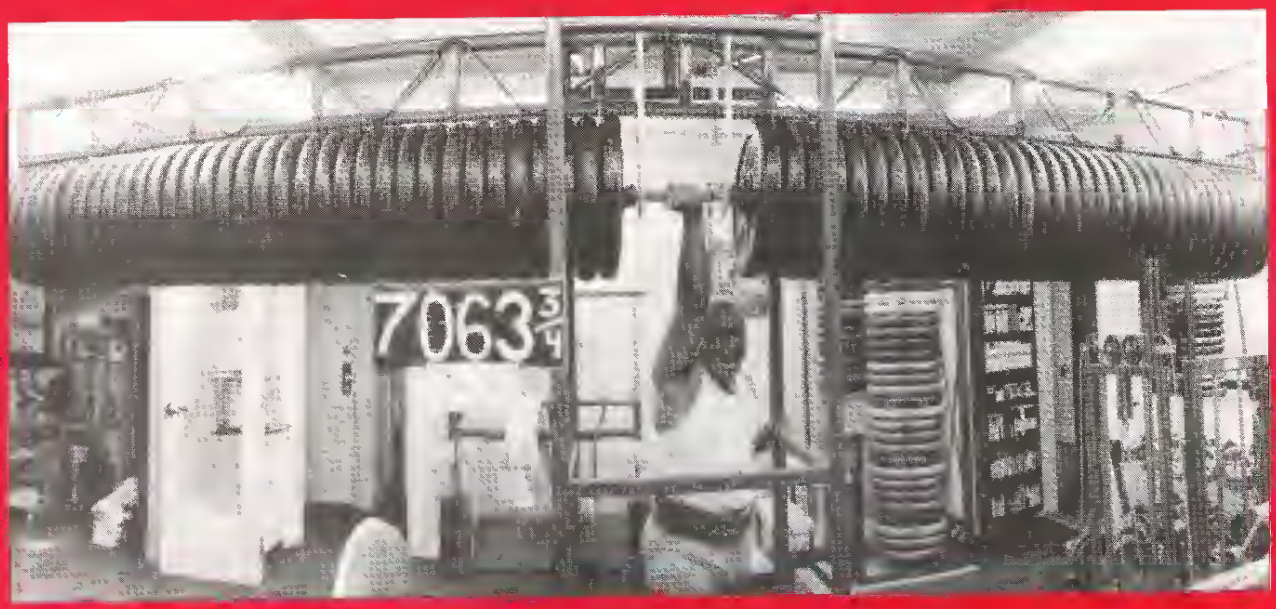
Although the Soviets have come to the UFO arena fairly late in the game, they are making up for lost time. Take the story recently publicized around the world by the Soviet news agency Tass. This past October, the agency announced, scientists confirmed the arrival of 9- to 12-foot-tall extraterrestrials with tiny heads. The aliens allegedly strolled around a park in the city of Voronezh.

Many Westerners don't know it, but this isn't the only Russian UFO story. In July 1988, Tass reported, a shining globe landed and disintegrated in eastern Siberia, leaving metal fragments behind. On April 15, 1989, a Moscow photographer allegedly shot a fleet of glowing objects. One expert called the objects "living, intelligent matter" and said they could dodge planes. And on June 6, four children in the Vologda region supposedly saw hovering globes, one of which disgorged a humanoid without a head. The Academy of Sciences, the story goes, investigated with a four-man team.

During the past year and a half, under the reduced repression and censorship of *glasnost*, a vigorous UFO culture has blossomed across the USSR. Nowhere is this movement more striking than at the Cosmos Pavilion, a gargantuan dusty old building full of depressing relics from the dawn of Soviet spaceflight. The building's main rotunda has been closed for years because the roof is collapsing and has never been repaired. Walk through a side door in the pavilion's central hall, however, and you'll see a brighter milieu. With its clean walls, cheery illumination, and colorful models, the exhibit on psychic powers and aliens attracts throngs of visitors. After all, they find the message upbeat. There is more to Soviet reality than this dilapidated old building and the grim world right outside.

Many of the alien enthusiasts, in fact, have joined official and unofficial UFO groups from Moscow to Leningrad to Tomsk—all across the USSR. What's more, real space travelers have joined the throng. Veteran cosmonaut Yevgeniy Khrunov attended a UFO roundtable in Leningrad. Pavel Popovich is deputy head of a UFO commission with the Academy of Sciences. Even the world's first man in space, Yuri Gagarin, has been posthumously enlisted. According to one recent newspaper article, his colleagues recalled how fascinated he had been by UFOs prior to his 1968 death.

This enthusiasm has not been lost on Soviet editors. Most of the Soviet news media, compelled by *perestroika* to attract readers rather than harangue them, have discovered what Western tabloids knew all along. Flying saucers and bizarre-looking aliens from space sell newspapers. —*JAMES OBERG*



LIFTING UP THE WORLD TOUR

An East Coast guru has taken metaphor to the extreme. Launching his "Lifting up the World" tour last year, New York-based charismatic leader Sri Chinmoy (above) journeyed from country to country lifting well-known athletes, actors, and politicians, as well as just plain folks. In the past, the sports-conscious guru has lifted elephants, airplanes, and huge stacks of weights.

In the focal point of the tour—the "one-arm lift," for which Chinmoy reportedly holds the world record—a man or woman climbs nine feet up a portable staircase and steps onto a small platform. Under the platform, Chinmoy whispers a few prayers to "my beloved supreme," then "empties my mind, making it as vast as the sky." Finally he pushes a bar upward with his left arm, hoisting the platform (and the nervous person atop it) several inches into the air. To set his world record, Chinmoy lifted *two* people at once, for a total of 332 pounds.

The diminutive, slightly paunchy Chinmoy, fifty-seven, committed himself to these feats (and the necessary three- or four-hour daily workouts they require) to lift the world's spirits and inspire peace and brotherhood. In that vein, about 20 of his followers sang "Lifting up the World with a Oneness Heart" (composed by Sri Chinmoy, of course) in resounding chorus before each lift.

During his travels, Chinmoy has lifted such notables as Jesse Jackson, Carl Lewis, and Bill Pearl, a former Mr. Universe, in addition to countless heads of state. The tour ended recently when Chinmoy lifted [illegible] Merrifield, last year's Nobel prize-winner for chemistry—his thirteen-hundredth lift.

Now that he's finished lifting the world, what will he do next? None of his 1,100 followers know for sure. He may have provided a hint, however, at a recent track meet of his worldwide congregation. Chinmoy, a high-level runner in East Bengal a few decades back, competed in five events himself. So possibly he's shooting for the 1992 Olympic decathlon team.—Mark Teich

"Gravity, electricity, fire, flood, hurricane, will crush or consume him if his hands are unsteady or his wits tardy."
—John Burroughs

"It's not enough to be Hungarian. You must have talent, too."
—Unknown

POSTMORTEM PRESENCES

[illegible] recent polls [illegible] group indicate that large segments of people throughout the world believe they've been contacted by the dead. But one nation particularly prone to such reports is Iceland, where 41 percent of the people say they've had "visits" from beyond.

Because of the robust response, University of Iceland psychologist Erlendur Haraldsson decided to study his countrymen's postmortem contacts in depth. First he collected reports from 100 people claiming contact from beyond. Of those, 59 percent reported visual sightings of the dearly departed, who sometimes spoke to the onlookers. Twenty-four percent only heard the deceased person's disembodied voice, and

others either felt the departed person's presence or smelled his or her odor in the air.

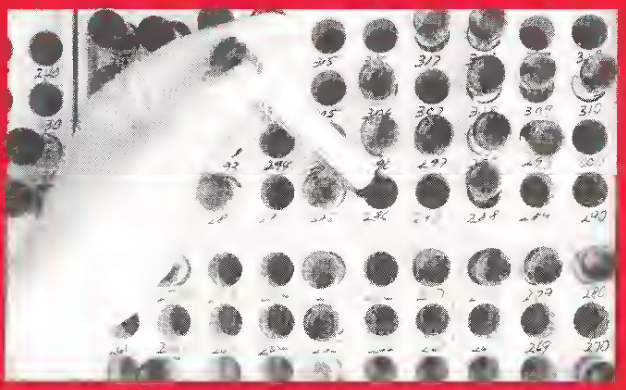
Most of the reported interactions were brief. One woman said she once saw her deceased eight-year-old standing in her living room wearing the same clothes he had on when he drowned. Another was trying to decide about marriage when her departed father, full of advice, appeared by her side.

Haraldsson was not interested just in collecting these reports, however, but in trying to figure out whether they were hallucinations or genuine contacts. His finding: Forty-four percent of the experiences took place in daylight or in normal electrical light, making the possibility of mistaken perception less likely than had been previously thought. What's more, Haraldsson believes that in most instances, his findings cast doubt on the most common explanation for postmortem contact experiences: that the bereaved subconsciously "create" them in order to be reunited with the lost person. Only 11 percent of the respondents were still grieving for the person who contacted them from beyond, he says.

Some experts disagree. "I'm impressed by Dr. Haraldsson's care," says UCLA psychopharmacologist Ronald Siegel. But, he suggests, some of Haraldsson's subjects had experienced the recent death of a significant other. And that can generate strong imagery.

But some parapsychologists say Haraldsson may have a winning card up his sleeve. In several cases, he claims, the returnee was reportedly seen by a number of people at once.

—D. Scott Rogo



BLOOD RELATIONS

How can you tell whether so-called psychic healing has any tangible benefit? Psychologist William Braud of the Mind Science Foundation in San Antonio suggests a simple experiment. Just isolate human blood cells from the body and then ask people to influence them through thought alone.

To execute this experiment, Braud withdrew 20 tubes of blood from each of 32 subjects and exposed the blood to a destructive saline solution. Using a double-blind procedure, Braud's subjects were instructed to visualize "protecting" half the tubes. The remaining tubes were used as controls. The result? The blood cells in the treatment group survived significantly longer than the controls. Because the subjects and the blood samples were located in separate rooms, Braud believes his procedure rules out more skeptical explanations and suggests psychic influence at a distance. Adds Braud, the source of the blood samples did not appear to alter the results.

Commenting on Braud's experiment, sociologist Marcello Truzzi, director of the Center for Scientific Anomalies Research in Ann Arbor, Michigan, says, "Science does not normally confirm an extraordinary hypothesis on the basis of a single study. In fact, the history of science is full of unreplicated anomalous results. Braud's experiment is consistent with some other lines of parapsychological research and certainly warrants independent confirmation, preferably by skeptics."

Hard-line skeptic Bob Steiner, Fellow of the Committee for the Scientific Investigation of Claims of the Paranormal and founder of the California-based Bay Area Skeptics, adds, "If Braud's results could be replicated, I would have to reevaluate my present thinking. However, until they are, there is nothing for me to do."—Keith Harary

"Every man takes the limits of his own field of vision for the limits of the world."
—Arthur Schopenhauer

AVATARS IN-TRAINING

Most of us think of an "avatar" as an altruistic, godlike being that assumes human form. Now, however, an entrepreneur named Harry Palmer says the tricky old business of being an avatar is a mere training course away.

Palmer, an ex-Scientologist, claims he discovered the secret to being an avatar while floating in an isolation tank in Ithaca, New York, in 1986. During his immersion in this altered state, Palmer redefined the term as "a being who understands that beliefs create reality and not the other way around." Developing the concept further, Palmer created a week-long course, based on mental exercises. Using his exercises, Palmer declares, participants can "discreate," or dismantle, any unpleasant creation in the world.

"Beliefs are creations," says Gerald Epstein, a New York psychiatrist who has taken an additional week of training to become an "Avatar Master." With practice, he says, discreation becomes a 15- to 30-second mental reminder to dispose of troubling or limiting thoughts. Different exercises, he explains, target different beliefs or creations. An exercise called Body Handle disposes of unpleasant sensations; an exercise called Limitation Handle enables participants to overcome "limiting thoughts" about what constitutes the self.

Epstein admits that Palmer's Avatar techniques are very similar to simple meditation. But while meditation requires a period of quiet calm, the Avatar exercises are "geared for a materialistic society so competitive that even twenty minutes of quiet meditation a day can be considered too long a time to spend on oneself."

On the other hand, Avatar is not cheap. The week-long course costs $2,000. The nine-day Avatar Masters course is an additional $3,000. And each time a Master trains a fledgling Avatar on his own, Palmer receives a royalty.

Palmer forbids freshly hatched Avatars to divulge the mechanics of his discreation exercises, because, he says, no one could understand the program without experiencing it anyway.

Tracy Cochran

PRISON ASHRAM

In the early Seventies Bo Lozoff and his wife, Sita, were living in an ashram, practicing yoga and studying meditation. Meanwhile Sita's brother was also living in a community shut off from the rest of the world—he was in prison.

