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RIDING COMETS  
TO THE STARS  
**CIRCUITS  
MAXIMUS:  
A PORTFOLIO  
OF ROBOTOONS**

GOD ON A CHIP  
**CREATE  
YOUR OWN  
REALITY:  
THE SCIENCE  
OF MAKE-BELIEVE**



**ONU**

VOL. 6 NO. 9

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CONTENTS		PAGE
FIRST WORD	Openers	G. A. Kayworth II
OBITUARIES	Contributors	8
COMMUNICATIONS	Correspondence	12
FORUM	Dialogue	14
EARTH	Environment	Karen Schwarz
LIFE	Bioscience	T. A. Hegenheimer
MIND	Behavior	Leah Weilach
SPACE	Cosmology	Thomas O'Toole
POETRY	The Arts	Anthony Liversidge
BOOKS	The Arts	Charles Phell
BREAKTHROUGHS	Technology	Eliane de Man
STARS	Astronomy	Marcia Barasak
ARTIFICIAL INTELLIGENCE	Computers	Phoebe Hoban
EXPLORATIONS	Travel	Scot Morris
CONTINUUM	Data Bank	45
COMET ODYSSEY	Article	Edward Regis, Jr.
SUNKEN GARDENS	Feature	Bruce Sterling
VOTERS' PREVIEW	Article	Tim Onisko and Thomas O'Toole
PROBOLUTION	Editorial	Phoebe Hoban
THE ART AND SCIENCE OF TAKEING IT	Article	Frank Kendig and Lisa Buck
COLIN TURNBULL	Interview	Vicki Lundner
AT THE EMBASSY CLUB	Fiction	Elizabeth A. Lynn
CIRCUITS MAXIMUS	Humor	103
ANTIMATTER	UFDs, etc.	109
COMPETITION RESULTS	Problems and Solutions	Scot Morris
HYBRIDOMA	Phenomena	Philip Harrington
GAMES	Overviews	Scot Morris
LAST WORD	Humor	John Picard



Dell Publishing Company  
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are characterized by  
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# FIRST WORD

By G. A. Keyworth II

With awards of up to \$100,000, the Reagan administration is persuading a generation of talented, young scientists to stay in teaching.

ILLINOIS PURDUE INSTITUTE OF TECHNOLOGY had to fill a vacancy for an assistant professor in its school of aeronautics and astronautics. But in 1983 this Indiana school was finally able to land Kathleen Howell, who had just received her Ph.D. from Stanford for research in aircraft mechanisms and aerodynamic dynamics.

Because qualified faculty are so scarce in this important and emerging field, Purdue considered itself fortunate to have found such a promising researcher, someone who, as it happened, also wanted to teach. The search committee, like those of hundreds of other universities throughout the country, knew all too well the difficulties of recruiting new Ph.D.s to academic positions. Since young faculty have often been stymied in their attempts to gain financial backing for research programs in academia, many of the best new Ph.D.s choose to enter industry instead. Other talented scientists leave academic positions after a few years in order to go where research opportunities are better.

But Howell is one of 200 young faculty who will not have to worry about where her research support will come from for a while. For the next five years, these 200 engineers and scientists will be receiving up to \$100,000 per year, in a combination of federal and industrial funds, as the first of the Presidential Young Investigators (PYI). The awards, which fund research for faculty just beginning their academic careers, are intended to help universities attract and retain outstanding young Ph.D.s who might otherwise pursue non-teaching careers. Moreover, each successive year the current PYIs will be joined by 200 additional recipients. After five years there will be 1,000 young faculty whose research will be supported through this novel program.

The awards, administered by the National Science Foundation, are a response to a serious problem. Last year nearly a quarter of the entry-level engineering faculty positions in American universities could not be filled. The staffing problems in computer sciences were as bad or worse, and there were shortages of good young faculty in other disciplines as well. The problem strikes big and small schools alike, affecting both prestigious universities and community-based junior colleges.

These shortages come at a time when undergraduate demand for extensive training in scientific and technical fields has been skyrocketing. Increases in engineering enrollment over the past few years have been nothing short of phenomenal: jumps of 50 percent over half a dozen years have been common in engineering departments throughout the nation. And since most of these students who get their bachelor's degrees now go directly to work, graduate students, who traditionally help faculty with their teaching responsibilities, have

been in short supply. For that dwindling number of researchers who stay on and get their Ph.D.s, industry becomes even more attractive once they've attained their advanced degree, since corporations have the financial resources necessary to support productive research. Why don't these young scientists stay in the university to do their research, as generations before them have? Many do, of course, but over the past decade the campus environment for scientific research has deteriorated, especially when compared with what industry has to offer. In particular, young faculty have found themselves spending increasing amounts of time trying to line up research support and struggling with aging research equipment and facilities—and then being underpaid for their trouble.

Solutions to most of the problems have to begin with the universities themselves. But there are some high-leverage mechanisms that the federal government can use to help the universities help themselves. The Presidential Young Investigators program is one of them.

PYI awards are restricted to people who have received their Ph.D.s within the past seven years. And unlike typical research grants, these awards are given not on the basis of a research proposal but on the basis of an individual's potential to do vital research. Moreover, the awards are remarkably unconstrained, permitting the young engineer or scientist to use the funds flexibly to establish a research program. The federal government provides \$26,000 outright and then matches funds that the university raises from industry, up to a total of \$100,000.

Of the first 200 awards announced in February 1984, three-quarters were in engineering and the physical sciences, with the rest in other fast-moving disciplines. In all, PYIs are now working at 74 universities in 35 states.

The PYI program is a highly targeted federal response to specific teaching needs in science and technology. At the same time, on a larger scale, the federal government is determined to improve the overall ability of universities to conduct research and train new people.

One of the best kept secrets today is that federal support for basic research at universities has grown by 55 percent since 1981! In the next fiscal year this support will be worth nearly \$4 billion. In fact, basic research in universities has emerged in the past few years as one of the Reagan administration's highest priorities—part of a concerted attempt to restore the health of American universities following the neglect that characterized the Seventies. We still have our work cut out for us, but we've made a substantial start. **DO**

G. A. Keyworth is science advisor to President Reagan and director of the Office of Science and Technology Policy.

# CONTRIBUTORS

## OMNIBUS



REGIS



O'ROURKE



TURNBULL



STERLING

**M**ost games people play are simulations—from Monopoly and Pac-Man to the elaborate and dangerous war games conducted by the United States and the Soviet Union. Omni asked Frank Krendig and Leo Buck to examine the make-believe world of simulation, where a person can realistically act out even the most dangerous scenarios without exposing himself to risk. Krendig and Buck investigated everything from simulated flight to simulated murder, and they learned that today, with the help of technology, you can pretend to be anything you want—brigadier general, divorcee or chairman of the board. As they report in "The Art and Science of Faking It" (page 82), "Simulation may be the primary process that makes us human; that sets us apart from the other animals."

Others might argue that the urge to explore is our strongest trait. One example: At the Los Alamos National Laboratory, space scientists are studying bold plans to use comets to colonize space. According to Edward Regis, Jr., author of "Comet Odyssey" (page 54), the theory behind interstellar comet riding is highly plausible. Comets are rich in energy and can support life for long periods of time. All we have to do is climb on and hitchhike through the galaxy.

Regis, a philosophy professor at Howard University, is interested in the ethical aspects of space exploration and in extraterrestrial intelligence. He has just

completed a book, *Extremesimals: Science and Alien Intelligence*, to be published by Cambridge University Press. Regis first heard about comet travel last year. He says, "At first I couldn't believe my ears. How could anyone take this stuff seriously? But after attending an interstellar-migration conference and listening to going-on space scientists propose plans for space exploration, I changed my mind. Now my attitude is, if it's not forbidden by the laws of physics, then it may happen."

If comet riding is to become commonplace 100 years from now, American presidents will have to become outspoken proponents of change. An entire generation of technology can develop during the first term of a presidency. Starting late last year, Omni began tracking down the views of potential presidents. We drew up a complex set of questions on space science, technology and nuclear war.

Thomas O'Rourke, political correspondent for the Washington Post, and freelance writer Tim O'Rourke presented these questions to the major candidates. "Voters' Privilege," on page 68, presents the politicians' answers so readers can make comparisons.

While candidates struggle with the problems of American society, anthropologist Colin Turnbull roams in the study of alien cultures. His mind simultaneously occupies different parts of the world, and he thrives on what others call culture shock. In this month's interview, on page

66, Turnbull discusses his research into primitive cultures, and draws comparisons with our own. Interviewer Vicki Longfellow, who characterizes herself as an ethnographic fiction writer, describes the effervescent anthropologist. "I felt sure you'd be a Pygmy too," he said when we last met. I was amazed at his energy. From the time he bounded up the steps of George Washington University's anthropology department, there was no stopping him. I barely got my questions in edgewise. The transcript of the three-day interview totaled three hundred pages. Like a genie, Turnbull appeared to be nourished by air. He denounced eating as a waste of time and declined my invitation to lunch, recalling the time the publisher had taken him to *The Four Seasons*, where he'd gotten so immersed in the coffee-pouring ritual as performed by waiters in togas that he neglected to order. I was moved by his difficulty in remaining an objective and aloof scientist.

In the alien and far-future universe of fiction writer Bruce Sterling's "Surien Gardens" (page 58), genetic engineering is a fait accompli. The protagonist is given the rare opportunity to alter her genetically determined biotype—it she can win a highly competitive contest. Elizabeth A. Lynn presents a haunting love story in "All the Embassy Club," on page 92. Lynn has won two World Fantasy Awards. Among her novels are *A Different Light* and *The Shadow Net*. **DC**



# DIALOGUE

# FORUM

OMNI welcomes speculation, the ones commentary, dissent, and questions from readers in this open forum. We invite you to use this column to voice your hopes about the future and to contribute to the kind of *useful* dialogue that generates breakthroughs. Please note that we cannot return submissions and that the opinions expressed here are not necessarily those of the magazine.

## The Problem with Prowlers

James Oberg's thought experiment, in which he suggests that the percentage of "true" UFO sightings would not diminish even if all true UFOs went away for a period of time, is amusing but irrelevant [UFO Update, May 1984]. Let us substitute prowers for UFOs in his experiment, and instead of having true UFOs vanish for a period, let us have all "true" prowers do so (perhaps to attend an international prowers' convention in Patagonia).

Following Oberg's reasoning, this leaves only prower reports from nervous old ladies and misperceptions of noises from faulty plumbing, creaking floors, and wind in the shutters. Some of these reports wouldn't be solved by the police; there would always be a residue of unsolved UFO—if mean prower—reports that some might hold were true prowers.

Now the true prowers come back from their convention, but there still remains a residue of prower reports that the police are not able to solve. So what is the difference? One week, no prowers but a residue of unsolved prower reports. Next week there are prowers but again a residue of unsolved prower reports. Thus the thought experiment says nothing about whether true prowers or true UFOs exist.

All yes, you may say. Sometimes the police catch prowers or find evidence of them, such as footprints. Aye, that's the rub! If the police operated on the principle that there were no legitimate prowers and that all prower reports were actually just so much nonsense, they would disregard all prower calls and never bother to investigate.

One wonders how many UFO cases Oberg has personally investigated by going out into the field with responsible witnesses, interrogating each separately and inquiring into their technical competence and integrity. But of course, why bother? Reports of UFOs are just a lot of rubbish, and all UFOs can be explained as misperceived Russian rockets, hoaxes, or hallucinations.

J. Allen Hynek  
Director, Center for UFO Studies  
Evanston, IL

James Oberg replies: Hynek's attempted refutation of my thought experiment contains two major failures of logic:

The first is the unstated assumption of his prowers: We know what prowers are, and we have an excellent model of their behavior and of the kinds of physical evidence they can be expected to leave behind. On the contrary with UFOs, there is no existing model for what they can be expected to do. Sometimes they reportedly stalk cars; sometimes they (the same they?) do not. Sometimes they

reportedly leave ignous kinds of physical traces; sometimes, not. I am well aware of the literature on this subject as well as the fact that it consists of catalogs, not theories or models.

Secondly, prowers and UFOs possess two distinctly different statistical characteristics. Even the most fervent UFO believer readily admits that the vast majority of all UFO cases (including those for which there is photographic evidence and physical artifacts) are honest misperceptions. The opposite is true of prower reports, the vast majority of which are caused by real prowers. If the prowers all "went away" (to a convention as Hynek so neatly hypothesized), there would be an immediate change in both the quantity and the quality of the remaining reports.

Hynek's hang-up on the technical competence and integrity of UFO witnesses bespeaks perhaps a basic philosophical difference and a severe scientific failing. When discussing honest misperceptions, the technical competence and integrity of the eyewitnesses is not just irrelevant, it may even be *inversely correlated*. Pilots and policemen, for example, can be shown to be poorer observers of identifiable UFOs than the average citizen or astronomer, of which fraternity Hynek is justly proud to be a member, are hardly immune, as a recent case shows.

A famous set of UFO observations from the Soviet Union involved testimony by astronomers—but the sightings were indeed prosaic in origin. They, to last misperceived Russian rockets, an explanation Hynek may sniff at because he originally endorsed those cases as being true UFOs.

Nonetheless, I consider ufology to be one of those high-risk, long-shot, high-payoff research areas where more competent attention and funding should be assigned. My cynicism is strictly of a personal nature, based on repeated instances in which I have personally investigated and solved famous cases previously endorsed by leading and responsible UFO scientists. **OO**



# TREEPEOPLE

# EARTH

By Karen Schwarz

**O**ne spring day in 1973, college sophomore Andy Lipkis learned that the California Division of Forestry was about to destroy 30,000 young saplings. He called to ask whether he could have them, figuring he and his friends could get them planted. The answer was a flat no, state property is not just handed out.

Not easily discouraged, Lipkis contacted a friend who worked for the Los Angeles Times. A reporter called Sacramento and asked some embarrassing questions. Government officials had 8,000 trees that hadn't already been destroyed delivered to Lipkis posthaste but that didn't stop the Times from running the story "Andy vs. the Bureaucrat's Deadwood."

That summer the California Air National Guard convoyed the trees into the mountains and with the aid of 3,000 summer campers, got them all planted. In the meantime, \$10,000 in small donations poured in. To administer the funds, TreePeople was founded.

California Senator Alan Cranston, an

early admirer, gave Lipkis a desk and telephone in the senator's office. Lipkis started applying for corporate and government grants to continue plantings in the San Bernardino Mountains, where 40,000 trees were dying each year from pollution drifting up from Los Angeles. He was soon joined by other young environmentalists willing to work for little or no salary: Scout troops, the disabled, senior citizens, school kids—all volunteered to pot seeds, make calls, write newsletters, and organize plantings.

Today TreePeople boasts 1,850 members and operates out of a newly-pashed Beverly Hills fire station donated by the city's Recreation and Parks Department. From these headquarters Lipkis, now twenty-nine, is working on TreePeople's most ambitious plan yet. The organization wants nothing less than to transform Los Angeles's endless concrete landscape into an urban forest. Specifically TreePeople is mobilizing city residents to plant 1 million trees in time for the summer Olympics. And the organization is mounting a huge publicity

campaign to see that it happens.

Aesthetics aside, trees are invaluable for improving air quality and can conserve energy used for heating and cooling. They also produce food and prevent erosion. California's political climate has furthered the need for Lipkis's plan. Proposition 13, a tax referendum passed in 1978, has strangled Los Angeles's trees to death by drying up half the city's tax revenues. The subsequent budget cuts have left the city's 600,000 public trees to the care of 200 employees in the municipal Street Tree Division.

A still more devastating blow followed in planning for the state's 1984 budget. Governor George Deukmejian issued all funding (\$910,000) for the urban-forestry program and recommended that environmental projects be financed from the revenues on vanity license plates.

Lipkis isn't so much concerned with making the city prettier for the athletes or for that matter compensating for political decisions. The urban-forest campaign represents a much bigger proposition. "We need to show what can be done without massive amounts of money," says Lipkis. "By using resources at hand, not only can people do it themselves but they'll find their lives more satisfying."

When the world is looking at Los Angeles this summer, it's not the profusion of green Lipkis wants everyone to remember. "My goal is for people in the rest of the country and in other nations to recognize our efforts are relevant to themselves and to realize that they can do it too. I hope they'll think, 'Look what the people in this city did! Look at what we could accomplish if we tried!'"

Lipkis's appeal may sound naive, but it is backed up by sophisticated promotional talents. In 1979 TreePeople closed off the Mar Vista Freeway for the first annual ten-kilometer TreeRun. No medals were awarded, just bags in milk cartons, one for each of the 3,000 runners. The following year Warner Brothers cosponsored the race to promote the film *Persuasion*. Local newspapers publish human-interest stories on TreePeople regularly, and celebrity neighbors like Ed Asner contribute on regular occasions.



California environmentalist Andy Lipkis is turning Los Angeles into an urban forest

# SHARK CURE

## LIFE

By T. A. Heppenheimer

**T**he great white shark in *Jaws* that terrorized the fictional New England town of Amity might have come to a different fate if it had ventured into Boston Harbor. There, a group of medical researchers are diligently collecting shark carcasses and extracting from the fish's cartilage a substance that has a curious effect on cancer tumors. It keeps them from growing.

While studying tumor growth, researchers Judah Folkman, director of the surgical research laboratories at Children's Hospital in Boston, and Robert Langer, a Massachusetts Institute of Technology scientist, began investigating the potential agent in cartilage. "I saw many cancer victims," says Folkman, "and in nearly each one, the tumors which infected the tissue and bone stopped at the line of [human] cartilage."

Several years before, Folkman had demonstrated that tumors are similar to glands and secrete a hormone-like substance called tumor angiogenesis factor (TAF). The substance encourages nearby blood vessels to grow toward the

tumor, interweave inside it, and function as a blood supply. The cancerous mass can then gain the nourishment it needs and rid itself of waste products. If a substance were found that could block the TAF, the researchers hypothesized, the tumor would be unable to grow.

Studies by Rubin Eisenstein and Klaus Kuehner of the University of Chicago had shown that cartilage could resist the invasion of blood vessels, so Folkman and Langer began experiments to see what would happen to tumors in rabbits when cartilage was placed nearby. Before the cartilage was implanted, capillaries grew straight toward tumors. But when we put a bit of cartilage between the tumor and the blood vessel, explains Folkman, "the capillaries stopped growing toward the tumor."

At first the researchers used cartilage from calves. But a pound of calf cartilage yields only a milligram of what researchers call the angiogenesis inhibitor, the active ingredient that inhibits tumor growth. Enter the shark, the animal with a skeleton made entirely of cartilage. Even

more auspicious, as Langer discovered, is the richness of shark cartilage. A single shark may contain 100,000 times more anticancer potency than a calf; in addition, autopsies done on sharks by scientists at the Smithsonian Institution showed the species almost never develops cancer.

While the researchers seek to isolate the angiogenesis inhibitor in shark cartilage, another form of angiogenesis inhibitor is being investigated. One of Folkman's students, Stephanie Taylor, discovered the active agent while doing a study in which TAF was introduced into fertilized chicken eggs. Such eggs have a membrane that is richly supplied with blood vessels. Placing TAF on the membrane made the capillaries grow together more thickly. As part of the experiment, Taylor added heparin, a drug used to control blood clotting, and found that the capillaries grew even faster. But there was a problem. Taylor had to use a fine saw to cut small windows in the eggshells in order to gain access to the membranes. These cuts produced shell dust, which irritated the membranes. Folkman suggested using cortisone along with the heparin, to reduce swelling and inflammation. What happened as a result was quite unexpected. I didn't believe it until I did the experiment myself," Folkman says. "Heparin and cortisone used together created a blank region which had no capillaries in the egg. The medium was acting as an angiogenesis inhibitor, preventing blood vessels from growing."

Further testing revealed the importance of the combined effect of cortisone and heparin. When used separately neither was successful in inhibiting tumor growth. But the two drugs used together produced amazing results.

There's no way to know whether this will work on people. Folkman cautions: "Many experiments that look great in mice fail in humans for a variety of reasons. One of the problems is that cortisone is toxic and can't be used for long-term treatment." But research in this area, "says Folkman, "may lead to a new way of thinking about treating tumors." **□**



Within the shark's skeleton lies a mysterious substance that seems to inhibit tumor growth.  
20 DMN

# HAIR TRIGGER



By Leah Wallich

**E**veryone—the other convicts, the prison employees, the prison volunteers—was happy when Jim made parole. He had been a member of an inner-city Chicago gang when he was twenty years old and had been convicted of murder. Now thirty-six, he seemed determined to make a good life for himself within the law. He was intelligent, handsome, popular, and everyone's candidate for prisoner most likely to succeed as a solid citizen.

One of the people who believed in Jim was William Welsh, a chemist at Argonne National Laboratory and a prison volunteer for 17 years. Welsh met Jim's wife and family. They were just what a psychologist would have ordered: loving and supportive. Welsh helped Jim get started in his own business. That venture went extremely well. Before long Jim had money and respect, just what a sociologist would have ordered.

A few months later Jim was arrested and convicted of murdering three people.

"I knew him so well," Welsh says, "it wasn't lack of love, lack of money, or a lousy environment that made him violent! It must have been something inside him."

That experience and hundreds like it made Welsh begin to think there was something to the theories that physical as well as psychological and sociological factors might help influence someone to commit a crime. Welsh decided to use his skills as a scientist to find out what that something was. After surveying the literature, he decided that hair analysis showed promise in relating some of the biochemical triggers of criminal behavior. And so he began studying hair samples taken from criminals.

After seven years of work, Welsh and Ronald Isaacson, also a research chemist, are ready to publish the results of their experiments. Their findings suggest that two distinct behavioral patterns are associated with two distinct patterns of trace-metal concentrations in human hair. Trace metals are microscopic quantities of such substances as zinc, copper, and manganese, which the body uses as catalysts for various metabolic

processes. Imbalances usually don't register clearly in a blood test because the blood quickly normalizes excesses by depositing trace metals in the hair and elsewhere. Hair contains sulfur (which is why it smells like rotten eggs when burned). The sulfur in hair follicles binds to metals in the blood, drawing them out of circulation. Eventually the metals are absorbed into the dead cells that come out of the scalp—the hair we stroke and comb.

Hair analysis has acquired a dreadful reputation because of false claims made for it: the faulty or nonexistent science associated with it, the unreliable techniques used by many labs, and the imaginative way researchers have interpreted results. Properly done, however, it can be a valuable screening technique.

Working in their spare time without formal funding but with the help of colleagues at Argonne, Welsh and Isaacson developed their own meticulous procedures for collecting and preparing samples and for establishing standards against which to test them. They had hair

samples analyzed by atomic absorption mass spectroscopy at two carefully chosen laboratories. This technique calculates the percentage of metals present in a substance by measuring the quantities of X radiation emitted when the hair sample is atomized at temperatures of 5000°C or greater.

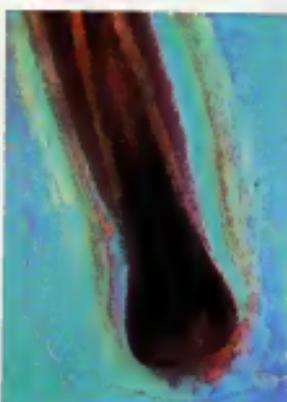
Welch began his hirsute investigations by studying 24 pairs of brothers ages eight to eighteen. It was an elegant approach to the problem—he had subjects of the same size, family background, environment, and diet. One of each pair had a long history of violence and delinquency; the other was a well-adjusted kid who had never even gotten into an after-school fight.

As Welsh had suspected, the trace-metal levels of the violent kids were very different from those of their pacific brothers. But the data on the violent boys seemed confusing. The figures were all over the map, Welsh recalls. After looking over his findings for about a month, he began to see patterns. The hair chemistry of the violent brothers came in two types. Significantly, the two types correlated with two distinct kinds of behavior often observed in adult criminals.

One pattern was characteristic of boys who exhibited the kind of impulsive, viciousness criminologists call episodic criminality. Episodic criminals may be kind and law-abiding for days, weeks, or even years, but without warning they may suddenly explode into violence. The other pattern was found in boys who already gave signs of possibly being sociopaths. Sociopaths are self-interestedly callous and coolly violent.

To test his hypothesis, Welsh compared the hair of 95 violent on-mates with the hair of 95 law-abiding citizens of the same age, race, socioeconomic level and hair color. As in the previous study, the latter were exceptionally nonviolent individuals who had never harmed anyone in all but four of the criminals. Welsh found one of the two patterns.

Welch wants to help violent people—not just point a finger at them. His Health Research Institute (HRI), which he formed



A human hair. Can it yield clues to violence?

# IRAS EYES

## SPACE

By Thomas O'Toole

**N**ASA Administrator James M. Beggs and Deputy Administrator Hans Mark saved the world news for last during a two-hour press conference earlier this year. Work on the Shuttle Infrared Telescopic Facility (SIRTF), which was supposed to have been carried into space by the shuttle in 1990 would not begin as promised this year. In fact, Mark told the press, SIRTF (pronounced *serf*) might not make it into orbit until 1993, when it would be a "very very strong candidate" to be put aboard one of the space-station platforms. Explained Mark, "That's where we're looking at now." If [SIRTF] is being delayed because the results of the Infrared Astronomical Satellite (IRAS) were so spectacular that they clearly demonstrated the value of having a tree-flyer rather than a shuttle-attached payload, which would have a limited lifetime in orbit."

Most astronomers were wildly disappointed. They agree with Mark that the Infrared Astronomical Satellite had been a spectacular success. And, yes, it would be better to make SIRTF a free-

flier orbiting through space on its own rather than letting it hang out of the shuttle's cargo bay, while its optics could be fogged over by rocket exhaust or the venting of the shuttle's toilet. The trouble with infrared telescopes is that they don't do well where there are people, says Charles Beichman, of California's Jet Propulsion Laboratory, where the Infrared Astronomical Satellite was hatched and developed. "People bring too much contamination into the picture."

That might help to explain why IRAS, all alone in a polar orbit 900 kilometers high, was such a dramatic success. Its polar orbit took it around the entire Earth 14 times a day, which means that its telescope observed an incredible 98 percent of the sky. It was launched by a Delta rocket on January 26, 1983, from California's Vandenberg Air Force Base, and for all but eight nights, it made spectacular observations of the heavens. On November 22, however, it stopped observing. It had run out of the supercold helium that allowed its beryllium mirrors and silicon detectors to find and photo-

graph celestial objects. The helium chilling sensors at the focal plane to -457° F., made it possible for IRAS to distinguish between an infrared stellar source and the telescope's own heat.

So of the nights the IRAS observatory missed in space were the six nights scientists waited to jettison the cover that kept the telescope free of contamination. Even so, a single speck of dust was still blotting the lens when the cover came off, a mishap that cost astronomers two more viewing nights.

How good was IRAS's performance? Cornell University's Carl Baugan calls it the greatest single achievement in astronomical history. The satellite and its discoveries made the cover of *Nature* magazine three times, an unheard-of event in the history of the prestigious British journal.

If nothing else, IRAS proved once and for all the worth of space-based astronomy. Above the atmosphere, away from city lights and unimpeded by rain, sleet, ice, snow, and fog, the infrared observatory in space never stopped seeing things until its helium ran out. "We lose a lot of observing time down here on Earth because of weather and even moonlight," says Gerry (pronounced Gary) Neugebauer, IRAS project scientist who also serves the California Institute of Technology as director of the Mount Palomar Observatory near San Diego. "Looking through IRAS was like having a year-long observing night."

What did IRAS accomplish? In its unlikely 10-month circling of Earth, the 2,249-pound satellite picked up the infrared emissions of more than 290,000 celestial sources, many of them never seen before. It revealed sources hidden by interstellar dust and found galaxies so young and so old that they were too cold to emit the kind of starlight that could have been detected by earthbound telescopes. Nearer to Earth, the infrared telescope identified at least five new comets and found a 1.2-mile-wide "miniplanet" inside the orbit of the planet Mercury. Scientists now believe the tiny object is the burned-out relic of an ancient comet.



Yellow, green knots and blobs are giant interstellar clouds in this IRAS view of our galaxy.

# POETRY

## THE ARTS

By Anthony Liversidge

**C**onfused by corticosteroids? Baffled by biogenetics? Mystified by membranology? Hold on. Riding to the rescue from an unexpected quarter—the realm of poetry—comes Michael Newman, thirty-five. For Newman, a protege of W. H. Auden, inspiration springs from the wonders of science and, in particular, cell biology. He sings the body scientific, versifying about the core of biological existence: the cell and its marvels. He is becoming, as a mildly bemused James Watson, of double-helix fame, puffed it “the poet laureate of microbiology.”

For a poet to devote himself to this topic makes sense. Newman insists: “Poetry is the language of life, and biology means ‘language or word of life.’” Moreover, in biology, “cellular form is the name of the game. You have the molecules conforming to the principles of cellular organization. In poetry the words have to conform to the rules of rhyme and rhyme, or you have no poem.”

Newman’s purpose is serious, although his method may be playful. He intends

to illuminate his knowledge of biology by making it entertaining through rhyme and game. “The playful impulse is distilled in science. Even though scientists are funny and have a lot of imagination, official science, the business end of it, condemns you for it. To me, humor is the most precious virtue.”

Given the thicket of new terminology that has grown up around biology, a versifier armed with plain English is bound to be helpful—and more fun. Verses are a nicer way to consider whatever you like—they bounce; they are lively. Most subscribers read only about 10 percent of the specialist journals in scientific fields, he reckons. But when one of my poems is published by, say, *The New England Journal of Medicine*, I’m sure they all read it.

And indeed, among such articles as “Cyclic Nucleotides and the Nervous System” or “The Adrenalin Chromaffin Vesicle as a Biological Model,” in *Trends in Pharmacological Sciences*, Newman is likely right in believing most readers turned first to “Steroids (an ode to what

just fixed my tendon),” which ends thus: “These hormones propagate their sort in the glandular adrenal cortex—and thus the cort that such words sport in our linguistic vertex.”

Pursuing this playful biologic, Newman has taken up what he calls “cloning poems,” much as cells are cloned. Creating new poetic life from old, he fashions new verses to follow the rhythmic and verbal blueprint of a famous original. Poetic masterworks are master templates for cloning. “He says, ‘A masterpiece shouldn’t be the last word, any more than a great man should be childless.’”

So far he has cloned some 40 of his favorite classics by Yeats, Donne, Millay, Shakespeare, Blake, and especially Eliot, in whom he has detected “a biomedical presence that could be sharpened by recent knowledge.” His current project in the clonal mode is nothing less than a total rewrite of Shakespeare’s *Hamlet*, renamed for the occasion *Hommelote* (*broken little-men-shit*). Newman’s version is, he explains, “a medical interpretation of the original play as diagnosing a cancer in the state of Denmark, possessed with disease and full of profoundly prescient physiological insights into life and death.”

In *Hommelote* the hero is Medicine, who ruminates as follows:

Beauty or unbeauty; that is the question;  
Knowing there is cement in the  
brain to muster  
The straight and narrow of  
chemical gradient!  
Opposed against a rug electroclic!  
Whose opposition starts life To  
live to see,  
again; and what we see we  
memorize.  
The fibrillating trillion napral!  
shocks  
That mind is hard to . . .”

Newman once conducted a famous interview with W. H. Auden, published in George Plimpton’s literary socially smart journal *Paris Review*. “If you were to go mad,” he asked Auden, “what do you think your madness would be?”

CONTINUED ON PAGE 198



Newman sings the body scientific in poetry, and in computer games like *Lymphophuzz* and *Cell City*.

# BOOKS

## THE ARTS

By Charles Platt

**A**rthur C. Clarke used one to write *2010: Odyssey Two*. Isaac Asimov used one for the final draft of *Foundation's Edge*. Gregory Benford, Frank Herbert, Jerry Pournelle, Gordon R. Dickson, Harry Harrison, Robert Silverberg, Joe Haldeman—almost every major science-fiction writer seems to have gotten rid of that old-fashioned gadget, the typewriter, and started using that much-publicized high-tech toy, the word processor.

Buying a word processor is not quite as big an outlay as it used to be, but a quality system still costs at least \$5,000. What's so special about word processing to make so many people want to spend so much money?

First, we should remember exactly what word processing is. At the heart of the system is a computer, which displays text on a video screen and stores the text in its electronic memory. By using coded keyboard commands (for example, **P** for **DELETE**) the typist can alter the words on the screen, make inserts, shuffle paragraphs, and correct errors. The

final, word-perfect text is then printed onto paper by means of a gadget like an electric typewriter, which is controlled by the computer. The text can be saved permanently on magnetic floppy disks and can be retrieved again anytime, to be edited or merged with other text.

Word processors were originally developed in the early Seventies as special-purpose, high-cost gadgets for office use. Their ability to generate error-free text, to insert personalized names, and other data into standardized documents made them ideal for mail-order companies, collection agencies, and law firms.

But word processing soon developed a wider appeal. Typists liked it because they could correct their errors on the screen rather than on paper. Journalists liked it because it made rewriting easier.

Before long, a few Silicon Valley entrepreneurs realized that it would be easy to program a low-cost personal computer to do word processing, just like an office system but at a quarter of the price. The die was cast; so to speak, so that today you can choose from at least

200 different word-processing programs.

Wordstar, the original best-selling program, remains one of the most expensive—about \$400 for disk and instruction manual of the full-feature version. Also, it requires a relatively large computer. But new programs have been scaled down in price and size. Quick Brown Fox, for instance, is a \$55 cartridge that converts the VIC-20, an ultracheap home computer, into a bargain-basement word-processing system.

Jerry Pournelle was the first science-fiction writer to spread the electronic gospel. Five years ago he published a series of articles claiming that, with a word processor, he had doubled his productivity and achieved high literary standards, too.

Gordon R. Dickson, award-winning author of the *Dorsai* series, was one of the first to follow Pournelle's prescription for easy writing. "Learning a computer is more complex than learning a typewriter," he says, "but once you've learned it, you feel as if you're wearing seven-league boots. If you're a writer by nature, as I am, the process of retyping corrections on a typewriter is tiring. A word processor cuts the effort down."

Gregory Benford, a more recent convert, tells a similar story—and also credits his word processor with clearing a writer's block. Arthur C. Clarke, who used to claim that he had retired permanently as an author, says that his word processor helped him tackle *2010* and lured him back into writing nonfiction as well. Isaac Asimov, who swore he would never abandon his Selectric, changed his mind when Radio Shack gave him a TRS-80 Model III computer.

Of course, science-fiction writers generally tend to be hung up on gadgets. Pournelle admits that part of the appeal of word processing, to him, is that he can play with his computer and make money at the same time.

Whether or not word processing really offers all the practical advantages it seems to us harder to prove, and the verdict varies from one writer to another. Joe Haldeman, best known for his



The word processor technology is a newest toy, claims writers and visionaries in the world of SF.  
38 OCTOBER 1982

CONTINUED ON PAGE 101

# BIONIC BAT

## BREAKTHROUGHS

By Elaine de Man

**O**n a quiet morning last September, twenty-four-year-old Parker MacCready zipped himself into a frail-looking airplane called the Bionic Bat, took off from the runway at Shafter Airport, near Bakersfield, California, and, pedaling steadily, set a new world's speed record for human-powered flight. His father, Dr. Paul MacCready, designer of the Bat, watched as his son piloted the first human-powered airplane to fly a mile-long course in under three minutes. The MacCreadys would have won the \$33,000 first prize in the Kremer World Speed Competition if it had not been for a technicality. But they are convinced the Bat can repeat its performance in the next few months.

President of AeroVironment, a Pasadena-based company, Paul MacCready earned a secure place in history seven years ago when his Gossamer Condor became the first human-powered airplane to fly a mile-long figure-eight course. At the time of that flight, British industrialist Henry Kremer, a health and fitness enthusiast, was offering a \$120,000 prize

through the Royal Aeronautical Society for just such a flight.

Two years later MacCready's human-powered Gossamer Albatross flew 22.5 miles across the English Channel to win more of Kremer's money, this time the largest prize in aviation history—\$205,000. The Bat has a chance to earn MacCready another substantial prize, but more important, it has infused new life into human-powered flight.

"I was afraid we had killed the idea," says MacCready. "The earlier planes were very large, tiring, and awkward and required very special weather to fly. [The Gossamer Condor was so delicate that a wing broke when the plane flew through a window left by a crop duster that had taken off five minutes earlier.]

