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OMNI

SEPTEMBER 1981

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A Long Sleep of Nightmares is the title of this month's cover, painted in oils by Czech artist Ludek Pesek. Known for his astronomical art, Pesek has painted a series of works that delve into emotional surrealism with meticulous portrayals of planets and moons in our solar system.

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FIRST WORD

By Noel W Hinners

Four good reasons led us to explore the planets: prestige, vision, knowledge, and the practical use of our discoveries. They are as valid today as when we began.

solar system for more than two decades, now producing a wealth of basic discoveries. Their dramatic successes made the Sixties and Seventies the golden age of exploration of the solar system.

Yet in an attempt to save money, our planetary research program has been cut back until there is little left of it. This short-sighted surgery has been a grave mistake.

Four good reasons prompted the United States to begin its planetary-science program, and they remain as valid today as they were at the dawn of the Space Age. They are national prestige, vision, knowledge, and the practical applications that may ensue from planetary research.

National prestige is a product of how we view ourselves as a nation and how others view us. In large part it is dictated by the way in which politicians and the news media perceive and report national events. Prestige is an elusive commodity, difficult to measure. Yet there can be no doubt that the prestige of the United States rose dramatically with the flybys of Saturn and Jupiter.

The Soviet Union understands this even better than we do. Its planetary program has been far more preoccupied than ours with attempts to be first. The Russians trumpeted their successes in planting the Soviet flag and Lenin pennants on the moon and on Venus. This, they seemed to feel, proved the superiority of their political system over democracy.

Both the European Space Agency and Japan are working to establish planetary programs. They have chosen to begin with missions to Halley's Comet in 1986. That their first missions are not as sophisticated as ours is beside the point. They will still reap the political benefits of a planetary program, and both Europe and Japan feel this is worth the investment.

This recognition that planetary science offers earthly rewards stands in painful contrast to our own current attitude. We canceled our Halley's flyby in a burst of budget cutting. Unless the administration reverses its policies soon, we will lose the chance to repair this mistake. Indeed, we may end up without any viable planetary program in the Eighties.

It seems our vision has failed. Vision is often invoked to justify planetary exploration. It's a vague concept, including both arguments as simplistic as the "exploration imperative" in human nature — "climb the mountain because it's there" — and more thoughtful philosophical discourses.

But vision is one of the most powerful of human motives. It was vision that inspired President Kennedy's commitment to Apollo in 1961. "We go into space because whatever mankind must undertake, free men must fully share." And it must have been such a vision that drove Robert Goddard through his decades of isolated research on rockets.

Many talents are needed to fulfill such a vision as space exploration. Goddard and Kennedy represent the extremes: the pioneer who develops the scientific and technological basis for the endeavor — often with a specific goal in mind — and the leader who can galvanize the resources, resolve, and patience to pull it off. There is room for all to make a contribution, and all benefit from their success.

So far the planetary-exploration program's greatest contribution has been what it has added to our collective knowledge. Its sheer bulk of new information is mind-boggling. Many years will pass before we can adequately measure the value of this information.

Yet we can already recognize some of the significance of our discoveries. The evidence, often reported in this magazine, shows just how much we have progressed toward understanding the origin and evolution of the solar system, how much better we understand Earth now that we have had a chance to compare it with other planets. A strong program of planetary exploration could provide many more such insights in the future.

For some people, though, new understanding is not enough. They demand a practical payoff from the dollars spent on exploration. But it takes a long time to assimilate the information sent back by spacecraft. Basic research, and geological exploration in particular, frequently take years to yield practical applications.

The idea that planetary exploration will yield practical benefits is still largely a matter of faith. Yet it is a faith supported by history. Few would deny that the development of the West grew from the first exploration of Lewis and Clark.

But we can also foresee more specific benefits. The use of lunar materials for a moon base and other construction projects, the capture of asteroids for their iron, nickel, and cobalt, and the colonization of Mars are opportunities that today's planetary exploration opened to us.

There is no guarantee that these benefits will ever come to fruition. But only by conducting the exploration in the first place will we ever have the chance to make intelligent choices.

We should not be too disturbed by the severe limits placed on our planetary-science program. The current situation should stimulate innovation and focus our resources. We must weigh our options, make our plans, and be ready to meet new challenges in planetary exploration.

Let us not wait idly for opportunity to strike, nor for the "exploration imperative." Opportunities are more often created than presented to us by luck. Things happen because determined people want them to. The solar system beckons. ∞

Adapted from The New Solar System, *edited by J. Kelly Beatty et al., copublished this May by Sky Publishing Corporation, Cambridge, Massachusetts, and Cambridge University Press. Noel W. Hinners is the director of the National Air and Space Museum.*

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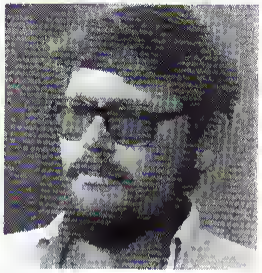

BENFORD

Anxiety is mounting inside the close-knit network of U.S. Intelligence. Semipalatinsk, a city deep in Soviet Central Asia, is thought to be the nesting ground of a brand-new generation of strategic weapons—high-energy particle beams that could spell an end to the epoch of the invulnerable intercontinental ballistic missile. Used in orbit, these powerful zap guns could knock down nuclear warheads or destroy other nations' military satellites. *Gregory Benford*, an authority on particle-beam weapons and a frequent contributor to *Omni*, analyzes how this latest development in the escalating arms race will alter the basic rules of nuclear confrontation. A professor of physics at the University of California at Irvine, Benford began work on charged-particle beams more than a decade ago. He became involved in this area of research because, in his own words, this new class of weapons has peace-inducing potential. Benford postulates, "If both Russia and the United States should develop a particle-beam defense system, there could be a nuclear standoff." His special report, "Zeus in Orbit," begins on page 52.

After growing up on sunshine and fresh air in rural Iowa, *Jane Bosveld* pursued a career in publishing that led her to the squalor of New York City. Fed up with potholes in the road, ill-conceived bicycle lanes, and rundown tenements, she set out to explore what technology is doing to help today's troubled cities. Her quest took her to the laboratory of Dr. J. M. Levitt, high-tech hero of Philadelphia. Whatever the problem—whether it be a baffling crime or the need for a brighter, more durable road paint—Dr. Levitt is the man whom city management calls on. In "Inner-City Savior" (page 62), Bosveld reports on the fruitful collaboration between local government administrators and scientists like Levitt, intent on making city dwelling that little bit more bearable. Now an editor at *Ms.* magazine, Bosveld confides that the story appealed to her radical mentality. "Progressive urban changes that help people! How much more radical can you get?"

Not everyone has as much time to comb the scientific literature as *Omni*'s European editor, *Dr. Bernard Dixon*. For readers who fear that they may be missing out on important findings, he has compiled some noteworthy excerpts from technical journals. They are noteworthy, however, more for their inanity than for their scientific insight.

For example: did you know: "Most people who are shot realize what has occurred"? So far as birds are concerned: some are true pets, others are not"? "Copulation time tends to be unusually long with very young females and relatively short with castrate males"? After scanning his list, your eyes may well settle on one choice bit of information Dr. Dixon gleaned from *New Scientist*: "Quite a number of research grants are definitely counter-productive." See Last Word (page 146).

Two science-fiction writers make their first appearance in *Omni* this month. *Jack Dann* ("Going Under," page 68) and *Wayne Wightman* ("The Fighter," page 56). Though new to this publication, both authors are well established in science-fiction circles. Dann, known for his anthologies and novels, has been a Nebula Award finalist four times and also a finalist for the British Science Fiction Association Award. Wightman began writing science fiction only two years ago, but he already has two novels to his credit and has had numerous short stories showcased in *Fantastic* and *Amazing*.

Ever since *2001*, *Arthur C. Clarke* has been incessantly nagged by film directors demanding to know: What next? Well, he's now prepared to reveal all in "The Songs of Distant Earth" (page 76), accompanied by the stunning pictures of internationally acclaimed space artist *Robert McCall*. Space aficionados should take note of a major exhibition of his paintings, which opens next month at the Scottsdale Center for the Arts in Scottsdale, Arizona.

Some other visual treats in this issue are an exclusive photograph of enzymes—the first time that nature's catalysts have ever been captured on film (page 20)—and a smashing pictorial featuring the work of *Laurence Baskin*, a whiz kid who has developed a unique process for transforming the gray microworld into a rainbow of hues. Don't miss this glittering gallery premiering on page 92.

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Well-endowed and Proud

Thank you for bringing to my attention the offensive findings of Dr Chris Kleinke that "big-breasted women are less competent, less intelligent less moral and less modest than women with small breasts" [Continuum June 1981] I have large breasts as do my mother aunt and sister, and we are all bright successful women with strong religious beliefs upon which we base our moral conduct I am curious whether any similar studies have been conducted to learn whether men with extra chest hair also rate as immoral incompetents

Paula Siddens
Effingham, Ill

The object of Dr Kleinke's study was not to gauge the moral competence of large-breasted women but to show how society perceives such women Dr Kleinke skirted the issue of extra chest hair —Ed

Conversion Resistance

In Gerard K O'Neill's "2081" [June 1981] I noted that the author varies his systems of measurement Sometimes he uses metrics sometimes the old English system and sometimes both When he reports a 'temperature ten degrees below zero,' I don't know whether he means degrees Celsius or Fahrenheit

It is mind-boggling to contemplate that even in 2081 the U S citizen will still be tackling the question whether to go metric or not

Ernest John Rubin
Certified Advanced Metrication Specialist
U S Metric Association
Boulder Colo

Return to Active Duty

Regarding your Life column "Testicular Threat" [July 1981] I had a seminoma type testicular tumor, which was removed in 1951 Soon thereafter I was returned to full flying status with the U S Air Force Then I retired with no medical disability in 1965

So I know what I'm talking about when I take issue with the implication that after such surgery most men "can *even* [my italics] maintain an active sex life" I'm almost sixty years old in excellent health and reasonably active sexually

Harold L Dillingham
Melbourne Beach Fla

Picture Perfect

Omni's latest photography invitational is most commendable in theme and format [June 1981] Many *Omni* readers including me who are artistically inclined have been waiting for such an opportunity to exercise their latent skills and talents Publication of an expanded spectrum of original works should be stimulating to *Omni*'s present readers and to future readers Such a contest would be a showcase for futuristic imagery

David W Rigirozzi
Aurora Colo

See our latest Photo Contest on page 128 —Ed

Say Amen

I have created a religion that can be proved by using the scientific method It is called Random Factor Faith and is based on the following premises

Given an infinity of combinations of matter and energy one will become a life form

Given an infinite number of life forms one will become an animal

Given an infinite number of animals one will become human

Given an infinite number of humans some will attempt to rationalize their existence

Given an infinite number of situations, all of the above could have come about randomly

Eugene Forrest Shelby
Palm Springs Calif

Consider this Given the infinite combinations of matter and energy and that time is similarly infinite, sooner or later all atoms will assemble in exactly the same configurations as they are at this very moment Which means that sometime in the future you will read this sentence again This is called the Religion of Replication Pass the plate —Ed

DIALOGUE

FORUM

In which the readers, editors, and correspondents discuss topics arising out of Omni *and theories and speculation of general interest are brought forth. The views published are not necessarily those of the editors. Letters for publication should be mailed to* Omni *Forum, Omni Magazine, 909 Third Avenue, New York, NY 10022.*

Meaningful Mathematics

As a student who has suffered through years of mathematics, ranging from plane geometry to pre-calculus, I was pleased to read *Omni*'s interview with Professor Morris Kline [June 1981].

From experience, I can say that the majority of mathematics instructors are much too involved with the numerical values to take the time to instill an appreciation of mathematical principles as they apply to the physical world. Similarly, many math textbooks require solutions to purely mathematical problems without any application whatsoever.

In essence, math without the physical sciences is like food without substance.

Lorentho S. Wooden
San Diego, Calif.

I was disappointed by some of Morris Kline's ideas.

Adding one quart of water at 40 degrees to one quart of water at 50 degrees and getting two quarts of water at 90 degrees is an example of the misuse of mathematics and has nothing to do with its certainty. Two plus two always equals four if added arithmetically, but who ever said they must always be added arithmetically? Vectorially, the sum of two plus two may have any value from zero to four, as any navigator well knows.

As to his assertion that the mathematics being created today is mostly a waste of time, who really knows? Once a mathematician delivered a paper in which he created the theory of imaginary numbers. "What I particularly like about this form of mathematics," he said, "is that it is strictly for mathematicians. No one will ever find a practical use for it."

An alert electrical engineer read his paper and said, "This is the form of mathematics I need for constructing an alternating-current theory."

Give the mathematicians complete freedom to create whatever forms of mathematics they desire. Let it be the responsibility of others to select the form that will solve their problems.

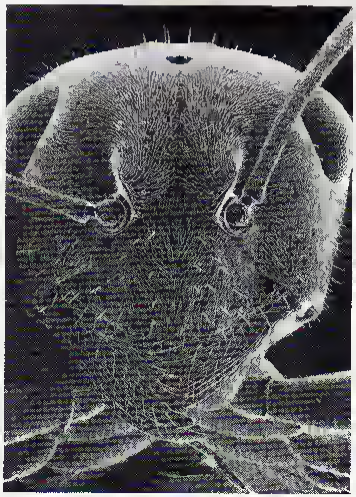
Charles A. Allsopp
Kew Gardens, N.Y.

Antecedent

I was surprised to read that "no one, not even NASA's top scientists, has attempted to send ants to space before" ["Tigers in Orbit," May 1981].

Years ago, inspired by John Glenn's flight, a neighborhood playmate and I soldered tin fins to a depressurized shaving-cream can, filled it with homemade gunpowder, and inserted a firecracker fuse. Atop the rocket, stuck in a wad of window putty, was a clear plastic capsule, the sort that contains small toys sold in grocery-store vending machines.

Apes being too large, and rats being unavailable, the capsule was occupied by a black ant—our courageous astronaut."



Antronauts: Lost chapter of space exploration

This particular rocket never got off the launchpad, melting instead into a fiery puddle. The plastic capsule was a total loss, and there was no sign of our brave test pilot.

May the record show our early attempts to shoot an ant into space—a decade and a half before the enterprising students of Camden High School.

Our antronaut died to further our reach into the heavens. May its ascendants on the shuttle descend safely and their fragile forms, like our hopes for the future, return intact.

Ron Schaumberg
Kansas City, Mo.

Early Airship

On September 8, 1863, the New York *Herald* reported that Solomon Andrews, the mayor of Perth Amboy, New Jersey, "has flown his airship up and away from Perth Amboy commons, and has demonstrated to an admiring crowd the possibility of going against the wind and of guiding [the craft] in any and every direction." This was 33 years before the Chicago *Times Herald*'s account of the "mysterious airship" referred to in UFO Update [June 1981]. Andrews's craft, called an Aereon, proceeded without any engine in a "porpoise-like motion" by alternately valving gas (hydrogen) and dumping ballast (sand). Presumably other airships could therefore have been designed, built, and flown well before the airship-shaped UFO reported by the Chicago *Times Herald* and other U.S. newspapers in 1896 and 1897.

Carl Baumann
Oswego, N.Y.

Growing Grass Roots

For too long I thought I was alone in backing the space program and in promoting the development of space colonies. But, thanks to *Omni*, I see that I am not.

The list of pro-space organizations [February 1981] prodded me to do something about it in northern South Carolina. And I am proud to announce

CONTINUED ON PAGE 122

EARTH

By Mark Washburn

Ever since Heinrich Schwabe and Rudolf Wolf first identified the 11.2-year sunspot cycle in 1843, people have been searching for links between events on the sun and events on Earth. In recent years the search for solar connections has centered on cycles of droughts. Droughts have run in a well-documented 22-year cycle in the western part of the United States. Major droughts hit in the 1930s (the Dust Bowl), the 1950s, and the mid-1970s. Relying on these statistics, we can expect another western dry spell in the late 1990s.

But can we? The problem with statistical match-ups between the solar cycle and terrestrial climate is that they tell us nothing about *why* such correlations occur. In the absence of a theory that explains why and how sunspots cause droughts, it might be equally valid to claim that droughts cause sunspots. Otherwise, the search for solar-climate connections is simply a numbers game.

Two scientists at the National Oceanic and Atmospheric Administration, Kenneth S. Gage and George C. Reid, now believe that they have pinned down not just a statistical match but a mechanism that links the solar cycle and Earth's atmospheric activity.

Gage and Reid looked at the dynamics of the atmosphere over the tropics. Warm tropical air rises through the troposphere, the bottom layer of the atmosphere, until it reaches its common boundary with the stratosphere, known as the tropopause. Because the earth rotates, the air at the equator has more momentum than air from higher latitudes, where the speed of rotation is slower. The energetic tropical air mixes with the cooler air between the thirtieth and fortieth degrees of latitude and forms a strong west-to-east flow—the subtropical jet stream. Most of the United States, in the north, and Australia and parts of South America, in the south, fall within this range.

If the amount of energy in the jet stream varies, the location of the stream may shift. One such shift occurred last winter when the jet stream jogged far to the north over Canada, then returned to the midlatitudes bringing with it frigid polar air. The result was a record-breaking cold winter in the eastern part of the United States.

If the weather in Buffalo, New York, can be affected by the amount of energy in the jet stream, then the question becomes: Is the energy level of the jet stream affected by changes in the sun during the 11-year sunspot cycle? Gage and Reid say yes.

Incoming solar radiation heats the waters of the tropical oceans, which in turn raise the air temperature. Since warmer air holds more water, as it rises, the water condenses, releasing still more energy. "The tropical oceans," Gage and Reid write, "act as a vast water bath that responds to small changes in the sun's radiative output. The resulting small changes in average sea-surface temperature are magnified at the tropopause."

Analyzing 22 years of records gathered from tropical weather stations, Gage and Reid have found that the tropopause level varies with the solar cycle. So the more sunspots there are, the higher the tropopause. The implication is that at the peak of the solar cycle, when the sun is spouting flares and "hot spots" in x-ray and ultraviolet wavelengths, more solar energy is being injected into the atmosphere. The sun warms the sea, the sea heats the air, the hot air inflates the troposphere, the tropopause rises, the jet stream shifts, and it rains in Cleveland.

Unfortunately, we understand even less about the sun than we do about the subtleties of atmospheric circulation. But if Gage and Reid are right, it may help scientists to make accurate long-range forecasts about the position of the jet streams and consequent changes in weather. "It might be useful," Reid says, "to know if India were going to be very dry in the 1990s."

In a world where crops that shrivel in an Indian drought must be made up for by farmers in Kansas and Alberta, dependable long-range forecasts are crucial. And if a drought is headed for the North American breadbasket region—where groundwater reserves are already dangerously depleted—accurate early warning may spell the difference between a mere inconvenience and global famine. ∞

The link between sunspot activity and the earth's weather may be in the air over the tropics.

ENGINEERING ENZYMES

LIFE

By Dr Bernard Dixon

What would you choose as the most wonderful product of evolution? The eye of the condor? A peacock's tail? A towering California redwood?

To my mind, the answer is no single animal, plant, or wondrously sensitive organ. It is those marvelous catalysts, enzymes, that fashion and sustain the whole rich carpet of life on Earth. These exquisitely precise agents are responsible for every one of the innumerable chemical transformations that take place inside all living cells. And they work with an economy that the mighty chemical industry simply cannot match.

Why should cabbages and kings, butterflies and buffaloes, be quietly and efficiently able to conduct reactions that otherwise would require high temperatures, powerful pressures, and poisonous metal catalysts? Until a few months ago we had only the haziest notion of an answer. But now molecular biologists are seriously discussing the prospects of fabricating enzymes—similar to those inside our own cells, but much better.

That exciting goal was explored at three recent conferences on biotechnology sponsored by Robert S. First, Inc. Since there is a $100 million annual market for industrial enzymes in the United States, the introduction of totally synthetic types could bring incalculably high rewards.

There are many motives for creating new enzymes. One is to enhance the effectiveness of their natural counterparts, thereby increasing the rate of chemical conversions. Another is to alter structural configurations to render enzymes more stable. For instance, heat-resistant enzymes would be of great value in high-temperature industrial reactions.

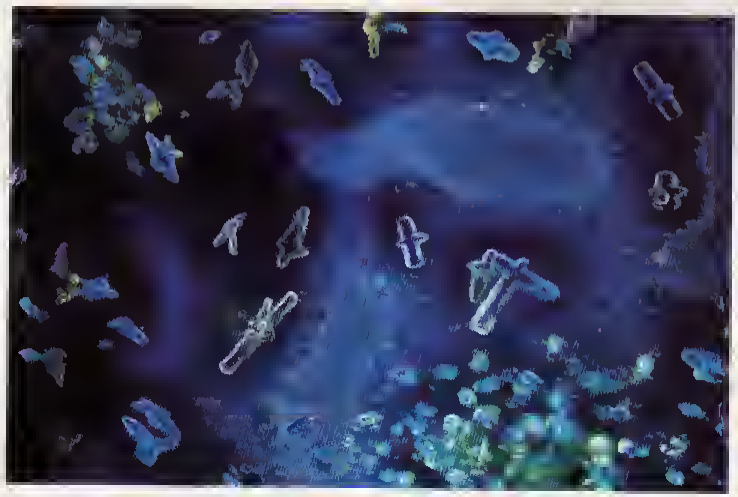
But how do scientists set about building a better enzyme? Like all industrial pirates, they begin by scrutinizing the competitor's product—nature's own catalysts. The enzymes contained within cells are proteins consisting of long chains of various amino acids. Each one has a distinctive sequence. That, and the way the molecule is folded into its three-dimensional shape, are what account for its unique activity. One enzyme promotes one particular reaction only. Such remarkable specificity is encoded in the lengthy sequence of amino acids, 150 or so are strung together in an average-sized enzyme.

To construct an organic catalyst from these building blocks is a long and painstaking task. Far better to imitate not only nature's products but also its way of manufacturing them. Like other proteins, every enzyme is made according to a corresponding DNA template. Can the new science of genetic engineering help? That was the suggestion of Dr. David Jackson, of Genex Corporation. What we require, Dr. Jackson noted, is the ability to read, write, and edit in the language of DNA. If these objectives can be achieved, we will have an elegant route for synthesizing even complex proteins.

Reading is no longer a problem. It is now four years since Dr. Fred Sanger, of Cambridge University in England, first described techniques for spelling out all the "words" in a piece of coded DNA. Since then a spurt of scientific activity has come up with several strategies for fabricating recombinant DNA. With the recent arrival of "gene machines," writing is fast becoming an automated process. In the future an enzyme's amino-acid sequence will be typed in one end and ready-made DNA will pop out at the other. Scientists are now perfecting methods for editing this genetic material, which entails transferring it to a bacterial host that will mass-produce the specified enzyme. Jackson prophesies that in only five years' time DNA synthesis will be as commonplace as reading is today.

So the way ahead is clear. We can conceive of enzymes much more industrious than those now in existence. Genetic engineers may even create enzymes capable of promoting reactions that neither man nor nature has ever contemplated.

According to a recent report from Battelle's Pacific Northwest Laboratories, the U.S. market for industrial enzymes will reach $200 million by 1985. If we can master the craft of enzyme design, that bullish estimate may prove conservative. ∞



Nature's catalysts are captured for the first time ever in this unique photograph by Roman Vishniac

MOTHER LODE

SPACE

By Brian O'Leary

Two billion years ago, probably before life appeared on Earth, an asteroid crashed into the plains of Ontario. Today the mining town of Sudbury stands not far away, supplying half the world's nickel.

Did the gigantic impact excavate subsurface ore? Or was this rich cache of nickel and iron brought to us from the depths of space? Geologists disagree. We may have been mining a fertile star.

Mining the asteroids is an old idea. What's new is that we may be able to do it economically by using current technology. Astronomers Michael Gaffey and Thomas McCord, of the University of Hawaii, in Honolulu, believe that asteroids could supply iron and nickel for years to come—and at a price we could afford.

One NASA study considered using an electromagnetic mass driver to bring back a 100-meter-thick asteroid weighing about 2 million tons. According to plan, solar collectors mounted on the asteroid power large superconducting coils mounted along a narrow tube. The coils' magnetic field shoots debris from the asteroid itself into space, much like a rocket's exhaust. Solar energy and asteroid-debris fuel are free, and the asteroid's near-zero gravity allows us to use a relatively small mass driver. These considerations keep the price of recovery at affordable levels.

MIT's Eric Drexler has a different scheme. He suggests that huge, gossamer-thin solar sails could tow an asteroid to Earth. "Asteroid mining," he notes, "might be justified if we used asteroidal steel in space as radiators to dissipate waste heat from satellite power systems or as shields or hardeners for military satellites." If space development is pursued vigorously, hundreds of thousands of tons of metals may be required for these purposes during the 1990s.

A third way to get an asteroid here is by brute force. Detonate hydrogen bombs on its surface. NASA's Advisory Council recently explored this technique and recommended that we step up our telescopic search for asteroids that might collide with Earth. On short notice, we could rocket hydrogen bombs to the asteroid and explode the bombs to alter its course. Or the warheads could divert a metal-rich asteroid earthward.

Less abundant metals may also justify mining the moon and the asteroids. "Geochemists have long known that many of the elements that are rare and costly in human commerce are not particularly uncommon in the solar system," Dr. Calvin Alexander comments. Rare metals, the University of Minnesota geochemist says, are far more common in our planet's core and in some asteroids.

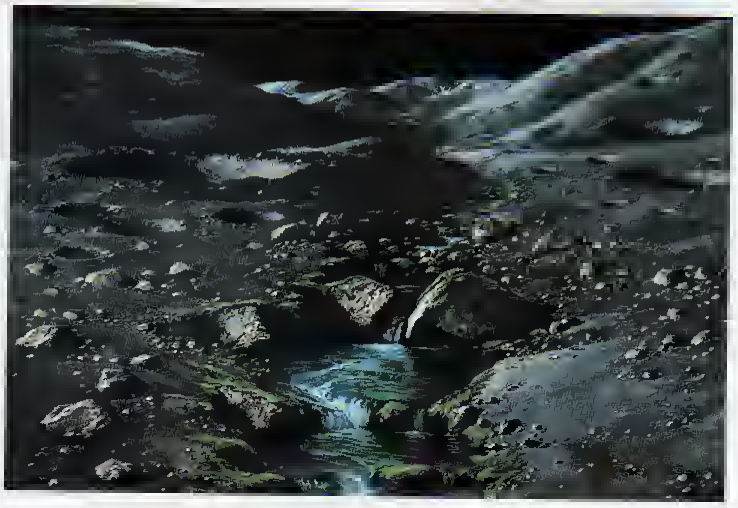
Likely candidates for extraterrestrial mining, Dr. Alexander believes, are the substances that first condensed when the primitive solar nebula began to cool. Among these elements, usually found as oxides, are aluminum, hafnium, molybdenum, scandium, titanium, iridium, ruthenium, yttrium, tantalum, and thorium. Many of these elements are relatively rare here on Earth. Yet they are about 17 times more common in parts of certain very old meteorites and probably in the asteroids.

Mining consultant David Kuck, an engineer from Oracle, Arizona, has assayed the rare metals found in samples from the moon and meteorites. He concludes that aluminum and titanium could be mined profitably on the moon. From some asteroids we could extract billions of dollars' worth of germanium, gallium, iridium, and platinum. Kuck feels that refining them by using free solar power would be simpler than earthly processes.

All the platinum from a 100-meter-thick asteroid would fill only two cargo loads on the space shuttle, but it would be worth $1 billion! Like Gaffey and McCord, who did their study while at MIT, Kuck thinks the profits of asteroid mining would far outweigh the investments.

The bold science-fiction dream of a precious-metals rush in space could soon become reality. But what about gold in the asteroids? Here the story is not as promising. The metal-rich asteroids contain only about one twentieth as much gold as they do platinum.

Yet that amount may still be worth extracting, at current gold prices. Then we could name the first asteroid-towing rocket the *Golden Retriever*.



Like the forty-niners of the California gold rush, asteroid miners could lead our way into space

MISDIAGNOSIS

MIND

By Walli F Leff

Two days after her husband had entered a mental institution Lorraine Hall received a phone call from the psychiatrist.

"George is much calmer now" he said "I've diagnosed him as a schizophrenic and given him a strong tranquilizer He'll need therapy twice a week"

This diagnosis stunned her From what she had heard schizophrenia meant a severe psychotic condition True when George got agitated he didn't always make sense but most of the time he seemed perfectly sane She did accept the fact that diagnosing mental disorders was the psychiatrist's job and that he should know what he was doing Still, she found the diagnosis hard to believe

Lorraine's uneasiness about the diagnosis might have been justified Numerous studies of diagnosis have shown that what passes as a science practiced by well-trained experts is actually an arbitrary exercise in judgment Although Lorraine and George Hall are not real people but a composite of many their situation is quite real, and the question about the diagnosis and relevant treatment is no small concern

Once judged as suffering a serious mental disturbance a patient can end up in the hospital be subjected to powerful drugs with irreversible side effects or even receive electroconvulsive shock treatments A patient is also stamped with a psychiatric label that often becomes a lifelong stigma

Vocal critics from psychiatry itself such as Drs E Fuller Torrey and Thomas Szasz, protest even calling mental disturbances diseases They argue against the use of a medical model to describe irrational thought and behavior

Compelling evidence challenges diagnosis as a valid and reliable psychiatric tool Stanford University psychologist D L Rosenhan dramatically demonstrated its questionable accuracy by getting eight perfectly sane men and women admitted to 12 different hospitals in five states for stays averaging 19 days One subject stayed 52 days All undercover patients told the admitting psychiatrist they heard voices saying 'empty' "hollow," and "thud" From this evidence seven were diagnosed schizophrenic and one was declared manic-depressive

Once admitted all the pseudopatients behaved normally and never reported hearing voices again but not one was ever detected as an undercover patient by any hospital staff member Nor did their diagnoses change discharges read 'schizophrenia in remission" not "normal" The pseudopatients' sanity was apparent to many of their fellow patients however "You're not crazy you're a journalist" they said Or 'You're a professor' or 'You're checking up on the hospital'

The first published evidence to question the accuracy of psychiatric diagnosis was psychologist Philip Ash's 1949 study Ash arranged to have psychiatrists interview incoming patients jointly at a clinic then diagnose them independently Groups of three psychiatrists were able to agree on specific diagnoses only 20 percent of the time For nearly one third of the cases they were in total disagreement In fact on only 3 of 35 occasions did all agree on a patient's serious pathology

Other researchers verified that psychiatrists use diagnostic categories in wildly unpredictable ways Psychologists Benjamin Pasamanick Simon Dinitz and Mark Lefton found that the administrator of one Columbus Ohio hospital ward had diagnosed schizophrenia 22 percent of the time while the administrator of a neighboring ward receiving patients from the same population diagnosed schizophrenia two thirds of the time

The reasons for faulty diagnosis are many Social scientists concur that defining abnormal behavior is very difficult in a culturally heterogeneous society like ours where behavior that people of one tradition find acceptable may be considered abnormal by people of another Also psychiatrists can draw their diagnoses from a wide variety of psychological theories some of which may be contradictory

The professional standard for diagnosis the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders (DSM)*, does not stand

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THE ARTS

By Jeff Rovin

Like the stooped witches in *Macbeth*, three special-effects magicians toil in gathering mist setting the stage for a conflict between the forces of good and evil.

One technician readies a small compressed-air gun. Another paints a guy wire coming out of the gun so that it blends in with the sheer plaster and fiberglass cliff. The carefully camouflaged wire is threaded through a hollow arrow which is fitted into the air gun. A third crewmember is on top of the towering mountain, making certain the wire is firmly attached to a metal plate worn under the shirt of a sinister-looking actor.

Behind this activity, suspended from a huge metal frame, is a massive, sky-blue canvas whose low-lying clouds swirl around the movie set—clouds that are actually dry ice dipped in hot oil, pumped from mixing tanks by thick hoses.

"This is the difficult part of playing James Bond," says Roger Moore as he watches the preparations on a sound stage at England's Pinewood Studios. "Action is what the Bond films are about, and setting up action scenes takes an incredible amount of time."

After an hour everything is in place. Moore, dressed in a natty Alpine outfit, is summoned to the set. He scales halfway up the facade, which is covered with rubber painted to look like rock—a surface that provides the actor with good footing. The cameras roll. The wily thug wrestles to dislodge Bond's guy ropes as the British superspy fights for a handhold. At this point in the script, Bond is rescued by a crossbow-toting ally, upon word from director John Glen, the air gun is fired and the shaft rockets upward. Guided by the wire, it impales Bond's adversary, who screams and plummets down onto a thick stack of mattresses.

The crew applauds the stunt, but the director isn't entirely satisfied with the way the victim's arms windmilled as he fell. Nearly three-quarters of an hour later they stage the death again, this time the blackguard dies more fittingly.

This precipitous bit of derring-do is one of many in the newest James Bond film, *For Your Eyes Only*. When intercut with scenes filmed on the peaks of the vertical Metéora mountains in northern Greece, this time-consuming shot accounts for only five seconds of screen time.

"We could never have done that closeup of the fall on location," Moore says as the company breaks for lunch. "Quick way to run out of actors, you see. We had a wonderfully realistic dummy to do the difficult part, dropping thousands of feet to the foot of the mountain while another dummy me held on for dear life. My wife says this set is less scenic, though when I look at those mattresses, I can't agree."

After lunch, Moore returns, wearing a three-piece suit to dangle outside a helicopter in the film's vertiginous opening. Huge fans create a pelting wind while Moore edges along a runner of the chopper, trying to reach the seat of the dead pilot. The shot is mostly of Moore, so that the audience will not notice that the helicopter has no propellers, nor will they see the technicians shaking the craft from the rear, causing it to pitch and yaw.

For making this shot, the background

007. Derring-do on stacks of mattresses

landscape is not a painted canvas but dizzying footage of a Thames gasworks. A realistic composite is created through front-screen projection, a process that uses a camera and a projector positioned perpendicular to each other with a two-way mirror bisecting the right angle. The projected gasworks footage is bounced from the mirror onto a highly reflective screen behind the actor and helicopter. The camera then photographs the entire scene through the transparent side of the mirror. Though most of this sequence was filmed in the air, tight shots such as this could not have been photographed as efficiently outside the studio.

His aerobatics done, Moore graciously thanks the men who shook the helicopter, then strides over. "Yours is a scientific magazine. Well, note how filmmaking has advanced over the years. We spend approximately thirty million dollars on a film, and we're shooting them virtually the same way as when I did television in the Fifties. The priorities of this industry have always been in the way motion pictures are showcased—laser transmission, Dolby sound, video discs. Maybe if some of those business people had to rock a helicopter or hang around for hours with a wire up their rear end, as I did simulating weightlessness in *Moonraker*, there'd be more R and D on *my* side of the camera."

Despite the long hours and undeniable rigors of making the Bond films, Moore says he enjoys playing the legendary secret agent. He has starred in five of the dozen James Bond adventures—films that have outgrossed the Sean Connery pictures by a wide margin. Moore plans to return in the next one, *Octopussy*, scheduled for release in December 1982.

"It's not unrewarding to do a Bond picture, or to costar in a popular movie like *The Cannonball Run*, where I play a Jewish clothing tycoon who thinks he's Roger Moore. I also had fun with *The Saint* for the seven years I did that show on television. Occasionally I do make special movies such as *The Man Who Haunted Himself* [1970] or *Ffolkes* [1980], which give me a great deal of satisfaction, but you might just as well sit and read poetry.

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COMPUTER GRAFFITI

THE ARTS

By Susanna Cuyler

All over the world graffiti artists chastise or expound upon the objects of their affections. So it is quite natural to see printed neatly in the men's bathroom of the computer-science department in a large university: ON A CLEAR DISK YOU CAN SEEK FOREVER.

New puns and witticisms are beginning to flourish on the electronic faces of CRTs (cathode-ray tubes) and on the long rolls of printout sheets. Retooled old saws, software graffiti, and in-joke ciphers are being programmed faster than Chinese fortune-cookie factories can stuff their products with pithy proverbs. There's a real intelligence to it. Not only is the material healthy, wealthy, funny and wise, but the language in which it is expressed—computerese—is artistic.

The other day, for instance, at Bell Labs, the research center for AT&T, I was standing idly by, waiting for a friend. While I glanced at the words sandwiched between rows of numbers on his terminal, I read the following:

WAITING
AN IDLE MIND IS WORTH TWO IN THE BUSH
MACRO CONTEXT SWITCH UNDER WAY PLEASE DO NOT LOG OUT!

And then a minute later:

IT'S HARD TO BE HUMBLE WHEN YOU'RE PERFECT

Well!

Computer-generated graffiti, or fortune-cookie programs, were born to amuse programmers while they waited for their programs to run. All programs are fed into computers by first typing in your name. Then the computer asks for your password, which is usually your initials, but it can be something more imaginative, such as THE PRINCE OF BABYLON. The password often betokens ethnicity. Big newspapers almost always have computers, and a very good password for a journalist, I learned, uses the first letters in the translation from the Latin: WHOM THE GODS WOULD DESTROY THEY FIRST MUST DRIVE INSANE.

When the computer okays you, you begin programming. Chances are, as other programmers get hooked up and then come on line, they see you're using the computer, too, and so they start punching in funny things. The fortune-cookie program is a collective endeavor and an ongoing one. It provides relief from the tedium that builds up while you're waiting for the computer to run some big jobs. Here are some samples from the Bell Labs fortune-cookie program:

HANGOVER IS THE WRATH OF GRAPES
AN ATHEIST IS A MAN WITH NO INVISIBLE MEANS OF SUPPORT
THERE'S NO ROOM IN THE DRUG WORLD FOR AMATEURS

Computer graffiti can be hazardous. What if someone finds out that you are making up witty fortune-cookie sayings instead of printing out quantizing theorems, logarithms, error-correcting codes, integer sequences, or equations of algebraic geometry in the eighth, twelfth, or twenty-fourth dimension? You can get caught. Is this what happened when I saw on a printout: YOUR PASSWORD IS PITIFULLY OBVIOUS? It must have been a bad day for the programmer who saw: IT'S A SAD WOMAN WHO BUYS HER OWN PERFUME.

Corny replays from old movies have extra charm when referring to electronic travails: MIGHT AS WELL BE FRANK, MONSIEUR. IT WOULD TAKE A MIRACLE TO GET YOU OUT OF CASABLANCA. At Bankers Trust, in New York City, a consultant's weekly TV and movie viewings surface in his signings: I HAVE LEFT MASADA AND AM NOW IN OZ. I HOPE I AWAKE FROM MY DREAM TOMORROW AND WE ALL LIVE HAPPILY EVER AFTER—KUBLA KEVIN.

The computer has its own poetic communications, as in YOU HAVE SLOWMAIL or TOT TRAP—CORE MELTED. The phrase YOU'LL HAVE TO SLEEP FASTER appeared after SLOWMAIL.

Along with the one-liners, "new sequiturs" also have much charm. Here is my favorite:

YOUR MIND UNDERSTANDS WHAT YOU HAVE BEEN TAUGHT
YOUR HEART WHAT IS TRUE
YOU DIALED 5483.

Computer talk is just coming into vogue. Soon we will all learn to pronounce the new words developed especially for computers and their programmers. For the last 10 to 15 years, a *Jargon File* of just such words has been accumulating in

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On a clear disk you can seek forever. *Are computer graffiti causing* bagbiters *in* spacewar *?*

THE ARTS

By Gini Kopecky

Jean Auel recalls watching a recent television episode of *Buck Rogers* in which Buck is transformed into a satyr. "That's the difference between the speculation of science fiction and that of prehistoric fiction," she says. "With science fiction you can imagine going to another planet and being turned into a satyr. With prehistoric fiction, there are more constraints. It's like a jigsaw puzzle where many of the pieces are in place, but there's an awful lot missing. I'm trying to see what's already there, so I know the outline, and then I fill in the missing pieces myself."