"While visiting my brother-in-law, I was struck by similarities in the penitentiary and ashram life-styles," Lozoff recalls. "The biggest difference was the mental outlook. I decided to reach out to inmates who wanted to try a more monastic orientation, since they had to be cloistered anyway."

Toward that end, the Lozoffs founded the Prison-Ashram Project in 1973. The nonprofit organization mails out free copies of Lozoff's book, *We're All Doing Time*, a newsletter and a collection of short stories. Lozoff receives about 50 letters a day from inmates and estimates that Prison-Ashram materials are now in more than 1,000 prisons worldwide.

But are prisoners who follow a contemplative life in jail inspired to follow a spiritual path when released? "I don't think that most of these people are regular meditators or yogis when they get out, and I don't really care," Lozoff answers. "We simply want to be available to these people in an open-hearted way without being limited by expectation of result."

Surprising as it may seem, Lozoff's ideas have taken hold. Psychologist Al Nagy, for instance, has incorporated the Prison Ashram concept into his program at the Federal Correctional Institution at Bastrop, Texas, where 200 inmates meditate and tend to their spiritual needs. Nagy says that some of the participants have even formed groups to help people in the community. Some of the prisoners, Nagy adds, have gone through dramatic changes. "though I would like to do some scientific research and get some concrete data before I brag too much."—Sherry Baker

"When a man knows he is to be hanged in a fortnight, it concentrates his mind wonderfully."

Samuel Johnson

"How different can places be if both are called places."

—Don DeLillo

LAST LAUGH?

CONTINUED FROM PAGE 48

a million tons. But a really big comet could be a hundred miles in diameter and would do some real damage.

What is the chance of any of this happening by the year 2000 or thereabouts? Here the scientists differ with the doomsayers. The mathematical likelihood of a collision between Earth and a comet is about once every 100 million years. We can't, however, be quite so blasé about the asteroid that just missed us. Scientists report that this collection of rock and dust orbits the sun once a year and regularly buzzes our planet. "Sooner or later," says Henry Holt, scientist emeritus at the U.S. Geological Survey in Flagstaff, Arizona, who discovered the asteroid, "it should collide with the earth or the moon."

EARTHQUAKE

Scenario: The earth will shake and split asunder. Buildings will topple. Charlton Heston will grit his teeth, just like in the movie. Coastal cities will slide into the oceans and be seen no more.

Who says? Just about everybody who is anybody in apocalyptic thinking seems to agree on this one. Nostradamus and Edgar Cayce both predicted widespread earthquakes around the year 2000. Hildegard of Bingen prophesied quakes, and psychic archaeologist Jeffrey Goodman predicted that the U.S. coastline would end up in Nebraska and Kansas by the year 2000. The Book of Revelation describes a terminal earthquake, and even Isaiah got into the act: "The earth will reel like a drunkard and it will sway like a hut...until it falls, never to rise again."

Seriously, now: Yeah, sure. Cities falling into the ocean? This will come as a shock to most doomsayers, but continents are not like rafts floating on the water. They are quite solid, with continental shelves sloping downward under the water, where they meet the ocean floor. These things are well built and firmly attached to the planet. Who do you think the contractor was, Morton Thiokol? Seriously, how are you going to knock big slices of a continent into the sea? The strongest quake ever recorded, in Chile in 1960, killed an estimated 3,000 people and dropped some 5,000 square miles of Chilean territory about six feet. Even so, large chunks of the country did not go slip-sliding away into the ocean.

NUCLEAR WAR

Scenario: You know how this one goes. George Bush dies in an electric guitar accident, and newly sworn in President Quayle says, "Hey, Marilyn! What happens if I push this big red button over here?..." There's an exchange of missiles and lots of people get blown up. Others die of radiation. But enough survivors climb from the wreckage to rebuild civilization, once they've wrested control back from the mutant apes ruling the planet, that is.

Who says? The Hopi, Mayans, Nostradamus, the Seeress of Prague, and the Fátima prophecy all vaguely agree. The Hopi said that "gourds of ashes" will fall from the sky, causing a disease for which there is no cure. Nostradamus predicted a horror "enclosed in containers. Launched from a fleet of ships, in a single night it transforms a city to dust and vapor..." The seventeenth-century Seeress of Prague, who predicted Queen Victoria and Hitler, described a war in which men "will sow a Mushroom, whose Seed will fall from the Sky to Earth... Life is wiped out." The 1917 Fátima prophecy predicts a great war in the second half of the twentieth century in which "fire and smoke will fall from heaven, and waters of the oceans will become vapors... Millions and millions of men will perish...and those who survive will envy the dead."

Seriously, now: It's hard to argue with this one. Nuclear holocaust is going to be a bummer. Our only hope is to count on the corruption of the defense industry and the ineptitude of the military. Maybe none of the missiles or warheads will actually work.

The big scientific news of the decade, however, is the nuclear winter theory, which holds that where there's fire, there's smoke, and it's the smoke that will really get us. According to Mark Harwell, director of Cornell University's Global Environment Program and one of the architects of the nuclear winter theory, just 100 warheads exploding in major cities in the Northern Hemisphere could generate enough smoke to create a "reverse greenhouse effect." The smoke will travel to the stratosphere and cut off sunlight. The earth will grow cold, as much as 15°C colder, and our major grain crops will die. In other words, we're more likely to starve than burn. "Most people point to Hiroshima and Nagasaki as the models for the aftermath of a nuclear war," says Harwell. "But the entire world will be a lot more like Ethiopia and the Sudan." Previously, the potential body count of nuclear war was estimated to be "only" in the tens of millions in the United States and a few hundred million globally. That would still leave four and a half billion humans on the planet, but Harwell says the long-lasting effects could eventually kill another 4 billion. What to do? Move to New Zealand. It's way the hell south and there are 30 sheep per capita, says Harwell. You can survive on lamb chops until the smoke clears out of the stratosphere.

HOW THE WORLD WILL END: FUNDAMENTALIST-STYLE

"And he gathered them together into a place called in the Hebrew tongue Armageddon. And the seventh angel poured out his vial into the air; and there came a great voice out of the temple of heaven, from the throne, saying, It is done.

"And there were voices, and thunders, and lightnings; and there was a great earthquake ..."

—Revelation 16:16–18

The final shoot-'em-up described in the Book of Revelation has long been the preeminent model of the end of the world, inspiring hosts of medieval commentaries in lavishly illustrated manuscripts. Nowadays, thanks to a chorus of Protestant fundamentalists, the "seven vial judgments" of Revelation (giant hailstones, earthquakes, careening heavens, and so forth) are being interpreted in the light of a thermonuclear war.

According to Hal Lindsey, a former Campus Crusade for Christ staff member and author of the best-selling *The Late Great Planet Earth*, Armageddon geopolitics involves an Antichrist who heads a "ten-nation confederacy" (probably a strengthened Common Market), achieves world domination, goes to Jerusalem, and proclaims himself God incarnate. Armageddon will start when a multinational army led by "Gog of Magog" swoops down on Israel from the "uttermost parts of the north," i.e., the Soviet Union. (One of Lindsey's chapters is titled "Russia is a Gog.") There will be a "nuclear exchange" in the Middle East, then a Chinese army of 200 million will march in. The "seven vial judgments" will be released just before the return of Jesus Christ. All the armies of the world will fight it out in Armageddon, wiping out most of the earth's population in the process. Then comes a Utopian thousand-year-long kingdom ruled by Jesus Christ himself.

This doomsdayism might be a mere cult curiosity if it were confined to a few biblical literalists in San Bernardino. But *The Late Great Planet Earth* influenced millions. And at several press conferences, the former leader of the free world, Ronald Reagan, let slip his belief in a nuclear Armageddon based on prophecies in Revelation, Daniel, Ezekiel, and the other prophetic texts of the Bible. The times they are apocalyptic.

HOW THE WORLD WILL END FROM THE BIBLE

According to the Bible, the last days will be just like an episode of *Dallas*.

"In the last days ...men will be lovers of self, lovers of money, boastful, arrogant, revilers, disobedient of parents, ungrateful, unholy, irreconcilable, malicious gossips, without self-control, brutal, haters of good, treacherous, reckless, conceited, lovers of pleasure rather than lovers of God...."—II Timothy 3

Just like the seven o'clock news.

"And he said, Take heed that ye be not deceived, for many shall come in my name, saying, I am Christ; and the time draweth near, go ye not therefore after them;

"But when ye shall hear of wars and commotions, be not terrified...

"Then said he unto them, Nation shall rise against nation, and kingdom against kingdom.

"And great earthquakes shall be in divers places, and famines, and pestilences; and fearful sights and great signs shall there be from heaven...

"...when ye see these things come to pass, know ye that the kingdom of God is nigh at hand."—Luke 21

Just like the United Nations General Assembly.

"For nation will make war upon nation, kingdom upon kingdom, there will be famines and earthquakes in many places... Many false prophets will rise, and will mislead many, and as lawlessness spreads, men's love for one another will grow cold."—Matthew 24

Just like a conference of transpersonal therapists:

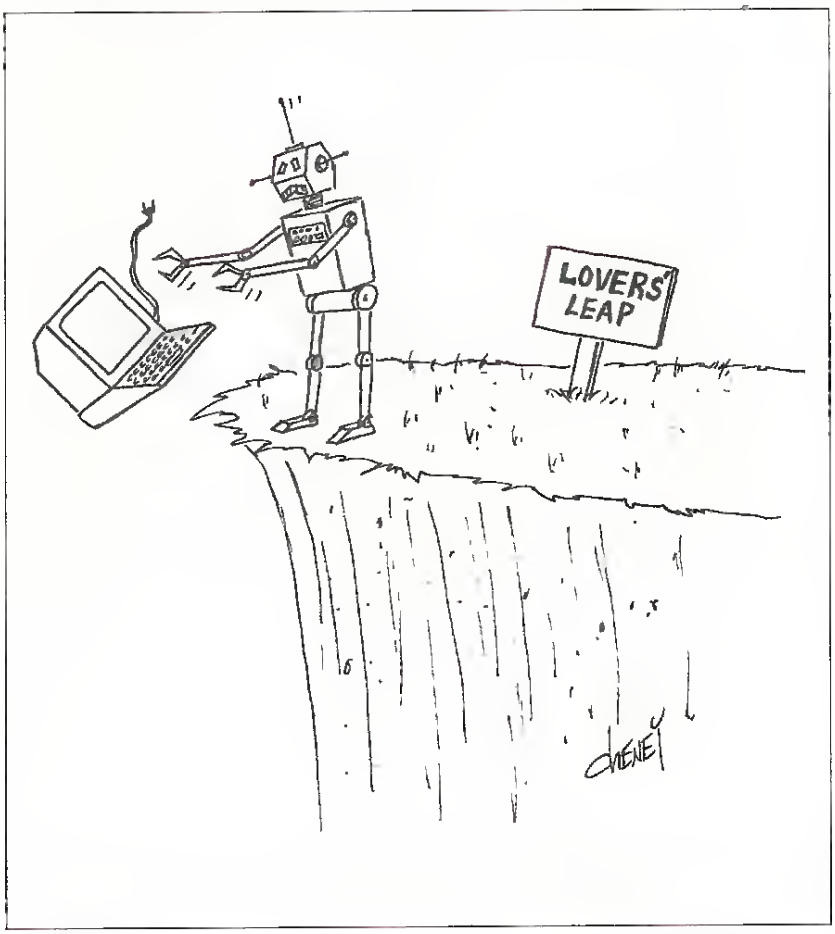
"And it shall come to pass in the last days, I will pour out of my spirit upon all flesh; and your sons and your daughters shall prophesy, and your young men shall see visions, and your old men shall dream dreams...."—Acts 2

But take heart, secular humanists. Most of the biblical passages that supposedly presage World War III really concern ancient politics, according to mainstream theologians. To fundamentalists the "king of the north" is a Soviet leader who will help launch Armageddon. But in Daniel, Chapter 11, the "king of the north" clearly refers to one of the Seleucid rulers of the Hellenistic Empire, according to Catholic University biblical scholar Joseph Jensen, O.S.B. The "beast" of Revelation, says Father Jensen, represents the Roman Empire, and its notorious ten horns "are not a ten-nation confederacy but probably represent contemporary governors in the Roman Empire...."

As for the Antichrist, "a widely held understanding of the 'number of the beast,' 666, is that it represents the numerical value of the Hebrew letters that spell *Neron Caesar* (i.e., *Nero*)."

HOW THE WORLD WILL END: FROM RELIGIOUS VISIONARIES

Apparitions of the Virgin Mary have been filling our skies. "Marian visions have been increasing since the nineteenth century," says Michael Grosso, an expert in the visions. "It's a very confounding phenomenon connected with millennialism—and with UFOs."



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While the typical UFO contactees are a middle-aged couple with a penchant for writing newsletters who hail from a sparsely populated Western state, the average BVM (Blessed Virgin Mary) contactee is an innocent child from a Catholic area. Both types of apparitions typically involve puzzling supernatural events and grim prophecies.