Unlike its fragile cousins, the Bionic Bat is a relatively small, rugged, streamlined airplane that is specifically designed for faster speeds. It has a 48-foot wingspan and weighs 84 pounds without the pilot. The main structural support for the wing comes from an elaborate carbon-fiber wing spar as

opposed to the drag-inducing, external bracing used to support the nearly 100-foot wings of the Gossamer Condor and Albatross. The rest of the Bionic Bat is a refined combination of high-tech and common household materials.

The wing ribs are made out of styrene foam (the stuff used to make picnic coolers and Styrofoam cups); the fuselage is covered with egg-crater foam; Kevlar, a plastic fiber that is, by weight, five times as strong as steel, is used to tie it all together. It looks as though the Man from Glad might have wrapped the wings but the see-through covering is actually made of pre-stretched Mylar.

The Bionic Bat also has a different aerofoil than MacCready's other planes, this one requires about 0.6 horsepower to fly. But even though it is incredibly efficient for a plane of its size, it's still twice as much horsepower as was needed to fly the Albatross.

"The human is a lousy engine," says MacCready. "It weighs one hundred fifty pounds and puts out only about one-third horsepower. You can buy a model-airplane motor that weighs only three ounces and does better than that."

The speed course for the Bionic Bat is considerably shorter than the cross-channel flight, and MacCready feels that an Olympic-class cyclist could fly without using an energy-storage system at all.

Like many of MacCready's other designs, the Bat's energy-storage device reveals an elegant simplicity: it uses a small direct-current generator, a pack of 24 nickel-cadmium batteries (the kind used in rechargeable electric toothbrushes and razors), and an Astro-Flight electric model-airplane motor.

Before making the record-breaking flight, Parker sat in the Bat and charged the batteries by pedaling steadily for eight and a half minutes while the pedals were connected to the generator. During the remaining 90 seconds of the storage period, he disconnected the generator and connected the motor wheel and propeller chain to the pedals. The energy device then provided about half the horsepower required to fly the course.



The creator of the Gossamer Albatross has designed a prototype for a recreational airplane.  
34 GMN

CONTINUED ON PAGE 145

# THE INCONSTANT CONSTANT

## STARS

By Marcia Bartusiak

In 1929 Edwin Hubble made one of the most profound discoveries of twentieth-century astronomy. Using the giant 100-inch telescope atop Mount Wilson, in Southern California, Hubble painstakingly determined that we live in an expanding universe where galaxies rush away from one another at tremendous speeds. The motor that drives this expansion, we now realize, originated in the cataclysmic explosion that gave birth to our universe many eons ago.

Hubble soon figured out that there is an orderly progression to this cosmic marathon. The more distant the galaxy he observed, the faster it moves away from us. Appropriately enough, the parameter that describes the rate of expansion is known as the Hubble constant.

It's an ironic label. To the dismay of observers everywhere, this most famous of astronomical constants has turned out to be quite mercurial, going down and up over the last 65 years like a carousel horse. The latest revision in this constant, in fact, has sparked a heated debate within the astronomical community over the age of the universe. The new estimate could force theorists to modify Einstein's equations of general relativity.

In the Thirties the Hubble constant stood at 526 kilometers per second per megaparsec (a megaparsec is an odd yet handy unit that equals 3.26 million light-years). That meant that two galaxies separated by one megaparsec would be speeding away from each other at 526 kilometers per second because of the universe's expansion.

Working that expansion rate backward in time has also given astronomers a rough handle on the age of the universe. The higher the Hubble rate, in a sense, the less time needed to get back to the Big Bang. With a Hubble constant of 526, the universe turned out to be 1.8 billion years old, an embarrassing result since geologists realized that the earth was more than 4 billion years old. A great sigh of relief was eventually heard once improved distance and velocity measurements of faraway galaxies brought the Hubble constant down to a sedate 50.

Kilometers per second per megaparsec. That corresponds to a universe some 20 billion years old—time enough to create all the galaxies, stars, and planets

But recently a number of astronomers such as Gerhard de Vaucouleurs, of the University of Texas at Austin, and Marc Ascension, of the University of Arizona's Steward Observatory, have completed new distance measurements that are inching the Hubble constant back up to 100. Some interpret this to mean that our universe is much younger than once thought—a mere ten billion years old.

Could our universe really be such a youngster? "Not at all," declares De Vaucouleurs. He contends that too many other lines of evidence—the well-determined ages of the globular clusters, for instance—confirm that our universe must be 12 billion to 20 billion years old.

What the new Hubble constant does suggest, he goes on to explain, is that Einstein's equations of general relativity long used to describe our cosmic expansion, may have to be revised slightly. Theorists may be forced to reintro-

duce Einstein's infamous cosmological constant, which the great scientist himself referred to as the biggest scientific mistake of his life.

Out of desperation Einstein tacked this extra term onto his equations in 1917. His original smoldered theory posited that the cosmos was dynamic, either contracting or expanding. But then-current observations of the heavens suggested our universe was static and unchanging, prompting Einstein to formulate this cosmological constant to resolve this impasse. The term said there was a repulsive force at work in the universe—a kind of antigravity—that exactly balanced the gravitational attraction of the galaxies, keeping them from moving. But once Hubble revealed that our universe was expanding, Einstein quickly dropped his cosmological constant.

"Physicists often say that Einstein's equations are more aesthetically pleasing without the constant," notes De Vaucouleurs. "But that's not a good reason to dismiss it. We like things to be simple in science, but nature usually turns out to be more complicated."

Inserting Einstein's controversial constant back into his equations would relieve the present dilemma. This is because the repulsive push inherent in the constant dictates that the universe would have expanded more quickly since the Big Bang, thus making the cosmos a bit older than the simple Hubble calculations now suggest. De Vaucouleurs points out that French physicist Jean-Marc Souriau has already derived a small cosmological constant by analyzing the distribution of quasars. Souriau's figure, coupled with De Vaucouleurs' new Hubble constant, makes our universe a pleasing 18 billion years old.

Many astronomers are still convinced, however, that the Hubble constant is closer to 50, making all these extra manipulations unnecessary. But if De Vaucouleurs' higher value is upheld, our cosmological models will assuredly come under closer scrutiny. One result is certain, the Austin astronomer concludes, "Something's got to give." **100**



Galaxies separating. How fast are they going?

# CHURCH ON A CHIP

## ARTIFICIAL INTELLIGENCE

By Phoebe Hoban

**T**here's an old story," recounts Rabbi Irving Rosenbaum, head of Chicago's Institute for Computers in Jewish Life, "about a scientist who builds a computer that he programs to be omniscient. Then he asks the computer, 'Is there a God?' And the computer replies, 'There is one now.'

Although computer worship has not yet spread beyond a few fanatical IBM and Apple stockholders, an increasing number of religious groups are using computers to teach the Word. Religious software ranges from an electronic version of the Responsa—a library containing more than 2,000 years of Jewish law—to Bible-based video games with names like *The Philistine Play* and *Samson and Delilah* (titled as the adventure games that took three thousand years to create).

By far the closest thing to a bona fide computer church is the One Attunement Group, created by Peter and Trudy Johnson-Lenz, a husband-and-wife programming team. As part of a National Science Foundation study, the Johnson-Lenzes became early participants in the New Jersey Institute of Technology's Electronic Information and Exchange System (EIES; see "Life in the Wired Society," March 1984).

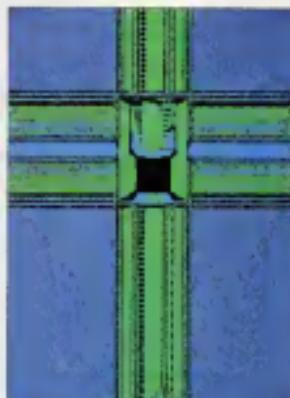
"Traditionally, people gather in the same place at the same time to meditate and worship," explains Peter Johnson-Lenz. But one of the central aspects of a computer network is that it is asynchronous and needs no meetinghouse. Since God is supposed to transcend space and time, why couldn't we take advantage of the abstract nature of the computer medium and share in the spirit electronically—luring in with different people around the globe and around the clock?

The One Attunement Group went online in 1980, just hours before the tragic murder of John Lennon, and became a place where EIES members congregated to share their grief. Currently, this electronic chapel has about 100 international members.

The format of the One Attunement software was inspired in part by the

Scottish utopian community Findhorn, whose members begin each day by clasping hands in a circle to attune with one another and themselves. Programmers also drew on the traditions of Heska Quaker meetings, in which members take turns sharing meditations or inspirations. WELCOME TO THE ONE ATTUNEMENT GROUP, the program begins. WOULD YOU LIKE TO ATTUNE NOW? PRESS Y FOR YES N FOR NO. NOW CLOSE YOUR EYES. PRAY QUIETLY FOR A FEW MOMENTS. AND HERE NOW ATTUNE YOURSELF WITH YOURSELF AND THE UNIVERSE AND DO WITH ALL OF US PRESS RETURN WHEN YOU FEEL ATTUNED. Random selections from 110 spiritual quotations from sources as diverse as Zen Buddhism and Antoine de Saint-Exupéry (author of *The Little Prince*) flicker onto the screen. If you are moved BY THE SPIRIT, the computer instructs, PLEASE SHARE YOUR INSPIRATION NOW. At that point, individual inspirations can be entered or inspirations from other members can be scrolled up. Finally, this message materializes:

THANK YOU FOR SHARING THE SPIRIT WITH US.



Computer circuitry: Attunement tomorrow

ATTUNEMENT. The One Attunement Group is currently available only to members of the EIES computer network, but the Johnson-Lenzes will soon introduce software that will enable it to run on a personal-computer-based network.

"The temple of the Philistines—you're at the top—but you are a praecox—at least Samson is—and you control his incredible power with nothing but a joystick!" reads the flier for Samson and Delilah—one of 100 religious programs from Davka Corporation, a division of the Institute for Computers in Jewish Life. Other games, complete with vivid graphics and spooky music (there's even a synthesized shofar—the ram's horn sounded on high holidays), are Bible Baseball, a quiz game, The Game of the Maccabees ("The Maccabees need you—Antiochus the emperor demands to be worshipped as a god—are you going to stand for it?"), Catch a Hamantaschen (the object is to prevent flying Purim pastries called Hamantaschen from squashing), and Crumb Easter, a Pac-Man-style Passover game. And if you want your computer to speak Hebrew, Davka has a computer chip called Hebrew Hardware that plugs into the Apple II and generates Hebrew letters. There's also a program that runs through the steps of the Passover Seder ritual, and even a kosher cookbook, Jewish Comp-u-chef. This may sound like somewhat frivolous fare. But Rosenbaum relates it to an ancient Jewish custom: "When a youngster first went to school, his teacher would smear the pages of his books with honey to make it sweet. These days the sweetener is a computer."

The more mystical side of digital Judaism is the huge Responsa database developed in conjunction with Israel's Bar-Ilan University. This electronic library contains 30,000 documents of Jewish custom and law, dating back several thousand years. Talmudic scholars can consult the database to shed the light of the ages on modern dilemmas. Ponder this question: With all this high-tech religion, can a robot be a member of a community? PAGE 146

# FLORIDA'S STONEHENGE EXPLORATIONS

By Scott Morris

**E**d Leedskalnin was a romantic. Born in Latvia in 1887, he fell in love, as a young man, with sixteen-year-old Agnes Sculfs. She had agreed to marry him, but on the eve of their wedding day she jilted him for another man. Heartbroken, Leedskalnin left Latvia and fled first to Canada, then to Texas, and finally to Homestead, Florida.

Leedskalnin always referred to his lost love as "my sweet sixteen," and in the late 1920s he began building a monument to her out of huge blocks of the "coral" bedrock found in the area. (Technically the rock is not coral but a soft oolithic limestone.) For 20 years he continued to work on a coral castle he hoped to share with his sweet sixteen, who he believed would someday join him in the United States. In 1961 Leedskalnin died in a Miami hospital, a victim of malnutrition (some say it was starvation). He was sixty-four years old.

Today Coral Castle's promoters point out that Agnes Sculfs, now in her mid-eighties and still living in Latvia, has never seen the monument built in her

honor. Thousands of other people have seen the castle, and many can't quite believe that Leedskalnin could have built it alone. The television show *That's Incredible!* announced that even the "world's greatest experts" cannot explain how 110-pound Leedskalnin managed to build his large open-air castle of enormous coral blocks—weighing up to thirty tons—doing all the work by hand. UFO buffs believe the rock monument in southern Florida stands as evidence that superintelligent aliens have lent their knowledge and skills to selected humans throughout history.

B. J. Cathie, a captain with National Airways, of New Zealand, theorizes that Coral Castle is part of a vast worldwide power grid that has been set up "between some groups on this planet and the UFOs." The interlocking lines of this grid, Cathie says, correspond to the lines of flight of verified UFO appearances. It is Cathie's opinion that Leedskalnin chose to build the castle directly on the power grid and was thus able to use antigravity to move the enormous rocks

Others have proposed that Leedskalnin must have gained his secret knowledge in an earlier life—probably as a builder of the pyramids in Egypt. In fact, Coral Castle has been compared with the Pyramids, Stonehenge, and the Easter Island statues—and rightly so. But those monuments were built by whole societies, perhaps by successive generations. Coral Castle was the work of one man, an ingenious self-taught physicist and engineer who had a remarkable ability to get things done.

Part of the mystique of Leedskalnin's creation is that few people saw him at work. He raised eight-foot-high walls of coral rock around his garden so that outsiders couldn't watch. Inside, he built beds, tables, contour chairs, and rocking chairs—all out of rock. He carved monuments to Mars and Saturn. He sculpted a huge table in the shape of Florida (complete with a water bowl at the position of Lake Okeechobee) at which, he said, government leaders could meet to discuss new ways to raise taxes. For Agnes, he built a heart-shaped dinner table with a living centerpiece of a variety of Florida wildflowers; and another rock table with a palm tree growing in its center. For their future children, he built a complete Goldilocks and the Three Bears set, right down to the tables, chairs, and porridge bowls.

Leedskalnin was also fascinated with astronomy, and he built two remarkable tools with which to pursue his hobby. One is a sundial on which it is possible to read the time to within five minutes, on any day of the year. His other creation is a Polaris telescope, a one-inch-diameter eye-level hole drilled through a rock. Nearby there is a 26-foot-high rock column with a second, larger hole at its top. Look through the first eyehole on any clear night and you'll be able to see the North Star shining through the aligned hole in the rock column.

Leedskalnin's crowning glory, however, and the feature that attracts the tourists and the film crews, is a giant "gate" said to weigh about nine tons, that is so delicately balanced a child can swing it



Some people believe aliens helped Ed Leedskalnin construct this monument made from limestone  
© DMW

CONTINUED ON PAGE 102



# CONTINUUM

## SHOCK'S VALUE

didn't go into psychiatry to shock people," the young doctor says earnestly. "I went into it to help people. And this just happens to be one of the ways to help."

The "this" he refers to is the cramped room on the hospital's ninth floor, where nurses are preparing a severely depressed young woman and a middle-aged schizophrenic man for electroconvulsive therapy (ECT), also known as shock treatment.

The woman, Anita, goes first. Wide-eyed but looking calm, she lies on a stretcher bed. Her attitude? The doctor explains: "Is one of: I don't like my illness. I want to get well." Although ECT is used to scramble the memory, Anita correctly gives today's date. She knows where she is, and she knows why.

When anesthetists failed to pull Anita out of what her doctor calls a "major depression of psychotic proportions," they suggested a course of ECT. This morning she will have her eighth treatment in as many weeks. It begins when the anesthetist injects her with drugs that put her to sleep and paralyze her body for two to ten minutes. The two ECT electrodes are secured on the right side of her head.

"Ready to treat," the doctor says. And then, "Treating."

Everything is still for the 1.5 seconds that the electricity courses through Anita's brain—everything except her right foot. On her ankle a tightly wrapped cuff has blocked the flow of blood carrying the anesthetic. Still sensitive, the foot goes purple yellow as the arch vaults high and the toes double over, trembling for nearly a minute. By the convulsions of her right foot, the doctors monitor the seizure in her peripheral nervous system. An electroencephalograph shows the seizure in Anita's central nervous system—the seizure that counts—it's lasting half a minute longer.

Anita's case is a success story. She began responding to treatment immediately and has been making steady headway out of her depression. The other patient in the ECT room is an altogether different story. In and out of mental hospitals most of his life, anxiously withdrawn, he shows no improvement. The doctors have decided that today's treatment will be his last.

ECT is still an utterly mysterious form of psychotherapy. Exactly 50 years have passed since Hungarian neuropsychiatrist Ladislas Meduna cured a catatonic man by giving him repeated seizures with injections of camphor. Soon after, in 1938, the Italian scientists Lucio Bin and Ugo Cerletti treated psychoses

by using electricity to induce seizures. But no one yet knows why or how convulsions shock patients into well-being.

Some professionals argue that the treatment carries such formidable risks that its use is never warranted. The handful of psychiatrists who vociferously campaign against ECT claim that it causes everything from bleeding in the brain to structural brain changes and learning disabilities that plague the patient for life. Better to suffer through depression and come out stronger for the experience, they say.

Former mental patients themselves have led the revolt against ECT, denouncing it as a disabling invasion that leaves its victims feeling helpless and compliant. In an effort to protect fellow patients from coercion, the Madness Network News has been publishing a "Shock Doctor Roster" since 1974, publicizing the names of psychiatrists who promote the treatment.

But ECT after losing ground to bad press and the promise of psychotropic drugs introduced in the Fifties is making a comeback. In February of this year a professional symposium on ECT drew 300 to New York City's 1,500 psychiatrists out of their homes on a cold winter's night—testimony to the medical interest in the technique.

The bulk of today's scientific arguments over ECT concern dosage levels of electricity and whether the two electrodes should be positioned on opposite sides of the head or on the same side—a placement that is said to minimize memory loss. ECT is praised not only for its safety and efficacy but for its speed. It can take two weeks or more to see results from a drug regimen, particularly with suicidally depressed patients. ECT, when it works, is quick and dramatic, proponents say.

It may be hard for the average person to separate the image of the therapeutic electric-shock device from the torture of the electric chair. Connecting a malfunction of the brain with a jolt of electricity may sound too much like kicking a television set to adjust its fine-tuning. Indeed, 18 months ago residents like these led voters in Berkeley, California, to ban ECT from their city. Other localities have not followed suit, and the intractable nature of mental illness ensures a place for ECT—at least in the near future. It seems that a desperate family, watching the degradation of a loved one, would rather kick him in the head than give him up for lost.—DANA SOBEL



# CONTINUUM



The Thrilla in Manila: Muhammad Ali described the bout as the closest fight come to death, but for many others it was sheer murder.

## BOXING AND MURDER

Battered by a rejuvenated Muhammad Ali, Smokin' Joe Frazier throws in the towel after the fourteenth round of The Thrilla in Manila on October 1, 1975. Three days later, the homicide rate in the United States rises by an astounding 32.2 percent.

An earlier fight between Ali and Joe Bugner was followed by a 27.8 percent increase in murders while the Ali-George Foreman fight in October 1974 was overshadowed by a 24.4 percent increase. All in all, according to an intriguing new study by University of California at San Diego sociologist David P. Phillips, the national homicide rate tends to rise by an average of 12.48 percent after heavyweight championship fights.

To make sure that the title bouts were not simply coinciding with homicides that would have occurred

anyway, Phillips monitored the National Center for Health Statistics figures on murder for a period of three weeks following each fight. Almost invariably he found, an increase in killings occurred on the third and fourth day after the reporting of each fight, then the homicide rate returned to the normal level. Moreover, Phillips discovered the rise in homicides seems to take place regardless of the day of the week or the year the fight takes place. His study, although preliminary and as yet unreplicated, offers what he calls "the first systematic evidence that some homicides are indeed triggered by a type of mass-media violence." —Bill Lawren

"The trouble with government of the people, by the people, and for the people is that we get killed for it if we criticize."

—Orson Arnold

## CUSTOMIZE YOUR HEART

A baby has the same number of heart cells as an adult. The heart enlarges as we mature because the individual cells grow—a process triggered by an unknown chemical. A remarkable breakthrough made by a researcher at the University of California at San Francisco, however, may have revealed the identity of the mystery chemical.

Working with rat cells grown in culture, Dr. Paul Simpson, an assistant professor of medicine, found that the hormone neuropeptide binds to special attachment sites or receptors on the heart tissue, stimulating growth. Because other types of chemicals can block this action, his findings suggest that drugs could be designed to enlarge or shrink this vital organ at will.

Simpson believes the ability to customize heart size will lead to new treatments for cardiac patients.



Want a prettier heart? With norepinephrine, no problem.

"When part of the organ is destroyed by heart attack," says Simpson, "it may be possible to induce the remaining heart tissue to increase in size to take over the function of the lost cells. Alternatively when you have excessive heart growth as seen in patients with high blood pressure drugs may be brought in that could shrink the heart back to size."

Another spinoff of his discovery could lead to improved cancer treatments. Simpson notes that most malignant cells double in size before dividing, so drugs that limit cell growth could conceivably impede the proliferation of tumors. —Rick Boiling

"Strange events permit themselves the luxury of occurring."

—Charles Chan

"I make a sharp distinction between intelligence and technology. It's easy to imagine a highly intelligent society with no particular interest in technology."

—Freeman Dyson

## MUSICAL GRAMMAR

Ever wonder why you tap your feet in time to a particularly rattling piece of music? Why you can hear a melody through the mass of seemingly unorganized notes in a piece of jazz improvisation?

Well, if linguistics professor Ray Jackendoff of Brandeis University, and composer Fred Lerdahl of Columbia University, are



The genetic scale: Our ears seek the musical skeleton

right, those abilities are derived from our brains' natural disposition to impose a sort of innate grammar on music.

Using an approach similar to that of MIT linguist Noam Chomsky, who postulated a genetically determined set of rules by which all languages are organized, Jackendoff (a former Chomsky student) and Lerdahl have come up with a set of basic structures that form the grammar of mankind's other language: music. These building blocks include "grouping" structure, the tendency to organize sounds into sections and phrases; pitch structure, which helps us to distinguish the significant parts of a melody and harmony from the purely ornamental parts; and metrical structure, which sets our feet to tapping.

These basic structures, Jackendoff and Lerdahl say, are part of our genetic

heritage. When we learn to appreciate a particular musical style according to Jackendoff, we unconsciously apply those pieces of our innate grammar that most directly fit the music we're hearing. Among other things, their theory explains why all music is organized in scales—whether it is a culture's 12-tone scale or the more complex multi-note scale of the Balinese. The theory also explains what happens when we listen to the improvisational flights of jazz musicians. The improvisational passages and the original tune share what Jackendoff calls a musical skeleton, and the listener is able to hear the melody implied in the improvisation because of his predisposed tendency to hunt for that skeleton.

The existence of musical grammar also explains why some forms of atonal music are more difficult to comprehend than traditional styles. Jackendoff and Lerdahl believe that our innate musical structures are organized largely along tonal lines.

"If a composer consciously goes about organizing his music along atonal lines," Jackendoff says, "the chances are smaller that he's going to ring those preestablished bells in the head of the listener." —Bill Lawton

"Any government that is big enough to give you everything you want is big enough to take everything you've got."

—Anonymous

## BEES 1, SCIENTISTS 0

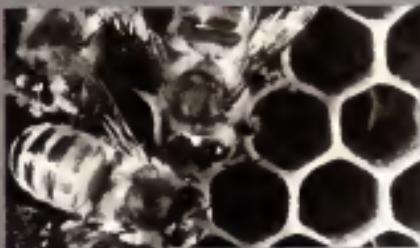
Bees have long been considered complex and intelligent. But when they outsmart human experimenters, it's time to accept knowledge that bees may be smarter than most scientists like to admit.

Princeton University ethologist James Gould reached this conclusion after studying bee societies for the past few years. In one experiment, he moved a beehive's food supply 50 meters away to learn whether the bees would be able to find it. After one

is clear that the bees anticipated the shift," says Gould. "They behaved more intelligently than we expected."

Does this behavior signify rational, logical thinking? Rationality pertains to reasoning, and it is doubtful that bees can reason or understand the consequences of actions," notes Gould. "Their natural habitat is predictable, so there's no great need to reason."

So how did the bees do it? Our lack of an explanation for this is simply due to the poverty of human imagination," Gould insists. —Giovanni Dodeles



Beehive society: Bees on the see displayed a collective intelligence at least one step ahead of a Princeton ethologist.

minute they located the feeder. Gould moved the food an additional 50 meters on two more occasions and on each subsequent run the bees tracked down the feeder in under one minute.

After five minutes before he had gotten a chance to carry out yet another food shift, an unsuspecting Gould glanced up to see the bees flying past him and on to the next station. It

"Let us say that there are two sorts of political minds—one kind apt at inventing heresies and the other disposed to believe them."

—Galileo Galilei

"I suppose the one quality in an astronaut more powerful than any other is curiosity. They have to get somewhere nobody's ever been before."

—John Glenn

# CONTINUUM

## BIG-BANG LEFTOVERS

If most cosmologists believe the universe was born approximately 18 billion to 20 billion years ago in the Big Bang, then there might still be some survivors left around. And indeed, astronomers may have found some at the fringes of the observable universe.

Teams from the California Institute of Technology and Cambridge University, England, have just spotted primordial gas clouds that existed billions of years ago. Because their light has taken that long to reach us, their presence on our telescopes is a window backward in time—perhaps to the first few seconds.

Caltech astronomer Wallace Sargent explains that the dark, gaseous clouds can be seen because they absorb certain wavelengths of light emitted

by more distant quasars—extremely bright bodies that lie at the edge of the universe. An analysis of the light that the clouds transmit to Earth reveals their constituents, since each atomic element yields a unique spectral-absorption pattern.

So far, says Sargent, only hydrogen has been detected in these ancient clouds, as would be expected in a primordial gas. The gas might also contain helium, which can't be observed from Earth. What the astronomers have not found is a single trace of such heavier elements as oxygen and carbon, which are made only in the stars.

The evidence, according to Sargent, suggests that these Big-Bang leftovers disappeared eons ago. In the regions of the cosmos nearer to Earth—where we view a time closer to the present—astronomers see fewer clouds. They appear

to have dissipated as the universe aged and expanded.—Jeff Hecht

When society requires to rebuilt, there is no use in attempting to build it on the old plan.

—John Stuart Mill

## COMPUTER SNITCH

The cruellest and most inhuman of beings, according to some teenagers, is the school truant officer. Now kids who cut classes at Newark Memorial High School, in suburban San Jose, California, are faced with the most cold-blooded truant officer of all: an electronic computer by the name of TelSol.

The system, developed by Digital Products of Florida and now in use in several San Francisco-area high schools, not only identifies absences but also acts as an electronic teletype by calling th

their parents.

The rationale for TelSol is simple. According to Newark vice principal Carol Hart, "It's tough to get in touch with parents who work during the day. And when the parents are home at night, it's not easy for us to get an employee to work those late hours."

So between 5 and 9 P.M., TelSol takes over. Parents are greeted by a recorded female voice that tells them it is calling to enhance communication between school and parents. Your child has been absent for one or more periods today. Please let us know

the reason for the absence. Parents are then invited to record the excuse on the computer's tape, which is read out by the school's attendance officers the following morning.

Since public schools are financed in great measure according to the number of students in daily attendance—with excused absences counting toward the total)—Tel-



CAROL HART, VICE PRINCIPAL OF NEWARK MEMORIAL HIGH SCHOOL, CALLS TRUANTS HOME.

Sol will call parents again if the child has been absent for three days. Hart says, "I have White Newark, which hasn't yet to transition... improvement into a better public school land, which installed last year, are said to paid the entire cost of the \$5,000 system with just four months of increased daily attendance money."

Although Hart admits that many parents were upset when TelSol first went into operation— "It's kind of a shocker," she says—"to be called by a machine"—she now indicates that 95



Quasar at the edge of the universe. An analysis of gaseous clouds reveals only lighter elements remain from the Big Bang.

OMNI

percent of the parents are "very pleased" with the increased communication. And what about the kids? "Their reaction was interesting," Hart says. "They felt proud that the school was on top of them. I think they expect it of us."

—Bill Lawson

"Is the surface of a planet really the right place for an expanding technological civilization?"

—Gerard K. O'Neill

"Natural selection is not always good, and depends on many caprices of very foolish animals."

—George Eliot

## FLUORIDE LAPSES

Is your water fluoridated? Your dental checkups may be good, but how are your perceptual motor skills?

In a recent experiment at Florida International University in North Miami, 21 female volunteers were given fluoride droplets that were 500 times more concentrated than the fluoridation level of municipal reservoirs. Then they were asked to play a simple video game. At the same time, they had to push a button whenever a light in their peripheral visual field flashed. The result: Subjects' reaction times to the flashing light were 0.3 seconds slower after they'd taken the fluoride.

What does it mean? "I've seen a bigger effect when people are under stress," huffs environmental psychologist James Rotkin, who con-

tacted half of the experimental team. But his co-worker allergist Robert Feldman takes a darker view: Fluoride is capable of producing an unknown number of reactions, he says, "some so insidious, so subtle, that many people may not recognize them."

—Eric Minkin

## SUPERMIRROR

Want to see yourself as others see you?

Now you can, with a high-tech mirror called Really Me. According to its inventor, David Eckel of Wilton, Connecticut, the product not only corrects the left/right reversal of the standard looking glass but it also simulates fuller three-dimensional depth perception.

The sophisticated optics of Really Me work something like your brain's. "The brain's capacity to see a composite image from each eye and meld the two into one object is built into the mind," Eckel explains. The device, which retails for \$20, actually consists of two mirrors at right angles, each of which sees a reflection of the other. Owing to this feature, the inventor claims, Really Me is to a conventional mirror what stereo sound is to mono.

The mirror already has a number of practical applications. Speech therapists have used it to teach patients exercises to correct stuttering, and dentists have demonstrated proper flossing and brushing in its true-to-life reflections.

—Connie Zweig

## NEUTRINO BEAMS

You've heard the tales of the elusive, massless neutrino capable of slipping gnatlike through countless trillion miles of solid lead. Now it appears that the slippery subparticle isn't all that elusive, after all. Theoretical physicists have discovered that as it gains energy, a neutrino's interaction with matter increases,

mobile detector 1,000 miles away. A prototype geotron, he says, could be added on to the 100-mile-circumference accelerator dubbed the Geotron, that is now being considered for the southwestern United States.

What the physicists really have in mind, however, is still more grandiose. Their dream is an ocean-based geotron that can shoot



Particle accelerator: A new superpowerful atom smasher could produce a beam of neutrinos strong enough to search for minerals

and at an energy level of around 10 trillion electron volts (10 TeV), it stands a good chance of colliding with an atom in the earth.

As a result, a group of American and European physicists wants to use beams of superhigh-energy neutrinos to search for minerals deep underground. The neutrinos would be generated by a geotron part of a giant particle accelerator with an energy of 10 to 20 TeV.

According to one of the physicists, Harvard's Sheldon Glashow, the neutrino beam would pass through an arc of the earth toward a

a neutrino beam through the entire earth, mapping its interior densities. Mapped beneath the waves, this accelerator could be located to any place in the world and would require a neutrino energy of just 2 TeV. Though the scheme is as yet unproved, Glashow thinks an underwater geotron is "quite possible" before the end of the century.

"It would cost about a hundred times less than a twenty-trillion-electron volt machine," he says. "The main difficulty would be in learning how to build and operate an accelerator at sea." —David Dreier



# CONTINUUM

## SOCIALIST POWER

It is one thing to thumb your nose at OPEC and buy an old-fashioned wood stove for your house. But it took Burlington, Vermont—one of the first U.S. cities to elect a socialist mayor—to power a whole electric plant with wood.

The past January, the world's first large-scale (30-megawatt) wood-powered electrical generating plant went into operation in this city of 38,000. According to Burlington Electric Department spokesman Timothy Cronin, the plant can burn roots, trunk branches, and leaves of any type of wood—a commodity that is abundant in Vermont. So, apparently, is self-reliance: 70 percent of Burlington's voters endorsed the project.

Producing a kilowatt of electricity from Vermont wood—which costs \$18 per ton—is no more expensive than burning coal to light the city. And because wood's sulfur content is lower, there's no acid-rain problem.



Wood stove: A real big one powers an entire city.

The new plant's high-burning temperature also eliminates creosote—the sticky black condensation that louts wood-smoke chimneys. The plant's only cleanup expense is the estimated \$6 million it costs to get rid of the remaining particulate emissions.

If the many curious visitors from power companies and energy agencies in Sweden, the Philippines, South Korea, and Japan are any indication, the \$80-million project could be the wave of the future. "People will be looking at Burlington to see how it goes," says Cronin.—Ben Barber

## URBAN FALCONS

Los Angeles executives lunching on the twenty-seventh floor of the Westwood Center Building have been treated to a rare sight of late: three young peregrine falcons sunning themselves on rooftop roosts.

Started pedestrians have even seen one of the falcons flying a mere 20 feet above busy Westwood Boulevard, chasing a flock of distraught pigeons.

These aerial diversions are the result of a program at the Western Foundation of Vertebrate Zoology and the Predatory Bird Research Group at the University of California at Santa Cruz. Beginning in 1981, the foundation has released three peregrines a year into the wilds of Los Angeles, hoping that the urban environment would protect the endangered species



Meet the friendly new inhabitants of Los Angeles:

from DDT, which thins eggshells and makes it difficult for chicks to survive incubation.

So far the program is succeeding beyond even the expectations of its organizers. Of the nine birds released so far, all but one have survived. In addition to the three Westwood residents, two more falcons are roosting atop the 28-story Plaza Building in the Miracle Mile district, roughly five miles away and two more are on the roof of the 37-story Union Bank Building downtown. The eighth bird has been sighted in the coastal wetlands near Marina Del Rey.

A building is just a cliff to a peregrine," says foundation director Lloyd Kiff, explaining the birds' rapid and delicious adjustment to city life. "People in Los Angeles are a lot more likely to shoot one another than they are to shoot one of our birds. And the falcons seem to have accommodated themselves to such urban hazards as helicopters and traffic. The birds

are already grouping themselves in tighter territorial patterns than found in the wild, indicating that city life may be even more to the peregrines liking than their natural habitat.

All this is fine with Kiff, who admits that his scientific altruism is tempered by selfish motives: "The decision to release the birds was almost a whim," he says.

"We wanted to be able to sit sipping drinks in the bar on top of our building [the Westwood Center Building] and watch peregrines flying around."

—Bill Lawren

"Sincere diplomacy is no more possible than dry water or wooden iron."

—Joseph Stalin

"I'd give my right arm to be ambidextrous."

—Graffito

"Courage is the first of human qualities because it is the quality which guarantees all the others."

—Winston Churchill

## SPIES ON THE COUCH

No one ever said that working for the Central Intelligence Agency would be easy. But there's job-related stress, and then there's job-related stress.

Imagine a man who has assumed so many identities that he has completely lost touch with his real self. Or another who is so immersed in intrigue that he trusts nobody—not even members of his own family.



Secret agents have many professional attitudes—secrecy, mistrust, paranoia—that do not make for a rich personal life.

Or a third who is so paranoid the lies in constant fear of imaginary enemies and conspiracies.

For years, agents who crossed into that psychological danger zone accepted their problems as part of the job. Recently, however, the CIA has begun to take care of its troubled employees.

The CIA effort is directed by psychologist Bernard Neiley who declines to comment on his department's ongoing work. CIA public-affairs spokesman Dale Peterson explains why: "It gets too close to talking about agency activity. It gets into areas like the kind of people we hire as agents and the kinds of problems they experience. This would, of course, be of interest to foreign powers, so all our work in that area remains classified."

Still, one need not stretch one's imagination to see why the skills developed in the field—secrecy, mistrust, paranoia—do not lend themselves to a balanced family life or good solid

relationships. "Those things may be healthy on the job—an agent's life may in fact depend on them—but they don't work at home," explains psychiatrist Steven R. Pezzcnik, who sees a number of CIA employees in his practice. "Once you stay in the system, it does certain things to you. There are the many problems of anxiety, of fragmentation, of a necessary distancing from people and family and of an increased obligatory paranoia, which is necessary for survival."

"It's a very Kafkaesque type of life. You have to keep so much under wraps that your closest friends—and sometimes even your own children—don't know what you do for a living."