Auel's bestselling *The Clan of the Cave Bear*—the first of her projected six-volume Earth's Children series (just out in a Bantam paperback)—is based on the scientific theory that approximately 35,000 years ago Neanderthal man and Cro-Magnon man may have lived at the same time.

So who were Neanderthal and Cro-Magnon? Why did the former disappear so rapidly once the latter appeared on the scene? And, more speculatively, might the two have met and interacted?

These are some of the questions Auel raises in her story of Ayla, the Cro-Magnon girl child, orphaned by an earthquake, who is adopted and raised by members of a Neanderthal tribe. Ayla, with her tall, straight-limbed body, her fair coloring, and her high forehead, is so pitifully ugly to the dark, squat Neanderthals. Ayla, the "Other," the stranger who must always repress her adventurous spirit and her verbal skills in order to master the patriarchal social code and the complex sign language of her new people.

The theory of the brief coexistence of Neanderthals and Cro-Magnons is not new. Nor is Auel's the first novel set in prehistoric times. She mentions as an example William Golding's *The Inheritors* (1955). "But Golding still had Neanderthals running around on all fours," Auel says. "Now with Donald Johanson's discovery of *Lucy*, we know that our forebears were up on their hind legs more than three million years ago.

"Scientists are discovering new things all the time. We didn't formerly think of Neanderthals as being so close to human as we do today. We think of Cro-Magnons as almost grunting around, dragging mates by their hair, and of Neanderthals as some sort of half-gorillas. The popular view of our prehistoric ancestors is so different from what most experts now believe. It's time to bring the two views into alignment. And the way to do that is through popular fiction."

Intrigued as she is by the scientific research, Auel is, first and foremost, a storyteller. "I'm a novelist," she says. "It's always the story that pulls me into the research. If you have the facts right, then it helps the reader to suspend disbelief. As long as I don't stretch the boundaries too much, almost anything should be fair."

What we have by way of facts, Auel says, are "bones and stones. That's what's left. Also antlers, which are longer-lived pieces, and pollen. The flowers, for instance, with which Iza [the clan's medicine woman] is buried are the actual flowers Ralph Solecki mentions in *Shanidar*." Auel happened upon *Shanidar: The First Flower People*, the factual account of the excavation of several Neanderthal skeletons at Shanidar Cave, in Iraq, back when her own book was little more than an idea for a story about a girl living with a more primitive people. Auel had already decided to have the girl adopted by an old man who had a crippled arm. One of the Shanidar skeletons was found to have been that of a crippled elderly male. "And I thought, 'Oh, my gosh! That's my character. There really was a Neanderthal walking the earth who looked like Creb.'"

Cavemen: More like us than we imagined

Like a medicine woman gathering roots, Auel collected her research, examining each fact for its fictional potential. "Just from the bones," she says, "you can make certain valid inferences. You can infer that somebody had to take care of that man. He was not out hunting woolly mammoths by himself, with only one useful arm. So speculate a little further. Was this a society that took care of its old people? Or did the old man have something valuable to offer in return for that care? Pretty soon I'm beginning to see the outlines of a culture, and I'm beginning to understand people."

Auel's distinction between Ayla's verbal facility and the Neanderthals' heavy reliance on sign language also stems from a scientific theory that Neanderthals may have been incapable of fully articulated speech. "This is based on the fact that the neck is shorter, the jaw slopes a bit more forward, and the palate is not as developed," Auel explains. "Now some people have said that speech predetermines communication. My concept was that there's no way Neanderthals could have evolved such an obviously in-depth culture without communicating."

So Auel began investigating various forms and uses of sign language in different cultures. "I started reading back. People have had sign languages for centuries. For example, in India there's a dance where the raising of a finger or an eyebrow indicates a shade of meaning. Nobody says a word, and yet the spectators all understand exactly what's being communicated."

The pivotal and most fascinating element of conjecture in *Clan* (soon to be fol-

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THE ARTS

By Brad Balfour

Folded up flat, it resembles a nondescript rectangle, a bizarre cigarette case. Unfolded Polaroid's SX-70 camera emerges as a machine of revolutionary consequence. Endowed with a near-science-fiction system of optics, sonar self-focus, and one-step color chemistry, the SX-70 is more than just an example of well-packaged technological wizardry. It democratizes photography, demystifies the photographer, and alters aesthetic perception. If is part of the technological matrix that writer Alvin Toffler predicts will liberate rather than enslave.

That's not overdramatizing, either. In *The Third Wave* Toffler proposes that this microprocessed, high-technology world decentralizes power even as it creates greater consumption. Calculators and SX-70s, when in the hands of consumers, accord them great powers to perform tasks previously left to such experts as accountants and commercial photographers. These devices eliminate an insidious and profound kind of consumption—servitude to specialists—even while being consumed. With SX-70 a nearly foolproof photo system makes pictures that are limited only by the photographer's personal vision, not by his level of technical proficiency.

Before I discovered the SX-70, I could barely handle Brownie Instamatics. Then, while watching photographer William Coupon produce lush SX-70 color portraits as rich as his painstakingly divined black-and-whites, I realized I could do something just as strong. Click, bzzzz, click, instant art. Not cheap, impermanent colors, either. A compact, miniature photo, better preserved than the best 35mm color print, appears with a painterly, one-of-a-kind status. A Mylar sheet protects the brilliant color dye emulsion from atmospheric exposure. And, supposedly, the recently introduced Time Zero film promises not only brighter film but a permanence unmatched even by the earlier film, which over a time often cracked if it was handled carelessly.

The SX-70 is almost a reinvention of camera design. Skeptics said that no single-lens reflex system could be squeezed into so small a body. But 30 months of computer work and $2 million later—after the proper curve for the single concave lens was found—a compact system using four reversals of image, four mirrors, and three lenses was created. The film represents an innovative developing procedure with dye and developer all in one. A special opacifier fixes the chemical layers into a single rich color shot.

The camera became a full-fledged robot when the sonar self-focusing attachment was introduced in the late Seventies. The sonar sends a high-frequency chirp toward a target, then receives the echo, automatically focuses the shutter, and releases a picture. Virtually every aspect of the camera construction is new—from the flat battery pack to the photocell that adjusts the aperture. (New York sculptor Jody Intermont attaches 0.5 watt light bulbs to used SX-70 battery packs to create low-light illumination, especially nice at dinner parties. Intermont recommends using the film's black spring-loading clip, unfolded, as a high-tech holder for the tiny lamp.)

For the average picture taker, though, all this stuff means nothing except "point and press." It fakes an artistic desire to become "the best fool at fooling this nearly foolproof camera," as photo critic A. D. Coleman puts it. If you "fool around" with this camera, however, personal work may become publishable, displayable art. The distance between concept and conception shrinks. The picture taker is freed of the photographer-as-technician mystique. Better yet, the camera's compelling limitations prompt a stubborn inventiveness. It really demands that one be clever with it—whether it's by using makeshift adaptations, such as tricking the shutter open in dim light, or just in composition.

When historian Barbara Tuchman recently wrote of a serious decline in quality in America, she did not consider the SX-70. But Polaroid founder-inventor Edwin Land considered artistic quality when conceiving the SX-70. As early as 1949, Land said, "By making it possible for the photographer to observe his work and his subject matter simultaneously and by

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For some artists the SX-70 means danger. Like Ali, when you didn't know whether he would win

THE PINE BUSH ADVENTURE

UFO UPDATE

By Harry Lebelson

Pine Bush was in a frenzy. Dozens of townspeople were concerned about the strange lights hovering above their farms. Their efforts to get the attention of Air Force officials also were being ignored.

About a year ago I was on duty one evening when I received a call," reports Tom Vicarro, an air traffic controller at Stewart Community Airport, ten miles from Pine Bush, New York. "Someone at the *Times Herald Record*, a Middletown news paper, was getting calls from people about a UFO sighting and wanted to know whether we could spot anything from the tower." Vicarro then looked out the window nearest him and scanned the sky. Unable to see anything out of the ordinary, he notified operations that he had nothing in sight in that area. About 30 minutes later, operations received a call directly from someone who had seen a UFO over the same area. "When I was notified of this, I decided to go over to the other side of the tower to take another look. What I saw was a very bright light hovering in the sky. It was much too intense and enormous in size to have been a star or a planet."

The lights puzzled Robert Comeau, too. As police officer for Crawford Township for the past four years, he has seen more than lights. Several years ago, Comeau was awakened by an object hovering above his home. "I could hear it whirring, like a turbine sound," he recalls. "I glanced out the window and this disc-shaped, silvery object was hovering a few hundred feet from my home. It was approximately one hundred feet in diameter with a row of windows around a domed top." Comeau dutifully reported the incident to his superior officer. When word got around, half the force believed him, but the other half didn't.

Other townspeople had witnessed these glowing objects. Three people driving in nearby Crawford Township were engulfed by mysterious beams of light shining down from some kind of metallic object. "I looked out the window and saw the object hovering silently over us," Harold Hunt remembers. He saw a series of lights around the edge of the large object. "I stepped on the gas and got the hell out of there as fast as I could."

Despite the repeated claims made by Crawford Township residents, the Air Force remained uninterested. It is the Air Force party line to feign disinterest in such matters, but the military's openly indifferent attitude toward UFOs belies its covert activities and its concern.

A document released to the public under the Freedom of Information Act ordered all Air Force personnel to downplay reports of unidentified aerial phenomena. "It is strongly urged that no indication of CIA interest or concern reach the press or public, in view of their probable overreaction and interpretation of such interest as confirmatory of the soundness of unpublished facts in the hands of the United States government," the document states.

My response, as a field investigator for the Aerial Phenomena Research Organization, to the Pine Bush events approached cautious skepticism, but I knew someone in the Middletown area and decided to ask some questions about the Pine Bush sightings. My Middletown connection proved far more interesting than I had expected.

Nestled among the hills and valleys of Upstate New York, Pine Bush is a remnant of the Thirties. Dust-covered asphalt roads wind in between the few buildings, old and new, that make up the town. The local gas station, diner, bar, and variety stores stand juxtaposed with buildings from a more prosperous time. Its outlying areas, composed of cornfields and horse farms, Pine Bush is one of many small towns typical of the area. It is 20 miles from Middletown, on Highway 52.

My colleague Ellen Crystall, a UFO researcher, and I were put in touch with two young persons who supposedly had interacted with strange manifestations they said were UFOs. The couple described the objects as intensely bright orange lights, ellipsoid in form. The objects had followed them through the countryside while they were joyriding on their motorcycles after dark. Meeting us at their home, the couple, Bruce and Wendy, introduced us to teen-aged friends

Mysterious effects photographed over a farm field in Pine Bush, New York, defy analysis.

who also claimed to have had collective and individual sightings of strange objects

Besides Wendy and Bruce and their friends, others in this residential farm community of 9,000 claimed to have witnessed the phenomena. Policemen, barbers, store clerks, and laborers, all average working-class individuals, have interacted with one aspect or another of the UFO phenomenon sometime during the last 12 years.

The sky was dark when we arrived at the site where Bruce and Wendy had encountered the eerie lights. "The metallic disc had an orange glow around it as it hovered over those nearby trees," Wendy recalled. "Just as she began talking, her attention was diverted to the far end of the field. "Look, there they are," she stammered. Ellen and I ran stumbling across the field in the direction of red and green lights that were suddenly rising at the base of a hill. We steadied our cameras and began to photograph them. The lights rose at the same rate of speed, while remaining equidistant from one another. This seemed to indicate that they were attached to certain objects. In addition, multicolored lights spinning in a clockwise direction could be seen suspended between the red and green lights of one object. It was too dark to make out other details.

The lights rose from the ground, moved across the sky, and appeared to land beyond some rows of trees. Their strange behavior led me to believe that my photographs could be significant at a later date. The patterns of the lights indicated that some objects were landing at one place and others taking off from another. It looked like Grand Central Terminal at the height of rush hour.

After documenting the evening's events, we headed back to Wendy and Bruce's home to discuss the phenomena. It was pitch-black outside as we began the drive home. A mile down the road, Bruce spotted a blazing red light. It had an ellipsoid shape. I jammed on the brakes as the object passed overhead. I tried to get out of the car, but the door was stuck, and I lost my opportunity to photograph the object. It was moving too fast. An instant later it disappeared beyond the horizon, leaving a faint glow.

After things calmed down, Wendy suggested that Ellen and I remain at their home overnight. The next morning we left early. We hoped to find the location of our sightings of the night before. After first scouring the area without any success, we came upon the remains of a dead deer. We stopped the car so that I could photograph the carcass for my photo collection. Two things happened when I bent down to take the photo. Coincidentally, we discovered we were at the precise location where the previous night we encountered the objects, and Robert Comeau came walking into my view-finder. He asked about the deer. After reassuring him that we had nothing to do with the animal's death, we inquired whether anyone had reported strange lights in the area the night before. He looked at me with a blank expression and said, "You mean like UFOs? Why, I saw them myself some years back." He went on to say, "Half the police department has seen them, and the other half thinks those who've seen them are crazy." We exchanged names and phone numbers, promising to be in touch with him shortly.

It was the next weekend before we realized that the photos we had taken that first night in Pine Bush bore some interesting results. Six of them taken on the same day showed what appeared to be some kind of ionization process taking place as the objects moved across the sky. None of these electrical effects were visible to either Ellen or me that evening.

I later showed the photographs to Samuel Stecher, a physicist from Stevens Institute of Technology in Hoboken, New Jersey. He thought the photos were significant and merited specialized analysis. He showed them to the head plasma physicist at Stevens. Unable to evaluate the photos and unwilling to venture an opinion as to their source, the plasma expert asked a photo analyst at the institute to evaluate them. He also was unable to offer any insights into the images.

"I could hear whirring, like a turbine sound. I glanced out the window, and this disc-shaped, silver object was hovering near my home, a short distance from the trees."

The mystery of the photographs deepened. Stecher's curiosity, enough for him to accompany us on a second visit to Pine Bush. It was just after dark when we arrived at the field. Within minutes two bright lights rose from beyond the trees. They silently bore down on us as we stood motionless. Three mute witnesses, transfixed, we watched as the object moved within several hundred feet of us. Suddenly it veered to the left. We could see three large, square windows directly behind the lights. Internally lit, they cast an eerie glow in the sky while they crossed over the farm and disappeared without a sound. This was the first of several encounters Stecher would have in Pine Bush during our stay in the area.

We contacted the *Times Herald Record*. We were amazed to find UFO activity dating back to 1965. From the 1960s up to the present time the phenomena have encompassed a broader geographical area than we thought.

I called Stewart Airport for verification of some of the sightings. Vicarro told me that no logs were kept of the incidents. He recounted to me his own sighting of over a year ago, for which he could offer no reasonable explanation. "Quite some time ago operations received a phone call from someone who reported a mysterious object over the Middletown area," Vicarro said. He looked out the window of the control tower and saw a very bright light over the area. "Boy! Was that strange!" he exclaimed. "It was only about a thousand feet in altitude. It remained stationary for a short time and then shot across the sky." He claimed that no pilot of an airplane would take a chance and fly so low. The air traffic controller was insistent that in his 14 years on the job he had never seen an object display such odd behavior.

Perhaps the experiences of Air Traffic Controller Vicarro, physicist Sam Stecher, and numerous residents of Pine Bush will offset the attitudes and conclusions of Dr. Robert L. Hall regarding the UFO phenomenon. Dr. Hall, who in 1968 was head of the Department of Sociology at the University of Illinois, spoke at a UFO symposium convened by the House Committee on Science and Astronautics in 1968 to probe the UFO enigma.

The social psychologist suggested there was strong evidence that some UFO cases resulted from contagious hysteria. "Once people are sensitized to the existence of some kind of phenomena and there is emotion or anxiety associated with it, which results from the uncertainty of the situation, then, lacking any explanation, people will generate the news and explanations that reduce that anxiety," he said. He claims that there are many well-documented cases of this kind of mass hysteria.

Contagious hysteria? It didn't seem that way as far as I was concerned. Those metallike objects and brilliant red-orange discs seemed real enough to me. The testimony of those we talked to, both policemen and ordinary citizens alike, did not reflect opinions generated by fear and anxiety. In fact, the people in these communities seem to have a "live and let live" attitude regarding the phenomena. They view them as a temporary inconvenience that will go away someday, they hope.

Robert Jastrow, the noted astronomer, asked to comment on the Pine Bush photos, distinctly separated them from any natural phenomena when he said, "I'm unable to interpret these images as atmospherical electricity. They may be something totally unknown to us at this time."

Perhaps they are ∞

QUICK-FROZEN METEORITES

EXPLORATIONS

By James E. Oberg

The NASA-released images might have been relayed back to Earth across 100 million miles of space from a Viking probe. Scattered rocks stretch toward a hilly horizon, with drifting sand sifting among them. Nothing living is in view. According to instruments, conditions of bitter cold and extreme dryness characterize the desolation.

Is this Mars? As far as the climate is concerned, it's not far from it, though considerably more hospitable to humans. The unearthly scenes are actually here on Earth, a unique region of Antarctica called the Dry Valleys, where mountain ranges block the advance of continent-covering glaciers and dry winds allow little snowfall.

As if to strengthen Antarctica's close kinship with outer space, a treasure-trove of meteorites has recently been collected from the surface of the continent's mile-deep ice sheet. These have escaped the biological contamination so unavoidable elsewhere on Earth. Antarctic conditions have allowed geochemists to measure accurately the biochemical composition of these stones from space, providing more data about the origin of life on this planet—and beyond.

The desolate valleys themselves are unique in their near-sterility and their perpetual winter. The three largest Dry Valleys—Taylor, Victoria, and Wright—are located about 100 miles west of the main American base at McMurdo Sound, on the southern edge of the Ross Sea, near the active volcano Mount Erebus (site of a commercial aircraft disaster in 1979 that claimed 170 lives). Hemmed in on all sides by glaciers, the valleys were first discovered in 1958 during the International Geophysical Year, but they were not explored until several years later.

The possible similarity between the Dry Valleys and Mars was soon noted by space scientists. It was on a field trip to Wright Valley, where he planned to field-test a device for detecting microbial life on Mars, that the noted biologist Dr. Wolf Vishniac lost his life in a climbing accident. A subsequent expedition was led by Dr. Thomas "Tim" Mutch, an expert on Martian geology who later became NASA deputy administrator for space science. (Mutch, too, died tragically in a climbing accident, while on a vacation in the Himalayas, in 1980.)

Other NASA scientists conducted follow-up visits. There, in 1979 and 1980, the latest group made findings similar to some puzzling information sent back by the Viking landers on Mars from 1976 to 1979. The scientists found many striking parallels between the two locales.

Space geologist Dr. Everett K. Gibson of NASA's Johnson Space Center in Houston enumerated the similarities. "Both have very low absolute humidities. The Dry Valleys are the coldest *and driest* deserts on Earth. There's very low precipitation there. It's never been observed to rain, and the light snow that occasionally falls soon evaporates without noticeably wetting the ground, because of the desiccating constant winds, which average fifty miles per hour. A daily freeze-thaw cycle occurs both in Antarctica's Dry Valleys and in the equatorial regions of Mars in summertime. Both locales have low magnetic fields.

Meteorite harvest in the Dry Valleys

One particular spot intrigued Gibson's team: the shores of an unfrozen brine pool called Don Juan Pond. Fed in summer by melting glacier water seeping through the ground, the pond is too salty to freeze. The NASA geologists determined that the behavior of the salty water could also account for several puzzling findings of Viking. A thin, hard covering was noted on Martian soil when the Vikings excavated trenches with their robot arms—geologists call it duricrust. A similar feature exists around Don Juan Pond, and Gibson explained it as the hardening of the surface-soil layers by salts, deposited there by percolating water that moved toward the surface and evaporated. The theory that a similar process created the Martian duricrust is substantiated by Viking's soil analyses, which revealed almost identical chloride concentrations and similar sulfur concentrations. It's one more piece of evidence for the former existence of a "wet Mars" with a much more hospitable climate than exists on that planet today.

The Dry Valleys recently revealed another secret with importance for the search for life on Mars. There are life forms in Antarctica that, if they existed on Mars, would not have been detected by the sophisticated instruments of the Viking landers in 1976. They are lichens that actually live inside rocks.

Lichens can grow in very hostile environments, including many other regions of Antarctica. But the Dry Valleys, because of the sandblasting winds, were long thought to be devoid of life of any kind—except for occasional spores carried there on the winds. When microbiologists tested various prototype "life search" instruments in the 1960s, the results were unanimous and unequivocal: a completely dead environment.

But then one researcher tried a new strategy. Dr. Imre Friedmann, a microbiologist from Florida State University, suggested that algae might be able to survive the low temperatures by inhabiting the porous sandstone boulders. His hypothesis was verified by on-site explorations, beginning in 1977. Algae

CONTINUED ON PAGE 127

CONTINUUM

Edited by Dick Teresi

SKY-HIGH

One evening last winter I walked out of a building in downtown Washington D.C., and looked up into a sky so crystal-clear that Ella Fitzgerald could have shattered it with a single note. The full moon glowed like green cheese, and two planets—Mars and Saturn—hovered nearby like friendly fireflies. Properly awed, I looked around for someone to share the spectacle with me. But the people pouring from the building had their eyes fixed on earthly destinations. Their heads were not screwed on right, it seemed, for looking up.

I don't usually walk around with my head in the clouds. Like most people, I rarely notice the sky. But something about that experience made me question the psychology of a society that keeps its eyes on the road, its nose to the grindstone, and its feet on the ground. Looking at the sky almost requires that you ponder the larger outlines of life, suck in a cool draft of fresh air and broaden your perspectives.

I confessed my suspicions about skygazing to an editor friend with whom I was discussing the seriousness of cuts in science education and science-awareness programs. To my surprise, she said, "I know exactly what you mean. I can always tell when things are not right in my life because I don't look at the sky."

The next day I received a notice that an organization named For Spacious Skies was launching an all-out campaign to foster sky awareness, starting with a conference at the Grand Canyon. The group was founded by former Boston TV journalist Jack Borden when he discovered that 20 of the 20 persons he interviewed on the streets of Boston did not know what the sky looks like. For Spacious Skies, among other things, had sponsored a study that showed that not looking at the sky may be hazardous to our mental health; then another that indicated residents of our nation's capital had the least concern about the sky, less than the inhabitants of any other large American city.

I was not surprised. Not after that evening last winter. I have been in too many 747s between New York City and San Francisco—where the view of the sky alone is well worth the fare—only to have other passengers upbraid me for peeking through the window during the movie.

Sky ignorance is epidemic. According to a study that For Spacious Skies commissioned, conducted by Ervin Zube, director of the University of Arizona's School of Renewable Natural Resources, fewer than half the respondents interviewed nationwide had even a clue as to what the sky looks like. Some people who participated in the Skywatch at the Grand Canyon, such as urban psychiatrist Leonard Duhl, concluded that insomnia and other ailments may even be related to too much time spent indoors (95 percent for most people). "Part of modern man's malaise is that he's isolated from the sky," Borden says. "When the whole world around you is raging and you're not part of it, your life force is sapped."

For Spacious Skies is planning an ambitious program to prepare a TV documentary, a traveling museum exhibit, and a sky curriculum for schoolchildren. Photographer Ansel Adams and landscapist Eric Sloane have already donated some of their works to further the cause.

Of course, all you really have to do to see stars is look up, preferably from flat on your back. Even from the most cramped backyard, back alley or rooftop, you almost immediately feel that you are floating in a broad expanse of space, viewing the world from underneath.

On a clear night the sky is a transparent window to outer space. The only testimony to its existence is the twinkling of stars, a refractory effect produced when warm and cool layers of air bend starlight into the shimmering image of a point source.

Sky-high is not so high. The entire atmosphere is but a decal on the surface of the earth. It amounts to the thickness of six sheets of notepaper on a sphere eight inches in diameter. Or the thickness of your breath on a marble.

There's nothing like contemplating the sky to give you a sense of perspective about your place in the sun. One of my friends likes to tell people who ask, 'Where is outer space?' 'We're in it.'

But poor sky! No longer a brilliant window into space, it is becoming a dark cloak. One morning last year I arrived in Pasadena, California, and was thrilled to behold snow-capped mountains. Next morning those mountains were gone, eaten by the angry polluted sky. "If people aren't able to grok the sky," Borden says, "how can they be vigilant about protecting it?"

When you don't sense the sky, you always have to ask the weatherman to know which way the wind blows. Just because gravity has stuck our feet to the ground doesn't mean that our eyes or spirits have to be earthbound, too. —*K. C. COLE*

CONTINUUM

MICE WITH ANTLERS

Mice with antlers may soon be providing important information to cancer researchers. Richmond Prehn, scientific director at the Institute for Medical Research, in San Jose, California, has succeeded in grafting deer antler cells into mice and expects to be studying fully horned rodents in about a year.

"Antlers fall off every year and regrow very rapidly," Prehn says. "There's reason to think that tissue like that is relatively resistant to cancer formation." Prehn wants to learn why antlers can grow so fast, yet remain organized, while rapidly forming cancer cells grow wildly.

Deer, however, would be too costly and inconvenient to study. So Prehn is trying to develop mice with antlers. "It's been found that you can transplant antlers from one site to another in deer. By transplanting a little bit of the surface of the bone underlying the antler to another site on the deer, antlers form where you put it," he says. He has taken samples of this tissue and transplanted them into rodents.

So far, his tissue transplants have developed into small bumps, similar to the bases of deer antlers. But because of the huge differences between mice and deer, there's still some fiddling that'll have to be done. —Howard Smallowitz

Laboratory mouse with antlerlike growth between the ears

"Cease to inquire what the future has in store, and take as a gift whatever the day brings forth."

—Horace

WATER WASTE

Anyone wondering why there are water shortages need look no further than breakfast. Because of increasingly water-intensive processes, it now requires 57 gallons of water to make a single egg. Add bacon, butter, toast, another egg and a glass of milk, and you get a whopping 510 gallons—enough to supply the average African nomad for almost two years.

The total includes water for irrigation, for mining and smelting metals to be used in farm equipment, for cooling and evaporation in making electricity that runs refrigerators, for washing henhouses, processing foods and preparing meals at home.

The Canadian Water Quality Association has found that many people let the equivalent of 20 glassfuls of water drain away before filling up a single glass to drink or to cook with.

The most water-intensive food is grain-fed beef. A half-pound steak represents 2,600 gallons of water, due largely to the huge amounts of water needed for all that grain that cows eat. An equal amount of pork requires 820 gallons; an equal amount of chicken, 410 gallons.

One hundred eighty gallons are needed for each half-pound of cherries; 50 gallons for an equal amount of watermelon; 41 gallons for green beans; and 26 gallons for grapefruit.

Experts say large amounts of water could be saved by recycling—instead of discarding—water used in industry.

Each time a useful product is discarded, precious water supplies must be used to produce a new one. For example, it takes 2,100 ounces of water to make a 12-ounce can of soda, most of it to produce the soda can. Thus, throwing out 15 billion cans each year wastes almost 1 trillion gallons of water.

—Stuart Diamond

It takes a lot of water to grow food: 180 gallons for a half-pound of cherries; 41 gallons for green beans; 26 gallons for grapefruit

'I am compelled to fear that science will be used to promote the power of dominant groups rather than to make men happy'
—Bertrand Russell

'When a person tells you I'll think it over and let you know' —you know'
—Olin Miller

HALF A BRAIN

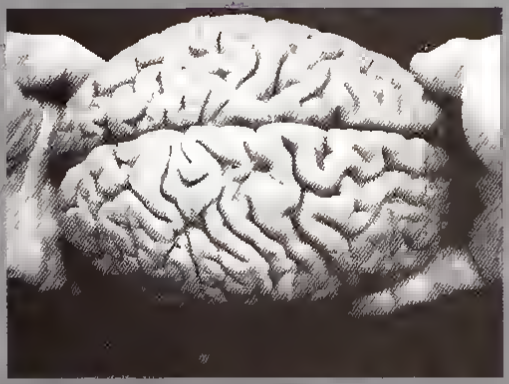
Half a brain is not only better than none it may be just as good as a whole one, according to one British psychologist

Writing in *New Scientist* magazine, Stan Gooch says that evidence coming out of operating rooms all over the world shows that the two halves of the human brain are not as specialized as some think and that the right side of the brain in particular has been underesti mated

According to what is known as the split brain theory the right half of the human brain which controls the left side of the body specializes in nonverbal mental work such as spatial or intuitive thinking The left side which rules the right half of the body and is considered dominant does more logical work such as handling language or math problems

By this theory, losing the left side of the brain should cripple a person both mentally and physically That says Gooch, is not what happens

His evidence comes from a drastic brain operation, called a hemispherectomy in



The split brain theory may not be what it's cracked up to be

which half the brain is surgically removed In operations done in England and in South Africa patients who had the left half of the brain removed were still able to perform what are usually considered left-brain functions

In one instance a forty-seven year-old man who had a hemispherectomy because of a large tumor on his left brain regained his use of speech and even sang old songs six months after the operation

In another case a twenty-one-year-old woman who had severe epilepsy and right-side muscle twitches from a defective left hemisphere actually improved her so-called left-brain skills after a similar operation Before the operation she did not read and had only sporadic control of her right side After the operation she was reading books and newspapers for pleasure had regained much of the use of her right side and even felt confident enough to take a job

Gooch s explanation for what happened is that all intellectual and motor functions can be done by either side of the brain What he suggests happens is that as the brain matures, each side does tend to specialize in right-brain or left-brain work but doesn t lose the ability to do it all if the need arises

—Douglas Colligan

HUMAN TIDAL WAVES

In some parts of Austria girls with small breasts stand in the light of the full moon and hope While proof that the full moon can make one buxom or incite werewolves remains inconclusive a study out of India proves that it does enhance a peculiar impulse to take, or give poisons

Chandeshwar Thakur and his colleagues at Patna Medical College found that the incidence of poisoning on the night when the moon is full is significantly greater than on any other night of the month

The researchers note that the moon is full only when the earth lies directly between the moon and the sun, and that on such days gravity acting in a straight line causes high tides As with seawater, body water might also generate some sort of tidal wave that increases, Thakur wrote in the *British Medical Journal* Since water constitutes so much of the human body it's possible he suggests that human tidal waves' cause brain changes that induce an individual to take poison

Speculation admittedly But menstrual periods and related body functions such as heart rate temperature weight and blood chemistry are now known to vary with the moon Also under lunarly influence are such unlikely nonhuman phenomena as rat running activity the grunion s breeding habits and potato metabolism

—Norbert Lempert

Moon madness From big breasts to poisonings

CONTINUUM

NEW RUNNER'S PROBLEM

Runners sometimes suffer what's called runner's fracture: a hairline break in the fibula, the smaller of the two leg bones. But doctors at Duke University Medical Center, in Durham, North Carolina, have found a new runner's fracture—in the other leg bone, the tibia, or shinbone.

Dr. Richard A. Daffner, associate professor of radiology, says the tibia break may be as common as runner's cancer. So Daffner urges doctors to get a complete medical history from runners who complain of suspicious shin pains, and to think fracture, not tumor.

He also recommends using radionuclide bone scans. X rays may not always show a hairline break, he says, but a positive radionuclide test says there is something wrong in the bone, even if X rays don't.

Ballet dancers and gymnasts may also have this problem, but Daffner has seen it only in runners.

The newest runner's fracture may not show up on X rays

fracture, but improperly diagnosed.

The break occurs a third of the way down the back of the shin, in a place where a muscle attaches to the bone. Dr. Daffner suspects it's a stress fracture caused by an improper or unnatural running gait.

Two of the first patients he and his colleagues saw were teen-agers who'd been diagnosed as having bone cancer.

The cure for runner's shin, Daffner says, is a simple one. Stop running for a month or so and let the bone heal. Otherwise, the hairline fracture could weaken and the shinbone could snap completely. —Joel Davis

"The mind of man is capable of anything—because everything is in it, all the past as well as all the future."

—Joseph Conrad

PYRAMID TECHNOLOGY

Why are Egypt's 5,000-year-old pyramids still standing while other ancient monuments have crumbled? The answer, according to a Smithsonian scientist, is in their shape.

The pyramids were built specifically to withstand the desert's wind-and-sand erosion. Their sloped sides conduct the searing winds up from the ground and dissipate more than 80 percent of the energy harmlessly into the sky.

"Had the pyramids been built square, they would not be standing at all," says Farouk El-Baz, a geologist for the Smithsonian's Center for Earth and Planetary Studies.

El-Baz, who has studied the pyramid phenomenon for six years, suggests that the ancient Egyptians built their monuments to the dead near Cairo after observing natural landforms in the Egyptian deserts—forms that have weathered erosion for tens of thousands of years. Three of those are about 600 kilometers from the pyramids. "The Egyptians combed and explored the desert," El-Baz says. "They must have had an incredible knowledge of the desert. I suspect they used it."

One piece of evidence that the ancients understood the strength of pyramids is the fact that desert tents are pyramid-shaped. "If they had had any other form, the wind would have torn them apart," El-Baz says. He also notes that the Sphinx mirrors natural, wind-sculpted desert forms. Called *yardangs*, they are aerodynamically stable and resemble an inverted boat hull with the bow upwind and rudder aloe.

The Transamerica pyramid

El-Baz says that if modern structures—particularly in sandy or salty windswept areas—were built in the shape of pyramids, they would last at least ten times longer. Among the few modern pyramids is San Francisco's tallest structure, the Transamerica world headquarters. Architect William Pereira, of Los Angeles, designed its pyramid shape a decade ago to attract attention and to protect it from earthquakes. El-Baz believes the building will be around for a long time. —Stuart Diamond

[Women jurors] are like arsenic and old lace; they come in crying in their lace handkerchiefs, and then they put you in the gas chamber."

—Melvin Belli

ICY OPERATIONS

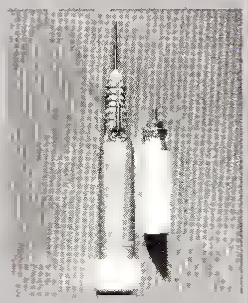
Cryosurgery or surgery with an ice lance has been around for over 20 years Now thanks to better instruments, it s being used in a new range of operations

In many situations the deep-freeze treatment has advantages over knife surgery because there's less blood loss little or no scarring, often no need for anesthesia, and a shorter period of convalescence Skin cancers precancerous changes of the cervix hemorrhoids prostatic disorders and nasal polyps are treated routinely with cryosurgery because they can be approached directly with a frozen probe without any need for extensive knife surgery

Probes used for cryosurgery are designed to emit universally available nitrous oxide or liquid nitrogen Benign tissue is destroyed when subjected to temperatures of −20°C to −50°C while malignant tissue is destroyed at a minimum of −50°C Cryodestruction works best when there s a rapid freeze at the lowest possible temperature Where large tumors are involved surgeons have been known to use the incredibly low temperature of −180°C

During the past two years Frigitronics of Connecticut the world s largest manufacturer of cryosurgical instruments, has developed probes that can perform extremely delicate surgery Neurosurgeons can now work with a 2 3-millimeter diameter probe containing a wire tip that is sensitive to precise temperatures while it is on tissue Such a probe can freeze and lift tumors off delicate nerve centers without having surrounding tissue adhere to the probe s shank Even ophthalmologists are turning to cryosurgery—using probes smaller than one millimeter in diameter to enter the eye and manipulate position and withdraw foreign objects and target tissue

—Caroline Rob



Ice lance Freezing malignant tissue to death

ASTEROID ALERT

To learn more about asteroids and not incidentally, to avoid disaster, scientists at the Jet Propulsion Laboratory, in Pasadena California and at the University of Arizona are working on a special plan to track these wayward space rocks

Astronomers Tom Gehrels, at Arizona and Eugene Shoemaker of the Jet Propulsion Laboratory have suggested a project to NASA that would include a device called a Spacewatch Camera, which would be mounted at the university's Kitt Peak Observatory

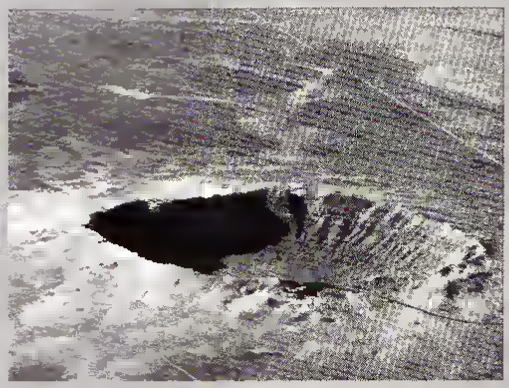
With this specialized camera they could identify and plot the orbit of the asteroids learn more about their physical makeup give us some clues about the origin of our solar system, and even identify those that might be rich in minerals for space-mining enterprises

As an added bonus Gehrels notes, Spacewatch could save us from a global disaster There are approximately 1 500 asteroids one kilometer and larger in diameter that have wandered from outer space into our solar system If a large asteroid, say ten kilometers across, ever hit our planet, it would have the equivalent impact of 10 million Hiroshima-type bombs

Killer asteroids have hit the earth in the past Just recently a group of scientists offered the theory that it was an asteroid that indirectly wiped out the dinosaurs 65 million years ago The dust cloud raised by that collision killed off the plant life the dinosaurs ate Some scientists also believe an asteroid caused the Tunguska explosion in Siberia in 1908

With the Spacewatch Camera, Gehrels says we could spot those asteroids approaching too close to Earth and nudge them into a different orbit with explosives or rockets Yet the chances of a big one hitting us are small about 1 in 100 million Gehrels says But given the tremendous amount of damage they could cause It wouldn t hurt to be prepared "We should be a little smarter than the dinosaurs were," he adds

—Douglas Colligan



Arizona crater Such holes in the earth can be avoided

"When all else is lost the future still remains"
—Christian Nestell Bovee

"If the only tool you have is a hammer you tend to see every problem as a nail."
—Abraham Maslow

CONTINUUM

VDT HAZARDS

Video data terminals, or VDTs, those nifty computerized TV screens that seem to be everywhere—from newsrooms to airline reservation counters—can be a pain and possibly a danger to use, according to one government agency.

Since 1975 investigators from the National Institute for Occupational Safety and Health (NIOSH) have been checking out and largely substantiating complaints that heavy VDT use can cause eyestrain, headaches, stress, and backaches. And now they are investigating yet another possible hazard: cataracts.

After a series of in-depth studies, NIOSH found that many of the VDT users' complaints were justified but could be eliminated with some design changes. Changing room lighting and using hood and nonglare screens on the terminals would ease some of the visual stress, as would installing contrast controls and using soothing orange or amber lettering for the screens.

Adjustable furniture and movable keyboards would help the muscle aches. Finally, NIOSH recommended a 15-minute break from using the machines at least every two hours.

There is also worry that VDTs may cause cataracts even though they give off radiation at levels considered safe by current government standards. Working at a VDT is equivalent to holding your face about two feet away from your television screen several hours each day, five days a week.

The first hint of trouble came in 1977, when two copy editors at the *New York Times* developed cataracts after using VDTs for about a year. After an investigation the VDT was exonerated, but interest perked up again this year when two other VDT users at another paper, the *Baltimore Sun*, also developed the same eye problems. That has prompted NIOSH to do a comparison study of cataract cases in users and nonusers.

With about 3 million VDTs now estimated to be in use and more than 5 million expected by 1984, the need for gauging the VDT risk factor will simply increase.

—Douglas Colligan

VDT users may be susceptible to eyestrain and cataracts

'A great truth is a truth whose opposite is also a great truth.'