In 1917 "a beautiful lady from Heaven" appeared to three children in a field near the village of Fátima, Portugal, while other observers saw baffling flying-saucerlike phenomena. "There were apparitions over a period of six months," says Grosso. "And during this time crowds of witnesses were seeing globes of light in the sky, hearing rocketlike sounds, and so forth. There were also UFOlike effects during the recent Medjugorje [Yugoslavia] apparition. The most spectacular case was the Marian apparition outside of Cairo in 1961, when thousands of people of all religious persuasions witnessed extremely dazzling apparitions of a goddess figure." There have also been recent Marian visions closer to home. Since 1970 more than 280 such messages and apparitions have appeared to Long Islander Veronica Leucken.

Grosso thinks that Marian apparitions, like UFO sightings, could be a case of "collective psychokinesis" brought about by millennial anxiety. "The destructive potential facing our planet, from nuclear war to AIDS, is inciting a global pattern of psychic phenomena—including more visions of Mary."

Our Lady of Fátima left behind a three-part prophecy, the first two parts of which were a vision of Hell and of World War II. The Papacy has kept most of the third part under wraps, although it was scheduled to be unveiled in 1960. But in 1963 the German journal *News Europe* published the alleged text, which contains many of the familiar ingredients of apocalypse.

"A great war will break out in the second half of the twentieth century. Fire and smoke will fall from heaven, and waters of the oceans will become vapors.... Millions and millions of men will perish, and those who survive will envy the dead. The unexpected will follow in every part of the world, anxiety, pain, and misery in every country." Et cetera.

HOW THE WORLD WILL END: FROM NEW AGE MILLENNIALISTS

New Age millennialism has a rather different flavor from the biblical Last Judgment variety. For one thing, the big event is not necessarily Armageddon, though there may be some rough sledding ahead for planet Earth.

The apocalypse is more often interpreted according to its secondary meaning ("a disclosure regarded as prophetic; revelation")—that is, as a collective coming of age, a gigantic planetary Bar Mitzvah. Take, for example, the following prophecies.

The world will end in AD 2012, according to the Mayan calendar stone as interpreted by José Arguelles, New Age eschatologist, art historian, and author of *The Mayan Factor*. But don't worry. There's a new world coming.

The Mayan calendar, or Tzolkin, describes a 5,200-year Great Cycle beginning in 3113 BC and ending in AD 2012, Arguelles claims. This cycle, in turn, is embedded in a longer 26,000-year cycle, composed of five Great Cycles, which also ends in 2012. (Meaningful-coincidence buffs may note that this long cycle, which Arguelles equates with the life span of *Homo sapiens*, corresponds to the 26,000 years of Plato's "Great Year" and of the astrological precession of the zodiac.) "What we are experiencing," he concludes, "is the climax of our particular species and evolutionary stage—the very last twenty-six years of a cycle some twenty-six thousand years in length!"

"The earth hurtles through space at 67,000 miles an hour. What if you drove your Ford Fairlane that fast down an interstate? Why, you'd topple ace over teacups when you hit the first good curve."

Hoping for a heavenly kingdom sans Armageddon, Arguelles masterminded the harmonic convergence on August 16–17, 1987—the very date that Aztec prophecies identified as the end of the nine cycles of hell that began in 1519—when thousands of people took to the mountaintops and the deserts to, well, be apocalyptic.

In 2012, according to Arguelles's interpretation, will begin a paradisiacal Solar Age, a postindustrial Utopia.

"Everyone will be a channel—a medium—and what we understand today to be psychic impressions or channeling will be but child's play compared to our actual potential." We'll live harmoniously in posttechnological New Age villages—equipped with "solar temples," lush gardens, synesthetic pleasure domes, and "houses of energy and information"—and hobnob with UFOs ("E.T.'s, UFOs, the 'space brothers'—these are not alien entities but emanations of being itself") and the returned Mayan masters. If we're around, that is.

Uh-oh. There's that date again. AD 2012. That's when Terence McKenna's prophetic software goes hyperdimensional. McKenna is a scholarly, Berkeley-educated visionary who may be unique among New Age prophets in avoiding such New Age cliches as "cleansing the planet" and "increasing the vibrational frequency." His compellingly literate "raves," as he calls his monologues, have made him a star of underground radio and the human-potential circuit. He also operates Botanical Dimensions, a sanctuary for rare plant life in Captain Cook, Hawaii. He peers at the future through a computer program called *Timewave Zero*, based on the ancient Chinese I Ching oracle system, which McKenna believes is the "smashed-up remains" of an ancient lunar calendar.

"I noticed there was something in history that science had missed," he explains. "I named it Novelty waves. It has been increasing since the universe began." McKenna's software uses fractal mathematics to map this "Novelty" as it becomes denser and denser, until—in 2012—"all cycles come to zero, a dimension emerges that goes off the graph. We are caught in a temporal maelstrom, spinning around the presence of some transdimensional object."

The I Ching's system of 64 hexagrams describes a nested set of timekeeping cycles, he maintains. For example: Life began on Earth about 1.3 billion years ago. Divide 1.3 billion by 64 and you have a cycle within a cycle that started 18 million years ago, at the height of the Age of Mammals. Divide by 64 again and you get a smaller cycle commencing 275,000 years ago—at the emergence of *Homo sapiens*. Divide by 64 again and we come to 4,300 years ago—around 2300 BC, historical time. Then things get really postmodern.

"The last cycle began with Hiroshima, August 5, 1945," according to McKenna. "This sixty-seven-year, one-hundred-four-day cycle at or near the end of the larger, forty-three-hundred-year cycle will terminate on December 21, 2012. This comes precisely at the end of the Mayan calendar. For some reason ancient people had a fixation on this winter solstice 2012."

The fact that McKenna's apocalypse coincides with the one Jose Arguelles has gleaned from the Mayan calendar does not mean that McKenna is a harmonic convergence groupie. McKenna says it was he who first brought AD 2012 to Arguelles's attention.

"I never thought that when I came up with the date 2012, I'd have to elbow my way through a crowd," McKenna says. "Now people say 'Oh, you're a José-ite.' But there is something about this 2012 date. The Mayans were obsessed with it. We shouldn't underestimate the power of mass psychology."

HOW THE WORLD WILL END.
FROM DOOM'S
MR. BIG, NOSTRADAMUS

"In the year 1999, and seven months from the sky will come the great king of Terror.

He will bring back to life the great king of the Mongols.

Before and after War reigns happily unrestrained."

Take the famous king of Terror prophecy above by Nostradamus, the sixteenth-century French seer. What does it mean? Beats us. In her newest book, *Final Prophecies of Nostradamus* (1989), Nostradamus exegete Erika Cheetham proposes, "In this gloomy prediction of the coming of the Third Antichrist [the first two—we think but aren't sure—were Napoleon and Hitler] in July 1999, Nostradamus seems to foresee the coming of the Millennium...."

Other Nostradamusologists think the king of Terror may be a nuclear warhead or something ominous from outer space. Anyway, consider spending the month of July 1999 vacationing under the North Pole or at the very least avoiding Mongolian cuisine.

HOW THE WORLD WILL END:
AND HOW TO BE PERSONALLY
SAVED FROM DOOM

Ever wonder why all those people are smiling as they hand you poorly illustrated tracts called *End of the World, World War Three*? It's because your world is going to end, not theirs.

Christian fundamentalists have a golden-parachute clause known as the rapture. The rapture, based largely on two passages in I Corinthians and I Thessalonians, means that the Lord will personally swoop down and whisk all good Christians into Heaven before the end—indeed, most fundamentalists believe, before the seven-year "tribulation" preceding Armageddon. (These pretribulationists often get into Scripture-quoting wars with the posttribulationists, who think true Christians will have to stick it out right up to Armageddon with the rest of us.)

When will the rapture happen? "We don't know," says Lindsey. "No one knows. But God knows." But most people who are into doomsday arithmetic believe they'll be raptured right out of their Ford Fairlanes any day now. (Hence the ever-popular bumper sticker, IN CASE OF RAPTURE THIS VEHICLE WILL BE UNMANNED.)

If you want the exact time, ask Edgar Whisenant, a former NASA engineer from Little Rock, Arkansas, who spent 14 years studying 886 biblical prophecies. "1988 is the Rapture of the church.... Fifty-seven people will either die or be raptured within the next seven years," he proclaimed in a widely circulated booklet, *88 Reasons Why the People Rapture Will Be in 1988*, that targeted September 11 to 13, 1988, as the date. Some people were so impressed they went out and ran up huge bills on their Visa cards, but, of course, everybody woke up in the same vale of tears on the morning of September 14.

There's a variation on fundamentalist rapture—and it comes from outer space. Soltec, a space being channeled by an Arizona-based psychic who goes by the name KaRene, announced last New Year's Eve: "Should you have a cycle closing out because of nuclear devices, don't you think for one moment that your air would not be filled with craft of all sizes.... All of us... and I speak for every member of the substation platform... are all working on the Exodus Plan."

The Exodus Plan, or World Evacuation Project, is to New Age "star people"—that is, UFO contactees and would-be contactees—what the rapture is to fundamentalist Christians. The extraterrestrials who have been communicating with Earthlings in recent years warn that Armageddon, or something like it, is near, and when it comes, the space brothers will arrive in their ships and save the believers. "Some will be put to sleep to lessen the trauma," explains one Commander Jycondria, assistant to Ashtar. "Some will remain on the ships.... Some will be escorted to their planets where acclimation is possible, while others may be transferred to the tremendous citylike ships. Destination depends upon the individual survivor, his life patterns and spiritual evolvement...."

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HOW THE WORLD WILL END:
WILL TOMORROW EVER COME?

While we're all sitting around getting ready for rapture, let's not forget that the end is near not for the first time. George Santayana once said that those who do not know history are doomed to repeat it. When it comes to apocalyptic doom, those who don't know their history may actually have to not repeat it. Before making any radical preparations for the Big Nothing, reflect upon the following remembrances of ends past.

A.D. 1033
Judgment Day
Various European Prophets

Shortly before 1033 a great famine struck Europe, inspiring fears of an imminent doomsday. "It was believed that the order of the seasons and the laws of the elements were now fallen again into the eternal chaos, and the end of the human race was feared," according to commentator Rudolph the Bald. As soon as the crops recovered, these anxieties subsided—for a while.

April 3, 1843
Judgment Day
William Miller

One of the most influential doomsayers of recent history was William Miller, a fundamentalist Protestant and biblical literalist from New York State. Hundreds of Millerites gathered on the New England hilltops to await the coming of the Lord in 1843—a date based on a passage in Daniel 8:13–1 about "2,300 mornings and evenings" since the desolation of Jerusalem. (Assuming the desolation happened in 457 B.C., 2,300 years later would be 1843.) When nothing happened, the Millerites fastened their hopes on March 21, 1844, then on October 22, 1844. Despite the Savior's no-show, the Millerites evolved into the Seventh-Day Adventists.

1910
Life on Earth Destroyed by Comet
Newspapers

After some scientists predicted that Earth would pass through the tail of Halley's Comet, headlines proclaimed the news that poisonous gases in the comet would asphyxiate all life on Earth.

February 1962
End of the World
Hindu Astrologers

In February 1962 there occurred an ominous alignment of eight planets in Capricorn, prompting Indian astrologers to predict the final curtain and millions of Hindus to panic. The fateful year 1962—with its astrological peculiarities—also figures in psychic Jeane Dixon's prophecies as the year of the birth of the Antichrist.

Mid-1980's
Comet Strikes Earth
Jeane Dixon

"Earthquakes and tidal waves will befall us as a result of the tremendous impact of this heavenly body in one of our great oceans. It may well become known as one of the worst disasters of the twentieth century."—Dixon, *My Life and Prophecies*

1988
Judgment Day
Fundamentalist Prophets

Several fundamentalist Protestant doomsayers have gravitated to the year 1988 for various arcane reasons—such as the fact that it was 40 years (one biblical "generation") after the founding of the modern state of Israel.

Last, but certainly not least, there's the Big One: the Apocalypse A.D. 1000.

You've probably heard that in A.D. 999 people sold all their possessions and headed for Rome to await the coming of the Lord. Cathedrals were left unfinished, and work came to a halt as the end of the world neared. Every thunderstorm, every shooting star, caused panic. In Aquitaine the sky was said to rain blood; in England a meteor caused stark terror; strange omens were reported in Rome. It was millennium madness.

This story has been repeated so often that it's part of the collective unconscious, prompting odd expectations for New Year's Eve 1999: sackcloth and ashes in Times Square? Donald Trump tearing down his glittering condos? Just yesterday we picked up a copy of *Psychology Today* and read an excerpt from Richard Erdoe's just-published *A.D. 1000: Living on the Brink of Apocalypse*, which restates the end-of-the-world scene popularized in the nineteenth century by Charles Mackay's *Extraordinary Popular Delusions and the Madness of Crowds*. The only thing is, it never happened. At least not that way.