Asked if his agency's patterns shared any common traits, Dr. Pezzcnik replies: "I think the agency attracts people who are more inner-directed, self-confident, controlled, and controlling. Those are the types I see more and more often." —Pablo F. Fenyes

## LIGHTNING RADIO STATIONS

Smokey the Bear exhorted us to smother campfires and stamp out cigarettes. The most common cause of forest fires, however, is not man but nature. Seventy-five percent of all wildfires are triggered by lightning. That's why fire-fighting personnel are so excited by ALDS, the Automatic Lightning Detection System. With this technology it is possible to tip many lightning-induced wildfires in the bud, controlling them before they have the chance to ravage thousands of acres of wilderness.

ALDS was invented by Dr. Philip Kider, a professor of atmospheric science at the University of Arizona. The system involves placing radio-finding stations in strategic locations (200 stations have already been installed in the western United States and in Canada, Australia, and the People's Republic of China), and then using those stations to detect radio waves that are given off by bolts of lightning.

Each station has a range of 200 miles and an accuracy factor of 1°, meaning that it can find the location of any given lightning strike within a radius of four miles.

Once the strike is pinpointed, which takes a few thousandths of a second, a fire-fighting agency can coordinate the location with data from the National Weather Service. This gives a profile of such important predictors of fire danger as

tree type, terrain, and ambient moisture.

When the data indicate the statistical probability for fire is high, Kider explains, "the fire fighters send their people right in whether there's an observed fire or not."

So far the system has been extremely successful in Canada. There, provincial fire-fighting agencies expect to pay for ALDS equipment in as little as one year because catching a



Smokey was wrong; only ALDS can prevent some forest fires.

fire when it's still small saves enormous sums of money. In the United States, the Bureau of Land Management already has ALDS stations in 32 western locations and plans to have the entire system operational by the summer of 1985.

—Bill Lowen

It is the business of the future to be dangerous. The major advances in civilization are processes that all but wreck the societies in which they occur.

—Alfred North Whitehead



# CONTINUUM



Frigid winter temperatures need no longer be a memory of warm summer fun, thanks to a \$400, 50-pound plastic bubble from Wales.

## SUN BUBBLE

For show-offs who like to flaunt their copper-tone tans in the dead of winter, now there's an alternative to ultraviolet parlors or expensive trips to the tropics. It's called the Sunpod.

A \$400 novelty item, the Sunpod is a casket-size plastic bubble made of a new acrylic known as Perspex. The material lets in 90 percent of the ultraviolet rays from the sun, permitting bathers to sit outdoors for an all-over tan even in below-freezing temperatures. Like a solar panel, the capsule converts sunshine into heat to create a greenhouse effect.

The 50-pound bubble is lined over a sponge-rubber mattress and has adjustable air vents that let hot air escape through the top of the dome. Tests in England showed that when the temperature was 37°F outside,

doors, for example, it was aasty 87°F inside the pod.

The chilly Welsh clime was the inspiration for the Sunpod, according to inventor Derek Tolley, director of CCP (Leisure) Ltd. in Dyfed, Wales, and manufacturer of the product. "I figured it would be nice for people to suntan when it's very cold outside."

The Sunpod is being marketed mainly as a product for the home, but Tolley soon hopes to interest resorts in buying a few. As for the future of his invention, he is currently designing a new, more private model with a higher base on the side. "The pod we have now is all revealing," he points out.

"Although most people are secret exhibitionists," says Tolley, "only about five percent are actually willing to expose themselves publicly."

—Robert Brody

## ESCAPED HAMSTERS

Three hamsters recently escaped from a broken cage at Yale University's supersecure infectious disease laboratory in New Haven, Connecticut. All three of the rodents had been injected with fatal Creutzfeldt-Jakob (CJ) virus, which attacks the nervous system, causing seizures and insanity. In the United States, 200 people die from CJ virus annually, and no known cure exists.

Exactly how CJ virus is transmitted is a mystery, but researchers believe someone would actually have to come in contact with brain tissue of the escaped hamsters to be in danger. Just the same, Yale officials have not installed the escape tightly. Not enough is known about CJ virus, so you've got to be very careful."

with it," explains Dr. Joseph Bove, chairman of Yale's Biological Safety Advisory Committee.

Yale employees conducted nighttime laboratory searches for the nocturnal hamsters and they set peanut-butter-baited traps. But the three escapees had seemingly disappeared into thin air. "We tried everything we could think of," Bove says, "and nothing worked."

So where are the escaped hamsters now? Bove suggests that they may have burrowed into a trash bin at the infectious-disease laboratory before being stemm-stenched and incinerated with the rest of the refuse. —Eric Mishra

A word or a stone once launched cannot be recalled.

—Spanish proverb



Monster rodents? In New Haven? Were the hamsters released or do they still haunt Yale, waiting to spread their killer virus?



# COMET ODYSSEY

*Swapping Earth for  
a chance to  
homestead the universe,  
future pioneers  
will use comets as  
spaceships*

BY EDWARD REGIS, JR. PAINTING BY LUDEK PESEK

**I**t won't be easy flying to the stars. If the sun were the size of a pea, the earth would be a grain of sand three feet away; the outer planets miles of dust a few yards more. But the stars are something else again. They'd be out of the picture entirely, with the nearest being some 140 miles distant.

Even fast-ship travel won't solve the problem, since moving at anywhere near the speed of light requires stupendously large amounts of energy. Cornell University astronomer Frank Drake has calculated that the energy necessary to propel a colony of 100 people, at one-tenth light speed, to one of

•Comet riders will be  
small tribes of dissidents with visions of founding  
utopias in space. ♦

the nearest star could support a major industrialized nation for hundreds of years. The workings of biology, the physical laws of energy and the vast distances combine to make interstellar colonization economically unthinkable for all time," says Drake. Harvard physicist Edward Purcell agrees. "All this stuff about traveling around the universe in space nuts... belongs back where it came from, on the cereal box."

But what if there were natural spacecraft—ships ready-made with velocity and direction, and well stocked with supplies, including water and raw materials—that could serve as energy sources? If there were spacecraft such as these we'd simply have to work out a plan for boarding and unfloating them, and we'd be on our way. Surprisingly, such interstellar vehicles already exist. They're called comets.

A comet, after all, is a small world on its way somewhere else. Since it has its own velocity, it doesn't need to be accelerated. And since it's a storehouse of raw materials in deep freeze, it's a potential craft for our journey to the stars. In a forthcoming book, *Interstellar Migration and the Human Experience*, Los Alamos National Laboratory physicist Eric Jones and University of Hawaii anthropologist Ben Finney detail a plan for cometary travel, a lift to the stars, which they think could take place some time within the next 1,000 years. "Just as now there are people willing to leave this terrestrial cradle to pioneer space stations in Earth orbit," they write, "in the future there will be those dissatisfied with life in the inner solar system and attracted to the prospect of wandering among the comets."

A comet is a nucleus of equal parts ice and rocky solids—a flying iceberg ranging in diameter from 0.5 to 30 miles. All known comets are hostage to the gravitational field of the sun around which they orbit in periods from 3 to 200 years. Nevertheless, astronomers think that large groups of interstellar comets not bound by Sol's gravity do exist.

"We observe comets shooting out of the solar system on hyperbolic orbits, which means they may never return," explains Michael A'Hearn, a University of Maryland comet watcher. Any reasonable model of the origin of comets tells us there ought to



Previous page: Unlike solar comets (above) which orbit particular stars, interstellar comets are believed to roam the universe, passing through deep space like space probes. Using the comet as an energy source will let human beings migrate to planets far beyond the solar system.

be comets around other stars. If the other stars are ejecting them in the same manner—which seems likely—then there ought to be lots and lots of interstellar comets'.

Once we've found one, according to Jones, we can colonize it by using its ices for water and energy and its metal ones for building artificial habitats. At first the colonizers would make their homes on the comet's surface, where, with the help of a fleet of smart robots and computers, they'd set up mining and manufacturing operations. "I don't imagine large numbers of flesh-and-blood people wrestling with nail guns," Jones says. "Rather, you'll have very capable, intelligent computers and robots working at refining ores and building habitats—all with a minimal amount of human supervision."

Once these habitats are made, however, they'd be positioned off the comet's surface, in nearby space. The colonizers would then take up permanent residence in these self-contained living complexes. Moving from a planetlike surface to the coldness of space may seem to us like the wrong way to go, having evolved and lived—so far—as terra firma. But Jones says that this planetary hang-up will be forgotten in the age of the space station, the lunar colony, and the free-floating space home. In the case of comets, there are at least two good reasons for not waiting to live on their surfaces.

The first reason is size. Even the largest comets aren't gigantic, and many will be too cozy for comfort. A comet six miles in diameter would have a surface area of 113 square miles, about the size of Denver. But an area far larger than this—the size of several cities combined—could be created by mining cometary metals and fashioning them into the beams, girders, and panels of an artificial habitat. Just as a shoe-box-size Erector set can be assembled into a structure that fills a room, a comet provides a small living space that can be taken apart and put back together again in a different form.

The second reason for not living on a comet's surface is the danger of heat escape. "People need temperatures of about three hundred degrees Kelvin—something above the freezing point of water—in order to live," Jones explains, "and some of this heat is going to escape and boil off the ices that you want to save for future generations."

Comet authority Fred Whipple of the Smithsonian Astrophysical Observatory, at Harvard, suggests another danger of heat escape on comets: "As soon as you start making some heat

CONTINUED ON PAGE 42



FICTION

## SUNKEN GARDENS

Ambitious plans  
to terraform Mars spark  
a fierce rivalry

BY BRUCE STERLING

### M

Minsol's crawler loped across the baldlands of the Mare Hellas basin, under a tormented Mars sky. At the limits of the troposphere, jet streams howled, dirty sinews across pale lac. Minsol watched the winds through the frosted glass of the control bay. Her altered brain suggested one pattern after another, nests of snakes, nests of dark eels, maps of black arteries.

Since morning the crawler had been descending steadily into the Hellas Basin, and the

PAINTING BY  
HENRI ROUSSEAU

air pressure was rising. Masa lay like a feverish patient under the thick blanket of air, sweating buried ice.

On the horizon thunderheads rose with explosive speed below the constant scrawl of the jet streams.

The beam was strange to Mirasol. Her faction, the Pattermists, had been assigned to a redemption camp in northern Syris Major. There, two-hundred-mile-an-hour surface winds were common, and their pressurized camp had been buried three times by advancing dunes.

It had taken her eight days of constant travel to reach the equator.

From high overhead, the Regal faction had helped her navigate. Their orbiting city-state, Terraforming-Kluster, was a nexus of monitor satellites. The Regals showed by their helpfulness that they had her under close surveillance.

The crawler lurch ed as its six picklike feet scrabbled down the slopes of a defilement at Mirasol suddenly saw her own face reflected in the glass palls and burst; her dark eyes dreamily self-absorbed. It was a bone face with the anonymous beauty of the genetically Reshaped. She rubbed her eyes with nail-bitten fingers.

To the west, far overhead, a gout of airborne topsoil surged aside and revealed the Ladder, the mighty anchor cable of the Terraforming-Kluster.

Above the winds the cable faded from sight, vanishing below the metallic glitter

of the Kluster, swinging idly in orbit.

Mirasol stared at the orbiting city with an uneasy mix of envy, fear, and reverence. She had never been so close to the Kluster before or to the all-important Ladder that linked it to the Marhan surface. Like most of her faction's younger generation, she had never been into space. The Regals had carefully kept her faction quarantined in the Syris redemption camp.

Life had not come easily to Mars. For one hundred years the Regals of Terraforming-Kluster had bombarded the Marhan surface with giant chunks of ice. This act of planetary engineering was the most ambitious, arrogant, and successful of all the works of man in space.

The shattering impacts had torn huge craters in the Marhan crust, blasting tons of dust and steam into Mars's thin eardrums' sheet of air. As the temperature rose, buried oceans of Marhan permafrost roared forth leaving networks of twisted badlands and vast expanses of damp mud, smooth and stony as a television. On these great playas and on the frost-cracked walls of channels, cliffs, and calderas, transplanted lichen had clung and leapt into devouring life. In the plains of Eridana, in the twisted megacyanosea of the Coprates Basin, in the damp and icy regions of the dwindling poles, vast growing thickets of its smolder growth lay upon the land—nuclear disaster areas for the innocents.

As the terraforming project had grown

so had the power of Terraforming-Kluster.

As a neutral point in humanity's factions war, T-K was crucial to financiers and bankers of every sort. Even the alien investors, those star-traveling reptiles of enormous wealth, found T-K useful, and favored it with their patronage.

And as T-K's citizens, the Regals increased their power, smaller factions faltered and fell under their sway. Mars was dotted with bankrupt factions, financially captured and transported to the Marhan surface by the T-K plutocrats.

Having failed in space, the refugees took Regal charity in ecologists of the sunken gardens. Dozens of factions were quarantined in cheerless redemption camps isolated from one another, their lives pared to a grim frugality.

And the visionary Regals made good use of their power. The factions found themselves trapped in the arcane bioaesthetics of Posthumarian philosophy, subverted constantly by Regal broadcasts. Regal teaching, Regal culture. With time even the stubbornest faction would be broken down and digested into the cultural bloodstream of T-K. Faction members would be allowed to leave their redemption camp and travel up the Ladder.

But first they would have to prove themselves. The Pattermists had awaited their chance for years. If had come at last in the Ibis Crater competition, an ecological struggle of the factions that would prove the victor's right to Regal status. Six factions had sent their champions to the ancient Ibis Crater, each one armed with its group's strongest biotechnologies. It would be a war of the sunken gardens, with the Ladder as the prize.

Mirasol crawled follow a gully through a chaotic terrain of rocky permafrost that had collapsed in karts and wrinkles. After two hours, the gully ended abruptly. Below Mirasol rose a mountain range of massive slabs and boulders, some with the glassy sheen of impact melt, others scabbed over with lichen.

As the crawler started up the slope, the sun came out and Mirasol saw the crater's outer rim jagged in the green of lichen and the glaring white of snow.

The oxygen readings were rising steadily. Warm moisture was drooling from within the crawler's lip, leaving a spittle of ice. A half-millimeter ton asteroid from the rings of Saturn had fallen here at fifteen kilometers a second. But for two centuries rain, creeping glaciers, and lichen had gnawed at the crater's rim, and the wound's raw edges had slumped and scarred.

The crawler worked its way up the eroded channel of an empty glacier bed. A cold alpine wind keened down the channel, where flourishing patches of lichen clung to exposed veins of ice.

Some rocks were striped with sediment from the ancient Marhan seas, and the impact had peeled them up and thrown them on their backs.

It was winter, the season for pruning the



sunken gardens. The treacherous rubble of the crater's rim was cemented with frozen mud. The crawler found the glacier's root and clawed its way up the ice face. The raw slope was studded with winter snow and storm-blown summer dust, stacked in hundreds of red-and-white layers. Within the years the slopes had warped and rippled in the glacier's flow.

Mirassol reached the crest. The crawler ran spattered along the crater's snowy rim. Below, in a bowl-shaped crater eight kilometers deep, lay a seething ocean of air.

Mirassol stared. Within this gigantic air-sump twenty kilometers across, a broken ring of majestic rain clouds trailed their dark skirts, like duchesses in quadrigle about the ballroom floor of a lens-shaped sea.

Thick forests of green and yellow man-groves rimmed the shallow water and had overtaken the shattered islands at its center. Pirogues of brilliant scarlet ibis spattered the trees. A flock of them suddenly spread keelie wings and took to the air, spreading across the crater in uncounted millions. Mirassol was appalled by the crudity and daring of the ecological concept: its crass and primal vitality.

This was what she had come to destroy. The thought filled her with sadness.

Then she remembered the years she had spent fanning her Regal teachers, collaborating with them in the destruction of her own culture. When the chance at the Ladder came, she had been chosen. She

put her sadness away, remembering her ambitions and her needs.

The history of mankind in space had been a long epic of ambitions and rivalries. From the very first space colonies had struggled for self-sufficiency and had soon broken their ties with the exhausted Earth. The independent life-support systems had given them the mentality of city states. Strange ideologies had bloomed in the hothouse atmosphere of the ovals and breakaway groups were common.

Space was too vast to police. Pioneer ethics burst forth, defying anyone to stop their pursuit of alien technologies. Quite suddenly the march of science had become an insane heeding scrabble. New sciences and technologies had shattered whole societies in waves of future shock.

The shattered cultures coalesced into factions so thoroughly alienated from one another that they were called humanity only for lack of a better term. The Shapers, for instance, had seized control of their own genetics, abandoning mankind in a burst of artificial evolution. Their rivals, the Mechanists, had replaced flesh with advanced prosthetics.

Mirassol's own group, the Paternists, were a breakaway Shaper faction.

The Paternists specialized in cerebral asymmetry. With grossly expanded right brain hemispheres, they were highly intuitive, given to metaphors, parallels, and sudden cognitive leaps. Their inventive

minds and quick unpredictable genius had given them a competitive edge at first. But with these advantages had come grave weaknesses: autism, fugue states, and paternistic Patriarchs grew out of control and became grotesque wobs of fantasy.

With these handicaps their colony had faltered. Patriarchal industries went into decline, outpaced by industrial rivals. Competition had grown much fiercer. The Shaper and Mechanist camps had turned commercial action into a kind of endemic warfare. The Patriarchal gamble had failed and the day came when their entire habitat was bought out from around them by Regal plutocrats. In a way it was a kindness. The Regals were suave and poci'd of their ability to assimilate refugees and failures.

The Regals themselves had started as dissidents and defectors. Their Posthumanist philosophy had given them the moral power and the blind resilience to dominate and absorb factions from the fringes of humanity. And they had the support of the investors, who had vast wealth and the secret techniques of star travel.

The crawler's radar antennae buzzed to the presence of a landcraft from a rival faction. Leaning forward in her pilot's couch, she put the craft's image on screen. It was a lumpy sphere balanced uneasily on four long, spindly legs. Silhouetted against the horizon, it moved with a strange wobbling speed along the opposite lip of the crater and then disappeared down the outward slope.

Mirassol wondered if it had been cheating. She was tempted to try some cheating herself—to clump a few frozen packets of aerobic bacteria or a few dozen capsules of insect eggs down the slope—but she leaned into orbiting monitors of the T-K supervisors. Too much was at stake—not only her own career but that of her entire faction, huddled bankrupt and despairing in their cold redemption camp. If was said that T-K's ruler, the posthuman being they called the Lobster King, would himself watch the contest. To fail before his black, abstracted gaze would be a horror.

On the craft's outside slope below her a second rival craft appeared, lurching and shivering with insane, aggressive grace. The craft's long, supple body moved in a sidewinder's looping and coiling, holding aloft a massive shining head, like a faceted minor ball.

Both rivals were converging on the rendezvous camp, where the six contestants would receive their final briefing from the Regal Adviser. Mirassol hummed forward.

When the camp first flashed into sight on her screen, Mirassol was shocked. The place was huge and absurdly elaborate: a drug dream of paneled goodnesses and colored minerals sprawling in the lichenous desert like an abandoned chandelier. This was a camp for Regals.

Here the artists and sophists of the Bio Arts would stay and judge the contest as the newly planted ecosystems struggled among themselves for supremacy.

The camp's air locks were surrounded



As a matter of fact, I would like to know where he gets his grants from.

with shining green thickets of lichen where the growth feasted on escaped humidity. Mirasol drove her crawler through the yawning air lock and into a garage. Inside the garage, robot mechanics were scrubbing and polishing the coiled, hundred-meter lengths of the snake craft and the gleaming black abdomen of an eight-legged crawler. The black crawler was crouched with its periscoped head sunk downward, as if ready to pounce. Its swollen belly was marked with a red hourglass and the corporate logo of its faction.

The garage smelled of dust and greases overlaid with floral perfumes. Mirasol left the mechanics to their work and walked stiffly down a long corridor stretching the kinks out of her back and shoulders. A lattice-work door sprang apart into filaments and revealed itself behind her.

She was in a dining room that clinked and rattled with the high-pitched, repetitive sound of Regal music. Its walls were paneled with tall display screens showing startlingly beautiful garden panoramas. A pulpy-looking servo, whose organometallic casing was squat, smiling head had a swollen and almost diseased look, showed her to a chair.

Mirasol sat, denting the heavy white tablecloth with her knees. There were seven places at the table. The Regal Adviser's tall chair was at the table's head. Miraculously assigned position gave her a sharp idea of her own status. She sat at the far end of the table, on the Adviser's left.

Two of her rivals had already taken their places. One was a tall, red-haired Sheper with long, thin arms, whose sharp face and bright, worried eyes gave him a querulous, birdlike look. The other was a sullen, metal-looking Mechanist with prosthetic hands and a penitentiary hump marked at the shoulders with a red hourglass.

Mirasol studied her two meals with silent, seducing glances. Like her, they were both young. The Regals favored the young, and they encouraged captive factions to expand their populations widely.

This strategy cleverly subverted the old guard of each faction in a tidal wave of their own children, indoctrinated from birth by Regals.

The birdlike man, obviously uncomfortable with his place directly at the Adviser's right, looked as if he wanted to speak but dared not. The gauntlet Mechanist sat staring at his artificial hands; his ears stopped with headphones.

Each place setting had a squeezebulb of liqueur. Regals, who were used to waging warlessness in orbit, used these bulbs by habit, and their presence here was both a privilege and a humiliation.

The door fluttered open again, and two more rivals burst in, almost as if they had raced. The last was a labby-looking Mech, still not used to gravity whose sagging limbs were supported by an extraskelletal framework. The second was a severely maimed Sheper whose bowed legs terminated in grasping hands. The pedal

hands were gemmed with heavy rings that clicked against each other as she waddled across the parquet floor.

The woman with the strange legs took her place across from the birdlike man. They began to converse haltingly in a language that none of the others could follow. The man in the framework gasped audibly, lay in obvious pain in the chair across from Mirasol. His plastic eyeballs looked as blank as chips of glass. His sufferings in the pull of gravity showed that he was new to Mars, and his place in the competition meant that his faction was powerful. Mirasol despised him.

Mirasol felt a nightmarish sense of entrainment. Everything about her competitors seemed to proclaim their sickly unfitness for survival.

They had a haunted, hungry look, like starving men in a lifeboat who wait with secret eagerness for the last to die.

She caught a glimpse of herself reflected in the bowl of a spoon and saw with a flash of insight how she must appear to the others. Her intuitive right brain was swollen beyond human bounds, distorting her skull. Her face had the blank prettiness of her genetic heritage, but she could feel the bleak stoniness of her explosion. Her body looked shapeless under her quilted pilot's vest and dun-drab, general-issue blouse and trousers. Her fingertips were raw from biting. She saw in herself the toy defeated look of her faction's older generation, those

who had tried and failed in the great world of space, and she hated herself for it.

They were still waiting for the sixth competitor when the plinking music reached a sudden crescendo and the Regal Adviser arrived. Her name was Arkadya Sonnen, Incorporated. She was a member of T-K's ruling oligarchy, and she swayed through the burbling choir with the careful steps of a woman not used to gravity.

She wore the investor-style clothing of a high-ranking diplomat. The Regals were proud of their diplomatic ties with the alien Investors, since Investor patronage provided their own vast wealth. The Sonnen's knee-high boots had tall, birdlike toes accented like Investor hide. She wore a heavy skirt of gold cords braided with jewels, and a stiff, waist-length formal jacket with embroidered cuffs. A heavy collar formed an arcing, multicolored thrill behind her head. Her blond hair was set in an interlaced style as complex as computer wiring. The skin of her bare legs had a shiny glossy look as if freshly enamelled. Her eyelids gleamed with soft, repilian pastels.

One of her corporate ladyships' two body servos helped her to her seat. The Sonnen leaned forward brightly, interlocking small, plump hands so crusted with rings and bracelets that they resembled gleaming garnets.

"I hope the five of you have enjoyed this chance for an informal talk," she said sweetly, just as if such a thing were pos-



"Do you have any change? It only takes quarters!"

said. "I'm sorry I was delayed! Our sixth participant will not be joining us."

There was no explanation. The Regals never publicized any action of theirs that might be construed as a punishment. The looks of the competitors alternately stonewashed and calculating showed that they were imagining the worst.

The two squat servers circulated around the table, dishing out courses of food from trays balanced on their fibby heads. The competitors picked uneasily at their plates.

The display screen behind the Advisor flickered into a schematic diagram of the Ibis Crater. Please notice the revised boundary lines, the Sonenti said. I hope that each of you will avoid trespassing—not merely physically but biologically as well. She looked at them seriously. Some of you may plan to use herbicides. This is permissible, but the spreading of spray beyond your sector's boundaries is considered crass. Bacteriological establishment is a subtle art. The spreading of tailored disease organisms is an aesthetic distortion. Please remember that your activities here are a disruption of what should ideally be natural processes. Therefore, the period of tree seeding will last only twelve hours. Thereafter, the new complexity level will be allowed to stabilize itself without any other interference at all. Avoid self-aggrandizement, and confine yourselves to a primal role as catalysts.

The Sonenti's speech was formal and ceremonial. Mirasol studied the display screen, noting with much satisfaction that her territory had been expanded.

Seen from overhead, the crater's roundness was deeply etched.

Mirasol's sector, the southern one, showed the long, tattered scar of a major landslide, where the crater wall had slumped and flowed into the pit. The simple ecosystem had recovered quickly and mangroves festooned the rubble's lowest slopes. Its upper slopes were gnawed by lemons and glaucias.

The sixth sector had been erased, and Mirasol's share was almost twenty square kilometers of new land.

It would give her factions' ecosystem more room to take root before the deadly struggle began in earnest.

This was not the first such competition. The Regals had held them for decades as an objective test of the skills of rival factions. It helped the Regals' divide-and-conquer policy to set the factions against one another.

And in the centuries to come, as Mers grew more hospitable to life, the gardens would surge from their craters and spread across the surface. Mists would become a warming jungle of separate creations. For the Regals, the competitors were closely studied simulations of the future.

And the competitors gave the factions motives for their work. With the garden wars to spur them, the ecological sciences had advanced enormously. Already, with the progress of science and taste, many of the

oldest craters had become ecocathedral embassies.

The Ibis Crater had been an early, crude experiment. The faction that had created it was long gone, and its primitive creation was now considered tasteless.

Each gleaming hexagon camped beside its own crater, struggling to bring it to life. Some craters were still raw and smoking. But the competitions were a shortcut up the Ladder. The competitions philosophies and talents, made into flesh, would carry out a proxy struggle for supremacy. The sine wave curves of growth, the ripples and declines of expansion and extinction, would scroll across the monitors of the Regal judges like stock-market reports. This complex struggle would be weighed in each of its aspects: technological, philosophical, biological, and aesthetic. The winners would abandon their camps to take on Regal wealth and power. They would roar, I-K jeweled coronets and revel in its perquisites: extended life spans, cor-

alpine species, and they hoped to exploit this strength. The landslide's long slope far above sea level was to be their power base. The crawler lurched down-slope, blasting out a fine spray of Ichneumon bacteria.

Suddenly the air was full of birds. Across the crater, the globe on stabs had rushed down to the waterline and was laying waste the mangroves. Fine wisps of smoke showed the slicing beam of a heavy laser.

Burst after burst of birds took wing, peeling from their nests to wheel and dip in terror. At first, their frenzied cries came as a high-pitched whisper. Then, as the laser spread, the screeching echoed and reechoed, building to a mindless surt of pain. In the crater's down-warmed air, the seal-kill moles hung in their millions, swirling and coalescing like drops of blood in the tall.

Mirasol scattered the seeds of alpine rock crops. The crawler peeked its way down the talus, spraying fertilizer into cracks and crevices. She pried up boulders and released a scattering of invertebrates: nematodes, mites, soil bugs, alkali midges. She splattered the rocks with gelatin to feed them until the mosses and ferns took hold.

The cries of the birds were appalling. Downslope the other factions were trashing in the muck at sea level, wreaking havoc, destroying the mangroves so that their own creations could take hold. The great snake looped and ducked through the canopy knotting itself, snapping up swathes of mangroves by the roots. As Mirasol watched, the top of its falcated head burst open and released a cloud of bats.

The mantis crawler was methodically marching along the borders of its sector, its saw-edged arms reducing everything before it into kindling. The hourglass crawler had slashed through its territory, leaving a muddy network of fire zones. Behind it rose a wall of smoke.

It was a daring play. Sterilizing the sea for life might give the new biome a slight advantage. Even a small boost could be crucial as exponential rates of growth took hold. But the Ibis Crater was a closed system. The use of fire required great care. There was only so much air within the bowl.

Mirasol worked grimly. Insects were next. They were often neglected in favor of massive sea beasts or fleshly predators, but in terms of biomass, gram by gram, insects could overwhelm. She blasted a carton down-slope to the shore, where it melted, releasing aquatic termites. She shoved aside flat shelves of rock, planting egg cases below their sun-warmed surfaces. She released a cloud of leaf-eating moths, their tiny bodies packed with bacteria. Within the crawler's belly rack after automatic rack was thawed and tied through nozzles, dropped through spiracles or planted in the holes jabbed by pickle feet.

Each faction was releasing a potential world. Near the water's edge, the mantis had released a pair of things like giant black sail planes. They were swooping through continents on net 19.

•Mirasol reached  
the crest. The crawler  
ran spiderlike  
along the crater's snowy  
rim. Below, in a  
bowl-shaped crater five  
miles deep, lay  
a seething ocean of air.♦

porate titles, cosmopolitan tolerance, and the interstellar patronage of the investors

When red dawn broke over the landscape, the five were poised around the Ibis Crater, awaiting the signal. The day was calm, with only a distant nexus of jet streams marring the sky. Mirasol watched pink-stained sunlight creep down the middle slope of the crater's western wall. In the mangrove thickets birds were beginning to stir.

Mirasol waited tensely. She had taken a position on the upper slopes of the landslide's raw debris. Radar showed her rivals spaced along the interior slopes to her left: the hourglass crawler and the jewel-headed knape; to her right, a mantis-like crawler and the globe on stabs.

The signal came, sudden as lightning. A meteor of ice shot from orbit and left a shock-wave cloud plume of ablated steam. Mirasol charged forward.

The Patriarchs' strategy was to concentrate on the upper slopes and the landslide's rubble, a marginal niche where they hoped to excel. Their cold crater in Bytia Major had given them some expertise in

# VOTERS' PREVIEW

*Presidential candidates told Omni their plans for future technological quests*

BY TIM ONOSKO AND THOMAS O'TOOLE



President Reagan's major challengers for the Oval Office are committed to shooting down his star-wars plans to test antisatellite weapons and to orbit defensive lasers. But curiously, Senator Gary Hart, former Vice President Walter Mondale, and Reverend Jesse Jackson seem to have given less thought than the President to a policy on space exploration.

Starting late last year, Omni began tracking down the views of potential presidents. We drew up a complex set of two dozen questions on space, science, technology, nuclear war, and other issues. We began delivering the questions by mail, telephone, and messenger, as candidates bottleneck toward the early primaries. Despite heavy schedules, most of the men in the race provided answers, sometimes voluminous ones. And many of the answers went further than previously unvoiced positions. The controversy over the future of space weaponry was only part of what we found. Each of the

PAINTING BY JASPER JOHNS

• President Reagan's plan for a space-based shield is an unproven, enormously expensive scheme. ♦



Mondale: 'Join allies for space exploration'

Democratic challengers also went beyond support for a nuclear freeze—which each favored—to suggest other steps to prevent nuclear war. Each proposed major new federal initiatives to improve the quality of science and math education in the United States. In these and other answers, the Democrats appealed united against Reagan's nuclear and educational policies.

But the answers also suggested some possible rifts within the Democratic camp on matters of science and technology. Our question about energy policy, for example, made specific reference to nuclear power. Hart responded that he opposed "massive subsidies for nuclear power." Jackson went further, calling for a halt in the construction of nuclear-power plants. Mondale offered nothing about the issue. No one would know from his answer that the atom had been split for peace or that public opinion was split as a result.

Mondale's public statements over the past few years appear to straddle both sides of the debate. Four years ago, as vice president, he expressed hope that alternate energy sources would "bring us to the point where we do not need nuclear energy." But in 1982 he praised former president Jimmy Carter's commitment to "the wise use of nuclear energy." In an early campaign appearance in New Hampshire last year, he said nothing about nuclear power; even though, at the time, he was speaking only a few miles from the controversial Seabrook nuclear plant.

In other instances as well, the lack of a response to Omni's survey is revealing. For example, we asked in a lighthearted question about whether each of the contenders would want to ride in a space shuttle. Front-runners studiously ignored us. Mondale, Hart, and Jackson gave no answers. Some onetime candidates, who fared poorly in early primaries, on the other hand, seemed delighted with the idea of getting away from it all. Senator Ernest Hollings of South Carolina, an early dropout, wrote: "As president, I would gladly entertain such an invitation

by NASA." And independent candidate John Anderson responded like a man who had his bags packed: "I would love to ride the shuttle into orbit," he wrote us. "So would my family and most of my staff. Send us the tickets."

The most notable nonresponse, though, came from the President. Omni persistently asked the White House to work through the same questionnaire we sent to other candidates. Reagan's campaign office said it would take six to eight weeks to get clearance for answers. That made it impossible to meet our deadlines. Campaign officials expressed regret. But as we went to press, we learned that the real reason for the reticence was that high administration officials didn't want to see the President's answers side by side with the words of a horde of hungry Democrats.

The President's positions are already well-known, however, on many of the issues in our poll. He has consistently supported the shuttle, for example, and proposed space-station plans. Reagan has kept money in the budget for the Galileo voyage to Jupiter, the Space Telescope, and the International Solar Polar Mission, despite the objections of David Stockman and the Office of Management and Budget.

Walter Mondale, as a senator from Minnesota during the Seventies, denounced the shuttle as a "multibillion-dollar space extravaganza." He favored a less ambitious space program based largely on unmanned satellites. In material prepared for Omni, the former vice president offered no bold new plans for space exploration. He wrote that he opposed Reagan's proposal to turn over control of weather mapping, and Earth-sensing satellites to private industry. The United States should encourage companies to investigate the potential of space production, he wrote, and we should pool resources with allies to conduct space research. Hart told us he was currently "reviewing [his] policy in this area." Jackson ducked the question.

The presidential season often spawns a few gaudy, glittering issues that flower

• I have tried to redirect energy priorities away from massive subsidies for nuclear power. •

on the campaign trail and then waver or mutate after the election. Remember the missile gap of 1960? Quayle and Matsu? President Lyndon Johnson's pledge during the 1964 race not to send American boys to fight an Asian war? Were confident, however, that the issues raised in our survey of possible presidents are perennial. Our next President's answers to these questions will determine the way we live far into the future.

Here are the questions that revealed, in sharpest focus, the candidates. Some of the responses are abridged, but they are otherwise verbatim:

In some instances, we've included statements from men no longer in the race—California Senator Alan Cranston, Ohio Senator John Glenn, and Senator Hollings. We've offered them space partly because their positions may influence their party's platform and partly because what they said provided an informative counterpoint to the positions of the men still in the race.

**Omni:** After taking office, what are the three most important steps you would take to prevent nuclear war?

**Hart:** While I strongly support the nuclear freeze, it does not go far enough. I am calling for upgrading the hotline between Washington and Moscow, establishing a joint U.S.-Soviet command center to monitor each country's nuclear activities, a negotiated worldwide freeze on plutonium production, and the cancellation of multiple warhead missiles like the MX. **Mondale:** Begin immediate negotiations on a mutual and verifiable freeze; propose annual summits with the Soviet leaders as a means of reducing the risk of mistake or misunderstanding, and abandon President Reagan's star wars program while reaffirming U.S. support for the antiballistic-missile treaty.

**Jackson:** Meet anywhere and anytime with the leader of the Soviet Union until we have agreed on a nuclear freeze. We must recognize that the immediate danger of a nuclear war arises from our involvement in flash points like the Middle East and Central America. We must reevaluate

U.S. foreign policy to disengage us from provocative roles in such flash points. We can also lessen the risk of nuclear war by changing our domestic priorities. If we can demand less of the world's resources, we will find it less necessary to intrude in other regions to "secure" our access to these resources. This way we will reduce tensions and lessen the chances of nuclear war.

**Hollings:** I would use the presidency and the moral authority it carries with it as a bully pulpit to develop mass feelings of outrage against the nuclear situation in the world today.

**Omni:** In his star-wars speech of March 23, 1983, President Reagan said he would investigate the possibility of defending the United States with weapons based in space. The military has already tested an ASAT, or antisatellite weapon. What is your stance on these issues?