—Thomas Mann

SHOCK THERAPY

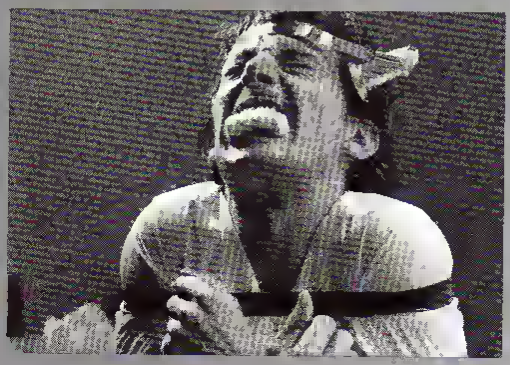
For 20 years psychiatrists have debated whether ECT—electroconvulsive therapy or shock treatment—helps cure depression. Radical psychiatrists such as R. D. Laing, have said ECT is used to control patients rather than to cure them. Research shows that people suffer loss of memory after being shocked. And now a recent experiment indicates that shock treatment is not even very effective.

A British team at Northwick Park Hospital, in London, has just completed a trial of 70 depressed patients. The patients were divided into two groups. One group received real ECT with the full electrical shock delivered right to the brain. The other group got simulated ECT: they were made to lie down on a special bed, electrodes were clamped to their heads, then they waited. But they were spared the shock. It has been argued that what helps patients may be the attention they are given before and after they receive the shock, not the jolt itself.

The patients were followed up a month and six months after ECT had been stopped. During the course of the testing those patients who were shocked improved more than did the patients who were not shocked. On the Hamilton depression scale, 'real' patients improved by 38 points while 'simulated' patients improved by 27 points. The researchers point out, however, that in real-life terms such a difference is not all that great. Also, there was no difference between the scores of the two sets of patients either a month or six months after ECT.

Most psychiatrists in the United States and Great Britain view ECT as an effective means of treating depression. This new study gives opponents of shock treatment more ammunition for its curtailment.

—David Cohen



Shock treatments may be useless as well as traumatic

COMPLAIN!

The more complex a society's technology, the more grounds for complaints by consumers, but the fewer avenues available to resolve those complaints successfully, a recent study on complaining concludes

University of California anthropologist Laura Nader found that one out of every six purchases in the United States leads to legitimate grounds for complaint, but consumers either do not complain or rarely get satisfaction when they do The reason, she said is that consumers have less power than the manufacturers stores or professionals with whom they deal so consumers can be ignored or fought successfully in court

In her study "No Access to Law—Alternatives to the American Judicial System' Nader compared the way complaints are handled in advanced and simple societies In the 3 000-member Zapotec Indian village in southern Mexico she found complaints are heard by a designated referee and are usually resolved the same day By contrast, a Pennsylvania woman with a defective stove tried unsuccessfully for weeks to convince the dealer, manufacturer, and federal agencies that the appliance was a hazard Before her complaint was resolved, the stove turned on by itself and burned her house down

"Unresolved complaints cost citizens disease, injuries, and fatalities, as well as money that has, in effect, been stolen from them," said Nader sister of consumer advocate Ralph Nader "The psychological costs are substantial '

Ms Nader said perseverance alone succeeds 70 percent of the time But she advocates a system of up-to date local files—open to the public—on firms against which complaints have been lodged Local consumer departments could be connected by a computer network, she said and companies with long complaint records should receive wide publicity —Stuart Diamond

Complaint department Americans are less effective at complaining about products than residents of simple societies are

SUPER SCAN

An X ray or a CAT scan can find a tumor But it takes a biopsy, an expedition under the skin, to determine whether that tumor is malignant NMR imaging may soon change this diagnostic approach

NMR (for nuclear magnetic resonance) imaging may be able to identify malfunctioning chemical processes in the body before there are any anatomical changes of the kind that show up on X rays It's like a window on the very early stage of medical pathology, says A Everette James Jr, chairman of the department of radiology and radiological sciences at Vanderbilt University School of Medicine in Nashville Tennessee According to Dr James NMR imaging has the potential to diagnose cancer heart disease and stroke much earlier than X rays do

The brain is the first place NMR imaging is likely to be used James says It will look at brain metabolism, cerebral blood flow tumors atrophy, degenerative diseases, and even functions connected with thinking

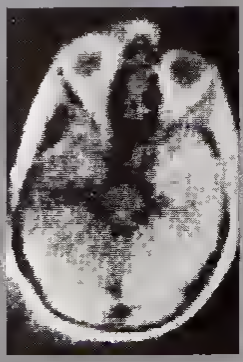
One of the original developers of NMR-imaging technology, physicist William Moore of Nottingham University, in England describes how it works You put the subject in a magnetic field Then you send in a radio signal and listen and a signal with both a size and a characteristic decay time comes back out again

To get cross sectional slices at different angles the CAT scanner uses motors to move the body or the x-ray apparatus Since NMR works with a magnetic field it can assemble any slice without moving parts

The researchers are just beginning to map out the meanings of the readings and the images produced The most exciting aspect is the ability to look under the skin to assess blood chemistry, metabolic activity and tissue composition without having to draw blood or use the knife

It may eventually be possible to use the accuracy of the magnetic field to destroy or modify unwanted tissues or chemical imbalances

—Robert Kall



NMR brain scan

CONTINUUM

SURPRISE SIGHT

A routine cataract operation on a sixty-two-year-old California woman blind from birth has shown that the brain can often fill in what the eyes cannot see. After a cataract had been removed from her left eye, Anna Mae Pennica astounded some vision experts by announcing that the world of sight was "pretty much as I expected."

A blind man's vision may be more beautiful than the real thing

Shortly after the operation she was able to read print and recognize certain colors such as green. The print she knew from having been drilled in tracing the shape of letters as a young girl. As for green, she explained that she often dreamed in colors.

Dr. Thomas Pettit, the UCLA surgeon who performed the operation, said he knew of no other case like Mrs. Pennica's where someone born blind was able to see so easily without experience.

A similar case did occur in the 1950s, according to Georgetown University psychobiologist Dr. Richard Restak. An English shoe repairman, known only as S.B., who had been blind since the age of ten months, had his sight restored by an operation when he was fifty-two years old.

He quickly began reading and doing other things such as telling time, but, according to British psychologist Richard Gregory, who had studied S.B., the man, unlike Mrs. Pennica, found the world a drab place." Formerly an exuberant person, the man became hopelessly depressed by his disappointment that the world did not look the way he had imagined it.

Since there is a running debate among theorists about whether a person can learn to see with little or no vision during the developmental early years, vision experts have been recommending that Mrs. Pennica's recovery be given special attention. —Douglas Colligan

'Science may never come up with a better office-communications system than the coffee break."
— Earl Wilson

POOR MAN'S COMSAT

Paul Csonka wants to put cobwebs in space, floating on beams of photons.

The University of Oregon physicist recently got a patent (now assigned to the Department of Energy) for a cobweblike communications mirror that would float in near space above a specific spot on Earth. It would relay telecommunications signals from the ground to distant receivers, much as a communications satellite in geosynchronous orbit does.

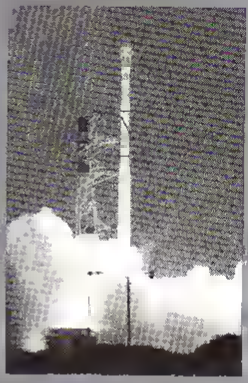
The mirror would be a circular grid of closely spaced wires, not unlike a screen door. A balloon would carry it partway up; then the pressure of electromagnetic radiation beamed from a cluster of ground stations would push it the rest of the way. Electromagnetic radiation consists of photons, particles that impart a force when they hit any object. Thus, the photon pressure would keep the dish aloft, hovering over one spot.

A cobweb mirror for shortwave communications would be about four meters in diameter, would weigh 0.003 gram, and would hang suspended 100 kilometers above the United States by a 150-kilowatt beam.

Such a mirror would cost about $100,000 to launch, Csonka says, and $130,000 a year to keep it up. Ground facilities would run about $450,000. By comparison, it takes $30 million to launch a communications satellite.

Csonka says his dish won't replace communications satellites, but it will have wide applications. Areas of dispersed population, such as the South Pacific, might find cobweb mirrors useful. So might underdeveloped countries that don't have the money to launch their own satellite or lease the use of one.

Csonka's cobweb mirrors could well become the poor man's Comsat. —Joel Davis



Communications-satellite launches cost $30 million

If you do not think about the future, you cannot have one.
— John Galsworthy

I think and think for months and years. Ninety-nine times, and the conclusion is false. The hundredth time I am right.
— Albert Einstein

Every time you scientists make a major invention, we politicians have to invent a new institution to cope with it, and almost invariably, these days, it must be an international institution."
— John F. Kennedy

Particle-beam weapons threaten to scuttle ballistic missiles and make the MX obsolete

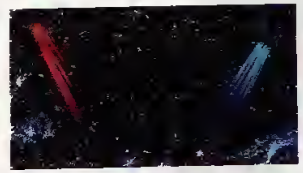
ZEUS IN ORBIT

BY GREGORY BENFORD

America's early warning satellites repeatedly detect nuclear debris in the air over the large city of Semipalatinsk, deep in Soviet Central Asia. The waste, remnant of an underground atomic blast, quickly drifts away on the wind, leaving no sign of what might have caused it, to be followed months later by another similar cloud. Since 1975 Air Force analysts have wondered what is happening at Semipalatinsk. The answer now emerging is more disturbing than any mere series of nuclear bomb tests could ever be.

The secret facility there is apparently not a nuclear-weapons laboratory at all, but the nesting ground for a new generation of strategic weapons. Used in orbit, these powerful zap guns could knock down ballistic missiles or burn up other nations' satellites.

The atomic waste over Semipalatinsk seems to be the signature of a new breed of power generator that uses nuclear minibombs to shoot beams of subatomic particles (high energy protons, most probably) that could destroy other nuclear bombs—specifically the weapons inside American ICBMs. Their aim is to upset the strategic balance between the United States and the Soviet Union, and they may very well succeed.



Until now both superpowers considered it extremely difficult to knock out ICBMs raining on their targets. The long-dead antiballistic missile program, which proposed using high-altitude hydrogen bomb bursts to destroy incoming warheads, is mercifully dead. Aside from the fact that it demanded very fast electronics and aiming, this plan would have left the defender with clouds of radioactive waste above his homeland. What's more, the antimissile weapons would carry their chemical or nuclear explosives to a target inside a relatively slow, heavy vehicle, such as an artillery shell or a rocket. The carrier could thus be deflected or stopped, and the payload might never explode at the target.

The particle beam, however, is a fundamentally different kind of defensive weapon—a ray of pure kinetic energy that is its own payload. Charged-particle weapons detonate simply by smacking into their target. They require no triggering that might go off too early, too late, or not at all. Anything that gets in the way of a particle beam receives the full jolt of its energy. And, because the beam moves close to the speed of light and in a straight line, there is no need for complicated guidance systems.

PHOTOGRAPHS BY PETE TURNER

The reason why such weapons are not already on the shelf is that it is extremely difficult to make them. To produce an intense, high-energy beam of charged particles you must apply a large voltage to a collection of them. If the voltage is high enough (over 1 million volts) it accelerates the particles to near-light speeds. Physicists in the past 20 years have invented several ways of applying such pushes. They can let the particles "surf" on an electromagnetic wave. The wave scoops up the particles and then, like an invisible slingshot, accelerates them. Another way is to use fast-pulsed magnets to drive the particles down a long tube that looks like a narrow-bore rifle. To make a beam that can "kill" a nuclear warhead takes about 1,000 amperes of current (about 100 times what you get out of an ordinary wall plug). We know how to produce such beams now, but development of beam accelerators promises to make "electromagnetic rifles" that can deliver up to 1 trillion volts to each particle. The U.S. Department of Defense understandably wants to know much more about this possibility.

At Semipalatinsk Air Force sources speculate a small nuclear explosion is set off inside a web of intense magnetic fields. These fields guide the expanding ball of hot, energetic gas through a nozzle and then into a series of electrical generators. The rushing energy drives a kind of turbine, which produces the fast, powerful burst of electricity needed to fire beams of particles at selected targets.

Though U.S. satellites never observed any beams shot into the air near Semipalatinsk, Air Force analysts are "about seventy percent certain that the nuclear waste there is directly linked to tests of a proton-beam system—which is pretty damned decisive given the uncertainties of this business," one intelligence source has stated.

The Carter Administration held that there was no established link between the Semipalatinsk experiments and charged-particle weapons. It is known, though, that the Russians have fired beams of electrons in space as part of scientific experiments. Also, American scientists visiting several Soviet laboratories have seen huge accelerators under development that could produce quite effective particle-beam weapons. A series of articles in *Aviation Week and Space Technology* publicized the issue within the last year, setting off speculation about Soviet motives.

One of the factors forcing a public discussion was the resignation and retirement in early 1980 of Major General George Keegan, former head of Air Force Intelligence. General Keegan was angry when the Pentagon did not accept the Air Force theory about particle-weapon development at Semipalatinsk. In retirement, Keegan became an outspoken critic of the skimpy U.S. particle-beam effort. And in July 1980 a high-level Defense Department official admitted that new intelligence information "pretty well vindicates George [Keegan]. He was about ninety percent correct in his assessment."

Both the United States and the USSR are responding to the possibility that the epoch of the invulnerable ICBM is nearing its end. Both sides are pursuing research on the basic problems of lasers and particle-beam weapons called "directed energy weapons." It is clear that the Soviet Union has a sizable lead. The Semipalatinsk experiments are extensive and rapid-paced. The Reagan Administration has responded to this situation by increasing the budget in this area. In particular, experiments with beams of ions are getting much attention under the code name White Horse.

Many experts still doubt that a full strategic system is technically possible soon. Awesome sums of money hinge on the answer. For example, suppose a particle-beam-weapons system could be deployed within a decade. Then the controversial MX missile scheme is pointless,

Washington hawks claim there is now a serious particle-weapons gap that could neutralize American missiles within five years. Most observers doubt this, but they are worried.

because its elaborately concealed race-track-running ICBMs would be doomed. The best strategy might therefore be to invest heavily in beam defensive systems—lasers and particle beams—and skip the gargantuan MX system.

Discovery of a probable Soviet lead prompted one faction among Washington's hawks to claim there is already a serious particle-weapons gap that could neutralize U.S. missiles within five years. Most observers doubt this, but they are worried about the possibility that particle weapons can be used against the satellites that keep watch on the strategic balance. These delicate spacecraft peer eternally downward, picking up the infrared or ultraviolet signatures of tanks, planes, and missiles. The sentinels are very vulnerable to attack. The United States and the Soviet Union have traditionally left each other's satellites alone, but in 1977 the Russians began testing antisatellite techniques in full view of U.S. satellite watchers. The United States responded in kind, and now both countries apparently possess killer satellites. These lethal eagles can swoop by their brethren on a fast flyby, pelting them with shrapnel-like buckshot. Though effective, they require one or two revolutions of the earth to close in on their quarry. This gives plenty of warning for retaliation.

For many situations such a time lag is unacceptable. Strategic war is a matter of minutes, if not seconds. A laser or particle beam could fry a delicate sensor satellite in moments, far faster than a killer satellite can. The job is much easier than knocking down ICBM boosters, which are hardened for reentry into the atmosphere. Thus the first employment of beam weapons will probably be to obliterate offending satellites. As a preliminary step, the U.S. Air Force plans to begin a laser-weapons program in 1983 by placing two big lasers in the southwestern United States. They will retaliate against Soviet satellites if any action is taken against U.S. spacecraft.

But lasers, though easy to aim, don't deliver much power to a target. They need to strike the same spot on the warhead for a full second in order to disable it. This means that laser weapons will have to track the booster, not just snap off a shot at it. Also, the first effect of heating a target is to make a cloud of hot, ionized gas, called a plasma, which quickly begins to reflect the laser beam, destroying most of its punch. A beam of particles, however, can bring to bear more energy than the most powerful blowtorch, punching fist-sized holes in a microsecond, and can pierce through a plasma. These facts argue for using particle beams to penetrate hardened boosters and lasers for frying satellites in orbit, where the lasers can focus on their targets for several minutes at a time.

The most difficult technical point is making the beams accurate and well focused. Brendan Godfrey of Mission Research Corporation observes, "The major issues in the jargon of the trade are pointing and tracking."

The particles must be charged—positively or negatively—to push them with electric fields. Most particle-beam designs call for an electromagnetic rifle to accelerate protons, which are positively charged. A packet of charged particles flies apart readily though, once it leaves the muzzle, because the individual particles, all of like charge, repel one another. To counteract this effect, designers plan to run the energetic bolt of protons through a thin gas, allowing the protons to pluck negatively charged electrons out of the gas. The electrons cancel the proton charges, and the bolt emerges as a neutral beam of hydrogen atoms. Since it is uncharged, the earth's magnetic field then cannot bend the bolt. This is the technical accomplishment that has made particle beams a real possibility for antimissile defense in space, where sharpshooting is the key. "The targets are so very small," Godfrey notes, "and space is so big."

A particle-beam satellite in a high geosynchronous orbit (hanging over one spot on Earth at all times) could conceivably cover half the world's nuclear

warheads. The trouble is that such a craft would have to have 40 times better aiming capability than a near-Earth platform. It will probably be necessary, then, for the United States and the Soviet Union to position more than 100 of these satellites just above the atmosphere, where they can pick off the boosters at relatively close range—within 700 miles.

An ICBM booster is about 30 feet long. A typical particle-beam satellite at a range of 700 miles from the booster has at most six minutes to pinpoint the rocket as it rises above the atmosphere and then plunges to its target. This means hitting with an aiming accuracy of one part in 100,000, "the best shooting ever attempted by any weapon ever," according to a scientist at Physics International, a private research organization in San Leandro, California. And a given satellite might have to hit dozens of boosters in those six minutes. Thus, it could not take long to fire, squint at the target with its sensors, and fire again, shooting at least ten bolts a second. If the bolts strike the thin upper atmosphere, they gradually fatten and falter. The attacking country can take advantage of this by exploding one of its own warheads early, high in the air above its own territory. The blast will push air up, blocking the incoming bolts. Of course, the explosion also blinds the attacker's own radar on the ground and starts the war with a bang—over home base.

Another brute-force way of throwing off particle-beam satellites is simply to hammer away at them with nuclear-tipped rockets or with other satellites. This is costly, and while the attacker does it, his enemy receives a loud warning. A more subtle ploy is to spread aluminum tinsel in the upper atmosphere, to blind satellites' radar. Or the attackers can try to cut off the satellites' communications with their homeland by jamming any and all radio signals.

How will particle beams fare against nuclear weapons *not* carried by ICBMs? Could they, for example, take on the cruise missile? This robot jet plane, not much bigger than a Volkswagen, can fly automatic missions at low altitude, evading radar for thousands of miles. Appearing suddenly on the horizon, the cruise missile swoops in faster than sound and triggers its hydrogen bomb payload dead on target.

Particle beams from orbit can't bore through the atmosphere to reach a cruise missile. But a beam battle station on the ground, near the target, could. The beam would tunnel its way through air, heating a channel all the way to the oncoming cruise missile in a thousandth of a second. And since the heated air channel will neutralize any beam charge, the defender can use electrons alone in the beam. Electrons are generally cheaper to accelerate to the needed energies than are protons, partly because electrons are so much lighter.

This idea has been under development for more than 15 years, although work on the basic problems a decade ago limped along with a token budget. Now the U.S.

CONTINUED ON PAGE 115

FICTION

In the biggest bout of his career, a man chooses between love and revenge

THE FIGHTER

BY WAYNE WIGHTMAN

Teichert Bohannon's face looked like someone had held a torch to it and melted off the details. When light hit him a certain way, his skin shone in smears of rose and blue. He had a kind of nose, two eyes, and a mouthful of normal-looking porcelain teeth, but he had no eyelashes or eyebrows or hair on his head. Teicherf Bohannon always tried to like being where he was, and he liked being in his dressing room with his friend Ricky Fandango and his manager, Galen Kalark. He would have liked it more if Kalark had not been there, and he would have liked it even more if he had not been looking at himself in a mirror. He did not like looking in mirrors.

"Settle down. Take it easy," Kalark said. "You have twenty minutes till your match."

Kalark was a smooth man. He had cashmere hair, and his features were so fine they might have been drawn with a very sharp pencil. And he had rare hands. TensorGrip hands, which were usually found only on those who were wealthy and eccentric. Teichert had made Kalark wealthy, but Kalark had been born eccentric. His hands were like steel spiders. He had never used them on Teichert, but once he had threatened Ricky Fandango with them and Teichert had placed a small white scar on Kalark's right TensorGrip for it.

Ricky was sitting in the corner on the floor, humming to herself. She seemed to be counting her fingers.

"Why do you always do that?" Kalark asked Teichert. "Stare at your face, I mean. Before every fight, you stare at your face. Does it make you mad, so you'll fight better?"

Teichert didn't answer. He turned away from the mirror and sat beside Ricky. She nodded her head sideways and bumped Teichert's

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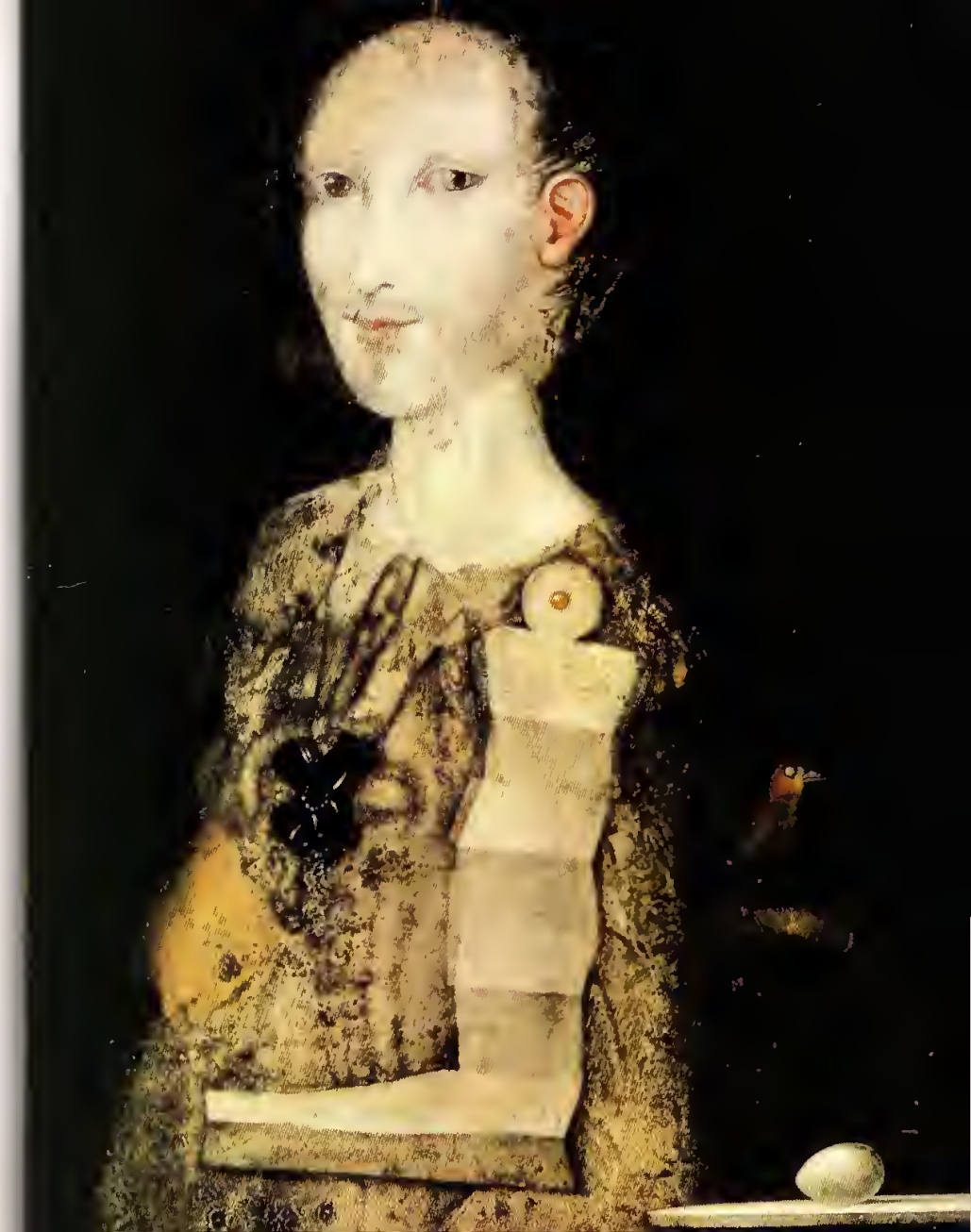


shoulder. It was Ricky's way of saying hello.

"You still get steamed when you think back at the way that Cinerarian torched you," Kalark was saying. "That's what you do, isn't it? Well, get good and steamed. In fifteen minutes you have another Cinerarian to fight who'd probably like to do the same thing to you." Kalark's hands delicately touched each other. "How's your implant feel?"

"It feels all right." He touched his left shoulder for reassurance.

"Look, I don't want you setting that thing off unless the Cinerarian uses a weapon first. I don't want you disqualified. If the judges get one look at that thing, well... Even if you have to use it, try not to let it show."

Teichert nodded. "Maybe you could leave me and Ricky alone for a few minutes so we can talk."

"Sure," Kalark said. He stood up suddenly. His pants and jacket were so soft the creases in them seemed to fold out in slow motion. "You and your friend probably want to talk about your little nest egg and how after this fight you can buy your little piece of dirt out in the country." He smiled. The door hissed open in front of him.

"I already figured it out," Kalark said. "Three or four more fights and you *might* have enough for a piece of dirt big enough for a two-room shack and four rows of petunias." He laughed. The door hissed shut behind him.

Ricky nodded her head sideways again and bumped Teichert's shoulder. She was seventeen years old. Part of her used to be his sister before she had been scrambled in a Cinerarian-contrived jump station accident. Part of her was somebody else—no one knew who. She and Teichert were occasional lovers. They both were too deformed for the public to look at them without disgust and wonder.

The last Olympic Games had been held on Cinerana, and just before the Fighting Contests Teichert had been standing at the jump station, waiting for Ricky. When the booth activated, instead of his sister appearing, there was a whump and a spray of blood and the soft jolting arms and legs and scraps of face hitting the floor of the booth. Mysteriously two people had been programmed to appear at the same place at the same time.

Surgeons worked for days, but both people could not be saved. When it was all over, the result was something they called Ricky Fandango. She did not speak, she sang. When she moved, she did not walk, she danced. Teichert suspected the surgeons had played games with Ricky's reconstruction. Had used her as an educational experiment, to see just how far their skills would take them while their hands were slick with blood.

"How is your arm?" she sang quietly.

"It's worse than I thought," Teichert replied. "I'll be able to go the first round, but after that... I don't know. What were the odds when you placed the bet?"

"Five to two against the Cinerarian," she told him. A sigh escaped her lips.

"And you did like I told you?"

She looked at him for the first time in hours. Her eyes were filled with tears. "I did as you said," she sang. "I placed it all on the Cinerarian to win in the third round." Tears rolled out of her eyes.

"I'm not losing on purpose," he said. "I told you that already. I know the Cinerarians, and I know my arm. I can't win. I'm not going to lose on purpose. I just know I won't win this time."

"But you never lost before," Ricky sang brokenly. "I don't want you to lose."

"If our money is on the Cinerarian, we won't lose. I'll lose the fight, but we won't lose. This arm's been rebuilt too many times." He twisted and flexed his right arm. It moved like a snake. "It won't take any more regrows."

The door to the dressing room opened. Kalark strode in. Behind him Teichert saw, draped elegantly from a naked rafter, a garish, multicolored banner that read:

WELCOME TO CXXIII OLYMPICS
WELCOME TO XXXVII WORLDS

"Get warmed up, Bohannon," Kalark said. "Five minutes and you're on."

Teichert stood up, his legs flexing liquidly. He was thinking how tired he was of Fighting—Fighting aliens, especially. No one ever knew quite what their capabilities were. Like the last Cinerarian. The lunatic had had a torch implanted in his left shoulder, and when he saw he wasn't going to win legally, he had burned Teichert's face off. Of course the judges had disqualified him, but the Cinerarians still considered it a victory. He had, after all, stopped Teichert in the middle of the third and last round, and stopping the opponent was all the Cinerarians cared about.

"Move it," Kalark said. "You've got at least four more fights in you, and you don't want to lose this one. I've got too much riding on you."

Teichert did twenty incredibly quick kneebends on his multijointed legs. This barely raised his pulse rate.

"How much money do you have on me?" he asked suspiciously.

"The signal chimed. As usual, Teichert felt some part of himself, the human part, recede into a back corner of his brain and watch while his body went through the motions."

"Enough so that if you lose, I won't be able to make the payments on my hands." He held them up and studied them with a smile. They were beautiful hands. They looked like brittle twigs, but they could squeeze an arm in two, muscle bone and all. Kalark had proved that on several occasions already.

"It would be too bad if you had to give up your hands," Teichert said. He coiled his three-elbowed arm in to his chest and snapped it out like a whip. He was very fast. The other arm was slower, but it was stronger and had only two elbows. He snapped the arms back and forth, testing them, two snaps of the whip arm, one for the power arm.

"It would be very bad if I had to give up my hands, Bohannon." Kalark's finely drawn features were expressionless. "It would be especially hard on you and your friend in the corner. What the hell's she doing anyway?"

Ricky was sequentially touching her fingertips together.

"I think she's counting something," Teichert said. "Who was drawn for my match?" He twisted his torso first one direction and then the other. He could turn a full three hundred sixty degrees, and when he uncoiled his whip arm at the same time as his body unwound, he could dent thick steel with his hand. He had no feeling on his knuckles and very little anywhere else. His bones had been specially hardened.

"It's a mystery man... or woman."

Teichert shrugged. Cinerarians were given to surprise. Two Games ago there had been a mystery man, and when Teichert got into the ring with him and they pulled off his wrap, Teichert laughed. They had made someone up to look just like him. They thought he might be reluctant to hurt his own image. They hadn't counted on the very human characteristic of self-disgust. He had done to that Cinerarian piece of surgeon's artwork everything he had ever wanted to do to his own revolting body. Before the first round was over, he had broken all its ribs and had crushed its spine in two places. He won. At the next Games, they scrambled his sister.

"Come on," Kalark said. "You aren't breathing yet. Combination exercise. I don't want you cramping up in there. Come on. Put 'em together."

Teichert went into a blur, and Kalark stepped away. The whip arm shot out in all directions from high positions and low, and the legs snapped so abruptly that the air sang. He was fast. The same company that made Kalark's TensorGrip hands had made Teichert's nerve harness and implanted it in him. A spokesman for the company had bragged that Teichert was so quick he could commit murder in front of witnesses and they would never know what they had seen.

When he stopped warming up, Kalark looked at him closely. He did not touch him. He never touched him. Teichert allowed Ricky to do that, but no one else. "You look

okay now Kalark said Then he turned to Ricky 'You Check out the weapon'

Ricky loped and swooped to Teichert and laid her hands on his left shoulder Beneath the skin was a small flat plastic tube Inside were a dozen flat discs that would shoot out through Teichert's skin spread into a meter-diameter pattern, and instantly paralyze anything that had circulating blood

Ricky nodded to Kalark. All Teichert had to do was want the weapon to fire It was hooked directly into a main circuit of his nerve harness

Again the door opened A gold-suited Olympic official nodded and smiled 'Fighter Teichert Bohannon it is time for your match' Trivid cameramen crowded behind the official Kalark grinned broadly Teichert did not smile Without expression he was merely hideous When he smiled, one could think of nothing but death

'What is your strategy for the bout Mr Kalark?' one of the newsmen called over the other questions

'What round?' another yelled

'Could we get a word from Fighter Bohannon!'

Kalark raised his hands—his famous hands—for silence, and got it

'Our strategy is to win gentlemen and we'll do that before the third and final round. Fighter Bohannon has not changed his practice of not speaking to the press before fights Could you make way for us, please'

On cue officials pushed back the men and their cameras The next part was the same—always the same no matter what world, what kind of opponent or whether the match was officially sanctioned or merely an exhibition Mindless cheering punished Teichert's ears and the Olympic guards, no matter how much they tried not to touch him (no one wanted to touch his burned and rebuilt body) were pushed against him by the crowds as they all staggered erratically to the ring Ricky clung to him like a leaf This terrified her more than the fight itself In the ring there were rules, but here there was only unmanageable excitement and a palpable thirst for pain blood, and broken bones

Teichert felt Ricky's fingers tighten on his whip arm 'Think of the country' he said into her ear 'Think of the two trees we'll have in the yard You will buy us some birds to sing in the trees'

Her hands still pressed against him but her fingers did not dig in so much

'Think of the leaves on the trees and how when the wind blows a little the leaves will flutter white and green'

'*Kill the slime, Teichert!*' someone screamed in his face He did not flinch

Ricky's fingers dug into him again

'Think of the flowers we'll have by the front door Ricky When we have the doors open in the summer, the whole house will smell like flowers'

'*Rip out his lungs Tikey Baby!*' a woman's voice shrieked

'When you wake up in the morning, the

sun will be shining across the bed, and the birds you bought will be singing in the trees in the yard."

"I don't want you hurt," she sang weakly into his ear. "If your arm breaks, he can hurt you. I don't want you hurt."

A sudden surge of the crowd near the ring nearly knocked them both to their knees. The Olympic guards sprayed the crowd in the vicinity with a repellant. Soon after that, Teichert was pushed up onto the apron of the ring. It was very hard for him not to hate being there. He tried to like being where he was at all times, but the growing roar of the spectators, his waving to them with his whip arm, his expressionless face appealing to the love of death in all of them. He could forgive them for their ignorance, but he knew what he was doing and there was no forgiveness for him.

He waited, trying not to think or anticipate or look into Ricky's face, turned to him from the crowded floor below him.

Because of the admission of nonhuman species to the Olympic Games, the Games had changed. Some were strictly human, like boxing, track and field, and gymnastics. Others were confined to certain groups of nonhumans. And new sports were invented, like Fighting. Everyone found this an intriguing sport because it matched individuals of different species in a contest so basic that it appealed to any race that cherished survival. Fighting was simple. Even primitives could Fight, and with some effort they could memorize the time-honored rules:

1. There are three rounds of diminishing length—five minutes, four minutes, and three minutes.
2. Any use of weapons or striking any part of an opponent's head results in disqualification.
3. A Fighter will be disqualified if his opponent dies in the ring or dies of fight-related injuries within forty-eight hours of the match.
4. A "win" is declared when only one Fighter can stand unaided.

Anyone could Fight, but having a good surgical team behind you certainly made winning much more likely.

As the officials planted the microdot sound transmitters at various points all over his body, Teichert looked down at Ricky.

Her lips moved soundlessly. "Try to win."

He nodded. He always tried to win. He would try to win this time, but it simply wasn't going to happen. It wasn't a matter of giving up. So he felt no shame. It was a matter of too many regrows on his whip arm. He was too strong, too quick, and the bone would take only so much of that kind of punishment.

The officials finished with him and stepped down. Again there was a roar, but it was for the hooded Cinerarian this time.

"What will they put up against me this time?" he wondered aloud tiredly.

Cinerarians were humanoid, but their mouths were unpleasantly insectile. The handlers waited until the roar reached its peak. Then in a single move they whipped off the Fighter's robe.

Their surgeons had done a beautiful job. Their psychologists hadn't done badly either. The thing was bigger than Ricky, but it was a duplicate of her, right down to the hatchwork of fine scars on the sides of her neck. It moved fluidly, the way Ricky moved. The crowd loved it. As much as Kalark tried to keep it secret from the press, there were frequent stories about Teichert's living with someone who used to be his sister, someone not as ugly as Teichert, but someone equally grotesque, and artists had drawn pictures of what they imagined it looked like when the two of them kissed. One popular holo poster of that subject was titled *The Love of Horror/The Kiss of Death*. Most fans of Fighting had one.

Teichert drew his eyes away from the thing and looked at Ricky. It was the first time he had ever seen hatred on her face.

"Teichert coiled his whip arm and flashed it at the thing, pulling the snap back before it touched flesh. Fear came into its eyes, and tears ran down its cheeks."

She stared at her larger image and did not move for several moments. Suddenly she looked to him. She sang nothing. Her face had gone loose and helpless.

The ring-entry signal blared. Teichert and the Cinerarian stepped toward each other. They were both naked now except for loincloths and their sound transmitters. No protective gear was worn anywhere.

At another signal the Lemas Vu-Dome sprang up around them. The audience could see the Fighters perfectly and, wearing receivers, the audience could hear the thump of each blow and the tearing of muscles and the breaking of bones. The Fighters were entirely isolated. Inside the Lemas Dome, they were surrounded by a milky light and were blanketed in utter silence. There was nothing to watch but their opponent, nothing to hear but bare feet moving over the mat and labored breathing. Nothing to do but to Fight.

The ten-second buzzer sounded. Teichert willed his reaction time to its quickest and willed his eyes to operate at slow time. Even the quickest movements would look slow to him now. The nerve harness obeyed his mental commands.

Across the dome, the Cinerarian preened itself. It had learned Ricky's movements, too. It stared at Teichert with its watery black eyes. Teichert knew he would be able to fight it. He knew he would try to break its back, but he wondered whether his arms and legs would obey as fiercely as they should. Unwinding his whip arm at blinding speed and feeling it crush into the spine of something that looked like himself was one thing, but crippling Ricky's duplicate. Something in him might hold back. Throw his reactions off.

In the last second of calmness before the signal to fight, Teichert looked at the preening thing and reminded himself that he was a professional, a Fighter, designed to put on the mat anything that stood up to him in the ring. And he reminded himself that if the fight went into the second round, there was no way he would be able to continue effectively. He would lose the fight, but the money he and Ricky had saved over the years of his career would be multiplied by two and a half. The Cinerarians, he also knew, would never put a Fighter in with him who would not last through the first round.

The signal chimed. Inside the dome, it became very quiet except for the prancing feet of the Cinerarian. In Teichert's eyes, the thing danced in slow motion to the center of the dome and bounced from side to side on alternate feet. As usual, Teichert felt some part of himself, the human part, recede into some back corner of his brain. It was as if he stood back and watched his body go through the motions of destroying opponents. He moved into the center of the ring at maximum speed and then veered away from the thing.

It flinched.

He lunged at it again, coiling his whip arm and lashing it over the thing's head.

It flinched again and threw up a defensive arm after Teichert's arm had already recoiled. It was moving slowly, very slowly. Almost too slowly.

Something was wrong. The Cinerarians would never put something like that in the ring with him—something he could drop in the opening seconds. He drew away from it, watching its movements.

It grinned crookedly, the way Ricky always grinned. It pranced and preened and offered its head for Teichert to slash open. He didn't accept the challenge. It would mean instant disqualification to strike the opponent on the head.

Teichert slowed his movement across the mat and presented a subtle opening where the Cinerarian could make a move at his knees, but nothing happened. Its eyes never left his. There seemed to be no light in the thing.

Teichert had covered himself again when the Cinerarian said, "Tei, listen to me. Tei. This is all wrong." But the voice didn't come through his ears; it whispered inside his head. It was the kind of voice that nuzzled around inside him. "Tei, I'm not a Cinerarian. It's me, Ricky, the *real* Ricky. The one you've been with the last month is a

CONTINUED ON PAGE 98

This scientist wants to save Philadelphia. But the local politicians may not let him

INNER-CITY SAVIOR

BY JANE BOSVELD

When a Philadelphia policeman was fatally shot in his apartment, the investigating policemen couldn't figure out where his killer had been hiding. So at 3 A.M. the police commissioner telephoned a scientist to ask for help. The scientist was Dr. I. M. Levitt, director of the city's groundbreaking Mayor's Science and Technology Advisory Council (M-STAC for short).