"It's a legend," says Father George Dennis, a historian at Catholic University of America in Washington, DC. The Italian author Umberto Eco agrees: "On that famous night [December 31, 999], nothing happened," he wrote in a recent article. "Oddly enough, the uneasiness did exist, but before and after." The year 1000—the Latin *M* to medieval man—would have held no particular numerical significance, and millennial thinking more often revolved around the dates of empires, according to Father Dennis. Besides, the end of the world had been foretold so many times before. "There is simply no contemporary evidence that such a panic took place," concludes author Daniel Cohen in his book *Waiting for the Apocalypse*.

In conclusion, then, the one thing about the coming of the apocalypse seems to be that it's forever coming. Since the beginning of history, the first thing we started thinking about was the end of history. Maybe that's what makes the apocalypse so human, it's always on the verge of being, just as humans themselves are always on the verge of the present, the past, and the future. Anyway, have a nice day. ∞

INTERVIEW

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pseudo answers. Though it sounds like a negative message, it has had a great impact on people.

Omni: In the book's ending you talk about our brains giving us the option of escaping the tyranny of our genes.

Dawkins: Brains are part of the machinery for propagating selfish genes. But in the course of becoming more efficient at effective gene survival, they've acquired the capacity to rebel, to take off in their own directions. This is particularly true in cultural environments, where whole populations of brains can get together and communicate. A social federation of brains can take evolution in directions radically different from those favoring the replication of genes.

Omni: Opposing genes, you posit the meme, a cultural unit of reproduction.

Dawkins: That's right. We can lead fulfilled lives by reproducing ideas rather than offspring. I'm interested in the possibility of ideas taking on a life of their own, of self-replicating entities that have the power, by mutation and selection, to club together into more and more efficient units of self-preservation. In *The Selfish Gene* I use the example of religions, which I see as collections of mutually compatible memes, just as bodies are collections of mutually compatible genes. When you've had a large number of generations for selection to go on, it becomes quite plausible that sets of mutually compatible memes will get together and become the great religions of the world.

Omni: Could life be defined as something that replicates itself?

Dawkins: Something replicating itself is the necessary prerequisite for Darwinism to get going, and Darwinism is the prerequisite for all forms of life. Although self-replication is the prerequisite for life, life doesn't immediately follow from self-replication. Life follows from many, many generations of gradual evolution, after self-replication has begun.

Omni: Will the self-replicating entities discovered elsewhere in the universe be different from life as we know it?

Dawkins: Such self-replicating entities could be some other kind of molecule than DNA. Perhaps they could even *be* DNA molecules, but they almost certainly won't use the same genetic codes that we do. Plenty of other molecules may be capable of entering into a self-replicating system the way DNA does. But these self-replicating entities might not even be molecules. They could be macroscopic entities, things big enough to be seen with the naked eye, such as cloud patterns. Anything that's self-replicating could be the basis for life.

Omni: Could we look at life elsewhere in the universe and fail to recognize it?

Dawkins: We could easily look at a self-replicating *entity* and not recognize it. But I doubt that we could look at the manifestation of a hundred million generations of evolution and not recognize it. And if we didn't recognize it, then it wouldn't be a very interesting form of life anyway. I'm inclined to think that life began with some other kind of self-replicating entity, and this provided an environment in which DNA was able to take over. Whether it's the original replicator or a takeover, DNA is very good at what it does. It's extremely faithful as a reproducer. The mutation rates are around one in a million. It's even evolved elaborate proofreading systems to remove most of its mistakes. Fortunately, it doesn't remove all of them, or evolution would come to a halt.

***Omni*:** If DNA wasn't the first replicator, could something succeed it?

Dawkins: Yes. Our brains have provided a silicon milieu in which some kind of further takeover is possible. An electronic takeover would seem to be the most likely. I am fascinated by complex functioning as a diagnostic feature of life. If you went to another planet, how might you recognize life? If it were something like a computer you'd see immediately that such a complicated piece of organization was created for a purpose. So you'd know life was or had been there. Life, I believe, can come about only through a Darwinian process of natural selection. Whether artifacts themselves are naturally selected is problematic, but they wouldn't be there if it were not for life. Computers are a particularly interesting form of artifact, because they provide a medium in which all sorts of lifelike processes can go on. Computers evolve in the sense that computer designs—the ideas of how to make computers—jump from brain to brain via language and written plans. You can make an evolutionary succession of computers that improve as the years go by. There is a kind of germ line, the equivalent of genes, in the blueprints for making computers. Computers themselves don't breed; they are used for a while and then tossed on the scrap heap. But the ideas that went into making them can breed as genes do.

***Omni*:** When are we likely to see self-replicating machines?

Dawkins: Self-replicating hardware may not happen, because there's no obvious reason why humans should want it to happen. Self-replicating software, on the other hand, already happens, with people copying files and sending them off to each other. This self-replication at the software level has sinister implications. You could have computer viruses capable of mutating in such a way that they become more invasive. A computer could easily have a copy of its own blueprint in its memory. Then all it would need to build another computer would be the equivalent of limbs—robot arms that would reach out, pick up integrated circuits, and plug them into their sockets. A factory making Macintoshes could be automated to run without human intervention. Whether these machines could launch a sinister escalation of evolution depends on the amount of random variation they allow in their assembly plan, their program. Any takeover by computers of the human world, however, won't come through computers manufacturing hardware copies of themselves. Robot arms are terribly inefficient compared with human arms for doing this kind of intricate work. More likely, the computing systems that control government organizations, like the Pentagon, could become more and more autonomous from human decision making. When artificial intelligence becomes more sophisticated, I don't see why large organizations where humans now do the donkeywork, shouldn't be taken over by machine intelligence. Humans will then sink into the background as functionaries or slaves. But if you extrapolate from the way computers have evolved during the last thirty years, we could be in for a nasty shock. Although the enslavement of humans by machines could be a positive thing, I don't find it at all an attractive possibility, aesthetically. Because I am very human and value human things.

"Most people go through life without ever really understanding Darwinism. They spend an enormous amount of time learning what the church teaches. This annoys me, out of a love of truth."

***Omni*:** What is required for the evolution of consciousness, and why did it happen in humans?

Dawkins: It's extremely puzzling. An efficient survival machine in a very complicated environment would benefit from having an onboard computer enabling it to behave in complicated ways. The more complicated the behavior the better, because it can effectively respond to a wider variety of contingencies thrown at it by the environment.

Beyond a certain level of complexity, the most efficient way for a survival machine to organize its behavior is to run a computer simulation of the world inside itself. That's what we do when we imagine things. Simulation programs are now commonplace in this computer world, but none of them are conscious. They don't need to be. So I don't know what consciousness is good for that could not be done by highly complicated, but unconscious, simulation.

***Omni*:** Have you any ideas where consciousness came from?

Dawkins: In highly social animals the most difficult part of the environment involves outwitting fellow species members, courting, fighting, or competing with them. Second-guessing what other individuals are likely to do becomes a major part of surviving.

Another theory comes from the philosopher Daniel Dennett of Tufts University, who uses a computer analogy. There are basically two kinds of computers: parallel and serial processors. My Macintosh is a serial processor. It has a single computing engine that deals with problems one at a time, even though it does this exceedingly fast. Our brain, on the other hand, looks like a parallel processor. We do many things all at once. But our subjective stream of consciousness is not parallel. It presents one serial phenomenon after another. Dennett thinks that consciousness is a serial machine running atop a basically parallel computer.

***Omni*:** Birth control provides one of the best examples of how humans have revolted against their genes.

Dawkins: There are no contraceptives in nature. All the selfish genes need to program into us is sexual appetites. Then we have no control over the rest. But now that we have artificial means of preventing conception, we can enjoy our sexual appetites and yet have no children. We desire children for their own sake, but it's not surprising that so many people happily subvert the designs of their genes in contraception.

***Omni*:** Tell me about your father.

Dawkins: He was very enterprising, always devising new schemes and technical inventions. He built up a nice little business selling cream from jersey cows. He designed his own system for pasteurizing the cream, which was full of flashing colored lights and controls. My fascination with computers probably stems from my father's interest in designing cream pasteurizers and other ingenious devices. While I worked on the farm in the school holidays, I never took to it terribly well.

***Omni*:** Much of your writing is devoted to giving scientific explanations for phenomena that are usually accounted for by "the hand of God."

Dawkins: I am a fairly militant atheist, with a fair degree of active hostility toward religion. I certainly was hostile toward it at school, from the age of about sixteen onwards. I mellowed a bit in my twenties and thirties. But I'm getting more militant again now.

It was a mind-blowing experience to discover Darwinism and realize there were alternative explanations for all the questions with traditional religious answers. I became irritated at the way the religious establishment has a stranglehold over this kind of education. Most people grow up and go through their lives without ever really understanding Darwinism. They spend enormous amounts of time learning church teachings. This annoys me, out of a love of truth. To me, religion is very largely an enemy of truth.

Omni: When did you meet Niko Tinbergen, the inventor of the modern science of animal behavior?

Dawkins: In my next to last term as an undergraduate, I was sent to him for tutorials. He was very complimentary about my essays, and when I first came to think about what I might do with my life, I decided to stay on as his graduate student. Tinbergen had a very balanced view of ethology. He believed in the importance of studying the control and development of behavior, as well as an animal's survival behavior in the wild. He had me study the old question of to what extent behavior can be called innate, as opposed to acquired. I studied the development of pecking in chicks, setting up a simple mathematical model of choice. What was going on inside the bird's head when it made a decision to peck? It didn't solve any important problems, but it was methodologically interesting. People thought it was fairly clever. I was noticed in the animal behavior field and was fairly in demand for jobs.

Omni: What do you remember most about Tinbergen?

Dawkins: On a personal level, his great kindness, the fact that he was always smiling, and professionally, his dogged determination to clarify. He would never tolerate fluffy or unclear thought. He was a very good influence on groups working together, because he insisted on clarity, sometimes to the point of exasperating people. This persistence on clarity was something I valued and practiced myself.

Omni: Are you a sociobiologist?

Dawkins: I suppose I am. [Harvard entomologist E. O.] Wilson's book [*Sociobiology*] and mine came out at roughly the same time. Because of the political backlash against Wilson's human speculations, the word *sociobiology* came to have a certain notoriety. And when *The Selfish Gene* arrived in America a bit later, some people mistakenly saw it as part of a movement Wilson had started. I rather resented being thought of as jumping on a bandwagon that I hadn't even heard of when I wrote the book. I also saw no need to coin a new word. I felt I was an ethologist and that Wilson's book was about ethology.

However, we seem to be stuck with the new word. So I don't mind being called a sociobiologist, unless people assume I believe things that I don't. Sociobiology has become a red rag word for political activists who think it's about the genetic determination of human behavior. I'm interested in natural selection, and genes are important only because natural selection can't work without them.

Omni: Because you talk about animals being "programmed" in the same way that computers are programmed, aren't you sometimes mistaken for being a genetic determinist?

Dawkins: People make two mistakes when they hear you talking about a gene "for" tying shoelaces or some other kind of behavior. They think it means that X is inevitably and irrevocably determined once you've got the gene for it and this gene is the only one that influences X. Neither of these is true. I use the analogy of baking a cake. You can liken genes to the recipe. You follow the recipe in the book, and then what comes out of the oven is a cake, but you would never break the cake up into bits and say this fragment corresponds to the recipe. There's no such thing as

a gene "for" a bit of cake. On the other hand, if you change one word in the recipe, what comes out of the oven is a different kind of cake—sweeter, moister, or whatever.

Omni: Why do people get upset when they hear you talk about a gene "for" tying shoelaces?

Dawkins: Throughout history people have misused genetics by saying we have genes "for" criminality, "for" aggression, "for" homosexuality. If you think this implies an irrevocable commitment to criminality, the political implications would be profound. You could put people in prison because they had certain genes. But this has nothing whatever to do with the reason why I talk about genes. Natural selection would be nothing without heredity. If peas with a gene for tallness are better at surviving than peas with a gene for shortness, then natural selection can choose tallness in peas. Natural selection works fundamentally at this level of individual difference.

Omni: Did your gene-oriented view of the world get attacked as soon as *The Selfish Gene* appeared?

Dawkins: There is a widespread view that *The Selfish Gene* met with a lot of flak when it was published. But it got the sociobiology backlash only after a hundred favorable reviews. Ironically, the book is seen as an extreme version of sociobiology because its thesis about the gene as the unit of selection is phrased in far more radical language. Sociobiology is hardly radical at all in the way it talks about natural selection. It's almost group selectionist. But there is no genetic determinism in *The Selfish Gene*. Quite the contrary, it ends up talking about rebellion. It doesn't matter if you've got genes for tying shoelaces. They are not little dictators.

Omni: How intelligent is the gene?