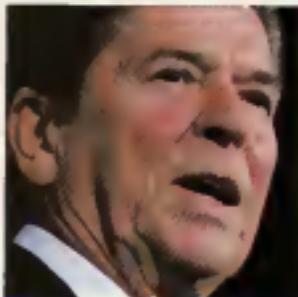
**Mondale:** President Reagan's plan for a space-based shield against ballistic missiles is an unproven, enormously expensive scheme that would create a false sense of security among the American people and its leaders. The Defense Department estimates this project would cost twenty-four billion dollars between 1986 and 1989. Even after this expenditure, there would be no guarantee the idea would work, and even if it did, it would not protect citizens from a nuclear attack, since it could do nothing against bombers or cruise missiles. With regard to antisatellite weapons, I have proposed a moratorium on the testing of such weapons by the United States and the Soviet Union as a prelude toward an agreement banning their deployment.

**Hart:** I have cosponsored a Senate resolution urging the President to negotiate with the Soviets to ban all space weapons, including ASATs and the space-laser system. In my judgment, the space-based antimissile system is a disastrous waste of this country's resources. **Jackson:** I would end the development of antisatellite technology and all ballistic-missile defense systems. Creating the illusion of invulnerability only increases our vulnerability.



Hart Develop an ethanol-fuel program

• High administration officials didn't want to see the President's answers next to those of Democrats •



Reagan: Star wars and space stations

Cronstrom: I believe it is important to the interests of the United States to keep space open and accessible. The United States depends on its access to space for verification of arms-control agreements, for communication, and for early warning of an attack. The proposed antisatellite system now being tested by the Reagan administration is particularly disturbing because it provides no protection for these essential satellites. The new ASAT system will put Soviet satellites at risk but do nothing to defend our satellites from a Soviet attack.

Omn: What can we do to stimulate the use of space? Should the United States sell its space technology to recover the huge sums it cost to develop and operate the technology?

Mondale: The United States should encourage companies to investigate the potential of space production through such means as providing more room on the shuttle to help them delineate the possibilities for space production and to develop low-cost methods that make production profitable. I believe the United States should maintain direct control over its weather, Earth-sensing, and mapping satellites so as to ensure that the information obtained is available to all who need it.

Hart: I am currently reviewing my policy in this area.

Jackson: [Did not answer this question.] Glenn: Without federal investment in space industry, U.S. firms will fall far behind. The question is how best to assist them. One modal worth considering is NASA's joint-endeavor agreement where government and industry risk resources together to test equipment and processes in orbit, and NASA permits the firm to retain certain proprietary rights to experimental data.

Omn: The energy crisis of the Seventies sometimes seems to be a thing of the past, but its causes remain: dependence on natural gas and foreign oil; a nuclear industry brought to its knees by such issues as safety, cost, and waste disposal. Alternate energy sources often appear too expensive to develop. What should we

do to protect ourselves against another energy crisis?

Hart: The most important step is the accelerated development of alternate and renewable energy sources, such as alcohol fuel. A program to develop ethanol would not only give us an alternative, it would provide an expanded market for our grain. I have tried to redirect energy priorities away from massive subsidies for nuclear power and toward more cost-effective ways to meet our energy needs.

Mondale: I would support the continuation of an active federal program to encourage conservation. I would continue to support energy-assistance programs for the poor and elderly, who have been hardest hit by the steep rise in energy costs. And I would reestablish information sources cut by the Reagan administration so that consumers can get the information they need to make informed decisions about personal energy use. I do not support a high tariff on imported oil to enforce conservation, since this would damage industrial productivity and drive up home-heating costs. [Mondale made no mention of nuclear power.]

Jackson: I have called for a halt in construction of nuclear-power plants and a phasing out of existing plants. We must conserve as a nation; we will not do without, we will do more with less. I also believe that fusion energy is expensive, unproven, not without risk, and unnecessary—given the alternatives. Solar systems and extended use of ethanol can replace one third of the present demand for gasoline with little or no reduction in food output.

Glenn: Our nuclear policy must ensure that all nuclear facilities operate safely as we increase funding for research on reactor safety and improved efficiency. I believe that fusion energy holds great potential in becoming a vital source for electric-power generation in the twenty-first century.

Omn: Modern life and industry are putting new strains on our land, air, and water. The dumping of toxic and chemical wastes continues to threaten health. What

(CONTINUED ON PAGE 11)

# SPACE

CONTINUED FROM PAGE 38

comet that came too close to the sun. To me this was one of the biggest single surprises we had through the entire mission," Neugebauer says.

It lends a lot of support to the idea that many of the asteroids we see are the remnants of ancient comets.

Among the brightest payoffs was the satellite's discovery of three bands of fine dust spread over 100 million miles in the asteroid belt between Mars and Jupiter. These bands are almost surely the debris from either a collision between two very small asteroids or from the breakup of a larger single asteroid. The satellite's asteroid count alone made news: IRAS catalogued something like 20,000 asteroids swirling across the solar system, four times as many as had been counted from Earth.

But the biggest surprise was what is now called the Vega phenomenon: IRAS discovered a young solar system forming around Vega, a star just 26 light years from Earth. There is no longer any doubt of this solar system's existence. "We expected to find rings of debris around dying stars, and we did, like the shell of gas we see around the star Betelgeuse," Neugebauer says.

But we didn't expect to find anything that looked at all like Vega. The Vega phenomenon is interesting because there's such an excess of large particles around the star that it can only be a solar system in the stage of formation.

Vega is about twice the size of our sun. Further analysis of IRAS data revealed a second star, Fomalhaut, orbited by solid material. Fomalhaut, 27 light-years from Earth, is about one fifth as bright as Vega.

IRAS has brought astronomers across a threshold of discovery. Scientists look to SIRTF to carry them further into alien realms. SIRTF is designed to be almost twice the size of IRAS. It will have an array of detectors at its focal plane that will make it 1,000 times more sensitive to infrared light than IRAS was. Not only will SIRTF be able to reach much deeper into space than IRAS did, it will be able to spot smaller and fainter objects closer to Earth. I like to compare SIRTF's sensitivity with that of the Space Telescope, which will look at the heavens in the visible light region of the spectrum," NASA's Nancy Boggess says. But the Space Telescope will not have the sensitivity of SIRTF. In fact, if there were a good-size planet around Vega, the Space Telescope would not see it.

The risks to SIRTF are that its technology will be held back by budget delays and that the astronomers who worked most closely with IRAS will move on to other things and even grow old while SIRTF sits on some shelf in Washington. "We've got a lot of momentum going for us right now," says Beichman. "We're on a roll. Trouble is, if NASA and the Office of Management and Budget prevail, the roll stops here." □

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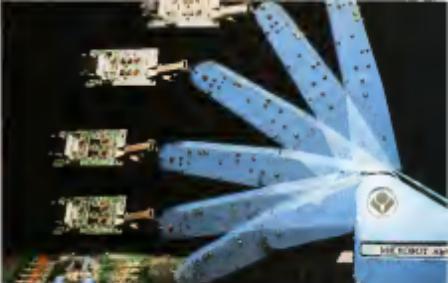
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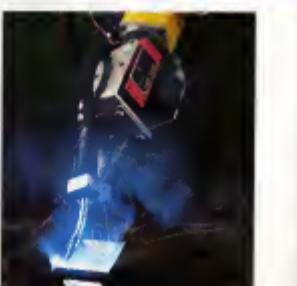
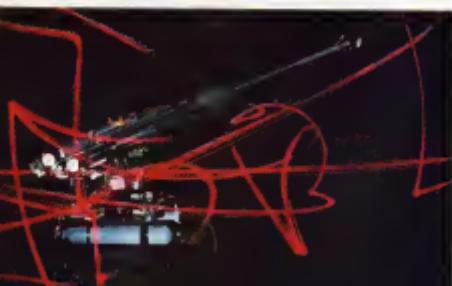
# ROBOLUTION

BY PHOEBE HOBAN

Early this month the world's biggest robot manufacturers are getting together for Robot '86, the largest convention of worker machines ever held. Appropriately it is taking place in Detroit, where automata began to revolutionize factory work. Over 200 companies will gather there to give the industry a glimpse of the steel-collar worker of the future and to underscore the fact that the robot revolution has begun.

Deft machines (clockwise from right): Ogerbot's six-legged robot; Microbot's mini robot arm; Japanese robot hand; Boston Digital's flexible cutting robot





By the end of the next decade, experts tell us, the robot invasion will have advanced far beyond automotive assembly lines. Some worker robots will be mining precious metals deep within the earth, others will be working along the ocean bottom and even out in the fields, where they will tend our crops and livestock. None will look like the simple goonish robots depicted in the old-fashioned drawings interspersed throughout these pages, but in their own ways the worker machines of today can be just as fearsome.

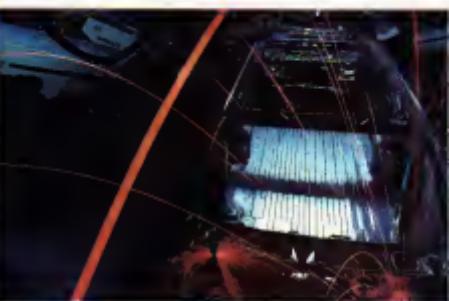
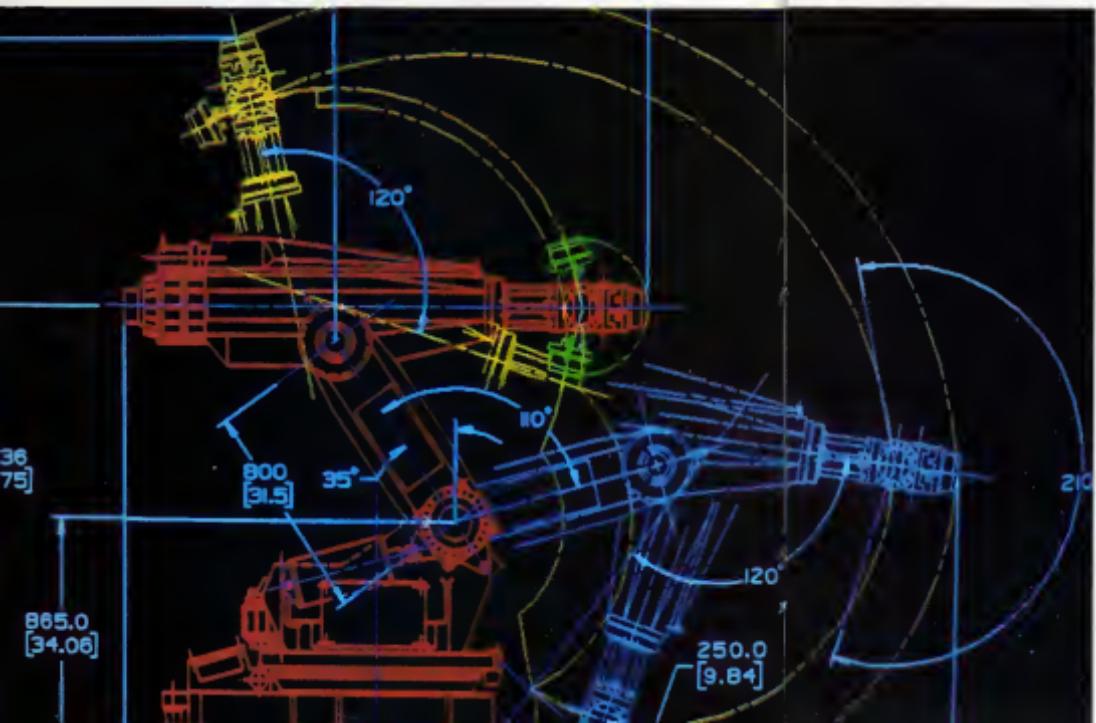
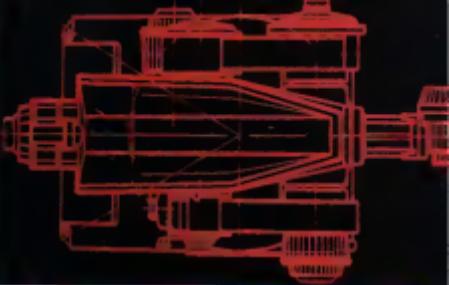
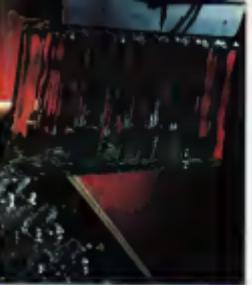
Robot drones are moving up the ranks of machine evolution. They now have the latest in high-tech gear, from laser welding guns to the

Welding is standard robot work, done flawlessly by the robot arm above and a GCA Corporation machine at near left. Other machines are more versatile: the Unimation robot (far left) and General Electric's hand-eye system (far right) are able to recognize and pick up specific parts on disc

sophisticated vision system used by a dice-rolling robot (top left)

The goal is a new breed of automatic ones that will interact with humans more skillfully and intelligently. Out of robotics have appeared such creations as a robot that can play an organ, and the spider-like "functionoid," which can walk or climb on ceilings (both shown in the opening spread). Research techniques are now so sophisticated that designers need not even have a robot in front of them to test it out. They can operate computer-generated clones, much as they would the real thing (photos below and top right). Figuratively—and literally—today's robots have entered another dimension **DO**

General Electric engineers try out a robot by feeding its blueprints into a computer and passing it through its computer simulated pages (below and far right). In the real world, automated drovers assemble minivans at a Chrysler plant (lower right) and whale the borders along a production line (near right).





Visit that shadowy land  
between reality and illusion, the  
realm of simulation

## THE ART AND SCIENCE OF FAKing IT

BY FRANK KENDIG AND LISA BUCK

**T**wo years ago high-ranking government officials, including some cabinet members, played a five-day superpowers game with the following scenario: After increasing tensions, both the United States and the Soviet Union mobilized their forces; war was declared when the Soviets attacked American bases overseas. The Soviets sank an American ship with a tactical nuclear weapon and launched chemical warfare attacks on US positions. In retaliation the US President, played by former Secretary of State William

Rogers, ordered a low-level nuclear counterattack. On the fourth day of simulated war, the Soviets hit Washington, DC, with a 5,000-megaton missile that killed the President. The Vice President—former CIA director Richard Helms—took over and launched an all-out counterstrike against the Soviets. The Reagan administration applauded Helms's performance, saying it proved we could absorb a nuclear strike that removed the President and still strike back. Because the game stopped soon after the US retaliation, we can only wonder how

the rest of us made out. The actions in this superpower showdown were playing make-believe, fighting a simulated war. As with all simulations, it was a lot cheaper, safer, and cleaner than the real thing. No radiation, no property damage, no wounded to attend, no body bags cluttering up the place. Today many real-life situations, from landing a 747 to managing a corporation, are rehearsed this way. Pretending has become a special science.

The word *simulate*, which comes from the Latin *similis*, meaning to imitate, feign,

or represent, describes what our particular species does best. Simulation may be the primary process that makes us human. That sets us apart from the other animals. We are the model builders, the scribes, and picture makers—the simulators. I simulate therefore I am is an arguable position. Keep on simulating could well be an admirable admission. The traditional tools of simulation—costume, masks, scripts, and an active imagination—are commonplace. Technology however has amplified the process, and today we have an incredible

PAINTING BY RENÉ MAGRITTE

•Situations are so realistic that even an experienced pilot's hands have been known to sweat—he's really flying.



array of machines—most of them the progeny of an upstate New York inventor named Edwin A. Link—that help us pretend. In 1929, in the basement of his father's organ factory, Link built the first flight simulator, a stubby wooden fuselage mounted on an organ bellows. The bellows, driven by an electric vacuum pump, caused the fuselage to bank, pitch, and turn as the pilot "flew" the simulator. Link described his invention as "part piano, part organ, and a little bit of airplane." What most distinguishes Link's "pilot maker" from today's sophisticated flight simulators is that it has wings and a tail; it actually looks like an airplane.

Link's invention offered three of simulation's most attractive features: It was safe, it was cheap, and it was fun. Link taught himself and his brother to fly it and, plotting his own plane, set out to market his invention. At first most of his trainees were used as rides in amusement parks, establishing a natural law in simulation technology: Toys sell quicker than tools. Finally he sold six simulators to the Army Air Corps. A \$2 billion industry was born.

Link and others continuously modified the invention, adding inclinometers, directional gyros, vertical-speed indicators, and other gear. Today the most sophisticated simulator is large enough to hold the entire six-man crew of a B-52 bomber. A fair cry from Link's tiny pilot maker, it weighs more than 43 tons, is controlled by 70 computers, and is capable of executing more than 500,000 instructions.

These machines are eerily realistic. The pilot of a flight simulator can take off from

his choice of airports, preselect the weather conditions, and choose how rough or smooth his landing will be. He will actually feel the bumps in the pavement as he taxis down the runway, hear the wind and rain on his windshield, feel the landing gear retract, and experience the jolt of turbulence. From his windows, he can watch the computer-generated terrain and clouds skim by. Anything that can be made to happen in simulated flight, engines can fail, brakes can overheat, runways can flood. Situations are so realistic that even an experienced pilot's hands have been known to sweat; he is really flying.

Simulation technology's success in duplicating the real thing was brought home in 1982, when the Federal Aviation Administration (FAA) approved a Boeing 727 simulator for phase-3 training of United Airlines and Northwest Orient Airlines flight crews. Phase 3 means total simulation. Pilots do all their flight training and take their flight exams on the ground, in the simulator. That means the first time the pilot takes off in a real Boeing 727, it can be filled with passengers.

That may not sound all that reassuring, but the FAA, the aerospace industry, and most pilots themselves maintain that total simulation is the safest and best way to train. Says Ed Bothe, manager of the FAA's National Simulation Evaluation Program: "In a simulator, flying in less than ideal weather conditions or with engine malfunctions can be safely demonstrated and practiced. None of that can be done safely in an airplane."

The economic advantages of total sim-

ulation are considerable. It costs about \$1,800 per hour for a training flight; in a real 727, for example, compared with \$65 per hour to fly a 727 simulator. For all these reasons, sophisticated simulators now exist for submarines, tanks, marine vessels, and nuclear-power plants—anything that is very expensive, complex, and/or dangerous to operate.

Most simulation machines are small, enclosed boxes, outfitted with sophisticated video and audio equipment and cabled to a computer or a computer network. But the science can do more than duplicate one machine. It can generate whole artificial worlds. NASA, for example, is an old hand at simulating what could be called alien environments. For the Apollo program, NASA scientists at the Manned Space Center, in Houston, painstakingly built a realistic patch of moonscape complete with craters, some as big as 64 feet across and 10 feet deep. There, astronauts practice for the real thing as cranes keep the trainees suspended like marionettes over the landscape, thereby simulating the substantially reduced gravity of the moon.

Today experiments are being conducted in which the psychological environment of space travel—solitude, confinement in a small area, social fragmentation—are duplicated on Earth. At the space lab of Johns Hopkins Hospital, in Baltimore, for example, volunteers are locked up for ten days in what is called a programmed environment, a living laboratory that simulates the cramped conditions of spacecraft and uncivilized vessels. Scientists study these volunteers to learn the psychological and physiological effects of prolonged confinement on two- and three-person microsocieties.

Environmental simulation can go beyond training exercises. Ronald A. Messier, for example, an associate professor of history at Middle Tennessee State University, in Murfreesboro, has designed a multimedia educational environment entitled "Napoleon on the March." It makes Napoleon's disastrous invasion of Russia come alive for his class. Messier's students sit in a dome-shaped room, where he bombards them with images of Napoleonic weaponry, uniforms, and troops of grenadiers. Some 400 slides, ranging from romanticized portraits of the Little Corporal to critical cartoons from the British press of the day, are projected on the dome. Loudspeakers blast the sounds of cannon fire, horses, crowds, raging storms, and, of course, Beethoven's *Emperor Concerto* and Tchaikovsky's *1812 Overture*. During battle scenes, puffs of smoke waft into the room. And as a finishing touch, Messier continues on page 10.



Famed chronicler of Pygmy life  
and the wretched Ik,  
the unconventional anthropologist  
contemplates what crimes  
to commit in order to study prisons  
under scientific conditions

## INTERVIEW

# COLIN TURNBULL

In 1949 an Oxford philosophy student, Colin Turnbull, asked to India to study the Hindu concept of the absolute at Benares University. He made the trip with the panomous blessing of his stern father, a wealthy Scottish land cum financier who had presented the young Turnbull with a one-way ticket and no extra cash. Once settled in India's holy city, Turnbull paid his respects to its leading female saint, Aandamayi, and promptly had a religious experience that he now says embattled him terribly.

"Have you come to stay?" the divine Mother asked, and Turnbull opened his mouth to utter a firm no. Instead, he rushed back to the university, collected his worldly baggage, and returned to the station. Where he remained for two years, studying a more practical curriculum than he'd planned for. There was no time to rest. Turnbull proved willing to take a personal plunge into another culture's spirit of the sacred. In 1951 he visited the San Indians in Zaire, and since has lost acquaintance with the Mbuk Pygmies and their ecstatic ceremonial music—an experience that led him back to Oxford for training in anthropology. Returning to the Iku to do fieldwork among the Pygmies, Turnbull participated in the okumbo, a puberty rite in

PHOTOGRAPH BY ANTHONY WOLFF

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which Pygmy and local village youths become men. His first book, *The Forest People*, published in 1961, vividly describes the idyllic existence of the primitive Mbuto who live together in a harmonious spirit of mutual cooperation and for whom the forest is an all-benevolent deity that unfailingly supplies their needs.

In 1962 he published *The Lonely African*, which he wrote during the decade he served as associate curator of African ethnology for the Museum of Natural History in New York. There he became friends with Margaret Mead and gave impromptu harpsichord recitals in her office. Eventually Turnbull was again ready to go into the field. This time he intended to study an elusive group of hunter-gatherers known as the Teuso. In a red Land Rover—which possessed the by-no-means-welcome ability to attract male elephants ostentuously in search of female company, the anthropologist headed into the mountainous region of Uganda where he found not the sought-after Teuso but a strangely inhuman group called the Ik. Relocated from its native hunting ground in what is now the Kidepo National Park the Ik had been unsuccessfully instructed by the government to farm a drought-stricken area.

If Turnbull saw the Mbuto as representative of the positive aspect of human potential the Ik embodied its negative extreme. A starving, diseased people who

would scramble 500 feet down an escarpment—with a nervous Turnbull scrambling after them—to beat a vulture to its feathered meal or would fill their empty stomachs with dirt, the Ik had adapted to severe deprivation by becoming a tribe of terribly isolated individuals. According to Turnbull they had abandoned all evidence of cooperation and love in their competition for food. The Ik family had disintegrated. Mothers taught their children to fend for themselves by throwing them out of the family compound when they were three, and food was snatched from the mouths of dying relatives. The spirit of the sacred Turnbull had so admired in other prim-



itive societies was reduced to mutterings of fatigued Mount Morungole residence of the Ik, now impotent gods instead of farmers as they had been ordered to do; the Ik exacerbated political tensions in the area by assaulting in intertribal cattle raids. Turnbull who had previously been immune to culture shock was shocked by the Ik and worse, he was appalled by the potential he saw in himself and his own society to become just like them.

On a subsequent visit to the Iru forest in 1970, he found his old friends the Mbuto suffering a similar political attempt to transform them into farmers. In three weeks Turnbull feverishly wrote *The*

*Mountain People*, a nightmare document of the fate of the Ik which he concluded with a warning to us all: For different reasons, he said, our own society like that of the Ik, was moving rapidly toward social isolation and greedy individualism. Some critics pooh-poohed his foolish and inappropriate sermon.

Undaunted, Turnbull delivered similar sermons. In his most recent book, *The Human Cycle* (1983), he drew a comparison between the ritual way major life stages are negotiated in small-scale societies and our own poverty of effective rites of passage. Contrasting his painful initiation to adulthood in upper-class English society with the way a child becomes a man in African, Indian and Tibetan tribes, Turnbull judges Western culture lacking in effective mechanisms for socialization. In *Tumbull's analyses* societies that we view condescendingly as primitive or underdeveloped often provide better ideals of the human community than we do. Critics again were dismayed. Some called Turnbull a romanticist and others accused him of recommending models that they thought were inapplicable to our highly technological Western society.

Winter Vide Lindner interviewed Turnbull in his office at George Washington University where he has been a visiting professor of anthropology since 1976. In the middle of the interview Turnbull de-



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sided to resign his position, saying he felt he needed to be unemployed for a while. George Washington students from Third World nations greeted the resident guru with embraces and beers. Why? According to Turnbull: "They are looking for someone they can touch in the cold, uncaring culture." A man of contradictions, a man of passions, Turnbull seems to run on the incandescent energy of his ideas, fueling them only with endless chains of cigarettes and ecstasies. Although the scurification scars are no longer visible above the leery Scotaman's bristling eyebrows, Turnbull still believes in the power of the sacred he encountered in the Pygmies forest so many years ago.

The most important task of the anthropologist, he maintains, is not to bring back academic monographs detailing yet another society's social structures, but to compile instructive first-person stories that impel us to revitalize our own lives. Turnbull continues to advise that those of us who worship false deities—the dollar, the self-made man, the rational answers taught by science and technology—have much to learn from the Pygmies and the ik.

Omni: You criticize fellow anthropologists for worshipping statistics and for eschewing value judgments in order to achieve objectivity. What is wrong with this detached approach?

Turnbull: There are two kinds of anthropologists: those who, by training or temperament, are better equipped to be scientific and objective and those who are more willing to be emotional—to feel their emotions and to deal with them. We are more humanistic. There's nothing wrong with statistics or with the scientific method. I think we should use them wherever applicable. But you can't quantify man's faith in God! I get mad at anthropologists who say they're holistic, yet deny that in other cultures the family, farming in the field, the political structure, disputes, and the way authority is divided are all extensions of religious belief!

Some men do have faith in gods, and it is a very powerful social force. I don't have to believe God exists, but if I am going to understand your culture then I must accept that you do believe. If you say "I'm sorry, I know God exists; I saw him yesterday," I can't ignore that. You can study certain aspects of any society objectively, but other aspects can be studied only by immersing yourself, and then all that you can report upon are your own feelings. To hell with objectivity and science!

When I first went to the fun forest in the Belgian Congo to study the Mous Pygmies, an old woman named Bakemunto died while holding my hand. It was a very moving experience. Then all the Mbundu went off into the forest to celebrate her death with a religious festival called the moimbo. They wanted to get closer to the center of the forest, which for them is the sacred center of the world. I didn't understand that at the

time, but I felt it, and if I had tried to be objective, if I'd gone there merely to observe their death ritual, I wouldn't have felt the sacred. They would sit around the fire, singing with an intensity you can feel only if you are there. I would close my eyes and sing with them—and when I opened my eyes, no one was there. Their bodies were there—their mouths were open and sound was coming out—but their souls were somewhere else. Those are the moments in anthropology when I feel terribly alone—when I lose touch with someone else's faith. When you have an experience like that, damn it, it's worth recounting for two reasons: to understand the Mbundu and their power of faith and also to remind us there is such a thing. If I write about it and make it beautiful for you, you may think, "My God why don't I have that?"

Omni: Is it more important for the anthropologist to convey his own involvement with the culture he is studying than it is for him to be "scientific"?

Turnbull: Anthropology has gone overboard in trying to prove it's a science. Our doctrine as anthropologists tells us never to make judgments, merely to observe and analyze. I frankly do not see how the hell you can live with people in intimate circumstances in a small village for two years without having human emotions. I don't believe in writing a monograph that pretends to be objective; that says "They do this and they do that." All I know is what I see them doing, and they may do what they do because I'm the kind of person I am! For example, I love music. Originally I wanted to be a musician, and I played the organ at Westminster and Worcester cat-

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theatricals I could have been a second-rate church organist. So in the field it I've got a choice between obtaining a bunch of people singing or a bunch of people cooking. I first gravitate toward the music. The people will know right away where my heart really is. They'll sing for me.

If you want to observe the structure of society then there's no need to be subjective or anecdotal. If you want to convey something of the quality of life in that society or of social forces like love and religious faith at work, then you can do that by objective study. Your participation has to be internal. When Jerzy Grotowski [Polish avant-garde theater director] talks about acting, he says the actor should be aware of the possibility of becoming someone other than himself. When this happens it is the greatest moment of an actor's life; he makes a total sacrifice of self. For the anthropologist, look! When we bring back what we pretend is an objective study of another society it's like taking that society and putting it in a museum showcase for everyone to look at as a curiosity. We say "How quaint," but it has nothing to do with us.

I was trained in a school that traces its anthropological tradition to the moral philosophy of the Enlightenment, a time when the concern of philosophers was one's own society. These philosophers began to recognize that by studying other cultures that

were rather simpler than our own, we could learn a great deal about general principles of human behavior anywhere. And that to me is more valuable than trying to reduce cultures as curiosities.

I think every anthropologist, whether he sees himself as a scientist or a humanist must come back to his own society with something of worth. Some of the science-fiction writers are the best anthropologists because they really care about their society. The best writing comes from those who are perceptive about our social ills and attempt to look for better alternative forms. They are giving us highly instructional fantasies. Long before ERA, we got science fiction about androgynous societies where you had the option to be male or female. Ours... In what ways does anthropology belie its intentions to be a science? Turnbull: It is a no no for anthropologists to go to the same place to study the same people. 'Oh' Margaret Mead already done the Samoans... Turnbull's done the Pygmies. There are scientists who say that. Surely the first step in science is to cross-check your information, or better still get other people to cross check it. This was neatly illustrated by my extended dialogue with Father Paul Schreber, one of the William Schmidt School of Austrian White Fathers, who were sent by the Vatican to discover the existence of a revealed religion—a divinity that appears through

revelation—among the primitives. Now if the Vatican tells you to find that, you'd better find it, baby! So Schreber, who learned his anthropology in a time before any real theory had been developed went tramping off to Africa and found revealed religions.

I disagreed totally with everything he said about the Mbundu Pygmies. Factually he was just wrong. He said the Pygmies had chiefs; they had no chiefs. He said their music was only instrumental. I found their music was vocal. We were looking at two completely different peoples! So we started writing to each other, as academics will do, and then we decided to meet each other. After a rather cool sort of squaring off, we began to realize how much more was to be had by putting our stories together and seeing why it was he'd got one picture and I'd gotten another. At the time he did his work, there was only one narrow mud road following the old Arab slave trail and security was minimal. Also there was no one to guide him into the forest, so he worked mainly in the villages along the trail, where the Pygmies trade meat for plantation products and provide labor for the villagers' farms. So he saw Pygmies behaving as they do in villages, and they will not display what is sacred to them in the pristine village.

When I went into the Belgian Congo in 1961 I stayed with American anthropolo-

CONTINUED ON PAGE 124



We ran into a little trouble with our experiment, dear. Don't hold dinner, just leave some garbage in the sink!

FICTION

## AT THE EMBASSY CLUB

BY ELIZABETH A. LYNN

The story was first told to me in a bar on Nexus where people like to talk about things that happen to other people. I had gone there looking for Stargatean named Hero who, rumor had it, had spent six months as a slave on Chetar. I did find him. But I

brought some drinks, and that was when I first heard about the navigator on Tendera who fell in love with a high-class engineer. It was a grim tale, and as it turned out, the engineer who told me the story got it wrong. But I never went back to connect her.

The second time I heard it, I was at the Embassy Club in Belka, on Tendera. I was sitting and drinking with the first assistant secretary to the ambassador. He was buying the drinks. I had been sent to interview the new ambassador, and the f.a.s. had been assigned to keep me entertained until the ambassador could find the time to see me.

He was an excellent host. We took an aerial tour of the city, and he pointed out the principal mansions (white stone towers behind high gates), parks (many flowers, and trees like giant feathers), and bazaars. We dined at a very discreet restaurant. Eating dinner piece in private on Tendera, and though there must have been other patrons, we never saw them. After dinner, the f.a.s. suggested we ride at the Embassy Club. I was surprised. No embassy club in the Living Worlds presents much in the way of nightlife. But it was my first night on Tendera and a little too soon to go out and soak up local color. I wasn't sure I could recognize it even if I could find it.

The Embassy Club on Tendera is an agreeable place. There is no public lounge. Patrons sit in screened booths and push a button (it rings a chime) to summon a waiter. The booths

PAINTING BY H. R. GIGER



look onto an inner court that contains a fountain and a magnificently tended garden. We both wore masks. I'd bought three—panofus—an unembellished mask with eyeholes—on the ship from Nexus. The one I wore was of black-and-blue-patterned silk and covered my nose and forehead. The first assistant secretary's mask was more elaborate. It was red, with two pearls in the lower left-hand corner near his ear, and concealed all of his nose and his cheekbones, forming a break over his nose that shadowed his mouth. In it, with his white Tandera robe flowing to his feet, he looked like an elegant, alien predator.

Everyone on Tandera. I had been told high caste to low caste, politicians to street thieves, wears a mask except Statecaptains, who wear anything they please, and even they will not walk maskless through Sekkian streets at midday. The custom originated with the early colonists over three hundred years ago, had changed from being a practical defense against the sun into a delicate social mechanism. Wealth, caste, and even political allegiances can be reflected in ones mask. To keep myself from asking stupid questions that the fairs would have heard before—thus embarrassing both of us—I said, "I once heard a story about Tandera in a bar."

His lips curved. "I bet I know which."

"Do you? It was the one about the navigator and the girl."

"Was it a Hyperbar?"

"As a matter of fact, it was."

"They like to tell that story in Hyperbars, and they always say the man was a navigator." He pushed the button to signal the waiter. "Another?"

"Sure." We were drinking a frothy white liqueur called *bassai*. It tasted like milk, except for the kick. "Not true?" I asked, after the waiter brought the connies and we were alone in our booth.

"Not that part of it. He was actually an embassy staff member."

"Did you know her?"

The f.a.s. nodded. "He was first assistant secretary to the ambassador when I was a lowly com-clerk."

I wondered how many questions he would answer. "When did it happen?"

"Seven years ago. Just after the Federation embassy was established here. As you can imagine, it was a sticky situation."

"And did it happen the way?" I paused hopefully.

"I'll tell you what happened," the f.a.s. said. "I'll even tell you the man's name—no, better not let's call him Ned." He smiled. He had white, very even teeth, which gave his face an even stronger look of the predator.

"Ned had been on Tandera for a year since the opening of the embassy. He thought it was long enough. He was young but not inexperienced in the service. He had been born-on Enricher, trained on Nexus, and had been second assistant secretary on New Jerusalem. He had a gift for languages and spoke good high-caste

Tandera. He liked Tandera food. He abhorred Tandera dances because he enjoyed them. He knew enough to avert his eyes when the grandmothers, who are the true rulers of Tandera, go through the streets in their sash chains.

"He understood the masks and how important they are on Tandera. He wore one everyone he knew wore one at the embassy, at parties, in the streets, everywhere, even in bed."

"One evening Ned went in his capacity as first assistant secretary to pay a call on a high-caste Tandera. Old Rakakum—his old fellow Tandera—admitted it—was a problem. He was the tribal head of his family respected for his name, which was ancient, and for his wealth, which was considerable. But he was ultraconservative and believed that all embassy staff members, the ambassador included, were cultureless, toothless barbarians. The Federation did not want to encourage such views, and so Ned—instead of the am-

the house when he saw her. She was leaning on the balcony railing. Her youthful skin was smooth amber; her hair was as black as night, her black eyes gleamed like pearls; her lips were like rose petals, her nose—"the first assistant secretary smiled slyly. "Suffice it to say that Ned stood in the inner court stamping like a fool and talking to himself in songs of very bad poetry. Remember, he had never before seen a Tandera woman's face. For a moment he could not look away from the stunning perfection of her profile."

The f.a.s. drank. I waited what seemed like a reasonable amount of time and then said, "Did she see him?"

The f.a.s. nodded. She looked directly at him, he saw her panicked start and heard her quick steps on the stone. Even then Ned did not realize what he had done. He actually opened his mouth to call to her. But old Rakakum entered the garden, and Ned's performance turned from a man consumed by passion into a diplomat.

He said all the right things and left as soon as he could. It was still light, though evening, and normally he would have gone home to eat. He did not. He returned to the embassy, where a com-clerk he knew happened to be working late. Ned asked him to locate a file. It was one he had skimmed earlier. Now Ned read it through, and when he had finished he knew who his amber-skinned beauty was.

"She was Sunya Rakakum, old Rakakum's sixteen-year-old daughter. Ned thought she was the most beautiful woman he had ever seen. He was thirty and had been in love before, but it didn't matter. He was smitten. He wanted to throw Tandera custom to the winds, to storm into her father's house and demand to meet her. But he knew—he was not a fool—that such behavior would immediately get him passage to Nexus and probably dismissal from the service.