M-STAC was the first of many city agencies in this country to attempt to put science to work solving problems especially linked with America's cities. Innovative scientific minds, it turns out, can often analyze something that's worrying the city fathers, define it clearly and then propose a solution. For today's troubled cities this new resource can mean the difference between chronic deterioration and a remarkable turnaround.

The payoffs are in cash as well as in the amelioration of urban life. By doing a single study of energy use in Philadelphia buildings, Dr. Levitt found the city government a way to save hundreds of thousands of dollars in fuel costs each year.

Levitt's work on the case of the policeman's murder furnishes a good example of how scientific thinking can solve complex

PHOTOGRAPHS BY DAN McCOY

problems. "The first thing we did," he explains, "was to run a string from the bullet hole in the bathroom door to the hole in the window and then sight along it. But the line of sight ran into an awning that blocked the line of fire." The bullet must have come from somewhere else. Where?

Levitt called Dr. Sydney Ross, then in charge of research at the now-defunct Frankford Arsenal. Could the arsenal's shop design a telescope that sees in two directions at once? Levitt asked.

"We finally mounted two elbow telescopes on a metal plate so they looked precisely one hundred eighty degrees apart," he says. A circular reticle inside the telescopes allowed the scientists to measure exactly how far any object in the field of view was from the line of sight. The killer's hiding place wouldn't have to be directly in the line of sight, but it had to be reasonably close. "We lined up one telescope with the path of the bullet, then looked through the other. We assumed that the opening, such as a door or window, closest to the sighting line was the most likely firing point."

The prototype worked like a dream and helped to solve the case. Each year it saves the Philadelphia Police Department more than 60 hours of investigating time.

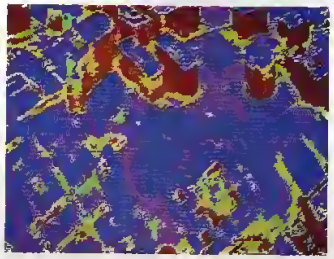
The idea of using technology to solve urban dilemmas most likely got its start in 1969, when Mark Keane and his colleagues at the International City Management Association got tired of hearing complaints about scientists who put men on the moon but do nothing to stem urban decay. Keane contacted NASA, "which at that time was the only agency we could think of that knew anything about science." He persuaded NASA, and a number of municipalities, to underwrite an experiment in technology transfer.

"We started with a two-day session at Cape Canaveral," Keane says. "For the first time it brought together local government administrators and scientists who were interested in cities but didn't know how they worked. The two groups nearly killed each other the first day. The second day they began to see each other's problems and the possibilities of working together."

After that meeting, Keane took the idea to the National Science Foundation (NSF), which consented to back quite a few test

Dr. I. M. Levitt (above left and preceding pages) displays a sample of sludge paving. Probeye (above right) and a computer-enhanced scan of Philadelphia's energy losses (right) are two of M-STAC's scientific answers to city problems.

"The scientists and government administrators nearly killed one another the first day, then they began to see the possibilities of working together."



programs. Their early efforts placed an experienced scientist or high-technology engineer in the city manager's office or in the mayor's. The technologist linked city officials with the scientific world, tracking down problems scientists might solve and working with officials to get the job done.

The program's products included designs for a faster more efficient fireboat and for night-vision goggles. One dramatic success was a seven-pound, hand-held box that resembles a large Polaroid camera. Called Probeye, it converts an object's heat into a visible image. Probeye can locate people through smoke and detect hot spots behind the walls of a burning building. Because of these developments and many others, Keane now believes the money the NSF gave to support our institutions has probably done more per dollar to create change in local government than any federal appropriation.

When Levitt agreed to become director of M-STAC in 1972, leaving a damned good job as vice-president at the world-famous Franklin Institute, the first thing he did was recruit 150 university professors, researchers, communications experts and other specialists. Then he asked city department chiefs for a list of their most pressing problems. Among their needs were a cheap and efficient way to remove lead paint, hazardous particularly to children's health, a way to clean the exteriors of municipal buildings, and a brighter, more durable road paint.

In less than ten years M-STAC has tackled all those problems and many others. Levitt's idea for an infrared scan of Philadelphia will eventually save the city millions of dollars. Levitt borrowed a C-54 airplane from NASA and the Naval Air Development Center, then rented infrared equipment. Graduate students from the University of Pennsylvania agreed to analyze the photographs, guided by their professor, a member of M-STAC.

"We flew over buildings that were ten, twenty-five, and one hundred years old," Levitt recalls. "What we found is that you don't lose heat through the roof, but through windows and doors." The 32 municipal buildings scanned use 60 to 80 percent of the city's energy. Because of the survey, these structures are being modernized to cut fuel bills.

Similarly, Levitt devised an ingenious way to restore precious city documents, applying NASA technology. Many documents have faded until they're virtually illegible, and hand copying each page would be prohibitively expensive.

"I remembered," Levitt says, "that the first pictures relayed back from Mars by *Mariner Nine* contained no detail whatsoever. NASA put them through a computer enhancement and brought up the most magnificent detail. If they can do that with a photograph, I thought, why can't they do it with an old document?" Again, he recruited NASA personnel to test the technique. The process was so successful that NASA gave Levitt a cash award and a citation for his unusual application.

M-STAC's office doesn't begin to rival the posh abodes of corporate executives. Located in Philadelphia's city annex building, the two-room office echoes with noise from the bustling hallway. But Levitt isn't the sort of person to care about his drab surroundings. His thoughts, like those of most creative people, transcend his environment.

And he is proud of his work—work that has brought him the respect of city officials and scientists alike. Even projects still in limbo are indicative of his fervor to improve the quality of life in our cities.

When, for instance, the mayor despaired over the number of killings in the city, Levitt got to work. The Department of Defense he found had developed a nonlethal bullet. So he took officers from six police departments to the Edgewood Arsenal, near Baltimore, for a demonstration. What they saw looked like a sawed-off shotgun with a muzzle 2.5 inches in diameter.

"The only thing we have that can stop a criminal without killing is lying unused in Edgewood Arsenal because some bureaucrat thinks that we don't need it."

The gun fires an object that resembles a hollowed-out hockey puck, half an inch thick. An ordinary blank shell kicks the puck out of the muzzle and spins it to stabilize its flight. The puck hits the target straight on, spreading the shock.

"It will knock you out colder than a flounder, but it will not kill," Levitt explains. The puck is moving at only two hundred feet per second, but your reflexes aren't fast enough to get you out of the way. That makes it a most effective weapon.

The scientists designed a mock-up gun that shoots four bullets; however, the Law Enforcement Assistance Administration decided against funding it. "The only thing we have in this country that can stop someone without killing him is lying somewhere in Edgewood Arsenal," Levitt says dispiritedly. "It's tucked away because some bureaucrat thinks we don't need it."

Aye, there's one of the major obstacles to technology transfer. "We can recommend a solution," Levitt says, "but then politics intervenes, and there isn't anything we can do about that. I will tell people what has to be done to make something work. If they want it to happen, it will happen. But I can't force them. I can only give them advice."

Bruce Reise, who helped win NSF backing for the early technology-transfer experiments, is aware of the problem, but he says it's only one element in the process. "The more successful technology agents," he explains, "work with government people who can guide them through local politics. Agents are also more successful if they themselves are adaptable. Scientists generally don't like compromise. Those who can compromise are more successful."

If it's such a hassle to straddle the two worlds, what attracts a scientist to community work at all? Several of the first technology agents accepted the job in part because they faced unemployment. "We funded the first projects right when the aerospace industry went into a slump," Reise says. "We took engineers who were going to be out of work and put them in a city hall, working for the city manager."

For Levitt, the decision was not merely one of economics. Throughout his career, which began with an engineering degree and a role in the Franklin Institute's eclipse expedition in 1932, he has tried to help others understand science and learn what it has to offer. For 19 years he wrote a space column called "Wonders of the Universe," which was syndicated in newspapers around the world and translated into 12 languages. Among his books are *A Space Traveler's Guide to Mars*, *Beyond the Known Universe*, and the recently reissued *Star Maps for Beginners*. His precedent-setting shows done for the Franklin Institute's Fels Planetarium probably did as much to channel young people into science careers as *Watch Mr. Wizard*.

Levitt's lightning-quick mind bubbles with new inventions, especially for his chosen field, astronomy. He even wound up explaining one to Albert Einstein. The device, built with Dr. William Blitzstein at the University of Pennsylvania, was the pulse-counting photometer, which counts the light from a star and which is now a ubiquitous observatory tool.

"I was the director of the Fels Planetarium when I was granted a visit with Dr. Einstein to discuss a planetarium show about relativity. I asked the proper questions and in many cases received answers that I did not wholly understand and that certainly were not usable for our show.

"But as I was leaving, he asked, 'Oh, by the way, with your photometer, do you count the background light of the sky?' When I heard that, I knew why I had been invited. He had heard of the pulse-counting photometer and wanted to know more about it. In my explanation I said, 'Not every photon will knock an electron out of the cathode. Only those above the threshold.' 'Yes, yes, I know,' Einstein said. I stopped dead, for it dawned on me that I was explaining the photoelectric effect to the man who in 1921 received the Nobel Prize for doing just that."

Combine that desire to share ideas with a practical, inventive mind, and you've got the beginnings of a good technology

CONTINUED ON PAGE 102

FICTION

Esme was there to experience the ultimate. Poppa had to make sure she did

BY JACK DANN

She was beautiful, huge, as graceful as a racing liner. She was a floating Crystal Palace, as magnificent as anything J. P. Morgan could conceive. Designed by Alexander Carlisle and built by Harland and Wolff, she wore the golden band of the company along all nine hundred feet of her. She rose one hundred seventy-five feet, like the side of a cliff, with nine steel decks, four sixty-two-foot funnels, and more than two thousand windows and sidelights to illuminate the luxurious cabins, suites, and public rooms. She weighed forty-six thousand tons, and

GOING UNDER

SCULPTURE BY NICK ARISTOVULOS
PHOTOGRAPH BY TONY GUCCIONE

her reciprocating engines and Parsons-type turbines could generate over fifty thousand horsepower and give her better than twenty knots. She had a gymnasium, a Turkish bath, squash and racket courts, a swimming pool, libraries, lounges and sitting rooms. There were cubicles and suites to accommodate seven hundred thirty-five first-class passengers, six hundred seventy-four in second class, and more than a thousand in steerage.

She was the R.M.S. *Titanic*, and Stephen met Esme on her promenade deck as she pulled out of her Southampton berth bound for New York on her maiden voyage.

Esme stood beside him, resting what appeared to be a cedar box on the rail and gazed out over the cheering crowds on the docks below. She was plain-featured and quite young. She had a high forehead, a small, straight nose, wet brown eyes that peeked out from under plucked, arched eyebrows, and a mouth that was a little too full. Her blond hair, though clean, was carelessly brushed and tangled around a barette in the back.

To Stephen she seemed beautiful.

"Hello," he said. Colored ribbons and confetti snakes were coiling through the air, and anything seemed possible.

Esme glanced at him. "Hello, you," she said. Then she turned away.

"Pardon?"

"I said, 'Hello, you.' That's an expression that was in vogue when this boat first sailed. If you'd care to know, it means, 'Hello. I think you're interesting and I'd even consider sleeping with you if I were so inclined.'"

"You must call it a ship," Stephen said.

She laughed and for an instant looked at him intently, as if in that instant she could see everything about him—that he was taking this voyage because he was bored with his life, that nothing had ever *really* happened to him. He felt his face become hot.

"Okay, *ship*. Does that make you feel better?" she asked. "Anyway, I *want* to pretend that I'm living in the past. I don't ever want to return to the present. I suppose you do, want to return, that is."

"What makes you think that?"

"Look how you're dressed. You shouldn't be wearing modern clothes on this ship. You'll have to change later, you know." She herself was perfectly attired in a powder-blue walking suit with matching jacket, a pleated, velvet-trimmed front blouse, and an ostrich-feather hat. She looked as if she had stepped out of another century.

"What's your name?" he inquired.

"Esme." She turned the box that she was resting on the rail and opened the side facing the dock. "You see," she said to the box, "we really *are* here."

"What did you say?" Stephen asked.

"I was just talking to Poppa," she said, closing and latching the box.

"Who?"

"I'll show you later, if you like." Bells began to ring, and the ship's whistles cut the air. There was a cheer from the dock and on board as the ship moved slowly out to sea. To Stephen it seemed that the land, not the ship, was moving. The whole of England floated peacefully away while the string band on the ship's bridge played Oscar Straus.

They watched until the land had dwindled to a thin line on the horizon. Then Esme reached for Stephen's hand, squeezed it for a moment, and hurried away without a backward glance.

Stephen found her again in the Café Parisien, sitting in a large wicker chair beside an ornately trellised wall.

"Well, hello, you," Esme said, smiling. She was the model of a smart, stylish young lady of the times.

"Does that mean you're still interested?" Stephen asked, standing before her. Her smile was infectious. Stephen felt himself losing his poise as he couldn't stop grinning inanely.

"But *mais oui*," she said. "That's French,

"She laughed and for an instant looked at him intently, as if in that instant she could see everything about him, that he was taking this voyage because he was bored with his life."

which no one uses anymore, but it was the language of the world when this ship first sailed." She relaxed in her chair, slumped down as if she could revert instantly to being a child, and looked around the room as it Stephen had suddenly disappeared.

"I believe it was English," he said.

"Well," she said, looking up at him, "whatever. It means that I might be interested *if* you'd kindly sit down instead of looking at me from the heights." Stephen sat beside her. "It took you long enough to find me," Esme said.

"Well, I had to dress. Remember? You didn't find my previous attire—"

"I agree and I apologize," she said quickly as if afraid of hurting his feelings. She folded her hands behind the box that she had centered pertectly on the damask-covered table. Her leg brushed his; indeed he did look fine, dressed in gray striped trousers, spats, black morning coat, blue vest and a silk cravat tied under a butterfly collar. "Now don't you feel better dressed up?"

Stephen was taken with her; this had never happened to him before. A tall waiter disturbed him by asking whether he wished to order cocktails, but Esme asked for a Narcodrine instead.

"I'm sorry, madam, but Narcodrines and inhalers are not sold on the ship."

"Well, that's what *I* want," she insisted.

"One would have to ask the steward for more modern refreshments."

"You did say you wanted to live in the past," Stephen said. He ordered a Campari for her and a Drambuie for himself.

"Right now I would prefer a robot to take my order," Esme said.

"I'm sorry, but we have no robots on this ship," the waiter said before turning away.

"Are you going to show me what's inside the box?" Stephen asked.

"It might cause a stir if I opened it here."

"I would think you'd like that," Stephen said with a touch of sarcasm.

"You see, you know me intimately already." Esme smiled and winked at someone four tables away. "Isn't he cute?"

"Who?"

"The little boy with the black hair parted in the middle." She waved at him, but the boy ignored her and made an obscene gesture at a woman who looked to be his nanny. Then Esme opened the box, which drew the little boy's attention. She pulled out a full-sized head of a man and placed it gently beside the box.

"Jesus," Stephen said.

"Stephen, I'd like you to meet Poppa. Poppa, this is Stephen."

"Who is Stephen? Poppa said. 'Where am I? Why is this going on? I'm frightened.'"

Esme leaned toward the head and whispered into its ear. "He sometimes gets disoriented on awakening," she said to Stephen confidentially. "He still isn't used to it yet. But he'll be all right in a moment."

"I'm scared," Poppa said in a fuller voice. "I'm alone in the dark."

"Not anymore," Esme said positively. "Poppa, this is my friend, Stephen."

"Hello, Poppa," Stephen said awkwardly, trying to sound casual.

"Hello, Stephen," the head said. Its voice was powerful now, commanding. "I'm pleased to meet you." It rolled its eyes and then said to Esme, "Turn me a bit now, so I can see your friend without eyestrain." The head had white hair, which was a bit yellowed on the ends, neatly trimmed at the sides, and combed into a rather seedy pompadour in the front. The face was strong, although dissipated. It was the face of a man in his late sixties, lined and tanned, with deep-set eyes.

"My given name is Eliot," the head said. "Call me that, please."

"Hello, Eliot," Stephen said. He had heard of such things but had never seen one before.

"These are going to be all the rage in the next few months," Esme said. "They aren't on the market yet, but you can imagine their potential for both adults and children. They can be programmed to talk and to react very realistically."

"So I see," Stephen remarked.

The head smiled graciously, accepting

the remark as a very generous compliment

"He also learns and thinks quite well," Esme continued.

"I should hope so," said the head.

"Is your father alive?" Stephen asked.

"I *am* her father," the head said, its face betraying impatience. "At least give me *some* respect."

"Be civil, Poppa, or I'll close you up," Esme said, piqued. She looked at Stephen. "Yes, he died recently. That's the reason I'm taking this trip, and that's the reason—"

She nodded at the head. "He's marvelous, though. He *is* my father in every way." Mischievously she added, "Well, I *did* make a few changes. Poppa was very demanding of me when I was growing up."

"You're ungrateful—"

"Shut up, Poppa."

Poppa shut his eyes.

"That's all I have to say," Esme said, and he turns himself off.

The little boy, who had been staring unabashedly, came over to the table just as Esme was putting Poppa back in the box. "Why'd you put him away?" he asked. "I want to talk to him. Take him out."

"No," Esme said firmly. "He's sleeping now. And what's your name?"

"Michael, and can I please see the head just for a minute?"

"If you like, Michael, you can have a private audience with Poppa tomorrow," Esme said. "How's that?"

"I want to talk to him now."

"Shouldn't you be getting back to your nanny?" Stephen asked, standing and indicating that Esme do the same. They would have no privacy here.

"Stuff it," Michael said. "She's not my nanny. She's my sister." Then he pulled a face at Stephen—he was able to contort his lips, drawing the right side toward the left and left toward the right as if they were made of rubber. Stephen and Esme walked out of the cafe and up the staircase to the boat deck, and Michael followed them, to Stephen's annoyance.

The boat deck at least was not too crowded. It was brisk outside, and the breeze had a chill to it. Looking forward, Stephen and Esme could see the ship's four smokestacks to their left and a cluster of four lifeboats to their right. The ocean was a smooth, deep-green expanse turning to blue toward the horizon. The sky was empty except for a huge, nuclear-powered airship that floated high over the *Titanic*. This was the dirigible *California*, a luxury liner that could carry two thousand passengers.

"Are you two married?" Michael asked.

"No, we are not," Esme said impatiently. Not yet, at least, and Stephen felt exhilarated at the thought of her really wanting him. Actually it made no sense, for he could have any young woman he wanted. Why Esme? Simply because just now she was perfect.

"You're quite pretty, you know," Michael said to Esme. He was in earnest.

"Thank you," Esme replied, warming to him. "I like you, too."

"Are you going to stay aboard the ship and die when it goes down?"

"No!" Esme said, as if taken aback. "What about your friend?"

"You mean Poppa?"

Vexed, the boy said, "No, *him*," giving Stephen a nasty look.

"Well, I don't know," Esme said. Her face was flushed. "Have you opted for a lifeboat, Stephen?"

"Yes, of course I have."

"Well, we're going to die on the ship."

"Don't be silly," Esme said.

"Well, we are."

"Who's we?" Stephen asked.

"My sister and I. We've made a pact to go down with the ship."

"I don't believe it," Esme said. She stopped beside one of the lifeboats, rested the box containing Poppa on the rail, and gazed downward at the spume curling away from the side of the ship.

"He's just baiting us," Stephen said. "Anyway, he's too young to make such a decision, and his sister, if she is his sister, couldn't decide such a thing for him even if she were his guardian. It would be illegal."

"We're at sea," Michael said in the nagging tone children use. "I'll discuss the ramifications of my demise with Poppa tomorrow. I'm sure *he's* more conversant with these things than you."

"Shouldn't you be getting back to your sister now?" Stephen asked.

Michael made the rubber-lips face at him and then walked away, tugging at the back of his shorts as if his undergarments had bunched up beneath. He only turned around to wave good-bye to Esme, who blew him a kiss.

"Intelligent little brat," Stephen said, to be ingratiating.

But Esme looked as if she had just now forgotten all about Stephen and the little boy. She stared at the box as tears rolled from her eyes.

"Esme?"

"I love him, and now he's dead," she said. She seemed to brighten then. She took Stephen's hand, and they went inside, down the stairs, through several noisy corridors—stateroom parties were in full swing—to her suite. Stephen was a bit nervous, but all things considered, everything was progressing at a proper pace.

Esme's suite had a parlor and a private promenade deck with Elizabethan half-timbered walls. She led him directly into the plushly carpeted, velours papered bedroom, which contained a huge four-poster, an antique night table, and a desk and stuffed chair beside the door. The harp-sculpture desk lamp was lighted, as was the lamp just inside the bed-curtains. A porthole gave a view of sea and sky, but to Stephen it seemed that the bed overpowered the room.

Esme pushed the desk lamp aside and then took Poppa out of the box and placed

Robert is a closet nonintellectual.

him carefully in the center of the desk. "There," she said. At rest the head seemed even more handsome and quite peaceful, although now and then an eyelid twitched. Then she undressed quickly, looking shyly away from Stephen, who was taking his time. She slipped between the parted curtains of the bed and complained that she could hear the damned engines thrumming right through these itchy pillows. She didn't like silk. After a moment she sat up in bed and asked him whether he intended to get undressed or was just going to stand there.

"I'm sorry," Stephen said, "but it's just—" He nodded toward the head.

"Poppa *is* turned off, you know," Esme said.

The head's left eyelid fluttered.

Michael knocked on Esme's door at seven-thirty the next morning.

"Good morning," Michael said, looking Esme up and down. She had not bothered to put anything on before answering the door. "I came to see Poppa. I won't disturb you at all."

"Jesus, Michael, it's too early—"

"Early bird gets the worm."

"Oh," Esme said, "and what the hell does that mean?"

"I calculated that my best chance of talking with Poppa would be if I woke you up. You'll go back to bed, and then I can talk with him in peace. My chances would be greatly diminished if I were to put it off."

"Come in."

"The steward in the hall just saw you naked."

"Big deal. Look, why don't you come back later. I'm not ready for this, and I don't know why I let you in the room."

"You see, it worked." Michael looked around. "He's in the bedroom, right?"

Esme nodded and followed him in. Michael was wearing the same wrinkled shirt and shorts that he had worn yesterday; his hair was not combed, just tousled.

"Is *he* with you, too?" Michael asked.

"If you mean Stephen, yes."

"I thought so." Michael said. Then he sat down at the desk. "Hello, Poppa," he said.

"I'm frightened," the head said. "It's so dark. I'm scared."

Michael gave Esme a look.

"He's always like that when he's been shut off for a while," Esme said. "Talk to him a bit more."

"It's Michael," the boy said. "I came in here to talk to you. We're on the *Titanic*."

"Oh, Michael," the head said, more confidently. "I think I remember you. Why are you on the *Titanic*?"

"Because it's going to sink."

"That's a silly reason," the head said confidently. "There must be others."

"There are lots of others."

"Can't we have *any* privacy?" Stephen mumbled, sitting up in the bed. Esme sat beside him, shrugged, and took a pull at her inhaler. Drugged, she looked even softer, more vulnerable. "I thought you told me that Poppa was turned off all night," Stephen continued angrily.

"But he *was* turned off," Esme said. "I just now turned him back on for Michael."

"I'll tell you all about the *Titanic*," Michael said confidentially to the head. He leaned close to it and whispered intensely.

Esme cuddled up to Stephen, as intimately as if they had been in love for many days. That seemed to mollify him.

"Do you have a spare Narcodrine in there?" Michael shouted.

Stephen looked at Esme, who laughed. "No," Esme said, "you're too young for such things." She pulled the curtain so that the bed was now shut off from Michael and the head. "Let him talk to Poppa," she said. "He'll be dead soon anyway."

"You mean you believe him?" Stephen asked. "I'm going to talk to his sister or whoever she is about this."

Michael peered through the curtain. "I heard what you said. I have very good hearing. I heard everything. Go ahead and talk to her. Talk to the captain if you like. It won't do you any good. I'm an international hero, if you'd like to know. That girl who wears the camera in her hair already did an interview with me for the poli." He closed the curtain.

"What does he mean?" Esme asked.

"The woman reporter from Interfax," Stephen said.

Michael opened the curtain again. Her

CONTINUED ON PAGE 04

THE SONGS OF DISTANT EARTH

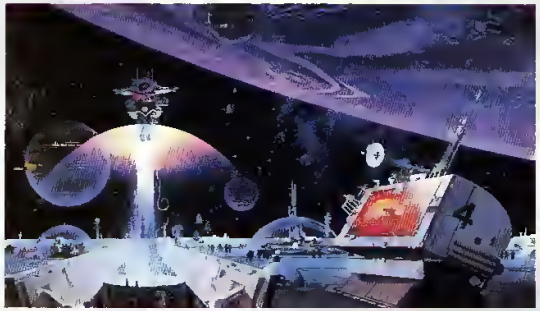
BY ARTHUR C. CLARKE

A certain film director had been bugging me after 2001 about what we should do next. I decided to shut him up. I asked myself, What should the next science-fiction movie be? At that point I hit upon "The Songs of Distant Earth," which is a

PAINTINGS BY ROBERT McCALL

"Diving deeper, they encounter the Shining Ones, giant squidlike creatures that communicate in the darkness of the abyss by displays of multicolored luminescence."

story I had written many years before, and it seemed to me that the background of that story would be appropriate. I also melded in a number of ideas from some of my other stories, including 'The Shining Ones,' in which beings like giant squids are endowed with human characteristics. All the other films that have been made about interstellar space have been fantasies. I tried to see whether it was possible to construct a realistic interstellar epic that would have all the necessary dramatic values as well as bold visual content. There is nothing in 'The Songs of Distant Earth' that I think can't and won't happen. Stanley Kubrick was quite interested but it wasn't his cup of tea. The treatment is still in circulation at present.



The locale is Oceana ("Shaana") an Earth-type planet 50 light-years and 500 years of voyage time, from the solar system, colonized 2,000 years earlier in the first wave of interstellar exploration. There is very little land, continents still lie 100 million years in the future, and there is still much tectonic activity. The largest island is about the size of Hawaii, and very similar to Hawaii in climate and culture.

Over the centuries the islanders—attractive, slightly feckless—have developed a stable, conservative society, largely based on intermediate technology. They still have access to all man's accumulated knowledge, but they have added little to it. Their boats, aircraft, and cars are built to last a lifetime, and they never throw anything away they can use again. Since there is no other habitable planet in the system, they have no spaceships, but they can still launch the (rather primitive) satellites essential for their scattered islands' communications and meteorological services.

Though they have had no physical contact with outsiders for centuries, they still inject their records and news, such as it is, into the local stellar network. The current update is long overdue, partly because of a mounting power crisis.

The Shaanans get most of their electrical power from OTEC (Ocean Thermal Energy Conversion), which employs the temperature difference between the warm surface water and the very cold water several kilometers down. (The first Earth-based OTEC factory began operating in Hawaii in 1979.) For some unknown reason, several of the factories have failed, apparently owing to damage at the deep end. Typically, the Shaanans don't have the submersibles needed to investigate at such depths, they are still arguing about what to do next.

Our protagonists on Shaana are a young couple, Loren (a marine engineer, marine engineering on Shaana is one of the most important professions) and Marissa. Their placid lives are disrupted by the arrival of the first ship from Earth in many centuries—and the last one that will ever be.

Five hundred years earlier the sun went nova. There was just sufficient warning to seek out the population and evacuate the survivors in hyperships, each carrying 1 million sleepers, along with records of all mankind's treasures and knowledge as well as gene banks of the main plants and animals.

Argo barely escaped in time. She left before preparations for the centuries-long journey were quite complete. She carries spectacular views of the destruction of the solar system recorded by cameras on Earth and some other planets. Jupiter boiling, Saturn's rings collapsing, the sun finally devouring its children, but, most poignant of all, unbearably moving scenes of the last moments of beloved earthscapes and artifacts (e.g., the Taj Mahal, St. Peter's, the Pyramids, etc., melting down).

Because there is appreciable erosion from interstellar dust at one tenth the speed of light, *Argo* travels behind a huge ablation shield formed of ice. This is now too thin for the voyage to continue, hence the stop at Oceana to build a new shield. About 100 of the ship's engineers have been revived for this task, among them Falcon.

During the decades of deceleration *Argo* has been studying the Shaanans' radio transmissions and has a very good idea of the local culture. But so far there has been no attempt at contact, because of the long-established policy of noninterference. There is much debate aboard *Argo* about this, especially now that it is in orbit and the beauty of the planet below is clearly visible. Falcon spends hours scanning the islands through the ship's telescopes, vividly reminded of the world he has lost forever.

Contact is finally made, with the inevitable enthusiasms and frictions. The voyagers have power, knowledge, determination, but they are slowly seduced by the beauty

CONTINUED ON PAGE 132

Dying cancer victims are thinking their way to health as research uncovers

THE HEALING BRAIN

BY DOUGLAS GARR

It is another hectic morning in a cramped neurophysiology laboratory. Hunched over his microscope, a researcher focuses on a nerve cell taken from the spinal cord of a mouse. He will hook up an amplifier to measure the neuron's activity, then punch the results into a computer.

Yesterday's figures light up the video display, and Dr. Jeffrey Barker, casually dressed in a blue turtleneck, checks them and nods. Dr. Barker and his assistant break into an arcane language fraught with references to synapses, dendrites, and axons. Brain-speak. If not for the Haydn on the stereo, a couple of stray fish tanks, and his daughter's playful crayon drawings, Barker's lab might belong to the ill-fated Dr. Jekyll.

But Barker's work at the National Institute of Neurological and Communicative Disorders and Stroke, in Bethesda, Maryland, is decidedly beneficial. "We're trying to find out how nerve cells communicate," he says. "We're taking the central nervous system apart. Right now all we have is unidentified flying neurons."

Thirty miles to the northeast, at Johns Hopkins Medical School, in Baltimore, Dr. Caroline Bedell Thomas is doing some very different sleuthing. Dr. Thomas has no fancy scientific hardware. Instead, she relies on questionnaires and the U.S. Postal Service.

In one of the longest-running studies ever conducted, Thomas asked 1,337 Johns Hopkins medical students who graduated between 1948 and 1964 to undergo a battery of psychological and biological tests—while they were students. She's been checking their health ever since. The experiment, known as the Precursors Study, was designed to uncover the medical effects of dozens of mental and physical factors, from alcohol consumption and cigarette smoking to anxiety and depression.

As the first students reach middle age—some have already died—Thomas is beginning to draw some preliminary conclusions. Those students whose personalities she calls "irregular-uneven"—brilliant, moody, over- or underdemanding, and over- or undercautious—developed cancer, hypertension, or coronary occlusions much more often than the 'slow-solid' or rapid-facile types. The "irregular-unevens" are considerably more likely to die younger than the other groups.

Though Barker's and Thomas's studies appear to have little in common, they—and many related projects—are contributing to a fundamental change in clinical medicine. From two distinct vantage points—Barker probing inside and Thomas peeking in from the outside—they are discovering that the brain exerts far more control over our bodies than we ever imagined possible.

Doctors once saw the brain as little more than a sophisticated computer, nearly independent of the body, which carried it almost as a parasite. That view started to change

PHOTOGRAPH BY HOWARD SOCHUREK

with the "chemical revolution" in the Seventies. First came the discovery that the brain manufactures endorphins and enkephalins, opiatelike substances that relieve pain and stress. More recently researchers have noticed that the brain is responsible for a variety of hormonal and chemical activities that affect our appetite, our blood pressure, and even our sex drive.

"It is quite clear that the brain is connected to everything else in a way that's beyond our understanding," says Dr. Robert Ornstein, of the Institute for the Study of Human Knowledge. "We've had to step back enormously in awe, as ordinary people, and in less awe as scientists."

We've known for some time that anxiety and depression can worsen such illnesses as diabetes, asthma, headaches, peptic ulcers, and cardiovascular disorders. For more than two decades Dr. Hans Selye, a Nobel laureate and founder of the International Institute for Stress, in Montreal, has been publicizing the psychic battleground and its physical implications.

The author of 38 books on stress and health, Dr. Selye believes that peaceful thoughts release beneficial hormones, while fearful ones let out harmful hormones. Cortisone, in Selye's words, is "a tissue tranquilizer," and adrenalin causes us to be aggressive. But Selye is careful to note that stress is a normal part of life. "You can't make many generalizations because some people take stress very well and others don't," he says.

René Dubos, the Pulitzer Prize–winning author and renowned microbiologist at Rockefeller University, offers a case in point. Now eighty, Dr. Dubos recalls his first wife's death nearly four decades ago with startling clarity. In 1942 she contracted tuberculosis, and Dubos says he was able to trace the origins of her illness to her childhood. Her father was a painter of china, and she was exposed to silica, a compound that might have promoted the development of TB. With standard medical treatment, she was partially cured and led a fairly normal life.

After two years, however, the disease reappeared. Dubos remembers attending a concert at New York's Carnegie Hall some time later. While walking along Fifty-seventh Street, his wife, a former pianist, became sullen when she realized she could no longer play. "Two weeks later she was dead," Dubos says. Though he doesn't claim that she died because she was upset, he realized that her depression might have exacerbated her illness. "The evidence of the psychological component in disease is overwhelming," Dubos now concludes.

Backed by a torrent of scientific papers, such incidents have caught the attention of doctors across the country. When author Norman Cousins contracted a rare and painful connective-tissue disease, physicians gave him a 1-in-500 chance of recovering fully. But Cousins took an active, aggressive role in his fight, often ignoring the dictates of conventional medicine. He left the hospital earlier than he was supposed to, took charge of his own therapy, and watched Marx Brothers movies, hoping that humor would ease his pain. After he recovered, Cousins wondered, "Does this mean that laughter stimulated production of the endorphins?"

Science hasn't yet answered his question. The same question has occurred to many physicians. When Cousins wrote about his illness in the *New England Journal of Medicine*, 3,000 doctors responded with letters.

Stress effects can be subtle, according to Dr. Barney Dlin, a psychiatrist at Temple University in Philadelphia, who has found a correlation between emotion and coronary disease. "For example, in our study we worked with a patient who had a heart attack when his child was four years old. We learned in our interview that his father had suffered a heart attack when the patient was four years old." Dr. Dlin noted in the journal *Psychosomatics*. Consciously or unconsciously, a patient may forecast his own sickness or death.

> *"The Simontons combine psychotherapy with normal cancer treatments, and on average their patients live twice as long as those who get only the medical therapy."*

And at the University of Maryland Medical School, psychologist James Lynch has conducted numerous clinical studies of emotion and its relation to blood pressure and heart disease. Though he commands a laboratory full of impressive monitoring equipment, Dr. Lynch is often more fascinated by the intangible factors that influence human health.

He likes to point to a 1965 study of heart disease in the United States. Nevada had one of the highest rates; neighboring Utah, the lowest. What caused such a disparity? Obviously it wasn't a simple answer like the quality of water or air or the medium-income level. They were nearly identical in the two states. But the people of Utah generally are very religious, the state has a stable population and an unusually low divorce rate. Nevada's principal industry is gambling. The state's inhabitants are often transient, and Nevada's divorce rate is triple Utah's.

Perhaps the explanation lay somewhere in the patient's mind. Lynch speculated: Could it be that loneliness had something to do with heart disease? In those days that was a brash proposal.

Lynch found the mortality statistics for heart disease in the United States are two to five times higher among unmarried people than among marrieds. Obviously Lynch admits, being single doesn't mean you're automatically destined to suffer a heart attack. But he thinks it would pay medical science to study the problem further. Lynch isn't optimistic that the research will take place, however. "Can you imagine writing a grant proposal for a project on love?" he asks rhetorically.

How is it that the brain affects our ability to resist illness? One likely route is through the immune system. In one study the hypothalamus, a section of the brain that regulates the pituitary hormones, has been linked with the body's ability to form antibodies to fight off infection. And recent research on one kind of infection-fighting white blood cell, the T lymphocyte, reveals the presence of brain hormones on the cell's outer membrane.

It is far from certain just how important this link between the brain and the immune system will prove. But scientists have speculated that a few of our healthy cells may turn malignant each day. The white blood cells, they suspect, recognize this transformation and destroy the cells before the cancer spreads. So if someone does contract an infection or develop cancer, his body's immune system may have broken down. Then the connection could be very important indeed.

One of the more striking examples occurred two years ago in Fort Lupton, Colorado. Jim Kunzman, a farmer, suddenly had to contend with the loss of his two young children, who were killed in an automobile accident. Kunzman, whose story was documented on film, found that he had lost interest in his work and in his life. Though never sick in the past, he began to feel ill, slept long hours, and lost his appetite. Eighteen months after his children had died, doctors found he had multiple myeloma, a bone cancer. Kunzman underwent chemotherapy, but its side effects only made him feel worse. Then, early in 1980, he began seeing a psychologist and talking about his feelings. Remarkably his cancer regressed. Today he's actively tilling his farmland.

"My immune system was at a very low ebb," Kunzman now says evenly. "I think that subconsciously I wanted to punish myself in some way, and my body simply obliged me."

Oncologists are very careful to note that Kunzman's cancer might have disappeared for any number of reasons. But no one discounts the possibility that his sickness and subsequent good health had a psychological basis.

In fact, physicians at the Cancer Counseling Research Center, in Fort Worth, Texas, have turned this idea into a practical—and highly successful—cancer treat-

ment. Developed by Stephanie Matthews-Simonton, a psychologist, and Dr. Carl Simonton, a radiation oncologist, the center's treatment program focuses on the psychology factor in cancer. The Simontons combine conventional psychotherapy with such standard medical techniques as radiation and chemotherapy.

Though the Simontons are careful not to make any miracle claims for their success stories, the results have been encouraging. In the past five years, their 200 patients have survived an average of twice as long as cancer victims who received only medical treatment. Some of the patients at the research center have had their cancer disappear completely.

The Simontons' technique grew out of experiments with biofeedback, which enjoyed its greatest popularity in the late Sixties and early Seventies. During the biofeedback studies, Mrs. Simonton says, she and her husband began to ask themselves, "If a person could be taught to influence heart rate, blood flow, and blood pressure, all physiological systems under the autonomic nervous system, could people be taught to put energy into building their immune system?"

The first patient they experimented on was a sixty-one-year-old man with an advanced, probably fatal, throat cancer. (The Simontons publish scientific papers only on patients who are diagnosed as having 12 to 18 months to live.) In addition to radiation treatment, the Simontons asked the man to relax and visualize a pleasant setting for a few minutes three times a day: a quiet mountain scene or an idyllic setting by a stream. Later, the patient began to visualize his tumor. Then he was told to think about his body's white blood cells invading the tumor in his throat and eventually destroying it.

In two months, his throat cancer went into remission. "What was astonishing," Mrs. Simonton says, "was not so much that his tumor shrank—which you would expect during radiation treatment—but that he experienced nothing in the way of side effects.' The man got stronger, gained weight, and became cheerful. 'When arthritis began to bother him, he turned his white blood cells on that, and it cleared up,' she adds.

Soon, the Simontons began to notice distinct emotional similarities among their cancer patients. "Typically what we saw was a high-stress pattern six to eighteen months before the diagnosis of cancer," Mrs. Simonton reports. "Frequently there will be a real or imagined loss of some kind—death of a spouse, a child leaving home—leading to a profound despair. This is something that the cancer-prone personality has a lot of difficulty dealing with, the mind-body connection."

The idea that cancer patients share a broad psychological profile is new and controversial. There are, after all, thousands of carcinogens to which many of us are exposed every day; any of them can surely cause death after 15 to 20 years of exposure.