Dawkins: There is no cognition in the gene. People who take gene selection over the top will say things like, "What were the genes doing, letting us develop contraception? It's not doing them much good." But genes don't have foresight. How powerful are genes? In terms of intelligence, zero. *The Extended Phenotype* advances the thesis that genes have greater power than they're normally credited with. But that's in the sense of reaching outside the body and manipulating other individuals, even the world at large. That's not a new theory; it's just an upside-down way of expressing what's already known.

Omni: How do genes do it?

Dawkins. Take a beaver dam. It's presumably an adaptation for the good of the beaver. So you'd want to make a Darwinian account of genes for dam building as being favored in beaver gene pools. But the phenotypical [external, as opposed to genetic] character the gene is influencing in order to benefit itself is actually the lake. So I regard a beaver lake as the phenotypic expression of beaver genes by the same logic we regard the beaver's tail as a phenotypic expression of the beaver. By extending that logic, genes in one body can be said to influence other bodies.

Omni: One example of genes manipulating other bodies to ensure their survival involves parasites. You even say that genes themselves can be thought of as parasites.

Dawkins: If the body is a temporary throwaway survival machine, with the genes constantly changing partners, why does it function as a coherent whole? Why do all our muscles and sense organs work together cooperatively? The answer is that our genes have only one means of going on down the river that runs from generation to generation. Since they can only leave via a sperm or an egg, they have to cooperate with one another to get into one of those vessels. But if some of them could find another way of getting into the future...

Suppose genes in cells lining the nose caused you to sneeze them into the air, where they were breathed in by somebody else and inserted into the DNA of that person's nose. This would be a very satisfactory way of getting down through the gene generations. These sneezing genes I'm talking about could well exist. Then, by definition, we no longer call them our own genes. We give them a separate name and call them viruses. In more orthodox kinds of parasites, like worms in snails, we tend to view host and parasite as two different individuals. I prefer to say the only reason worm and snail tissue pull in different directions is that they have different exit routes from the body they share. If they had the same exit route—if the worm put its genes into the sperm or eggs of the snail—then they would have exactly the same interest in the future.

Omni: Are there examples of parasites hijacking the reproductive mechanism of their hosts?

Dawkins: Some bacteria pass on their genes to the next generation in the eggs of insects. Since they have exactly the same interest at heart as the host genes, I predict that someday they will cease to be parasites. The very concept of "parasite" genes and "own" genes will no longer have any meaning. Maybe we should look upon all genes as mutually parasitic. Local clubs of them cooperate only because they have discovered the same joint solution to the problem of getting into the future.

Omni: Why do you think sex evolved?

Dawkins: The advantage of sex is to increase variety at the species level. Species practicing sexual reproduction have a greater capacity to avoid extinc-

tion. They will have a larger range of types to call upon when the going gets tough. An asexual species is likely to be entirely uniform. It may be doing very well in the present climate, but as soon as there is an ice age or a major drought, the whole lot gets wiped out.

Omni: What is the advantage of sex at the gene level—the level that you say counts most?

Dawkins: People have tried to think of ways in which an individual can be more successful at reproducing, through variety. This argument seems to depend upon a world in which there is competition between siblings. If our offspring compete among themselves, and the winner of my little competition takes on the winner of your competition, then you can see the advantage of having variety in your family. You want to have a champion who has been selected from among a great variety of contenders, and sex does provide that.

Omni: You and Stephen Jay Gould recently debated the theory of evolution before an audience of a thousand people in Oxford. What was the nature of the debate?

Dawkins: I advocate the gene as the level at which natural selection acts, while he advocates a variety of higher levels. Gould wants to be catholic in his approach, while I want to be rigorous. Natural selection has to work on something that's self-replicating, and your individual organism is *not* a unit of selection. The debate was cordial. It was hard-hitting. But we both went away feeling just the way we did when we came in.

Omni: Is your work revolutionary or profoundly conservative?

Dawkins: I'm orthodox in the sense of being Neo-Darwinian, but I see the implications of what Neo-Darwinism has to mean in a different way from most people. Gould is also fundamentally orthodox, but he expresses his ideas in an unorthodox way. But he chooses to *describe* himself as unorthodox. He uses phrases like, "The modern Darwinian synthesis is effectively dead." I don't think it is, and I see myself as squarely in the Neo-Darwinian tradition, even if I reexpress it in unfamiliar imagery.

Omni: You spend your days in front of a computer, wandering through biomorph space. What is this?

Dawkins: *The Blind Watchmaker* gives a realistic model of evolution. It shows the power of cumulative selection to generate an almost endless variety of quasi-biological forms. The fundamental form of all the biomorphs is a branching tree. But by breeding through generations, they can assume amazing shapes. The program is the equivalent of embryology. It allows you to change genes systematically, to collapse and stretch limbs in ways that resemble genetic influences on embryology.

Omni: Why did you call these shapes biomorphs?

Dawkins: I borrowed the term from my friend Desmond Morris, who uses it to describe the shapes in his surrealist paintings. He claims biomorphs evolve from canvas to canvas and so take on a life of their own. Now that I've gotten into color and more solid-looking forms, mine are starting to look more like his. I keep altering the biomorph program so that it embodies the biological changes I'm thinking about—changes in segmentation, symmetry, and so on. I'm thinking a lot about embryology, by analogy, in the world of biomorphs. Certain kinds of embryology are good not only for individual survival but also for giving rise to further evolution. You have to go back to embryology and change the fundamental form before you can get a whole new flowering of evolution. That's probably what happened in the history of life. Every now and then there's been a major change in the way the embryology works, which maybe didn't have any immediate benefits as far as survival but which opened up floodgates of further evolution. So today we have embryology that is very good not only at surviving but also at evolving. ∞

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vironment shared by siblings contributes only a little to the remainder—fly in the face of our modern beliefs about how we have come to be who we are. Furthermore, of the two main conclusions of the Minnesota study, virtually all other studies support the first, and most support the second.

As early as 1976 a study of 850 twin pairs conducted by John Loehlin and Robert Nichols, psychologists at the University of Texas, concluded that little of the twins' parallels in personality could be attributed to the environment in which they grew up. Other studies showed that twins reared apart were more similar than twins reared together. And in 1981 Susan Farber, a clinical psychologist now in private practice in Boise, Idaho, said in her book *Identical Twins Reared Apart*, "The more separated the twins, the more similar they appeared to be in some personality traits." In fact, the similarities were "so striking as to be unnerving," and not just in realms such as moods and patterns of anxiety. "Why," Farber asked, "should most of these twins laugh alike, describe symptoms in the same way, smoke similar numbers of cigarettes, choose similar creative pursuits, and sometimes even marry the same number of times? Someone will have to fathom why twins reared in different environments should so frequently bite their nails, grimace, tap their fingers in such similar ways." (This paradox may result from parents' attempts to make twins different when they are raised together, while twins raised apart are allowed to express their natural similarities.)

Other studies of the personalities of twins have shown that general personality types are also linked to the genes. Hans J. Eysenck at the Institute of Psychiatry at the University of London, Lindon Eaves at the Medical College of Virginia, and Nicholas Martin at the Queensland Institute for Medical Research in Australia have repeatedly found tendencies toward extroversion (characterized by a happy-go-lucky sociability), neuroticism (characterized by anxiety, depression, and low self-esteem), and psychoticism (characterized by aggressive and antisocial behavior) to be strongly determined by genetic factors in tests of both sexes in England, Australia, and the United States. Two large twin studies—with thousands of twin pairs—recently undertaken in Sweden and Finland, where systematic national records make such research possible, confirmed Eysenck's research, showing a strong connection between gene differences and behavior differences in neurotic or extroverted behavior.

Richard Rose, a psychologist at Indiana University who collaborated on the Finnish study, also teamed up with psychologists Kay Phillips and David Fulker of the University of Colorado for a sophisticated study of common phobias in twins, nontwin siblings, and their parents. Fears of dangerous places, morbid settings, illness, heights, social criticism, and social responsibility were all shown to be partly heritable, in decreasing order of genetic influence. And in a new study of 410 twin pairs, who were tracked from adolescence to young adulthood, Rose found six out of nine factors of the widely used Minnesota Multiphasic Personality Inventory (neuroticism, psychoticism, extroversion, somatic complaints, inadequacy, and cynicism) to be significantly heritable, with values comparable with those found previously in older twins.

Behavioral scientists now believe that alcohol abuse may be heritable. Donald Goodwin at the University of Kansas Medical Center has shown that alcoholism is three to five times more frequent in the parents, siblings, and children of alcoholics than among people in general. Being raised by alcoholics as an adopted child does not increase your risk, but having alcoholic biological parents certainly does, no matter who raises you. You can even inherit either of the two specific types of alcoholism: early-onset, which usually afflicts males and is associated with fighting and arrests, or late-onset, which affects both sexes and is associated with guilt and depression. An environment that encourages drinking is a factor, especially for the late-onset type, but for individuals without a genetic predisposition it rarely results in alcohol abuse.

"To the skeptical eye of the behavioral scientist, the results of these studies are stunning. About 50 percent of measured personality diversity—how we behave—can be attributed to genetics."

Another major behavioral disorder, schizophrenia, has commanded the attention of geneticists for decades. Work by Seymour Kety, a neuroscientist at the National Institute of Mental Health in Bethesda, Maryland, and others on adopted schizophrenics has long since demonstrated what twin studies first confirmed. This devastating psychosis is more likely to occur in primary blood relatives of those whom it has struck—independent of rearing conditions. Irving Gottesman, a psychologist at the University of Virginia and a leading behavior geneticist, has recently proposed an explanation: Vulnerability to developing schizophrenia is due to a system of genes; the more predisposing genes you have, the greater your risk; and depending on how vulnerable your genes make you, one of a spectrum of environmental insults can then bring out the disorder. Other medical disorders, such as manic-depressive illness and depression, also seem to run strongly in families—according to patterns partly explained by genes.

Corroborating evidence for many of the statistics in the twin and adoption studies has come from investigations into the physiology of behavior. For example, some whose genetic makeup puts them at risk for alcoholism metabolize alcohol in a different way than do others. They also have distinctive electroencephalograms. Similarly, abnormal receptors for the neurotransmitter dopamine may be implicated in the appearance of schizophrenia. This work is in its infancy, however, and much more research must be conducted to better understand the neurochemical factors that influence behavior.

The study of behavior genetics has also begun to address the issue of development, of how personality unfolds from infancy to adulthood as our genetic predispositions confront a succession of environments. Sandra Scarr at the University of Virginia, for instance, has advanced a theory emphasizing the child's ability to organize around itself the psychological environment it needs because of the genes it has. In this view, environment is only the genes' handmaiden. Robert Plomin at Pennsylvania State University is focusing on the part of family life that is experienced differently by two different siblings, rather than on the shared family environment. And Harvard's Jerome Kagan has meticulously documented the stability of one temperamental dimension, timidity, in infants and young children and tried to understand how genetic factors influence the constancy of the trait.

Finally, there is a newly discovered continent that we have just set foot upon: the direct study of the "behavioral genes" themselves—the molecular genetics of the nervous system. Huntington's chorea, a movement disorder whose first manifestations are often emotional, has been localized to a region on the short arm of chromosome 4. One form of Alzheimer's disease, with its devastating memory loss and consequent loss of identity, has been tentatively traced to chromosome 21. Manic-depressive illness, a disorder of catastrophic mood swings, has been tentatively

linked to the X chromosome. Schizophrenia may be influenced by a gene on chromosome 5. With these tentative discoveries we have begun the genetic dissection of the human brain. As these genes are pinned down, the way they work will become apparent in a direct chemical sense, and the mystery of how genes could affect the mind will begin to dissolve before our eyes.

Already, using animal models, various labs are working out the structure of genes for key functional proteins of the nervous system. They are examining the receptors for neurotransmitters, which make possible the conveying of specific messages from one brain center to another, enzymes for neurotransmitter manufacture and removal, and neuromodulators, hormonelike chains of amino acids that modify the responsiveness of brain cells. These lines of research will ultimately converge to provide a convincing physiological substratum for the conventional genetics of behavior.

Even the gap between sociobiological theory and the data of behavioral genetics has begun to close. J. Phillippe Rushton, working with Eysenck's London group, looked at the heritability of altruism and aggression in a 1986 study of 573 twin pairs. Items such as, "I have given directions to a stranger" and "I have donated blood" were part of the altruism rating form, while, "Some people think I have a violent temper" was one of the items on the aggression form. As in more general studies of the genetics of personality, genes were found to account for at least half the spectrum of differences. One common criticism of sociobiology in the Seventies—that there was no evidence for heritability of its most important behaviors, altruism and aggression—is now being laid to rest.

The genetic studies prove that as much as they prove the importance of the genes. Some environmental influence is undoubtedly prenatal—nutrition, hormones, maternal-fetal immune responses, even the process of birth itself. However skeptical the hard-liners may be about the importance of human childhood experience, studies of early deprivation and stimulation in rats, dogs, and monkeys show decisively that such experience changes the personality. It's just that in humans we don't know how. It is perhaps the crowning irony of current research that we need behavior genetics to help us find out.