So he did nothing, except to hint to his Tandera friends that he was finding his work dull and that if it did not seem forward of him to ask, he wouldn't mind the opportunity to attend a few parties.

"For all their love of privacy, Tandera aristocrats are high-spirited folk. They like to give parties. Since Ned was known to enjoy Tandera music—he could even play respectably on the smaller a flute—and could dance, he was of course invited to them. At each gathering he inquired politely as to the presence of any of the children of old Rakakum, suggesting, without saying so, that he had diplomatic reasons for his questions.

"He met old Rakakum's heir, an engaging young Tandera named Inara, with whom he formed a friendship, and several of Inara's younger siblings.

Eventually of a large ball given by one of the city's most prominent high-caste families, Inara said casually to him, with a gesture toward the women's side of the ballroom, "Ned, come meet my youngest sister! This is her first ball. Her name is

### There was a woman in his bedroom He thought then that she was a clairvoyant, a woman from the Court of Joy, hired by some well-meaning, insensitive acquaintance.

bassador himself or his secretary. Ned's boss, who was everyone knew a Very Important Man—was silent to make the vest.

Ned arrived at the home of this Tandera aristocrat at the arranged time, wearing an unassuming blue poncho and carrying the traditional visitor's gift, a flower. He was welcomed by the thinnish official household greeter and shown to the inside court.

"He strolled through the garden. It was winter, the lushest time of the Tandera year, and the plants were rich with blossoms. He admired the graceful stoned tower of the house and the pure lines of the fountain. The tower's six balconies overlooked the garden. They were stone, covered with trimmed ivy. The ground-floor chambers were Ned knew, the common rooms: kitchens, dining chambers, and bedroom. The second floor held libraries and music rooms, and the top four floors were the living quarters. Magnificently fabuous parapet-gables leered from the corners of the top-most story, to warn the casual glance away from the Women's Court. But Ned did not know that.

"He was gazing at the topmost story of

Sunya, and she's never met an owl-wonder.

This was his beloved. Ned trembled. Inani brought Sunya to him. He bowed. She wore a gauzy green mask like the wings of a butterfly, through which her dark eyes gleamed. She was tiny, a sylph, and her voice was soft and delicate, as the chiming of bells. Ned danced with her twirls. At the end of the second dance he raised everything and said to her, "May I see you again?" As he said it, his voice broke like a boy's.

"Sunya knew a handsome stranger when she saw one. She considered her father's reaction, but after all, her brother had introduced them. She tipped her masked face to him and said, "Yes."

The next day Ned appeared at the embassy to find a package waiting for him. It contained a brief note suggesting that he walk in the Pavilion of a Thousand Flowers that afternoon at a certain time. It also contained a blue parrot, ordinary enough, except that two diamonds had been set at the outer corner of the left eye.

"Ned touched the mask to his lips. He worked like a madman all morning and at the time named in the note he walked, wearing the diamond-studded mask, through the arched gate of the Pavilion of a Thousand Flowers.

"Sunya was there. They ambled through the pavilion with her hand on his arm, and whatever they said to each other seemed good to them both. After an hour, which seemed like minutes to poor Ned, Sunya murmured that she had to leave but that she would be at the house of a certain Tandera family that night, a small gathering could he come? Ned recognized the name as that of someone he knew, a liberal aristocrat who would not mind a surprise guest from the embassy. He promised her that he would.

"He did go to the gathering, and he wore the diamond-studded mask. Sunya was delighted. She thought Ned was the most wonderful person she had ever met. They met every day for a month; they stalked in the parks, they danced, they talked. He told her tales of other worlds. Sunya, who had never been past the gates of the city she had been born in, charmed them in. She told him of her family, her brothers and sisters, her father, who was, she said sadly quite silent, and her grandmother, the family's true head, the peasant, inaccessible Chrysanthemum Rakakum. Inani, who thought his father's attitude toward outsiders too parochial, saw no harm in this. Perhaps she was wrong. But he saw his little sister bloom like a rose when Ned entered the room, and he could not say to her, "You should not see so much of him."

"No one knows how old Rakakum came to hear of their romance. Perhaps a slave went let something slip. Perhaps Inani was careless. Sunya herself may have been indiscreet. But one day Ned arrived at the Pavilion of a Thousand Flowers to find, instead of Sunya, a formal messenger from the Rakakum household, who handed him

a letter. Thinking it a note from Sunya, Ned tore it open.

"It was a stiff missive from Papa Rakakum, informing him that Sunya would not be walking in the park with him now or any time. She was not, the letter said, interested in continuing her acquaintance with a dastardly knave.

"Ned realized at once what had happened. Old Rakakum had been misinformed. Someone had gossipied. With the letter in his lap, Ned marched to the Rakakum mansion, determined to explain to Sunya's father that his intentions were entirely honorable. He loved Sunya; he wanted to marry her. He arrived at the house and asked the maid to inform old Rakakum that the first assistant secretary from the Federation embassy desired to speak with him. The thukru did not bother to enter the house. He merely explained that Rakakum had already commanded that Ned not be admitted.

"Undaunted, Ned went to the embassy

She sat on an  
embroidered mat, she was  
wearing silken  
robes, a red mask, and a  
great, jeweled  
headdress. All Ned could see  
of her was her  
black eyes and her hands. ■

and wrote a letter to old Rakakum. It was returned to him, unopened. He tried again to gain entrance to the house. This time Inani came to the door.

"I am sorry," he said, laughing, as Tandera do when they are embarrassed, "but my father does not want you here."

"I could just speak to him—" said Ned. Inani shook his head. Then let me see Sunya, just for a moment. He did not want Sunya to think that he had abandoned her or ceased to love her.

"But Inani simply stepped back and began to close the door. Ned put his foot in the crack. Is she all right? he demanded, suddenly frightened. The colonists on Tandera had been isolated for three hundred years, and though they seemed decent enough, he had heard stories. . . . He could tell nothing from Inani's face, because he could not see it.

"Tell me she's all right!" But Inani would not answer. They wrestled for a moment over the doorknob, then Ned realized that he was behaving like an idiot, and he left peacefully.

"He wrote letters to old Rakakum, to Inani, to Sunya. They were returned. He went

to parties. Sunya was never there. Inani and the other Rakakum children avoided him. He did not know what to do. He tried to bribe Rakakum's servants to let him in the house, and though they cheerfully took his dakras, he did not get into the house. He began to drink more than was good for him and to laugh too loudly at balls. After a while he stopped receiving party invitations from his high-caste Tandera friends.

"Word came to the ambassador that his first assistant secretary was in trouble over a Tandera girl. Normally he would have left such a situation to his secretary, but he was on Nexus, enjoying a rare vacation. So the ambassador tried. He called Ned into his office and spoke to him. Ned stopped going out and spent most of his waking hours at the embassy, and when he went home, he did not drink. But he lost weight steadily.

"One day Ned arrived home to find Skumjee, his servant, gone. Ned was annoyed but not surprised; he knew that his luck had turned bad and that sooner or later something would happen to him—he's house would burn, or he would fall sick and be ordered to leave Tandera—and he assumed that Skumjee had recognized the ill luck and had decided not to be around it. He called a few times, and then he walked into his bedroom to do what he did every day when he got home: which was to lie on his bed for hours and stare blankly at the ceiling.

"There was a woman in his bedroom. She was sitting on his bed with her back to him, and he assumed that she was a thief. But her robe was high-casta silk with flowers embroidered on the sleeves. He thought then that she was a dancer, a woman from the Court of Jay, hired for him by some well-meaning, insensitive acquaintance.

"He started to order her out of the bedroom when she turned her face toward him. She had Sunya's glowing eyes and streaming blue-black hair. But across her delicate features, like a barbed ornament, lay two diamond-shaped scars, one on each cheek. Ned had seen such scars before. They were made by the heated blade of a ritual knife and are the mark of complete dishonor.

"Honored! he drew back as the woman said his name and stretched her arms to him."The first assistant secretary paused to drink.

"Another one?" he said, gesturing to my empty glass. He smiled when I shook my head no.

"The woman was Sunya, of course. Old Rakakum was more conservative than even the children had thought. Scarring is a not-uncommon punishment among the lower castes, but an aristocrat should not take the club to his youngest and most naive daughter. It must be done by a shaman. Those who have been branded are forbidden to wear masks. They are called *eskri*, the facelies ones, and they live—they must—in the outermost circles of the city.

nearest the walls, and work in butcher shops and sewage plants and mortuaries, handling offal and the dead.

His voice was somber. I sighed. That was how I had heard it, less well told except in the version I had heard, the poor lover had walked into his bedroom to find the girl's still-warm corpse.

"So what happened to him?" I asked.  
"You said he was first assistant secretary. I assume that he resigned or was transferred elsewhere."

The faul's smile broadened. He shook his head. Neither Ned was impulsive but not a fool, and he was a diplomat. He comforted Sunya in all the ways he knew, and then he went to the secretary his boss who, although he was a Very Important Man, was not a fool either.

He told the secretary Everything. The secretary listened, and when he had finished, commented that though Ned was not a fool he had been doing his almighty best to behave like one. "Why didn't you come to me sooner?" he said. "Bring your girl to me! Ned brought Sunya through the city right to his house. She walked proudly, spine straight, scorning fears. The secretary bowed deeply.

"They talked through the night. The next morning, Ned presented himself at old Rakakum's house with a request written on the ambassador's personal and private stationery bearing the ambassador's seal. It was elaborately couched in diplomatic

language, and it said that the ambassador wished Ned to be admitted to the presence of the one person in the house whose word was law even to Rakakum, his mother, Chiyasathi Rakakum.

Did Rakakum turned. But he could not forbid the request, not if his mother chose to honor it. She did. She was old enough to believe that even tradition should be subordinate to her will, and besides, she had never met an offworld barbarian, and she was curious. She received Ned in the garden. The faul stood behind her holding a bare curved knife as a reminder to the dishonorable kins of her position.

She sat on an embroidered mat, she was wearing silken robes, a red mask, and a great jeweled headdress. All Ned could see of her was her black eyes and her hair, which were as soft and delicate as a young girl's.

"He said—Sunya had told him what to say—'O most august lady, I bring you loving greetings from your miserable granddaughter Sunya.'

"Chiyasathi Rakakum said, frowning at Ned. What have you, a barbarian, to do with my granddaughter, and why is she misnamed?"

And Ned took a deep breath and told her Everything. Chiyasathi Rakakum listened and was angered and deeply grieved. Her exitable son had neglected to consult either her or the shaman about her granddaughter's transgression. Such

behavior was unfilial and untraditional! It was also, she reflected, stupid. She wondered what the barbarian thought he could do about it.

"But she was not a woman to display her emotions like goods at a fair. She studied Ned blandly and said—Sunya had warned that she would—Sunya has been wronged, but my granddaughter is now okum. There is nothing to be done."

"Ned bowed low to her and said softly, 'O grandmother of my beloved, but what if there is?'

"The next week Ned was gone from the embassy, taking the secretary (it is known, some overdue leave). He went to Enchanter...he had, after all, been born there—and Sunya went with him."

"Enchanter!" I repeated. The Enchanter labs specialize in medical transformations. If you want to change your smile or your sex, they can do that; if you want to look like an elephant, or a tiger, or you own mother they can do that! Of course, were they married than?"

"Later," said the f.a.s. "When they came back to Tandina."

"How did old Rakakum take it?"

The f.a.s. shrugged. "He was furious. But Chiyasathi Rakakum had given the lovers her permission. Not only that, she deposed Rakakum as thular head of the family. Inani has that honor now. The barbarians she said had more sense than her son don't."

He looked at his watch. "But come!" He rose. I followed him as he weaved his way expertly around the booths, glad that I had not accepted that third drink.

We entered another booth. It was large enough for four, and there were two people in it already. The f.a.s. made introductions. The ambassador rose and shook my hand. He was lean, not tall, with steady, gray eyes. Enchanted men tend to be beautiful, and his mask—a simple blue pancho, with two diamonds set at the left-hand corner—did not conceal his good looks.

"A pleasure," he said cordially. "May I present my wife, Sunya?"

Her skin was flawless amber. Her eyes and hair were black. Her lips were rose petals. She smiled and stretched out a hand, I stammered and bowed over it. We sat for a time, and then the ambassador said he would see me in the morning for the interview; the f.a.s. would tell me the time, and was he keeping me entertained? I said yes.

The f.a.s. and I said our good-byes and went back to our booth, and I bought the f.a.s. a drink.

"Did she look like that before?" I asked.

"I don't know," said the f.a.s. "I was only a clerk. I never met her."

"That's one hell of a mask," I said. And we drank buzzes while I meditated upon love and masks and the skills of the Enchanter labs and upon the two diamonds—like acers made by a knife—set, one on the left, one on the right side, of Sunya Rakakum's perfect face. ☐

+ G. SAWYER

"I used to feel sorry for him until I found out most of it's a fibrom."

## EXPLORATIONS

CONTINUED FROM PAGE 4

open. Professional engineers would have had a hard time duplicating the structure today even with advanced knowledge and the use of modern equipment.

Coral Castle is a wondrous American landmark, but how much of a mystery is it? I visited the site recently accompanied by two University of Miami geologists, Daniel Cottrell and Douglas Irion. With their assistance I began to piece together the remarkable construction techniques of Ed Leedskalnin.

The largest rock in Coral Castle is the centerpiece of the north wall, which the guidebooks describe as weighing 30 tons. We found it to be virtually square, ten feet four inches on a side. Its maximum thick-

ness is three and one half feet, but there is a large scooped-out depression on one side so the rock is only two feet two inches thick at its center.

According to Cottrell and Irion the rock is made of calcite ( $\text{CaCO}_3$ ) and a block this size would weigh about 30 tons, just as the guidebooks say. But this estimate is for solid calcite, the Florida limestone Leedskalnin used is heavily burrowed and highly porous. The porosity or amount of empty space in the rock, ranges from 30 to 60 percent, I am told, which means the rock weighs 30 to 60 percent less than prior calculations indicated. Thus this 30-ton rock probably weighs only half that amount especially when we consider the scooped-out depression on one side.

In the world of publicity a 100 percent overstatement isn't unusual. And we can't

get too smug about our corrected figures because after all 15 tons is 18 tons—whatever it weighs—is still an enormous piece of rock, much larger than any of the blocks in the Great Pyramid. The question remains: How could a skinny, middle-aged man move such large objects?

Although levitation and antigravity grids have been proposed as possible explanations, it is more likely that Leedskalnin used a block and tackle to move the giant stones. For one thing there are photographs of Leedskalnin lifting a large rock by means of a chain and pulley suspended from a 30-foot-high tripod formed by three telephone poles. (The photo may have been taken secretly without Leedskalnin's knowledge.)

Hanging from the top of the tripod is a chain fall. Auto mechanics are familiar with such a device, which can be used to lift the engine out of a truck in a matter of seconds. Leedskalnin's rocks weighed more than the biggest truck engine, to be sure, but he had years to devote to his project. For him, building the Coral Castle was not a weekend hobby to be pursued in his spare time; it was the dedicated purpose of an entire lifetime.

Although Leedskalnin never let anyone watch how he moved the rock slabs, we can speculate that after lifting a rock with his tripod and chain fall, he swung the slab back and forth and then dropped it in a new position. After doing this he presumably tilted the tripod over it. In this way the tripod and rock could gradually "walk" across the ground. After each a stone was raised, Leedskalnin could have placed other rocks underneath it to keep it propped up while the tripod was moved.

It's interesting to note that the large eight-foot blocks in the outer wall were not moved far. They were cleared just outside the garden boundaries then raised on end into place. Most of the other limestone was cut from the ground beneath the castle. In a nearby shed we found the chisels Leedskalnin probably used when he cut the slabs out of the ground. He may have pounded the chisel into every few inches of rock and, when the surrounding limestone was cleared away, removed his selected piece. He may also have used wooden wedges which when wet expanded cracking the rock.

As for the swinging nine-ton gate, it rests on automobile wheel bearings and is held in place at the top by a metal rod that extends through a hole in the archway. It is not known how far into the rock this rod extends or how Leedskalnin originally managed to balance the gate. It seems likely that he stacked the rock into position and held it vertically while the arch was placed over it. Then the rod was inserted through the holes in the arch and the rock itself. How he located the exact balance point of this enormous piece of stone remains one of the marvels of Leedskalnin's lifework, the remarkable but not so mystifying Coral Castle.  $\square$

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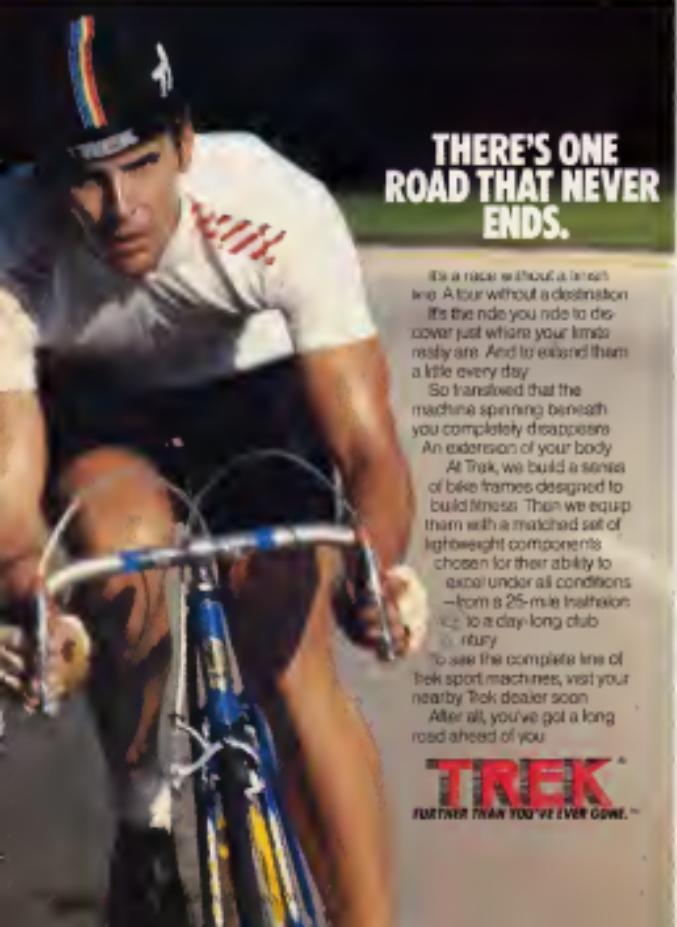
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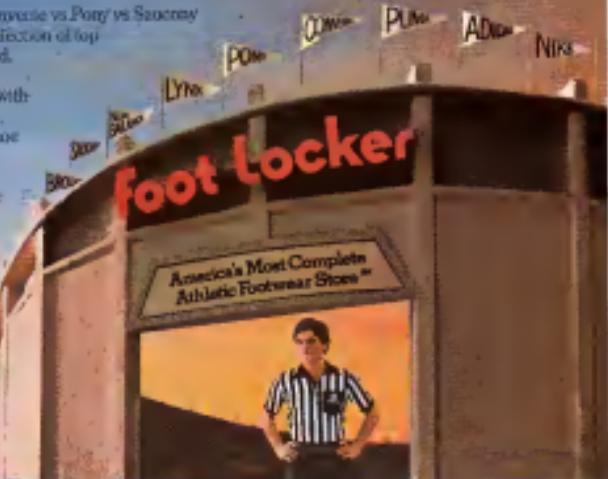
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## BOOKS

CONTINUED FROM PAGE 18

landmark book *The Forever War* and his recent *Worlds Trilogy*, recalls, "I had always written very slowly. I would do a novel in only one draft, but it would take me eighteen months. I went over to a word processor because I thought it would speed me up. But it didn't. Other writers seem to write much faster than I do. I agree with the general principle that you ought to get all the text down first and then cut. But that's not a principle I've been able to apply myself."

Algis Budrys, author of the acclaimed novels *Rogue Moon* and *Michaelmas*, has other objections. "I have noticed that many writers who have word processors tend simply to rearrange paragraphs rather than do a true rewrite, possibly because you can see only a few paragraphs on the screen at one time. Also, I know writers who are dead broke and should be buying groceries or paying the rent, but instead have bought word processors. This is not rational; it's just blind faith in technology."

Philip Jose Farmer, author of the best-selling Riverworld series, has a different kind of skeptical perspective. Currently he types a rough draft, corrects it by hand, employs a typist to produce a final draft, and makes a few final corrections before

he hands the manuscript to his publisher. He's thinking of switching over to a word processor not because it might speed up his work habits but because he simply likes the idea of playing with it. "It's a lot of fun moving those letters around on the screen. It's a great toy," Farmer says.

Probably the most adamant holdout against word processing among science-fiction writers is Piers Anthony. Anthony publishes half a million words of fiction a year, but he uses an old manual typewriter and writes his first drafts in longhand, on a clipboard, because this way he can continue writing wherever he goes. "I'm working literally almost all the time that's available if I'm not sleeping or eating. Actually, I write even when I'm eating." He says he wouldn't want to depend on any gadget that could be affected by a power failure.

Anthony's large volume of work, all of which goes through three separate drafts, tends to dislodge the claim that writers need word processors to produce a high output. History tends to confirm this. More than a century ago Honore de Balzac wrote nearly 100 novels, and about 50 others in incomplete drafts, in just 18 years, using nothing more advanced than a quill pen.

A more convincing argument for word processing is that it will ultimately bring down the costs of book production—a benefit that could be passed on to readers in the form of lower book prices. What fol-

lows is the ideal scenario:

The writer types his book on a word processor and saves the text on a magnetic disk. He sends a duplicate of this disk to the publisher. There, an editor loads the text from the disk into the publisher's word processor, makes revisions, and transfers the new text onto another disk. This is passed to the printer, who uses it to create pages directly, eliminating the operations of typesetting and proofreading.

Three obstacles make this scenario impractical. First, not all writers want to use word processors. Second, publishers are reluctant to make the big investment in word-processing equipment. Third, there's a lack of standardization. With so many different systems currently on the market, chances are that the writer's disk will have to be converted to a different format before it can be used on the publisher's system and that another conversion will be needed to make it work with the equipment owned by the printer.

However some computer-book publishers have already found that, even with all these hassles, it's still worthwhile to get writers to submit their work on disks whenever possible. So it seems that ultimately all writers will be under pressure to switch over to the new technology, simply to suit the needs of book production.

And at that point, the typewriter will become as obsolete as the quill pen. **DO**



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# EARTH

CONTINUED FROM PAGE 18

Jack Nicholson, Linda Kasey, and Shaun Cassidy turn up on the donations roster and stop by for tours of the headquarters.

More than anything else, however, what catapulted TreePeople into the limeight was the catastrophic winter of 1982, when Los Angeles was hit by three weeks of the worst storms in its history. When people called the fire and police departments, "they were told, 'Sorry, there's nothing we can do for you, we can't even get to you.' Trying to call TreePeople! 'Despite their millions of dollars in equipment, they recommended us because they knew we could get our hands on a lot of people fast.'

With a couple of extra phone lines and a ham-radio dispatcher, Lipkis and his staff mobilized 3,000 volunteers. They sandbagged and hundreds of yards of plastic sheeting, dammed floodwater, and shoveled mud, saving 1,200 homes in ten days.

This landed Lipkis on the Tonight Show. Standing out from behind the curtain, Lipkis handed host Johnny Carson a small bag sealed with a paper milk carton.

"So this is going to be a redwood?" quipped Carson.

"It's a redwood," Lipkis shot back.

The audience exploded in laughter and Carson turned beet red. But he was so impressed by Lipkis' efforts that he wrote TreePeople a check for \$15,000 during a commercial a few moments later.

Carson's generous donation came at a fortuitous time. Lipkis had just learned of a study by the Los Angeles Department of Planning that made him more eager than ever to proceed with the urban forest. The department, it turned out, had its own reasons for wanting to plant 1 million young trees. Research showed that in 20 years' time, the full-grown trees could filter 200 tons of particulate matter daily, bringing the city to within 80 percent of meeting the cleaner-air standards set by the Environmental Protection Agency. The calculations also indicated that it would take the city 20 years to plant the saplings at an estimated cost of \$200 million.

"I told the city that TreePeople could plant the million trees in just a couple of years at a fraction of the cost," Lipkis explains. "I had just come through the floods, and saw environmentalists and members of four-wheel-drive clubs working hand in hand to save the city. When people dropped their ideological barriers, they accomplished miracles."

Lipkis got a local advertising agency to volunteer its services, and now everyone in Southern California is being reminded daily to start digging. Slogans such as *turn over a new leaf*, *LA and Urban REEF* are seen on 400 buses and 780 billboards. Seventy radio stations broadcast the urban-forest message, and a commercial featuring Gregory Peck airs on all local, network, and cable TV channels. Tree

nurses throughout Southern California are displaying banners identifying themselves as URBAN FOREST HEADQUARTERS.

Lipkis' low-budget, big dreams are magnetic. People feel good supporting his work, and he has attracted several loyal and well-placed friends. Los Angeles Mayor Tom Bradley supports TreePeople's work, as does Senator Cranston and local city councilmen. But as environmental concerns become hotter political issues, Lipkis shows savvy in remaining completely neutral. He refused to endorse Bradley's bid for the governorship in 1982. "The state of the environment should stand above politics because it's an issue so basic to everyone's survival," Lipkis believes. "No one can afford to lose. And since TreePeople has a lot of popular support, it's wise for politicians to support us. That's why I expect President Reagan to come play with us. His belief in volunteerism is aligned with our thinking."

By March 1984 TreePeople had planted only 250,000 trees, but that figure represents a 400 percent increase over the previous three months. To boost the count, General Telephone and Electronics (GTE) is lending the organization 675 of its employees. On paid company time they are giving classroom presentations and distributing trees to approximately 100,000 schoolchildren to plant at home.

Media attention, which has been mounting steadily as the summer approaches, also helps. A local television news program recently ran a five-day miniseries on TreePeople. The same channel updates the tree count as a regular part of its evening news. Television crews from Sweden, France, Australia, and Japan have traveled to Los Angeles to shoot documentaries on TreePeople. A recent radio show on the organization that aired in Tokyo received more listener response than any other broadcast in the station's history. One major Japanese corporation wants to start a TreePeople in its own country.

Last fall Lipkis addressed the United Nations' annual conference of nongovernmental organizations. These 600 representatives from human-service organizations around the world convened in New York City to discuss their participation in the UN's 1985 Year of the Youth campaign. One aspect of the campaign is a worldwide planting of 1 billion trees. Lipkis was invited to advise the group.

When Lipkis returned to Los Angeles there was a phone message from the U.S. State Department. A visiting official from Lesotho in southern Africa wanted to see what sort of community involvement there was in environmental issues and requested a meeting with Lipkis.

Even if all 1 million trees aren't planted in time for the Olympics, the group's message will still be heard. Lipkis explains that TreePeople is about "bridging people." Or as one associate puts it, the urban forest is "a test case not for planting trees but for uniting people in a common cause." **DO**

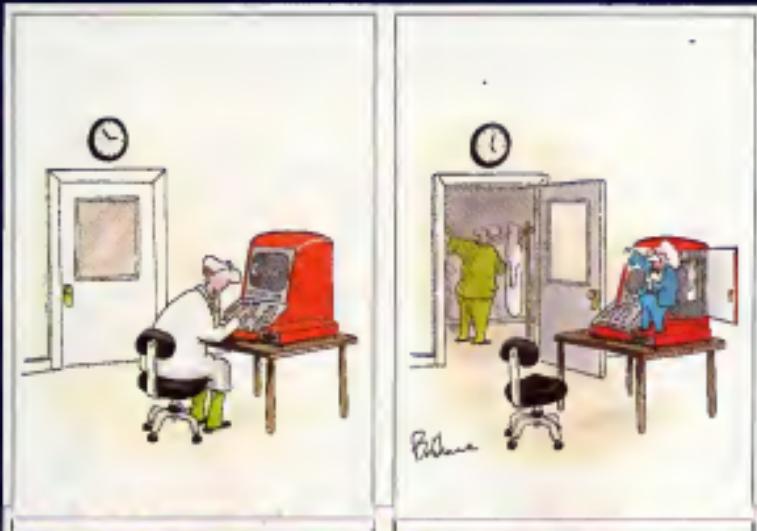


Bill Lee

Dr. Mike Sacks  
Robotics professor, the greatest educational  
team on Earth

## CIRCUITS MAXIMUS

A quirky look at the world of robotics



Bilbo



Go Bilbo

"It doesn't want to work on the assembly line; it wants to redecorate my office."

**IF YOU VOTE FOR ME: I'LL CUT ALL  
TAXES, BALANCE THE BUDGET, BRING  
PEACE ON EARTH, CLEAN  
UP ALL TOXIC WASTE  
SITES, HALT THE  
RISING CRIME  
RATE,  
ELIMINATE  
THE DRUG  
PROBLEM...**



Sulli



"But you can't quit, you're the only piece of  
high-tech hardware I've got."



"Now, not only is this model a sophisticated  
high-tech hardware, it can play hopscotch."



"You're the latest product from Silicon Valley, no doubt!"



"That's the trouble with you atomic-powered robots, just when things start to get interesting—meltdown."



"Look, just because my intelligence is artificial doesn't mean my problems aren't real!"

•The internment  
of any UFO crewmen constitutes  
an unwarranted  
deprivation of their freedom to travel. •

## AUTH MATTER

We warned the court to consider the constitutional rights of visitors to this planet," says Larry W. Bryant, a career civil servant and an administrator for the group Citizens Against UFO Secrecy (CAUS). According to the government's own documents [exculpate], have been detained illegally and denied due process of law. So last summer, Bryant decided to file a petition for a writ of habeas corpus extraterrestrial claiming that the Air Force maintained custody over one or more co-captains "dead or alive." I crashed flying saucers.

"This was my latest attempt to break open the cosmic watergate," says Bryant, who has tried for the past 25 years to blow the lid off the government's alleged cover-up of UFOs. His petition held that the capture and internment of any of the UFO crewmen constitutes an unwarranted deprivation of their freedom to travel, and that any postmortem on their corpses violated their right to privacy and their right to be claimed intact by their relatives. As evidence, Bryant cited an authentic FBI memo dated March 22, 1950, which notes that the Air Force had recovered three flying saucers in New Mexico, each of which contained the bodies of three-foot-tall humanoids dressed in a fine metallic cloth.

The Air Force treated the petition as a serious matter, says its spokesman, Captain John Whitaker, "just as we would any other court summons." Whitaker checked with the foreign-technology division at Wright-Patterson Air Force Base and the space-systems division at the Pen-



## UFO UPDATE

the crashed saucers and retrieved occupants were not coming forward because they had not been released from the oaths of secrecy they had taken while in service.

Royce Lamberth, the assistant U.S. attorney appearing on behalf of the Air Force, moved that the petition be denied on technical grounds. The person bringing the writ or his attorney has to be quizzed, he says, and obviously since they have never talked to these extraterrestrials or met with them, they cannot represent them.

The judge, ex-judge-janner Oliver Gascon, ruled in favor of the defendant. "I didn't think the case had any merit," explains Gascon, "though it was imaginative and it did create quite a bit of interest."

The judgment left Bryant unfazed. "It's just a momentary setback," says the fierce civil libertarian, who is planning a renewed legal attack. So the E.T.s, if they exist, will just have to cool their heels in the federal dobor until Bryant gets another day in court.—PATRICK HURGHE



### ONE-OF-A-KIND PRIMATE

At first glance Oliver looks like a cold chimp, but with a few variations. His ears are at the top of his head, rather than at the center. He has a nose that protrudes like a human's rather than the flattened mug of a chimp. And he walks upright.

No apes walk upright all the time—they prefer to walk on their knuckles. But walking erect is natural for Oliver. He was reportedly discovered in the Congo about a decade ago, and no one has yet determined what he is.

Some say he's a new species of chimp, a reasonable possibility in Central Africa. Others claim he's a mutant, but if he is, he has numerous mutations. Still others suggest he's a hybrid. One test gave him 47 chromosomes, which places him between the ape's 48 and man's 46, suggesting a crossbreed or perhaps Down's syndrome. But Oliver's intelligence

seems to rule out the latter. "I've never seen anything like him," says Ralph Heiter, an animal behaviorist who heads Gentle Jungle, a Burbank, California, organization that trains animal actors and also houses Oliver. "His intelligence is extremely high."

Oliver will watch TV Westerns and action programs for hours on end. A chimp gets bored after only a few minutes of TV. "We've had everybody, from the Sesame Street group to anthropologists, observe him," says Heiter, who was one of the producers of *Galaxy* and who is currently coproducing NBC-TV's *Mr. Smith*. "We have never had anyone say he's a chimp, nor have we had anyone say he's baby bigfoot. Whether professional, amateur, or layman, all describe him as an unusual primate." —Alan Darling

"No fact is so simple that it is not harder to believe than to doubt at the first presentation." —Lucrèce

### HOST STORY

When people die violently or suddenly according to psychic Shawn Robbins, their unresolved emotional attachments prevent their spirits from leaving the earth. The result? Robbins claims that New York City, a town with a death toll exceeding 10,000 a year, is not only congested with traffic but is bumper-to-bumper with ghosts.

"I once grabbed a seat on a bus," says Robbins, and my heart began beating wildly. So that night I checked with the police and learned that a man had died of a heart attack on that very day, bus, and seat after being mugged. You see," she adds, "ghosts leave behind their energy and that's how I know they're out there."

Robbins spends a lot of time ghost hunting on Manhattan's posh Upper East Side. "This area is the most affluent," she says. "So it has the most crime. You can barely find an apartment that hasn't been the scene of a murder."

that has left off sweet one poor soul still roaming around restlessly.

In fact, Robbins claims, ghosts are often to blame when new apartment tenants become plagued by feelings that they're not alone and that someone is going to murder them. That's when I'm called in. For fifty dollars I'll contact the tortured soul and help my client make peace with his new roommate.

O Scott Rogo, however, a parapsychologist who was a consultant on the movie *Poltergeist*, points out an obvious flaw in Robbins's ghost theory: If ghosts resulted simply from people dying under tragic circumstances, he says, "the whole world would be cluttered with them. Yet documented hauntings are relatively rare." —Judy Katz

"What we were watching that evening was the delirious of a world on which too many men came out to look at the stars when they should have been dancing."

—Ronald Burgess-Heldane





DARTH VADER IN FLORIDA

Thousands of Floridians tuned in to *Table for Five* on their Stone Communications/ Home Box Office channel recently. But in the middle of the cable feed, there was an unexpected surprise—a figure cast in black appeared on the television screen and began to talk in a smirky, mechanized voice.

"He had on a mask and cape. He looked and sounded exactly like Darth Vader of Star Wars fame," says Metro-Dade cable coordinator Tony Bello, who viewed the intruder on videotape.

Speaking in a synthesized voice, Darth Vader appeared twice in one evening, claiming he was going to "make scrambled eggs out of Stone Communications." He said that Stone's

prices for HBO were too high and that he would sell people black boxes that could unscramble cable-channel signals for free.

The signal decoders he referred to are illegal in Florida. People caught with the boxes can spend six months in jail and be fined up to \$500.

"It was probably a practical joke," Bello surmises. He gave out a telephone number for the boxes, and it was the phone number for the Biscayne service-report office.

Who was that masked man? So far, no one has been able to come up with a clue. Local police tipped off that Darth Vader would strike again, set up a surveillance network. But the investigation came up empty-handed.

"We believe it was a stunt by someone who knows a lot about electronics. If the industry does know how it was done, it's being kept secret. After all, they sure don't want other people to try it," Bello emphasizes. Of course, what Darth said was not nearly as important as the fact that he got on the air without what if a lunatic could get on TV and say he was with Civil Defense and that a nuclear war had started? It could be a real serious problem."

—Sherry Baker

"And there's a dreadful law here—it was made by mistake, but there it is—that if anyone asks for machinery, they have to have it and keep on using it."

E. Aszkenasy

### LASER-GUN CONTROL

At a Boston science-fiction convention, according to organizer Pat Vandenberg, guests were waving toy laser guns about the hotel lobby. Unaware these were fakes, the manager called a SWAT team. When they arrived, one science-fiction buff raised his laser and fired a harmless beam of light into a bulletproof vest. Fortunately, says Vandenberg, "the SWAT team didn't fire back."