In the late Fifties, Lawrence LeShan, a clinical psychologist who practices on Manhattan's Upper West Side, developed the notion that people who got cancer had certain psychological traits in common. This idea was scoffed at. Today LeShan smiles wryly when he recalls the resistance that greeted his wish to conduct a study to confirm his idea. Thinking he was a charlatan, the administrators of hospitals and cancer clinics refused to let him interview terminal patients.

Finally, though, LeShan was allowed to talk with cancer patients at a program run by the Institute for Applied Biology. Two patterns began to emerge. First, he found cancer patients lacked a strong will to live. Second, the patients found it difficult to express their anger or resentment.

In one experiment considering psychological factors alone, LeShan was able to predict correctly who had cancer in 24 of 28 cases. Of 22 "terminal" cancer patients whom he began treating a decade ago, 12 are still alive.

"One puzzling feature of the mind is pain. The brain decides how severe it is. In some primitive cultures, the husband hurts during his wife's labor. She seems comfortable."

Since then, two Rochester, New York, doctors have tried to guess—again basing their guess on personality traits—which of the women who entered the hospital for cervical biopsies actually had cancer. They were right 72 percent of the time.

Though we have grown to accept the theory of the cancer-prone personality, LeShan hints that American clinics may be lagging behind those in the rest of the world. During a trip abroad, he was startled to find great interest in the psychological treatment of cancer. "In West Germany," he learned, "if you want to set up a cancer clinic, you can't get federal funding unless you agree to set up a psychological rehabilitation ward."

All this raises some questions. How do the patients who survive cancer react to their illness? Do they take an active role, as author Norman Cousins did? Or do they remain passive?

"What we're seeing," Mrs. Simonton finds, "is that the ornery, scrappy, cantankerous patient does better than the passive, compliant, sweet, denying patient who bottles everything inside."

LeShan adds, "Bad patients do better than good patients. The oncologists know this, but they haven't really come to grips with it."

One of the mind's most puzzling influences on the body appears in cases of chronic pain. Pain is subjective. It is the brain that feels it and decides how severe it is. "We've known for years that soldiers wounded in battle often don't feel pain until hours later. And in dozens of studies, doctors have reported that ordinary sugar pills or salt pills relieve pain in up to half of the patients who take them. Recently, researchers have suggested that the placebo, though it has no direct effect, eases pain by triggering the release of enkephalins in the brain. Anthropologists have even seen primitive cultures in which the husband feels pains during his wife's labor and the woman seems comfortable.

It seems that our culture has a great influence on how we feel pain. Dr. Richard Black, codirector of the Pain Treatment Center at Johns Hopkins, believes that he has seen the proof among his own patients. "We have found some interesting sociological problems with our own chronic-pain patients," he says. "Some have what I guardedly call inadequate personalities. They have never been able to hold down a job; when they do, they get injured frequently. They're always running for the pill or the bottle. A high percentage tend to be child abusers and were abused as children themselves. So you are dealing with a deep-seated problem that goes on from generation to generation."

Dr. Black says that pain patients are often misdiagnosed frequently because of psychology. He recalls the case of one patient, a fifty-two-year-old woman who'd had a mastectomy seven years earlier. She was technically cured, and although her arm was swollen and her chest was scarred, she experienced only mild pain.

Then her next-door neighbor got a fulminating carcinoma of the breast and died within six months, Black reports. "This was a neighbor our patient hardly knew, but she had an intense grief reaction nevertheless." Soon afterward, the woman sought out another doctor and complained to him of severe pain.

"He diagnosed her as hurting rather than having an anxiety attack," Black continues. "He gave her a painkiller and a tranquilizer to help her sleep. Both drugs, because of their chemical effect on the central nervous system, made the woman feel depressed. When you're depressed, everything's worse and you hurt more. Meanwhile, the doctor had done nothing to ease her anxiety. In fact, by doing nothing, he had made it worse."

One of Black's colleagues at Johns Hopkins, Dr. Nelson Hendler, saw so many patients with back pain that he devised a ten-minute psychological test to sift out people who lack an apparent 'organic'

basis for their pain. Dr. Hendler says the 'objective' pain patient has 'a history of stability, a sense of independence, and a resentment of incapacitation.'

Hendler is also director of the Mensana Clinic, a pain center in Stevenson, Maryland. At Mensana, treatment concentrates on the behavioral aspects of pain. The patients take responsibility for their own medication. There are no nurses to coddle them. "In group therapy, patients are encouraged to talk about their pain, sort of like Pain Anonymous," Hendler says.

As clinical medicine is adjusting to our new understanding of the brain's role in health, neuroscience is ferreting out still newer insights. For example, Dr. Quentin Pittman, assistant professor of pharmacology at the University of Calgary, in Alberta, Canada, and his colleague, Dr. Warren Veale, have discovered that the brain may control fever. During their experiments, Drs. Pittman and Veale noticed that newborn lambs never developed a fever, so the pharmacologists began to search for natural substances that might repress fever.

What they found was vasopressin, a hormone first discovered in the Fifties. Acting on the kidneys, vasopressin controls the body's water content and helps regulate blood pressure. And, according to Pittman and Veale, the higher the level of vasopressin in a test subject's bloodstream, the lower the fever.

"As a result, we have come to suspect that the brain has its own type of aspirin," Pittman says, much as it has its own morphinelike substances. The next question is obvious. Is there some way we can stimulate the body to produce its own aspirin? "If so, he hopes, we may soon be able to eliminate a headache at will.

And brain research is just beginning to help us understand our sex drive. In 1971, scientists first isolated a substance known as LH-RH (for luteinizing hormone-releasing hormone) in the pituitary gland. Shortly thereafter, Dr. Robert Moss, of the Dallas-Southwestern Medical School's department of physiology, found that LH-RH induced sexual activity in female rats, even after the animals' adrenal and pituitary glands had been removed. "The only place LH-RH could have acted was in the brain," Dr. Moss concluded.

Moss repeated the tests on other animals, both male and female, with similar results. In humans, however, LH-RH seldom worked except when it was given to people with sexual dysfunctions. "Still," Moss reflects, "the idea of chemical reactions affecting neural activity . . . we've just scratched the surface."

The work continues. Dr. Barker, in Bethesda, is struggling to find out how brain cells talk to one another. Someday he may identify some of his flying neurons. Dr. Thomas, at John Hopkins, continues to collect data on her surviving medical students, helping to unravel the physical and psychological bases of cancer, heart disease, and even suicide. She has published 80 papers so far, and another researcher will probably pick up where she leaves off.

Scientists are beginning to look at memory as a physiological problem. Is senility simply an inevitable part of old age, or is it an ailment that can be evaded or cured? Dr. Dubos likens the brain to a muscle. If not exercised, it atrophies in every way.

At the neurological-research arm of the National Institutes of Health, there is already talk of neural prostheses for paralyzed limbs. Why can't a microcomputer, activated by brain waves and embedded in that limb, be programmed to control basic motor functions? It may soon happen.

Meanwhile, the mold of Western medicine is slowly wearing away and being recut. "I've seen a swami take random spots on his hand and raise the temperature on one and lower it on the other," LeShan marvels. "But what does this do? We can get an alpha wave and control our electroencephalogram, but why? What's the value?"

Everyone expects the easy route to health, but it cannot be done in two weekends. People think that if they jog and if they take ten extra milligrams of vitamin C a day, zinc, and so on, they'll be sexually attractive and will live forever. But it doesn't work that way.

How it does work, we're not exactly sure. Today's studies of the brain will eventually show us the path. ∞

Photograph by Norman Seeff

The V-2 colleague of Wernher von Braun and creator of mighty rockets now turns his technical clairvoyance toward humans in outer space

INTERVIEW

KRAFFT EHRICKE

There's nothing like a good vacuum to keep a man happy. Particularly if that man is Dr Krafft A Ehricke and if that vacuum—the vacuum of space—can be filled with bold, imperative rationales for humankind's leap outward into the cosmos Simply put, Ehricke is one of the world's great rocket men

It was in 1928 that a flickering motion-picture screen in his native Berlin first enticed the then twelve-year-old Ehricke to reflect upon astronautics and rocketry After no fewer than a dozen viewings of Fritz Lang's *The Woman on the Moon* Ehricke totally immersed himself in the study of space travel

The outbreak of World War II soon led the young aeronautical engineer into military service In 1942 Ehricke was recalled from the war front and assigned to engineering development work at Peenemünde—the birthplace of the V-2 rocket There, his association with other members of the Peenemunde rocket team, such as Wernher von Braun and Walter Thiel, buoyed Ehricke's belief that beyond the immediate task of developing specific weapons for the German arsenal lay the greater calling of astronautics

When Germany fell, Ehricke, Von Braun, and other members of the German rocket team were flown to the United States under the U S Army's Operation Paperclip Until 1952 Ehricke contributed his talents to the U S Army's rocketry development program From 1952 to 1954 Ehricke studied long-range glide rockets as an assistant project engineer for Bell Aircraft In 1954 he moved to Convair Astronautics in San Diego to aid in the development of the Atlas Intercontinental Ballistic Missile

There he began to incorporate a yearning for spaceflight into memos for the future many fashioned to transform the Atlas from an ICBM to a space station or to loft unmanned satellites into Earth orbit and beyond One of his concepts—that an entire Atlas missile could boost itself into orbit—materialized into Project Score, launched on December 18 1958 Circling the earth every 101 minutes, the Atlas carried in its nose cone a small tape recorder transmitting a Christmas message from President Dwight D Ei-

"We should not make ourselves smaller so that our limited planet may again appear larger, but make our world grow with us."

senhower—the first communiqué in space.

While at Convair, Ehricke also conceived, designed, and directed development of the Centaur, the world's first hydrogen-oxygen upper-stage rocket. His crusade to utilize high-energy fuels for launch-vehicle upper stages enhanced America's ability to blast heavier payloads out of Earth's gravity toward interplanetary targets. The flyby of Saturn by *Voyager 2*, scheduled for August 28, was made possible in part by Ehricke's determination and in part by a powerful push from a Titan/Centaur booster.

From 1965 to 1977 Ehricke worked for Rockwell International as assistant director of the astronics division. Later he became chief scientific adviser for advanced programs in Rockwell's space division.

Today he is president of Space Global, Inc., based in La Jolla, California. Among the many awards he has received are the first Guenther Loeser Medal, presented to him in 1956, and the Kurt Laskowitz Aerospace Engineering Award, presented in 1972. In 1966 he was named to the International Aerospace Hall of Fame.

Ehricke is the author of hundreds of articles that outline his vision of the future. He is currently putting the final touches on his book *The Extraterrestrial Imperative—From Closed to Open World*, in which he explains his philosophy of space exploration-and industrialization as it relates to the future of unlimited human growth.

Ehricke was interviewed exclusively for *Omni* at his home in La Jolla by journalist Leonard David.

Omni: Many years ago you established four principles to which a spacefaring civilization should adhere in laying down a basis for planetary management in space. Secure our access to the greater laboratory of space as a way to acquire new knowledge, through that, gain new technological capabilities, open to mankind the material resources of the solar system, and displace war—or even the threat of war—as "the father of all progress." As we enter the era of the space shuttles, do you see any midcourse corrections in these principles?

Ehricke: There are some midcourse corrections in detail, but no basic changes in overall philosophy. The bottom line is still understanding these enormous new perspectives and understanding how we, as a nation and as mankind, should proceed. This has not changed at all. The extraterrestrial expansion belongs in the chain of evolution.

Omni: Do you mean a blend of human and technological evolution?

Ehricke: Yes, in the sense that the basic concepts are in sync with evolutionary principles. The points you listed, I have deepened to a great extent in the past few years. I showed that comparing past and present conditions permits us to understand a past Great Crisis and the warning signs of its recurrence now. A Great Crisis is the collapse of an Open World through a confluence of crises. The warning signs are an energy crisis and environmental confrontations, followed by industrial limitations, compounded by spreading raw-material shortages. They force us into either new growth or resignation.

Omni: Please explain your concept of an Open World.

Ehricke: Briefly, an Open World is characterized by adequate source-to-sink systems and an environmental tolerance for these systems. Metabolic processes require an Open World to steer clear of starving from lack of energy or lack of raw materials, and of being strangled by wastes. And human industrial processes are not different in principle, from biological ones. Earth was once large enough to offer an Open World to human growth. No more.

But Earth is part of a greater system of environments. The *extraterrestrium*—as I call the great variety of environments beyond Earth—forms a new cosmic setting, accessible to us for productive and constructive uses. My Extraterrestrial Imperative is a philosophy of recognizing that we should not make ourselves smaller in order that our limited planet may again appear larger, but that we should integrate new environments to make our world grow along with us.

Omni: It sounds as if a mass exodus from Earth is required and that we have gone beyond the point of no return.

Ehricke: I am not advocating a mass exodus into space or the abandonment of Earth, but rather integration of Earth and the *extraterrestrium*—the expansion of a one-room apartment into a mansion. Expansive integration offers the only prospect for a stable base for further growth. In that sense we are beyond the point of no return.

Omni: With both the Soviet Union and the United States working to develop operational space weaponry, won't the prospect for space warfare short-circuit your plans for an Open World?

Ehricke: It could, but it hasn't short-circuited the old Open World on Earth. To build a new Open World means to be able to expand creatively—at the price of being able to destroy creatively. Both are wrapped up in the humanization of space. It would be naive to expect it to be all love and selfless cooperation. When humans leave Earth, the magnetic field of the hostilities and distrust with which they were impregnated at the origin will to some extent be frozen into them, just as the solar wind carries the sun's magnetic field frozen into its structure. It is difficult to see an entirely peaceful evolution in space. I see no reason, even in a nonideal world, not to strive unwaveringly for a new Open World.

Omni: China, Japan, France, and India are now capable of lofting their own satellites into orbit, with no assistance from the United States or the Soviet Union. Could the increase in other nations' space prowess frustrate the possibility of all nations' using space together peacefully?

Ehricke Other countries using space will complicate the situation especially if we do not assist them I would like to see the United States encourage close participatory partnerships not only with Western Europe and Japan but also with newly developing countries It would benefit the Third World tremendously and would also strengthen the attractiveness of the system in which many of us believe The stronger and larger the Western bloc the more attractive it could become for the East and for Third World countries to cooperate with us in the peaceful utilization of space Though there is a potential for major confrontation in space as on Earth there is also a strong infrastructure of scientific and technological cooperation—a camaraderie of astronauts and cosmonauts This infrastructure should be strengthened

Omni: To what extent do you feel the control of technology by military authorities inhibits civilian use of specific technologies? What is the appropriate balance?

Ehricke Technological advances in military applications have traditionally benefited the civilian sector and vice versa A recent example is the space shuttle, opposed in the early 1970s by some space scientists but supported by the Air Force Without that support we might not even have had the shuttle today But that doesn't make the shuttle a military tool per se

The balance? I advocate that we stop painting ourselves into a semantic corner with all this talk about military and civilian space technology Like the Soviet Union I would treat military and technological developments as one A strong industrialization effort in space by its very existence implies military strength America's impressive deterrent is its now somewhat endangered ability to produce abundant and formidable armor when angered

Space technologies can, and will, lead to new weapons If, simultaneously these technologies are used to build up the new Open World plowshares will ultimately become more important than swords at least until another cycle begins in some distant future Of course if we insist that these creative aspects of the Open World shall not overcome our frozen emotional force field of hatred and distrust if we insist on operating as one-world Neanderthals instead of growing into true polyglobal cosmopolitans then nothing will save us We certify our kind as evolutionary failures I consider this scenario unlikely

Omni: Perhaps we should focus on specific proposals such as space stations Within NASA there appears to be some confusion as to what a space station should represent

Ehricke We will do scientific and technological work and we will then make it into a factory, space dock defense command vacation retreat, an Astropolis city with condominiums for those who wish to live or because of handicaps need to live at 0 16 to 0 5 g [in an environment with 0 16 to 0 5 the gravity of Earth] Later there can be emporiums with wares from many worlds

Omni: Do you feel that the United States leapfrogged perhaps wrongly, past the development of a space station in favor of landing on the moon in the 1960s?

Ehricke Someone of my persuasion could hardly be against [President John] Kennedy's goal of a lunar landing However at the time I tried to argue that we might be better off building a space station first because it would improve our transportation capabilities in space it would make space useful to people and it would then be a basis for sustained exploration of and subsequent operations on the moon

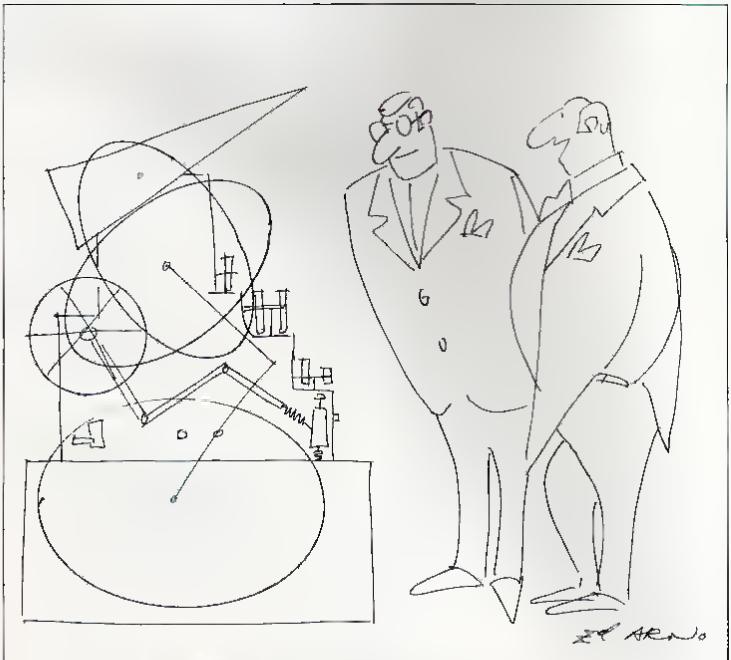
Omni: Project Apollo became a dead-end program and we still have no support base—no station—from which to expand

Ehricke President Kennedy's reference system was one of response to an entirely unexpected demonstration of Soviet technological prowess and the desire to meet the challenge in the same arena in which it was posed by accomplishing an even more spectacular feat I don t think he or his national security advisers thought about what was to come thereafter The space community at that time hoped of course that this would be the big breakthrough and that spaceflight would become self-propelled from then on What happened was quite unexpected The descendants of pioneers began to block pioneering at the space frontier Some said Spaceflight is socially irrelevant Let's stop it ' And' in the technophobic hysteria of the day the astronaut was depicted as the apocalyptic rider symbolizing ultimate alienation from nature Socially irrelevant? Ultimate alienation from nature?

They did not comprehend that the tidal wave of another Great Crisis was approaching the shallow waters in which they played They did not comprehend that life means a mighty leap even higher above its origin into the radiant infinity of space time and understanding At first I did not believe that this could be the result of anything except a lack of understanding

Omni: But wasn t the moon a convenient target? Don t you think that without it this nation may never have explored space?

Ehricke I would not say never But a world nearby is a tremendous encouragement Just imagine the predicament of a Venusian Kennedy after a Venusian Khrushchev had fired his cosmonauts into Venusian orbit The closest next available target would have been Mercury or Earth or Earth's moon Or imagine that the Russians had landed on the moon Our first response would have had to be Mars In the early 1960s it would not have been a relevant response because it would have taken us too long and we would probably have made a training and demonstration flight first to the moon I am convinced that it is the next focus for major exoindustrial developments and for the creative extraterrestrial development of the human



"This is our ultimate design breakthrough
It's expensive it's complicated it needs frequent repairs
and it doesn t do a damned thing"

Omni: Is it becoming very difficult to develop a focus for a U.S. space program? Short-term political processes seem to stifle long-range planning. How can we realistically plan our long-range goals?

Ehricke: It is very difficult. Too many interests are at cross-purposes. There are some scientists who do not believe in the use of space, only in its exploration. There are neo-Ptolemaians such as one president of Friends of the Earth who, in effect, stated publicly that "Earth and its resources are all we have and all we will ever have." Then there are politicians who want to be reelected by a constituency for most of whom space is the least immediate concern. This country is rich, and people see many other ways to solve their problems over the short term. Religious beliefs, cultural traditions, and political considerations definitely take precedence. In the United States long-range planning smacks of controls. We have yet to synthesize freedom and common purpose.

Omni: And what is the solution?

Ehricke: Muddling through is the first and probably the most popular solution. Preferring long-range national solutions to the satisfying of our short-term interests is the second. Another—and this one is more likely than popular—is to go through a period of intense suffering, with an obvious causal connection to past neglects so that we can arrive at the realization that the future is serious business and that people must support an energy program and a space program that realistically meet this nation's needs.

Omni: Do you believe the Reagan Administration will decide to build a permanent space station?

Ehricke: Yes. I think President Reagan realizes the importance of space. But he is under enormous pressure. The country no longer has the freedom of options it possessed during Kennedy's term. This will affect longer-term commitments. Still, a modularized six-man station could reach operational readiness. We have done enough studies. Space-station technology is crucial in near-Earth and circumlunar orbits. But it can be only a stepping stone to the larger task that awaits us on the moon.

Omni: Is there a trend toward the dehumanization of space with robotics?

Ehricke: I have nothing but admiration for the epochal accomplishments in planetary exploration with automated probes. Automated systems will play a still larger role in the future. But the human must play the supreme, creative, and guiding role in space. I see a synthesis of the information metabolic and the nonreflective intelligences, based on the strengths of both.

Omni: Nothing has aroused the wrath of those desirous of extraterrestrial expansion more than the Moon Treaty has. It appears to be dead. The United States is apparently reevaluating its support of the document. What do you think about it?

Ehricke: I would reject the treaty in its present form, though not totally. I appreciate

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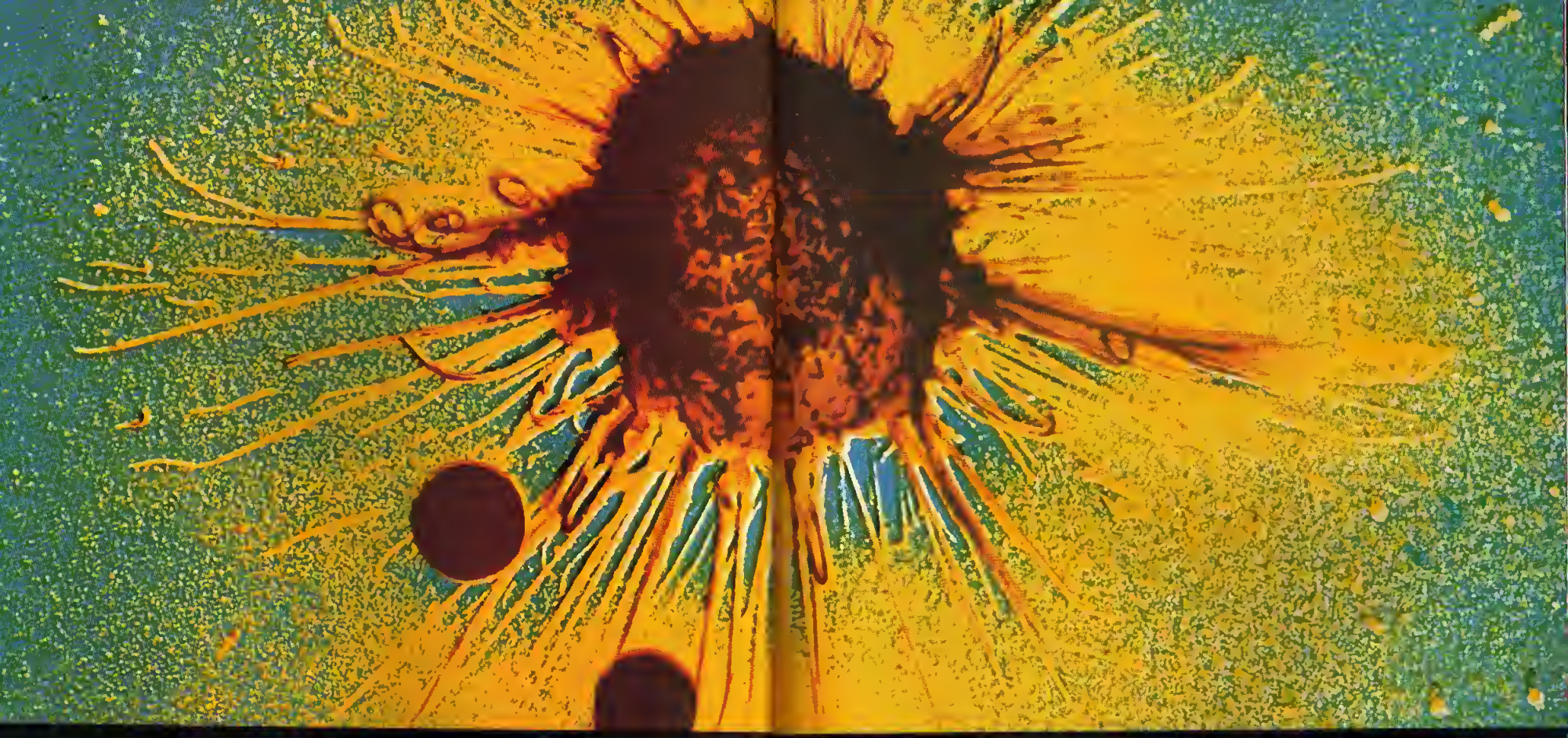
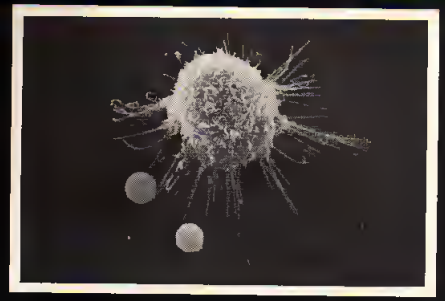




Vibrant color shatters the gray molecular world

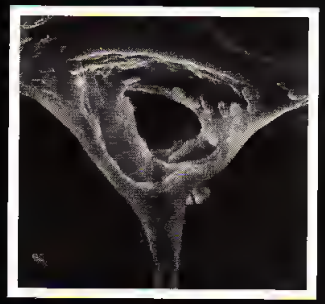
MICHROMATICS

BY KATHLEEN McAULIFFE

A lung macrophage stalks its prey. Its spaghettilike arms seize hold of the foreign invaders. The massacre begins. To accent this microscopic drama (above), Laurence Baskin decks the combatants in blood-red. A senior at the University of California at Berkeley, Baskin is a pioneer in the brand-new field of color electron microscopy. His unique process transforms conventional black-and-white micrographs (the

"By virtue of their size, atoms are colorless"

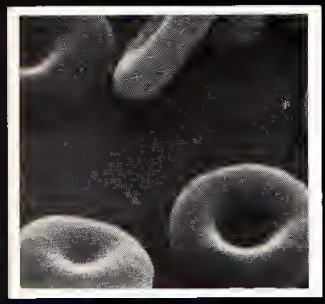
smaller pictures on these peges) into a rainbow of vibrant hues. The color accentuates three-dimensional contours but has no bearing on the true appearance of the specimen. In electron microscopy, images are produced by scanning the object with an electron beam rather than with visible light. Color is sacrificed to achieve a higher power of magnification. In fact, the electron microscope can now take pictures of atoms and other objects that are themselves far shorter than the wavelength of light. By virtue of their size, atoms are colorless. While Baskin's process is clearly an artificial embellishment, it does serve a purpose. His work has already attracted great interest as an educational aid. Students find that their memory for anatomical detail is enhanced through color associations. Teachers appreciate



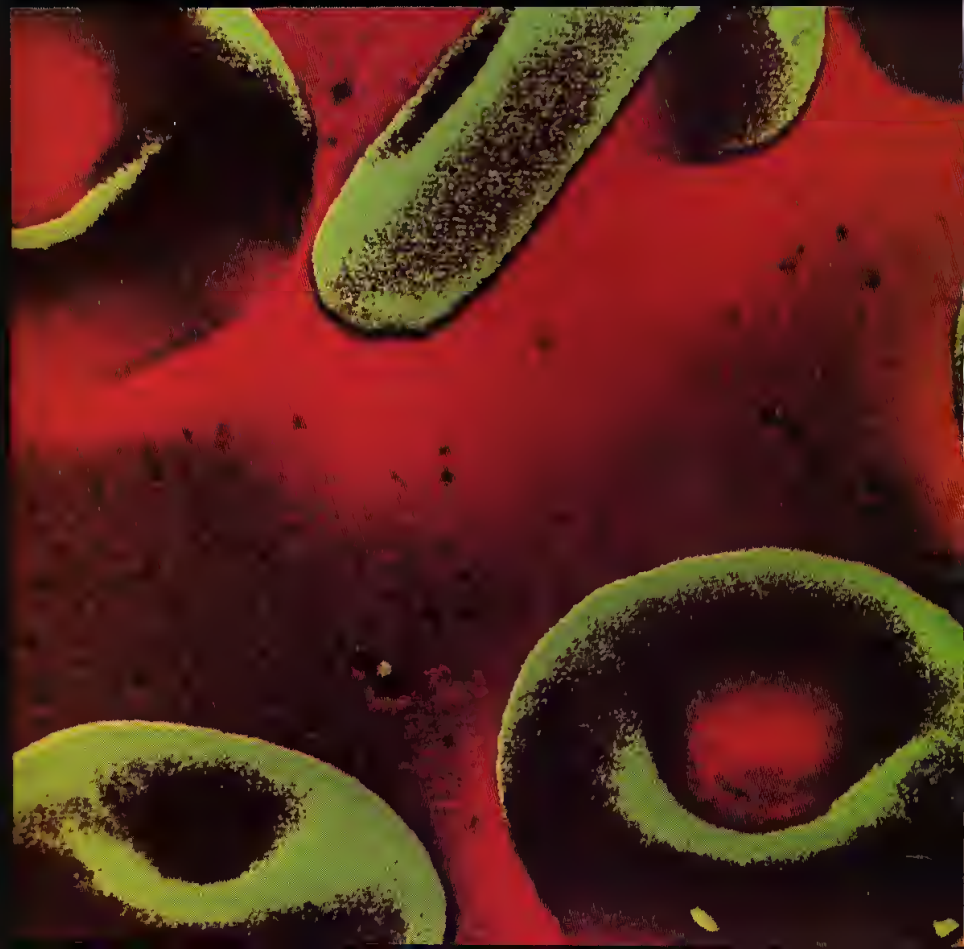
Vortex. *Lung tissue extracted from septum, magnified 2,000 times.*

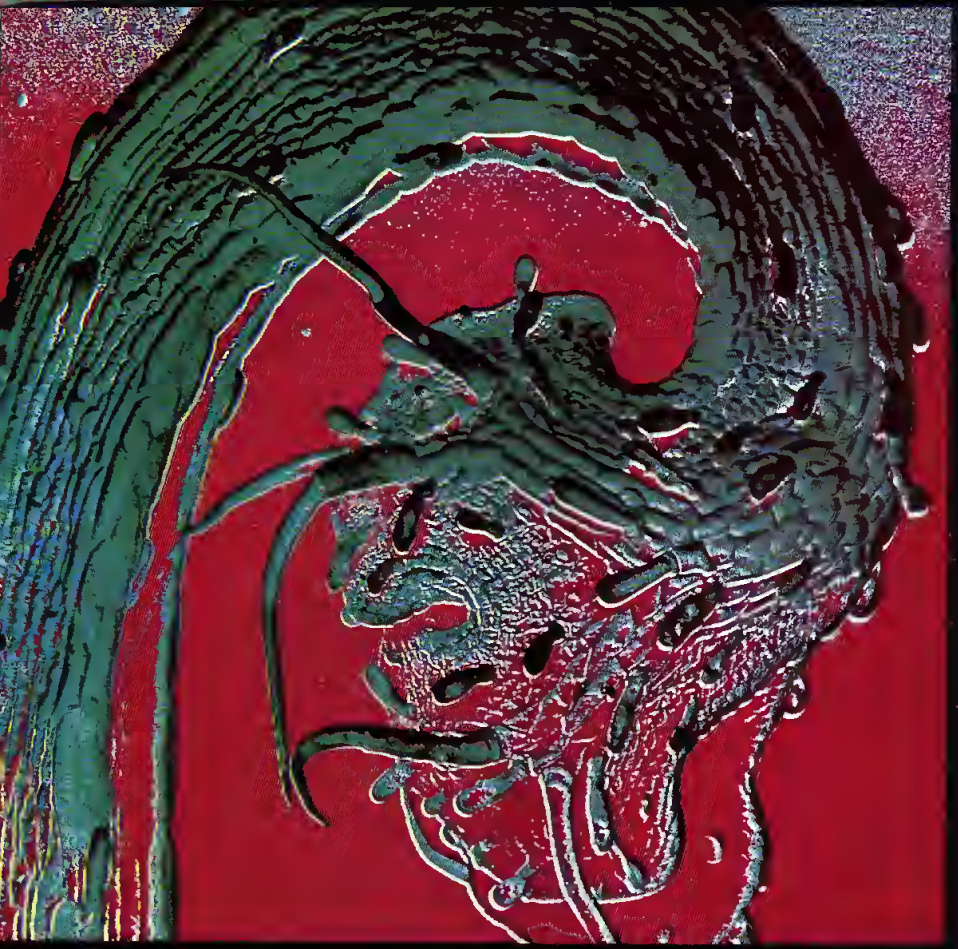
"Pupils have better recall for color micrographs."

Baskin's slides because the color key makes it easy to describe different areas of e picture. But the aesthetic appeal of the slides, in his opinion, is their greatest asset in the classroom. Baskin says, "They always have a bigger impact than their black-and-white counterparts." These stunning interpretations of the microscopic world are the result of only two and a half years of experimentation, although Baskin admits to an avid interest in photography ever since he was fourteen. Eventually he hopes to computerize the coloration process, which can take up to a week for a single micrograph. Until such time, it remains a fine craft that is not readily duplicated. "It's essentially a photographic manipulation," Baskin explains. He begins with the original black-and-white electron micrograph negative and splits



Donut Derby. *Human red blood corpuscles, magnified 16,500 times.*

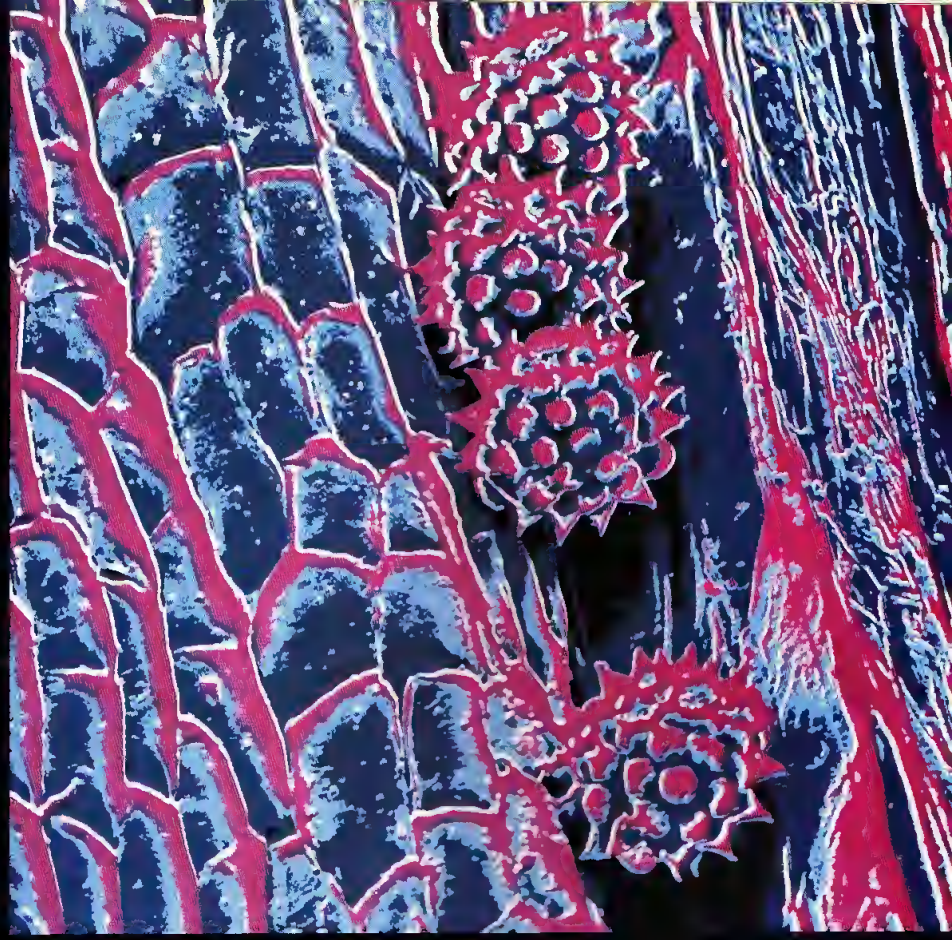


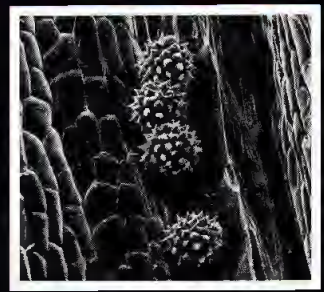


"The process is more a craft than a science."

the continuous gray scale into discrete bands based on the optical denseness of the specimen. In this way, particular areas of the image can be either enhanced or filtered out. Colors are then assigned to the different bands of the modulated image. "I have complete control of the colors; so an infinite number of combinations are theoretically possible." Whatever factors govern his artistic sense, realism is not one of them. When asked why red blood cells are emblazoned green, Baskin replies, "I must have had a hangover that day." Attitudes toward the photographic subject and mood often seem to be crucial determinants of his mode of expression. He made a micrograph of one of his wisdom teeth last year, shortly after it was painfully wrenched from his mouth. The color-enhanced version screams

Body Language: *Common house fern, magnified between 50 and 70 times*





"Colors reflect my feeling about the specimen."

out in punk pink. When speaking of his compositions, Baskin tends to use their formal titles, micrographs are rarely identified by the real-life objects they depict. The image above, for example, is always referred to as the *Devil's Golf Course*. Mention blood corpuscles, and he's inclined to say, "Ah, yes, the *Donut Derby*." An exhibition of Baskin's work appeared in the Lawrence Hall of Science at Berkeley in the spring of 1980. When he graduates from college next year, Baskin plans to team up with David Scherf, whose black-and-white electron micrographs were compiled in the popular book *Magnifications* (featured in the April 1979 *Omni*). As for his more recent work, Baskin prefers subdued shades to the dazzling colors that fill these pages. "My life's quieted down a bit, I guess."

The Devil's Golf Course: *Pollen grains, magnified more than 10,000 times.*

FIGHTER

CONTINUED FROM PAGE 60

fake I'm Ricky Tel please don t hurt me "

It was an obvious trick If the Cinerarians put half as much energy into helping themselves as they put into swindling other races they would be living in a paradise Teichert had known for years that someone someday would use psi powers as an offensive weapon in Fighting But he had hoped he would be able to retire before he encountered it

Tel don t hurt me I ve been hurt too much already "

Teichert coiled his whip arm and flashed it at the thing and as a final test pulled the snap just before it touched flesh Again the defensive move was late Fear came into its eyes and tears ran down its cheeks

Tel believe me the voice whispered again "If you hit me it will kill me I m not a Fighter Please don t kill me!

The thing was holding one skinny arm up in front of its face as if for protection Teichert knew the Cinerarians wouldn t set up a situation where he could damage their Fighter immediately They were counting on him to hold back perhaps hold back through all of the first round and make a fool of himself degrade his skill as a Fighter and then allow himself to be set up and dropped in the second or third round That wouldn t happen!