Twin studies of personality and human behavior genetics in general have produced some of the bittersweet controversies in all of twentieth-century science. The challenge to individual identity is only part of the threat. Even more important, perhaps, is the challenge to human potential: If at least 50 percent of our personalities can be attributed to our genetic makeup, then isn't our potential development also limited by the content of our DNA? It is this "predestination" part of the behavior genetics story—the surreptitious modern return of the ancient, classical Fates, which we thought we had abandoned in the eighteenth-century Enlightenment—that makes us irretrievably uneasy. If a few strings of nucleic acids tossed together in the heat of lust control our psychological lives, unfolding for most of a century, then what does this say about social programs? Morals? Education? Psychotherapy? What of our hopes for ourselves or even our children?

During the Sixties and Seventies scientists exploring genetic answers to psychological questions evoked strong, even violent passions from well-meaning people disturbed by these implications. Scarr, the doyenne of developmental behavior genetics—a brilliant psychologist with a dignified, appealing personal style—was spat upon by demonstrators. E. O. Wilson, Harvard's undisputed intellectual leader of the new field of sociobiology, which attempted to find the evolutionary underpinnings of behavior, had water poured on his head as he sat on the podium at the annual meeting of the American Association for the Advancement of Science. Picketers and hecklers intimidated professors and students at many universities. It was not a noble episode in the history of American science.

But the unsung heroes of this revolution—Scarr, Rose, Plomin, and others—have continued their solid research. The question now is, What can we do with their information, other than retreating to what Farber, and Freud before her, called "hereditarian nihilism"?

We need to recognize that to no small extent we are who we are when we are conceived. To deny this is to deny the essence of human individuality. We seek our environments and we influence them as much as they influence us. Each infant comes to us unique, and the illusion that we can mold our children exactly as we wish is both authoritarian in intent and hopeless in execution. Even behavior modification, if it is to work, must itself be modified for children with different temperaments.

A prayer asks that we be given the strength to change the things we can change and the wisdom to accept those we cannot, but in this, as in most things, we are left to our own human resources. Thanks to the courage and perseverance of a handful of scientists in the face of extreme criticism, we have in the past decade greatly increased those resources. As we pursue this "genetics of the soul," we can look forward both to greater sympathy with our human foibles and more deliberate influence over them. And we can at least hope for a steady increase in the requisite wisdom and strength. ∞

LOOKING

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There are, now and then, more serious requests, though always made smaller than one would think to ask. "All I ask," for instance, "is that my daughter should see for just one season or just one month or, if one of these is too much to ask, then for just one short day" I think, half requests, like the half-people that make them. "All I ask is that I be allowed to live through this next month until the birth of our baby so I can see if boy or girl and give the name" On and on it goes. "All I ask is that I should be pleasing to Lutha."

I'm tired . . . tired of the whole thing. "Granted," I say.

It had evidently not been foreseen that the god, himself, would actually take part in any of this. Everyone except the guards leaves, and I can hear there's much discussion both outside near the windows and in an anteroom I'd not realized was there. I can't hear much of it for they speak as though to keep their words from me, but I do find out a startling thing: that Lutha is the half-woman who has been looking after me, that she is considered the most beautiful woman of all the half-women and has had many suitors, but that she has dedicated herself to me alone, that she has, in fact—the thought is so shocking to me that I almost can't take it in, and I think that I must not have heard properly—she has married me, that she is called the "Bride of the gods," that the ceremony had been performed before I'd come to and that a proxy stood in for me to say my parts, that she had wanted only and always to have one of us as husband. I learned all this because now she is chastised for it. They raise their voices. They tell her I am a false and a sick god who will continue to interrupt important ceremonies, perhaps even those that are to take place later on to ensure a happy winter.

We mate for life, so it is not a decision we make lightly. That this half-woman should have been given to me as bride is so ludicrous, so ridiculous . . . and it's odd, for she has never even seen me at my finest. Only seen me sick and fainting, feathers in such a deplorable state so that even if I were healed enough to fly, I might still not be able to.

I have to laugh then—to clack and cackle at the same time—weak as I am. The ridiculousness of everything—everything!—catches me up in spite of myself, that I, of all of us . . . I make such a racket that the guards run away. In here the sound rings out in a different way than at the cliffs, but I see the people outside run from the windows. I've no idea how far they go, but to see them scatter makes me laugh all the more. Good to laugh but not so good to laugh alone. I wish for the sound of one of us to alternate my hollering with, so that, at the same time that I'm laughing, loneliness comes upon me and tears flow. I can feel them dropping onto the down of my chest. Oh, but none of us would have nursed me like this. We don't do that. Who would stay with one of us through the winter? It can't be done. You would be helped only if you could go south, otherwise you were to die and best if you fall into the sea to be taken by a sea creature. But if such a thing as that can't be, then at least stay on the cliffs where even the best climbers of the half-people can't come.

But for all the noise, *she* hasn't run away along with the others. No doubt the words *for good or for bad and worse* or some such have been said and promises made so she endures it. Perhaps she has plugged her ears with wool. I stop, though not for her sake, and she takes a soft cloth to wipe my tears.

"As I get better I get angrier and I think more about my plan. Am I to live by her whims? Masked when she wants? I will show her what the anger of a god is like."

"Sweet, sweet, sweet," she says. One would think it was she who is of bird and sky. "How sweet a god this be." Odd that she would say such a thing when I would, and gladly, even at this moment, take a piece out of her hand, except who then would look after me? But I am forgetting she is my mate. Though we haven't done any mating dance that I know of, there are customs to be kept to even so. She, of all of them, I must not harm. She says, "Next time I will be seeing to it that you will be behaving as a god should," and I'm thinking she is clever with her herbs. No doubt she will see to it. But now she's seeing to a different thing. She gives me a drink unlike anything I've ever tasted. After giving it to me, she covers my face with a hood made especially for me. In a few minutes I find out what the drink is. An aphrodisiac. No doubt of that. Why? How? My wing stretching back upon the rack and me fastened to my throne? But now she has untied my feet and legs. (I'll not let her know that my left arm is free. I'll *try*, that is, not to let her know, but the drug has caught me up so that already I hardly care.) She sits on my lap. She guides me. I feel myself inside her. With my legs and lower body free, I can arch up and down and sideways. As the drug takes hold of me I lose all sense of reality. I know I feel pain in my wing, but I don't care. It's as if I fly again. I glide, I feel the lift of the thermal, up from below. All I need do is spread myself out and balance on the pillow of air pushing up under me. And I have power, the power of a god. Yes, these are god doings. I think I am a god indeed. Truly a trinity of bird and snake and cat but mostly snake or bird-snake. Flying lover. And *she* says it as though she knows my mind: "Flying lover," and, "My lover from the upper air and of the cliffs." All the things I feel, *she* says.

And when it's over, it begins again.

Afterward she nestles into my breast, her arms around me. I am feather bed and downy pillow for her for the rest of the night. If she knew, at any time, that my arm is loose, she must have forgotten it, but how could she not know by now! Perhaps she did and would tempt the god. And I will be tempted, of that I'm sure.

The next night a ceremony and the next also and the night after that. I am both too tired and too drugged to understand or care what it's all about. And I'm hooded again. I see nothing of any of it. I doze but always wake when I hear *her* telling them what I say and said and have predicted. " 'Glory, glory, to us all through the winter,' he says," she says, and often, and, "because he is here among us as Bask, the cat, as Crackle, the bird, and as old Squam, the snake, 'and lo, also, a god child will be born of these three,' he says," she says, "so that we will live with gods among us forever after this."

They sing in chorus (and it is the one thing that I find really worthy of myself in all that they do), sing, "Who gives the lilies clothing?" and, 'Rise, crowned with light," and, "There is an arm that never tires beneath the wings of night," which makes me wonder do they all know about my free arm and all wish to tempt gods? They sing, "If on joyful wing" and, "Sometimes a light surprises." I like that one best of many good ones, and I think, yes, yes, sometimes a light *does* surprise as the midnight light of snow. When they stop I wait for them to sing again.

Then there is a period of resting. We are deep in winter. I begin to really recover and no more drugs either. Except for the aphrodisiac, especially on stormy nights when *she* is bored with dozing inside all through the day. But even so, I feel like myself. I wake early full of energy. I do what preening I can. (I have a plan.) I exercise against my bounds. They have, anyway, stretched, and often, when she ties my legs again after

ten, when she ties my legs again after our matings, she leaves the thongs looser. As though all the care she's giving and the sex have made her love. She hasn't the kind of tenderness to dance and bob, nor for mutual preening, but I see that the half-people have their own ways. We do not talk. She talks *at* me, that is, but clearly doesn't want a reply. I think she feels that if we speak to each other as one fellow creature to another, I might lose my godlike qualities. She wants me silent and remote . . . inscrutable. Clackings, roaring, yes, but nothing of the ordinary.

What she talks most about is of our child (it has begun to show). That it will be a boy and king of the people. (She calls herself and the others people, not half-people.) I don't trust any of her predictions, though some have come true. Chances are it won't come to term.

As I get better I get angrier and I think more about my plan. Am I to live by her whims? Masked when she wants me masked? Drugged when it suits her? (Fornicating. That's all it is.) Hand-fed as though to make me tame? I will show her what the anger of a god is like and that that anger, and my strength also, are beyond the understanding of any half-person. And I will take her on my own terms. I will set god rules and god schedules. My anger, also, will be precise and cool as a god's should be.

I wait for a sunny day. Then, carefully, feeling my muscles bulge against the thongs, I stretch them, I break them, one by one. As to the rack, I must loose myself from that even more slowly. My wing, though healed, is stiff and sore. I can't fully fold my wing over my back. It's a problem in this small place. Without wanting to, I knock down the herbs that are hanging from the ceiling. I knock the painted pots from the shelves. I knock the little statues of myself from their stands and the little cat gods and little snake gods from theirs also. By now *she's* standing in the archway that leads to the anteroom, still dressing herself in her long wife-robe. I push her back into the room she came from. There I see that she has a soft bed while I've had a hard throne. She has a fat coverlet of duck down (we have just such in our aeries), while I've not had anything (though I must admit she's seen to it I was never cold). I split her wife-robe with one claw and push her onto the bed. I'm careful. The anger of the gods is careful.

At first her utter nakedness stops me . . . surprises me. Though I already know about the half-people's lack of any fur or feather, I've not seen any of them completely naked. It's revolting. No wonder she blindfolds me. Only when I think to myself *newborn chick not yet dry* am I able to approach her, though she looks more like food than anything else—tender, like a suckling pig. She lies quietly looking at me. Her eyes are . . . yes, they are beautiful, expressive in a way ours never are. I can see she accepts what is to happen. Welcomes it, even. I would not be able to see any such thing in the eyes of a mate of my own kind, and it is this that turns me back onto her. I sit on the edge of the bed. I touch. Their breasts are larger and rounder than our women's but as soft as though covered with down. I lie upon her then and my wings enclose the whole bed. *What an odd way to mate,* I think, *and such a strange season for it,* and I take her . . . at my own time and timing . . . at a god's time. Afterward I rest upon her within the tent of my wings. I'd not seen any such thing before, but I didn't find it bad or wrong. And since it was *my* love-making, I was conscious that she was my mate, as, indeed, she was, even though without any proper dance. I had found it, until now, hard to realize this.

But I must be carrying out my plan, so I get up, see the shelves of jars and bottles, and sweep them to the floor. See her loom and crush it into its corner, strings dangling and tangled. See she has been weaving something for the god because it's blue and there are gold and silver threads worked into it. I know why blue. For the lord of sky. I tear my claws across it. What care I, who come from *in* the blue, for gold or silver. There's no more damage to be done, so I open the outside door and laugh out at the village, that this should be the morning of the loss of their god as they know him and become the morning of the god as he knows himself. It's white outside. Dazzling. Blinding, so that I'm wondering who is the lord of all this snow? I have been too long in the dark. I step out and keep laughing, but I know I don't sound the same, and I stop and wait until I can see. Paths are cleared from here to there, her door to other doors, but the snow is knee-high on each side of all those curving walkways, a god's knee-high. In fact even more than that.

I take steps in the stuff, thinking to get up speed in order to fly. I sink. I flap. We have always felt awkward getting into the air from a flat place and have laughed at each other and ourselves, but I care how I look to them, and they're out now, half dressed and dressing, pulling their hoods over their heads, and they see me flap and sprawl. The snow rises around me in a powdery cloud. I stand up. This time I follow a path and do get some speed, grab at the air. It's cold, dense air, easier to hold onto than I'm used to. I manage to raise myself, legs dangling in the snow, pump harder, but this is the wrong direction for what light breeze there is. I turn and try again the other way, back toward the shack, and I do get up this time, but there's more pain than I thought there would be. I stagger in the air, turn again, flop and fall and

flop and fall, up, then down and down onto her roof. Perch there. Feel, for the first time, what cold really is. *This* is cold. I'd not known about it until now. I'd not even suspected. I'd thought to fly to my cliff. Live there, come back and feed on their goats, but that's impossible. You can't build a fire in even the best of nests. I think, for a moment, of living in one of our kilns, but that would be worse than in these shacks. Besides, I know I'd never make it to the rookery.