This incident prompted Vandenberg to alert science-fiction fans of the need for laser-gun control. Ap-

gun could pack enough wallop to blind an eye at close range.

James Dennis, chief of the Laser Products Unit of the National Center for Devices of Radiological Health, claims that laser manufacturers are already adequately regulated. "All laser products must carry a label warning of their dangers," he points out. "In addition, every laser must have a shutter on it to keep its beam from accidentally escaping."

For Vandenberg, this isn't good enough. She intends to post a warning on the invitations of future science-



fan conventions. "Participants who insist on bringing lasers," she says, "will be told to keep them in brown-paper bags in their hotel rooms under lock and key. Although we're not hiring armed guards to enforce the rule, we're sure everyone will comply. Despite popular opinion, science-fiction nuts are normal people too, and they don't want to get hurt." —Jeff Hecht



### THE BATS

First it was *The Birds*, then the Killer Bees, and now it's time to watch out for the bats. On a recent Friday the thirteenth (of course) a student at a junior high school in Leisa City, Florida found a dead Mexican free-tail bat on the floor of the school gymnasium. Analysis showed that the bat was rabid, which quickly brought local health officials. They quarantined the gym, then crissed in one dark night and flipped the lights on. "We had to start ducking," says Columbia county environmental health director Steve Knight. "Those bats were everywhere."

Knight found that the bats—some 500 of them—had squeezed through tiny spaces between exterior junctions and had roosted inside the gym's double-thick concrete walls. As far as they were concerned, Knight says, it was just like a cave. Outside, a row of mercury-vapor lamps attracted insects on which the bats fed. "They had everything they needed," Knight concluded. They had their

housing, and they had their dinner all laid out for them. It was bat paradise.

The school board quickly called in a local pest-control company which began wiping out the invaders who were by then perching on the steel ceiling girders and chattering loudly behind the gym's electronic scoreboard. First the pest-control people tried putting mothballs in every hole they could find, but the bats simply pushed the mothballs aside when they wanted to get out. Next they tried shooting the critters with 22 caliber rifles, but the cost of individual executions was \$10 per bat. "They could have gone on doing that forever," says Knight, "and it still wouldn't have solved the problem."

In the mean time the invasion had caused quite a stir. Alarmed by statistics that showed that as many as 40 percent of the bats could be rabid, the townspeople appealed to Knight and the school board with angry phone calls. A couple of times, Knight admits, felt like I was in a Frankenstein movie, where all the villagers have got the

torches lighted because they're going to burn down the mansion and get rid of the monsters.

In the wake of this public outcry, the pest-control company finally decided to get mean. They sealed up every possible exit, then pulled their trucks up to the gym and pumped carbon monoxide from the exhausts into the gym walls, turning the meanwhile bat cave into a gas chamber. According to Knight, that whole place is now a cemetery. It's like the pyramids of Egypt, one big tomb. —Bill Lawren

*"A day will come when the earth will scratch herself and smile and rub off humanity."*

—Robinson Jeffers

### GHOST LADY

Margaret Royal was out on a stroll one afternoon when she passed an acquaintance and nodded hello. Nothing strange about that. But when she got home and opened the newspaper, she was startled to discover that her friend had been dead for a week! Muses Royal, "I must've seen her ghost."

But that's no big deal for the woman who has earned the title, *The Ghost Lady of Bath*. Author of three compilations of British ghosts, Royal claims that her hometown of Bath is so awash with spirits that she has organized a ghost walk around town. As tourists follow the "ghost circuit" from one haunted to

another she says, they feel sudden shivers, smell hovering rotten odors, and even see apparitions.

Talks the sword-bearing macho ghost, for instance. He's revealed himself to only a few fortunate men, Royal says, "but many visitors complain of a sudden chill near his house indicating he was killed in a duel nearby. Another ghost thumps people on the back, and yet another—a tall woman in black—appears by a bed and rips off at the blankets."

Where do the ghosts come from? "When you see or sense a ghost," Royal explains, "you go through a bend or crink leading to another time. Some ghosts may even talk from the future," she notes, "and those entities may think that we're the spirits."

Katherine Jason



To investigate the relationship between violent behavior and metabolic disorders has been sending violence-prone people from all over the country to Dr. Carl Pfeffer at the Princeton Brain Bio-Center for treatment. Pfeffer, an expert in identifying chemical imbalances in the mentally ill, has found that abnormal trace-metal patterns found in criminals' hair are associated with various metabolic problems. And he has devised treatments that use vitamins, minerals, and chelating agents (substances that bind with metals) and that the body discharges easily. The results, Walsh says, have been "very, very encouraging."

HIS SUCCESSORS are so far only anecdotal, but Walsh and Saenger are now completing preliminary plans for a study that will involve testing and treating 100 very violent boys in a western state. "I decided to begin working with young people whose lives were not yet ruined," Walsh explains. "We're not going to try and empty out the prisons first, but that might be the long-range goal."

His grandest hope is that hair analysis could one day be useful not just in rehabilitating the violent but in preventing crime. His discovery of different trace-mineral levels in the hair of brothers from similar

environments suggests that the abnormal patterns indicate an inherent metabolic imbalance. Early screening of infants, he thinks, could identify children at risk so they could be given treatment before they develop problems. "I'm not suggesting it for now," he says, "but eventually, if we have a cure, I think it would be wonderful."

It remains to be seen whether Walsh's results can be duplicated by others and whether his study stands up to the criticism it is sure to receive. The effectiveness of nutritional therapy in modifying antisocial behavior has already been demonstrated by more than ten studies done in the last two years, says Alexander Schauss, director of the American Institute for Biosocial Research. In general the discipline of biobehavioral therapy—the study of the physiological underpinnings of our actions and responses—is gaining credibility as is the possibility that science will play a greater role in the criminal-justice system.

Behavioral scientists are excited about this turn of events; lawyers are blasé. ("The field is littered with the corpses of biological ideas that seemed promising at one time," says John Monahan, professor of law at the University of Virginia.) And civil libertarians see signs of 1984.

This new biobehavioral research raises controversial questions. One centers on the notion of guilt: If a person's biochemistry makes his behavior difficult to control, can

he be held responsible for a crime? If biochemical deficiencies are evaluated the way mental illness is, the consensus is that he can, even by the most liberal definition of insanity. And lawyers and judges are moving toward a stricter definition of legal insanity: inability to distinguish between right and wrong. The voluntary definition—the inability to control one's behavior—has proved too vague, though it is in force in many states. The notion that a broader insanity defense is kinder because it is unfair to punish people who are messed up, has turned out to be too simple-minded. Even criminals seem to feel they are better off serving their sentences as convicts than as hospital inmates. (In one instance when about 200 convicts were given a choice between serving out their sentences at a high-security hospital or a prison, 88 percent chose prison.)

Biobehavioral therapy could alter the nature of rehabilitation. Unlike job training, education, or counseling, it offers the quick fix, a promise of changing people physically. In some European countries this is already being tried, according to experts from the National Institute of Mental Health. Criminals convicted a second time for sex crimes are offered a choice of incarceration or parole while taking potent anti-androgen drugs to blunt their sex drives.

In another application, biobehavioral research like Walsh's could be used to pre-



"Well, it looks like a few more bugs will have to be worked out before we get breakfast in bed."

dict possible behavior that might be dangerous to self and others. Two factors that are considered when handing down a sentence or reaching parole decisions. Although techniques like hair analysis can't predict a person's behavior, they could add more grit to the actuarial mills used to gauge how he might behave. These calculations are now based on such factors as criminal history, age, and history of drug or alcohol abuse. Lawyers are still inclined to think that nothing could or should replace human judgment for predicting behavior, but biobehavioral scientists disagree. "I think these techniques will be able to redefine behavioral tests so they'll be better than our intuitive judgments," says Schauss, "though we're always going to be wrong with some people, of course."

Because of this margin of error, there have been some strong objections to using these methods for labeling people as potentially violent. According to some, by preschooling children, we might end up treating people for problems they don't yet have. "The whole idea of early intervention bothers us," notes Norma Rollins, director of the American Civil Liberties Union privacy project. Let's assume Walsh's test works and that it's objective. It's still an intervention in someone's life before he has done anything. Labeling creates other kinds of problems as well. Suppose these kind of screening tests become routine. People whose scores indicate they are at risk would be unlikely to find jobs or be accepted by schools.

The greatest potential threat to liberty posed by this kind of biobehavioral work is the assumption that certain socially undesirable behavior is a symptom of sickness. Calling violence a physical problem justifies the use of therapies to "cure" people of being the kind of people they are.

And it's not just the civil libertarians who are worried. Biobehaviorists themselves have thought about the implications of their work. "My greatest concern," Schauss admits, "is that in the future, we will want to make everyone normal." What will happen to the Van Goghs of the world?

Walsh himself is ruefully aware of how well-intended discoveries can serve unanticipated ends. He once converted a battery to be used in electric cars, which would help reduce air pollution and conserve petroleum. "Today there is only one commercial application," he says. "It's in every missile and warhead that we have. Now I'm waiting for the CIA to see this study and come to me and say 'Hey, we'd like you to do this project.'

Despite this fear, Walsh is confident that his work will ultimately help people. "I've known hundreds of people in prisons who have done terrible things," he says, looking back over his years as a prison volunteer. "And some of them are wonderful caring, terrific people who are my friends. I guess that's one of the reasons I did this to understand how wonderful people can do terrible things." **OO**



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# PREVIEW

CONTINUED FROM PAGE A

and your answers to these vital concerns?

**Mondale:** The Reagan administration has repeatedly tried to gut environmental programs that include the Clean Air Act, the Clean Water Act, and the Superfund, all of which I strongly supported while in the Senate and in the White House [The federal Superfund, maintained by a tax on gas and other chemicals, is used to clean hazardous waste sites]. The administration's neglect of the acid-rain problem has been especially serious. To date the EPA [Environmental Protection Agency] has cleaned up only six out of four hundred sites on the Superfund list. There are sixteen thousand documented sites around the country that threaten the drinking water of our cities and towns, all of which need cleaning up. The second major national problem is acid rain. Our nation must commit itself to achieving a fifty percent reduction in the sulfur dioxide thrown into the atmosphere each year. I would support a self-financing trust fund to pay for cleaning up lakes and streams and to develop and install technology to remove pollutants at their sources. The fund would be financed primarily by the polluters themselves so it would no longer be more profitable to pollute than to clean up.

**Hart:** I have done more to protect the environment than any president has. In my nine years of service on the Senate Environment and Public Works Committee I have led the fight to clean up hazardous wastes by taxing those who produce them and using revenues to increase the Superfund tenfold; eliminate acid rain by reducing sulfur dioxide emissions by half; repeal the Price-Anderson Act, which limits the nuclear industry's liability for accidents; eliminate federal subsidies for the nuclear-power industry and terminate such projects as the Clinch River Reactor. In these areas I have been the principal author or leading sponsor of legislation.

**Jackson:** The government's immediate role should be to strengthen and aggressively enforce basic environmental laws, such as the Clean Air Act, the Clean Water Act, the proposed Safe Drinking Water Act, and the Toxic Waste Superfund program. Acid rain epitomizes the crisis we face. After all attempts to solve air pollution through taller smokestacks, acid rain reminds us that there is no such thing as "away."

**Omn:** Among today's students who will graduate from high school, eighty-four percent do not study physics, sixty-four percent do not study chemistry, sixty-two percent do not study calculus, and forty-eight percent do not study geometry. In the Soviet Union all students are required to take ten years of geometry and four years of chemistry. What action can be taken quickly at the federal level to bring American education back in line?

**Mondale:** The Reagan administration's

policies have seriously damaged our educational system especially in the sciences. I have proposed a national fund for excellence to improve education at the local level. I have also proposed an Education Corps to attract a new generation of talented Americans into teaching. Corps members who plan to teach in critical fields especially math and the sciences, would be eligible for scholarship awards to help pay for college, would be forgiven their student loans if they teach for four years after graduation, and would be eligible for assistance in graduate training.

**Hart:** The federal government must play a role in upgrading our scientific education in this country. One specific scheme I would promote is the American Defense Education Act, which gives incentives to school districts to improve and increase their programs of math, science, foreign languages, and communication skills. I have also proposed the high-technology Merril Act, designed to increase the num-

ber of teachers, and congressional scholarships for prospective ones. All these activities should be administered through a Cabinet-level department of education.

**Omn:** The technological lead of the United States is under siege as never before.

Japan is moving ahead with its fifth-generation computer-research project. France, Germany, and Great Britain are all developing their own space-transportation systems, communications satellites, and computer hardware and software. How can we keep our lead in technology?

**Mondale:** We must adjust antitrust regulations to permit pooled research ventures so that corporations will be more willing to make long-term commitments to research. We must realize that a large part of this nation's research budget starts in the military and that we must find new ways to transfer the results of this work to commercial use. Whenever possible we should encourage research ventures with our allies to pool our resources. This would be especially helpful in the scientific exploration of space.

**Hart:** There must be a revision of the patent laws to strengthen their protection while making that protection more available to important innovators, the small firms. Government procurement policies can also be used to encourage innovation. For example the procurement of government vehicles can be used as an incentive for pollution control and fuel-economy research.

**Jackson:** We need to shift our resources back into civilian research, particularly applied research aimed at creating new products and processes that will provide new jobs. We cannot maintain our economic competitiveness when our best minds are designing weapons systems.

**Omn:** The United States has stopped several shipments of high-tech equipment thought to be destined for the Soviet Union. How do you feel about restricting high-tech trade with the Soviet Union? Should we also ship defense-related technology to the People's Republic of China?

**Mondale:** The transfer of technology should not include equipment such as high-speed computers, which can be used to enhance the performance of the Soviet Union's strategic arsenal. We should consider technology transfer only on a case-by-case basis taking into regard military considerations and the political climate. In the case of China, we should be sensitive to the political and military relations between our two countries as well as China's need for economic development.

**Hart:** The maintenance of American defense depends now more than ever on our technological advantage over the Soviets. I am in favor of continued restrictions on technology exports to the Soviet Union when there is a national security interest.

**Jackson:** The United States should not be a merchant of destruction. Just as we should not be shipping military technology to South Africa, so we should not be shipping it to China or to the Soviet Union.

• **Front-runners studiously ignored a question about whether they would ride in a space shuttle. Others seemed delighted with the idea of getting away from it all. ♦**

ber of scientists and engineers graduating from our universities. This bill develops an educational trust fund to provide grants to colleges and universities for strengthening science, engineering, and technical education [The original Merril Act established the federal land-grant college system in 1862, leading to dramatic advances in agricultural education and production].

**Jackson:** Our campaign www.education as the cornerstone and crown jewel of democracy. In a Jackson administration public education would have the highest value and be reflected in our priorities and budget. I believe in rigorous education and see universal science and math education as a concrete goal.

**Glen:** We can begin by devoting more research to our planet's last and greatest frontier—the human mind. We need to know more about how people learn, how to teach more effectively, and how to adapt our educational system to the technologies to be created in the future. We must improve science and math education at all levels. We must increase the supply and improve the quality of science and math teachers. And we can do it with summer institutes for cut-

# COMPETITION

By Scott Morris

Last October we wondered aloud whether there was any advantage to being brilliant. So you're a whiz at the problems in *OMNI's* Games column. Big deal. Does that mean you're any good at solving the problems of life?

As inspiration, we told off four problems, including (a) the truck that was just an inch higher than a bridge's clearance; and (b) Alice's Cookies problem of arranging a bookcase of hundreds of volumes about United States geography.

The solutions were (a) to let some air out of the tires, and (b) to put books about Texas in the middle of the bottom shelf, books about Alaska in the upper left-hand corner, Maria in the upper right-hand corner, and so on to approximate their positions on a map of the United States.

We asked readers to send in examples of practical problems with brilliant solutions. We said we would prefer real-life cases but would accept hypothetical ones as long as they were realistic. Here are our favorite entries. Each of the ten winners will receive, in addition to a cash award, a copy of our new book, *OMNI Games*.

## GRAND PRIZE-WINNER: \$100

1. Since fall was approaching, I decided to flush out my car's radiator and fill it with new antifreeze. I removed the radiator cap and loosened the nut at the bottom of the radiator so the water could drain out. After flushing the radiator with water several times, I proceeded to pour in two gallons of antifreeze. Unfortunately, though, I had forgotten to tighten the nut. I tumbled around underneath the car, but the threads were stripped so I couldn't fasten the nut. Fortunately, I thought of an easy way to stop the antifreeze from running out. What was it?

—John F. Preble  
Fairborn, OH

## RUNNERS-UP: \$25

2. I am very nearsighted. Without my glasses, I can see things that are near me but anything farther away than an arm's length is a blur. Once, after scrutinizing *OMNI*

using a geyser at close range, I couldn't recall where I'd left my specs.

My wife was away, and there was no one to help me. I couldn't find the glasses in any of the usual places or where I had picked up the geyser. To find my glasses I would have to be able to look for them. But I couldn't look for them without my glasses. Then I figured out a way and found them. How?

—C. A. Erickson  
Worthington, MN

3. After pouring the first serving from my two-liter plastic bottle of coke, I realized that the remaining drink would go flat within a day or so. What was my solution?

—Ken Faulknerbaw  
Saint Simons Island, GA

4. I left a half-eaten hamburger on the front seat of my expensive, new sports car and found the car crawling with ants the next day. Apparently I had parked over a giant anthill! How did I get rid of all those ants?

—David Rothberger  
Vedderosa, GA

5. I was sleeping overnight in a cabin that had a leak in the roof right over a corner of the bed. Using some ordinary supplies I had packed in my backpack, I found a way to get a quiet, dry sleep.

—Alan M. Young  
Buckland, MA

6. I am a projectionist in a movie theater. While one reel is running, I am usually not watching the film but catching up on my reading. Once I lost track of the time, and a reel ended before I was ready to start up the next one. I was roused to action by the flapping of the film on the completed reel and the boos of the audience. Then I learned the projectionist's trick to prevent this from happening. What is it?

—Philip A. Leesha  
Sapapham, NY

7. I was almost out of gas and miles from the nearest station. I had a spare gallon

of gasoline with me, but the can had no nozzle, and I had no funnel. I had to figure out how to pour the gas into the car. Looking through the car, I found a spare tire, jack, broken papers, and a soda bottle my daughter had left, but no funnel! What did I do?

—Terry D. Lyng  
Rockland, NY

8. Confined to a wheelchair and unable to bend over, I was alone in a classroom with 30 minutes to finish an essay test, when I dropped my pen. In the room were 30 desks and one table with the test question taped to it but no other pens or pencils. How did I retrieve my pen to finish the test?

—John M. Smith  
San Diego

9. I was miles from help, trying to get into my car. The locks were all frozen solid. If I could not get in quickly I too would be frozen. Matches and lighter proved useless—they blow out before warming the lock at all. As I was cursing my luck and imagining the miserable trek before me, I thought of a way to unlock my car. Can you?

—Douglas E. Mowell  
New London, CT

10. My daughter was born with a clubfoot. Standard treatment would have placed her in a device consisting of two hard, straight-sided shoes fixed to a board that turns the feet outward. The cumbersome confining rig wouldn't allow her the mobility to crawl, kick, or turn over. She would have been miserable. I found a better way.

—Patricia J. Weber  
Mount Pleasant, SC

## HONORABLE MENTION

11. A boy has been fishing, and his shoes are muddy, so he washed them in the creek and promptly loses one. The water is moving very rapidly and the shoe disappears downstream. He searches for hours with no luck. Then a man walks up, asks what the problem is, and

CONTINUED ON PAGE 14

# ART OF FAKING IT

CONTINUED FROM PAGE 84

raised the temperature of the room to above 80° when cannons fire and cities burn and then drove it to a chilly 35° when the French armies encounter the Russian winter. Messier compared his students with a control group that did not experience the simulation and concluded that his students came away with a more positive attitude toward Napoleonic history in particular and history in general. His guiding principle: "The more real the media, the better."

Excluding obvious factors of cost and complexity, the line between simulated environments and sophisticated video games is a tenuous one. Both the flight simulator and the video game are designed to create illusion, and both use a sense of intimacy or immediacy to achieve their realistic effects. "You have to have immediacy," explains Alan Kay, chief scientist at Atari. "That is what maintains the user illusion, the involvement with the task itself rather than being distracted by the equipment. Any lag at all breaks the fantasy."

Kay points out that the art of simulation entails more than simple attention to detail. "I think control tends to dominate detail. You see a nice progression from live theater—which has an enormous amount of detail—to movies—which have less detail but are more accessible—to television—

which has even less detail but that you can turn on and off—to video games—which have even cruder detail but that you can contribute to some extent. Most video games are a kind of visual radio. The images are just icons to guide your fantasy."

What the training simulator and the video game definitely have in common is that all-purpose simulator: the computer. And in the field of artificial intelligence (AI), it has been used to meet perhaps the ultimate challenge: simulating the human mind. Central to the AI problem is the question of whether intelligence is best simulated by copying the brain or by trying a different approach. The quandary has sharply divided researchers in this field. AI researcher and Nobel laureate economist Herbert A. Simon, for example, prefers using mathematical logic. "The inside of a computer does not look like a brain any more than it looks like a missile when it is calculating its trajectory," says Simon.

In the humanistic camp is Roger Schank, chairman of the computer science department and professor of psychology at Yale. "The brain does it," says Schank, "so I know it can be done. I try to design programs that work the way the brain works. Other guys use formal mathematical logic to get the computer to solve problems. That's not the way the brain does it."

The astonishing power of computers has elevated these questions beyond technological problems to philosophical issues:

A scientific theory, for example, could be described as a simulation. When Newton devised his theories, he was asking us to pretend that such things as gravity and centrifugal force existed. If this pretending turns out to be useful—if it agrees with experimental data and allows us to make accurate predictions—then Newton's theory could be considered a fairly accurate simulation. Now what if a computer, not a human, proved a particular mathematical theorem? Is the computer program a valid proof? Is the computer intelligent?

If the computer is the most recent addition to our store of simulating aids, the game is probably the oldest. Think about it. Most games are simulations of real experiences—Monopoly, chess, capture the flag. Games are such powerful simulating tools that gaming has become one of the language's most potent metaphors. How often have you heard of the survival game, the game of life, the dating game?

Gaming as simulation began to be taken more seriously in the early Fifties, when a scholarly classic on the subject, *Theory of Games and Economic Behavior*, by mathematicians John von Neumann and Oskar Morgenstern, was published. Picking up on Shakespeare's adage that life is a game, Von Neumann and Morgenstern analyzed mathematically why some players are better than others. "The typical problems of economic behavior," said Von Neumann, "are strictly identical with the mathematical notions of suitable games of strategy." In other words, the intelligent player usually wins. One of the games of strategy Von Neumann investigated was poker, which the celebrated mathematician called a zero-sum game, that is, the total losses and winnings add up to zero. By contrast, most scenarios in life are not zero-sum situations. The best example: nuclear war.

Von Neumann's rigorous mathematical analysis of gaming strategy spawned a new generation of serious simulation games. Today a game player can become a general commanding a brigade or the chairman of the board of a major corporation. If he thinks these situations are too far removed from everyday life, he can join in games that simulate the traumas of divorce or the ritual of dating. (In California these are called structured experiences.)

Of all such simulations, easily the most expensive and sophisticated are war games. At the Army War College, in Carlisle, Pennsylvania, for example, high-ranking officers sit at \$100,000 combat stations. They have troops, artillery, jets, helicopters, and even an arsenal of tactical nuclear weapons at their disposal. The players are involved in Janus, a simulation named after the two-faced Roman god of war. The Pentagon calls it the most powerful combat simulator in the world.

Janus, developed by programmers at the Lawrence Livermore National Laboratory, provides the officers with incredible detail. Seated at high-tech battle stations, game-playing officers watch the simu-



"I'm sorry, but the food and drug administration has recalled your house."

lated combat on computer screens and summon troops and equipment to action by sliding plastic "mice" across electronic graphics pads. Land mines explode in bushes on the screen; towns are reduced to rubble before their eyes. Using the resources of the Defense Mapping Agency, *Jesus* can produce full topographical detail of any 16-square-mile patch on the planet. According to Newsweek, one will never need to regain a lost position by dropping a nuclear weapon on the main enemy force. The tactic achieved that purpose, but it also wiped out his own troops. Said the officer: "Holy smoke."

War games predate Caesar's legions. Now, as twin generals divide their armies into teams and conduct exercises that simulate battle instead of using swords and spears, today's soldiers are armed with rifles and machine guns loaded with blanks. But there has always been one long-standing problem: "With the blanks, you had the old 'bang! bang! you're dead' situation," says Marine Lieutenant George Word, in charge of a new combat simulation system called MILES (Multiple Integrated Laser Engagement System) at Camp Pendleton, California. "And the men who were hit would say 'No, I'm not you missed me.' They didn't like little kids."

MILES eliminates such juvenile arguments. War-gaming marines at Camp Pendleton still use M-16 rifles loaded with blanks, but the guns also have special fe-

sors mounted on the barrels. In addition, in their backpacks the marines carry small computers that are wired to sensors on their torsos and helmets. The lasers fire harmless beams that have the same accuracy and effectiveness as M-16s do. If a shot narrowly misses a soldier, MILES emits a few short beeps; a clean hit sets off an alarm. The laser is activated by the sound of the blank firing and works only as long as the ammunition holds out. If the marine has been hit, the laser shuts off.

While not as sophisticated or as highly computerized as war games, simulation games in business, education, and even therapy have sprouted like weeds since the Sixties. The New York University School of Business, for example, offers two sophisticated management simulations: MetroBank, whose annual report defines it as the "one hundred tenth largest bank in America," and InvestCorp, a simulated investment-banking firm that according to its glistening black-and-silver annual report, has over \$1 billion in assets. In elaborate simulations that run from three to five days, both MetroBank and InvestCorp allow potential managers to put their management theories to practice.

Many businesses now use such elaborate simulations as *Looking Glass*, produced by the Center for Creative Leadership in Greensboro, North Carolina, to train their executives. *Looking Glass* is the name of a made-up corporation founded by A. J.

Locking, a fictitious linkman in Thomas Edison's laboratory. The glossy annual report of *Looking Glass, Inc.*, states that the company which is involved in all aspects of the glass industry, has annual sales of \$200 million and profits of \$11.5 million. Executives sharpen their business skills by taking key roles in running *Looking Glass* and seeing how they do at making a dollar. Say the developers of *Looking Glass*, "The design of the simulation accurately recreates the demanding, fast-paced, complex world of a large organization. By studying the behavior of managers participating in *Looking Glass*, researchers hope to answer questions about the managerial role and about the relationship between managers and organization."

There is also much talk these days about simulating the future—nifty although admirable business. To understand the risks, you must appreciate the difference between prediction and projection. Simulations are better at projection—extrapolating a trend into the future—than at actual prediction—forecasting a definite event or development. Simulations are excellent for predicting possible futures but have little power to predict a particular future. An incredibly sophisticated simulation of the earth's atmosphere, for example, is locked in the computers of the National Meteorological Center in Silver Spring, Maryland. It receives information from satellites, on-the-ground observers, and myriad other sources. It can project possible future weather scenarios by the thousands but, because of the incredible complexity of variables, is dismal at predicting whether it will be raining in two weeks.

Simulating the future becomes even more complicated when the human factor is figured into the model. Future events don't happen in a vacuum. Present attitudes and expectations shape them. As economist/ futurologist Kenneth Boulding points out, "The image we have of the future has a great deal to do with determining that future. Making predictions makes the parameters change." Simulating any mechanical process, says Boulding, is considerably simpler than simulating any living organism. He likes to illustrate this with what he calls Peagans's law: "If you've seen one redwood tree, you've seen them all." Not so, says Boulding. "Peagans's law applies only to hydrogen atoms."

But simulation's power of projection should not be discounted. It presents us with the possibilities and protects us from the unknown. The pilot of a 747 may never experience engine failure; the Janus-playing officer may never find himself in battle; and the junior executive of *Looking Glass, Inc.*, may never have to deal with the threat of Chapter 11 bankruptcy, but if they do, they will be better prepared. It could be said that simulating, more than anything else we do, prepares us for the future and the shock of the now in whatever form it may take. So to avoid future shock, keep on simulating. ☐



"If you don't love me why are you tickling my eggs?"

# INTERVIEW

BY DAVID LITTMAN

get Patrick Putnam, who'd been living there for a quarter of a century and was trusted implicitly by the Pygmies. When they saw I was interested mainly in their music, they said, "You know, that isn't really our music. Oh, no, that's just what we sing for the villagers. If you want to hear our music you've got to come off into the forest with us." I did. And I heard much more exciting music. That was why I started working with the Pygmies rather than the villagers. But my work from the forest was as limited in perspective as Schobesberger was observing the Pygmies in the villages.

**Critics** Critics have branded you a romanticist in your portrayal of the Pygmies. How do you respond?

**Tumbull** I'm delighted to be called a romanticist. It tells me I'm on the right track. They mean I'm reporting only the good and trying to make everything seem perfect. In other words, I'm inventing it. I can respect anthropology only if it is a form of pilgrimage where we are on a sacred quest to bring back from other societies the good things that can enhance our lives. To hell with people saying, "Oh, here goes the romantic again!" Anthropologists really get down to the nitty-gritty not when we deal with theoretical abstractions called social structure—just an invention of the mind—

but when we touch upon caring, compassion, and love and examine how it arises. What makes love so intense that it binds people in a spirit of total sacrifice? Where do we have that in our society?

Look at what we've done even with the marriage service. We've taken out the words "to love, honor and obey" and substituted contracts. We are fed a perception of marriage as a calculating relationship that may well be temporary. The real mystical union is now just the right to copulate without getting run into jail by the sheriff. *Omnis!* Would you say that you invented your concept of the Pygmies?

**Tumbull** Actually, in another book I reported in a rather tedious way on the Mbula disputes and quarrels. But the objective of *The Forest People* was to convey to people in my society what I found among the Mbula that was good for me and what I think might be good for others. In Mbula society I admired the power of faith, a quality we frequently lack here yet which is lacking in our culture. So I said, "Let me assure people in our society that these ideals are alive and well in the world."

If they read *The Forest People* and feel that something is lacking in their own lives, then they're on the right track. And even when they say, as they did about the Ik, "Oh, Lord that could never happen here!" that is recognizing that it can happen somewhere.

Cyber said *The Forest People* was ro-

mantic, but when I described the Ik, a people who did not look exotic, they suddenly got upset in a very different way. It's all right to be a romantic if the people are nice and if the anthropologist turns out to be a kind of woolly but nice guy. But if you describe a people who are nasty and the anthropologist turns out to be a rather nasty person, which I think he does in that book, oh, boy! then the criticism really comes. Many students of The Aburam People say I'm pessimistic, a doomsday prophet. I don't see anything depressing about that book. On the contrary, it's a hopeful sign that people who are starving manage to persist in circumstances where most of us would give up and want to commit suicide. *Omnis!* At what point in your fieldwork with the Ik did you realize you were becoming a nasty person?

**Tumbull** My first revelation occurred when a black American anthropologist and old friend, who is also writing about the Ik, came to Uganda and was horrified at the way I was treating—or rather, not treating—the Ik. They were just items for my notebook. I had a bottle of one thousand tablets of emeritiform. Ten tablets cure the worst kind of amoebic dysentery. So I could have safely had one hundred attacks of dysentery in the two year held trip. My friend took one tablet to give to a child who had dysentery, and I blew my top. "What are you wasting that? My medicine! You didn't bring it! That's mine, and these you are wasting it!" And he just looked at me. At that moment, I stopped and suddenly realized, I didn't care about these people at all. If they died it was just fodder for my notebook. I wasn't going to do a thing to help them because they weren't going to do a thing to help me. I had actually become a good anthropologist. I was scientific and objective and participating fully. I began to wonder if my moral ideals were phony. The Hindu scriptures inquire that if you do not see the need to intervene, then there is no need.

Looking back, I still agree with the way I behaved. Unless we were willing to make it a full-time occupation to wipe out dysentery among the Ik, we should not have accustomed them to the fact that one pill can stop a child's dysentery. They would have become careless about getting it again. Also, we would have increased the population and caused more starvation.

When I saw Peter Brooks play based on *The Mountain People*, my guts were just churning. I knew exactly what was going to happen. I saw that bastard of an anthropologist up there doing such stupid things, and I knew how mean and selfish he was going to become. I didn't want to see the mother laugh when her child burned its hand in the fire. I didn't want to see the fourteen-year-old retarded girl Adupa get locked in the house by her parents to die of starvation, or Lohim, the last ritual priest indicated by his grandchildren when he was dying. I didn't want to see any of that! And the audience just sat there enthralled!



You're only human. Gingiby. That's why I'm letting you go.

Omni: How do you view the Ik now? Is there anything in your work with them you would have done differently?

Turnbull: When I first started work among the Ik I wrote a letter to Natural History in which I said they were a bunch of savages. That is not the kind of language I'd used in my life before, but damn it, that was how I felt. These really are inhuman barbarians! Later I recanted to the extent that I realized they weren't savages at all. They were just another example of what humanity can beled by then I knew I had the same potential myself. If I found myself back there again and saw the people in such horrible straits—unable to live fully as human beings, unable to love, which is a deprivation like being amputated—I would say "To hell with research, my prime obligation is to do what I can to improve the living of these people". I would spend more time trying to work out with the government of Uganda, other anthropologists, and medical people what could be done to restore fullness of life to the Ik.

Omni: What can members of large-scale highly technological societies learn from small-scale primitive societies?

Turnbull: I like the word primitive because it suggests a situation where man's values, his focus of interests, his aspirations, and source of inspiration are all primal, that is direct, original, and basic. Primitive implies a people who know what the first things are, and these are not material lux-

uries but affective human relationships. The Pygmies are perfectly aware of the existence of motorcars, guns, and technology and they say, "You think these things make you so much better? What good would that be to us?" They've got a clear perception of exactly who they are, because they see themselves in relation to the natural world around them. Their perception of the forest is of a benevolent deity that they can depend on just as children depend on their parents. They will not take any foreign artifact that would militate against their sense of identity. For example, they don't like clothes made of cotton, which does not grow in the forest; they like to wear bark cloth, which comes off the tree.

Because the primitive believes he is ruled by God, who is invisible, he has an enormous degree of security. And somehow the proof of the pudding is in the eating—he survives. Some of those early cultures have survived for thousands of years. And how long has any civilization survived? A very short time. Why isn't it you don't find neurotics in primitive societies? They have an incredible amount of security. We've got our little retirement plans and our social security, but he has a thousand other people to whom he's obligated and who are obligated to him. And I think this is what we desire for ourselves.

Omni: What has our culture substituted for faith in God?

Turnbull: We've been fooled until recently

into thinking science has all the answers. I think the great thing about space travel is that it shows how little we know. I'm delighted when those rockets lose their insulation; it shows how fragile we are and our technology is. Once you think you have a rational moral way of resolving conflicts and problems, you have no need for an absolute. Yet today we have a demonstration of the inadequacy of science. All of a sudden there are new questions about the nature of the universe. And we still don't have the answers to our mortal problems—violence in the streets, overflowing prisons. We blame human beings—the mayor, the police chief, the prison system. We have come to believe that the sacred is dissociated from our everyday life. If we all belonged to a common belief system, if our social order supposed something that is above us all, our behavior would be mutually predictable. Young people—and damn it, I take my hat off to them—realize that there is no rational human answer. They look back in history and see failure after failure to deal with the same problems. Science does not have the answer! So we get young people doing great things like joining cults. I think they're splendid! They are learning what it is to live in a community according to a higher law without external coercion but internal cohesion.

Omni: Did your contact with primitive societies teach you anything that changed your life?

Turnbull: I find the Mburi concept of spherical time useful. You're always in the center and everything is equal around you. There's no up, down, forward or backward. In Mburi there's no distinction between disruptions in time or space; either it is here and now, or it isn't here and now. And if it isn't here and now, it doesn't affect you. This comes from the Mburi's dependence on the forest, which supplied them with food every day; they don't have to plan for tomorrow. I find that absolutely great, and it also works like a charm in our culture, though it is a little difficult for other people. Omni: What did the Ik teach you?