The thing was still trying to hide behind its thin frail arm

Teichert faked with the whip arm and then shot his left hardened-boned foot at the arm The arm snapped crisply in two The top half dangled by ligaments like a branch broken by the wind and hanging by bark alone

"Tel" the voice howled in his head

The Ricky replica grabbed the arm with its good hand and tried to keep it from dropping off Like a spray of pink flower blossoms blood squirted from severed arteries and Teichert s slow-motion eyes could see the stream break into a shower of flattened globules like petals

Inside his head his name as howled by the replica changed to a muffled sigh of pain Then all in a burst

The trees Tel I wanted the trees in the yard and the birds that would sing in the morning and the sunlight in the morning across the sheets and you there lying beside me and through the window I wanted to see the leaves fluttering green and white in our garden "

"*Stop!*" he screamed

He never thought of the spectators outside the Lemas Dome, staring open-mouthed at their hero Fighter Teichert Bohannon as he went to pieces before their very eyes screaming, unable to land more than a quick, third-rate blow at his opponent s arm

"You couldn t know that!" he was screaming "You can t know! *It has to be a Cinerarian trick*," he prayed beneath his screams *It has to be There s no other explanation*

Tel don't hurt me anymore," the nuzzling voice whispered "We can get out of here without you hurting me The Cinerarians want to punish you by making you kill me Please don't hurt me "

He had dropped his guard, then he recoiled as if about to charge the thing

A scream like Ricky s scream pierced his head She was cowering before him her good hand still trying to squeeze off the dripping blood from the dangling arm Over her half-turned shoulder one wet black eye stared at him waiting for the strike in the center of the back waiting, it seemed to Teichert for the white flash of pain to slice up her back and blind her thoughts

But he knew he wasn't going to hit her In frustration his arm whistled through the air and hit the mushy resilience of the Lemas Dome He realized in a split second that he had turned his back on the crouched figure He spun expecting to find his opponent in midair in a slow-motion dive toward his spine but she still cowered where he d last seen her

Teichert circled the inside of the dome trying to gather his thoughts and put some sense into what was happening breaking the primary rule of Fighting The moment a Fighter stopped to think was the moment he took a heavy one from his opponent Still Teichert circled the figure

The Cinerarians were capable of anything including kidnapping Ricky but this one was bigger than Ricky he thought He *thought* this one was bigger but he couldn t tell from the way she crouched on the mat

"I don t want to die here" she was whimpering to him in his head "I don f want to die while while so many people are watching me "

Teichert wondered whether she was reading his memory of Ricky and feeding it back to him but he hadn t thought about Ricky until it had started saying things she would say

As he circled his opponent he tried to remember whether the Ricky he knew had changed at any time during the last two months whether there had been anything she had said or done that didn t tally

"I m bleeding Tel I hurt I hurt

He did not move any nearer to her If she were a Cinerarian, it would be the end of him An arm or a foot could strike straight at his throat If Teichert got his throat ripped out and died in a heap on the mat the Cinerarian would be disqualified, but his people would treat him like a hero He would have finished his opponent, terminally, and that for Cinerania was victory So Teichert kept his distance and watched the blood pool and waited At last down the corridor of a year or more the signal chimed and the Lemas Dome dissolved letting in the noise of the mob once again

They were wild they were insane with hatred for the Fighters The arena shivered with their stamping feet and their howling voices The air smelled of opened mouths

and acid breath and the smoke of cigars

When Teichert focused his eyes on the edge of the mat he saw a triple line of Olympic Guards pushing spectators who wanted to kill the Fighters for having disappointed them by not spilling more blood. Behind him, the replica of Ricky lay motionless. No Cineranan dragged her out of the ring as Kalark was dragging him back to his corner.

"Over here. God damn it." Teichert didn't even notice that Kalark was touching him. "What in hell's wrong with you?" Kalark threw a cup of icewater into Teichert's face. "All during the round those son-of-a-bitching Cinerarians have been broadcasting that they've got the ultimate Fighter out there." Kalark tried to stare into Teichert's eyes, but Teichert was looking around him, looking for something else. "What's got into you? It scares you that that thing looks like your freak friend over there?"

Teichert pushed Kalark with his power arm. Kalark knew not to resist him.

"You *fight* when you get in there, Bohannon. Snap that god-damned thing's back and snap it fast."

Teichert pushed toward Ricky. She stood at the bottom of the six steps, her face a white mask of frightened confusion.

"I don't want you to kill it," Kalark was yelling over the pulsing roar of the audience, "but you get back in there and—" The crowd saw Teichert coming out of the ring, and their noise blanked out everything but thought.

Ricky didn't pull back when Teichert pushed his dripping, slick face into hers. His lips pulled back, and his long porcelain teeth caught the light and glinted just inches from her lips.

She said nothing. Over the heavy roar Teichert could hear her harsh breathing.

"It—that thing in there—says it's you," he rasped without moving his lips. "It said you're the Cineranan."

Only his eyes could see that she minutely shook her head negatively.

"*Teichert!* Get back up here! It was Kalark's desperate voice. "Come on! It's time!"

"I don't understand," Ricky whispered. "I don't know what I am, but you know I would never hurt you."

Teichert leaped over the six steps and landed inside the arena just as the Lemas Vu-Dome closed over him, cutting off the madness of the crowd—like a knifeblade.

His opponent stood unsteadily just off-center in the middle of the mat. Its skin was white, and blood streaked its bare legs with long, narrow stripes. Terror marked its face. It toppled to its knees.

"Tei—" The nuzzling voice was weak now, barely audible even in the silence of the dome. The opponent's crooked head dropped to its chest. "Help me to your corner. Take me out of here."

Teichert stepped toward her, his guard braced. She made no unusual moves.

"Please. Tei. Just move me. Please help me move—to your corner."

He was standing within her striking distance, but she made no moves other than to blink one of her wet black eyes slowly. One tear dropped off her eyelash. Teichert half-covered himself with his shorter power arm and reached toward her with the other. Her hand, bloody and sticky, reached toward his.

He had blinked. It took only that long. She had opened up his whip arm from his palm to his second elbow and was moving quickly around him. She laughed a kind of sniveling, wet laugh. Teichert glanced at the wound to see how much time he would have. His four-ply skin was opened up like a kind of elongated flower. The arteries closed automatically, but that meant he had only two minutes' control left in his arm. He had expected it to go in the first round. So it was not the defeat the Cineranan probably thought it was.

He turned to face the loping thing.

In a kind of pinwheel, he threw himself at it, both arms and legs churning at the Cineranan. It half-blocked one of his ankles and slipped away. It was fast—as fast as Teichert, or maybe faster. And it kept laughing that wet, sniveling laugh.

"I know about your roll of money, you-twisted slime," said the voice in his head. "You plan on losing, and then you want to take your girlfriend, your garbage collection, to your dirt paradise in the country." It laughed and lunged at Teichert half-heartedly. He easily evaded the blows and circled to the right.

He felt himself recede into the back of his head. This was business now—no thoughts needed. Everything was clear again. He plunged at the opponent, launching his quickest move, his whip arm. He felt his hardened knuckles hit its side, and something cracked, but that wasn't good enough. The Cineranan had moved and had avoided the power of the strike.

"I saw you coming, you patchwork of scars. And if you think I would let you lose, you don't know Cinerarians. I don't want to beat you. I want to hurt you. I want to ruin you, Bohannon."

The thing laughed again, and drool spilled out of its mouth. It waved two good arms at Teichert. The once-broken limb had been a breakaway arm—one of the oldest illusions of Fighters. The Cinerarian's hand flashed, and Teichert felt something tickle up his power arm. Then he felt something wet and hot streaming from his fingers. Quickly the arteries clamped shut.

"I won't kill you, Bohannon. The dead don't suffer. You will suffer."

Teichert sprang through the air as if he had been launched, and he lashed out with a sweeping right foot. It glanced off the Cinerarian's shoulder.

"I won't kill you," it was repeating in his head. "I'll leave your scrambled friend something to visit in the hospital and hold in her crooked arms and drool over."

Then it hit him square in the forehead. Teichert never saw what it was, foot or hand or weapon. It wasn't even painful. It was as

If someone had gently placed something very large and hard and hot against his forehead. Mysteriously he lost his balance and fell to the mat. What hurt, oddly enough, was the back of his head when it first hit the mat.

He thought, as he lay there, of the little house in the country, with the pot of flowers by the front door and the warm breeze blowing the sweet scent through the house. Now he knew he would never see it. The Cinerarian would be disqualified for hitting him in the head. As soon as the Lemas Dome dissolved, the judges would pronounce Teichert the winner by disqualification, and he would have no choice but to fight again so that he and Ricky someday would sit and rest far away from all this.

The Cinerarian stood over him. Again Teichert never saw it coming. Something buried itself in his side. He felt things breaking in him. The animal in him wanted to roll over, to expose his back, but he fought back that urge. If he exposed his spine— He lay writhing on his back.

'You are a humorous object,' the voice said to him.

This time Teichert saw the right hand of the Fighter loop gracefully up and back over his head and swoop down faster, and he heard the dull thump as it struck his ribs. The body of the Cinerarian jiggled when the blow struck. Teichert felt a spreading warmth behind the ribs. This had happened once before. His liver had ruptured.

Unaccountably the Cinerarian turned his back and strolled away. He circled the mat, playing to the invisible audience. Teichert imagined their frenzied excitement, with their hero lying there, the victim of something that astonishingly resembled his deformed girlfriend.

Teichert pulled one knee up to his chest. So far his legs were not injured. If he could only get on his feet—

"Up, Teichert!" the voice was saying. "On your feet. We have another round. Another three minutes." The Cinerarian spun quickly and positioned himself over Teichert's head. His fist was cocked back.

"Teichert Bohannon, this is called fist dodge." The fist plunged at his eyes. Miraculously he dodged it. The fist broke through the mat. Teichert tried to pull himself away, but again the Cinerarian was off, parading around the arena, his deadly fist waving over his head.

Teichert knew he had just one chance. He pulled both knees under him just as the Cinerarian turned his back. Teichert exposed his spine, but he had to, in order to stand up. He tried to push himself up with his arms, but they were dead, useless. He heard himself breathing the word "Help." But he knew he was alone. No one was there to urge him on, to give him a shot or a pill, or to measure the tide of pain that oozed from his ribs through his liver and into his stomach. Teichert planted one foot on the mat, shifted his weight, and then planted the other. He thought he would die, but he stood up. He was a Fighter.

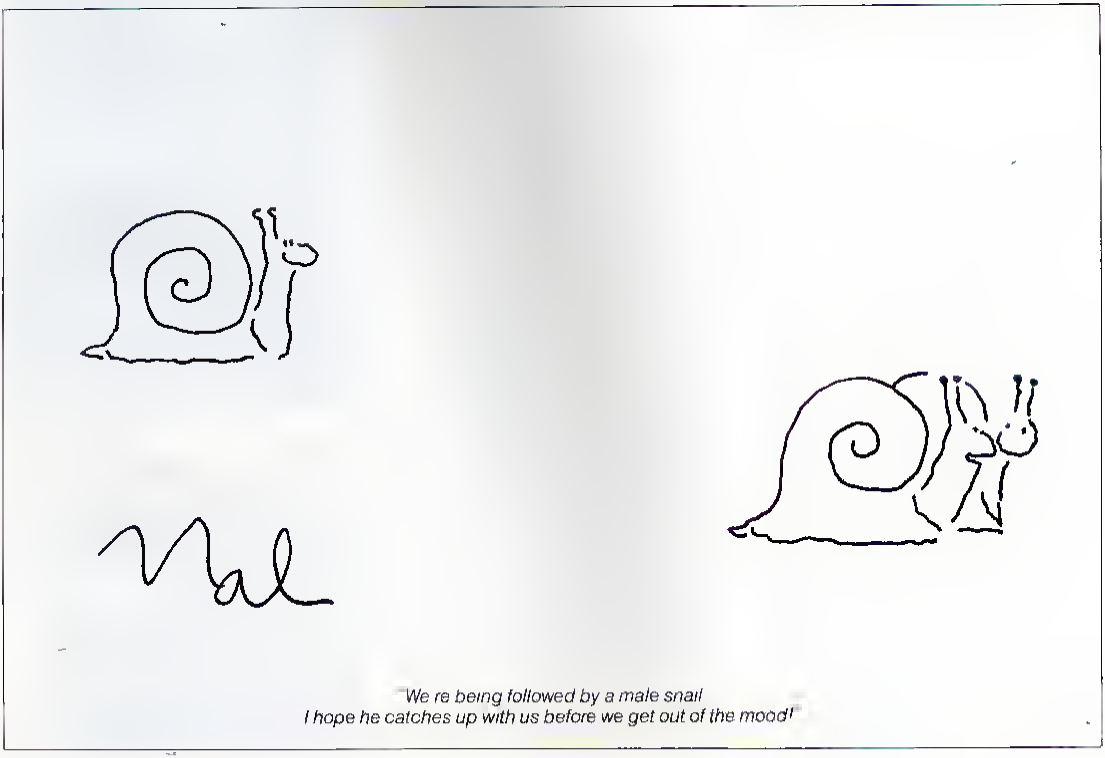
The Cinerarian came at him, making that wet laugh again, and struck him, crushing ribs on both sides now. More than ribs broke. He felt several arteries closing off. He tried moving his feet to keep from falling sideways. Had he gone down, nothing could have saved him. Using shoulder muscles, he tried to move his arms and hands to hold his stomach, to hold himself together. He felt the skin parting below his ribs. He moved his hand there in a futile effort to keep himself from tearing open any further.

He let his head loll sideways. The Cinerarian loped across the mat toward him. Teichert could tell it would be a hand strike. The alien was already poised for it.

The Lemas Dome dissolved, but Teichert did not notice. The Cinerarian noticed—he apparently noticed that the dome had vanished and the audience was stone-silent, waiting for the kill—and it must have broken his concentration. He must have stopped to think.

Teichert did not calculate the angle or his balance or the distance. As if drawn by some irresistible force, his right foot lifted from the floor and, like a bird in an upward swoop, it arced through the air and struck the Cinerarian in the soft flesh under the jaw. In the dead silence of the arena the quick snap echoed against the far walls.

The Cinerarian was dead even before his



"We're being followed by a male snail.
I hope he catches up with us before we get out of the mood!"

body hit the mat the victim of a double foul

Teichert staggered Something heavy oozed out of his side He couldn t see for some reason but he heard the decision of the judges The Cinerarian was declared the posthumous winner He had committed only one foul a head strike

Someone gripped Teichert's shoulder very hard It was Kalark He was talking at Teichert s unseeing face

Why did you do that, you stupid son of a bitch? Did you *want* to lose? You had it won! All you had to do was stay there—on the mat—just *stay* there But you you ugly—you surgical nightmare You had to stand up and *lose* by kicking the bastard s brains all over the first three rows He twisted Teichert s skin in his beautiful TensorGrip hands Through the blurring, burning feel ing across his belly Teichert could tell that Kalark was tearing the skin off his shoulder

You ve lost the championship, Bohannon You ve lost your chance at four upcom ing Fights And worst of all you miserable pile of meat you ve lost me every dime I put on you I ll see that the surgeons jimmy you up so you never have a night s sleep for the rest of your life I m going to ruin you Bohannon "

Teichert was still in too much pain to see clearly but he could feel Kalark s breath on his face and sense one of the TensorGrip fingers touch bone Teichert thought of the weapon implanted in his shoulder

In all the rushing noise of the arena neither he nor Kalark heard the soft hiss of compressed oxygen fire the small discs into Kalark s face The discs dissolved al most instantaneously sealing the minute wounds they made going in Kalark looked surprised almost apologetic When he fell he knocked Teichert to the mat

'I ordered birds today Ricky sang

"What color?

The ad said the gray ones sing best They aren t pretty but considering who we are I didn t think we would mind

How many will we get?"

Six," she said melodiously "I splurged '

Teichert sat down on the back doorstep "I can smell the flowers from here, he said "Just like we planned

She nodded And they ll blossom all summer long She stood beside him and let her hands touch the side of his face

How many trees shall we put in the backyard?" he asked dreamily

While she considered her answer Teichert realized that he did not have to try to like being where he was He didn t have to try at all

'Twelve in a grove ' she sang softly

Teichert Bohannon loved Ricky Fan dango and they bought twelve trees and planted them in a grove where they grew tall and spread their branches together till they meshed like fine lace Teichert and Ricky walked together under them for many years and they never tired of watching the breezes flutter the leaves green and white while gray birds sang DC

SAVIOR

CONTINUED FROM PAGE 66

agent Levitt views Philadelphia's problems both as creative exercises for his imagination and as challenges to his ability to find solutions—with the help of others.

A good example is his answer to Philadelphia's sludge problem. In the early Seventies the city was told that a federal highway would run through Philadelphia's massive lagoons, which were full of sewage sludge. Hauling the waste to the country if anyone would accept it, would cost almost $12 million, and the Environmental Protection Agency had prohibited dumping sludge into the ocean.

Levitt came up with the idea of turning sludge into concrete by mixing it with fly ash, lime, and sulfates and using that in place of road fill for the highway. The only drawback was the cost of establishing a conversion plant, which M-STAC found would amount to about as much as the cost of the road fill needed. Even with a $25 million plant, Pennsylvania would save the $12 million for sludge transport.

The Pennsylvania secretary of Transportation, "for some reason known only to himself," Levitt says, rejected the project, and in time the idea was dropped.

Levitt has always felt that recycling waste is a major goal of today's cities. "If our standard of living continues to improve," he warns, "then solid waste can very well threaten society by choking the cities to death. Despite the problems of recycling, conversion of solid waste to energy will become a way of life in this country."

M-STAC is now awaiting the results of a feasibility study on two trash-to-steam plants that might save Philadelphia 800,000 barrels of oil each year and rid the city of 3,500 tons of solid waste each day. One facility would be built in a city-owned complex and would burn a carefully selected trash. The energy would heat the government buildings and provide electricity, hot water, and steam.

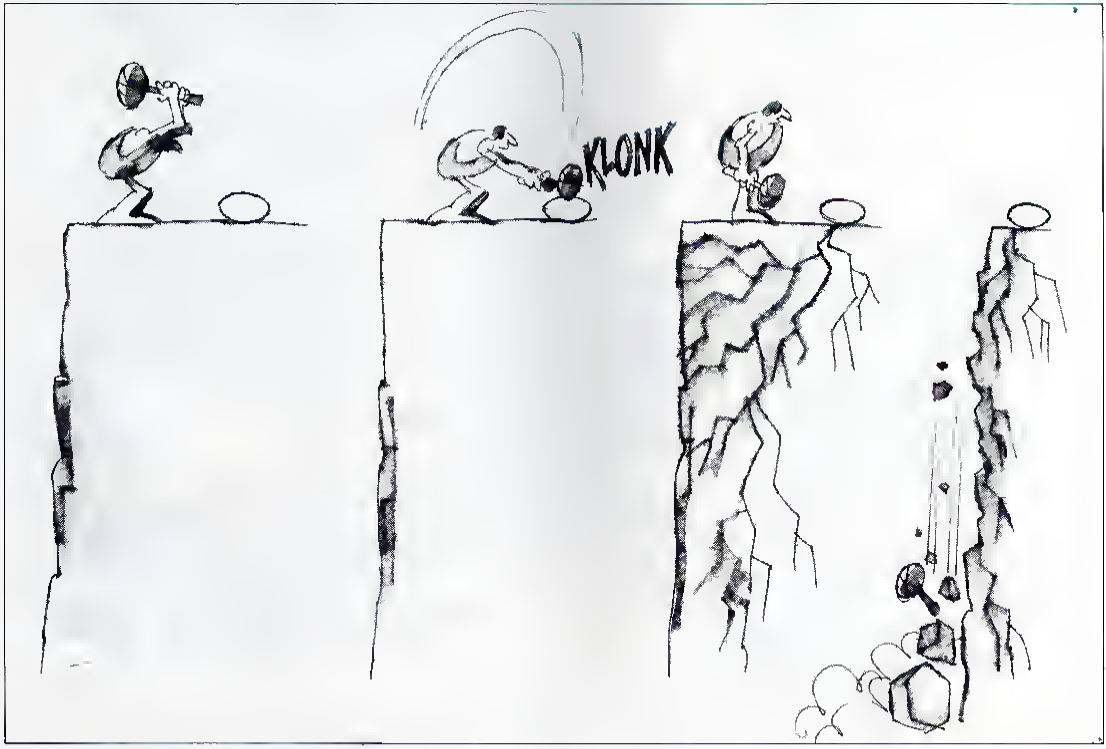
The ideas aren't all Levitt's. Some come from M-STAC's consultants; others spring from meetings of the Urban Consortium for Technology Initiatives, which is coordinated by Public Technology, Inc. PTI concentrates on problems that state and municipal officials have given high priority and that are important to cities throughout the country. To keep its members abreast of advances in technology, PTI publishes numerous reports describing ongoing research and future products.

One of PTI's most promising projects is Terrascan, a downward-looking radar that can probe the earth to depths of ten feet. The machine weighs about 40 pounds and is mounted on a vehicle that looks like a golf cart. The user watches the radar image on a display and can identify underground pipes and similar objects.

"Unlike a metal detector," says Graham Casserly, PTI agent for this project, "Terrascan will tell you within six inches where the object is and distinguish how many pipes there are and what they're made of." Approximately 20 machines are in use, but the manufacturer felt a redesign was needed. Company engineers are trying to cut Terrascan's weight and cost and are developing a backpack model.

Despite PTI's success, Levitt thinks a national science and technology clearinghouse should be established. One good project for it, he suggests, might be a science TV network. "If a problem originated in Washington or Los Angeles," he says, "it could be presented to scientists in studios across the country. The germ of an idea from one individual, hopping from TV to TV all across the country, could be developed into a possible solution. Even if the answer never materialized at the meeting, thousands of fertile minds could dwell on it. A solution might evolve later."

Such a clearinghouse may develop into more than a daydream. Since Californians approved Proposition 13, local governments have felt more and more pressure to limit their spending. Usually this has resulted in cutting services. But essential services remain and must be improved. Cost-effective, efficient alternatives to existing technology will help. And people like Levitt are working hard to improve them and pass them on. ∞



GOING UNDER

CONTINUED FROM PAGE 73

job is to guess which passengers will opt to die and why. She interviews the most interesting passengers, then gives her predictions to her viewers, and she has a lot of them. They respond immediately to a poll taken several times every day. Keeps us in their minds, and everybody loves the smell of death." The curtain closed.

"Well, she hasn't tried to interview *me*," Esme said, pouting.

"Do you really want her to?"

"Why not? I want so much for this experience to be a success. Goodness, let the whole world watch us sink, if they want. They might just as well take bets." Then, in a conspiratorial whisper, she said, "None of us knows who's really opted to die. *That's* part of the excitement."

"I suppose," Stephen said.

"Oh, you're such a prig," Esme said. "One would think you're a doer."

"A what?"

"A doer. All of us are either doers or voyeurs, isn't that right? But the doers mean business," and to illustrate, she cocked her head, stuck out her tongue, and made gurgling noises as if she were drowning. "The voyeurs, however, are just along for the ride. Are you *sure* you're not a doer?"

Michael, who had been eavesdropping again, said, referring to Stephen, "He's not a doer, you can bet on that! He's a voyeur of the worst sort. He takes it all seriously."

"Now, that's enough disrespect from both of you," Poppa said richly. "Michael, stop goading Stephen. Esme says she loves him. Esme, be nice to Michael. He just made my day. And you don't have to threaten to turn me off. I'm turning myself off. I've got some thinking to do." Poppa closed his eyes and turned himself off.

"*Well*," Esme said to Michael, who was now standing in front of the bed and trying to place his feet as wide apart as possible, "he's never done that before. He's usually so afraid of being afraid when he wakes up. What did you say to him?"

"Nothing much."

"Come on, Michael. I let you into the room. Remember?"

"I remember." He shrugged. "Can I come into bed with you?"

"Hell, no," Stephen blurted.

"He's only a child," Esme said as she moved over to make room for Michael, who climbed in between her and Stephen. "Be a sport. *You're* the man I love."

They discussed the transmigration of souls. Michael believed in it, but Esme thought it all too confusing. Stephen had no real opinion on the subject.

They finally managed to lose Michael by lunchtime. Esme seemed happy enough to be rid of the boy, and they spent the rest of the day discovering the ship. They tried a quick dip in the pool, but the water was too cold, and it was chilly outside. If the dirigible was floating above, they did not see it, because the sky was covered with heavy, gray clouds. They changed clothes, strolled along the glass-enclosed lower promenade deck, looked for the occasional flying fish, and spent an interesting half-hour being interviewed by the woman from Interfax. Then they took a snack in the first-class smoking room. Esme loved the mirrors and stained-glass windows. After they explored cabin and tourist class, Esme talked Stephen into a quick game of squash, which he played rather well. By dinnertime they found their way into the garish, blue-tiled Turkish bath. It was empty and hot, and they made gentle but exhausting love on one of the Caesar couches. Then they changed clothes again, danced in the lounge, and took a late supper in the café.

He spent the night with Esme in her suite. It was about four in the morning when he was awakened by a hushed conversation. Rather than make himself known, Stephen feigned sleep and listened.

"I can't make a decision," Esme said as she carefully paced back and forth beside the desk upon which Poppa rested.

"I'm still scared," Poppa said in a weak voice. "Just give me a minute. This was so *sudden*. Where did you say I am?"

"The *Titanic*," Esme said angrily, "and I have to make a decision. Come to your senses."

"You've told me over and over what you know you must do, haven't you?" Poppa said. His voice sounded better; the disorientation was leaving him. "Now you change your mind?"

"I think things have changed."

"And how is that?"

"Stephen. He—"

"Ah," Poppa said, "so now *love* is the escape. But do you know how long that will last? Not long, I'd wager."

"I didn't expect to meet him, to feel better about everything."

"It will pass."

"But right now I don't want to die."

"You've spent a fortune on this trip and on me. And now you want to throw it away. Look, the way you feel about Stephen is all for the better, don't you understand? It will make your passing away all the sweeter because you're happy in love, whatever you want to claim for it. But now you want to throw everything away that we've planned and take your life some other time, probably when you're desperate and unhappy and don't have me around to help you. You wish to die as mindlessly as you were born. You're hopeless."

"That's not so, Poppa. But it's up to *me* to choose."

"You've made your choice. Now stick to it, or you'll drop dead like I did."

"Esme, what the hell are you talking to your father about?" Stephen said.

Esme looked startled in the dim light and then said to Poppa, "You were purposely talking loudly to wake him up, weren't you?"

"*You* had this programmed to help you. I

"At last a breakthrough for Global Chemicals, sir! We've developed a substance that will effectively neutralize the Environmental Protection Agency for the next five hundred years."

love you and care about you. You can't undo that. Nothing can."

"I can do whatever I wish," Esme said petulantly.

"Then let me help you as I always have. If I were alive and had my body, I would tell you exactly what I'm telling you now."

"What *is* going on?" Stephen asked.

"She's fooling you," Poppa said gently to Stephen. "She's using you because she's frightened. She's grasping at anyone she can find."

"What the hell is he telling you?" Stephen asked.

"The truth," Poppa said. "I know all about fear, don't you know that?"

Esme sat beside Stephen on the bed and began to cry. Then, as if sliding easily into a new role, she looked at him and said, "I did program Poppa to help me die. Poppa and I talked everything over very carefully. We even discussed what to do if something like this came about."

"You mean if you fell in love and changed your mind about living."

"And she decided that not under any circumstances would she undo what she had done," Poppa said. "She has planned the best possible death for herself, a death to be experienced and savored. She's given everything up and spent all her money to do it. She's broke. She can't go back now, isn't that right, Esme?"

Esme folded her hands, swallowed and looked at Stephen. "Yes," she said.

"But you're not sure," Stephen said. "I can tell that."

"I will help her as I always have," Poppa said. "I will make her sure."

"Jesus, shut that thing up," Stephen shouted.

"He's not a—"

"Please," Stephen said, "at least give us a chance. You're the first authentic experience I've ever had. I love you. I don't want it to end—"

Poppa pleaded his own case eloquently until Esme told him to shut up.

The great ship hit an iceberg on the fourth night of her voyage, exactly one day earlier than scheduled. Stephen and Esme were standing by the rail of the promenade deck. Both were dressed in the early twentieth-century accouterments provided by the ship: he in woolen trousers, jacket, motoring cap and caped overcoat with a long scarf; she in a fur coat, a stylish Merry Widow hat, high button shoes and a black-velvet two-piece suit edged with white silk. She looked ravishing and very young, despite the clothes.

"Throw it away," Stephen said authoritatively. "Now."

Esme brought the cedar box containing Poppa to her chest, as if she were about to throw it forward, then slowly placed it atop the rail again. "I *can't*. I just can't."

"Do you want me to do it?"

"I don't see why I must throw him away. Because we're starting a new life together, and you don't need it anymore."

At that moment someone shouted, and as if in the distance a bell rang three times.

"Could there be another ship nearby?" Esme wondered.

"Esme, throw the box away!" Stephen snapped, and then he saw it. He pulled Esme backward, away from the rail. An iceberg as high as the forecastle deck scraped against the side of the ship. It almost seemed that the bluish, glistening mountain of ice was another ship passing, that the ice, rather than the ship, was moving. Pieces of ice rained upon the deck and slid across the varnished wood, and then the iceberg was lost in the darkness astern. It must have been at least one hundred feet above the smashing of the waves.

"Oh, my God!" Esme screamed, rushing to the rail.

"What is it?"

"Poppa! I dropped him when you pulled me away from the iceberg."

"It's too late for that—"

Esme disappeared into the crowd, crying for Poppa.

It was bitter cold, and the boat deck was filled with people, all rushing about, shouting, scrambling for the lifeboats and, inevitably, those who had changed their minds at the last moment about going down with the ship were shouting the loudest, trying the hardest to be permitted into the boats, not one of which had been lowered yet. There were sixteen wooden lifeboats and four canvas Engelhardts, the collapsibles. But they could not be lowered away until the davits were cleared of the two forward boats. "We'll let you know when it's time to board," shouted an officer to the families crowding around him.

The deck was listing. Esme was late, and Stephen wasn't going to wait. At this rate the ship would be bow down in the water in no time.

She must be with Michael, he thought. *The little bastard has talked her into dying.*

Michael had a stateroom on C deck. Stephen knocked, called to Michael and Esme, tried to open the door and finally kicked the lock free.

Michael was sitting on the bed, which was a Pullman berth. His sister lay beside him, dead.

"Where's Esme?" Stephen asked, repelled by the sight of Michael sitting so calmly.

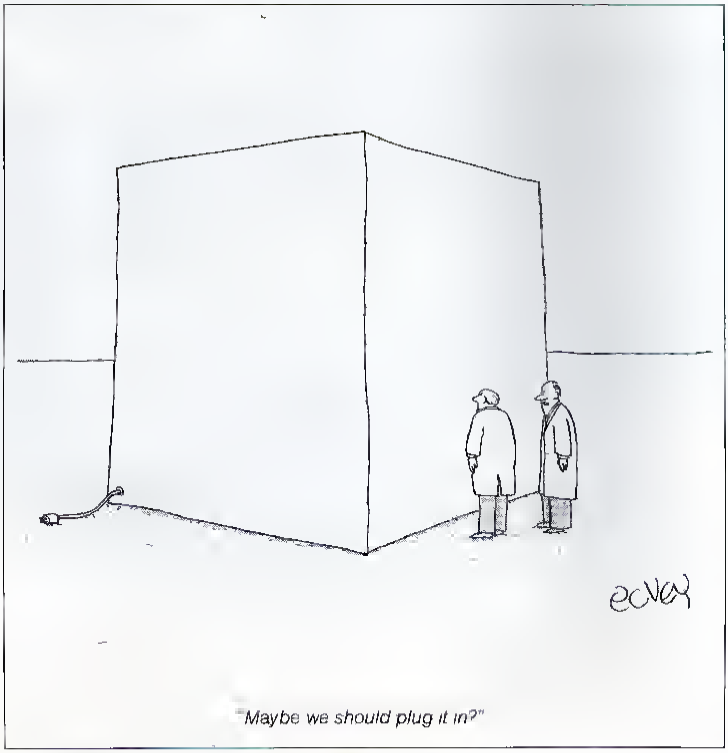
"Not here. Obviously," Michael smiled and made the rubber-lips face.

"Jesus," Stephen said. "Put your coat on. You're coming with me."

Michael laughed and patted down his hair. "I'm already dead, just like my sister almost. I took a pill, too, see?" He held up a small brown bottle. "Anyway, they wouldn't let me on a lifeboat. I didn't sign up for one, remember? I told you all that."

"But you're only a baby—"

"I thought Poppa explained all that to

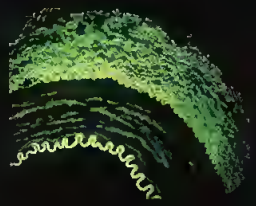
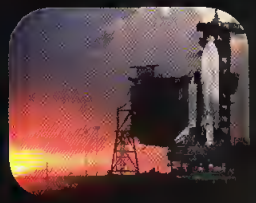


"Maybe we should plug it in?"

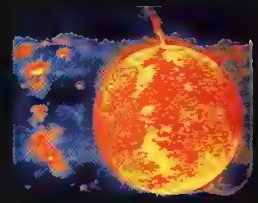
OMNI

IS
ABOUT
TO
EXPLODE
IN
YOUR
LIVING ROOM

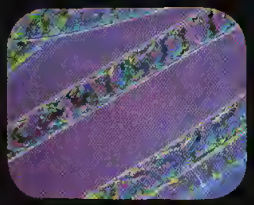
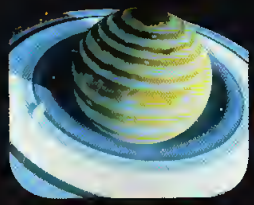
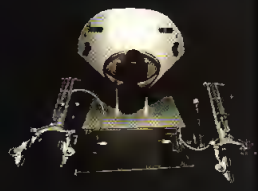
STARTING IN SEPTEMBER, OMNI COMES TO TELEVISION

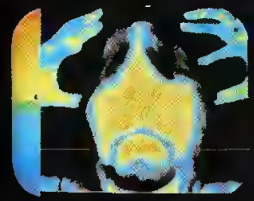
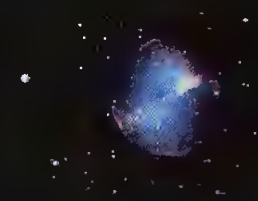
WITH A BREATHTAKING WEEKLY LOOK INTO THE FUTURE.

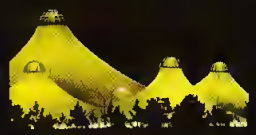
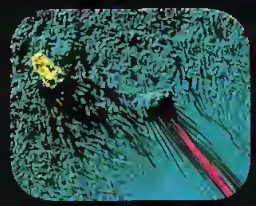

OMNI: THE NEW FRONTIER WILL SWEEP YOU AWAY

INTO FANTASTIC NEW WORLDS BEYOND THE HORIZON.


WHY WAIT FOR YOUR FUTURE? YOU CAN SEE IT NOW.


OMNI: THE NEW FRONTIER. COMING IN SEPTEMBER.

OMNI

CHECK LOCAL LISTINGS FOR STATION, NIGHT, AND TIME.

you" Michael lay down beside his sister and watched Stephen like a puppy with its head cocked at an odd angle

"You do know where Esme is don't you? Now tell me"

"You never understood her She came here to die"

An instant later Michael stopped breathing and was still

Stephen searched the ship level by level broke in on the parties where those who had opted for death were having a last fling looked into the lounges where many old couples sat waiting for the end He made his way down to F deck where he had made love to Esme in the Turkish bath The water was up to his knees it was green and soapy He was afraid for the list was becoming worse minute by minute The water rose even as he walked

He had to get to the stairs had to get up and out onto a lifeboat away from the ship, but he walked on looking for Esme unable to stop He had to find her *She might even be on the boat deck right now*, he thought wading through a corridor But he had to satisfy himself that she wasn't down here

The Turkish bath was filling with water and the lights were still on giving the room a ghostly illumination Oddments floated in the room blue slippers a comb scraps of paper cigarettes and several seamless plastic packages

On the farthest couch Esme sat meditating her eyes closed and hands folded on her lap She wore a simple white dress Overjoyed he shouted to her She jerked away looking disoriented and without a word waded toward the other exit dipping her hands into the water as if to speed her on her way

"Esme where are you going?" Stephen called following "Don't run from *me*"

An explosion pitched them both into the water and a bulkhead gave way A solid sheet of water seemed to be crashing into the room smashing Stephen pulling him under and sweeping him away He fought to reach the surface and tried to swim back to find Esme A lamp broke away from the overhead just missing him "Esme!" he shouted but he couldn't see her and then he found himself choking swimming as the water carried him through a corridor and away from her

Finally Stephen was able to grab the iron curl of a railing and pull himself onto a dry step There was another explosion and the deck pitched He looked down at the water which filled the corridor the Turkish bath the entire deck and he screamed for Esme and looked around frightened

The ship shuddered Then everything was quiet In the great rooms chandeliers hung at angles tables and chairs had skidded across the decks and seemed to squat against the bulkheads like wooden beasts Still the lights burned as if all was quite correct except gravity which was misbehaving Stephen climbed followed by the sea as if in a bad dream

Numbed he found himself back on the boat deck. Part of the deck was already submerged. Almost everyone had moved aft, climbing uphill as the bow dipped farther into the water.

The lifeboats were gone, as were the crew. There were a few men and women atop the officers' quarters. They were working hard, trying to launch Collapsibles C and D, their only chance of getting safely away from the ship.

"Hey!" Stephen called to them, just now coming to his senses. "Do you need any help up there?"

He was ignored by those who were pushing one of the freed collapsibles off the port side of the roof. Someone shouted, "Damn!" The boat had landed upside down in the water.

"It's better than nothing," a woman shouted, and she and her friends jumped after the boat.

Stephen shivered; he was not yet ready to leap into the twenty-eight degree water, although he knew there wasn't much time left and he had to get away from the ship before it went down. Everyone on or close to the ship would be sucked under. He crossed to the starboard side, where some other men were trying to push a boat to the edge of the deck. The great ship was listing heavily to port.

This time Stephen just joined the work. No one complained. They were trying to slide the boat over the edge on planks. All these people appeared to be in top physical shape. Stephen noticed that about half of them were women, wearing the same warm coats as the men. This was a game to all of them, he suspected, and they were enjoying it. Each one was going to beat the odds one way or another; the very thrill was to outwit fate, opt to die and yet survive.

But then the bridge was underwater.

There was a terrible crashing, and Stephen slid along the deck as everything tilted. Everyone was shouting. "She's going down!" someone screamed. Indeed the stern of the ship was swinging upward. Her lights flickered. There was a roar as the entrails of the ship broke loose: anchor chains, the huge engines and boilers. One of the huge black funnels fell, smashing into the water amid sparks. But the ship was still brilliantly lit, every porthole afire. The crow's nest before him was almost submerged, but Stephen swam for it nevertheless. Then he caught himself and tried to swim away from the ship, but it was too late. He felt himself being pulled under. He was being sucked into the ventilator that was in front of the forward funnel; he gasped, swallowed water and felt the wire mesh, the air shaft grating that prevented him from being sucked under. He held his breath desperately.

Water was surging all around him. Then there was another explosion. Stephen felt warmth on his back as a blast of hot air pushed him upward. Then he broke out into the freezing air. He swam for his life, away from the ship, away from the crashing and

thudding of glass and wood away from the debris of deck chairs planking and ropes, and especially away from the other people who were moaning, screaming at him, and trying to grab him as a buoy trying to pull him down while the great ship sank.