The half-people have come out and gathered round to see the sorry sight of one of us (*she* also, now dressed and hooded), to see a lord of the sky (and cat and snake) sit and shiver.

"Now you will believe," I hear a half-man say to her (he is the one to whom I said *Granted* before I knew that *she* was mine), "will you believe," he says, "that he is a false god, as I've told you?"

"No," *she* says, "nor will his son believe it. And where is it written that any human can understand the ways of gods?" (Human, she calls herself!)

Ladders are brought, and chains that I could never break, but I already know that all I care about is to go back where the fire still smolders. I let them take me. As they do, they sing, "Look upward when the morning shineth . . ." and it *does* shine. "Heavenly hosts o'er yon horizon, cleaving to the sky . . ." That's us, though I can hardly consider myself as one of "us" anymore.

The loom is repaired. The blue robe rewoven and tucked around me. I sit chained (often blindfolded, often drugged), crowned, jewels hang about me, hymns are sung, offerings brought. I sit and sit. My strength fails. My wings ache from disuse. Sometimes I howl at night and clank my chains. I wake the whole town. "Deeds!" I cry it out even in my dreams. "The gods must do deeds! Not sit silent, else the gods will surely fail." They don't care to listen. They don't answer.

And *she*. When not blindfolded I see how she grows bigger and bigger. I keep wondering what sort of funny chick it will be. Spring is late, but I can smell it. We . . . they, the flocks will be coming back. I look forward to it with both eagerness and dread.

And then the birthing time comes. I hear the bustle of it in the anteroom. I hear *her* groans. I hear its first cries. Impossible to tell if it sounds more like one of theirs or one of ours. Then I hear *her* making a great wailing sound, and I wonder, *Is it dead already?* for I have just heard its peeps and squeaks. But no, I hear that her grief and horror is that the chick is female. She needed a god, not a goddess . . . not a rival to herself.

"Kill it," she says. "Do it or let me do it," but instead they bring it in to me. The three men come, one holding it carefully. They ask that I should name my child. I think *Mother, sister, I'll be privileged to use your names*, but then I see the creature, face of the real people, yes, but the weak and naked body of those others and tiny, useless wings better cut off altogether. Streaks of yellow down here and there not yet dry. Up on the cliffs we'd have killed such a one on sight and no regrets. I refuse to name the thing. But then I look again more closely and I see the tiny beginning of the topknot shining in the firelight—a golden one such as my own. She will be one of the bold, as we say about ourselves. And is she really any more crippled than I am? All of a sudden I know I want to live, to await the season of my freedom and see summer again. I have let this go on all this time out of foolish pride and because I thought of myself as person while they were only half-people. "I *will* name her," I say, "but first I must tell you that I'm not a god. None of us are, wings or not. We are half-creatures like yourselves and no better. We perceive the patterns of directions in the sky, but we do not perceive the patterns of destiny, and though I am like a cat and like a snake and often feel myself as such, I am not these three except inasmuch as snake and cat are bird-like. I have nothing to give but of myself and of my brothers and sisters if I can persuade them. Let me go free so I can give what I can give. My child also is not a goddess. Sing your songs. Do sing, 'How sweet the truth,' and sing that 'every flower is full of gladness,' but not in praise of us. These are the first true things I've ever said," I say.

The three men fall on their knees. "You are a god indeed," they say, and I'm thinking it will all go on as before or maybe even more so, but it doesn't. They *do* believe me. They get hammers to snap me free. (Who would have thought that freedom could be won so simply?) They give me my chick into my arms. They help me stand up. I'm so stiff I can hardly walk. "My mate is weeping," I say. "Help me to go to comfort her." She will be surprised to find me not a god after all, and not a trinity, but I think I know ways to make her happy even so. ∞

CREDITS

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STARS

CONTINUED FROM PAGE 22

group of astronomers in charge of deciding who would get to use the large telescopes wrote him a letter. "They stated that if I didn't change my line of investigation, they would deny me all telescope time," Arp says. "And naturally I wrote back saying no, I would not alter my line of investigation." Quickly he found himself unwelcome not only at Palomar but at the world's other major observatories as well.

Branded a heretic, Arp left the United States and moved to West Germany, where he wrote a book titled *Quasars, Redshifts and Controversies*, which pulls together all his evidence underpinning why quasars must be associated with nearby galaxies. Yet the critical evidence explaining away the large redshifts for quasars is still unresolved. For Arp the question of whether he is right or wrong has become secondary; the real question is whether ideas that run contrary to established scientific belief should be ignored or entertained. "Everyone is convinced that their view is the way things are," he says. "The test is whether they will permit discussion of contradictory evidence. If they say, 'No, we won't permit it,' then I think you have to be suspicious that they don't have the right answers."

Despite his ostracism, Arp holds no grudges. But he finds it curious that in science, supposedly an open forum for the discussion of ideas, majority opinion often decides the outcome. "People have a psychological need for certainty in their lives. If the ideas people rely on are shown to be incorrect, then they feel adriff and insecure."

The keenest example of this, according to Arp, is that most astronomers decided to look at "comfortable" objects while paying little heed to more bizarre phenomena. "There are so many objects that should be observed," he says. "Some of them are being ignored now, and I would do anything I could to get them observed." It irks him that the most promising sites for proving his case, galaxies that seem to be pouring out quasars, have been "pretty much deliberately cut out from the Space Telescope Observing Program."

Arp's ideas may overturn astronomy, or they may founder in the light of ongoing research. But he hopes that the ordeal he lives through each day will produce a new generation of astronomers who will be less rigid and more open minded in their approach. "It always takes more time than you think," he says philosophically. "And the stakes are getting higher and higher. I would prefer not to be a heretic—but it's more important to get the right answer than to feel good." ∞

The Artist

Decipher our clues in the pages of next month's issue and you could wrangle yourself a Jeep or another gem in

THE GREAT OMNI TREASURE HUNT

An Italian sailor navigated an uncharted ocean in 1492, searching for untold wealth. Ever since, the same dream has lured millions to the Americas, across seas, deserts, and mountains, through jungles and forests. And for some their quests did indeed bring riches, success, and power. Featured in next month's issue, the fifth annual Great *Omni* Treasure Hunt will offer readers a similar opportunity—without, of course, any of the physical trials and tribulations.

Decipher our clues and enter your solution and you could be the grand prize-winner of a 1990 Jeep Wrangler (retail value of $9,393), a 117-horsepower four-wheel-drive vehicle as comfortable in the outback as it is tooling down the interstate. You might just find yourself sailing down the mighty Mississippi aboard Delta Queen Steamboat Cruises' *Mississippi Queen*. Maybe you'll end up relaxing at home with a Grundig package worth $4,200: View your favorite television programs in stereo on a Grundig Monolith monitor/receiver with a 35-inch screen, plus tune in the world via Grundig's Satellit 500. The international world-band receiver is capable of providing FM, AM, LW, and seamless, continuous shortwave frequencies and a multitude of other features and functions for clear and precise broadcasts from around the globe. Or you'll be listening to your favorite recordings on Infinity Systems' $3,000 three-piece Modulus speaker system, with its two compact satellites, on resonance-damping stands, and a 12-inch, 250-watt subwoofer.

There are plenty more treasures to be found in the pages of *Omni*. For all the contest details—including the clues and the official rules—of the fifth annual Great *Omni* Treasure Hunt, look for our February 1990 issue, your guide to the ultimate treasures of the twenty-first century and beyond.

From gags to riches
Competitions past and future

GAMES

By Scot Morris

Ax = chopstick, *bumblebee* = a Jerry Lewis film festival, *cube root* = diced carrots, *drive-in movie* = wall-to-wall car petting, *English Channel* = station where you watch *Masterpiece Theatre*.

These are examples of our first entries in *Omni*'s Fractured Dictionary, which were called for in Competition #25 (September 1982). Readers were asked to send in original definitions for words starting with the first five letters of the alphabet, *A* through *E*.

The winner of that outing was Chris Doyle, of Burke, VA, with these three entries: *circular saw* = a rose is a rose is a rose, *digger wasp* = preppy archaeology student, *damnation* = the Netherlands.

Some other *Omni*esque words that got redefined in that competition were *Alpo* = what Edgar's friends call him, *Betamax* = totally awesome radiation particle, *Christmas elf* = subordinate Claus, *dove* = bird of pray, and *exorbitant* = *Skylab*.

Competition #31 took us further into the dictionary, with words starting with the letters *F* through *J*. Definitions included *French leave* = much adieu about nothing, *geometry* = what the acorn said when it grew up, *harmonize* = effect of Mace, *inheritance* = dead giveaway, and *Java man* = Mr. Coffee.

Parts III and IV of the *Omni* dictionary search took us from letters *K* through *S*, producing such fractured lines as *khakis* = what a Bostonian needs before he can start his automobile; *legalize* = 20/20, *microchips* = small fries, *negligent* = knight gown, *Omni* = medical condition suffered by kneeling meditators, *punish* = adjective describing the *Omni* dictionary, *quadruplets* = four crying out loud, *radioactive dating* = plutonic relationship, and *superconductivity* = plight of the ohmless.

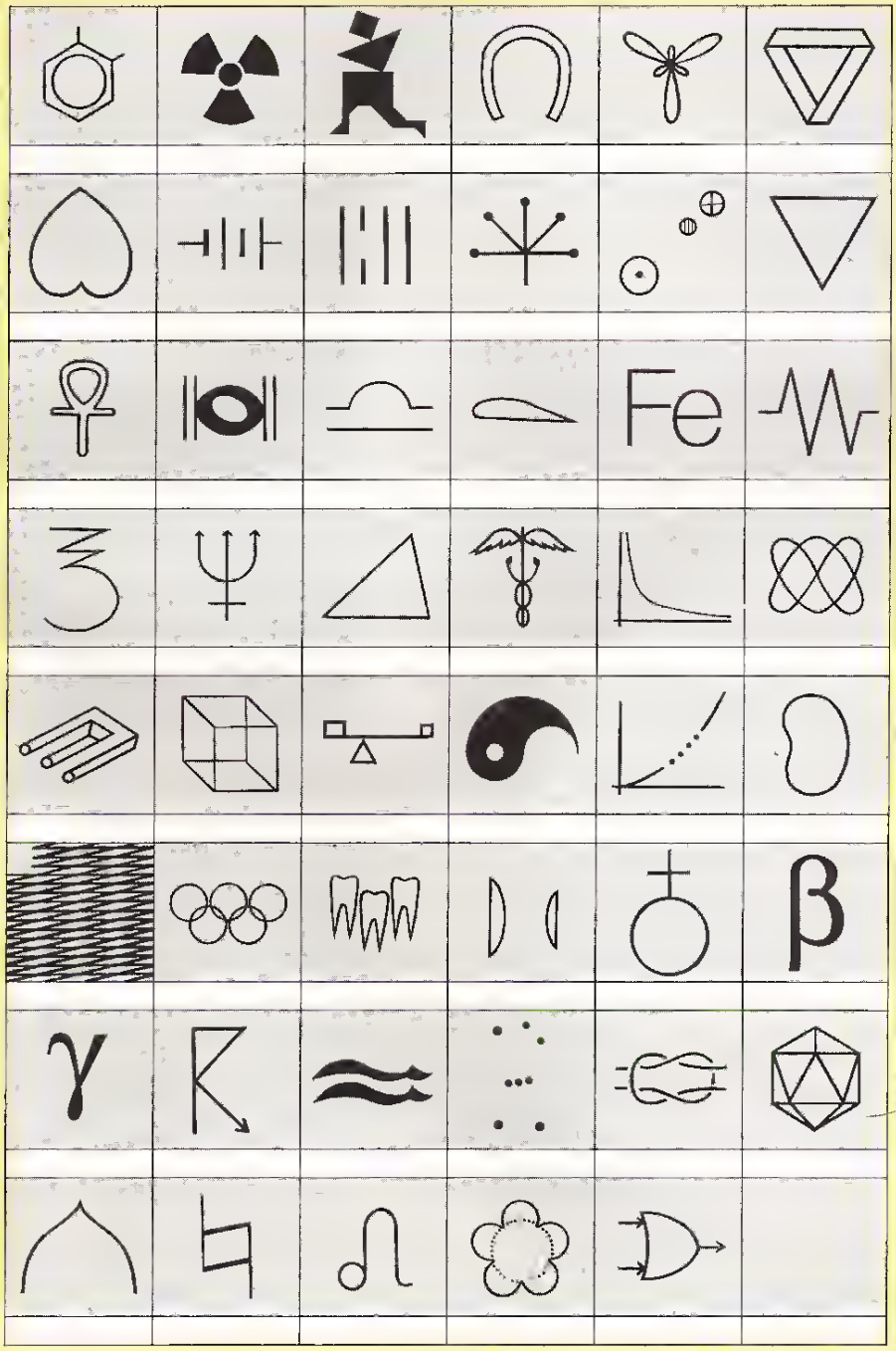
Our trek through the alphabet has finally brought us to the last chapters of the *Omni* dictionary and to Competition #50. It's time to close it out with definitions for words beginning with the letters *T* through *Z*: *tears* = glum drops, *usher* = a theatrical leading man, *venetian blinds* = drapes of lath, *will* = a device for splitting heirs, *Xerox* = zose sings zat zee mountains are made of, *yawl* = every one of you, *zebra* = 25 sizes larger than an A bra.