Turnbull: It was easier for me to live in New York after having been with the Ik. Before that I had been uncomfortable and critical, up tight morally, while being thoroughly immoral myself. I gave quarters to beggars every now and again, thinking how good I was. I would get very upset about the bums. After living among the Ik, that changed. I thought, What would they do? and unless there were profit in it, they wouldn't do anything. I began to ask myself what the rightness would be in intervening. I thought first if I were going to give something with any pretense of its being a right or moral act, I would have to give that bum a lot more than a quarter. Was I prepared to give him a dollar or five dollars or invite him into the house and take full responsibility for him? I lied it out on the bums. I'd ask, "What happens if I give you a quarter today?" and they'd answer, "I'll expect a quarter tomorrow." So it was just



# The Artist

© ART CUMINGS

Mind giving me a hand?



OK. But...



My work must evolve  
at its own pace



Know what I mean?



I'm learning



an immediate payoff they wanted.

Omn: You've implied that primitive societies like the Pygmies' value that which ensures survival, whereas our social values are ultimately self-destructive. Which of our values do not work to our advantage?

Turnbull: Our society lacks a real sacred, but we kid ourselves into thinking we have one. By sacred I don't mean church membership, but recognition of an ideal that binds us. We are not primal or primitive enough. We worship individual wealth and the widely touted idea of the self-made man who came up from nothing and is now a billionaire. That encourages us to aspire to a material and very isolated goal. We set about filling our bankbooks with all the determination and single-mindedness that the starving ink show in filling their stomachs. And similarly we get separated from our fellow human beings who have separate bank accounts. We may preach equality and brotherly love, but forget it. That's a damn lie! We are actually teaching inequality as hard as we can.

In all our competitive sports we honor inequality. What, after all, is a game? Claude Lévi-Strauss, one of the few anthropologists who is both a scientist and a humanist, defined a game as a situation in which the players start theoretically equal and wind up unequal. There is a winner and a loser. Listen to the terminology we apply to sports. We say, "I am going to beat you." You can't say, "I am going to win you." So even in our language we have the seeds of violence and individuality. And competition, thus understood, can easily turn into a form of cutthroat economics when we pursue our own good or corporate success, knowing full well it will be at the expense of others. Almost anything goes if you can get away with it. The real critique is being caught!

Omn: Do you think that competition is necessarily self-destructive?

Turnbull: In the economic world, corporate competition is not a bad thing if it encourages the development of a sounder, more reliable, or cheaper technology—providing we have our ideals straight. But if we have ideals that are in conflict with one another—like our hypocritical notion of equality—I think competition is a disaster. Where does one see the competitive spirit really employed for the common good? As a social anthropologist who has lived in small societies, I believe that the greatest assurance of success comes from society. We're not born social creatures; we're born individuals, and we have to learn to be social through our educational system. When we teach competition, we're not teaching society.

Omn: You have said that social change in our society has not kept up with technological change. Why hasn't it, and what are the results?

Turnbull: The UK adapted over a short period of time to the factor of starvation, they lost their basically human qualities: the potential for loving and sharing. In our society

## If you want a smoother vodka, ask for it in English.



Now the English  
have done for vodka what  
they've always done for gin.

Burrough's. The English word for vodka.

the social changes due to technology have been going on very slowly since the Industrial Revolution—a couple of hundred years in which the process has been developing and increasing in intensity and scope. My father, for example, went on one of the first flights in an old biplane across the English Channel. Now most of us take air travel for granted, and we're now already taking space travel for granted without thinking about the social implications—the increasing isolation that we might carry into or bring back from space. The whole process of mechanization and the development of the cash economy has gradually made it possible for us to isolate ourselves from one another and, indeed, regard one another as machines.

Our worship of individual success leads us to believe we could live without anyone else forever if we've got enough money in the bank. I think we are adapting slowly to the possibility of increasing isolation without being conscious enough of the adaptation that is taking place. Technology is helping us to adapt. Machines can deliver what I need to the gate, and I can use a machine to get down to the gate and bring what I need to the house. I can still keep up my interest in the world around me through television. I myself am adapting, though I argue against it. I am being sucked into the whole process of isolation.

OMNI: Will our technology push primitive societies into oblivion, and if so, what el-

lent will their demise have on us?

Turnbull: We might push ourselves into oblivion first. We're more likely to exterminate Moscow and New York than the Iru forest. We're not liable to waste a bomb on the Iru forest. There's a good chance the Pygmies might survive. That would be one up for the planet because then we would have human beings who care about human beings and claim it, about nature. I wouldn't like a nuclear attack if I were in New York, but I'd love it if I were in the Iru forest. I'd rather be copaxed and see that glorious flesh! Seriously, I think the primitive way of life is going to change; it should change. No anthropologist is enough of a romantic to want to keep primitive cultures as they are, but I hope we can learn from the primitive while he's still there to teach us. What we can learn is not how to camp out for the rest of our lives and live close to nature, but what is meant by effective human relationships.

OMNI: What do you predict would happen to our social values if we managed to survive a nuclear attack?

Turnbull: Our social values would take an upswing because we would need one another again. At first there would be the usual competitive reaction, like when gas was rationed, and people shot one another to get a gallon of gas. It's frightening to think how easily we could keep others out of the shelters. "I'll go down to my cellar and I'll blast your guts out if you try to get in after

me." Then attitudes might change. It's possible, but it sometimes takes a war to make people behave like human beings.

During the bombing of London in World War II, class barriers disappeared and I found myself in the basement of our house with the maid-servant, cook, parlor maid and gardener. Curtains were threatened and we were living together in a very improper way. The subway stations were filled with people, and the wealthy would bring down food, clothes, or blankets because they also wanted shelter. People perceived very directly the need to be with one another and be concerned. It was a lovely lovely time!

OMNI: You've stated that the anthropologist's first concern should be for his own society. What aspects of our culture do you intend to study?

Turnbull: I've been looking at the mundane things we do and trying to see whether I can analyze them in a way that will help us better recognize ourselves and our own strengths. Take all that fuss over that screwball James Watt, who seemed a rather dull sort of man, probably no more foolish than any of us. The focus was really not so much on him as on the environment—save the whales, save this or that. Personally I don't give a damn about the whales! Lots of animal species have died out in the course of our history, and lots more are going to. It would be a pretty miserable planet, after all, if the dinosaurs were still wandering about.

Concern for the environment does, however, tell me that people feel there is a part of themselves lost in their lack of relationship to the land. Their distance from the land they seem to feel is depriving them of a certain mode of self-expression. With this in mind, we should look at such institutions as the picnic. No anthropologists have dealt with picnics. What is the essence of a picnic? It's gotta be in the country. In rural communities there are special places, perhaps sacred places, where picnics are held. Eating, an act of communion, is an essential part of a picnic. There may be more going on in a picnic than we think. The picnic may be an attempt to reinforce the ritual relationship between ourselves and the land. Actually it is really a wretched occasion—we sit on the ground, the ants get in the sugar, the butter is all melted. Were there almost at the mercy of nature, but that's all part of it.

OMNI: You have also said there is more than meets the eye in the time-honored institution of tourism.

Turnbull: Tourists are a lot closer than they think to being on a sacred quest. I always met tourists in the field—rather intelligent people who, because of their interests, shed new light on the work I was doing. I began to wonder why someone comes all the way to the middle of Africa, feeling uncomfortable, endangering his health. A lot of tourists travel to foreign countries to seek historical roots, but why does a white tourist go on an African safari—to see the an-



And do you, Marvin, from Three Mile Island, Pennsylvania, take Cleucha, from Love Canal, New York, to be your lawfully wedded wife?

imals? I began to feel rather sorry for tourists because they always seemed disinterested. They had seen everything the travel agency promised, yet they were unenthusiastic. In the East African tourist reports, they often said they missed seeing the ordinary African farmer or herder moving in and out among the animals. They wanted to see the intimate relationship between the human and the animal world because they felt that not long ago in history they were also like that. Tourists do crazy things. They think, When no one's looking, I'm going to get out of this car go up and feed that lion, and it will not harm me.

In my recent trip around the world I began to explore the issue of tourism for a series of columns that appeared in *Natural History*. I began interviewing tourists, though it kind of spoiled their holidays to have me suggest they were on a spiritual quest. But what is a pilgrimage if it isn't a search for transformation? Eavesdrop on tourists. Listen to them talk, watch how they behave—going native, wearing a sarong, isn't this tourist saying. It is my potential to be other than someone from Sugar Grove, Ohio. I could be African; I could be Chinese. I could live with animals. On a tour as on a pilgrimage there is a personal challenge to your body and mind. You break away from the norm, you are in limbo, separated from your past and given a different identity. Your trip brings you much closer to a world you never knew before and you come back with your faith revitalized. Which I think is what's happening when tourists say, 'Oh, how dirty Africa is, and disgusting. I could never do that.' Really they are saying, *But I am from Sugar Grove, Ohio*, and that is what I am going to be when I go back. Their belief in the way of life in Ohio as a Baptist, or whatever is being revitalized by comparison. Omen: If you could get into any field to do anthropological work, where would you go? Tumbull: Prison, because I'm interested in studying inter-personal relationships—when we relate to one another as human beings and when we don't. When I was at Virginia Commonwealth University the state prison was right around the corner. A friend, teaching a creative-arts class, asked me to talk to the prisoners, who were mostly black, about African poetry, music, and dance. Here was this hard, tough bunch of black prisoners from the South, and there I was this homecoming coming in to talk about Africa. They threw out a challenge: 'If you know so much, why don't you tell us more? You'd have to come twice a week and be locked in with us.' I was a little scared, but I went! That was some of the best teaching I've done in my life. The quality of their thinking was beautiful.

I talked about just systems in other societies, in Africa there are places with no prisons—order without law. The prisoners asked very shrewd questions about why those people behaved themselves. They started looking at their prison system and trying to figure out why the guards be-

haved in such an obnoxious and sometimes brutal manner. They tried to see what pressures in outside society were on the guards. There was a tremendous chance there for making the system more bearable for the guards and the inmates. At that point, of course, the prison got rather nervous about the whole thing.

It would be very useful work for me to go back to prison. In prison basically human impulses—unexpected examples of compassion and kindness—come out. The prisoners said, 'None of us really trust one another around here,' but the more I got into it, the more I saw that wasn't true. They were expressing a self-defense mechanism that made me realize they had discovered affections that some of them openly said they had not experienced outside. I was rather jealous of them. Many aspects of prison life are tightly structured: their naming systems, the subgroups they form, the eating groups, dope smuggling, food sharing, the gift packages.

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● I can respect  
anthropology only if it is a  
form of pilgrimage,  
a sacred quest to bring back  
the good things  
from other societies—those  
that can  
enhance our own lives. ●

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I would like to study these structures. I could tackle it and go in so that no one but the warden would know who I was, but it would be found out, and I wouldn't be able to work that way. I've been trying to think what kind of crime I could commit that would get me two years—the legitimate period for hardwork. It would have to be a crime of passion.

Omen: What do you have in mind?

Tumbull: Well, I can think of all sorts of crimes I would love to commit in the county in Virginia where I live. That damn sheriff—I'd love to get rid of him for one thing. I feel very passionate about the sheriff and his hand troopers. I think I'd be doing the community a service if I got rid of that sheriff somehow—not by killing him but by proving his liability. He's the wrong man for the job. He's not in touch with the community. He has a limited, narrow sense of what is right. It's probably impractical even to think about it, but it would be a very exciting piece of hardwork.

Omen: Why have you spoken vehemently against the death penalty and condemned this electric chair?

Tumbull: I was asked to do an article on

the death penalty. I found prisoners on death row saying, 'Oh, have you seen the chair? What is it really like?' and others asking, 'Have you seen the gas chamber?' So I had to start compiling these two death devices and prisoners' thoughts about them. I found prisoners on death row complaining about the terrible smell of burnt hair and flesh when someone was electrocuted. They were also horrified at the idea of drowning or decapitating during electrocution. I told them that Leonardo da Vinci studied execution after hangings for his biological drawings. These kinds of stories lighten the life of prisoners on death row. In any case, I thought, Wouldn't it be rather simple to house condemned men somewhere else so they wouldn't have to smell the burning bodies? The guards, who had been through it, also described the smell, and some of them said it made them want to vomit the first time.

Now most prisons have installed screened and ventilated enclosures for the witnesses and a vent over the death chair to take away the smell. So you have technology coming in all back to front. It made me want to puke just looking at the vent because it made me think about the smell. That got me thinking about the terrible effect electrocution has on the prison officers who have to be there. They become brutalized and they begin to enjoy it. Then I began to enlarge that idea to the whole prison system: electrocution is the most extreme and graphic example of the whole process of brutalization that affects not only the inmates but the prison guards, the wardens, and, indirectly, the correctional authorities sitting in their plush offices in the state capital!

If we are going to put people to death, why can't we do it like they do in other societies—in a way that serves as a reminder of our obligation to be socially responsible people. My Lord, the old Jewish rabbis wrote volumes trying to find out how to be just in the infliction of punishment and how to reduce the sacrifice of killing someone by stoning him in a way that sin would not attach itself to those who had done the stoning. They were concerned about the good of society, we're concerned only about getting rid of one criminal and satisfying the victim. We're honoring vengeance. And yet, no one is satisfied. The criminal is not satisfied, because he's being punished. And he's got ways of saying, 'Of course it's your fault! I did it in the first place.' The victim is not satisfied either, because he doesn't get back his television set or whatever. We should let the criminal work his way back into society so that when he comes out and he meets me again, he can say, 'We have been through a ritual. I have been in a limbo period, and I have been transformed back into a social member of this community. I have paid you back; we are equal again.' Omen: You have said that our society as a whole lacks the rituals that would bring us closer to one another and to the idea of the

sacred. Do we have sacred rituals of which we are not aware?

Turnbull: Saluting the flag standing up before the national anthem—those are rituals that equalize us before a common sacred nation. I get a lump in my throat when I hear the national anthem. I feel a sense of a vast state. I just sat this in the old Madison Square Garden in New York City, at an ice hockey match. Huge crowds! Very impressive! All the skaters skated out skated to a stop and the spotlight turned to Marian Anderson. She opened that big mouth of hers and let out that enormous sound. That was a religious experience!

Omn: Didn't you write in *The Human Cycle* that you once had a similar religious experience upon hearing the Nazi anthem? Turnbull: Sure. Any national anthem will do it for me. That's the problem. I can get a lump in my throat at almost anything. Last night I watched this rather trashy TV program *WKRP in Cincinnati*. It showed that some crew-cut majors in the army do understand the forces that make a man deserve. I got a lump in my throat at one comic scene, but I thought, Good, I touched the sacred once again. And all those romance novels—I read them frequently. They're not healthy literature, but they serve a healthy function of filling our lives, so empty of love with the idea that it is possible.

Omn: Could we institute more such sacred experiences into our lives?

Turnbull: Any ritual we devised would ob-

viously have to be entertaining. What is ritual if it is not entertainment? When the Cathars put on those multicolored vestments and swing incense and ring bells, and those staunch black-robed Presbyterians where I come from in Scotland condemn everyone to hellfire, it's all wonderful drama. It carries you away and you are being programmed and brainwashed or if you like educated into a recognition of your morality and social responsibility.

NASA missed a good bet to provide a sacred experience when we landed on the moon. Instead of a great moment we got very poor drama! They needed a theater person to stage-manage that. I mean if you're going all the way to the moon, surely you can afford a big, lightweight flag instead of that little pocket-size flag they planted. If we had known what ritual was, boy we could have done something big with that! We could have played a brassy recording of someone singing the national anthem with a really big sound that vibrates your whole body. And what did the astronauts do? They got up there and bounced up and down like little children is that what we went to the moon for? Oh my Lord, what a waste of opportunity.

I would have choreographed it by exploring the full implications of the landing with the astronauts—not just the economic, political and technological implications but the personal implications. Let them think about the immensely Some

pretty banal things were said by the spacemen when they got up there and looked back at the earth—expressions of marvel of tiny and infinity. I wish the astronauts had been a little more articulate when they came back. Technology could be used to create ritual and also instructional fantasies.

Omn: What exactly do you mean by the term instructional fantasy?

Turnbull: It would be easy to devise an entertaining television program that groups people. This is one of the advantages of fantasy—it illustrates an alternative way of solving problems. Take *E.T.* I didn't like the movie particularly, but I liked what it was trying to say—that children have a need for wonder and an unknown. Why introduce the sacred—what *E.T.* was meant to stand for—as though it exists only on another planet? Why not let children discover a sacred child who looks just like them? That would be a much more powerful move. In any case a sense of private and personal wonder is something we should develop in children. We should encourage their fantasies instead of telling them "Oh, that's a lot of nonsense." Father Christmas doesn't really exist. I think that's dangerous. It leads to our focus on the superiority of the human race. Childhood is where we start to get info trouble in this society. The Mbuts recognize that children are uncontaminated—among the holiest. They are held up as symbols of goodness, greatness, and purity. The child also represents the sacred to us, yet we deny the child priority to his personal perception of the sacred when we deny him the right to fantasize. If I had a child I would take field notes of all his fantasies because I would want to be revitalized.

Omn: What in general has been the overall effect of your work?

Turnbull: Some people have perceived something in my books, translated it into their own experience, and are using it to help them understand the world around them differently. On my last trip to the Iban longhouse in the Seventies I found students coming through with copies of *The Forest People* in their hands, feeling it described something they wanted out of life that was too good to be true. The Pygmies named Kengé, who as a young man had served as my guide had become famous. The villagers were upset because Europeans would come through asking "Where is this Kengé Kin?" And the villagers would say "Oh Kengé! Here they go again. Everyone wants to see that little Pygmy, and they don't want to see us. There was Kengé always so proud, saying 'I can't see them today. I'm too busy.'

I am aware that my work has an effect on individuals, but I doubt that it has had, or will have, any effect on anthropology as a discipline. I hope, however, that some of what I've written has encouraged young anthropologists to be more adventurous in spirit and to participate more fully and intimately in other cultures. ☐



"It's match my sperm count against any man in the house!"

# POETRY

CONTINUED FROM PAGE 30

"I couldn't imagine going mad" was the interviewee's reply.

After Auden's death Newman found himself in possession of a large vocabulary and a commitment to form and rhyme and thus somewhat alienated from the contemporary poetic scene—it's mid流派 very minimalist and free-form, to me very anti-intellectual. During this slack period he happened to read through the medical texts of an internet neighbor.

The library contained volumes on cell biology by James Watson and Albert Lehninger of Johns Hopkins author of Biochemistry, a standard text in its field. Inspired by his new understanding of the arcane area, Newman found his vocation, bringing a poetic sensibility to the latest discoveries about the workings of the cell.

Newman won invitations to give poetry readings both at Watson's Cold Spring Harbor Laboratory of Quantitative Biology and at Lehninger's Johns Hopkins School of Medicine, after having sent his work to both men.

One offshoot of his visit to Cold Spring Harbor was Newman's establishment of the Warm Spring Harbor Laboratory of Quantitative Biology, an institutional affiliation existing mainly in Newman's imagination but solemnly noted by The New York Times and other august publications printing Newman's contributions.

Not content with this hyperkinetic poemism and influenced by his study of bioenergetics with Lehninger, Newman has turned to inventing educational games that aim to make the workings of cell membranes and genes readily accessible to children as young as ten.

"In penetrating biology," he says, "I found a phenomenon that started out as a sequence of digits—latin, literary—but this sequence specified something three-dimensional, that is, visual or sculptural."

So Newman expanded from linear poetry to cartoons and then to inventing board games readily transferable to the computer to display the processes of genetic regulation and chemiosmosis.

By designing such games as software he hopes to persuade a whole generation of kids to share his educational enthusiasm. "Today they're playing Pokeman or Drakonslayer in arcades," he says, "and teachers are moaning. But tomorrow they'll be playing games of mine like Cell City Lymphofuzz and Repression, and their teachers will wake up to what computers can teach that books can't."

"Lymphofuzz," he continues, "relates many of the essential concepts of immunology, virology, and endocrinology into a scenario that a child can grasp. The humor of the presentation belies the seriousness of the material."

Lymphofuzz demonstrates the immune system by presenting it as "a police acade-

mico where white cells stage police riots (inflammations) put out by fire engines (steroid hormones) in a shoot-em-up, arcade-type of game."

In Repression colorful cards, dice and counters enable players on each turn to follow the transcription of a strand of the DNA double helix into a messenger RNA strand. Another game codesigned by Colombian neurobiologist Hilario Chiel is Action Potential, a game of nerves that teaches the biophysics of neural-cell firing and the biochemistry of neurotransmitter synthesis and release.

As a substitute teacher recently at Manhattan Country School, Newman tried out a colored dice game, Chance and Necessity on a tumultuous class of sixth-graders. It teaches the translation phase of protein synthesis in an E. coli cell. "It was chaos until I put them in four around a game board and gave them the colored dice." Soon they were executing base pairings of codons and anticodons and specifying "polypeptides of aminoacids" (the game names for polypeptides and amino acids). A day later he returned and had the kids fill in a Genetic Color Code with crayons. One student asked why all the "squakers" (the game name for hydrophilic amino acids) were grouped together—a question regarding the structure of the genetic code that geneticists didn't ask for ten years.

Newman's wife, Joan, a video animator who won an award for her work for Saturday Night Live and who is now at Time Warner, creates colorful visualizations of the games he designs. Her computer-graphics system worked out the Cell City design.

But Newman will need a stage set designer for his biggest productions. He found that to deal properly with amino-acid chemistry and all its designations and categories, he had to write a play with 20 characters. This separate role is depicted visually by uniforms with military-style side stripes.

For the future, Newman may even become a composer in his search for ways to mirror biological truths. "After a point there's too much molecular detail for the eye to make out," he says. "At that point, you have to start orchestrating all these solids with music theory."

To this end he has been collaborating with Bergman Folkman, cocreator (with Walter Carlos) of Switched-On Bach. Together they have worked out "extremely extensive correspondences between music and cell chemistry," he says. "They may be the basis of some models of the more extensive moving processes, such as the counterpoint of metabolism, that quantitative biological procedures are able to measure."

So what generates this abundance? Simply the joy of microbiology itself. "It's enough to make you believe in God," says Newman, "when you really appreciate the way it all works."

# GARDENS

CONTINUED FROM PAGE 68

the clouds of ice opening great seined mouths. On the islands in the center of the crater's lake scaled wallabies clambered on the rocks, blowing steam. The shit ball was laying out an orchard in the mangroves' wreckage. The snakes had taken to the water, its faceted head lashing a wave of V-waves.

In the hourglass sector, snakes continued to rise. The fires were spreading, and the spider met frenetically along its network of zones. Mississi watched the movement of the smoke as she released a horde of marmots and rock squirrels.

A mistake had been made. As the smoky air pushed upward in the feeble Marian gravity, a fierce vortex wind of cold air from the heights flowed downward to fill the vacuum. The mangroves burned fiercely. Shattered networks of flaming branches were flying into the air.

The spider charged into the flames, smashing and trampling. Mississi laughed, imagining demons piling up in the judges' data banks. Her talus slopes were safe from fire. There was nothing to burn.

The lava flock had formed a great wheeling ring above the shore. Within their scalloped ranks fitted the dark shapes of airborne predators. The long plume of steam from the meteor had begun to twist and break. A suet wind was building up.

Fire had broken out in the snake's sector. The snake was swimming in the seas-muddy waters, surrounded by banks of bright-green kelp. Before its pilot noticed this was already roaring through a great piled heap of the wreckage it had left on shore. There were no whimbrels left. A poured down the crowded slope. The smoke column quivered and twisted its black clouds alive with sparks.

A flock of ice plunged into the cloud. Only a handful emerged, some of them were flaming visibly. Mississi began to know her. As smoke rose to the crater's rim, it cooled and started to fall outward and downward. A vertical whirlwind was forming, a torus of hot smoke and cold wind.

The crawler scanned seed-packed hay for pygmy mountain goats. Just before her anios fell from the sky with a Clark squirm shape, all claws and teeth, clinging to its neck. She rushed forward and crushed the predator then stopped and stared dismally across the crater.

Fires were spreading with unrigged speed. Small puffs of smoke rose from a dozen places, striking large heaps of wood with uncanny precision. Her altered brain searched for a pattern. The fires springing up in the manta sector were well beyond the reach of any falling debris.

In the spider's zone, flames had leapt the firebreaks without leaving a mark. The pattern felt wrong to her, every wrong as if the destruction had a force all its own, a raging synergy that fed upon itself.

The pattern spread into a downwelling crescent. Mirasol felt the dread of lost control—the sweating fear an orbiter feels at the loss of escaping air or the way a suicide feels at the first bright gush of blood.

Within an hour the garden sprawled beneath a hurricane of hot decay. The dense columns of smoke had flattened like thunderheads at the limits of the garden's sunken troposphere. Slowly a spark-shot gray haze, dripping ash like rain, began to ring the crater. Screaming birds circled beneath the foul torus, falling by tens and scores and hundreds. Their bodies litened the garden's sea; their bright plumage blumed with ash in a sheer gray sum.

The landscatt of the others continued to fight the flames, smashing unharmed through the fire-charred borders. Their efforts were useless, a pathetic ruse before the disaster.

Even the feis' malicious purity had grown tired and tainted. The oxygen was failing. The flames were dimmer and spread more slowly, releasing a dark nastiness of half-combusted smoke.

When it spread, nothing that breathed could live. Even the flames were killed as the smoke billowed along the crater's crushed and smoldering slopes.

Mirasol watched a group of striped gazelles struggle up the barren slopes of the talus in search of air. Their eyes fresh from the laboratory, rolled in timeless animal fear. Their coats were scorched, their flanks healed, their mouths dripped foam. One by one they collapsed in convulsions, kicking at the Helesian Maran rock as they slid and fell. It was a vile sight, the image of a blighted spring.

An oblique flash of red down-slope to her left attracted her attention. A large red animal was skulking among the rocks. She turned the crawler and picked her way toward it, winging as a dark surf of poisoned smoke broke across the hotted glass.

She spotted the animal as it broke from cover. It was a scorched and gasping creature like a great red ape. She dashed forward and seized it in the crawler's arms. Held aloft, it clawed and kicked, hammering the crawler's arms with a smoldering branch. In revulsion and pity, she crushed it. Its body of tight-severed feathers tore, revealing blood-spattered human flesh.

Using the crawler's grip, she tugged at a heavy tuft of feathers on its head. The light-filling mask noped free, and the dead man's head slumped forward. She rolled it back, revealing a face tattooed with stars.

The ornithopter scuttled above the burned-out garden, its long red wings beating with dreamlike fluidity. Mirasol watched the Sonent's painted face as her corporate ladyship stared into the shining visescene.

The ornithopter's powerful cameras cast image after image onto the tabletop screen, lighting the Regal's face. The tabletop was littered with the Sonent's elegant knick-knacks: an inhaler case, a half-empty jew-

eled squeezebulb, loquettic binoculars, a stack of tape cassettes.

"An unprecedented case," her ladyship murmured. "It was not a total setback after all but merely the extinction of everything with lungs. There must be strong survivorship among the lower orders: fish, insects, arachnids. Now that the rains settled the sea, you can see the vegetation making a strong comeback. Your own section seems almost unscathed."

"Yes," Mirasol said. "The natives were unable to reach it with torches before the fire storm had smothered itself."

The Sonent leaned back into the sealed arms of her couch. "I wish you wouldn't mention them so loudly, even between ourselves."

"No one would believe me."

"The others never saw them," the Regal said. "They were too busy fighting the flames." She hesitated briefly. "You were used to confidence in me first."

Mirasol locked eyes with her new

*• The woman with  
the strange legs took her  
place across from  
the birdlike man. They  
began to converse  
haltingly in a language  
that none of  
the others could follow. •*

paleness, then looked away. "There was no one else to tell. They'd have said I built a pattern out of nothing but my own fears."

"You have your faction to think of," the Sonent said with an air of sympathy. "With such a bright future ahead of them, they don't need a renewed reputation for paranoid fantasies."

She studied the screen. "The Patternists are winners by default. It certainly makes an interesting case study if the new garden grows tiresome we can have the whole chapter sterilized incognito. Some other faction can start again with a clean slate."

"Don't let them build too close to the edge," Mirasol said.

Her corporate ladyship watched her intently, staring her head.

"I have no proof," Mirasol said, "but I can see the pattern behind it all. The natives had to come from somewhere. The colony that attacked the crater must have been destroyed in that huge landslide. Was that your work? Did your people kill them?"

The Sonent smiled. "You're very bright, my dear. You will do well, up the Ladder. And you can keep secrets. Your office as my secretary suits you very well."

"They were destroyed from orbit," Mirasol said. "Why else would they hide from us? You tried to annihilate them."

"It was a long time ago," the Regal said. "In the early days, when things were shaky. They were researching the secret of star flight, techniques only the investors know. Rumor says they reached success at last in their redemption camp. After that, there was no choice."

"Then they were killed for the investors' profit," Mirasol said. She stood up quickly and walked around the cabin, her new jeweled skirt clattering around her knees. "So that the alarm could go on laying with us, hiding their secret, selling us trinkets."

The Regal folded her hands with a clicking of rings and bracelets. "Our Lobster King is wise," she said. "If humanity's effort failed to the stars, what would become of transforming? Why should we trade the power of creation itself to become like the investors?"

"But think of the people," Mirasol said. "Think of them losing their technologies, degenerating into human beings. A handful of savages, eating bird meat. Think of the fear they felt for generations, the way they burned their own home and killed themselves when they saw us come to smash and destroy their world! Aren't you filled with horror?"

"For humans?" the Sonent said. "No!"

"But can't you see? You've given this planet life as an art form, as an enormous game. You force us to play in it, and those people were killed for it! Can't you see how that brights everything?"

"Our game is reality," the Regal said. She gestured at the visescene. "You can't deny the savage beauty of destruction."

"You defend this catastrophe?"

The Regal shrugged. "If it worked perfectly, how could things evolve? Aren't we posthuman? Things grow, things die. In time the cosmos kills us all. The cosmos has no meaning, and its emptiness is absolute. That's pure terror, but it's also pure freedom. Only our ambitions and our operations can fill it."

"And that justifies your actions?"

"We act for life," the Regal said. "Our ambitions have become the world's natural laws. We blunder because life blunders. We go on because life must go on. When you've taken the long view, from orbit—when the power we wield is in our own hands—then you can judge us." She smiled. "You will be judging yourself! You'll be Regal."

"But what about your captive factions? Your agents, who do your will? Once we had our own ambitions. We failed, and now you isolate us, indoctrinate us, make us into rumors. We must have something of our own. Now we have nothing."

"That's not so. You have what we've given you. You have the Ladder."

The viscan stung. Mirasol power, light, the hint of justice this world with its sun and sadness shrunk to a bright arena far below. "Yes," she said at last. "Yes, we do. DC

# COMING IN THE JULY

# OMNI

## FICTION



In July Ray Bradbury proves once again that he is a versatile master of modern fantasy. *"I Suppose You Are Wondering Why We Are Here,"* examines the relationship between children and their parents. Strange, mysterious, evocative, the story is just what you have come to expect from Bradbury. Our other fiction selection is by William Gibson. With a novel, *Neuromancer*, and four *Omni* stories to his credit, Gibson is gaining a reputation as a top high-tech SF writer. "Now Rose Hotel" shows how a search for big bucks can leave relationships vulnerable.

## INCA CHILD



The body was a calling card left by extraterrestrials, one rumor claimed. Scientists disagreed, but for years they were at a loss to explain why a small child was buried alive, 15,000 feet up in the Chilean Andes. Now two new sciences, high-altitude archaeology and paleopathology, have come up with the answer. Five centuries ago Incas abandoned the boy on the glacier slope as a human sacrifice to the mountains. In the July issue of *Omni* you will read the fascinating saga of how these experts, using the rugged skills of the mountain climber and the medical-diagnostic tools of a coroner, gradually unraveled the mystery of the Inca child and the society that killed him.

## INTERVIEW



Nobel Prize-winner Wassily Leontief ranks with Adam Smith, Maynard Keynes, and other great thinkers who have left a permanent imprint on economic history. In the United States the men charged with defining fiscal policies ignore Leontief because of the "incipient socialism" of his ideas. In 70 other countries, however, Leontief's economic models have changed the way commerce operates. Read about Leontief's unique global economic outlook in this month's *Omni*.

## ASTRONAUT



Alan Bean was the fourth man to walk on the moon; he had also been a naval engineer and a test pilot. But in 1981 he resigned his position at NASA as Chief of Operations and Training for Astronauts, to become a full-time painter. "I knew it was a gamble," says Bean. As it turns out, that gamble's paying off. In this month's *Omni*, writer Frederick C. Durant II takes us along on a visit to the not-so-inexpensive world of Bean's paintings: a realm of massive lunar boulders, and astronauts waving the American flag atop the moon's barren horizon. Like Frederic Remington, who preserved the Western frontier in landscape paintings, Bean is documenting his vision of one of the most significant events of the twentieth century... humanity's journey into the wild deserts of space. Also in this month's *Omni*: a fascinating look at the ongoing research of that most intangible of parapsychological phenomena—spirit projection, or out-of-body travel.

# COMET ODYSSEY

CONTINUED FROM PAGE 58

inside a comet, you're going to blow it up," he contends. "Of course, maybe you can dig a hole and insulate it and slowly use it. But there are materials that when heated—say, one hundred degrees Centigrade—have a phase transformation, put out a lot of energy, and explode. I think the last place I'd want to live is on a comet."

The interstellar nomads, then, will wind up in off-comet habitats, using the comet as their energy base. "The scarce resources in the interstellar deep is energy," says Jones. "But we've hypothesized that enough deuterium is in the comet's ices to fuel fusion-power plants." Comets are thought to contain stores of deuterium—the heavy hydrogen molecules that catalyze the initial reaction in fusion power—at the rate of about one for every twenty thousand hydrogen atoms. That works out to about eighty thousand tons of deuterium per comet, Jones says. "Assuming an efficient and controlled thermonuclear process, this represents enough energy to support a community of millions for a few centuries."

But even that energy won't be sufficient. Because of a comet's slow speed through space, the interstellar migration will take thousands of generations, longer than the deuterium is expected to last. Fortunately," adds Jones, "there's another energy supply—starlight."

With the comet far beyond the solar system, the sun is no more than a heatless pinprick of light; just another star. Its energy as well as energy from other stars, can be captured and utilized, but only if their thin proton streams are concentrated at a single point. To accomplish this, Jones modeled an idea of physicist Robert L. Forward. Forward has proposed using laser-driven light sails to propel spacecraft across interstellar distances. The spacecraft, dwarfed by 1,000-mile-wide sails, would be pushed along by laser beams emitted by powerful generators near the sun. Jones, however, wants to take these filmy thin aluminum sails—fashioned, of

course, from cometary aluminum ices—and transform them into large parabolic mirrors, which would capture and focus diffuse starlight. Because the stars are so dim and distant, the mirrors would have to be enormous.

"At half a parsec [about 1.5 light-years] from a sunlike star," Jones estimates, "the mirror would have to be three thousand kilometers in diameter, roughly the size of the United States. Of course, practically and financially sense might well dictate a large number of much smaller collectors." Such a "mirror farm," together with the energy from deuterium fusion, would be sufficient to support a community of several hundred people virtually forever.

ters of gathered comets," Jones says. "But my colleague Ben Finney quickly realized that instead of this, the natural mode of human society—the band/tribe structure in which humanity has lived for millions of years—might reassert itself."

Finney should know. As professor of anthropology at the University of Hawaii, he spent some 15 years in the South Pacific developing and testing his theories of Polynesian migration. The Polynesians moved into unknown seas to find and settle uninhabited islands, uninhabited worlds. Finney says, "It seems emotionally very similar to a migration into space—or at least it's the best earthly preview for such a monumental journey."

The Polynesians came to their island homes from thousands of miles away. In 1978 Finney re-enacted their voyage. Sailing in a double canoe with 18 other people and an assortment of animals, plants, and seeds—requirements for a small founding population—Finney set out to cross the 2,600 miles of trackless ocean between Hawaii and Tahiti. They had no navigational equipment to help them get there: no compass, sextant, or maps. Finding their way by the sun, waves, wind and the stars, they landed in Tahiti 33 days later (Finney describes his voyage—the subject of a National Geographic television special—in *Hoku'a: The Way to Tahiti* [Dodd, Mead, 1979].

Like the Polynesian migrations of 1,000 years ago, cometary migrations

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With access to energy, the comet colonizers would outfit their habitat with everything needed for life. Their world would have its own atmosphere, agriculture, and ecosystem. It would be as if they took a rural village and its surrounding countryside—farmland, forests, and all—peeled it off the earth, and turned it outside in, causing a hollow sphere lined with people, animals, roads, and homes. This artificial world would fly in formation with the comet from which it was made and, as the only source of raw materials, would support and sustain the community.