Swimming, he heard voices nearby and saw a dark shape. For a moment it didn't register. Then he realized that he was near an overturned lifeboat, a collapsible he had seen pushed into the sea. There were almost thirty men and women standing on it. Stephen tried to climb onto it, and someone shouted, "You'll sink us. We've too many already." A woman tried to hit Stephen with an oar, just missing his head. Stephen swam around to the other side of the boat. He grabbed hold again, found someone's foot, and was kicked back into the water.

"Come on," a man said. "Take my arm, and I'll pull you up."

"There's no *room*!" someone else said.

"There's enough room for one more."

"No, there's not."

The boat began to rock.

"We'll all be in the water if we don't stop this," shouted the man who was holding Stephen afloat. Then he pulled Stephen up. Stephen stood with the others. Truly there was barely enough room. Everyone had formed a double line, now facing the bow, and leaned in the direction opposite the swells. Slowly the boat inched away from where the ship had gone down, away from the people in the water, all begging for life, for one last chance. As he looked back to where the ship had once been, Stephen thought of Esme. He couldn't bear to think of her as dead, floating through the corridors of the ship.

Those in the water could be easily heard, in fact the calls seemed magnified as if meant to be heard clearly by everyone who was safe, for the time being, as a punishment for his or her past sins.

"We're all deaders," said a woman standing beside Stephen. "I'm sure no one's coming to get us before dawn, when they have to pick up survivors."

"We'll be the last pickup. That's if they intend to pick us up at all."

"Those in the water have to get their money's worth. And since we opted for death—"

"I didn't," Stephen said almost to himself.

"Well, you've got it anyway."

Stephen was numb but no longer cold. As if from far away, he heard the splash of someone falling from the boat, which was very slowly sinking as air was lost from under the hull. At times the water was up to Stephen's knees, yet he wasn't even shivering. Time distended or contracted. He measured it by the splashing of his companions as they fell overboard. He heard himself calling Esme as if to say good-bye or perhaps he meant to greet her.

By dawn, Stephen was so muddled by the cold that he thought he was on land, for the sea was full of debris: cork, steamer chairs, boxes, pilasters, rugs, carved wood, clothes, and of course the bodies of those unfortunates who could not or would not survive. And the great icebergs and the smaller ones called growlers looked like cliffs and mountainsides. The icebergs were sparkling and many-hued, all brilliant in the light, as if painted by some cheerless Gauguin of the North.

There, someone said, a woman's hoarse voice. "It's coming down, it's coming down!" The dirigible, looking like a huge white whale, seemed to be descending through its more natural element, water, rather than the thin, cold air. Its electric engines could not be heard.

In the distance, Stephen could see the other lifeboats. Soon the airship would begin to rescue those in the boats, which were now tied together in a cluster. As Stephen's thoughts wandered and his eyes watered from the reflected morning sunlight, he saw a piece of carved oak bobbing up and down near the boat, and he noticed a familiar face in the debris that seemed to surround the lifeboat. There, just below the surface in his box, the lid open, eyes closed, floated Poppa. Poppa opened his eyes and looked at Stephen. Stephen screamed, lost his balance on the hull, and plunged into the cold, black water.

"By dinnertime they found their way into the garish, blue-tiled Turkish bath. It was empty and hot, and they made gentle but exhausting love on a couch, then took a late supper."

The Laurel Lounge of the dirigible *California* was dark and filled with survivors. Some sat in the flowered, stuffed chairs; others just milled about. But they were all watching the lifelike, holographic tapes of the sinking of the *Titanic*. The images filled the large room.

Stephen stood in the back, away from the others, who cheered each time there was a close-up of someone jumping overboard or slipping under the water. He pulled the scratchy woolen blanket around him and shivered. He had been on the dirigible for over twenty-four hours, and he was still chilled. A crewman had told him it was because of the injections he had received when he boarded the airship.

There was another cheer, and horrified, he saw that they were cheering for *him*. He watched himself being sucked into the ventilator and then blown upward to the surface. His body ached from the battering. But he had saved himself. He had survived, and that had been an actual experience. It was worth it for that, but poor Esme—

"You had one of the *most* exciting experiences," a woman said to him as she touched his hand. He recoiled, and she shrugged, then moved on.

"I wish to register a complaint," said a stocky man dressed in period clothing to one of the *Titanic*'s officers who was standing beside Stephen and sipping a cocktail. "Yes?"

"I was saved against my wishes. I specifically took this voyage that I might pit myself against the elements."

"Did you sign our protection waiver?"

"I was not aware that we were required to sign any such thing."

"All such information was provided," the officer said, looking disinterested. "Those passengers who are truly committed to taking their chances sign, and we leave them to their own devices. Otherwise, we are responsible for every passenger's life."

"I might just as well have jumped into the ocean at the beginning and gotten pulled out." The passenger said bitterly.

The officer smiled. "Most want to test themselves as long as they can. Of course, if you want to register a formal complaint—"

The passenger stomped away.

"The man's trying to save face," the officer said to Stephen. "We see quite a bit of that. But *you* seemed to have an interesting ride. You gave us quite a start; we thought you were going to take a lifeboat with the others, but you disappeared below deck. It was a bit more difficult to monitor you, but we managed—that's the fun for *us*. You were never in any danger, of course. Well, maybe a little."

Stephen was shaken. He had felt that his experiences had been authentic, that he had really saved himself. But none of that had been *real*. Only Esme—

And then he saw her step into the room. "Esme? He couldn't believe it. "Esme!"

She walked over to him and smiled as she had the first time they'd met. She was holding a water-damaged cedar box. "Hello, Stephen. Wasn't it exciting?"

Stephen threw his arms around her, but she didn't respond. She waited a proper time, then disengaged herself. She opened the box and held it up to him.

"And look," she said, "they've even found Poppa. Isn't that marvelous?" She smiled. "I'm going to have him reprogrammed, though. He almost had me talked into going through with it this time."

"But I really *do* love you," Stephen said.

Esme opened the box and said, "Poppa—"

Poppa's eyes fluttered open. "I'm scared," he said. "I'm all alone in the dark. I'm so afraid, and it's so dark. Oh, please, Esme, please help me, don't let me die. I dreamed that I was a head in a box, and I'm so frightened—"

And then Poppa began to cry. ∞

COMPUTER CRUFT

CONTINUED FROM PAGE 28

artificial-intelligence laboratories at Stanford, MIT, the University of Utah, and other institutions. It is part of the budding computer dictionary available by printout. A glimpse of this new terminology shows what intelligence lies within.

A *bagbiter* is something within the computer that fails. The *File* offers the following example of the term's usage: "This *bagbiting* system won't let me out of spacewar."

A *crock* in a computer is something awkward or a feature, says the *File*, "that ought to be cleaned up." Here is its example of *crock*: "Depending on the machine, opcodes having particular bit patterns you can use instructions as data words too, an almost completely unmodifiable structure. It sounds serious."

Crufty means overcomplicated—that is, poorly built. According to the *File*, it is unpleasant, especially to the touch, often encrusted with junk. It is like spilled coffee smeared with peanut butter and ketchup. As a noun, it is *cruft*, a mess. The *File* definition of *cruft* is accompanied by the question, "Does cruft have anything to do with the Cruft Lab at Harvard? Answer: 'I don't know, though I was a Harvard student.' CLS."

Mumble is used as in, "Well, mumble, or, 'Well, it's too complicated,' or, 'The explanation will take a long time.' It is used by someone who hasn't thought out the answer yet or who is reluctant to get into a big discussion. But as an expression of disagreement, it is an excellent reply. "I think we should buy it." "Mumble."

Mung stands for "Mung Until No Good." As a verb it means "to make big changes in the computer file." These changes are usually irrevocable. Sometimes the changes occur by accident, which introduces a second meaning of *mung* or *munge*: to destroy accidentally—and if *munged* by the system, it is done maliciously.

Flush means "to scratch out superficially." It is standard wording for aborting an output operation. "If you're leaving work for the day, you say, 'I'm going to flush now,' or, 'Time to flush.' A third meaning is meaner: to exclude someone from an activity." Even the computer has its cliques.

In English we have *phooey!* and, in Yiddish, *feh!* Computers have *foo*, which means disgust. It describes temporarily bad programs, and at Stanford they say *baz* or (rarely) *rag* instead of *foo*.

Frob, especially at MIT, is a protuberance; it is a word from the model-railroad handbooks. To *frobnicate* is to adjust or tweak. But it gets more specific. "*Frob* connotes aimless manipulation; *twiddle* designates gross manipulation, often a coarse search for a proper setting; *tweak* signifies fine-tuning." The noun *frobnitz* means a widget, an unspecified object.

When it's abbreviated to *frotz*, it means electronic black boxes.

Frog lies between *foo* and *crock*. There's also *froggy*, used as an adjective.

Gas is the abbreviation of gas chamber. It is a nasty expletive, full of vitriol and deep disgust. Its popularity began on the West Coast after George Moscone, the mayor of San Francisco, was murdered in 1978 and his murderer was expected to go to the gas chamber. Examples for the computer usage of *gas* include: "Some loser just reloaded the system for no reason. Gas!" Or verbally as in "You should gas that old crufty software."

Gronk out means cease to function. A person says, "I guess I'll gronk out now, see you all tomorrow."

What is an enthusiastic programmer? A *hacker*. But a *password hacker* is a meddler trying to find out information by just poking around.

What does *infinite hair* mean? It connotes extreme complexity.

Glark expresses surprise. *Gobble down* simply means to obtain. *Lose lose* is the reply on a bad situation, and *moby* is a biggie. It is something immense or complex and is derived from Moby Dick. Actually it describes how much space a machine's maximum address has (not just the physical memory capability). There is usually a low moby and a high moby. Another definition for *moby*: a third-person reference of respect, as in "So, moby Knight, how's the CONS machine doing?"

Now what if you don't understand something—that is, you don't *parse it*? The lexicon uses seafood to explain *parse*: "a *parsed* fish has been deboned." However, there is some controversy over whether *unparsed* should mean bony or also mean deboned. "If you do understand everything, you are *in parse*. But if you are fuzzy about something, you call out, 'Wall!' The *File* says *wall* means 'an indication of confusion, usually spoken with a quizzical tone.' Wall? A second meaning is 'a request for further information.'"

And yes, there is also morality in the definitions. Again, here's a selection. *Bogosity* is the degree to which something is bogus, either nonfunctional or false. "*Autobogophobia* is fear of becoming bogotified." *Brain-damaged* is a theoretical disease explaining "certain utter cretinisms." It also implies that something is unusable. *To bum* is "to make highly efficient, either in time or space, often at the expense of clarity." *To fry* is to fail or, more generally, to make nonworking, "never said of software, only of hardware or humans." A *Gabriel* is an "unnecessary stalling technique—as in someone is pulling a Gabriel, or you're in the Gabriel mode. It is called Gabriel after a volleyball fanatic, or a bouncer or someone who plays too much."

Look. What is the computer printout saying now?

S 07 537 SOME CRAY DATASETS LOST—SEE INFO/INFO

Are they now making typing errors? ∞

ZEUS IN ORBIT

CONTINUED FROM PAGE 55

Navy has a program called Chair Heritage which, despite its antique sound is a scheme to defend aircraft carriers against cruise missiles Flying just a few feet above the water the cruise missiles will pop into view on radar when they are about five miles from a carrier On command energy storage capacitors below the flight deck will then fire a steady stream of high-energy electrons Magnetic fields will bunch the electrons and ferry them up to the deck, where a carousel spinning at high speed will shoot them in all directions The carousel will be able to fire 1,000 shots at the onrushing missile before it comes close enough to do damage Even if the electron bolts miss their target by as much as 33 feet they can still cripple the missile by overloading its electronics

Suppose both superpowers install fleets of charged-particle weapons in orbit Critics have argued that this would be just another step in the perpetual arms race leading to no true security Even if the satellite defenses work for the first half-hour or so of a war the argument goes eventually they will be exhausted and then the warring superpowers will exchange salvos of hydrogen bombs just as they might have done anyway

This objection ignores the very real possibility of war by accident If the U S President or a Soviet chairman has an extra hour to straighten out misunderstandings he can stop a fatal salvo

Consider this possible scenario It is a spring day in the late 1980s At 6 48 A M a bright orange plume arcs up from a frozen plain in Siberia Within seconds four other fiery rockets roar out from their hidden silos American detectors high in orbit instantly spot the exhaust plumes of the rockets which all carry multiple targeted warheads When the rockets reach deep space each one will break apart into at least eight hydrogen bombs together with some decoys to mislead the Americans At 6 51 A M the President is told that in half an hour at least 40 Soviet warheads will fall on American soil hammering at ground missile bases and charming U S cities

The President suspects that an accident must have occurred The Russians would not risk a mere piecemeal attack They would commit all their missiles, 1,000 or more Still this might be a first strike designed to confuse the United States and disrupt the American defense network Should the President move to retaliate?

Had this situation occurred before the late 1980s the fate of civilization would have hung on the answer But now the United States has another choice besides complete inaction or catastrophic retaliation The President picks up a telephone and speaks three words In 20 seconds a dozen bulky American satellites spring into activity, high above Earth They find the

rising rocket exhausts with their infrared sensors. They lock on the boosters as the rockets begin to lift clear of the atmosphere. On board each satellite, giant capacitors pulse. Stored electrical energy crackles into accelerators. Rippling electric fields pick up atoms, charge them, and fling them down long tubes. Gathering energy, the charged particles are bunched together into bolts and then are fired out into the vacuum of space toward a Soviet warhead. Faster than a tick of a clock, the bolt strikes, searing the tough ceramic skin, punching through steel and aluminum to the hydrogen weapon itself. The bomb has a chemical explosive trigger around it. The bolt shock-heats this in a few microseconds. The explosive goes off in an irregular way not concentrating its implosion on the hydrogen core. The nuclear bomb fails to assemble. The warhead becomes a fiery yellow ball.

Below a Siberian farmer trudging to his cold fields sees five bright flares on the horizon. They fade within seconds, and he wonders idly what they could have been. Some new kind of airplane, perhaps. He soon forgets about them.

Within a minute the U.S. satellites have erased the threat. There is time now for the hot line, for the slowness of human conversations, for the diplomacy that can avert future accidental launches.

The difference between apocalypse and apologies is a scant six minutes. Our general defense philosophy of Mutually Assured Destruction (with the appropriate acronym MAD) is necessary because we have no defensive weapons. There have been attempts to devise defenses against nuclear bombers (fighter planes, the Nike rockets) and against nuclear missiles (the antiballistic missile system), but they have all been outclassed and overfaken by offensive technology.

By the end of this decade, when particle-beam weapons will have come on the strategic stage, there will be at least one new ICBM-armed power. China. Probably others will be itching to get into the same private club—India or France, for example—but what use will they have for ICBMs that the two superpowers can knock down at will? The United States and the Soviet Union will have spread an umbrella over the planet capable of stopping cold any sneak attack that uses warheads soaring above the atmosphere. That fact will probably prevent an ambitious nuclear power from investing billions in expensive rockets, since they will be useless without a charged-particle defense system, too. The down payment for a strategic presence would then be much higher. This fact alone might well limit the strategic arms club to a permanent membership of only two nations.

Thus, it seems possible that particle-beam battle stations might stop the more serious nuclear threats and swing the strategic pendulum back toward defense. In the opinion of many, it's about time, after three decades of strategic competition that have swamped all efforts at any realistic *dis*armament.

To be sure, the development of particle-beam weapons will be attacked as yet another acceleration of the arms race. But it is important to see that these are qualitatively different kinds of arms. They cannot be used offensively against our planet from space, because beams disperse in our atmosphere. No sky-high battle station will ever pound a city into submission. But they can be planetary policemen, spreading a shield over the upper atmosphere.

The deployment of charged-particle weapons will give space development a strong military flavor. The first colonies in orbit may well house skilled engineers who serve as on-call repairmen for particle-beam stations. This is indeed a far cry from the peaceful scenarios of space industrialization or from the even less likely vision of farmers in the sky so beloved of the L-5 Society. Those are good, sound, long-range ideas, but we should face the fact that putting a cap on our nuclear madness is more important. There are more dollars available for defense than for industrialization—a sad but undeniable fact. Still, *any* venture into near-Earth orbit will eventually pay off for *all* uses. Once we know how to live and work up there, many possibilities, L-5 included, will open up to us. ∞

"I think I know what's wrong with you, but it's difficult to pronounce."

'A knot!' said Alice
"Oh, do let me help to undo it!"

COMPETITION

By Scot Morris

Our eighteenth invitational announced last December asked readers to revive that most ancient form of puzzle the riddle Boxes full of postcards kept us guessing Many were culled but few were chosen

For the uninitiated clues such as "My first My second" usually refer to the syllables of a word Syllables are sometimes punned and the breaks between them are not always in the standard places Some clues refer to an entire word or idea Anagrams and acrostics provide an occasional twist

Most entries used rhymed clues as did our examples Some made no attempt to rhyme In a few instances we edited lines to improve scansion or clarity Some excellent entries had to be rejected merely because of length

The answers are on page 136

GRAND PRIZE WINNER $100

1 We are fruit oddly shaped
And harvests sometimes
Reformed we won t punish
Made over we re crimes
We can turn into stone
Or a weapon of war
Break down parts of speech
Make cuts to the core
In Turkey we re money
A musical cue
In France we form after
We imitate you
Apart we are nonsense
In order absurd
Though five is our number
We're one in a word
—Chris Doyle Burke Va

RUNNERS-UP $25

2 My first s a trinity My second's mobility
My third s antithetic My fourth s egocentric
My fifth's your endeavor to put me together
The mastery of bight—acute obtuse or right
—Ron Feldman Denver Colo

3 My first s a train that s lifted high
My second like could be
My third s a twitch My whole you stitch
It s spring year round for me
—Mary K B Carter Columbus Ohio

4 My first is short for tops in sports
My second small in mass
My third s an ancient dynasty
My whole a typed in task
—Scott Simcox Minneapolis Minn

5 Dearborn s where my first is wrought
My second s dearly borne
By the yard my whole is bought
And by the foot it s worn
—James Bell Alexandria Va

6 I follow the river I m on the main street
I give time to the fire to break me is sweet
—Anthony Armstrong
Sudbury Ont Canada

7 One name have I and yet I am three
A messenger fair for those in authority
I m the least of my family yet first in a way
I come down each night and go up each day
—Ernest V Jones Huntsville Tex

8 My first is an obeisance
My second becomes my third through use
What is small for my whole
Is a giant leap for all
—James D May Louisville Ky

9 If *my first* cannot *my second*
With *my whole* inside
Then please tell me where oh where
Does your baggage ride?
—L A Dillard Temple Tex

10 Although I seem odd you never would see
Just by looking my way what the matter could be
A bane to my neighbors destroyer and foe
Yet once they embrace me they never let go
I m a singular thing though not one of a kind
I can only be viewed with the eye of the mind
Now if what I am can be clearly inferred
It hasn't dawned on me you can rest quite assured
—Rob E Nelson
Colorado Springs Colo

HONORABLE MENTION

11 To a scientist it isn t charged
Not positive or negative by and large
But to others with a different accent
It s giving battle to management
—Tom Carr Baton Rouge La

12 My first some say inspires thought
My second has a cap
My whole is all yet can be bought
And held upon one s lap
—Kathleen Kirkland
York Pa

13 My circle circles your circle
Only showing part of me
On your leash I flee forever—
Never touching never free
—Trish Jordan Humble Tex

14 My first swindles money
My second is money
My next two restrict money
My whole needs no money
What am I?
—Paul A Carlson Los Angeles Calif

15 My first two a weed that a state of mind makes
When you (mindless or mindful) perchance partake
Irrational acts do my second two seem
Devoid of—or hidden behind a mad gleam
My third alone floats as a point in the sky
A short joke well-spoken a speck in the eye
The total summation conclusion cephalic
Equestrian vehicle albeit metallic
—Samuel M Gon III Davis Calif

CONTINUED ON PAGE 130

selection will transform this accommodation into one of reciprocal compatibility.

I am of course talking about genuine desires. The evolutionary explanation of sexual fantasies is another matter.

Dr. Freya Mora
Department of Philosophy
La Trobe University
Bundoora, Australia

Solar-Power Splinter Groups

The two articles on solar power in *Omni*'s April 1981 issue made a fascinating contrast. The Glaser interview was rational, informed, moderate in tone. Dr. Glaser made a closely reasoned, factual case that was a pleasure to read. Trouble is, John Q. Public isn't persuaded by mere facts.

The solar-power radicals have done a first-rate job of whipping up antinuke hysteria, but they introduce "philosophical" garbage into their engineering at the expense of feasibility. Solar power might seem practical in California, but what about the northern United States, or here in Great Britain? It seems that the more impractical an energy strategy is, the more favorable its media image is.

Luckily, this impracticality is leading the extremists to take counterproductive actions. From a pro-nuke viewpoint, "Solar Sisters" [Earth] was the best news in years. First, they'll scare away male support with paranoid antimale tirades. Next, they'll scare off heterosexual women with Lesbians for Solar Power. Let's have other sexual minorities speak up: pedophiles for perpetual motion; zoophiles for horsepower. In the end, what sort of mass movement do you have? A small, exclusive clique of radical lookalikes who talk only to themselves.

If you really want a sane energy strategy, don't publicize Peter Glaser; go for Lesbians for Solar Power. Give them a regular column, put them on the cover and give them a centerfold if they want it. The more publicity they get, the faster they'll discredit the whole solar-power movement. Then we can have a rational energy policy instead of a political one.

David Taylor
Birmingham, England

FORUM

CONTINUED FROM PAGE 14

the creation of Piedmont Advocacy for Space (PAS for short).

We aren't very old, but we're growing rapidly. In a few months we have recruited 25 staunch backers of the space program!

One of the goals of PAS is to provide educational information to students in our area, emphasizing future careers in the space program. We are determined to prove that a small rural area of South Carolina is a grass-roots source of support for the space program. If Oconee County is interested in space, think of the untapped support in other parts of America.

S. J. Reidhead
Piedmont Advocacy for Space
P.O. Box 197
Fair Play, SC 29678

The Campaign for Space Political Action Committee is coordinating a nationwide letter-writing campaign to the President and members of Congress to coincide with the second flight of the space shuttle, tentatively scheduled for September 30, 1981. Space supporters across the country can demonstrate their support for an expanded U.S. space program by sending the message to Washington that the American people are behind a strong civilian space effort. Hundreds of thousands of letters from individuals will demonstrate the breadth of the space constituency and will send a signal to our leaders that cannot be ignored.

For more information write to:
The Campaign for Space Political Action Committee
P.O. Box 1526
Bainbridge, GA 31717

Thomas Frieling
Bainbridge, Ga.

Symons Says

I should like to raise a small point regarding your recent interview with Donald Symons [March 1981]. Symons argues that men are naturally selected to desire polygamy—or promiscuity—and women to desire monogamy. Presumably this entails that successful males *achieve* polygamy and successful females *achieve* monogamy. Since we all carry the genes of our successful ancestors, it follows that men *are* polygamous and women *are* monogamous. But this is a contradiction because the desire for monogamy is a desire for a relationship that is exclusive on *both* sides. So either men are not polygamous or women are not monogamous. The sexual desires of the two genders may be different, but they cannot conflict, otherwise extinction would necessarily ensue. Sex is rather special in this respect. Logically each of the parties has to accommodate the other's desires. Eventually natural

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PHOTOGRAPHY

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removing most of the manipulative barriers between photographer and photograph it is hoped that many of the satisfactions of working in the early arts can be brought to a new group of photographers."

But according to his critics Dr Land's obsessive quest for the finest in instant art has not justified a $600 million research-and-development bill and ten years' time.

Ex-painter Lucas Samaras has worked with Polaroids of one kind or another for over ten years. But since 1973, when the large-format Polaroids were introduced, Samaras has toyed exclusively with the SX-70. "It's like making a drawing you can erase," the forty-five-year-old Samaras says. "And you're free to work with it without caring about technical things. All you worry about is what you see."

As Samaras mastered the camera's nuances, he pioneered the manipulated-image technique. With a pen or other instruments he shifted the emulsion under the Mylar sheet, producing eerie, grotesque transformations. This is something that is now almost impossible with the new Time-Zero (Polaroid says it's too cost-prohibitive to produce the old film in limited quantity). For Samaras, however, the SX-70 still means immediacy and a certain aesthetic peril. "It's dangerous because it's a hairbreadth close to amateurism. The other photography is like a conjurer's mysticism. That magic still pervades photography, photographers are like men from Mars. With Polaroid, you're skirting the line—like Muhammad Ali, when you didn't know whether he was going to win the championship. That's when he was exciting."

Another early SX-70 aficionado is multimillionaire pop-art painter/entrepreneur Andy Warhol. "When I got the camera years ago, it was just a magic camera. It did all the work. All I did was point and press the button. Then the picture came out. You didn't even have to wait for the picture." Warhol neglects to mention his compositional skills, but the antiart, antiself-conscious stance is part of his style. The Polaroid perfectly suits him for that very reason. His work naturally extends from a contemporary culture made of image-myths, for example, Muhammad Ali and soup cans. Warhol recognizes the SX-70's ability to superimpose a mythical reality of its own on any subject: one picture, with its claustrophobic frame and slightly unnatural colors winning for the photographer the awe reserved for a shaman.

"I like only a great photographer or a total amateur to take my picture," Warhol adds. "In either case he need only take one picture of me. I believe in taking as few pictures as possible. But usually I have to make more than one, because everybody is always stealing my pictures."

There's a surreal apprehension of reality with the SX-70. It transforms nature by means of its own form. Instead of approximating nature. "In the hands of an artist, SX-70 assumes an introspective calligraphy," says acclaimed photographer Ralph Gibson, whose Lustrum Press published *SX-70 Art*. Calling SX-70 a reinvestigation of technology on its own terms, Gibson proclaims: "What are the tricks of today are the truths of tomorrow."

When Polaroid organized its admirable One-of-a-Kind exhibit—later transformed into a book, *One of a Kind* (Godine)—it reinforced what Coleman called "a retrograde concern with antiquated images that are the most effective images for a book documentary." In its remarkable sponsorship of artists, Polaroid has unfortunately and unintentionally supported images of the past that suggest quality status for their products. Exceptions such as Samaras and John Reuter only confirm the rule. However, it seems almost unavoidable that SX-70 will lose something with publication. As a camera of the future," Coleman adds, "it's heading us away from the contemplative toward the accelerated absorption of information. By eliminating the delay between the encoding of the negative and the looking at the positive [the SX-70] thrusts you into the position of responding instantaneously to the image produced."

The SX-70 eludes easy categorization. Just as the term *new wave* seems vague as a definition of rock and roll music, it also somehow fits, and yet doesn't quite fit, SX-70. Certainly both the music and the photography reassess their respective media in terms of concept, not technique. With both SX-70 and new-wave rock and roll (from Brian Eno to the Sex Pistols), specific ideas have been far superior to general dexterity. Eno speaks of being a nonmusician, as Samaras is a nonphotographer; both make art according to their own peculiar procedures. Investigating the language specific to their proper medium, both new-wave rock and SX-70 are performance art. Immediacy, spontaneity, even audience intervention make the two an alternative to just about everything that has been known in either art.

SX-70's performance capabilities don't quite refute social philosopher Susan Sontag's charges that photography reduces human experience to passive image collecting. The camera does, however, twist things around. SX-70 insinuates itself into situations the photographer cannot remain a passive observer. The photographer and the subject are knotted together in real-time and simultaneously. When Sontag attacks photography for substituting image for reality, she overlooks the SX-70.

One incident remains fresh in my mind. Late one night, while I was fumbling for change at a corner phone booth, two women tried to help me. One dropped her pocketbook. Out tumbled SX-70 prints of her in erotic poses with her boyfriend. Reduction of experience? Or fun? The Polaroid exposes itself as the third party in a human/technological *menage à trois*. ☐

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international recognition of the provisions that any equipment or facility necessary or useful for peaceful purposes shall not be prohibited and that the placement of radioactive materials on the moon is acceptable because nuclear energy I believe is essential for a sound lunar industrial economy But why the establishment of an international regime? Why the imposition of a state-run perfect social order without any protection of human rights and private property with the further rejection of private enterprise? There seems to be altogether too much unwarranted interference in the economic and social aspects of lunar industries. The Moon Treaty's sole purpose should be to ensure a legalized consensus, recognizing equitable benefits for all mankind that accrue from progress. Spacefaring countries should by that very treaty be encouraged to strive for progress—whether by private enterprise or by state-run operations But that is their internal affair Other disturbing aspects are the Earth-parochial tenor of the treaty's environmental provisions, the limitless extent of its jurisdictional claims—across the solar system and beyond—and the claim that everything is mankind s property rather than that everything is mankind's rightful field of activity In a sense the Moon Treafy is as imperialistic as the treaties of Tordesillas and Saragossa, which made the New World solely the 'property' of Portugal and Spain. This treaty seems to post *Verboten* signs throughout the solar system before we even get there

Omni: Have U N space treaties endured new technologies? Are they still valid?

Ehricke: They are valid The 1968 agreement on the rescue of astronauts, the return of astronauts and the return of objects launched into outer space the 1973 convention on international liability for damage caused by space objects and the 1976 convention on the registration of objects launched into outer space are valid and are being adhered to These matters are relatively easy The 1976 Outer Space Treaty or OST and the 1980 convention on the prohibition of military or any other hostile use of environmental-modification techniques—both also ratified by the Russians and by us—are also valid and are being adhered to at this time The OST binds signatories—essentially all nations—to the peaceful exploration and use of space. Wisely the OST does not prohibit reconnaissance satellites, which are important tools in the cause of peace Article IV of the OST prohibits the orbital and ground placement "on other bodies of nuclear weapons but the same article permits any equipment or facility needed for peaceful use Thus, the Russians are operating within the terms of the OST when they use nuclear-power reactors on Kosmos satellites, just as the use of nuclear power for peaceful industrial purposes on the moon or other celestial bodies is within the terms of the OST, subject to certain environmental constraints in Article IX

Omni: Will the opening of the frontier of space necessitate a world authority to regulate activity by all nations?

Ehricke: Objective regulatory functions are needed and are beneficial, analogous to traffic controls fire regulations, objective laws designed to preserve freedom from anarchy on the one hand and to stifle regulations and the arrogance of power on the other hand Coercive regulatory functions—the type that intrude upon an individual s or a country s freedom on behalf of ideological or religious causes or for other reasons—have no place in these regulations They are arbitrary and unjust

Omni: Is it possible that future lunar explorers will find specific locations on the moon to be more valuable than others leading to even more disagreement over who owns what on that body?

"I am not advocating a mass exodus or the abandonment of Earth, but an integration of Earth and the extraterrestrium, the expansion of a one-room apartment into a mansion."

Ehricke: Some places almost certainly will be found to be more valuable than others Article XIII of the OST provides a framework for resolving 'questions' Article IX of the Moon Treaty recognizes the possibility of dispute and prayerfully recommends consultations, hoping that the Declaration Concerning Friendly Relations in Article III will hold Whether this will work obviously depends on what's at stake

Omni: With the legal regime for lunar operations settled should President Reagan make moon utilization a national goal?

Ehricke: Yes We should return to develop and settle the moon industrially as people develop a continent; the moon is what I call Earth's eighth continent It is a constructive national and human goal that creates a large job market, advances technology, and provides important new raw materials pure iron, titanium chromium nickel manganese It is a natural base for large-scale, diversified industries and settlements and for accelerated low-cost construction, placement, and servicing of space installations. There is much surface area, almost equaling the size of the Americas, for expansion and for uncrowded diversification It is a world in which cultivated places can alternate with wildernesses, a world of openness, pleasant gravity, beautiful nights, vast horizons—located just days from Earth on the shores of interplanetary space.

Omni: If you were allowed to make full use of the moon, how would you proceed?

Ehricke: I have developed a five-phase evolution with specific achievement plateaus ranging from the 1980s to the middle of the next century The first phase—landers and electrically propelled orbiters—could begin during President Reagan's present term

The second phase is a circumlunar space station, or CLST as the control center for more sophisticated ground systems sent directly to the moon from Earth, as an engineering laboratory for lunar materials, and as a livable operations base for the moon terry I stipulate two to three years for Phase Two during which time marketing and customer identification work and production planning are to be completed By 1997 the construction of the first-generation Central Lunar Processing Facility with a nuclear-power station could begin probably in the Oceanus Procellarum, on the moon's equator This facility would be maintained in nine- to twelve-month shifts by Phase Two crews accustomed to six- to nine-month shifts of duty on the CLST The CLST will grow into a zero-g factory and staging center for training second-generation selenonauts [moon dwellers]

By 1998 production runs could begin transferring oxygen, silicon, aluminum, iron, and glass, then on to powder metallurgy, vapor-phase metallurgy, glass technology solar cells computer parts space-station and reflector structures and so on Phase Three already aims at diversified markets The moon cannot be a one-project banana republic The lunar economy should not be built up with tax money but with profits from value generation

Economic growth during Phase Four would support a growing lunar population Life on the moon would be more urbanized.

Phase Five is contingent upon a strong economic base and a powerful fusion-energy source, making possible the development of Selenopolis, a city-state, the seat of lunar civilization capital of the lunar biosphere Thereafter no more phases would have to be planned The eighth and last continent grows into the future

The inhabitants become a people apart gradually diverging from the peoples of Earth just as America diverged from Europe They will not remain a colony of the blue-white marble in their sky Living on a small island, the Selenians are cosmopolynesians shipbuilders spacefarers outward bound for other worlds—with or without their terrestrial big brothers who, I hope will rise above jealously possessive desires And that sociocultural diversification may well be the most far-reaching contribution to the development of the New Open World


NASA
USA
RICO

CONTINUED FROM PAGE 40

were present along with at least five species of lichen. So the case for life on Mars remains open, thanks to the Dry Valleys.

Antarctica's other outer-space connection—its excellent collection of fallen meteorites—has also attracted scientific interest. Their recovery is made easier because dark objects stand out against ice.

The first meteorite was found in Antarctica way back in 1912, but it is only in the past ten years that any systematic searches have been made. Japanese and American scientists discovered that some sort of local concentration effect seems to be operating. For instance, the Allan Hills area, next to the Dry Valleys, is strewn with the rare objects. Occasionally several meteorites would be visible to a man standing in a particular location. The harvest has been sensational. Only about 2,500 meteorite fragments had been collected until a few years ago when 4,000 more were recovered in Antarctica.

According to geologist Dr. John Annexstad, who has led several NASA expeditions, there are certain preferred hunting grounds. He found that mountain ranges form a natural blockage to ice flow, creating regions of stagnant ice whose surface layers are evaporated by dry winds. This exposes meteorites that have fallen over many hundreds of thousands of years.

Some of the recovered meteorites have been in the ice for more than 1 million years, possibly longer. These ages can be determined by precise radioactive-dating techniques. Geophysicists can observe the effects of cosmic rays on the isotopes of the minerals and thus gauge when the cosmic radiation stopped interfering with normal radioactive decay—a measure of when the object reached Earth's surface. These data not only shed light on the meteorite's history but, as an added bonus, help date the layer of snow in which it has been entombed. Serving as chronological markers, meteorites have provided glaciologists with some unexpected ages for the climatological history of Antarctica itself.

The meteorites collected by NASA are treated as delicately as moon rocks, according to Dr. Annexstad. Field parties are supplied with clean, lunar-type collection materials and special shipping containers. Specimens remain frozen and are brought back to the United States under locked refrigerated storage. Once in Houston, the meteorites are handled in a dry nitrogen environment to prevent further weathering. They are cataloged, weighed, sliced to be examined microscopically, and then distributed all over the world.

Antarctica has always seemed to be at the virtual edge of the world, hardly one of planet Earth's most attractive spots. These recent results suggest that, at least in the Dry Valleys area, Antarctica is over the edge of the world and more rightfully belongs to outer space. ☐☐

A request for startling special effects

PHOTO CONTEST

By Geoffrey Golson

When the camera lies, it creates some of the most striking most surrealistic views of our world. With special-effects equipment, a photographer can make subtle shifts in perspective, radical distortions of form or wholly new images.

For our fourth photography invitational we ask readers to break the boundaries of reality: we're looking for spectacular examples of special photographic effects.

The photo below, by Anna Pomaska, is one such example. It is a collage, two black-and-white photographs, both hand-colored, then rephotographed together. This process, a combination of painting and photography, is just one of many methods that can produce unexpected results. Pomaska also used a darkroom technique to change her photo into a new art form. Before coloring the pictures, she soaked the prints in a toner bath to dissolve silver nitrates and dye the paper with tone color.

Mirrors, chemicals, dyes, filters, and especially lenses are the tools that change a run-of-the-mill photograph into an interesting and innovative work.

Light, the basis of photography, can also be manipulated to advantage. Not only can light change color, cast strange shadows, or range in intensity from dazzle to darkness, but it can also be given movement of its own—by a well-executed time exposure.

Many new technological developments add to the array of options open to the special effects photographer. One option, laser light, can be generated to illuminate minute areas, reach unerringly across miles of darkness, and trace light pictures that are far more detailed and vibrant than anything ordinary light could produce. Laser light is a recent invention, but it has already revolutionized many technologies and promises to do the same for the art of photography.

These are just hints of what is possible, of what a resourceful photographer can tap to transform what the camera sees into what the mind sees.

For this Special-Effects Photo Contest, the First Prize winner will receive a gold-embossed certificate from *Omni*, $500 in cash, and guarantee of publication in a subsequent issue. The Second Prize winner will be presented a silver-embossed certificate. The Third Prize winner will receive a bronze-embossed certificate.

Here are the rules:

1. All photographs submitted for judgment must be original, previously unpublished, and solely your property.
2. You may enter more than once, but each entry must be described, packed, and mailed separately.
3. The competition is open to everyone except employees of Omni Publications International, Ltd., and their families.
4. Color slides: Print your name and address on the slide's border as well as on an accompanying letter explaining the subject of the photo and how, specifically, the photo was made.
5. Prints: Print your name and address on a small slip of paper and tape it to the back of the print. Put your name and address on the accompanying letter.
6. All entries must be accompanied by the following information: camera, film, lens, aperture size, special equipment or procedures used, and a short statement about what the photo represents.
7. We cannot return any photos. If you wish to keep the original, have a duplicate of your slide or print made, and send that.
8. Special-Effects Photo Contest finalists will be chosen by the contest editor, Geoffrey Golson; *Omni* Art Director Frank DeVino, and *Omni* Editor, Publisher, and Design Director Bob Guccione.
9. *Omni* will have the right to reproduce all entries in *Omni*, its advertising, promotion, and displays, and in shows and exhibits, without limitation. *Omni* will pay its standard fees for editorial use of any entries for purposes not connected with the Photography Contest.
10. Prizewinning contestants may not permit publication or display of prize-winning photographs without the prior written consent of *Omni*.
11. Entries must be postmarked by November 1, 1981. Send them to: Omni Special-Effects Photo Contest, 909 Third Avenue, New York, NY 10022.