Send postcards only, please, with a maximum of three definitions on a card. You may enter more than once, but each entry must be mailed separately. Our grand prize winner will receive $100. Nine runners-up will each receive $25. Send entries by February 15, 1990, to *Omni* Competition #50, 1965 Broadway, New York, NY 10023-5965. All entries will become the property of *Omni*; none will be returned.

BOUNTY HUNT

Last February we gave readers 12 visual clues and challenged them to fit together the pieces of our puzzle in the 1989 Great *Omni* Treasure Hunt. The 30 winners—out of more than 260,000 entries—and the prizes they won include: Robert Orefice Henderson, VT (Jeep Wrangler Islander); Clifton Brown, Lawrenceburg, TN (Kawasaki Jet Mate); Paul Schraecke, Quincy, IL (Kenwood DAT deck and tuner); Jeffrey Heebner, Philadelphia (Caribbean holiday); Mildred Nevels, Napa, CA (Infinity Systems loudspeakers); Ruben Burch, Sanford, FL (Casio digital synthesizer); Ansie Dienes, Freehold, NJ (Ricoh Mirai camera); Raymond Donat, Forsyth, MI (Brother word processor); Chad Aspengren, Ankeny, IA (Shimano American tackle package); Bea Stevens, Tempe, AZ (Montague mountain bikes); James Curtis, Tuscaloosa, AL (Cotler bike and clothing package); Cindy Poupard, Inman, SC, and Suzann Holmstrom, Chisholm, MN (Carillon liquor); and Brenda Carraway, Baton Rouge, LA (Sanyo/Fisher car audio receiver). Six winners each received a Psion Organiser II: Leena Sjoman, San Francisco; Greg Ellis, Charlotte, NC; Delores Geardino, Edison, NJ; Donna Zdanovec, Jacksonville, FL; Terry Lee Holtz, Steubenville, OH; and Joseph Norris, Long Beach, CA. And ten winners each received a collection of Maxell products: Clarence Wolff, Anoka, MN; Randolph Falcon, Camarillo, CA; Amy Leroux, Watertown, NY; Jeannette Marie Carr, Portland, OR; Mae Narverud, Ravensdale, WA; Val Ann White, Richvale, CA; Jean Necker, Sumner, IA; Margaret Adkins, Sandyville, WY; Mary Rickerson, Augusta, GA; and Evelyn Becicka, Cedar Rapids, IA. Don't miss your chance to win this year's treasure hunt. Look for details on page 96.

SYMBOL NAMES	ICOSAHEDRON	OLYMPICS
AIRFOIL	IMPACTION	OR
ANKH	INTERPOLATE	ORBITALS
AQUARIUS	IRON	ORION
ASYMPTOTE	LEO	ORTHO
BATTERY	LIBRA	OUNCE
BETA	LISSAJOUS	RADIOACTIVE
BREVE	MOBIUS	RAMSDEN
CADUCEUS	MOIRE	REEF
EARTH	NABLA	RESISTOR
EPICYCLOID	NATURAL	SCALENE
EQUILIBRIUM	NECKER	SYZYGY
ESCHERISM	NEPHROID	TANGRAM
EULER'S CONSTANT	NEPTUNE	THUNDERSTORM
HIPPOCREPIFORM	OBCORDATE	UMBEL
I CHING	OGEE	YIN



SYMBOLIC LOGIC

The collection of forms and symbols at left makes up a puzzle sent in by Michael N. Van der Riet, a South African pharmacist. After faring well on the *Omni*–Mega test (April 1985), Van der Riet joined several high-IQ societies, among them Cape Town Mensa, the Triple Nine Society, and the Minerva Society. He began writing puzzles for the journals of those societies, delighting in constructing difficult puzzles that could be solved only with a lot of thought and research.

We have constructed this quiz from Van der Riet's original puzzle, which contains a more complicated collection of scientific symbols. The 47 images at left draw on disciplines ranging from music to astronomy to medicine. Provided alongside are 47 words in a box, each one representing an association with each item. You should be able to match up a few right away, others may take some research. (Don't give up too readily, you can find some verbal descriptions in the dictionary.) Once you have labeled each box with its name, solve the puzzle contained in the sequence of diagrams and draw the figure that belongs in square 48. (Keep in mind what figures have gone before.) Next month we'll match up the images and their names and, of course, give you the answer that fits in the final square. ∞

STAR TECH

ACCESSING THE FUTURE

FLIGHT LITE

The Falcon (left) seats two, cruises at 90 mph, and offers the ultimate in quick getaways. Price: up to $150,000, depending on options. Contact: American Aircraft Corporation, Long Beach, CA; (213) 595-0701.

FULL MEASURE

The Timex K-28 Surf (left) measures lap times and splits and has a Fahrenheit/centigrade bar graph thermometer that works both in the air and underwater. It comes with a detachable case for lip balm, too. Price: $65. Contact: Timex, Waterbury, CT; (800) 367-8463.

POP TENT

Take the Exodus (above) out of its carrying bag, give a pull on the cord at its top, and it springs into a fully assembled position in 60 seconds. It weighs 12 pounds and sleeps four. Price: $210. Contact: Camel Outdoor Products, Norcross, GA; (404) 449-4687.

LIFE'S A BEAT

You can exercise efficiently with the CIC/ Polar Vantage XL heart-rate monitor (above). Price: about $369. Contact: CIC, Hempstead, NY; (516) 483-8200.

TORCH OF CLASS

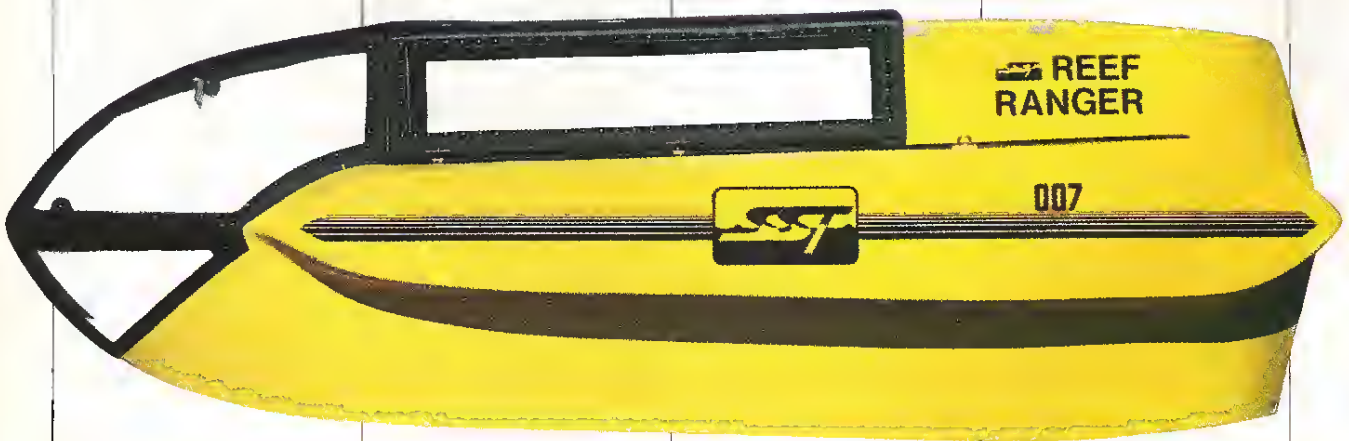
Starting a reliable fire can be critical. Now from Switzerland comes Ikari (right), a hand torch that works in cold, rain, and gale-force winds. Price: $79. Contact: Precise International, Suffern, NY; (914) 357-6200. Outside New York: (800) 227-1314.

ACHE AND BAKE

The Hot Red Thermal Massage Roller (above) can be filled with hot water to relax muscles with heat and pressure. Price: $22.95. Contact: Wylan Health Products, Corpus Christi, TX; (800) 477-7704.

SHIP SHAPE

Reef Ranger (below) lets three scuba divers travel in style. Price: $34,995 (with battery chargers, training, and trailer). Contact: Submersible Systems Technology, Riviera Beach, FL; (407) 863-9701.



LAST WORD

By Linda Sunshine

"Our experts project that dating in the twenty-first century will most closely resemble the classic Roller Derby—that is, a life-threatening contest to determine which partner gets dumped first."

Single people today face the greatest challenge in the history of dating—namely, getting a date for New Year's Eve of the year 2000. Following that monumental hurdle, unmarried men and women have to wonder: What does the future hold for singles in search of significant others?

To answer this question we interviewed Kirby Denver, editor of *Dating Industry Scene*, a magazine tracking the singles market. "We project that dating in the twenty-first century will most resemble the classic Roller Derby," reports Denver, "that is, a life-threatening contest to determine who gets dumped first."

In its 1989 annual shareholders' report, *Dating Industry Scene* predicted that from 1990 to 2020 instances of dating will increase 10 percent in units and 47 percent in dollars, while decreasing 97 percent in personal satisfaction. According to Denver, "The increased population will account for the rise in units, inflation will account for the rise in dollars, and bad press about various social diseases will account for the decrease in satisfaction."

Denver bases his forecasts on shifting trends in today's dating market. Consider these indicators:

•Increasingly demanding work schedules have made it ever more difficult for men and women to linger around singles bars, swilling margaritas in the hopes of meeting the ideal mate. Thus the dateless and desperate are turning to personal ads in newspapers and magazines. Connecting through the mail is so popular today that Dr. Armand Rumbacon, a physicist at the Arkansas Atomic Energy Commission, has projected that "the only survivors of a nuclear holocaust will be the cockroach and the personal ad."

•Telephone answering machines have all but taken the place of actual conversation between men and women. Singles have become adept at "telephone tag," whereby his machine flirts with her machine. Clever opening one-liners ("Didn't I see you on the cover of *Cosmo* last month?") have been replaced by jazzy phone messages ("Do it when you hear the beep!").

•Recent studies reveal important new developments in our understanding of how singles feel about sex. For example, when asked, "What is the most thoughtful gift you can bring a date: flowers, chocolates, or ankle-length pearls?" most singles replied, "A note from your doctor." It is no coincidence then that, according to Denver, "sex has become an activity most safely practiced in the privacy of your own home, preferably on evenings when you're alone."

These data leave experts to conclude that the future of dating resides in the postal relationship. It was George Bernard Shaw who once said, "The ideal love affair is one conducted entirely by post."

Postal relationships are perfect for the twenty-first century because they're safe, sanitary, and very romantic. In the beginning they fax a lot; they send telexes, then telegrams, but as their ardor cools (as it inevitably does), they Fed-Ex long overnight letters to each other. Eventually, they slip comfortably into an idyllic first-class correspondence. The postal relationship eliminates the worry of physical contamination because the safest sex is when a couple never makes contact or even meets. Double dates can be conducted through the use of integrated modems and speakerphones. Fashionable ZIP and area codes will replace BMWs as status symbols.

While the postal relationship totters on the cutting edge of the ultimate twenty-first-century high-concept/safe-sex relationship, one can never predict the future. Scientists may ultimately discover that an intimate exchange of ideas, jokes, and addresses can cause irreparable brain cell damage. Thus the surgeon general advises all postal mates to secure satisfactory answers to the following questions before committing their hard disks to a permanent file labeled with his or her name:

1) Are you currently involved in another postal relationship? If so, how often do you write?

2) How many postal relationships have you had? (Note: A quick exchange of postcards counts!)

3) Have you ever engaged in a postal relationship with a member of your own sex?

In the future, we, as grandparents, will inevitably reminisce about the good old days when a blood donor card was not required for a good-night kiss, when babies were conceived in the backseat of a Buick instead of a petri dish, and sex could be performed without a petroleum by-product. In the meantime, though, let's look on the bright side. In the twenty-first century singles won't have to worry about receding hairlines or expanding waistlines because, in the postal relationship, appearances don't count for much. Postal mates can concentrate on more profound matters, such as punctuation and spelling.

Linda Sunshine, author of Women Who Date Too Much (And Those Who Should Be So Lucky) *(NAL), lives in New York City. Her last postal relationship ended in a bitter exchange of postcards.*