Inside the comet society would thrive. "At first I envisioned big communities, a million people strong, supported by clus-

probably will begin on a small scale. Villages of hundreds of people, towns of thousands, and cities of millions are all new creations," Finney explains. "They are the artifacts of the agricultural revolution of some ten thousand years ago. For the previous five million years of human evolution, our ancestors lived out their lives in hunting and gathering bands of about twenty-five people."

This is a magic number even today. "Groups of this size still form the units we seem to prefer in our mass, urban society. Consider the garden club or bridge club, the army platoon, the political cell, or a collection of close colleagues at work," says Finney. "This suggests that by sen-

ting comets with small bands of pioneers, we may actually be returning to the size of the social unit that is most congenial to human nature.'

Edward O. Wilson, author of the landmark treatise *Sociobiology*, agrees with Finney but thinks it's tricky to extrapolate from the original hunter/gatherer to the far more technical and demanding conditions of space.

Clearly, comet driving is not for everyone, especially not for most of us earthbound types today. A fact that Jones and Finney realize: 'We aren't contemplating groups of earthbound people deciding to hitch rides on comets,' says Jones. 'By the time we'll be able to board comets for the stars, humanity will certainly already be living in space and probably as far out as the Oort cloud [a shell of comets far beyond the orbit of Pluto]. It's these people who will be wanting to move on, to ride comets into the interstellar deep.'

Earth after all, may one day become uninhabitable, our resources exhausted, the land strikingly overcrowded. Earthlings may want to escape. 'An extended family seeking refuge from the megalopolis society of the inner solar system,' reasons Finney, 'is a small congregation of dissenters with a vision of founding a utopian community in the splendid isolation of interstellar space—these are the kinds of people who'd pull up their stakes, pool their resources, and leave the Oort cloud for whatever's beyond.'

The resources of a small group would be enough to finance the expedition, they say, because the cometary pioneers will be making use of technologies that will have existed for other reasons. 'Think of it this way,' Jones suggests. 'Every day thousands of people arrive in the United States aboard 747s. They each paid a few hundred dollars, rather than billions, for a ticket because the cost of developing 747s and building airports has been spread out among millions of people. The technology that will enable our nomads to leave the solar system will grow out of the needs of the solar society—probably many trillions of people.'

'The expense won't be small,' Jones continues, 'and not everyone would be

able to afford it. But it takes only a relative few to get migrations started. Those few would have to be dedicated and touched with the pioneering spirit—the same spirit that led us to colonize virtually every speck of land on this globe.'

The pioneers would be giving up a lot more than just money and the light and warmth of the sun, however, as they ride out of the solar system. Wilson, in a just completed book, *Biosapiens*, details what else space colonists would be missing:

'Our propensities are to live in a niched environment,' Wilson says. 'People react more quickly and fully to organisms than to machines. They prefer entities that are complicated, growing, and unpredict-

able. 25 would soon burgeon into a tribe of some 600 people. They see new bands of 25 splitting off from the original settlement and attaching themselves to other comets, until a cluster of 20 inhabited comets proceeds in loose formation through the depths of space. And should other nomads depart from other regions of the Oort cloud, then families of clusters could carry populations of hundreds of thousands of people outward into the galaxy.'

Although each band would live in a separate habitat, they would gather together at frequent intervals for tribal rituals,' predicts Finney, with an eye to the rites of our tribal ancestors. 'Bride ships could go from comet to comet, exchanging manageable youths. And should someone want to leave the tribe entirely there would be opportunities—every decade or so—to transfer to a passing comet.' An interstellar society will arise, re-creating in space the progress of the progress of our forefathers.

The human migration, then, may someday begin on a small scale, with an adventurous band of pioneers. It may start when they discover a comet with just the right hyperbolic trajectory, one that will bring it from the edge of the solar system to the realm of the stars. Matching velocities with the comet, the first group of nomads will send a party of scouts to explore the small, dark surface. Under their floodlights, the ball of ice will glisten and shimmer as it slowly rotates on an invisible axis. All around them the horizon falls sharply away, the view broken by irregular spines of ice and rock. Slowly, the comet will be transformed. Robots will work the surface while, on a nearby floating habitat, the first interstellar wanderers will chart their expanding universe. As these interstellar nomads drift outward, Jones predicts, 'the flood of sunlight will grow faint. After fifty thousand years and twenty-five hundred generations, the wanderers will be approaching the nearest stars.'

Having swelled into a great population, the founding colony will have seeded a diaspora of settlements on other comets. Before long there will be men and women on the planets of other stars. The greening of the galaxy will have begun. **DD**

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able enough to be interesting. In space colonies no seasons, such niched, growing, and unpredictable environments won't exist. This makes him skeptical about the prospects of comet travel.

'Even if a stable ecosystem were put together,' Wilson continues, 'it would still be an island of minute dimensions, desperately isolated from the home planet, smaller and less diverse by orders of magnitude than the environment in which the species evolved. This environment would be oppressive for people used to a conventional biosphere.'

But diversity will grow along with the comet colony. Jones and Finney hypothesize that the initial founding population of



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## COMPETITION

CONTINUED FROM PAGE 14

suggests a way for the boy to find the lost shoe. It works—and two minutes later the boy has both shoes in hand. What was the mama plan?

—Teddy Bartoshevsky  
Wilmington, DE

12. While playing golf I hit a ball onto a green and it rolled into a paper bag that had been blown there by the wind. In order to putt, I had to remove the ball from the bag, but that would result in a two-stroke penalty which I didn't want. How did I solve the problem without touching the bag or the ball, and putt normally without taking a penalty?

—T. O. Carpenter  
Janesville, WI

13. The large merchandising factory was old and sprawling. A place was needed for employees' check cashing booths that would be conveniently located, yet away from merchandise that might be misappropriated. Each floor thought the pay booth should be located on that floor, for maximum convenience, yet no department had room for it. Where in the building would you put the pay booth?

—Michael J. Kelly  
Calumet City, IL

14. At a picnic with a friend and our wives, why did I elect to carry a metal cooler [the heavier of two containers, as opposed to a large box containing blankets, a radio, utensils, and other sundry items] down the hill to our selected spot? My friend is stronger and more muscular than I; he seemed the logical candidate to carry the heavier load.

—Marshall T. Baker  
Denver

15. It is Thursday. I have no cash, and my checking account balance is zero. A \$15 check that I cashed at a local supermarket on Monday is due to hit the bank at any moment, and I don't get paid until Friday. How do I prevent my check from bouncing, get some gas in my car, and buy dinner tonight?

—Richard H. Blummer  
Longport, NJ

16. I am part of a three-way screenwriting team. In one of our more contentious moments we wonder how we will divide our royalty checks. That is, what would be the best way to split the dollars and pennies evenly among three people?

—Gary Peterson  
Chicago

17. How do you equally divide a piece of cake between two argumentative children, each of whom wants to get the larger piece? There's a simple fair way:

—P. E. Haddenbach  
Lakewood, OH

18. Each time you pull a cookie from the cookie jar or a slice of cake or butter a piece of toast, you leave crumbs on the kitchen counter. I always thought the job of every "heat-break" was to wipe them into the sink, rinse the sink, dry his hands, and walk away with a snack. Then I learned a shortcut that my sister-in-law always uses. What was it?

—Michael W. Sonderman  
Akron

19. While building up horseshoe pits in a mountainous area, it was necessary to build one pit up about three feet above the surrounding terrain with logs holding in the dirt. The pits were 40 feet apart. Using only standard garden tools, we were able to bring the two pits elevations to the same level. How?

—John Paganelli  
Chico, CA

20. The problem was to move a generator weighing 30 tons into a ten-foot-deep vault. We had no crane, and the vault was in a place where overhead rigging was impossible. If we had dropped the generator even a few inches we would have damaged it. How did we do it?

—John T. Horan  
Newburgh, NY

21. Problem: Tepid bear, no ice or refrigeration for 20 miles, stranded in a mountain log cabin with four thirsty friends, none with English tastes. We discarded the notion of dangling the bear in the lake, which was nearly as warm. Then I realized that our rental cabin, with its wood-burning stove, was probably equipped with just the right item to cool our brew. It was—and it worked. What was it?

—John Hudon  
Zimmerman, MN

22. A man wants to board a bus with a five-foot-long steel rod, but the bus company's regulations say that the maximum length of any object or parcel brought on board is four feet. Without bending or cutting the rod, or altering it in any way, how did he manage to bring it aboard the bus without violating the rules?

—Brian A. Denby  
New York

23. A mischievous boy in our neighborhood used to open our backyard gate and let the dog out. We tried using a lock with a key, but the key was always getting lost, and it was inconvenient to make separate copies of the key for everyone in the family. We tried a combination lock, but our own young children had difficulty remembering the combination. Finally we found a solution which had the added benefit of causing great frustration to the neighbor. What was it?

—Mary Ezzell  
Boulder, CO

Answers on page 180 **□□**

## BREAKTHROUGHS

CONTINUED FROM PAGE 34

The B-6000 promises an exciting future for the recreational pilot. In fact, it's the first human-powered airplane with much of a future at all. It is a realistic prototype of a sport airplane that could alternate its power sources switching between human power and electricity. The pilot could simply plug it into a wall socket to charge the batteries and, if necessary, recharge them during the flight by pedaling.

But perhaps the most significant thing about the Bionic Bat and other human-powered airplanes is the lesson they teach in aerodynamics and efficiency. MacCready predicts that with a little more work the Bionic Bat could fly as fast as 40 miles per hour. The only thing even remotely comparable in commercial aircraft today are gasoline-powered ultralights, and they require about 30 horsepower to do essentially the same thing.

More important to MacCready, the problems of human-powered flight serve as a catalyst for new ideas and perspectives about more than just flying. In the words of one member of his team, "It's an expression of the spirit of what you can do."

### NEW PRODUCTS

Real-estate customers may already have noticed that non sale signs are heading into the twenty-first century. Amcast signs from Audiocom, are designed to deliver a concise, three-minute sales pitch. The talking signs are not exactly high tech. The spiel is broadcast over a simple short range radio transmitter, and interested parties can tune in on their car radios. Amcast signs come complete with a cassette on which to record the appropriate information (\$495 from Audiocom, Inc., Box 4337, Auburn Heights, MI 48064.)

Homeowners on the go may soon be able to take their homes with them; it the prototype for the Flexible House makes it into production. Designed in Sweden, the portable (7.75 feet by 19.5 feet) house is made of 7.5-foot high hinged-aluminum panels and has inflatable bags built into the frame. When pumped up with air, the structure quickly assumes a boxy shape. Since it's insulated, the Flexible House is suitable for most climates. And although it weighs 1900 pounds, the "upwardly mobile" house collapses in minutes into a flat, portable unit. (\$5,000 from Granges Aluminum, S-612 21 Finspang, Sweden.)

User-friendly dashboards are here. Some of the newest cars come equipped with talking dashboards, but the Voice Warning System from Audi Systems lets my cat, The syntheso-speech machine's female voice reports on 14 different automotive functions—from oil pressure to seat-belt connections. It also tells the time. (\$185 from Audi Systems, Inc., 114 Royce Street, Los Gatos, CA 95030) DO

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# INTELLIGENCE

CONTINUED FROM PAGE 40

minyan—the traditional ten-member Jewish prayer group?

After the two key words, robot and minyan are punched into the system, it takes the database less than a minute to search 600 million bytes and spit out 59 related citations. One holds the answer attributed to a sixteenth-century rabbi, Zen Ashkenazi. An android—or golem—cannot be counted as part of a minyan because no matter how intelligent this being is, it is not human and therefore not responsible for its actions or obligated to fulfill the commandments.

Have you ever wondered how many bytes there are in the Bible? Bible Research Systems, of Austin, Texas, has squeezed the King James version of the Good Book onto a set of eight double-sided disks. This technological miracle was performed using a proprietary program developed by company founders Kent Dohel and Bert Brown. It condenses 36 million bytes of data that could have filled 50 disks. This aptly named software, The Word Processor, accesses any verse in the Bible by searching for key words, phrases, sentences, or even character strings. And a new program, called the Translator, provides the Greek root of every word in the King James text. Both of the programs cost \$200 and run on most personal com-

puters, including the IBM PC, Kaypro, Compaq Columbia, and a number of Apples. There is also a Macintosh version in the works. The Word Processor has been shipped all over the world, from Chicago to China, but perhaps one parish in Phoenix, Arizona, holds a vision of future religious services.

There a beleaguered pastor tends his flock, all of whom can use a reference code printed on the TV screen during the sermon to scroll up accompanying Bible text on their home computers.

A host of other religious software is also being developed. Satu Kalsa, president of the Chicago-based Kryia Corporation, maker of the best-selling program Typing Tutor, is a member of the Indian Sikh religion. He is developing a database that will contain holy scriptures, dietary and nutritional information, as well as some of the 2,000 yoga exercises practiced by his sect. Computerized catechism may soon become standard in some Catholic schools, thanks to a program called In Christ Jesus, Feeling Program and Computerized Inventory, developed by the Benziger Corporation, a Catholic publishing house in California.

And there's some spin-off software from the giant Mormon genealogical database which has been computerized for the last decade. The \$35, six-disk Personal Ancestral File should help members of the Church of Jesus Christ of Latter-Day Saints.

and others, trace their ancestry.

With computer screens scrolling out holy texts (some in their original language), are the faithful in any danger of defying a mere machine? Rosenbaum doesn't believe so. "Computers will never be rabies or serve Communism. If you use a tool such as computer technology for teaching ancient truths, then technology becomes the handmaiden of religion rather than its master. But," he warns, "any device can be used for good or evil. It depends on the user's intention whether it serves God or the devil."

"A computer is no more an idol than a church pew is," says Peter Johnson-Lenz. "God is in people, not in a machine." Moreover, he points out, computers can enhance the spirituality of religious ritual because in an electronic church, "you can't see if someone is fat, short, beautiful, or ugly. People are pared down to pure spirit."

But Ochoe's judgment is the most down-to-earth. "Once you've used a computer for a few weeks and seen how many bugs you can run into, you realize it is not a god in any way, shape, or form."

## NEW WARES: HARD AND SOFT

According to Apple Computer, the number of people using online databases is increasing dramatically. Some 25 to 30 percent of all computer owners take advantage of electronic services like shopping, banking, and mail by buying a modem within two months of their initial purchase. Because of the trend, Apple has decided to introduce two modems, the Apple 300 and the Apple 1200, which run, respectively, at 300 and 1,200 bauds (the data-transmission rate). Both models plug into the RS232 port of most personal computers and have an automatic dialing function. The modems are supplied with a software package compatible with the Apple II and III computers; the program provides easy access to The Source and CompuServe databases (\$495 for the Model 1200; \$325 for the 300-baud model, from Apple Computer Inc., 2065 Marion Avenue, Cupertino, CA 95014.)

In Search, a new program from Menlo Corporation, was designed to simplify data retrieval from the huge Dialog database. In-Search has disks containing Dialog's four basic subject categories: 1) arts, education, and social sciences; 2) biology and medicine; 3) business, government, and news; and 4) engineering, math, and physical sciences. The program works like an electronic file-card catalog, alphabetically displaying simulated index cards for the different databases within a category. Each category is identified on the card by its own icon. The cards, complete with search commands, make the data-retrieval process much easier. In-Search runs on the IBM PC and on most IBM-compatible machines, (\$398, from Menlo Corporation, 4633 Old Ironsides, Suite 400, Santa Clara, CA 95050.)



"And just what are you planning to do with your silly intergalactic demolecularizing time-traveling module?"

# COMPETITION

ANSWERS TO COMPETITION (PAGE 144)

1 I put the radiator cap back on. Since no air could get in to fill the previously occupied volume, no antifreeze could get out, and the leak was stopped.

2 I found the prescription that always sits in my wife's sewing supplies and used a pin to poke a tiny hole through a piece of paper (by placing the hole in the paper close to my eye [like a particle camera lens], my vision improved enough for me to find my wayward specs).

3 Each time I poured a drink from the bottle I would squeeze the bottle enough to raise the liquid level near the rim. Then I would screw on the cap so that there was very little air in the container for the carbonation to escape into.

4 I got a bag of sugar, poured it on the driveway, and then pushed the car over the sugar. Within a few hours all the ants left the car on their own.

5 I took a threaded needle and stuck it into the spot where the water came through the ceiling. I tied the thread to the sink faucet. I then led the fast drop along the thread to the sink, and the need ones followed in quiet, military precision.

6 When rewinding a reel we stick a coin into the wrap of the film a couple of minutes before the end. When the reel is shown again, the coin falls on the floor, alerting me that the reel is about to end.

7 I took several small stones from the roadside, put them into the bottle, and shook it vigorously. The stones broke through the bottom of the bottle, leaving me with a perfect glass funnel.

8 I took a bit of the tape from the table, rolled my wheelchair up to the pen, and then backed up, visually marking the spot on the wheel that had just touched the pen. I attached the tape to this spot, sticky side out, rolled forward to let the tape touch the pen, then rolled back to bring the pen up to my hands.

9 By unscrewing on the lock, I was able to thaw it enough to open it quite easily.

10 I bought two pairs of soft leather shoes. Since her right foot was the problem, I let her wear only the left shoe. The gentle reverse curve of the left shoe on her right foot gradually straightened it in less than a year. Today her feet are beautiful!

11 The boy had the fishing line to his other shoe and put it into the water where the first shoe was lost. He let out some slack and then followed the line to where the current had taken both shoes.

12 I burned the bag.

13 A largely unused elevator was turned into a booth and a counter was added at the front. Each payday it moved at a set schedule from one floor to another.

14 I guessed correctly that at the end of the day's picketing, the cooler would be empty, leaving me the lighter load to carry up the hill.

15 I go to the supermarket and cash another check, this one for \$30, deposit

\$15 into my checking account and still have \$15 for gas and food. Tomorrow I can deposit my paycheck in the bank and balance my checkbook.

16 Since the number of pennies is as good as random, there are three possible remainders after dividing the amount by 3. 0, 1, or 2. We decided beforehand that one person would receive the extra penny if there were one left; the other two would take the pennies if there were two left. That gave each of us a one-third chance of getting the one extra penny!

17 Let one child cut the cake, let the other child have first choice of the pieces.

18 She opens the dishwasher door, brushes the crumbs in, and walks away. Mission accomplished.

19 Using a watering can and a 60-foot hose we kept the hose full and stretched it between the two water-filled pits. Knowing that the water level would be the same at both ends of the hose, we built the pit up to the same level.

20 We filled the vault to its level with blocks of ice, rolled the generator into place, and let nature take its course.

21 Since we were renting a backwoods log cabin with a wood-burning stove, we knew that there had to be a carbon dioxide fire extinguisher around. There was. After several blasts from the extinguisher, we had frosty beers for the entire crew. Success! No party should be without one.

22 He remembered that the hypotenuse of a  $3 \times 4$  right triangle is 5. All he had to do was package the rod kitty-corner in a 3-foot by 4-foot box.

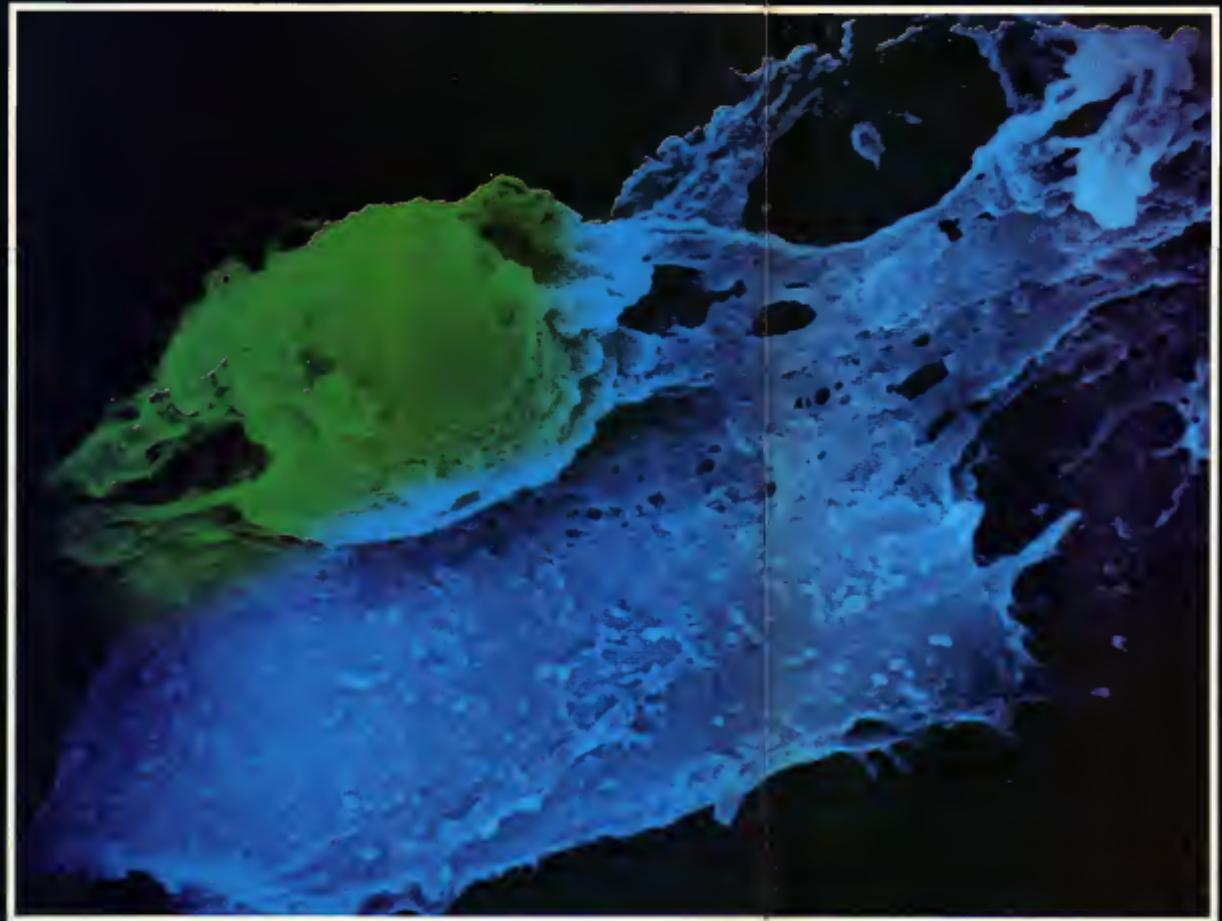
23 We used an ordinary combination lock and wrote the combination—actually, an incorrect version—in plain sight on the gate. The members of the family had to remember only to add five to each digit, but the neighbor wore cut-off fingers trying to open the lock using the combination as we had written it. ☐

## CREDITS

- Rosa E. Palmer, *Human/Dolphin Foundation*, page 10  
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## PHENOMENA

An evolutionary freak-takes form as two cells are bound together into a biological anomaly called a hybridoma—half cancer cell, half white blood cell. The hybridoma here (yellow-green) is joined to a spleen fibroblast, or connective-tissue cell, shown here in blue. Microscopic users like this are used to manipulate immune-system cells to produce antibodies against specific kinds of cancer. The results are biochemical guided missiles called monoclonal antibodies. They are genetically programmed to destroy one kind of cancer. Photographer Philip Harrington shot this surreal cellular marriage through a scanning electron microscope for the Schering-Plough Corporation. The initial photo was done on black-and-white film, which he color-enhanced to highlight the two cells. Then he rephotographed this starting image on Kodachrome 64 film. **DO**



*Hereworth, the winners  
on rhymed English sinners*

# GAMES

By Scott Morris

Inspired by a couple of couplets from *The Wall Street Journal's "Pepper and Salt" column*, we asked readers to write a poetic tribute to their favorite example of meiosis and overuse in the English language. This was *OMNI* Competition #29, announced in July 1983. Willard R. Eddy, the English-language commentator, provided a sample example:

**Critica.**  
There's but one Critic.  
Folks intern/Say "one critica."

Herewith, our favorite entries. Hopefully each of them got what they deserve.

**GRAND PRIZE-WINNER: \$100, PLUS A COPY OF OMNI GAMES**

**The FonAs Prime Evil**  
The pop song that he's wailing  
is the story of his life—  
He's singing to her girlfriend,  
'Girl! I want you for my wife.'

And assuming he's successful—  
That the girl responds, comes hither—  
A question in my mind is raised  
What will his wife do with her?

—Gary Drew, Tallahassee, FL

**RUNNERS-UP: \$25 EACH, PLUS OMNI GAMES**

**Nor a Looner Be**  
Though Shakespeare had the gall  
to scrawl  
"The most unlodest cut of all"  
He would have wrung his peers to tears  
With "Romans and countrymen, loose  
me your ears!"  
—Sunny Anderson, College Park, GA

Double negatives—why object?  
They get Rodney Dangerfield lots of respect  
—Alan Levine, Massapequa, NY

**On Deathless Poise**  
These days people pass away,  
For dying has an ugly ring  
Death has gone on holiday,  
Oh passing away, where is thy sting?  
—Mary Montague, Redding, CA

It's very, very plain to see  
The prize should go to Bill and me  
Now if you dare to ask me why—  
I didn't write, "to Bill and I."  
—Carol and Bill Patsko, Philadelphia

**Borsom pervades every language,**  
Not just English alone—nay, nay  
The Neopersons had it in Latin,  
Just as Gerpersons have it today

From Tagalog, sayed in Personia,  
To the asthmas where monies sit and say  
Their persontras before personolias,  
Like personorequins in an array

Spanish has it, alas, too;  
Personas won't wash it away  
Fight on! Don't be cupinchechevered  
Unto supersons! into the fray!  
—John Hennick, Seattle

**Schatterbrains**  
If shedula and shemer sound right  
Then shooting is needed tonight  
A shism, you see, is shizoid to thee,  
And shosans play shenzos when light  
—Roy Franklin, Fort Collins, CO

For "in this crazy world we live in"  
Paul McCartney is to groan  
—J. Fred Walker, Long Beach, CA

Only a commonna  
Says one phoneme  
—Guy S. Gissler, Portland, OR

Call a Spayed a Spade  
We spaded the cat—  
She oined like the dewi  
But what the heck?  
We used a shovel  
—Nancy Roastcap, Fayetteville, AR

**HONORABLE MENTION**

I think that I shall never see  
A poem quite like the art as a tree  
—John R. Powell, Westland, MI

I think that I shall never see  
A poem as lovely as a forest management  
replacement module  
—Ron Matheson, Burnaby, BC

**Thanks for Nothing**  
If your work has been called *mawtacousa*,  
Or you've offered a job adventurous  
Or if in recent days  
You've received *Asome* praise  
Go look those words up—they're vicious!  
—John Henrick, Seattle

To lay on the beach is a terrible breach  
Of codes both civil and moral  
But to lie hand in hand on the sun-warmed  
sand  
Is unlikely to cause any quarell  
—Mary Montague, Redding, CA

Our supermarkets' grammar  
Is really in a mess  
For "ten items or fewer"  
They show "ten items or less"  
—Carol Patsko, Philadelphia

Please join me in this sad refrain  
For the tragic deaths of *le* and *lae*  
Following the crowd, perhaps I should  
say  
"Requiredas in peace—I mean, let 'em  
lay!"  
—Charles M. Hudon, Columbus, MO

Some folks with excessive ambition  
Use big words far beyond their cognition  
"Fruition" sans clause,  
They think means come to *frust*  
May their prys fructify in perdition!  
—Lucy Cross, New York

**Ponderation**  
One who's tending to leave—  
Must he repair to the door?  
One who could really care less—  
Does he mean he cares more?  
One who's had a near miss—  
Just how hard was he hit?  
One who's broken his arm—  
Was he scratched or just bit?  
—Laura Pfeuchot, Spring, TX

Aint it nifty  
To add fifty and fifty?  
I've always wanted  
Why dummys say honner!  
—Leonard Coomarko  
Newport Beach, CA

Me and him seen the error of our ways  
When told we don't talk so good  
But there isn't many who do these days  
So we ain't sure we should

—Pete Vaughan, Hamilton, Ont.

#### Ad Nauseam

Nauseous and nauseated  
Aren't synonyms by far  
When someone moans,  
"I'm nauseous,"  
Reply "You surely are!"

—Ann K. Scheweler, Laramie, WY

Though people use it many ways  
There's no such word as anyways  
—Nancy Haberman, West Hempstead, NY

Why do airlines announce so scarily,  
"We'll be airborne momentarily?"  
—T.A.A. Quarn, Walnut Creek, CA

"Prepare for takeoff" the pilot has said  
But the way that he said it has filled  
me with dread  
We will fall back to Earth in a minute or  
three  
For we're just taking off momentarily  
—Arthur Petton, Mount Royal, PQ

#### Sportswriter's Taboo

Crushed, checked, moused, or stomped;  
Holed, stamped, drubbed, and popped  
Mauled, wasted, trounced, and thumped  
Whacked, gut-punched, or even bumped  
Why is it considered a cardinal sin  
To say that the victor also can win?

—Wayne L. Vincent, Oklahoma City

TV stations should be awarded  
secondary citations for prerecorded  
—Nancy Haberman, West Hempstead, NY

To those of us with time to spare  
There's no need to say it right  
We'll just switch 7 A.M. in the morning  
To 7 A.M. at night

When dining out it's very nice  
To act genteel all the way  
Order pie à la mode with ice cream—  
And soup du jour of the day  
—G. V. Carter, Seattle

Man, you gotta get orientated  
To grammar mangled and nouns verbed  
It might not be quite the same  
If you'd of lived in another time frame  
—E. Michael Hansen, East Peoria, IL

To my most sincere "I love you, dear"  
You replied, "Me, too."  
While that may be, I ask of thee,  
Is it me that you love, or you?  
—Ann F. Brown, Rutherford, NJ

Flammable or inflammable,  
The book says both are right  
I'm just confused or out of date  
Hey, buddy, got a light?  
—John H. Wylie, Zimmerman, MN

You Should Live So Long  
The morning sunnies, the evening sunsets  
Are redundancies we'd best forget  
Or save them for that fatal day  
They come around the other way  
—Martha H. Freedman, Sarasota, FL

To get ahead in business  
Never be direct  
Always say impact upon  
When you mean affect  
—Ken Yauk, Tuckec, GA

Words that contradict each other  
Are words that make no sense  
The Moral Majority's neither  
And what's Army intelligence?  
—Allen B. Roth, Walkersport, PA

Phenomenon's one, aren't  
Phenomena're common  
—M. R. Fletcher, Mountain Brook, AL

I have a pet peeve in grammar—viz.,  
He is one of those people who is

it's for its  
Gives me the fits  
But I tear my hair madly  
When I hear, I feel badly  
—Charles M. Hudson, Columbia, MD

Lots of people, cleverly  
Start their sentences, "Hopefully"  
—Elio Summers, Great Neck, NY

#### To News Announcers

You have mastered coup d'état;  
And Que sera, sera  
But in juntas, where's the "who"?  
Do you need phonetic cue cards, too?

—Estrelita Thomas, Ontario, CA

Nowadays, as they say  
It's everyone to their own way  
For everyone seems to think he needn't  
Concern himself with his antecedent  
—Stephen Sobel, Chatsworth, CA

#### A Puzzlement

Such a dilemma: What should I do?  
Can man include women? I'm told it's  
taboo,  
The solution, some say, is use person in  
less  
That surrogate's popular, but I am no fan,  
For person contains the child of the man  
—Bill Palmer, Montreal, PQ

If folks are enthused  
Then, oh, what confusion  
For then, does it follow  
They're fired with enthusiasm?  
—Barbara Samson, Twin Falls, ID

Don't Say It Again, Sam  
The old crone, the baby pup,  
Descending down, receding up—  
Delete before you speak in haste,  
A word's a terrible thing to waste  
—Suzi Finkenstein, Sarasota, FL

I sometimes consider an early retirement  
When students respond to their  
environment  
—Jim Peacock, Halifax, NS

Uninformed exaggeration cannot make  
me cry  
Every time I hear it I literally die  
—John R. Powell, Westwood, MA

Comparing calories from our brewer  
We now have less instead of fewer  
—John Sharpe, West Hempstead, NY

Very unique is as hard to be  
As slightly dead or a little pig  
—Mary Montague, Redding, CADD



# LAST WORD

By John Ficarra

•One future research organization will aid victims of Yeow-A-Phobia, the fear that the little alligator on your shirt will bite you on the nipple.

As scientific and medical advances continue in the coming years, many of the serious diseases and ailments that once affected mankind will be conquered. Among the organizations that have been built around these diseases and that raise money and sponsor research will no longer be needed. What will become of them? Will they simply close up shop and go home? Not likely. When the vaccine for polio was discovered, the March of Dimes switched over to fighting birth defects. In much the same way, other organizations will most likely put new names on their dooms, and focus their attentions on other illnesses. In time, they may be reduced to attacking some of the lesser maladies that plague us, which means that at some point in the future you may be receiving letters or calls soliciting contributions to such causes as:

#### The Crook Foundation

This multifaceted research organization will reach out to help those individuals who suffer knee-pulled muscles, sprains, and strains while attempting to duplicate exercises hyped by the likes of Jane Fonda, Victoria Principal, and Jayne Kennedy. The Crook Foundation will provide a 24-hour Ben-Gay hotline; free transportation to and from the chiropractor; and—available for rent—a series of videotaped inspirational messages from Jack La Lanne.

#### The National Association for Victims of Yeow-A-Phobia

The publicly financed institution will aid the thousands of anxious victims of Yeow-A-Phobia, the irrational but overpowering fear that the little alligator on your polo shirt will bite you on the nipple. Specially trained tennis and golf pros will work with victims of all ages, and the association will provide emergency Yeowm road service and, when needed, free milk-in-mat奇 outlays from the local K-Mart until anxiety attacks have passed.

#### The American Canceled Society

A popular, fan-funded group set up to provide emotional and financial support to the 500 present and former baseball players who have undergone the painful ordeal of having managed or of having been considered to manage the New York Yankees under owner George Steinbrenner. In addition to providing free chewing tobacco during the off-season, the league will aid its victims known as Billy's Kids, with group therapy and special spring-training workshops on such topics as "Where Billy Went Wrong the First/Second/Third Time," "How to Break Into Little Beer Commercials" and "Yup, Genius or Too Much Yoo-Hoo?" Workshops will be open to the public; general admission is \$2; box seats, \$4.50 and up.

#### The Never Satisfied 'R' Us Foundation

This nonprofit organization will sed those MBAs who have read and absorbed such books as *In Search of Excellence* and who have become obsessed with perfection. Operating on an expense-account budget, the foundation's storefront clinics will encourage excellence-obsessed people to walk in and discuss how yesterday could have been better.

#### The Million-Dollar March Against Muggage

Funded by the Tongue Institute, this drive will sponsor mini-lotteries and public service announcements for those individuals who, in their zeal to win first prize in the Publisher's Clearing House Contest, licked all the magazine-subscription stamps and by so doing suffered from what is known as whiplashed tongue. Originally the group had planned to offer a special 24-hour helpline for victims, but this idea was quickly shelved when it was discovered that most victims have too much glue in their mouths to be able to talk. Prior to treatment, all patients will be required to sign an agreement stipulating that in the event they ever actually won anything in the big give-away, the agency automatically gets half.

#### The I'm-Not-Quite-Feeling-Myself Foundation

Perhaps more than any other single outfit, this organization will directly affect the lives of millions of Americans every day. I'm-Not-Quite-Feeling-Myself volunteers will work quality all over the United States to do what they can to battle common everyday depression. The bulk of the foundation's time will be spent distributing such emotionally uplifting strategies as Dial-A-Joke numbers, Have-A-Kiss car bumper stickers, Snoopy greeting cards, FTD tickler bouquets and those red, white, and blue knit sweaters found in novelty stores and designed to warm the male gonads.

#### The National Institute for Obscure Unpopular Afflictions

[Also known as the Single Way] Unlike the other foundations, TNFOUA (pronounced infou) will not devote itself to a single malady. Rather, its aim will be to draw attention to all those afflictions too minor, ridiculous, or unique to warrant their own foundations. It will offer solace to those afflicted with halitosis, clandestine vague stomach disorders, and back pains the doctor can never seem to cure. The individual support tentacles will take many forms, from free plasticine cardboard cups that victims can yippe while soliciting donations outside shopping malls to bulletin-board listings of local hypochondriacs who might be interested in new and fashionable ailments. ☐

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