This hand-colored collage of black-and-white photos epitomizes the concept of special effects

COMPETITION

CONTINUED FROM PAGE 118

16 I'm older than time and I'm older than space
I died when the first thing appeared in this place
But if you ask people "What's new?" you will see
That nine times in ten they will tell you it's "me"
—Lillian Borgeson
Thousand Oaks Calif

17 I am merely five and my associate is but four
Although as one we have survived five hundred years or more
Discover my identity—and in time if you will—
In order for my associate his *face* to reveal
—Allen See Fairfax Va

18 My first is nothing my second is common
My whole is in this thought expressed
The Loch Ness monster wears a dress
—Christy Marx Los Angeles Calif

19 My first part entices men
My second burns them without pain
I am because I died before
At stake to die again
—Anthony Armstrong

20 With a space in between I'm a sound widely heard
That cheers up our race through this sad vale of tears
But put me together in one longer word
And I'm good for a jail term of many long years
—Jon Bunce Portland Ore

21 *In* my first? I'd tell you yea
Conversely I say my second is nay
Of my third the body at five does halt
My whole is in no sense at fault
—Adam Morrison
West Palm Beach Fla

22 My first is what you did down to tea
My second a vessel that never sees the sea
My whole is the sixth in my whole family
And I have many rings though there no fingers be
—Heather Henderson
Phoenix Ariz

23 I'm popular and right enough
My proper title's due
It really gets my shekels up
When someone says "Ey you!"
—John Huolani Minnetonka Minn

24 My second's of intelligence my first is similar When spoken I'll agree to be sure And in the same manner I'm in the same manner
—Mike Roney Decatur Ill

25 My first's deceptive or opposite
My second's in the can
My third's the female all wools fit
My fourth's a pause by man
My whole goes on—it's infinite
As if a master plan
—Sarah S. Ingram
Whites Creek Tenn

26 A cooling agent is my first
My next the means to travel
My whole announces I've arrived
Now please this knot unravel
—M. E. Griffith-Jones
Temple City Calif

27 A modern invention such as we are
Traveling miles though we never go far
Rarely faster than three miles an hour
We carry the fuel that fuels our power
Within one another our wheels on the floor
We're here to prepare you for what is in store
—Gail Howe
St. Petersburg Beach Fla

28 Today my lads you use my first
To keep my second true
Tomorrow you will use my whole
To show my first to you
—Rick Hansard Chattanooga Tenn

29 Come in since you seek Three ways you'll find gold
Come in since you peek The first has been told
United I am knowledge unbounded by structure
Divided I give passage by proof and by picture
—Joel Boydston
Gainesville Fla

30 My first is an animal whose breeding's unclear
My second's a price that you pay
My whole can be found in the river of time
And refers to events of today
—Shelley Krause Elmira N.Y.

31 The man who makes it sells it
The man who buys it doesn't want it
The man who uses it doesn't care
—Raymond Charzewski
Spotswood N.J.

32 I am quite elusive and often hard to find
You can look right at me and be completely blind
A different name have I each different time you seek
But I am finally told though it might take a week
When you started reading to find me you were bound
And when you see the answer, of course you'll have me found
—Dave Davison
Tacoma Wash

CONTINUED FROM PAGE 26

to yourself considering the limited number of people who come to see them

'It's my job as an actor to entertain the widest number of people possible, and if that means I spend my career trying to elude beach buggies on foot or outracing adversaries on the Olympic bobsleigh run at Cortina d'Ampezzo, as I do in this film then you pay up your insurance and do it.'

Though most of Bond's on-screen time is of necessity consumed by his audacious exploits, Moore spends a lot of time going over each script with the writers, looking for a way to reach beyond the charm and humor that are the cornerstone of his performance as 007. Even as a shot is being prepared, the actor may sit down with the director and try to find a fresh word or phrase that will make the character a little less two-dimensional. Moore is particularly pleased that *For Your Eyes Only* gave Bond a touching scene beside the grave of his wife, Tracy, who was slain at the end of *On Her Majesty's Secret Service*, the film in which model George Lazenby made his first, and only, appearance as Bond.

There are very few days when you have a scene like that, or one that opposes you mentally, with another actor. The problem is that no matter how well-intentioned, scenes like these stop the action. People have been attracted to the Bond films for over twenty years because they get what they're searching for entertainment with a capital E. And they're never cheated. You can't, therefore, grind to a halt in the middle of a car chase, so that Bond can lean back in his Lotus Esprit and say something revealing like, 'I never had toys as a child.'

'One must also keep in mind that we're not dealing with a real man, which is extremely limiting. Bond doesn't behave like a real spy, such as John le Carré would write about. A spy has to blend in with the background, yet here we have a man who at the beginning of every film says to the leading lady, 'My name is Bond, James Bond,' and expects a gasp of admiration. He's also immaculate, which is the surest way *not* to disappear in a crowd. If spies behaved like Bond, they'd be dropping like flies."

However, even within Bond's rather unlikely world, Moore has established traits that he uses to suggest humanity that is rarely in the script. "He's never as violent as Bond the way Sean played him, and I always try to keep in mind something Ian Fleming wrote about him. At the beginning of one book, Bond was returning from Mexico, where he had killed a man. It said that he didn't particularly like killing, despite his '00' license to do so, yet he took a certain pride in doing his job well. I could not describe my Bond any better.'

For Your Eyes Only helps Bond's credibility somewhat by offering him one of the most believable missions he's had in years, returning to the cold war mentality that made the early films so naively topical. Without spoiling too many surprises, the story involves Bond and marine archaeologist Melina Havelock (Carole Bouquet) in a search for a piece of equipment vital to British security—a quest shared by a heroin smuggler who hopes to auction the lost item to the highest-bidding world power. Even the huge slice of screen time turned over to the obligatory hardware and gadgetry strives for greater realism. As was not so in previous Bond films, most of the paraphernalia here really exist. This is especially true of the underwater gear employed to search sunken archaeological sites for the missing equipment.

The most amazing conveyance is the *Mantis*, a one-man submersible seven feet long that is run by an operator lying belly down. In reality, the *Mantis* can descend nearly a half-mile and conduct underwater research by using two armlike fixtures set in both sides of the bow. For the sake of Bondian drama, the arms' revolving tool cylinders were fitted with viselike pincers and a destructive drill.

Also used in the underwater scenes is the versatile JIM diving suit (named for diving pioneer Jim Jarratt). Fully jointed and able to descend nearly 1,500 feet, it was fitted for the picture with various weapons, and there are the Deep-Dive 55 life support suits which look properly sleek and futuristic for a Bond film and which recirculate the air supply, thus functioning without unphotogenic umbilical hoses.

The one fanciful craft in the 007 underwater fleet is Bond's two-person submarine, *Neptune*. Twenty-three feet long and eight feet wide, the vessel is totally unseaworthy. To keep *Neptune* stable during underwater film sequences, the hatches had to be opened and the insides flooded. The actors were forbidden to exhale during a take lest they release air bubbles, but they were provided with air between shots. Closeups, mercifully, were filmed on a dry set.

Moore says he felt right at home inside *Neptune* ("It wasn't the first time I've been sloshed"), that he didn't mind the mountain climbing, and that he even had fun filming a car chase that pitted his lowly Deux Chevaux against a pair of Peugeots. What he did *not* enjoy was the gunplay.

"It stems from the army," Moore relates. "I was out on the shooting range with a Sten [automatic] gun. It had a blockage, two up the spout already [two bullets jammed in the chamber], and when it went off, I couldn't hear for days. That was traumatic, and it literally chills me to pick up a bloody gun. Explosions are even worse. You can't get all the flame and noise the producers like without real detonations. So in addition to the noise you get nasty powder burns." Moore grins, then dryly offers a perfect Bondian perspective on the matter. "As I said before, you do what you have to do to make these pictures. And one thing is certain. There will never be any getting away from the banging in Bonds."

DISTANT

CONTINUED FROM PAGE 79.

of Oceana—such a contrast to *Argo*'s sterile corridors—and become appalled by the lonely centuries of travel that still lie ahead. The Shaanans are happy and perfectly adjusted (though getting worried about the power situation). Yet they become envious of *Argo*'s wonders and a little guilty about their past indolence.

Also, despite taking elaborate precautions, each group infects the other with nasty head colds.

It is agreed that *Argo* can siphon (by means of a space elevator at the equator) several million tons of water to build a new shield. It is frozen in the shadow of a giant sunshade, then it is assembled by robots in a slow-motion ice ballet lit by the cold light of Oceana's three moons.

Meanwhile Falcon meets Loren and Marissa and falls in love with them both. Despite their cultural differences the two societies are equally civilized and sexual jealousy is (almost) extinct. But ironically another problem arises. Falcon is deeply attracted to Oceana, while Loren and Marissa feel the lure of the great unknown universe beyond.

During the weeks of shield building, there is a catastrophic power failure in another OTEC grid. The Shaanans appeal to *Argo*. After some debate (they don't want to make the islanders even less self-reliant) the voyagers re-create a deep-diving submersible from the ship's information banks. Falcon plugs in temporarily to the recorded skills and personality of a long-dead deep-sea explorer and he dives with Loren. They discover that the installation had been damaged deliberately.

Diving deeper, they encounter the Shining Ones, giant squidlike creatures which communicate in the total darkness of the abyss by beautiful displays of multicolored luminescence. They can even produce pictures the way giant TV screens do.

Falcon and Loren are also astonished to see that the squids are using tools fashioned from whalebone. They are on the verge of developing technology, and the OTEC conductors are their source of metal.

Falcon and Loren escape with difficulty. The Shaanans want to destroy the squids, but this horrifies the voyagers, who have already seen too much death.

With the help of special equipment and the ship's computers, they reach a limited understanding with the squids, which are bought off with a gift of metal. But one day the Shaanans may be faced with a more serious threat from these beautiful and magnificent beasts: the future of the planet will belong to the more energetic race. In this coming conflict *Argo* cannot and should not interfere. The threat from the deep may be exactly what is needed to revitalize the Shaanans.

Argo's shield is complete, the ship is ready to depart.

To help the Shaanans understand, Falcon takes Marissa (now bearing his child) and Loren up to orbit.

They enter the hibernaculum. At its portal stands one of the greatest works of art ever produced by mankind: the golden mask of the young Pharaoh Tutankhamun, one of the last treasures saved from Earth. Now it guards the sleeping, as once it guarded the dead.

They pass thousands of men and women in their crystal cells until they find Falcon's wife, who is in the last stages of pregnancy. Falcon explains that they had intended the child to be born on Earth, but time ran out. Soon he will join them both in their long sleep and will awaken in time to greet them when *Argo* reaches its goal, 500 years later.

On the beach where they first met, beneath the light of the three moons, Marissa and Loren await the moment of departure. Thousands of kilometers overhead, the plasma drive ignites, brighter than 100 suns, as *Argo* draws away from Oceana and heads out to the stars.

Loren comforts Marissa and reminds her of the child they will cherish all their lives. Yet always there will be the phantom image of another child, conceived 500 years before, to be born 500 years hence.

A child whose father will remember them when he awakens, centuries after they have turned to dust. ☒

FICTION

The world was strange and scary just like it always is!

MR. MOUSE

BY FRANK L. CALLOWAY

Hello, mouse," the little girl said.

"Squeak," said the mouse, wriggling its nose curiously.

"I'm not afraid of any old mousie," said the little girl, her pigtails swinging from side to side as she shook her head no.

"Squeak," the mouse replied.

"My daddy says to watch out for wild animals," she went on, "but you don't look very wild to me."

The mouse was silent.

"He says since the last war things have grown funny. Have you grown funny, Mr Mouse?"

"Squeak?" the mouse asked.

"You look like any other mouse to me." A malicious gleam had come into her eyes. "Daddy gave me a special gun to protect me from wild animals."

She brandished a small, metallic object that had been concealed in her pocket. The mouse watched apprehensively.

"This special gun only shoots animals, not people."

She pointed the gun at the mouse.

"If you don't get out of my way, Mr. Mouse—or whatever your name is—I'm going to shoot you."

The mouse, since it obviously hadn't understood a word she said, made no attempt to move.

Zap! went her gun, and the mouse fell over dead without so much as a twitch of its furry, gray tail.

"You weren't very special at all," the little girl sniffed disdainfully. Then she continued on her way.

The next morning a tow truck came to haul off the body of the mouse, which had been blocking the street. DC

PAINTING BY
MARSHALL ARISMAN

MIND

CONTINUED FROM PAGE 24

as an unblemished authority Epidemiologists have long questioned its reliability, psychiatrists such as Dr Hugh Drummond who writes about the influence of social class and ideology upon psychiatric judgment, find its approach quite arbitrary Even the new edition *DSM III*, with its extensive revisions and redefinitions he says is no exception "What they've done is simply draw new lines around a very fluid, ambiguous array of human behavior" Dr Drummond notes

Many psychiatrists apparently believe that their profession should have the right to exercise more authority and enjoy more prestige than the other disciplines in the mental-health field Such a view invites bias concerning the judgments made by members of the other disciplines

My colleagues psychologists Bertram Raven and Robert Gunn and I decided to do our own study on the effects of professional bias on diagnostic judgment We asked staff psychiatrists and clinical psychologists at a Veterans Administration hospital to indicate how much they agreed with a number of case-history diagnoses each of which had allegedly been made by either a psychiatrist or a clinical psychologist The profession of the alleged diagnostician made no difference to psychologists The psychiatrists did use profession as a judgment criterion they differed with the psychologists more than with one another

Other research on prestige suggestion was done at the University of Oklahoma in Norman by psychologists Maurice Temerlin and William Trousdale Groups of psychiatrists clinical psychologists and students in various disciplines diagnosed the mental stability of a person after hearing a tape recording of what was supposedly a preliminary psychiatric interview The voice was actually that of a healthy normal actor playing the role of a person who had read a book about psychotherapy and wondered whether it would help him

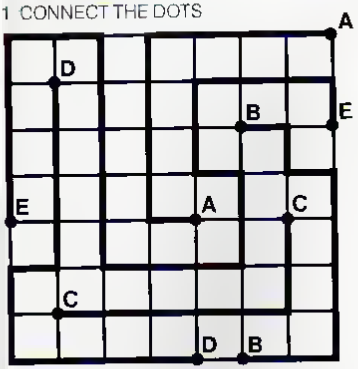
A prestigious person in each field told each group that the man looked neurotic but actually was quite psychotic Sixty percent of the psychiatrists diagnosed the person as psychotic, compared to a high of 30 percent for the other experimental groups Although nearly 16 percent of the others rejected the prestige suggestion entirely and diagnosed the person as normal, not one psychiatrist did so

Drummond holds out scant hope that future psychiatrists will be more objective and competent than their predecessors Drummond says "Each year psychiatrists are more arbitrary in their diagnoses more smug They just decide that somebody is psychotic assume that there's a biochemical cause for it, and treat it with a drug Psychiatry doesn't work anymore it may do more harm than good I think we're a bankrupt institution" ◻◻

GAMES

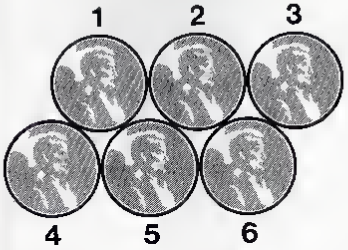
ANSWERS TO GAMES (PAGE 144)

1 CONNECT THE DOTS



2 MINIMUM RULE The bar is an integral inch ruler with which one can measure any whole number of inches between 1 and 13 For example one- and two-inch lengths can be measured with the 1- and 2-inch marks A three-inch distance can be marked off between the 10 and 13 marks four inches between the 6 and 8 five inches between the 6 and 1 and so on

3 PENNY PACKING The shift can be made in just three moves (1) Slide coin 6 to touch 4 and 5 (2) then move coin 5 to touch 2 and 3 from below in the position previously occupied by coin 6 and (3) move coin 3 to touch 5 and 6 In his *Mathematical Carnival* Martin Gardner recommends this puzzle for a sneaky bar bet Demonstrate the three-move solution slowly Then bet your friend he can't repeat it When you put the coins back in their starting position set them in the mirror image form of the original parallelogram Chances are the person will not notice the difference with the result that when he tries to duplicate your three moves he will be in serious trouble



4 ORDER Forty (Actually this is the *only* alphabetical number in English)

5 NUMBER One to one thousand

6 SEQUENCE Each of the numbers contains the letter *i* Next in the series is 31

7 THE STUDENTS AND PROFESSORS. 6*P*=*S* Nothing surprising here except for the fact that so many people get it wrong In a recent sample of college algebra students who were nonscience majors the *majority*—57 percent—got it wrong Among calculus-level college students the error rate was 37 percent (*American Mathematics Monthly* Vol 84, April 1981) Most people blow this one by reversing the variables for example 6*S*=*P* Did you?

8 WORD Queue and aitch

9 HOWDY The number of people who have shaken hands with an odd number of people is even If you were to number every person in the world according to how many times he or she has shaken hands with some other person some will have tallied an odd number some an even number The total of all handshakes will be even, however, because each handshake will have been counted twice—once by each of the two people who shook hands Since the total is even the number who have tallied an odd number of handshakes is also even

10 JEALOUS CROSS Eleven crossings are required 1) A and wife cross 2) A returns 3) B's and C's wives cross 4) A's returns 5) B and C cross 6) B and his wife return 7) A and B cross 8) C's wife returns 9) A's and B's wives cross 10) C returns 11) C and his wife cross

11 NO CHANGE $1 19 made up of one fifty-cent piece one quarter four dimes no nickels and four pennies

ANSWERS TO RIDDLES (PAGE 116)

1 Anagrams of the same five letters by stanza pears / reaps / spare / rapes / prase / spear / parse / pares / asper / presa / apres / apers "In order" refers to alphabetical order

2 Trigonometry (tri-go-no-me-try)

3 Elastic (el-as-tic)

4 Programming (pro-gram-Ming)

5 Carpet

6 Bank

7 Mercury

8 Neil Armstrong

9 Cargo

10 A black hole

11 Unionized

12 *Omni* (Om-knee)

13 Moon (note the acrostic first letters of each line)

14 Concentration (con-cent-ration)

15 Locomotive (references are to locoweed motive mote mot and iron horse)

16 Nothing

17 The lines of the musical staff ("my associate" the spaces in the staff uses the letters in *face*)

18 Nonsense

19 Vampire (vamp-pyre)

20 Man's laughter (manslaughter)

21 Innocence (in-no-sense)

22 Saturn

23 Gold (Au)

24 Likewise

25 Continuum (con-tin-ewe-um)

26 Fanfare

27 Grocery carts

28 Starship

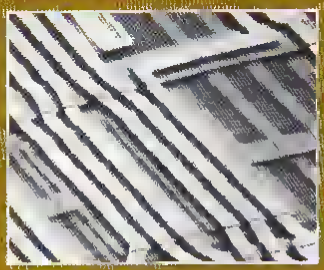
29 Omniscience ("come in since" is an anagram)

30 Current

31 A colfin

32 The answer to a riddle ◻◻

NEXT OMNI



FICTION

KEYS TO THE FUTURE—*Omni* will be three years old in October. A spectacular issue will mark the occasion with an insightful section devoted to breakthroughs the growth mechanisms of science and technology. The course of our world is dictated by how, when, and where science leaps forward. Next month *Omni* presents the need for breakthroughs in 22 fields of human endeavor, including: • Food. We can vacuum-pack, freeze-dry, vitamin-enrich, preserve, and irradiate just about any food. What we need now is a reasonable, inexpensive way to freeze a tomato. Why? Once we achieve that, we're on our way to freezing human beings. • Office. That great breakthrough in technology the computer promised to eliminate the need for paper. It has become a prodigious paper producer. *Omni* looks at future machines and asks whether there will ever be a "paperless" business office. • Plus: Thinking machines, religion, shelter, travel, money, and much more.

COLD CURRENTS—Superconductors carry electricity forever without losing a single amp—but they do it only at low temperatures, say, 450 degrees below zero. Now physicists think room-temperature superconductors may be on the way. If so, they'll give us a supercomputer in a one-inch cube and wire that could carry all of New York City's electricity inside a single cable. Find out how next month in *Omni*.

BRAINSTORMING—All communications networks, including the brain's, are built on electricity. Fifty years old, the electroencephalograph has been a fairly blunt instrument for examining the brain's software. But scientists at the University of California at San Francisco have developed a method for tracking brain waves that promises to revolutionize the way we think about our cortex. In an exclusive story, *Omni* heralds this tool that may shed "electrical" light on our cerebral musings.

SCIENCE FICTION—*Omni* previews *Oath of Fealty*, Jerry Pournelle and Larry Niven's new novel about an elite community within the confines of Los Angeles. Also, lightning uncovers an ancient secret in Harlan Ellison's story "On the Slab," and humankind pays a high price in its quest for knowledge in "Hinterlands" by William Gibson. In addition, Bill Chamberlain has a computer program, named RACTER, that has written a bizarre story entitled "Soft Ions." Human authors, watch out!

BOOKS

CONTINUED FROM PAGE 30

lowed by *The Valley of Horses*) is Auel's intriguing speculation on the nature of Neanderthal intelligence: capable of recalling the accumulated knowledge of past ancestors, incapable of abstract thought and of anticipating change. "Let me give you the numbers," Auel continues. "Modern human beings average a cranial capacity of approximately fourteen hundred cubic centimeters. Cro-Magnons—a taller, more robust people—averaged closer to fifteen hundred. Neanderthals averaged sixteen hundred to sixteen hundred fifty. Nevertheless, the Neanderthal forehead did slope back and the frontal lobes were not as developed. Here's this tremendous brainpower sitting at the back of the head."

Curious about the nature of that brainpower, Auel began reviewing what is known about the modern human brain and, in the process, discovered how much is still unknown. And so, novelist that she is, Auel began to speculate. "You know that old line, 'Somewhere in the back of my mind, I think I remember something'? All of a sudden I said to myself, What if this whole thing called instinct were more conscious?"

Auel began looking again at the two cultures. "What we know about ourselves is that modern man has been around for at least forty thousand years. In that time we have altered the earth. We have gone to the moon. Neanderthals were around for at least one hundred fifty thousand years before we came along, with almost no change in their culture or environment. This speaks of a very traditional society—a society that resists innovations. So I'm saying, 'Hey, this is beginning to fit.'"

Her next step was to transfer into that Neanderthal brain an encyclopedia of botanical information. "I thought it added a sense of realism," she says. "But I also wanted to show that Neanderthals really had this tremendous in-depth knowledge that they took for granted. We tend to think of our forebears as simple savages. I wanted to show that you have to be just as intelligent to live in a natural environment as to live in a modern society."

To read *Clan* is to be reminded of how estranged humankind has become from that natural environment. It is also to ponder how little we humans have actually changed, particularly in our abiding need for human intimacy. "I believe that we're learning to live together," Auel says. "It's just that we're going through a horrible transition right now. Maybe it's not so different from the Neanderthal/Cro-Magnon era. Things are changing so quickly. The world is getting smaller. One way we can cope with these changes is to destroy ourselves and start over again. But I don't think we're on the edge of the world, ready to fall off and annihilate ourselves. I think we're still a young and vibrant people. I have tremendous faith in humanity."∞

CANNIBAL GALAXIES

STARS

By William Herbst

Species that devour their own kind seldom flourish. In deep space however the laws of survival are sometimes quite different from what they are here on Earth. For many years astronomers have suspected that some enormously large galaxies became such by regularly feasting on smaller companions. Now there are some remarkable new observations to support this theory. And there is even a hint that our own galaxy was a cannibal early in its career.

The lair of these cannibals seems always to be a great cluster of galaxies where smaller 'feed' galaxies abound. Photographs of the great clusters have revealed one or two monstrous galaxies lurking near the center of these clusters. Hundreds of times larger than our own Milky Way, they are known to astronomers as cD galaxies — "c" because they are found in clusters and "D" because they differ structurally from the common spiral (S) and elliptical (E) galaxies.

The origin of the cDs always has been a mystery. Originally it was thought that they had merely been formed in a particularly dense region of space. But that didn't account for all of their unusual properties. For example, many cDs are brilliant radio sources. Others have immense jets of gas shooting from their centers.

To account for these properties, the Russian astronomer Iosif S. Shklovsky proposed during the early Sixties that great intergalactic gas clouds were falling into the cD galaxies. The clouds would power the violent explosions and radio emissions and would provide the substance for the formation of new stars. However, intergalactic gas clouds proved impossible to locate.

In 1975 astronomers at Princeton University, in New Jersey, proposed an alternative idea. They showed that if a small galaxy passes close to a larger one, it is slowed down by the combined gravity of all the stars. Just as *Skylab* plummeted to Earth because of friction with air molecules, this so-called dynamical friction will cause the small galaxy to fall into, and be absorbed by, the larger one.

What happens when a large galaxy eats a small one? Surprisingly, very little. There is so much space between stars that two galaxies can merge without a single stellar collision. Computer simulations done at MIT do show one effect, however. Like a stone skimmed into a pond, two colliding galaxies send ripples through the survivor. These ripples can still be seen billions of years after the event.

Just this year François Schweizer, of the Cerro Tololo Inter-American Observatory, in Chile, discovered such ripples in a cD galaxy, Fornax A. Fornax A, it seems, suffered a close encounter with a smaller galaxy fairly recently. In fact, Schweizer argues, the engulfment is not yet complete. Fresh gas and dust can be seen inside Fornax A, spiraling toward its center. When it gets there, we can expect a gigantic explosion.

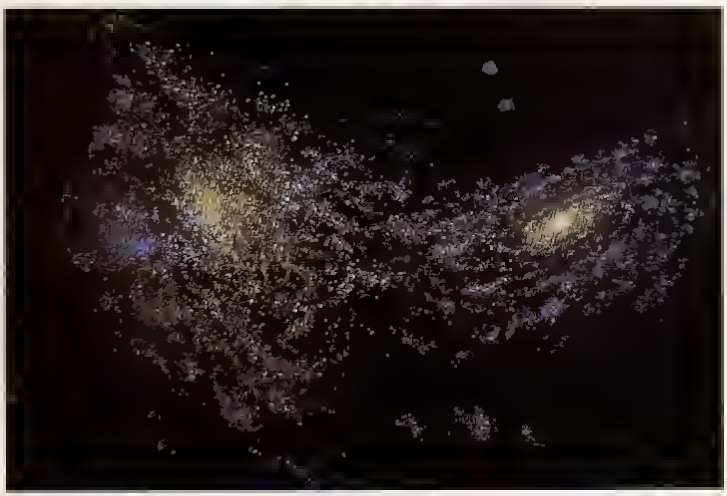
And just recently three Australian astronomers have suggested that our own galaxy absorbed a small, irregular one about 2 billion years ago. According to A. W. Rodgers and his colleagues, there are many metal-rich stars far above the galactic plane — stars too young to appear there according to accepted theory. The most likely source, they suggest, is a collision with a small, gas-filled galaxy swallowed whole by the Milky Way.

So it seems that cD galaxies are born as essentially normal, if somewhat large, galaxies somewhere near the center of a large cluster. Here they await the passage of a smaller galaxy, a fairly common occurrence in these clusters. When one passes too close, it is sucked in by dynamical friction.

The cannibal does have a problem, though: digesting the gas and dust that often accompany the smaller galaxy. This matter apparently flows toward the center of the large galaxy, whereupon it may be spewed out in a violent fit of indigestion.

An even greater problem, perhaps, is the small galaxy's nucleus. This may be massive enough to survive the collision intact and to spiral with the gas and dust toward the cannibal's nucleus.

When two nuclei meet, who knows what may happen? Only one thing is certain: When nucleus meets nucleus, the result is bound to be impressive. ∞



Massive explosions, gas jets, and unexplained radio sources may be simply galactic indigestion

PHENOMENA

A red hermit crab (*Paguristes cadenati*) stirs from the base of a violet sea-fan plant near Grand Cayman Island, in the British West Indies. Underwater photographer Jim Beck took the crab from its natural habitat and placed it on the fan to create an aesthetic subocean still life. From its stonelike shell the hermit crab protrudes squirming legs and unknowingly accentuates the chromatic and textural contrasts in the setting. Before the crab scurried back to its coral niche, Beck photographed this unusual composition of tropical marine life with a Canon F-1 and a 55mm macro lens. The aquanaut-artist recorded the image on Kodachrome 25 film, while the motif was lit by subsea Mark 150 and Vivitar 283 strobe lamps.

The Impossible Box revealed, and selected short subjects

GAMES

By Scot Morris

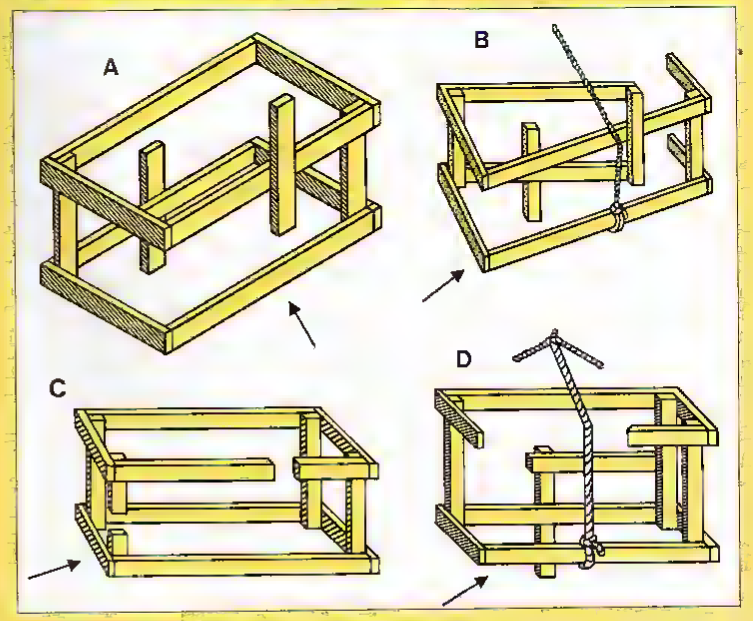
Our May issue featured an article on magician Jerry Andrus that opened with the photograph immediately to the right We wanted to see how readers would react to the contradictory crate in the picture and we asked them to send their hypotheses about how it was built

More than 1,000 readers sent in sketches About 30 sent photos of models they had been inspired to build on their own and another 20 shipped packages containing physical models We were delighted with the response with readers' explanations of their solutions ' and with such comments as these

I think Mr Andrus is amazing Even when I had decided that I had envisioned the real shape of the thing, in referring back to the photo, the reality kept getting lost in the illusion" (Roger E Luft Eau Claire Wisconsin) 'I think I know how the Paradox Box was made Your photograph is actually a well done painting ' (Steve Goedde Maplewood, Missouri) This has been the most interesting deception since NASA claimed to have sent men to the moon" (Frank Malanga Doraville Georgia) "Somewhere in the cosmos M C Escher is doing cartwheels!" (Janet Duncan Boulder Creek, California) "I presume in a following issue we can expect to see Escher s *Waterfall* realized huh?" (Bill Baker San Luis Obispo California) 'I would imagine several interesting bets to be riding on the solution" (James C Frye West Des Moines Iowa)

HOW HE DID IT

It's time now to settle those bets Our original photo was taken from a precise spot about 130 feet away using a 210mm telephoto lens with extender (making it effectively 420 millimeters) We waited until the structure was in the shade, otherwise direct sunlight would have weakened the illusion The photo at top right shows what the contraption looks like from another angle The four long horizontal boards and the four vertical boards are all nailed to one another and in the same plane The two diagonal boards on the left actually stick out in front of the



Photos of illusion and reality (top) Alternate A and others (bottom) Arrows show viewing angles

structure toward the camera, the corresponding boards on the right side stretch into space behind As seen from above the box" is actually Z-shaped

That leaves only the ropes "They give a rationale for the box s being tilted " says Andrus "but they also enhance the illusion that the box really has width ' Three ropes are 'true " but the one in front actually touches no upper boards its bend is artificial and passes about three feet in front of the board it apparently touches The rope s lower half is stiffened with a thin metal rod In fact the bend is a bit lower than it should be ideally—a detail that several readers caught

WHAT READERS SAW

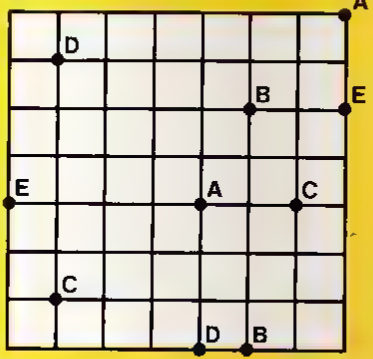
Of the thousand-plus who wrote in fewer than three out of ten were correct: A whopping 65 percent sent *the same incorrect answer* which we came to call Alternate A. What's interesting is that this design would work as many readers proved photographically. As shown at top left in the group of four sketches, Alternate A looks like a real box except for the two vertical boards that seem to defy three-space. These are attached at their middles; their ends are connected to nothing. Readers who saw Alternate A thought that dummy nails had been added for show and that "shadows" either were painted on the wood or were airbrushed onto the photograph.

In sorting readers' drawings at first we used three files: Correct, Alternate A, and ?. The last category was for ideas that didn't fit the mold. It was a small file with 55 entries, many too sketchy to be understood. A close look at the remainder revealed, to our great surprise, a whole variety of strange, idiosyncratic designs *all of which would work!* When we were through tallying, we had Alternates B through L—fully 12 possible ways to build an Andrus Box that are different from the method Andrus used! Alternate B is a hybrid that uses an 'Alternate-A' type design on one side and a "correct" design on the other. Note that this structure, rotated horizontally through 180 degrees, would still produce the same illusion. Our article did state that all the boards in Andrus's box were "straight and uncut," terms that some readers interpreted loosely. After all, how long is "a board"? Some of these alternate designs (C and D, for example) relied on breaks in the boards (or, if you wish, on two short boards that appear to be one long one).

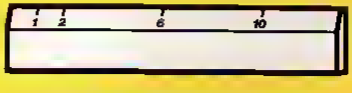
"I'm tickled to death that this created so much interest and that so many people submitted correct answers," Andrus says. "I found that *Omni* readers actually got the correct design more often than did my magician friends. I'm even more pleased that so many minds got to working and came up with so many other workable solutions. I had never imagined there would be so many ways to do this."

SELECTED SHORTS

1. CONNECT THE DOTS. On the grid below, connect A to A, B to B, etc., by following the lines on the grid so that no two routes cross or touch.



2. MINIMUM RULE. An iron bar 13 inches long is marked in four places (as shown), 1, 2, 6, and 10 inches from one end. Of what special use is such a bar?



3. PENNY PACKING. Six pennies are closely packed in the parallelogram array below at left. The objective is to slide pennies, one at a time, to new positions and end with the circular pattern at right. The circle must be precisely aligned and not just "eyeballed." To do this, you must slide each coin so it touches two other coins that rigidly determine its position. What is the lowest number of moves required?

4. ORDER. There is one number between 1 and 100 the letters of whose English name are in alphabetical order. What is it?

5. NUMBER. How far do you have to count before you'll use the letter *a* in the English spelling of a number?

6. SEQUENCE. What is the rule behind this progression, and what is the next number in the series?

5 6 8 9 13 15 16 18 19 25 26 28 29 30

7. THE STUDENTS AND PROFESSORS. Martin Gardner sent us this one. Write an equation for the following statement: There are six times as many students as professors at this university. Use *S* for the number of students and *P* for the number of professors.

8. WORD. There are two five-letter English words whose pronunciation is unchanged after four of their letters are removed. What are these words?

9. HOWDY. Is the number of people in the world who have shaken hands with an odd number of people even or odd?

10. JEALOUS CROSS. In the fantastic land of Riverrun, three apprentice wizards are traveling with their wives. They come to a river where they find a boat moored to a jubjub tree on the bank. It's a tiny rowboat that can carry only two people at a time. The apprentice wizards are jealous of their wives, and they don't trust one another. No man is willing to leave his wife alone in the boat or on shore with another man unless that man's wife is also present. How many river crossings are necessary to get all six people to the other side?

11. NO CHANGE. What is the maximum amount of money you can be carrying in U.S. coins (not including a Susan B. Anthony dollar) and still not be able to give anyone exact change for a nickel, a dime, a quarter, a fifty-cent piece, or a dollar?

Answers to games (and to riddle competition results, page 118) on page 136

LAST WORD

By Dr Bernard Dixon

'Beetles which moved were counted as alive, beetles moving but unable to walk as monbund, and those immobile for three days as dead'

[illegible] the task of scouring literature for the latest gems in research. But there are other rich rewards from this scavenging process, particularly the splendid haul of great ideas that do *not* make headlines. Herewith, a selection of outstanding announcements, which I guarantee are genuine, although prudence dictates that I draw a thin veil over the authors' names.

"Most people who are shot realize what has occurred." (*Archives of Dermatology*, 1967, 96, 701.)

"Copulation time tends to be unusually long with very young females and relatively short with castrate males." (*Annals of the Entomological Society of America*, 1968, 61, 1566.)

"Development of hydro power in the desert of North Africa awaits only the introduction of water." (*Nuclear News*, 1968, 11, 29.)

"Studies on brain amines in patients who commit suicide have been somewhat disappointing." (*Biochemical Society Agenda*, November 1970, 4.)

"The group is building a large furnace to simulate the solar atmosphere." (*U.K. Science Research Council's Astronomy, Space and Radio Board Review*, 1968, 13.)

"It would be a very rash person who would attempt to put an upper limit on the size of viruses." (*British Journal of Hospital Medicine*, 1969, 2, 1970.)

"The clinical manifestations of congenital and post-natal CMV infection are strikingly similar and different." (*Infectious Diseases of Children and Adults*, by S. Krugman and R. Ward, fifth edition, 1973, 4.)

"Singh *et al.* studied 100 post-infarction patients, of whom 75.8 per cent were indulging in intercourse." (*Ciba Review*, April 1972, 18.)

"Beetles which seemed to be moving normally were counted as alive, beetles moving but unable to walk as monbund, and those not showing movement within three days as dead." (*Nature*, 1973, 245, 388.)

"Biologists discovered quite early that animals are born possessing certain abilities." (*Impact of Science on Society*, 1973, 23, 149.)

"Meat mincing machines in which only some parts can be dismantled must be treated as two distinct pieces of equipment for cleaning purposes. Those parts which cannot be removed must be given special attention by what might be described as 'in place cleaning'." (*Journal of Hygiene*, 1973, 71, 743.)

"[illegible] true pets, others are not." (*Biologist*, 1973, 20, 69.)

"It may be suggested that children tend to wear more clothing during cold weather than adults, which, removed in summer, would lead to relatively greater increases in thermal requirements." (*Journal of Hygiene*, 1973, 71, 457.)

"It should be pointed out that, although good electron micrographs can be obtained by spraying virus particles, this is also a very good technique for spreading potential pathogens." (*Journal of Medical Microbiology*, 1973, 6, 576.)

"Photosynthesis is the process by which green plants reduce carbon dioxide to carbohydrates and oxidize water to oxygen. This process makes the food we eat and the oxygen we breathe." (*Proceedings of the National Academy of Sciences*, December 1976, 4502.)

"Burned patients were found to be without statistically significant differences in terms of race, sex or ability to pay hospital bills." (*New England Journal of Medicine*, February 10, 1977, 315.)

"It appears that the less overall pleasure and stimulation the penis receives in sexual intercourse, the less likely it is that the individual will want to have sex frequently." (*New Society*, January 20, 1977, 126.)

"When a face [illegible] is viewed upside down much of its facelike quality seems to be lost." (*Science*, January 21, 1977, 312.)

"The lack of biophysical activity or interest within the Institute of Physics is no doubt a result of the small proportion of biophysicist members." (*Physics Bulletin*, February 1977, 55.)

"Send your typescript to the editor at the address given in a recent issue of the journal [illegible]. The pages should be held together by a paper clip." (*Scientists Must Write*, by Robert Barrass, Chapman and Hall, 1978.)

"When one party to a debate possesses important knowledge which the contending party does not share, it has a great tactical advantage." (*Minerva, A Review of Science, Learning and Policy*, 1978, 16, 23.)

"It should not come as any surprise to find that in taking advantage of the grazer the apparently passive plant is less green than it's cabbage-looking." (*Nature*, January 31, 1980, 430.)

"Quite a number of research grants are definitely counterproductive." (*New Scientist*, 1973, 59, 436.)